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***Ventus Energy NZ Ltd***

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**ECOLOGICAL ASSESSMENT OF  
PROPOSED WIND FARMS  
Taumatotara West Rd, Taharoa**

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***Kessels  
& Associates Ltd***



ecology & environmental planning

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## 1 Introduction

This report details the ecological investigations carried out at a site of a proposed wind farm in the western King Country. The site is on a ridgeline exposed to winds from all points of the compass, but particularly the prevailing westerlies and south-westerlies. While the site is on pasture which includes little or no indigenous vegetation, the access roads pass through or beside stands of native forest and shrubland, and two small wetlands. Due to the size of the turbine blades to be transported in to the site, some corners on these roads will require straightening, with consequent loss of indigenous vegetation. The objective of this investigation is therefore to:

- Describe the ecological features in and adjacent to the proposed wind farm, and particularly of the access roads;
- Identify the sensitivity of those ecological features; and
- Assess potential measures by which and adverse effects may be mitigated.

## 2 Methodology

### 2.1 Bird Survey

On the 22/23 November 2004 a three hour session was spent in the early morning (6.30 am onwards) and one late afternoon session to maximise the chance of hearing less conspicuous species during the “dawn chorus” and all birds heard or observed noted along the following locations:

- At Taumatotara - along the road wherever native bush occurred adjacent to the road and along the bush line at the top of the cliffs on the property owned by N & L Harper.

### 2.2 Vegetation and Significance Assessment

The site was visited on 23 November 2004. Vegetation on and adjacent to the wind farm site was assessed visually. The clearances required for trailers on access road corners were measured by tape, and where road widening and vegetation removal was found to be necessary the species present were recorded, with particular attention paid to uncommon or unusual species. Location of the corners with significant amounts of indigenous vegetation was determined by GPS; for other corners grid references were identified from NZMS topographical maps (R16).

The assessment of the ecological sensitivity (significance) of the areas was undertaken using Environment Waikato’s Proposed Regional Policy Statement criteria for assessing sites of significant indigenous vegetation and habitats of indigenous fauna. The site have been assessed based on criteria outlined by Whaley *et al.* (1995), which is summarised as follows:

1. Representativeness
2. Diversity and pattern
3. Rarity/special features
4. Naturalness/intactness
5. Size and shape
6. Inherent ecological viability/long-term sustainability
7. Buffering/surrounding landscape/ connectivity
8. Fragility and threat (threat process and agents, effects of proposed modification)
9. Management input (nature and scale/intervention necessary, restoration potential)

## 3 Results of Bird Survey

### 3.1 Taumatotara

<u>Native birds</u>	<u>Comment</u>
Grey Warbler	Commonly heard and seen.
Kingfisher	2 heard, 1 seen.
Kereru	2 seen.
Australasian Harrier	2 seen.
Fantail	Commonly heard and seen.
Silvereye	Seen
Paradise Shelduck	1 pr
Tui	N Harper pers comm.

#### Introduced birds

Blackbird  
 Thrush  
 Yellowhammer  
 Skylark  
 Chaffinch  
 Magpie  
 Black swan (+ 3 cygnets)  
 Welcome Swallow (self introduced)

### 3.2 Comments on species not recorded but possibly present.

No Bellbirds were recorded in spite of the species showing up in Ornithological Society of NZ records or by Moynihan (1986). In the intervening period Bellbirds may well have died out as a result of predation by introduced mammals.

No North Island Kokako were heard and there have been no historic records of the species having been present at the site. As with Bellbirds, Kokako have probably become locally extinct as a result of pressure from mammalian predators. Even if Kokako were present, they are relatively poor flyers and it would not be in their nature to venture out into an area of open farmland (the sites for the turbines).

NZ Falcon have been recorded as being present in the locality by Moynihan (1986) and the occasional bird may still utilise these areas as part of their very large home ranges.

### 3.3 Migratory Waders

The site is not on any known migration route for either international or internal migratory waders. The most likely migratory waders to pass over the mainland North Island are internal migratory waders such as South Island Pied Oystercatchers which head inland from the Firth of Thames and turn up again in the South Island. It is unknown what route is taken, but the chances of the migratory route passing over the site is extremely low<sup>1</sup>. The site is not in a direct line between significant fresh or estuarine bodies, therefore it is unlikely that a significant number of waders would pass over the site.

