Arcus GIBB (PTY) LTD

Environmental Impact Assessment for the Establishment of the Caledon Wind Farm, Western Cape Province

Environmental Scoping Report
Bird Impact Assessment Study

Date: November 2009
EXECUTIVE SUMMARY

Caledon Wind plans to construct a 300 MW wind facility in Caledon in the Theewaterskloof Municipality in the Western Cape Province. The size of the Caledon wind facility is expected to be 300 MW and will comprise of approximately 150 wind turbines, 2 MW each in size, covering an area of around 3750 hectares. Apart from the turbines, the wind facility will also require the construction of a 132kV power line to link the facility to the national electricity grid. Associated infrastructure that will be required includes access roads from the wind farm to the main roads and navigation lights (for aircraft) mounted on the top of the wind turbines. Activities that will be required for the construction phase of the project include the abstraction of water and the storage of fuels for construction vehicles and machinery.

The natural vegetation in the study area consists primarily of renosterbos, which forms part of the fynbos biome, and is of importance for the Red listed Black Harrier and Denham’s Bustard. The study area has undergone extensive transformation and the majority of the land cover currently consists of dry land cereal crops and pastures. This habitat is of specific importance to the endemic, Red listed Blue Crane, as well as the Red listed Denham’s Bustard, and Agulhas Long-billed Lark.

The following impacts are potentially associated with the wind facility itself:

- Disturbance of breeding birds during the construction phase, particularly Red listed Blue Crane and possibly Denham’s Bustard.
- Sterilisation of breeding and foraging habitat by the operation of the wind facility, particularly for Blue Crane and Denham’s Bustard.
- Collisions with the wind turbines during the operational phase, particularly raptors of several species and possibly Red listed Agulhas Long-billed Lark.

These aspects will be further explored in the EIA phase report, and appropriate mitigation measures will be suggested, where and if necessary/possible.

The following impacts could potentially be caused by the associated infrastructure:

- Collisions with the guy wires of the wind mast. This impact is not envisaged to be significant.
- Potential impacts of the lighting on the wind turbines. This impact is not regarded as significant.

In the Overberg, power line collisions have long been recorded as a major source of avian mortality. Most numerous amongst power line collision victims are Blue Crane and Ludwig’s Bustard. It has recently been suggested that as many as 10% of the Blue Crane population in the Overberg are killed annually on power lines, and figure for Denham’s Bustard might be as high as 30% of the Overberg population. These figures are extremely concerning, as it represents a possible unsustainable source of unnatural mortality.

The impact of power line collisions is potentially a much bigger than that of the wind facility itself, and will require further investigation during the EIA phase of the project.
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Figure 3.1. Radar tracked movement of ducks and geese relative to an offshore wind facility in Denmark. Scale bar = 1000m.
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APPENDICES

Appendix 1: Satellite image of the study area
Appendix 2: Photographs of the micro-habitat in the study area
1 INTRODUCTION

1.1 Background

Caledon Wind plans to construct a 300 MW wind facility in Caledon in the Theewaterskloof Municipality in the Western Cape Province. The size of the Caledon wind facility is expected to be 300 MW and will comprise of approximately 150 wind turbines, 2 MW each in size. The hub height will be 80 m and the turbine blade length 40 m. The wind facility will span several properties, which are adjacent or connected to each other (see Appendix 1 for a satellite image of the study area). Apart from the turbines, the wind facility will also require the construction of a 132kV power line to link the facility to the national electricity grid. Some of the associated infrastructure that will be required includes access roads from the wind facility to the main roads and navigation lights (for aircraft) mounted on the top of the wind masts. Activities that will be required for the construction phase of the project include the abstraction of water and the storage of fuels for construction vehicles and machinery.

Chapter 5 of the National Environmental Management Act (NEMA) (Act 107 of 1998) requires that an Environmental Impact Assessment (EIA) is conducted for the proposed development. Arcus Gibb was appointed by the proponent as independent impact assessment consultants to manage the EIA process. They in turn appointed Chris van Rooyen Consulting to investigate the potential impacts that the proposed facility could have on birds. This scoping report is the first of two reports which will address the issue of potential bird impacts.

1.2 Scope and Limitations

The terms of reference for this bird impact scoping report are as follows:

- description of existing environment, bird communities and micro habitats;
- description of potential impacts;
- indication of confidence levels and gaps in baseline data;
- the identification of issues that require further investigation during the EIA phase.

