TAUMATATOTARA WIND FARM

Ecological Effects Assessment of the Existing 22 Turbine Consented Activity plus the Proposed Tip Height Variation in response to s92 Requests

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1 Executive Summary

Introduction

This report is in support of the application to vary the Resource Consent of the currently consented Taumatatotara Windfarm. Avoidance of potential effects is the initial step which will remove half (11) of the originally planned turbines. This change will provide a greater avoidance gap between the ground and the blade tip up from 10 to 17.5m. New technology allows larger turbines which will provide a small (7%) increase in total rotor swept area (RSA) at turbines 1 to 11 vs the consented 22 turbines however that increase is at higher elevations (and presents a lower risk to avifauna).

Regard is also given to modernising the historical consent conditions that were first issued in 2008. Those consent conditions related to 22 smaller diameter (but closer to the ground) wind turbines.

Notably, this report investigates the *Avoid, Remedy and Mitigate* protocols. This variation application requires the reader to invert and re-context some traditional thinking around application of these protocols. The *Avoid* protocol is applied to the variation application of removing 11 turbines. The *Avoid and Mitigate* protocol is applied to the existing consent in order to modernise. It makes no logical sense to apply *Avoid and Mitigate* to the variation application which demonstrates positive effects.

We also refer to and extend of the best practice employed by Boffa Miskell in advising Meridian Energy on Harapaki Wind Farm consent variation application that was recently non-notified and approved by the Hastings district Council. The ratio of bat monitors deployed vs the number of turbines in that variation application is significantly lower than that deployed at Taumatatotara.

There are directly relevant aspects of the Boffa Miskell reporting including the avifauna flight height analysis and recommendations on non-notification that we draw upon in this report.

International data suggests that while the vast majority of bats killed are migratory species. Long-tailed bats (*Chalinolobus tuberculatus*) share behaviour common to all bats of being active when temperatures are above 9.5^{o}C and wind speeds are below 6m/s. Taumatatotara are offering to place bat detectors on up to four turbines with higher bat activity that will activate deterrents if bats are detected.

Recent publications and case law has reinforced the acceptance of focussing on a comparison of alternative scenarios (counterfactuals[1]) as well as a greater focus on qualitative assessment over further requests for additional quantitative data[2].

The qualitative outcomes of varying the consent for a reduced size of the Taumatatotara Windfarm including positive ecological effects and voluntary biodiversity actions are compared with the biodiversity outcomes of leaving the site undeveloped. The biodiversity outcomes are predicted to be higher with a windfarm plus pest control and wider area bat surveys which provide good potential to extend further remedy programmes.

[1] Bull, JW; Strange, N; Smith, RJ and Gordon A. 2020. Reconciling multiple counterfactuals when evaluating conservation impact in socio-ecological systems. Conservation Biology 35: 510-521.

[2] The use of modelling for terrestrial biodiversity offsets and compensation: a suggested way forward. Baber, M; Christensen, M; Quinn, J; Markham, J; Kessels, G; Ussher,G and Ross, RS. 2021. Resource Management Journal April 2021: 28-33.

2 Contents

3 Introduction

3.1 Scope

Green Inc Ltd and New Zealand Ecology have been contracted by Taumatatotara Wind Farm Ltd to respond to S92 requests from Waitomo District Council. Rather than enter a spiral of increasing data collection we offer a justification of an alternative process.

3.2 Site Location and Project Description

The proposed windfarm site is 10km south of Taharoa Village and above the Taumatatotara Gorge in the Waitomo District, and is located on farms owned by three separate landowners, all of whom have given their approval to the project. The site and the adjacent hills generally have very defined but level ridgelines with steep slopes on the flanks. The local peak to the northern end of the site has an elevation of 340m with the remainder of the site ranging between 300m and 320m at the southern end. The gradient of the construction site is moderate to steep with slopes generally between 1 in 20 and 1 in 5. The site is currently used for grazing cattle and sheep with a very small plantation of radiata pines (recently felled) at the location of turbine 7.

Ventus Energy was granted consent to construct a 22-turbine wind farm at Taumatatotara West Rd, Te Anga in 2008 (after an appeal to the Environment Court was withdrawn). All turbines were to be 110m high. Regional consents for earthworks were also granted by Waikato Regional Council but these have since expired. A new consent has been applied for and granted from the Regional Council.

In 2011 Ventus Energy applied for a change in the conditions of the 2008 consent to increase the turbine height of the northern 11 turbines to 121.5m. This was approved by the Council. A lapse date extension was applied for in 2016 for a further 8 years until 2024. This was also approved.

In line with trends elsewhere in New Zealand and internationally, TWF wishes to increase the tip height of turbines at its Taumatatotara site. The proposal is to increase the tip height above existing ground of the 11 northern turbines from 110m to 172.5m. A consequence of this increase is the deletion of the southern 11 turbines from the project, leaving a total of 11 turbines.

3.3 Potential Ecological Effects of Windfarms

Windfarms are considered to have potential effects during construction and during operation. Minimal biodiversity effects of construction were handled in the initial application that led to the granting of the consent. The existence and operations of turbines are also considered to have potential effects of displacement and blade strike leading to injury or death. For bats, barotrauma of rapidly changing air pressure has also been shown to affect some bats, primarily migratory species, at wind farms overseas.

The standard methodology is to observe which species of bird or bat are present in the wider landscape. Then for especially rare or threatened bird observations of flight patterns such as flight heights are recorded. Where activity provides sufficient quantitative data, this is put into the Band

Model[3] to estimate a likely strike rate. The size of a bird, its flight speed and flying height are the key inputs. Results from one situation in New Zealand should provide clear guidance for other sites.

For a minority of birds and possibly for bats, avoiding the immediate area of the turbines can happen but is likely to be a temporary and minor effect. Certainly in flight, birds avoid turbines.

Most ecological assessments create a tension of how much information is adequate to predict the level of effects and the eventual outcome. This tension comes to the fore when opponents and consenting authorities request more information. While it is possible to gain extensive data for a site and always collect more, the increase in outcomes can be trivial. A recent publication[4] has argued for the value of qualitative scenarios rather than just collecting greater amounts of information. This approach has been recognised in recent hearings. As seen in the following judgement in the Dome Valley hearing.