## 4 Description of Indigenous Vegetation

### 4.1 The Site

The Taumatotara site occupies a ridge running northwest-southeast on either side of Taumatotara West Rd (see Figure 1). Vegetation in the immediate vicinity of all pylons is exotic pasture grasses and herbs.

A small forest remnant occurs on the hillside below the proposed sites of Turbines 2 and 3. This has a low, wind-shorn canopy of mahoe, pigeonwood, kohekohe, mangeao, hangehange, rangiora and kawakawa. Stock have eaten out much of the understorey, but some shrubs, including taurepo and *Coprosma*

<sup>1</sup> Keith Woodley, Manager Miranda Naturalists Trust and Phil Battley OSNZ, *pers comm*

*rhamnoides* remain. Parataniwha grows densely in a small gully. A feature of the stand is the diversity of ferns, which remains high despite browsing pressure. Species present include *Dicksonia fibrosa* (small), *Blechnum fluviatile*, *Blechnum chambersii*, *Blechnum filiforme*, *Pneumatopteris pennigera*, *Histiopteris incisa*, *Lastreopsis glabella*, *Polystichum richardii*, *Asplenium flaccidum*, *Asplenium polyodon* and *Pyrrisia eleagnifolia*. From the abundance of epiphytes, which include *Astelia solandri*, *Metrosideros perforata*, *Metrosideros diffusa*, and *Earina autumnalis*, it appears this remnant is frequently in low cloud.

More extensive patches of forest are found along the steep ridge slopes running south from the road. These are rather more diverse than the remnant above, being larger, and with some protection from stock provided by the steepness of the terrain. Wind has shorn the canopy close near the ridgetops, but trees grow taller further down the slope. Along with the above species are kahikatea, kamahi, mamaku, rewarewa, tawa, lancewood, kanono, pate, kiekie and bracken.

The existing farm race on the south side of the road is likely to be rerouted across a small wetland. At present this is grazed and supports a low diversity of predominantly exotic wetland species, such as *Juncus effusus*, *Juncus articulatus*, *Juncus planifolius*, *Juncus prismatocarpus*, *Lotus pedunculatus*, watercress, creeping buttercup, Yorkshire fog, and mercer grass. The only indigenous species recorded was *Isolepis prolifer*.

Towards the southern end of the site the farm race crosses a dam behind which is a small pond with a variety of wetland species around its margins. *Isolepis prolifer* also occurs here, along with raupo and a large indigenous rush, *Baumea articulata*. Again, most species are exotic. Some widening of the roadways and extension of the culvert pipes may be necessary, however, this would result in an insignificant loss of wetland vegetation.

Figure 1 Location of proposed Taumatotara Wind Farm



## 4.2 Taumatotara West Rd

Corners on Taumatotara Rd were numbered 1 to 29, starting from the intersection with Taharoa Rd and heading uphill. Five of these corners (no.s 9, 12, 18, 19 and 20) were identified as requiring straightening and removal of indigenous vegetation, although at site 12 this consists only of low herbs, ferns and small seedlings (Figure 2.) All references to orientation of corners relate to travel up the road from the Taharoa Rd intersection.

The road at first passes through farmland then skirts the eastern edge of a small forest remnant; no road works should be required along this stretch, however. From about Corner 13 to 29 the road then passes along and through the north-western side of an east-facing gully of second growth forest and scrub. Mahoe and mamaku are prominent, with kamahi quite numerous though not generally growing to large size, and several pole rimu are present. Typical roadside weeds, such as blackberry, *Montbretia*, *Calystegia silvatica* and *Tradescantia fluminensis* are widespread.

### 4.2.1 Corner 9 (Grid ref. E2667748 N6330936)

The vegetation is a low, scrubby mix of indigenous and exotic species: pate, mangeao, *Pneumatopteris pennigera*, *Muehlenbeckia australis*, *Hebe stricta*, karamu, manuka, kanono, mamaku, kiokio, matsudana willow, *Calystegia silvatica* *Montbretia*, blackberry, and Japanese honeysuckle. The corner is left-handed, with the inside of the turn on the downhill side. It is likely that only trimming, rather than wholesale removal of vegetation would be required.