The following limitations need to be pointed out:

- Little long term, verified data is available of species distribution on micro-habitat level in the study area.
- This study made extensive use of data from the Atlas of southern African Birds (ASAB) (Harrison et al., 1997). For a full discussion of potential inaccuracies in ASAB data, see Harrison et al. (1997). It is important to note that the quarter degree squares (1:50 000 map units) in the study area were not equally well covered during the bird atlas period, which means that the reporting rate of species should not necessarily be taken as an accurate representation of densities on the ground as it was at the time of the atlas project. Reporting rates were therefore approached with appropriate caution, especially those squares that were not extensively covered during the atlas period. It should be noted though that the two relevant quarter degree squares, namely 3419AA and 3419AB, were relatively well covered, with 316 and 174 checklists completed respectively for each square.
• Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will hold true under all circumstances. However bird interactions with electrical infrastructure, especially power lines, can be predicted with a fair amount of certainty based on experience gained by the author through the investigation since 1996 of hundreds of localities in southern Africa where birds have interacted with electrical infrastructure.

• Wind facilities are a relatively new development in South Africa. An extensive body of knowledge of avian interactions with wind generation facilities in a southern African context has yet to emerge; therefore strong reliance had to be placed on studies from overseas. Some speculation with regard to how certain species of southern African birds are likely to interact with the proposed wind facility was therefore unavoidable.

1.3 Methodology

The following data sources were consulted for purposes of the study:

• Detailed satellite imagery from Google Earth and aerial photographs were used in order to view the study area on a landscape level and to help identify bird habitat on the ground.

• Atlas of southern African Birds (ASAB) (Harrison et al., 1997) species lists and vegetation classifications of each of the quarter degree squares (or 1: 50 000 map units), within which the study area is located were obtained from the Avian Demography Unit at the University of Cape Town. These were used to determine which sensitive species could potentially occur in the study area.

• The area was visited to obtain a first-hand perspective of the proposed habitat and birdlife. An attempt was made investigate the total study area as far as was practically possible, and to visit potential sensitive areas identified from Google Earth imagery.

• Bronwyn Botha, The Endangered Wildlife Trust field worker in the Overberg, was consulted in order to gain more information on crane movement and habitat preferences. Additional information was acquired from Hennie Lötter, one of the affected landowners.

• Relevant literature on bird impacts associated with wind facilities, both published and unpublished, was consulted on the habitat preferences of the species occurring in the area, as well as on the envisaged impacts of the proposed power facility on these species and birds in general (see section 10: References).

• The conservation status of all recorded bird species occurring in these two quarter degree squares was determined with the help of The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Barnes, 2000).

• The power line bird mortality incident database of the Eskom - Endangered Wildlife Trust Strategic Partnership (1996 to 2007) was consulted to determine which of the species occurring in the study area are typically impacted upon by power lines.

• A classification of the vegetation types in each quarter degree square was obtained from Harrison et al. (1997).
1.3.1 Study Area Sensitivity Analysis

In the tables below, the habitat in the study area was categorized in terms of the potential for an impact to occur. Emphasis was placed on Red listed species. These impacts are discussed further in the sections that follow.

Table 1.1: Sensitivity analysis: Habitat sterilisation for and disturbance of breeding Red listed species

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Lower Sensitivity</td>
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<tr>
<td>Medium Sensitivity</td>
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<tr>
<td>Higher Sensitivity</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exotic trees, homesteads, roads</td>
</tr>
<tr>
<td>Natural renosterveld</td>
</tr>
<tr>
<td>Agricultural areas, particularly north sloping</td>
</tr>
</tbody>
</table>

Table 1.2: Sensitivity analysis: Collisions with the turbines – Red listed species

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Lower Sensitivity</td>
</tr>
<tr>
<td>Medium Sensitivity</td>
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<tr>
<td>Higher Sensitivity</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exotic trees, homesteads, roads</td>
</tr>
<tr>
<td>Agricultural areas</td>
</tr>
<tr>
<td>Natural renosterveld on top of ridges</td>
</tr>
</tbody>
</table>

Table 1.3: Sensitivity analysis: Collisions with the power line – Red listed species

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Sensitivity</td>
</tr>
<tr>
<td>Medium Sensitivity</td>
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<tr>
<td>Higher Sensitivity</td>
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</tbody>
</table>

<table>
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</tr>
<tr>
<td>Natural renosterveld</td>
</tr>
<tr>
<td>Agricultural areas</td>
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</tbody>
</table>

Table 1.4: Combined Sensitivity analysis: All impacts

<table>
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<tr>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Lower Sensitivity</td>
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<tr>
<td>Medium Sensitivity</td>
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<table>
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<td>Natural renosterveld</td>
</tr>
<tr>
<td>Agricultural areas</td>
</tr>
</tbody>
</table>
2 DESCRIPTION OF THE RECEIVING ENVIRONMENT

2.1 General Study Area

2.1.1 Bird habitat in the study area

The study area is located near the town of Caledon in the Theewaterskloof Municipality in the Western Cape. It comprises an area which overlaps with 2 quarter degree squares (i.e. 1:50 000 maps), and comprises 15 farm portions, with an overall surface area of about 3750 hectares. Appendix 1 is a satellite image of the study area.