15.12.3 Adequacy of Offset/Compensation Modelling Approach

283. Offset/compensation modelling is a tool to assist in decision making processes. Some submitters (e.g. Forest & Bird) were critical of the qualitative approach taken by the applicant, highlighting that quantitative data could have been used instead if more assessments were carried out. Regarding frogs, bats, and lizards, we do not consider that further assessment work (e.g., radio-tracking for bats, further frog surveys, quantitative fish data) would have allowed for meaningful quantitative modelling that would further assist with decision-making. While the quantitative results of such further assessment may give the impression of increased precision, survey and monitoring data for the fauna groups concerned are inherently variable and difficult to interpret. The applicant's approach to this uncertainty was to adopt a conservative approach towards assessing effects and applying a comprehensive effects management package that seeks to achieve a net gain, which provides more confidence in at least achieving no net loss. We accept the applicant's approach.

3.3.1 Construction and Operational Effects

Noise and disturbance during construction can cause temporary displacement of some species. Others including fantail and New Zealand pipit (At Risk - Declining) can be attracted. Bats are unlikely to be affected as they are usually active outside of daily construction times.

3.3.2 Bird Strike and Displacement

Bird strike was a major feature of early windfarms in other countries. Migratory birds moving through narrow areas with old style lattice towers which offered perches, suffered high mortality. Large slow flying birds were also disproportionately killed. Measurement of bird flying heights fed into the Band Model showed that avoidance of individual turbines or even the whole windfarm is the most common response. As a consequence, the most influential part of the Band Model is the "avoidance rate". This is a measure of the number of birds flying at RS height that are not killed. The avoidance rate for most species is between 98 – 99.9%.

[3] as above

[4] Baber, M. Christensen, M, Quinn, J, Markham, J, Kessels, G, Ussher, G & Signal Ross, R. 2021. The use of modelling for terrestrial biodiversity offsets and compensation: a suggested way forward. Resource Management Journal April 2021: 28-33.

3.3.3 New Zealand Experience

New Zealand has a number of operational windfarms. Only a few have had post construction monitoring to determine the likelihood of avian fatalities from turbine blade strike. The results of the first two years of a three-year avian mortality monitoring programme at one of the few monitored sites, Project West Wind, are summarised in Table 1[5].

Table 1: Avian mortalities recorded during post construction monitoring at Project West Wind

Species	Threat Status	West Wind
Australasian Harrier	Native - Not Threatened	12
Paradise shelduck	Native - Not Threatened	5
Southern black-backed gull	Native - Not Threatened	4
Tui	Native - Not Threatened	2
Spur-wing plover	Native - Not Threatened	1
Fairy prion	Native - At Risk	1
Chaffinch	Introduced	6
Mallard	Introduced	4
Redpoll	Introduced	4
Finch sp.	Introduced	3
Yellowhammer	Introduced	3
Skylark	Introduced	2
Blackbird	Introduced	1
Dunnock	Introduced	1
Eastern rosella	Introduced	1
Goldfinch	Introduced	1
Greenfinch	Introduced	1
Song thrush	Introduced	1

A number of windfarms have been built or consented where it is known that New Zealand falcon (At Risk – Recovering) both nest and forage within the windfarm envelope. These include Mahinerangi, Turitea, Puketoi and others. The speed of falcon flight ensures that blade strike is very unlikely.

3.3.4 Bat Strike and Displacement

Considerable work has been done on bats internationally. Migratory bats are especially prone to barotrauma, where a rapid change in air pressure immediately adjacent to a turbine can cause trauma and death. Large bats tend to be found in large groupings and are slow flyers which makes them prone to blade strike. Hoary bats which are 2 – 3 times larger than New Zealand long-tailed bats make up the greatest number of bats killed in North America[6]. They are migratory which puts

[5]Bull, L. S., Fuller, S. A., & Sim, D. (2013). Post-construction avian mortality monitoring at Project West Wind. *New Zealand Journal of Zoology*, *40*(1), 28–46.

[6] Frick, WF; Baerwald, EF; Pollock, JF; Barclay, RMR; Szymanski, JA; Russel, AL; Loeb, SC; Medellin, RA & McGuire, LP. 2017. Fatalities at wind turbines may threaten population viability of a migratory bat. Biological Conservation 209: 172-177

them at risk of multiple windfarms. Research has confirmed that they are most active on warmer nights with temperatures above 9.5°C and at slow wind speeds of less than 6m/s.

Bat detection devices have been developed that can activate bat deterrence mechanisms at a turbine when bat activity is detected in the immediate vicinity. These work at frequencies that overlap those used by New Zealand bats[7].

3.3.5 New Zealand Operational Experience

Bats have been detected in the vicinity of a number of windfarms. Only one windfarm had a requirement for post construction monitoring. At Te Uku, a three-year program failed to detect any bat harm. Bat monitoring methodologies implemented at Te Uku included fortnightly carcass searches and acoustic monitoring. No long-tailed bat mortalities were detected during the fortnight searches conducted at eight study turbines over the three-year post-construction monitoring period. Statistical analysis of pre- and post-construction bat activity showed that there were no significant changes in bat activity due to the construction and operation of the turbines.

Department of Conservation records show multiple bat recordings in the wider area. Despite the presence of bats at many sites, predicted fatalities are close to zero. In the case of Harapaki, despite minimal (only 4) use of bat detectors and recording of bats, no negative effects were predicted.

4 Methodology

4.1 Birds

The standard methodology of five-minute bird counts[8] was undertaken on 15 February 2021 and 23 March 2021. Counts were done at the proposed location of all 11 turbines. This methodology would fail to detect occasional visitors.

Both counting days were warm with minimal wind and no rain.

In addition, the extensive radar monitoring[9] at the previously consented coastal site of Taharoa C was overlaid on a topographic map to assess whether any migratory shorebirds may be at risk.

4.2 Bats

A total of 17 AR-4 automated acoustic bat detectors (ABMs) were deployed at the consented turbine locations on 23 February 2021 (Appendix 1). ABMs could not be installed at five of the turbine sites due to a lack of suitable features (trees, fence posts, etc.) to install them in. The ABMs were retrieved on 15 March 2021 giving a total of up to 19 nights of recording.

The ratio of bat monitors to turbines at the recently consented Harapaki wind farm variation was 11 to 55 or **0.2** monitors/turbine whist the monitoring at Taumatatotara far exceeds that level at 17 to 11 or **1.55** monitors/turbine.