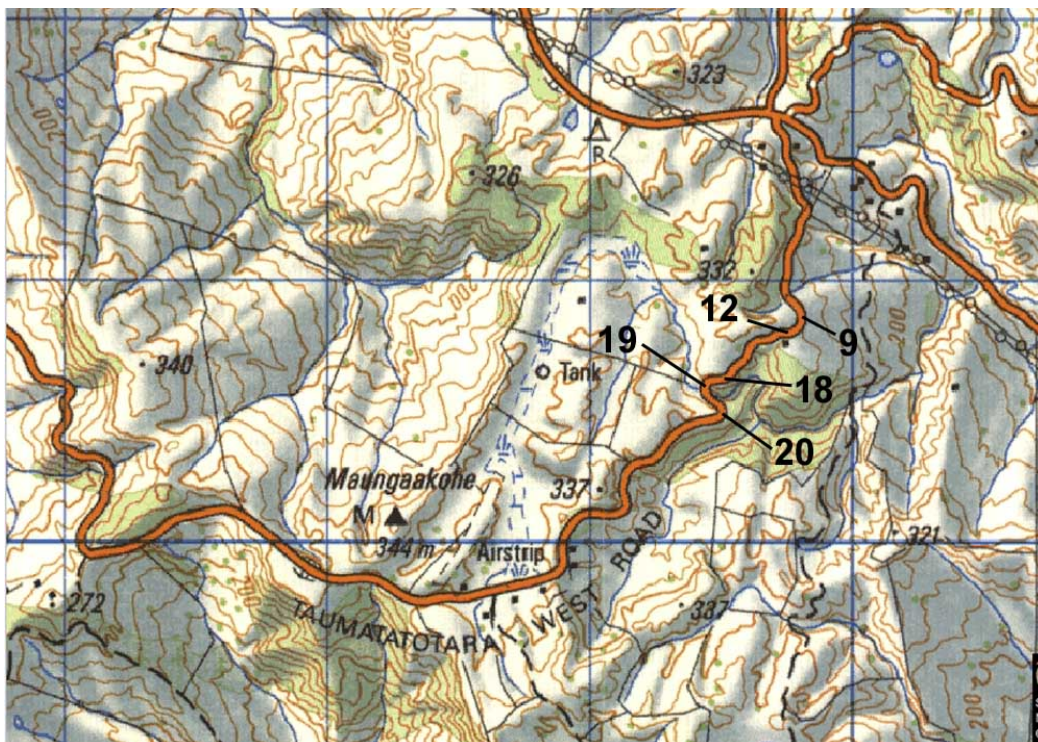
### 4.2.2 Corner 12 (Grid ref. E2667740 E6330810 approx.)

A right-hand turn around a low, grassy bank with kiokio, foxglove, *Haloragis erecta*, *Acaena anserinifolia*, bracken, *Paesia scaberula*, exotic herbs and seedlings of kamahi and hangehange.

### 4.2.3 Corner 18 (Grid ref. E2667479 N6330597)

The corner is a sharp right-hand turn with a steep bank on the inside. Several metres of this bank and the vegetation immediately above will need to be removed. The bank itself has predominantly kiokio, *Gaultheria antipoda* (snowberry), exotic herbs and indigenous seedlings (eg kamahi). The insectivorous native sundew *Drosera binata* is the most notable species. On top of the bank is a pole rimu and a variety of indigenous shrubs (manuka, lancewood, *Cordyline banksii*, hangehange, mamaku, karamu, small kamahi and mangeao) and the exotic conifers macrocarpa and redwood, growing in an open situation among *Paesia*, bracken, kiokio and browntop.

Figure 2. Corners requiring straightening on Taumatotara Rd





#### 4.2.4 Corner 19 (Grid ref. 2667390 N6330524)

The corner is a left-hander with a gully on the inside of the turn. The road has slumped immediately before and at the culvert and will require restoring and widening. Little vegetation will require removal, though some mahoe will have to be trimmed. There is a dense patch of *Tradescantia* on the bank just before the culvert; it would be desirable if this were sprayed.

#### 4.2.5 Corner 20 (Grid ref. E2667491 N6330468)

This sharp right turn has a steep bank on the inside, which will need to be cut back 8-10m. The bank itself has *Pratia angulata*, *Lycopodium volubile*, kiokio and native seedlings. The top of the bank is open in the angle of the corner, with bracken, browntop, *Hebe stricta*, lancewood and mapou. Further back, but still requiring removal, are kamahi, pole rimu, mamaku, a large heketara, rewarewa and a clump of greenhood orchids (*Pterostylis banksii*).