It is widely accepted that vegetation structure is more critical in determining bird habitat, than the actual plant species composition (Harrison et al., 1997). The description of vegetation presented in this study therefore concentrates on factors relevant to the bird species present, and is not an exhaustive list of plant species present. The description of the vegetation types occurring in the study area makes extensive use of information presented ASAB (Harrison et al., 1997). The criteria used by the ASAB authors to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. As can be seen in Table 2.1, the natural vegetation in the quarter degree squares where the study area is located are predominantly classified as fynbos vegetation.

Table 2.1: The percentage area of each quarter degree square in the study area that is classified as each vegetation type according to ASAB (Harrison et al., 1997).

<table>
<thead>
<tr>
<th>Vegetation type</th>
<th>3419AA</th>
<th>3419AB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fynbos</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Afromontane Forest</td>
<td>99%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Fynbos is dominated by low shrubs and can be divided into two categories, fynbos proper and renosterveld, the latter being more common in the study area. Despite having a high diversity of plant species, fynbos and renosterveld has a relatively low diversity of bird species. The only Red Data species that are closely associated with fynbos in this study area, are the Black Harrier *Circus maurus* (which may breed in fynbos), (Harrison et al., 1997) and the Denham’s Bustard (H. Lötter pers. comm., Harrison et al., 1997). Other Red Data species that sometimes use this habitat are Secretarybirds which are sometimes found in fynbos and renosterveld (pers. obs.), and Martial Eagles on occasion forage in this habitat. Much of the fynbos and renosterveld in the study area have been transformed for agriculture. Whilst this obviously resulted in substantial natural habitat being destroyed, several species have in fact adapted well to this transformation. One such species, which is highly relevant to this study, is the Blue Crane *Anthropoides paradiseus*. This species has thrived on the grain lands and pastures in the southern and western Cape. This will be further discussed when the micro-habitats are explored below in Section 2.2.

Afro-montane forest occurs marginally in 3419AB, but is of no relevance for the present study.
2.1.2 Avifauna in the study area

The study area comprises two quarter degree squares, 3419AA and 3419AB. Within these two squares, a total of 13 Red listed bird species have been recorded during the bird atlas period. TABLE 2.2 below lists the Red listed species that have been recorded in the study area by ASAB. It also states the conservation status, habitat preferences as well as the primary potential type of impact that the proposed wind facility and associated power line (collisions, habitat destruction and disturbance) could have on the species.

Table 2.2: Red listed species recorded 3419AA and 3419AB by ASAB (Harrison et al., 1997)

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Conservation Status (Barnes 2000)</th>
<th>Collision</th>
<th>Habitat destruction and disturbance</th>
<th>Habitat requirements (Barnes 1998; Barnes 2000; Hockey et al.2005; Young et al.2003; Harrison et al.1997; personal observations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Stork</td>
<td>Ciconia nigra</td>
<td>NT</td>
<td>x</td>
<td>x</td>
<td>Cliffs for roosting and breeding, and rivers and dams for foraging. Could be present at some of the larger dams in the study area.</td>
</tr>
<tr>
<td>Secretarybird</td>
<td>Sagittarius serpentarius</td>
<td>NT</td>
<td>x</td>
<td>x</td>
<td>Grassland, old lands, open woodland. Most likely to be encountered in fynbos, pastures and fallow lands in the study area.</td>
</tr>
<tr>
<td>Cape Vulture</td>
<td>Gyps coprotheres</td>
<td>VU</td>
<td>-</td>
<td>-</td>
<td>Large cliffs for breeding and roosting, open woodland and grassland. Roosts on transmission lines. Unlikely to be encountered in the study area.</td>
</tr>
<tr>
<td>Species</td>
<td>Scientific Name</td>
<td>Status</td>
<td>Recovery</td>
<td>Distribution</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------</td>
<td>--------</td>
<td>----------</td>
<td>------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Martial Eagle</td>
<td><em>Polemaetus bellicosus</em></td>
<td>VU</td>
<td>x</td>
<td>Diverse habitats, from open grassland and scrub to woodland. Typically found in flat country. Could be an occasional visitor to the study area.</td>
<td></td>
</tr>
<tr>
<td>African Marsh-Harrier</td>
<td><em>Circus ranivorus</em></td>
<td>VU</td>
<td>-</td>
<td>Large permanent wetlands with dense reed beds. Sometimes forages over smaller wetlands and grassland. Unlikely to be regularly recorded in the study area.</td>
<td></td>
</tr>
<tr>
<td>Black Harrier</td>
<td><em>Circus maourus</em></td>
<td>NT</td>
<td>x</td>
<td>Highest densities in remnant patches of renosterveld. Present in the study area.</td>
<td></td>
</tr>
<tr>
<td>Peregrine Falcon</td>
<td><em>Falco peregrinus</em></td>
<td>NT</td>
<td>x</td>
<td>A wide range of habitats, but cliffs (or tall buildings) are a prerequisite for breeding. May occur from time to time.</td>
<td></td>
</tr>
<tr>
<td>Lanner Falcon</td>
<td><em>Falco biarmicus</em></td>
<td>NT</td>
<td>x</td>
<td>Generally prefers open habitat, but exploits a wide range of habitats. Could be an occasional visitor to the study area.</td>
<td></td>
</tr>
<tr>
<td>Species</td>
<td>Scientific Name</td>
<td>IUCN Status</td>
<td>Breeding</td>
<td>Non-Breeding</td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------------------------</td>
<td>-------------</td>
<td>----------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>Lesser Kestrel</td>
<td><em>Falco naumanni</em></td>
<td>VU</td>
<td>x</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Summer migrant most likely to be encountered hunting over agricultural areas in the study area.</td>
</tr>
<tr>
<td>Blue Crane</td>
<td><em>Anthropoides paradiseus</em></td>
<td>VU</td>
<td>?</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cereal crops, old lands, pastures, wetlands, dams and pans for roosting. Common in the study area.</td>
</tr>
<tr>
<td>Denham’s Bustard</td>
<td><em>Neotis denhami</em></td>
<td>VU</td>
<td>?</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cereal crops, fynbos and pastures in the study area. Large dams. Unlikely to be encountered in the study area.</td>
</tr>
<tr>
<td>Great White Pelican</td>
<td><em>Pelecanus onocrotalus</em></td>
<td>NT</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Large dams. Unlikely to be encountered in the study area.</td>
</tr>
<tr>
<td>Aghulhas Long-billed Lark</td>
<td><em>Certhilauda brevirostris</em></td>
<td>NT</td>
<td>x</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fallow and recently ploughed fields, sparse shrubland dominated by renosterveld. Most likely present in the study area.</td>
</tr>
</tbody>
</table>