[7] Weaver SP, Hein CD, Simpson TR, Evans JW, Castro-Arellano I. 2020. Ultrasonic acoustic deterrents significantly reduce bat fatalities at wind turbines. Global Ecology and Conservation 24: e01099.
[8] Dawson, DG & Bull, PC. 1975. Counting birds in New Zealand forests. Notornis 25: 257-278.
[9] Fuller, S., McLennan, J., Dowding, J., Barea, L. & **Craig, J**. Assessment of potential avian mortality at the Proposed Taharoa wind farm, Taharoa Beach, Kawhia, Waikato. Pp125 (2009)

Weather data obtained from the nearby Aotea Harbour weather station indicated that substantial precipitation occurred on no more than five of the 19 nights, and minimum overnight temperatures never dropped below 12°C (bat activity tends to drop off below approximately 10°C).

The ABM datasets were analysed with BatSearch software (version 3.11). For each ABM, the total number bat passes were divided by the number of survey nights to calculate average bat passes per night as an index of activity. Bats were still active on nights with precipitation therefore data from those nights were not excluded from analyses. Two of the ABMs failed to operate correctly and did not record any data.

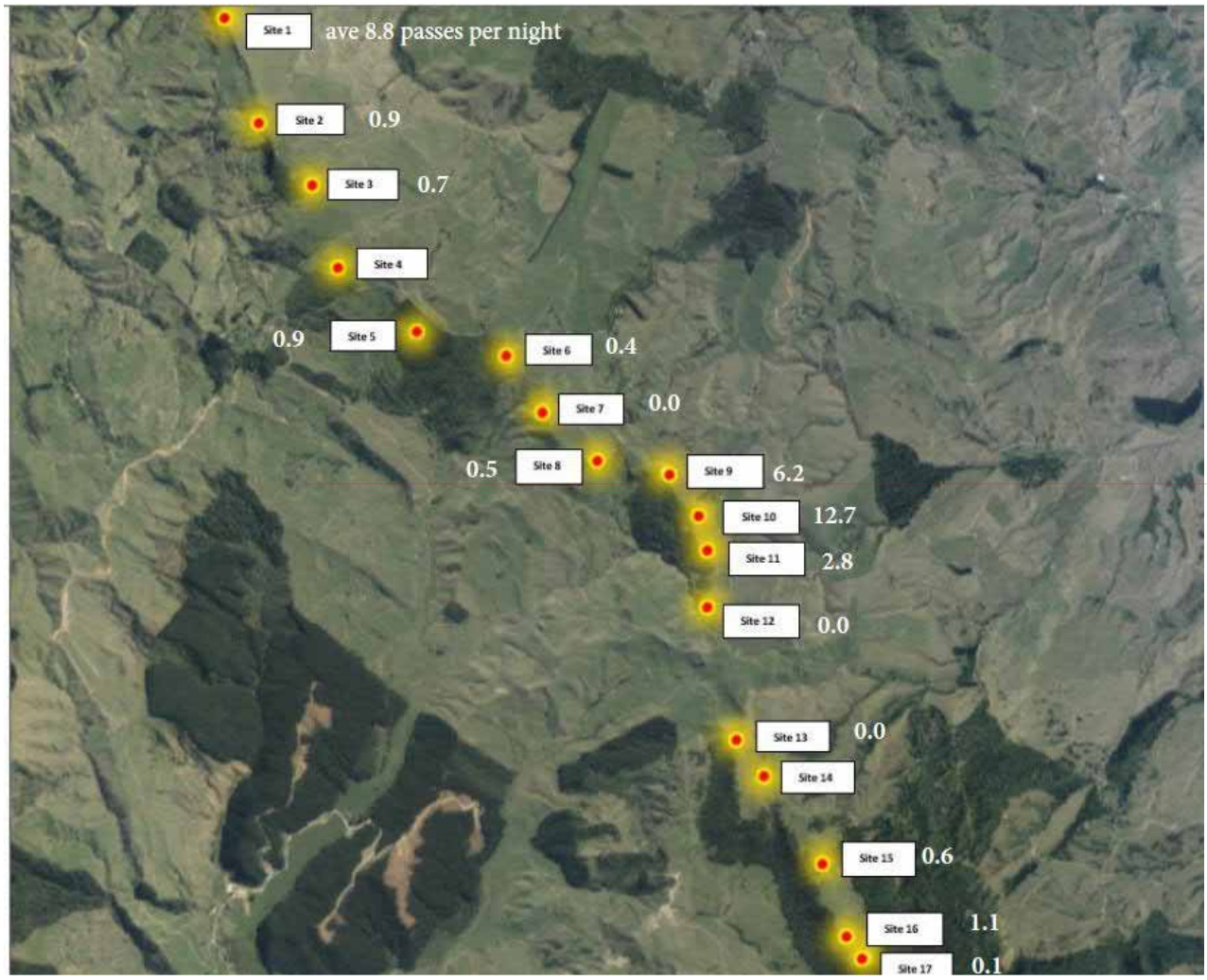

Figure 1: Bat monitoring locations (numbers provide average bat passes per night recorded at sites where units operated correctly).

5 Results

5.1 Significant Ecological Areas

There are no significant Ecological Areas recorded in the immediate area.

5.2 Birds

5.2.1 Species seen and heard

A total of 10 species were either seen or heard on site (). The most common species were Australian magpie, European goldfinch and welcome swallow. Common forest natives such as fantail, grey warbler, kereru and tui were less common.

Species	Threat status	Seen	Heard	Total
Australian magpie	Introduced & Naturalised	42	28	70
European goldfinch	Introduced & Naturalised	5	23	28
Canada goose	Introduced & Naturalised	4	0	4
Chaffinch	Introduced & Naturalised	0	3	3
Welcome swallow	Native & Not Threatened	27	0	27
Grey warbler	Endemic & Not Threatened	0	5	5
New Zealand fantail	Endemic & Not Threatened	1	3	4
Paradise shelduck	Endemic & Not Threatened	4	0	4
Tūī	Endemic & Not Threatened	0	2	2
Kereru	Endemic & Not Threatened	1	0	1

Other native species recorded as present in the initial AEE include kingfisher, Australasian harrier and silvereye. All of these species are Not Threatened. Only the harrier has a known history of blade strike. The AEE also records a sighting of falcon in the 1980's but none were seen or heard at the time of the original survey or the more recent survey.

Migratory waders are not known to cross the site (Figure 2). The results of radar monitoring at the previously consented Taharoa C site are represented on the topographic map in Figure 2 and verify that the movement of these birds do not overlap Taumatatotara. Note the figure includes the originally consented 22 turbines.