## 5 Assessment of Ecological Effects

### 5.1 Summary of Potential Ecological Effects

Potential impacts of wind-farms on indigenous vegetation and wildlife can be divided into two groups – direct impacts and indirect impacts:

Direct impacts could include:

- habitat loss and damage, and destruction of plants and other wildlife, in the course of wind farm and road realignment construction;
- sediment run-off from road and turbine construction affecting waterways;
- collision mortality of individual birds, flying insects (and perhaps bats) with the turbines or associated wind farm structures.

Indirect impacts could include:

- disturbance either from the wind farm and associated activities (noise, visual);
- reduced breeding success of individual birds or other wildlife nesting in close proximity to the wind farm;
- increased predation and scavenger pressure in treeless, unbuilt-up areas and adjoining fauna habitats, as the wind farm may provide suitable perches and shelter predators that previously did not inhabit the area.

### 5.2 EW Regional Policy Statement Ecological Significance Assessments

**Representativeness:** The first criterion assesses the contribution the vegetation makes to the conservation of all indigenous ecosystems present in the natural landscape. The patch of forest through which Taumatotara West Rd passes (in the vicinity of corners 18-20) is secondary growth forest with a mix of species typical of the western King Country. Other, comparable or larger patches of forest are found in both vicinities and are well represented within the Herangi Ecological District (Harding, 1997 & Leathwick et al, 1995).

**Diversity and pattern:** Although impinged upon by livestock and of limited size, the forest blocks are moderately diverse. Vegetation is more open on ridges, and rather less diverse (at least in the vicinity of the roads), with mahoe particularly common, in gullies.

**Rarity/special features:** No rare species were identified at the Taumatotara site.

**Naturalness/intactness:** Millable trees have largely been removed, and forest vegetation in the vicinity of the roads is of low stature, but regenerating. Earlier road works have already opened up the forest along the roadsides.

**Size and shape:** The area of the forest along Taumatotara West Rd is 23.5ha, with a long edge on or near the road, tapering somewhat further down the gully to the east.

**Inherent ecological viability/long-term sustainability:** The block is regenerating, and those areas in the vicinity of the road should eventually revert to kamahi forest with scattered rimu, with a reasonably diverse understorey of mostly indigenous species. Farm livestock currently have access, however, and these are having a visible impact on vegetation around the margins. Possums are also having an impact, and weeds are spreading into the blocks from the roadsides.

**Buffering/surrounding landscape/ connectivity:** The forest block on Taumatotara Rd is one of many comparable patches in the vicinity, which can be regarded as outliers of the extensive forest running south from Kawhia Harbour a few kilometres to the east. Highly mobile species such as tui and kereru visit these patches to feed, and may also breed here. The small stream that flows through the forest patch rises in a wetland on adjoining farmland, and drains into the Mangaohuinga Stream, and ultimately to the Marokopa River. It is likely to provide a limited extent of habitat for migratory native fish species.

**Fragility and threat (threat process and agents, effects of proposed modification):** At present the greatest threat to the vegetation of these forest patches is from wandering livestock and possums. Exotic plant species are also spreading into them. The proposed road works will result in a small loss of indigenous vegetation at the road corners, perhaps 500m<sup>2</sup>.

**Management input (nature and scale/ intervention necessary/restoration potential):** Fencing to exclude stock and control of possums would be the most important management efforts, while formal protection of those areas already not within DoC estate (eg by the way of a DoC or QEII covenant) would secure their long-term sustainability.

Table 1 assesses the area with regard to the EW Regional Policy Statement Criteria for assessing ecological significance.

Table 1: Assessment of the Site against Environment Waikato RPS Criteria for Significant Indigenous Ecosystems, Taumatotara

Specific Criteria (see key below)	Significant under this criterion? Y/ N/ NA	REASONS
1	N	
2	N	
3	N	
4	N	
5	N	
6	N	
7	N	
8	Y	Small stream likely to have some native fish
9	Y	
10	N	
11	Y	In parts, if possum controlled and stock excluded

