Mr John von Mayer
Senior Environmental Consultant
Savannah Environmental (Pty) Ltd
Tel: +27 11 656 3237
Fax: +27 86 684 0547

5 September 2016,

RE: PROPOSED AMENDMENT TO AUTHORISATION FOR CASTLE WIND FARM - AVIFAUNA

Dear John,

WildSkies Ecological Services (Pty) Ltd previously conducted pre-construction bird monitoring, scoping and EIA assessment for the Castle Wind Farm (Smallie, 2014).

Castle Wind Farm would now like to apply for an amendment to their authorization as follows:

Current	New
3.5 MW turbines	4.5 MW
120 m Hub Height	130 m Hub Height
132 m rotor diameter	150 m rotor diameter
54m to 186m = rotor zone (above ground)	55m to 205m rotor zone (above ground)

During September 2016, WildSkies was asked to write a brief report to "describe whether the significance of any of the impacts identified in our EIA studies would change with the new turbine specifications".

Our previous findings were as follows:

- Formal assessment of the significance of impacts on avifauna, according to criteria supplied by Savannah Environmental, resulted in habitat destruction, disturbance of birds, and displacement of birds being rated as MEDIUM significance. Collision of birds with turbines was rated as LOW significance, and collision or electrocution on the grid connection power line was rated as MEDIUM-HIGH significance.

The proposed amendment will have no bearing on the significance of habitat destruction (since the total area of habitat removed remains the same), disturbance of birds, displacement of birds, and

collision/electrocution on power lines. The only impact that could be affected by the amendment is that of collision with turbines.

There are two main factors to consider in assessing the difference that the amendment will make:

1. **Height above ground of rotor**

The table below shows the original findings on bird flight height above ground, per species. The proposed change to the turbine model and the effect on the height above ground of the rotor zone will make very little difference to the previous findings, since most recorded bird flights were well below rotor zone anyway. In one case, Verreaux's Eagle, most flights recorded were above the rotor zone, and would not have been at risk with the original turbine model. Only one flight record would have been at risk with the new turbine model but was not at risk with the original model.

We conclude that the change in the rotor zone height above ground (from 54-186m, to 55-205m) as a result of the change in turbine model would have no material effect on our original findings.

2. **Total area of risk window posed by the rotors**

The original turbine authorised previously, with a 132m rotor diameter, presented a bird collision risk window of 54 739.11m² per turbine. The change to a 150m rotor diameter will increase the collision risk window presented by each turbine to 70 685.83m². This represents an increase in the area of collision risk window of 29.1%. Since the number of turbines will remain the same (31) under the proposed amendment, the overall collision risk window of the wind farm will increase by 29.1%.

This is a significant increase in risk window at face value. However, based on the actual data collected on site, the majority of bird species do not fly through this risk window anyway. The change in risk window presented by turbines is of no consequence if birds do not fly through it anyway. Only 7 species were recorded flying more than once in 192 hours of observation. This is an exceptionally low flight activity. Three of these species were Red Listed: Verreaux's Eagle (7 records - Vulnerable); Karoo Korhaan (3 records - Near-threatened); and Ludwig's Bustard (2 records - Endangered). These species are at low risk of collision based on data collected on site.

We (Smallie, 2014) recorded 15 bird species flying on site, mostly at very low frequency. These are shown in the table below:

Species	EIA finding – Smallie, 2014 Passage rate	EIA finding – Smallie, 2014 Flight height	Implications of proposed amendment
Verreaux's Eagle *Aquila verreauxii* (Vulnerable)	7 records in 192 hours or 0.04birds/hr	4 of 7 records above 186m (rotor zone) Mean 189.3m	Minor change, mean flight height within rotor zone now 3 of 7 records above 205m (rotor zone)
Northern Black Korhaan *Afrotis afraoides*	35 records or 0.18 birds/hr	100% of records below 54m	No change 100% of records below 55m
Karoo Korhaan *Eupodotis vigorsii* (Near-threatened)	3 records or 0.02birds/hr	10m, 20m, 80m – mean 36.7m	No change
Ludwig's Bustard *Neotis ludwigii* (Endangered)	2 records or 0.01birds/hr	80m & 50m, mean 65m	No change
Pale Chanting Goshawk *Melierax canorus*	12 records or 0.06birds/hr	100% below 54m, mean 10.5m	No change 100% below 55m
Jackal Buzzard *Buteo rufofuscus*	2 records or 0.01birds/hr	40m, 100m	No change
Booted Eagle *Hieraaetus pennatus*	2 records or 0.01 birds/hr	All flights below 54m, mean 26.6m	No change All flights below 55m rotor
Black-chested Snake Eagle *Circaetus pectoralis*	1 record or 0.01birds/hr	30m	No change
Secretarybird *Sagittarius serpentarius* (Vulnerable)	1 record or 0.01birds/hr	3m	No change
Yellow-billed Kite *Milvus migrans*	1 record or 0.01birds/hr	100m	No change
Lanner Falcon *Falco biarmicus* (Vulnerable)	1 record or 0.01birds/hr	20m	No change
South African Shelduck	8 records or	15m, 10m, 40m,	No change

Tadorna cana	0.04birds/hr	80m Mean of 36.3m	
Egyptian Goose *Alopochen aegyptiaca*	8 records or 0.04birds/hr	10m to 80m, mean 36.3m	No change
Black-headed Heron *Ardea melanocephala*	1 record or 0.01birds/hr	15m	No change
Spur-winged Goose *Plectropterus gambensis*	1 record or 0.01birds/hr	30m	No change

Examination of available international literature on the relationship between turbine size and bird fatalities revealed the following:

- Everaert (2014) concluded that in the Netherlands no significant relationship could be found between rotor swept area and fatalities.
- Barclay *et al* (2007) analysed data from multiple sites in North America and concluded despite the expectation that as rotor swept area increases so would more birds and bats be killed, this is not substantiated by data.
- Barrios & Rodrigues (2004) concluded that 'tower structure' had little effect on bird mortality, unless in combination with other factors (such as bird abundance)

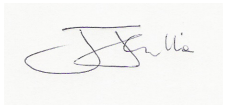
Although not an exhaustive literature review, this does point towards the proposed amendment having little effect on the original findings.

In summary, we conclude that the proposed amendment does not substantially alter the risk to avifauna, and does not change the significance of the impacts as previously assessed. The significance of collision of birds with turbines remains of LOW significance. As a result there is no need for additional mitigation as a result of the proposed amendment.

Please don't hesitate to contact us if you require further clarity in this regard.

Kind regards

C: 082 444 8919 | F: 086 6155654 | Email: jon@wildskies.co.za | W: www.wildskies.co.za
36 Utrecht Avenue, Bonnie Doon, East London, 5241
WildSkies Ecological Services (Pty) Ltd | Reg: 2011/131435/07 | VAT: 4340260779



Jon Smallie

Barrios, L., Rodríguez, A., 2004. Behavioural and environmental correlates of soaring-bird mortality at on-shore wind turbines. J. Appl. Ecol. 41, 72–81.

Barclay R.M.R, 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.

Everaert, J. 2014.Bird Study (2014) 61, 220–230, http://dx.doi.org/10.1080/00063657.2014.894492.

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