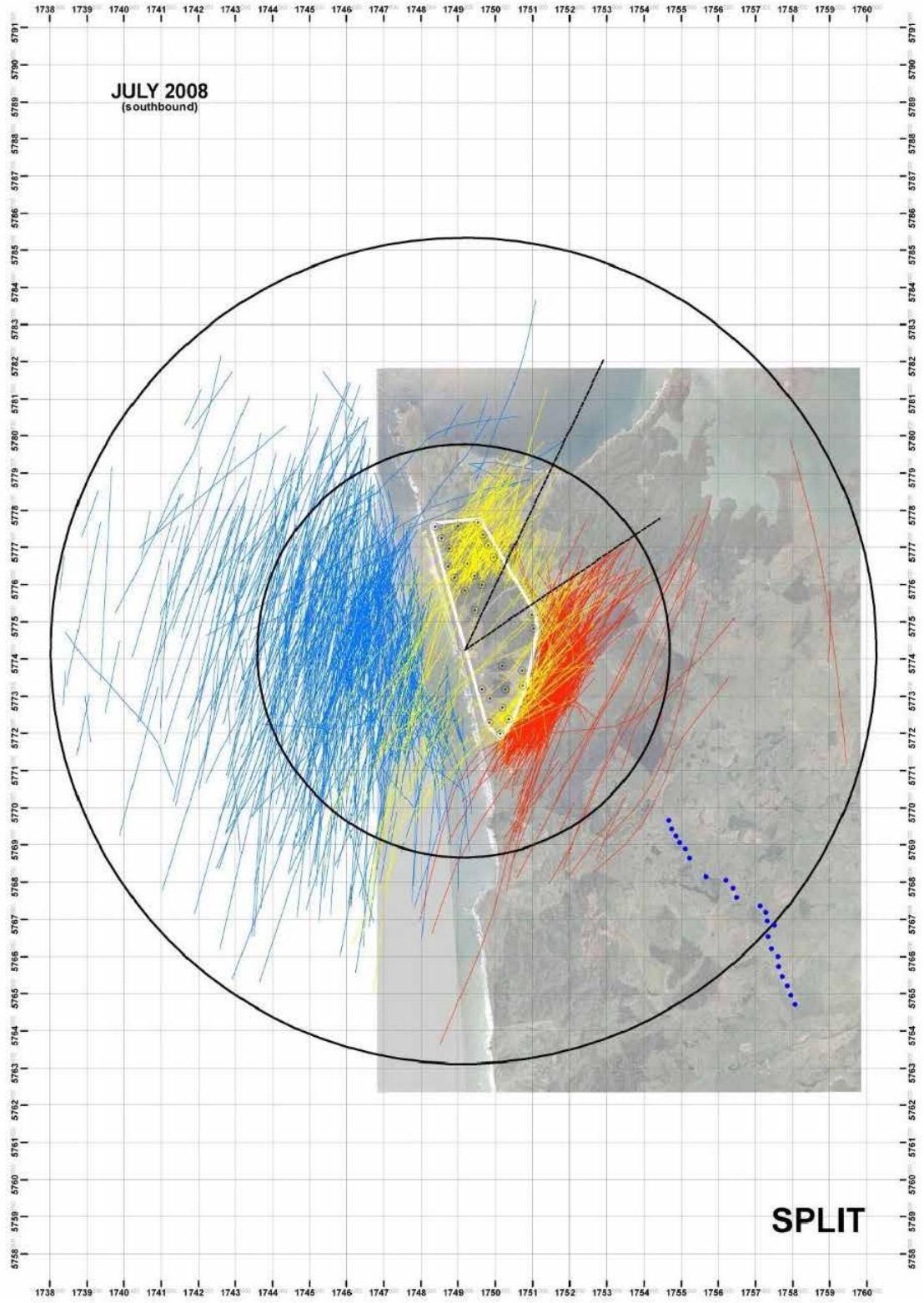

Figure 2 Shorebird flightpath lines with proposed Taumatatotara turbines in purple.

5.2.2 Flight Heights

Bird activity was low and recording flying heights was considered inconsequential.

5.2.3 Experience of other Windfarms

There is no record of Australian magpie being killed at West Wind but deaths have been recorded at other windfarms. It is likely that magpie will be killed but it is an introduced and unprotected species. Introduced finches such as the chaffinch and goldfinch are likely to suffer some deaths. Paradise shelduck have been killed at West Wind and other windfarms and it is likely that occasional deaths may occur. These are a game bird that can be shot during the duck shooting season. Canada geese are also likely to be killed but as these are considered a pest species and a game bird, if deaths happen this may be considered positively.

Welcome swallow is a native species and a recent arrival from Australia, but with small mass and high flying speed, deaths are unlikely. The remaining native species are endemic, uncommon and at most may contribute very occasional deaths. No deaths will have a population level effect even at a local level.

5.3 Bats

5.3.1 Species Detected and activity

New Zealand long-tailed bats were detected at 12 of the 15 sites where functioning ABMs were present. . Only two sites within the area of the proposed turbines (1 & 9) had more than 1 bat passes per night whereas three sites in the area previously proposed for turbines averaged more than one bat pass in a night. Only sites 1 and 9 are suggestive of further work or conditions requiring the fitting of bat deterrents.

Site #	Date deployed	No. of nights recording	No. of bat passes	Average bat passes per night
1	23/02/2021	8	70	8.8
2	23/02/2021	14	13	0.9
3	23/02/2021	11	8	0.7
4	23/02/2021	0 (failed)		
5	23/02/2021	16	15	0.9
6	23/02/2021	15	6	0.4
7	23/02/2021	15.5	0	0.0
8	23/02/2021	13	7	0.5
9	23/02/2021	20	123	6.2
Limit of	Proposed	turbines		
10	23/02/2021	20	253	12.7
11	23/02/2021	12	34	2.8
12	23/02/2021	20.5	0	0.0
13	23/02/2021	15	0	0.0
14	23/02/2021	0 (failed)		
15	23/02/2021	20.5	12	0.6
16	23/02/2021	15	17	1.1
17	23/02/2021	15.5	2	0.1

When considering further work and the quantum and patterns of the bat activity recorded, it is worth noting that bat activity patterns recorded at Taumatatotara are comparable with those recorded at Te Uku wind farm and many other site around New Zealand. For example, as with Taumatatotara, most Te Uku monitoring sites also had mean bat passes per night of between zero and one. Spikes in bat activity at some Te Uku monitoring sites in some years were commonly up to

five passes per night and even exceeded 25 mean passes per night at one site during the third year of monitoring. Despite having these higher levels of bat activity, no fatalities were recorded at Te Uku as noted above.