**Key to Column 1.** Full criteria wording is provided in the RPS. A summary is presented here:

1. It is indigenous vegetation or habitat that has been specially set aside by statute or covenant for protection and preservation, unless the site can be shown to meet none of Criteria 3-11.
2. It is indigenous vegetation or habitat recommended for protection by the Nature Heritage Fund or Nga Whenua Rahui committees, or the Queen Elizabeth the Second National Trust Board of Directors, unless the site can be shown to meet none of Criteria 3-11.
3. It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are: threatened with extinction, or endemic to the Waikato Region
4. It is indigenous vegetation or habitat type that is under-represented (10% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally.
5. It is indigenous vegetation or habitat that is, and prior to human settlement was, nationally uncommon, such as geothermal, Chenier plain, or karst ecosystems
6. It is wetland habitat for indigenous plant communities and/or indigenous fauna communities<sup>2</sup> that has not been created and subsequently maintained for or in connection with: waste treatment; or wastewater renovation; or hydro electric power lakes<sup>3</sup>; or water storage for irrigation; or water supply storage; unless in those instances they meet the criteria in Whaley *et al.* (1995).

<sup>2</sup> Does not include exotic rush/pasture communities.

<sup>3</sup> Does not include Lake Taupo.

7. It is an area of indigenous vegetation or naturally occurring habitat that is large relative to other examples in the Waikato Region of similar habitat types, and which contains all or almost all indigenous species typical of that habitat type.
8. It is aquatic habitat that is a portion of a stream, river, lake, wetland, intertidal mudflat or estuary, and their margins, that is critical to the self sustainability of an indigenous species within a catchment of the Waikato Region and which contains healthy, representative populations of that species.
9. It is an area of indigenous vegetation or habitat that is a healthy, representative example of its type because: its structure, composition, and ecological processes are largely intact, and if protected from the adverse effects of plant and animal pests and of adjacent landuse (e.g. stock, discharges, erosion), can maintain its ecological sustainability over time.
10. Is it an area of indigenous vegetation or habitat that forms part of an ecological sequence that is either not common in the Waikato Region or an ecological district, or is an exceptional, representative example of its type.
11. It is an area of indigenous vegetation or habitat for indigenous species (which habitat is either naturally occurring or has been established as a mitigation measure) that forms, either on its own or in combination with other similar areas, an ecological buffer, linkage or corridor, and which is necessary to protect any site identified as significant under Criteria 1-10 from external adverse effects.

### **5.3 Effects on Indigenous Vegetation at the Taumatotara Site**

Impacts on indigenous vegetation on the wind farm site itself is insignificant, as virtually no indigenous species occur at the site. Of primary concern is the vegetation along the access roads, which will be affected by road widening activity, and these ecological significance assessments relate to that vegetation.

The vegetation at sites chosen for wind turbines consists entirely of exotic pasture, which is of minimal value from a biodiversity perspective. The turbines themselves are also most unlikely to have any impact on the bush remnant below Turbine Sites 2 and 3, and the bush along the ridge running south-east from Taumatotara West Rd.

The primary impacts on vegetation from the proposal involve upgrading of the access road. The farm race providing access to the southern turbine sites is to be rerouted across a small wetland. This, however, is currently grazed heavily by stock, and contains only common species, almost all of them exotic. The race also runs across a farm dam, behind which is a pond with a fringe of vegetation which includes several indigenous wetland species. The race will require widening at this point, with a small amount of fill being placed in the wetland and the culvert pipe extended. The amount of indigenous wetland vegetation lost as a result of this would be insignificant (less than 20-50 square metres).

Of more significance is the loss of vegetation involved in straightening five of the corners on Taumatotara West Rd. Of these, Corner 12 has a minimal amount of indigenous vegetation, and little more than trimming is involved at Corners 9 and 19. The bank at Corner 18 has an attractive mix of small herbs and seedlings, all of which are found elsewhere along the road. These should re-establish quickly on the new bank face, however. The top of the bank has open vegetation which includes several exotic species, and one pole rimu which would require removal. Corner 20 is the only one with anything resembling forest habitat scheduled for removal – perhaps 100m<sup>2</sup> in total. This includes a large heketara, some medium-sized kamahi, pole rimu and a clump of greenhood orchids. No rare or threatened species were recorded.

### **5.4 Post-construction Invasion of Exotic Weeds**

Fresh earth exposed during clearance and construction will provide ideal conditions for the further spread of weeds already existing within the area. Furthermore, machinery brought in from other areas increase the risk of new exotic weed species establishing within the area. Therefore it is critical that all machinery is thoroughly cleaned before it is brought on site to remove any attached seed or plant matter.

