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# MEMORANDUM

**Attention:** Glenn Starr, Ventus Energy (NZ) Limited

**Date:** 30 June 2020

**From:** Simon Chapman, Principal Ecologist

**Subject:** Taumatatotara (T4) Wind Farm – Ecological Assessment of Increased Turbine Height, Increased Rotor Diameter, and Reduced Number of Turbines

Dear Glenn,

## INTRODUCTION

This memorandum provides an ecological assessment of the proposal to increase the maximum tip height and rotor length of the turbine blades at the yet-to-be-constructed Taumatatotara (T4) Wind Farm. As part of the revised application, the number of turbines will be reduced from 22 to 11. The resource consent for the project allows for a maximum turbine blade tip height of 110m for 22 turbines. Turbine technology has advanced rapidly since consent was granted. Taller turbines with longer blades and greater ground clearance have been developed to increase turbine efficiency and reduce ecological effects. An increase in maximum allowable turbine blade tip height from 110m to 172.5m, and an increase in maximum rotor diameter from 100m to 155m, is proposed for Turbines 1 to 11 so that the T4 wind farm can be constructed using up-to-date turbine technology. Turbines 12 to 22 have been removed from the application.

## ASSESSMENT OF ECOLOGICAL EFFECTS

The primary potential adverse ecological effects of the T4 wind farm are bird and bat death and injury resulting from direct strike by turbine blades. Barotrauma (i.e., injuries or deaths resulting from changes in air pressure) poses an additional risk to any bats that fly too close to turbines.

Given that consent has already been granted for turbines with maximum blade tip height of up to 110m, this assessment is focused on assessing the effects of the 62.5m increase in maximum blade tip height to 172.5m. While an increased blade tip height is proposed, I understand that ground clearance (the distance from ground level to the blade tip at the lowest point) would remain the same with taller turbines and larger rotor diameter.

International literature regarding the ecological effects of wind farms on birds and bats focuses almost entirely on wind farm location and the configuration/positioning of individual turbines. For example, the European guidelines[1] for consideration of bats in wind farm projects makes no mention of factors such as turbine size or blade length or tip height. A review of the impacts of wind farms on birds published by the New Zealand Department of Conservation concluded that it is unknown whether larger turbines cause increased bird mortality[2].

I could only find one study that specifically investigated the influence of turbine dimensions on bird and bat fatalities[3]. That study concluded that turbine rotor dimensions did not influence the rate of bird or bat fatality. Turbine height also had no effect on bird fatalities. While the study concluded that increasing turbine height may increase the risk of fatalities of migrating bats, it is important to note that New Zealand's bat species are non-migratory. On that basis, I predict that the risk of long-tailed bats encountering turbine blades and/or zones of higher/lower air pressure) would remain unchanged with the proposed increase in turbine size.

A comprehensive meta-analysis of international literature relating directly to the impacts of wind farms on birds and bats concluded that a smaller number of large turbines resulted in lower predicted mortality rates for birds and bats compared with a greater number of small turbines[4]. That conclusion indicates that in the unlikely event of an increase in impacts on birds and bats resulting from increased turbine size, the ecological benefits of a 50% reduction in turbine numbers will vastly outweigh any negligible increases arising from larger turbines.

The most commonly used approach to estimate bird fatalities at wind farms is strike risk modelling, with most widely used model being the "Band Model"[5]. The Band Model is used to estimate the number of birds that will be killed as a result of collision with rotating turbine blades. While turbines with different dimensions theoretically have differing risk of collision, fatality estimates based on the Band Model are consistently more sensitive to avoidance rate as by far the most influential factor in fatality estimates. On that basis, comparisons of bird fatalities estimated using the Band Model for different turbine designs would not be useful in this case.

## CONCLUSION

In my opinion, the potential adverse ecological effects of increasing the maximum turbine tip height from 110m to 172.5m and increasing the rotor diameter from 100m to 155m are likely to be negligible at most. While bird and bat fatalities are unlikely to change with increased blade tip height and rotor diameter, the 50% reduction in turbine numbers is highly likely to reduce fatalities, which would be a positive ecological benefit overall.

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[1] Rodrigues, L., Bach, L., Duborg-Savage, M.J., Karapandza, B., Kovac, D., Kervyn, T., Dekker, J., Kepel, A., Bach, P., Collins, J. & Harbusch, C. (2014) Guidelines for consideration of bats in wind farm projects - Revision 2014. EUROBATS Publication Series 6.

[2] Powlesland, R.G. (2009). Impacts of wind farms on birds: a review. Science for Conservation 289, Department of Conservation, Wellington. 53pp.

[3] Barclay, R.M., Baerwald, E.F. and Gruver, J.C. (2007). Variation in bat and bird fatalities at wind energy facilities: Assessing the effects of rotor size and tower height. Canadian Journal of Zoology 85:381–387.

[4] Thaxter, C.B., Buchanan, G.M., Jamie, C., Butchart, S.H.M., Newbold, T., Green, R.E., Tobias, J.A., Foden, W.B., O'Brien, S., Pearce-Higgins, J.W. (2017). Bird and bat species' global vulnerability to collision mortality at wind farms revealed through a trait-based assessment. Proc. R. Soc. B Biol. Sci. 284: 20170829.

[5] Band, W., Madders, M., and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. In: de Lucas M, Janss GFE, Ferrer M eds. Birds and wind farms: risk assessment and mitigation. Madrid, Quercus. Pp. 259–275.

Should you require any further information please do not hesitate to contact me on 021436841 or at simon.chapman@ecologynz.nz.

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