Another example is Titiokura Windfarm[10] and Hawkes Bay Wind farm (collectively known as Harapaki) where only 11 ABMs were used to assess bat activity on the fringes for an array of 55 turbines covering c. 4 x 7km. Three bat passes were detected at the fringe of the array in low wind speeds and the risk to bats at that site was considered low.

6 Ecological Significance

All Councils are required to determine Ecological Significance of areas for development. The criteria for "an area of significant indigenous vegetation or a significant habitat of indigenous fauna is an area or habitat whose protection contributes to the maintenance of indigenous biological diversity at the Ecological District level"[11]. The key issues here are the scale and the requirement of "maintenance" not just presence. In our opinion, maintenance, like protection, is only possible with pest control.

Criteria for assessment include Representativeness, Distinctiveness, Intactness, Size, Protected Status, Connectivity, Threat and Scientific or Cultural Value. The greater ecological area of the Taumatatotoara windfarm includes low quality pasture with small semi-isolated patches of unfenced and degrading forest.

Representativeness relates to the presence of an ecosystem that is now considerably reduced in relation to its former extent. This does not apply. Distinctiveness refers to the presence of rare or threatened species. This applies through the presence of long tailed bats which are classified as Threatened – Nationally Critical although given the more widespread recording of this species, this ranking is unlikely to remain. Some of the forest patches adjacent to turbine sites are larger than the minimum requirement of 5ha, none are fenced or receive pest control so they are not intact or of scientific value.

In conclusion, the assessment undertaken for the original consent and the subsequent variation remain unchanged. The pasture ridge tops where turbines will be sited cannot be of ecological significance but with remediation and pest control the forest patches will gain some ecological value.

7 Assessment of Ecological Effects of the Consented Wind Farm

It is relevant to update the assessment of effects of the consented wind farm due to the passage of time since the award of the consent (13 years) and any change in the best practice (as well as more information becoming available from the recent ecological monitoring. Effects can range from high to negligible or even positive.

[10] Boffa Miskell 2011. Meridian Wind Farm: review and completion check of baseline ecological studies. Report W11106 -003.

[11] Regional Policy Statement, Waikato Regional Council.

Loss of pasture where roads and turbines are placed. We assess that this would have no negative effect on habitat of native species although it will enhance habitat for New Zealand pipit which are not currently found in the area but may return. They appear preferentially attracted to gravel roads where there is pest control.

7.1 Potential Effects on Birds

Given the bird list for the area which is mainly introduced and open country species, effects of construction remain minimal. Indeed they will be reduced by the halving of the number of proposed turbines.
In relation to bird strike, it is worth listing known risks.

Risk factors	Taumatatotara Windfarm
Large concentration of turbines	Moderate scale at 22 turbines
Closely spaced turbines	No. There are gaps between turbines of at least 250m meaning the minimum gap between blade tips (for 111m rotor diameters) is over c. 140m
Turbine Array, which is more difficult to navigate between turbines	No. There is a single row along the ridge top.
Turbines are placed in saddles or steep sided valleys	No.
Turbines are on a known migration route	No
Turbines are adjacent to areas where birds congregate such as large wetlands or breeding colonies	No
Threatened or At Risk species are likely to regularly use the site	No
Turbine blade tips are close to the ground minimizing option of avoidance	No, blade tips will be higher at 17.5m above ground
Large prey base to attract birds of prey	No. Area will be used by harrier at times.

None of the known risk factors are present at Taumatatotara. The spacing of turbines and the minimum height of blade tips from the ground provide multiple options for avoidance for the few birds that are using the area. Moreover, the halving of the number of turbines along with the minor reduction in the cumulative rotor swept area from the currently consented windfarm provide a clear positive in relation to potential effects on birds.

For uncommon but possible visitors such as falcon, Band modelling from Puketoi windfarm[12] where they are common and nest within the proposed windfarm envelope showed that it would take in the vicinity of 36,000 flights at RSA height to result in one death. The reduction in the number of turbines and RSA further reduces the minimal risk.

[12] Evidence of J L Craig to Environment Hearing for Puketoi Windfarm.

7.2 Potential Effects on Bats

Long-tailed bats are in the local area and are recorded on ABMs placed within 1m of the ground. International literature on bats at windfarms shows that strike rates for migratory bats can be significant. Both direct hits and barotrauma can be lethal. In contrast, New Zealand's long-tailed bats do not migrate and are extremely small (8 – 11 grams). Data on their behaviour in open pasture locations such as Taumatatotara is unknown. Such a small bat flying above 17m over pasture is possible but highly unlikely.

In forest areas they do travel along road and other forest clearings when hunting. In windy conditions, it is unlikely that they would be flying above the ridge and certainly not at 10m above ground or tree level at this wind-prone site of the consented wind farm. Even in low wind conditions this is unlikely. Hence, the effect on bats from the turbines is likely to be negligible.

Similar conclusions have been reached at other proposed windfarms such as the Harapaki wind farm incorporating the Hawkes Bay Wind Farm and the Titiokura Windfarm. Despite the presence of an At Risk bird, the presence of a number of RAPS (Recommended Areas for Protection) nearby, low recordings of bats as well as an array design where there are potentially multiple turbines that birds would have to avoid, Boffa Miskell concluded that the variation of removing 40% of turbines while increasing ground clearance and RSA, all features in common with this application, was positive.

It is recommended that this assessment is checked after construction. ABMs should be attached at least 15m up the towers in the two areas where more than one pass per night was detected by ABMs placed 1m above ground level. In the unlikely event that bats are detected at this level, bat detectors that activate deterrent devices should be installed. A condition covering this mitigation is offered (see below).

Risk factors for bats	Taumatatotara Windfarm
Large concentration of turbines	Moderate scale at 22 turbines
Closely spaced turbines	No. There are gaps between turbines of at least 250m meaning the minimum gap between blade tips (for 111m rotor diameters) is over c. 140m
Turbine Array, which is more difficult to navigate between	No
Turbine blade tips are close to ground or tree tops	Moderately, there is a 10m clearance
Turbines are placed in steep sided valleys	No.

7.2 Avoid Remedy or Mitigate

The original assessment and consent conditions in 2008 considered avoiding, remedying and mitigating the ecological effects of the wind farm.

Since that time, further investigations have been carried out that demonstrate bat populations at the site but not extra bird populations.