Post-construction weed control (e.g. targeted herbicide spraying) should be carried out where necessary - both at the wind farm and along the affected length of the roads.

In the long-term, provided initial weed control is carried out, it is expected that the scrubland species will quickly gain a foot hold and dominate vegetative cover, suppressing weeds such as gorse and blackberry.

### **5.5 Effects on Indigenous Fauna**

#### **5.5.1 Indigenous Birds**

While any tall structure poses some risk to birds, the impact of wind turbines on bird mortality rates is very small if careful consideration is given to the wind farm location in respect of the natural ecology of the area.

Available overseas evidence indicates that any impacts of wind farms in wildlife tend to be limited where wind turbines are sited to avoid flight paths and significant habitats (Crockford, 1992).

The bush areas adjacent to the proposed wind farm site contain the more “common” species one would expect to find in forest areas of their size and at that latitude. None of these species are likely to spend much time on the open farmland where the wind generators are likely to be sited. Tui, Shining Cuckoo, bats (if present) and Kereru are the species most likely to venture far enough from the forest to possibly come within range of the wind generator blades.

Generally, noise generated by the turbines is considered unlikely to disturb forest birds within the vicinity of the turbines, apart from those present along the immediate boundary and then only until they become habituated to the presence of the wind turbines. Overseas studies suggest that the disturbance effect of wind turbines on breeding and roosting birds in adjacent areas is negligible (Benner, 1993). Of course this depends on the behaviour of each particular species, but ecologically important birds such as Bellbird, Tui and Kereru appear to adapt to noise associated with roads and urban environments which are likely to be louder than wind turbines (personal observations).

The ability of these key indicator species to adapt to the turbines and become accustomed to associated noise and movement should not be underestimated. The birds would easily be able to fly around the turbines to gain access to other remnant bush areas within the locality.

While the regular occurrence of NZ falcon within the study area is unlikely, this species has been recorded as being present in the locality in the past (Moynihan, 1986). The foraging behaviour of the NZ falcon and its flying characteristics in relation to wind turbines (flight height, distance of flying birds to turbines and turbine blades, and frequency of perching on turbine structures) are unknown and may or may not make this species susceptible to collisions. Nonetheless, combined with the birds rarity and threatened status, even occasional mortalities may be significant.

Biosystems Analysis (1992) found that the highest wind turbine collision rates for raptors in the US were when the wind farm was located in important foraging habitat. The proposed wind farms site in this case would be located in known important foraging habitat for the NZ falcon. The US study also found that mortality rates were also significantly higher in close proximity to canyons than those farther away (Biosystems Analysis, 1992). The site would be situated on ridge tops are not near any major “canyons” (gorges, large gullies). Given these mitigating factors, it is considered that the risk of NZ falcon striking a turbine is minimal.

### **5.5.2 Bats**

It is likely that long-tailed bats exist in the Aorangi Scenic Reserve and possibly in the forest on the cliffs adjacent to the Taumatotara site (Moynihan, 1986). It is possible that bats could hunt at night for insects in the vicinity of the turbines. However, bats are extremely agile and have the assistance of echolocation to help them to capture prey and avoid obstacles, so the risk of them hitting the structures, blades or power lines is considered to be extremely low.

### **5.5.3 Native Frogs**

Native frogs (*Leiopelma hochstetteri* & *L. archeyi*) are present in the Herangi Range, which is about 10km west of Aorangi Scenic Reserve. Therefore, these were searched for briefly; none were located, however, nor was any suitable habitat for these species identified.

### **5.5.4 Aquatic Biota**

No significant streams or wetlands would be directly affected by the proposed wind farms or road realignments. However, there is a risk that sediments from road works and turbine site construction could enter waterways and adversely affect aquatic macroinvertebrate or fish and their habitats. Provided standard good practice silt control techniques are implemented during construction, these effects will be no more than minor.

## **5.6 Power Line Upgrades**

New poles shall be required for approximately 2km to join at Taharoa Rd. At this stage the existing Low Voltage route may be used or a new route used. However, the final route will be determined by the lines company and any associated ecological effects would be assessed at that time.

## 6 Conclusions & Recommended Amelioration Measures

### 6.1 Summary

In conclusion, forest areas along the road is mostly low second growth, although with occasional taller vegetation, as at Corner 20, Taumatotara. Overall, the proposed works involve the removal of only small areas of indigenous vegetation, most of which is already degraded either through previous road works or invasion by exotic species and well represented elsewhere within the Herangi Ecological District.

The wind farm would not involve the removal of any significant indigenous vegetation or habitats of significant indigenous fauna.

The wind farm *may* increase the incidence of bird strike or impede the movement of resident or migratory bird species but currently available information suggests that the site is not within important resident or migratory wader flight paths. Overseas evidence indicates that any impacts of wind farms on wildlife tend to be limited and minor, where the wind farm is not situated within an important migratory path or part of habitat ecological significance. Furthermore, from a regional perspective the loss of indigenous bird habitat is considered to be inconsequential, as a relatively small area of indigenous vegetation would be removed.

As the proposed road realignments follow the existing formed roads, effects on wildlife habitat and corridors for species with large home ranges is likely to be minor. Therefore, effort toward fauna habitat replacement is not considered to be necessary provided no nesting or roosting sites of threatened species are found within the extension footprint during construction.

Consequently, the proposed wind turbine construction, road realignments and ongoing operation are expected to result in minor, insignificant adverse ecological effects provided that suitable mitigation measures are undertaken as detailed in this report.

### 6.2 Recommended Avoidance, Remediation and Mitigation Measures

The following good practice performance standards should be adopted during road widening and turbine construction:

#### ***Construction Phase***

- Restrict clearance and trimming of native vegetation within the designation to the minimum required for the road realignment and any realignments of the power line routes;
- Minimise as far as practicable the construction footprint of the proposed road and cut and fill batters;
- Install appropriate sediment control geo-textile or hay-bale swales when working near or in waterways and wet areas;
- Tape off the areas of indigenous vegetation to be removed during construction as required;
- Avoid removal of pole stand rimu wherever practical;
- Ensure all machinery is thoroughly cleaned before being allowed on site to prevent introduction of weeds; and

#### ***Operational Phase***

- Develop and implement a weed control programme for the site and access road for the first 1-2 years of operation; and
- Mitigation for any *potential* adverse effects on indigenous birdlife caused by turbine strikes is unlikely to be necessary, but a donation to the Otorohanga Kiwi House/Department of Conservation to assist with the ongoing North Island Brown Kiwi recovery programme within the King Country may be appropriate.

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# Appendix I Flora Species Lists

# Taumatotara Plant Species

## Gymnosperms

* <i>Cupressus macrocarpa</i>	Macrocarpa
<i>Dacrycarpus dacrydioides</i>	Kahikatea
<i>Dacrydium cupressinum</i>	Rimu
<i>Libocedrus plumosa</i>	Kawaka
<i>Prumnopitys ferruginea</i>	Miro
* <i>Sequoia sempervirens</i>	Redwood

## Flowering Trees/Shrubs

<i>Aristolelia serrata</i>	Wineberry
<i>Beilschmiedia tawa</i>	Tawa
<i>Brachyglottis repanda</i>	Rangiora
<i>Coprosma grandifolia</i>	Kanono
<i>Coprosma rhamnooides</i>	
<i>Coprosma robusta</i>	Karamu
<i>Cordyline australis</i>	Cabbage Tree
<i>Cordyline banksii</i>	Forest Cabbage Tree
<i>Coriaria arborea</i>	Tutu
<i>Dysoxylum spectabile</i>	Kohekohe
<i>Fuchsia excorticata</i>	Tree Fuchsia
<i>Gaultheria antipoda</i>	Snowberry
<i>Geniostoma rupestre</i>	Hangehange
<i>Griselinia lucida</i>	Puka
<i>Hebe stricta</i>	Koromiko
<i>Hedycarya arborea</i>	Pigeonwood
<i>Knightia excelsa</i>	Rewarewa
<i>Kunzea ericoides</i>	Kanuka
<i>Laurelia novae-zelandiae</i>	Pukatea
<i>Leptospermum scoparium</i>	Manuka
<i>Litsea calicaris</i>	Mangeao
<i>Macropiper excelsum</i>	Kawakawa
<i>Melicytus ramiflorus</i>	Mahoe
<i>Myrsine australis</i>	Mapou
<i>Olearia rani</i>	Heketara
* <i>Populus deltoides x nigra</i>	Flevo Poplar
<i>Pseudopanax arboreus</i>	Fivefinger
<i>Pseudopanax crassifolius</i>	Lancewood
<i>Rhabdothamnus solandri</i>	Taurepo
<i>Rhopalostylis sapida</i>	Nikau
* <i>Salix cinerea</i>	Grey Willow
* <i>Salix matsudana</i>	Matsudana Willow
<i>Schefflera digitata</i>	Pate
* <i>Ulex europaeus</i>	Gorse
<i>Vitex lucens</i>	Puriri
<i>Weinmannia racemosa</i>	Kamaha