There is also now in 2021 a greater moral expectation that infrastructure projects fund ecological restoration and enhancement projects far beyond the effects they generate.

The background ecological health and well-being of the site and environs has almost certainly degraded in that time.

Given these changes, it is proposed that three measures are added to the existing consent conditions relating to:

- **Monitoring and Deterrent Devices (*Mitigate*):** Further field assessment of bat presence will be undertaken during construction to determine the level of risk. ABMs will be situated at 15+m heights to detect if bats are flying well above ground level. If detected, bat deterrents will be added at 17m height on Turbines 1, 4, 7 and 11. Investigation and confirmation of the appropriate frequency of these devices has been carried out.
- **Bat Population Survey (*Remedy*):** the Developer is prepared to offer financial support for a wider investigation of bat populations in the area. A principal sum of up to $10,000 per year for 5 years is offered to support an investigation of bat populations in the wider area. This can be offered through a University research scholarship or other mechanism to be decided among the Developer, WDC and DoC. Whilst not strictly a *Remedy* the information can be used to effectively design *Remedy* programmes or publicized to enable landowners to *Remedy* at their discretion,
- **Pest Control (*Remedy*):** The operator offers to undertake intensive pest control over a minimum of 20ha of the two larger forest areas in the surrounding landscape to create biodiversity gains as has been proposed at other windfarms[13]. The pest control will include the two immediately adjacent forest remnants that need traps and bait stations to control major pests such as stoats, cats, rats and wasps. Fencing to exclude stock would also assist but needs approval of the landowners. These pests are far more deadly for birds and bats than wind turbines as shown in the following graphic from EV News 2020. Given that two bird species have gone from the area in the last 40 years, something needs to be done before 2050

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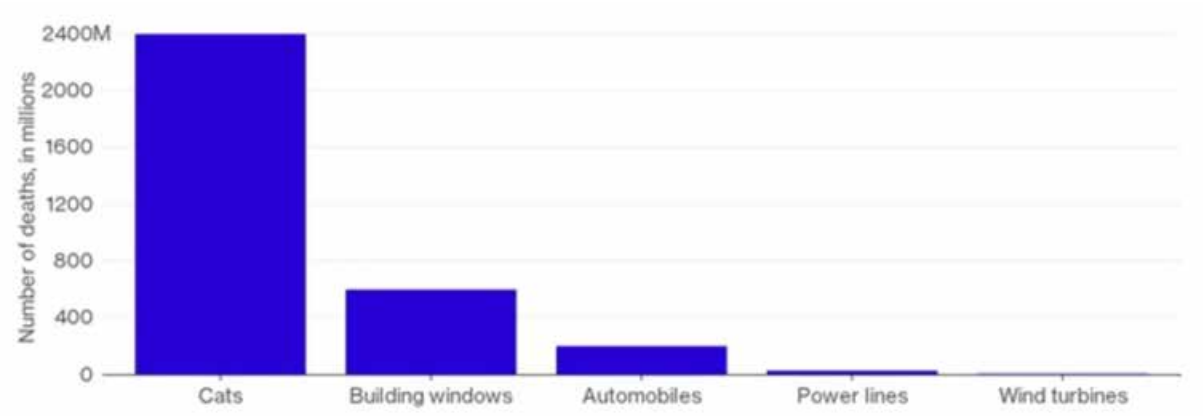

Avoiding effects in relation to a wind farm is principally related to not carrying out the activity or carrying it out in a different location and is not relevant to this assessment on the existing consented activity.

[13] Craig, JL; Kessels, G; Langlands, P & Daysh, S. 2015. Planning for net biodiversity gains: a case study of Hauturu ma raki Wind Farm, New Zealand. In: Wind and Wildlife. C. Hull et al. (eds). Springer.

8 Summary of the Level of Ecological Effects of the Variation

The following table is an updated view (from the modified consent approved in 2011) on the level of effects of the currently requested variation to the windfarm. This assessment with turbines halved to 11 and with an increased ground clearance of 17.5m, considers the historical information and reporting, supplementing with recent data collection plus consideration of the best practice reporting and investigations carried out

Ecosystem component	Ecological value	Magnitude of Effects	Overall Effect of Variation
Pasture	low	Negligible	Positive
Falcon	Moderate	Negligible	Positive
All other native birds	Low	Negligible	Positive
Long-tailed bats	High	Negligible	Positive

7.2 Avoid Remedy or Mitigate

The variation is considered an act of *Avoiding* effects due to the reduction in the number of turbines from 22 to 11 as well the increase in the ground clearance from 10 to 17.5m.

As the effects are entirely positive due to this variation (centred around the paradigm of *Avoid*) the drive to *Remedy* or *Mitigate* therefore do not arise.

9 Residual Effects from the Variation

9.1 Positives

- The number of turbines has been halved which reduces the number of sites where native fauna may be at risk. This is especially relevant to bats as three of the highest recording sites (10, 11 & 16) for bat passes will not have turbines in the revised design.
- The height of the towers has been raised increasing the avoidance gap between the blade tip and the ground.

Wind turbine diameter and ground clearance changes

Consent	Rotor diameter	Ground clearance
2008 original	100m	10m
2011 consented modification	111.5m	10m
2020 current application	155	17.5m

The increases in ground clearance sought are not dis-similar to the recently consented variation on the Harapaki Wind Farm, image below. Only two avifauna species were identified as being of

concern in that investigation – kereru and NZ falcon. Bats were not selected as species of concern and not considered for flight height analysis.

10 Alternative Scenarios or Counterfactuals

10.1 Site remains unchanged

New Zealand has a major biodiversity crisis. More than half of our bird species are Threatened or At Risk. Both our remaining bat species are the same. The greatest threat to these species is introduced mammalian pests and wasps. The current campaign of Predator Free 2050, the ongoing campaign by Forest and Bird to counter the estimated 72,000,000 bird deaths from introduced predators and the community efforts with fenced sanctuaries demonstrate the national appreciation of this problem. There is also a large amount of science has been published demonstrating the problem and offering solutions[14].

In comparison with the known effects of introduced pests such as stoats, weasels, ferrets, feral cats, rats and wasps, losses to wind farms are trivial. The risk to the biodiversity from the Taumatatotara windfarm is negligible compared to the biodiversity risk from introduced pests in the indigenous forest habitat of bats and birds in the locality of the windfarm. The threat from these pests is frequent, relentless and is a clear threat to local populations.