## Climbers

* <i>Calystegia silvatica</i>	Convolvulus
<i>Clematis paniculata</i>	Clematis
<i>Freycinetia banksii</i>	Kiekie
* <i>Lonicera japonica</i>	Japanese Honeysuckle
<i>Metrosideros diffusa</i>	Rata vine
<i>Metrosideros perforata</i>	Aka
<i>Muehlenbeckia australis</i>	
<i>Parsonsia capsularis</i>	
<i>Rubus cissoides</i>	Bush Lawyer
* <i>Rubus fruticosus</i> agg.	Blackberry

## Herbs/Grasses

<i>Acaena anserinifolia</i>	Bidibid
* <i>Agrostis capillaris</i>	Browntop
<i>Astelia solandri</i>	
<i>Baumea articulata</i>	



* <i>Cardamine</i> sp.	Spitweed
* <i>Cirsium vulgare</i>	Scotch Thistle
<i>Collospermum hastatum</i>	
* <i>Crocosmia xrocosmiiflora</i>	Montbretia
* <i>Dactylis glomerata</i>	Cocksfoot
* <i>Digitalis purpurea</i>	Foxglove
<i>Drosera binata</i>	Sundew
<i>Earina autumnalis</i>	Autumn Orchid
<i>Elatostema rugosum</i>	Parataniwha
<i>Haloragis erecta</i>	
* <i>Holcus lanatus</i>	Yorkshire Fog
* <i>Hypochoeris radicata</i>	Catsear
<i>Isolepis prolifer</i>	
* <i>Juncus articulatus</i>	
* <i>Juncus effusus</i>	
* <i>Juncus planifolius</i>	
* <i>Juncus prismatocarpus</i>	
* <i>Lolium perenne</i>	Ryegrass
* <i>Lotus pedunculatus</i>	Lotus
* <i>Myosotis laxa</i>	Water Forget-me-not
<i>Oplismenus hirtellus</i>	Bamboo Grass
* <i>Paspalum distichum</i>	Mercer Grass
<i>Phormium tenax</i>	Flax
<i>Pratia angulata</i>	
<i>Pterostylis banksii</i>	Greenhood Orchid
* <i>Ranunculus repens</i>	Creeping Buttercup
* <i>Rorippa microphyllum</i>	Watercress
* <i>Senecio jacobea</i>	Ragwort
<i>Thelymitra</i> sp.	Sun Orchid
* <i>Tradescantia fluminensis</i>	Wandering Jew
* <i>Trifolium repens</i>	White Clover
<i>Typha orientalis</i>	Raupo
<i>Uncinia uncinata</i>	Hookgrass

### **Ferns/Fern Allies**

<i>Asplenium bulbiferum</i>	Hen and Chicken Fern
<i>Asplenium flaccidum</i>	Drooping Spleenwort
<i>Asplenium oblongifolium</i>	Shining Spleenwort
<i>Asplenium polyodon</i>	
<i>Blechnum chambersii</i>	
<i>Blechnum filiforme</i>	
<i>Blechnum fluviatile</i>	
<i>Blechnum novae-zelandiae</i>	Kiokio
<i>Cyathea medullaris</i>	Mamaku
<i>Cyathea smithii</i>	Whe
<i>Dicksonia fibrosa</i>	Whekiponga
<i>Dicksonia squarrosa</i>	Wheki
<i>Histiopteris incisa</i>	Water Fern
<i>Lastreopsis glabella</i>	
<i>Lycopodium volubile</i>	
<i>Microsorium pustulatus</i>	
<i>Microsorium scandens</i>	Fragrant Fern
<i>Paesia scaberula</i>	
<i>Pneumatopteris pennigera</i>	Gully fern
<i>Polystichum richardii</i>	
<i>Pteridium esculentum</i>	Bracken
<i>Pyrrhosia elaeagnifolia</i>	

# Appendix II Photo Inventory