Currently the site and most of the wider ecological area is fully grazed and has no pest control. Forest remnants as described in the initial AEE are unfenced and grazed, are in mostly a poor state and are in decline. A low density of common forest bird species remain but bellbird and kokako reported in the 1980s[15] are no longer present. Long-tailed bats are still present but are likely to be at severe risk of local extinction from rats in particular. Ongoing decline is the only option for the future.

10.2 Wind farm with funded pest control and bat population monitoring

The developer of the proposed windfarm has not only reduced risks from the currently consented line of 22 turbines but has also proposed to put in a program of pest control that includes the adjacent forest remnants. The outcome will be enhanced native bird and bat populations. The return of bellbird is also possible with sufficient area of pest control. This commitment is formalised in a proposed condition.

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[14] www.predatorfreenz.org.nz
Craig, J, Anderson, S, Clout, M, Creese, R, Mitchell, N, Ogden, J, Roberts, M & Ussher, G. Conservation issues in New Zealand. Ann. Rev. Ecol & Syst 33: 61-78 (2000)
Craig, J; Moller, H; Norton, D; Saunders, D & Williams M. Enhancing our heritage: conservation for the 21st century New Zealanders: ways forward from the Tahi Group of Concerned Scientists. Pacific Conservation Biology 19: 256-269 (2013)

[15] Moynihan, KT. 1986. Wildlife and Sites of Special Wildlife Interest in the Western Waikato Region. Fauna Survey Unit report No 41, Wildlife Service, Dept of Internal Affairs, Wellington.

That this approach works and native bird populations increase and species return is easily demonstrated in major unfenced sanctuaries run by the Department of Conservation and private unfenced sanctuaries such as Tahi Estate[16].

11 Conclusions

The variation to consent conditions at Taumatatotara will have clear positive effects. The number of turbines is halved from the previously consented wind farm and the clearance area under the blades will be increased.

The proposed outcome with associated pest control and bat population survey offers a future for the biodiversity of the area as distinct from the ongoing decline without the windfarm.

Suggested S92 requirements for gathering further data offer no discernible advantage and only serve to delay the chance of biodiversity enhancement.

12 Proposed Conditions

The proposed conditions are to modernise the consent which was awarded in 2008. The variation application of reducing the number of turbines and increasing ground clearance will have an obvious positive environmental effect.

The Applicant is happy to accept the existing conditions 37 – 46 (Appended) but offers the reworded conditions 1 – 3 below as possible alternatives.

We have taken the suggested conditions for the Harapaki Wind Farm project (copied below) and modified them for Taumatatotara. We have then gone further than those conditions and offered condition 4 (bat deterrent) and condition 5 (pest control) and 6 (bat population survey).

Candidate areas for pest control attention was provided in the Ecology NZ memo dated Dec 2020 – we attach that map for ease of reference. Should the councils advisers have a view on a particular area then the applicant is interested to listen.

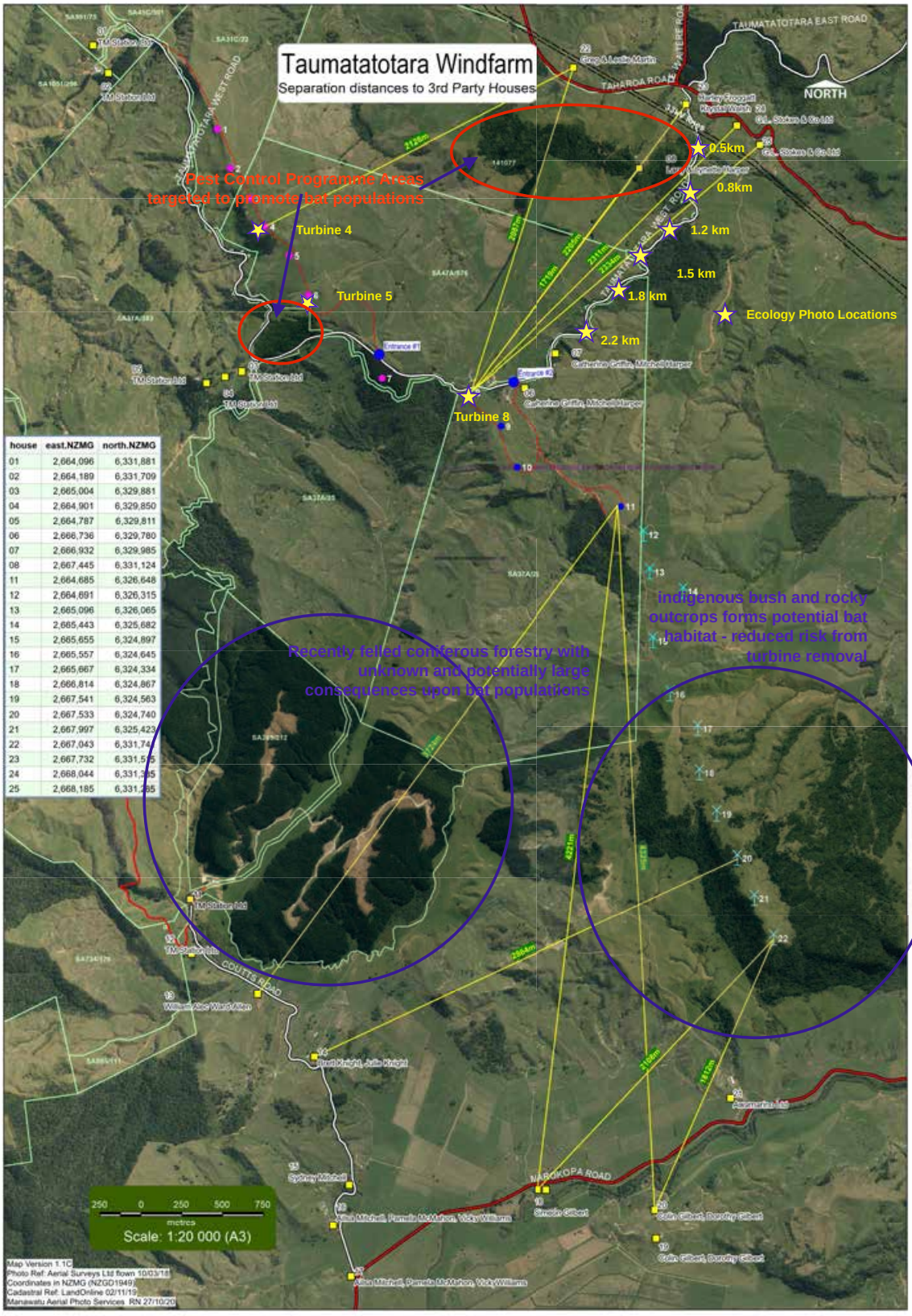
In this way the best practise deployed by Boffa Miskell and accepted by the Hastings District Council is extended:

1. The consent holder shall record and report any evidence of bird strikes detected post-construction. Should a bird species listed in the Department of Conservation's most current threatclassification system as Threatened or At Risk at the time be found injured or dead at the site, the Director General of Conservation and the Waitomo District Council is to be notified immediately and the bird provided to the Director General of Conservation or its nominated agent for autopsy or rehabilitation.
2. If in the opinion of a suitably qualified avifauna expert, any monitoring required under Condition 1 identifies a significant adverse effect from the operation of the wind farm or any individual turbine on species listed in the Department of Conservation's most current threat

[16] www.tahinz.com

classification system as Threatened or At Risk at the time, the consent holder shall discuss the findings with the suitably qualified avifauna expert and, if necessary, determine and implement areasonable course of action to mitigate those effects. The consent holder shall inform the Departmentof Conservation and report to the Waitomo District Council regarding this condition.

3. The applicant shall forward bat records to the Department of Conservation.
4. Immediately after construction, the consent holder shall attach automated bat detectors to turbines 1, 4, 7 and 11 at a height of at least 15m. Results are to be analysed in relation to wind speed after 12 months of data collection. Then one bat deterrent device shall be deployed to the turbine that recorded the highest bat activity and operated for a period of 2 years. A report on the devices effectiveness shall be written by avifauna specialist and supplied to the Council and the Department of Conservation.
5. The Consent Holder provide a biodiversity enhancement plan that includes pest control over 10Ha. At a minimum this will include sustained pest control within these remnants with a minimum of a double DOC 200 boxed trap and a Steve Allen trap for every 10ha plus at least an equal number of Philproof (or equivalent) bait stations positioned at 50m spacing. Bait stations are to be run with alternating baits for rats and possums at least twice yearly and traps are to be checked and rebaited at least every 4 weeks in spring and bimonthly for the rest of the year. This condition will apply for the life of the windfarm.
6. A principal sum of up to $10,000 per year for up to 5 years is committed to support an investigation of bat populations in the geographical area running from Marokopa, Te Anga, Te Waitere and Taharoa. This will be offered through a University research scholarship or other mechanism to be decided among the Developer, WDC and DoC.



house	east.NZMG	north.NZMG
01	2,664,096	6,331,881
02	2,664,189	6,331,709
03	2,665,004	6,329,881
04	2,664,901	6,329,850
05	2,664,787	6,329,811
06	2,666,736	6,329,780
07	2,666,932	6,329,985
08	2,667,445	6,331,124
11	2,664,685	6,326,648
12	2,664,691	6,326,315
13	2,665,096	6,326,065
14	2,665,443	6,325,682
15	2,665,655	6,324,897
16	2,665,557	6,324,645
17	2,665,667	6,324,334
18	2,666,814	6,324,867
19	2,667,541	6,324,563
20	2,667,533	6,324,740
21	2,667,997	6,325,423
22	2,667,043	6,331,74[illegible]
23	2,667,732	6,331,5[illegible]
24	2,668,044	6,331,[illegible]
25	2,668,185	6,331,[illegible]

Appendix 1. Current Ecological and Wildlife Conditions

Reporting:

41. An annual report, detailing the information required in conditions 37 – 40 above shall be provided to Waitomo District Council and the Department of Conservation. Any unidentified species remains recovered shall be referred to the Department of Conservation for identification as soon as is practicably possible following their discovery.

Bird Perches

42. No telecommunications devices or signs shall be connected/attached to any part of the turbines and/or the accessory structures.

43. With the exception of the transmission lines connecting the substation to the existing transmission lines, all other intra project lines within the wind farm shall be underground.

44. The turbine towers shall be tubular in design.

17.8 Ecological Effects

Native Vegetation

45. The clearance and trimming of native vegetation associated with the wind farm activities shall be restricted to the minimum area required to undertake the road realignment works, and any realignments of the power line routes. In particular, the consent holder shall avoid the removal of pole stand Rimu where practicable.

46. The consent holder shall develop and implement a weed control programme for the site and access roads, to the satisfaction of Council, and for the first 2 years of operation.

17.7 Effects on Wildlife

Register

37. The consent holder shall keep a register of observations of effects of the wind farm activities on wildlife. This will include evidence of turbine strike (with species, date, weather conditions and other relevant observations), notes of avoidance behaviour observed, and other observed interaction of wildlife with the wind farm. Ground inspections with nil results should also be recorded. The register shall be maintained for the life of the consent, and shall be made available to Council within 2 working days of its request.

Inspections

38. In accordance with Condition 37 above, all wind farm personnel will inspect the area around the turbine bases when visiting or passing by a turbine, throughout the life of the consent, for evidence of wildlife mortality.

39. The consent holder shall undertake dedicated inspections of all turbine bases for evidence of wildlife mortality at monthly intervals for the first two years of operation. If construction is staged, later turbines shall also continue to be inspected for a full two years.

40. If no significant adverse effects on wildlife are evident then dedicated inspections shall be discontinued, with the prior approval of the Manager, Policy and Planning, Waitomo District Council.

If a significant adverse effect is found (through dedicated monitoring or other monitoring) then monthly inspections shall continue in the interim and a plan developed, to the satisfaction of the Manager, Policy and Planning, Waitomo District Council and in consultation with the Department of Conservation, acting reasonably, to address the effects. Such a plan shall propose a monitoring regime and identify methods and options to avoid, remedy or mitigate the adverse effects. Specifically excluded from a plan will be any modification or restriction on the operation of the wind turbines.

Appendix 3: Rotor area.

T4 Turbine Rotor Area

	TURBINES 1	TO 11			TURBINES 12	TO 22	
	Diameter	Area	no.	Area	Diameter		No.
Original - 2008	100	7850	11	86350	100	7850	11
2011 Consent modificatior	111.5	9759	11	107352	100	7850	11
APPLIED FOR 2020	155	18860	11	207456	0	0	0
Diameter to get for parity	150	17663	11	194288	0	0	0

Ground clearance	m
Original - 2008	10
2011 Consent modificatior	10
APPLIED FOR 2020	17.5

Appendix 3: Photographs of Taumatatotara Site