### 2.2 300 MW Wind facility and Associated Infrastructure

Whilst much of the bird species distribution in the study area can be explained in terms of the above broad vegetation description (based on the quarter degree square level), there are many differences in bird species distribution and density that correspond to differences in habitat at the micro level. These bird micro-habitats are evident at a much smaller spatial scale than the broader vegetation types or biomes, and can largely only be identified through a combination of field investigation and experience. Furthermore, as mentioned above, large portions of the study area has been highly transformed, which requires a more detailed analysis of the habitat at the actual proposed wind facility site. Appendix 2 contains photographs of the different micro-habitats present in the study area.
2.2.1 Bird micro-habitat in the study area

The following man-made bird micro-habitats were recorded in the study area:

- Cereal crops and pastures

The study area is a good example of the Overberg Wheatbelt: a mosaic of wheat, barley and canola fields interspersed with pastures which are classified as an Important Bird Area (Barnes 1998). It is of specific importance to the endemic, Red listed Blue Crane, as well as the Red listed Denham’s Bustard and Agulhas Long-billed Lark. The study area forms part of a large agricultural district that stretches from Caledon to Riversdale and mostly encompasses the area south of these two towns, running between the coastal towns of Hermanus and Stilbaai. The topography consists of low-lying coastal plains and consists primarily of cereal croplands. In the study area itself, rolling hills are present.

The Overberg holds the largest population of Blue Cranes in the world. At times the Overberg can hold nearly 20% of this species’ global population, as well as containing large numbers of Denham’s Bustard and White Stork *Ciconia ciconia* during the summer (Barnes 1998). The Blue Crane has relatively recently expanded its range into the Overberg, where it feeds on *inter alia* fallen grain and recently germinated crops. They also feed on supplementary food put out for small stock, and can congregate in huge numbers around these feed lots. The Blue Cranes favour agricultural areas above natural Renosterveld. The current land use in the study area is around 75% agricultural areas which are roughly divided half-way between grain crops and pastures. The remaining 25%, mostly on steep slopes unsuitable for agriculture, consists of natural renosterveld.

The Black Harrier is also found frequently in the modified agricultural matrix of the Overberg region, where several pairs breed (Barnes 1998), although it prefers the natural renosterveld in between the cereal crops. Some typical karroid birds such as the endemic Karoo Korhaan *Eupodotis vigorsii* is also found in the wheat matrix (Barnes 1998).

- Dams

The study area contains many dams, some of which are important roosting areas for Blue Cranes. Blue Cranes tend to roost in dams at night, probably as a protective measure against predators. Cranes also require water for drinking and typically take nestlings to water within 24 hours of hatching (Bidwell 2004), and prefer nest sites close to dams. Apart from cranes, agricultural dams are also important for several common species such as Egyptian Goose *Alopochen aegyptiacus*, White Stork and Spur-winged Goose *Plectropterus gambensis*. The Red listed Black Stork could also visit some of the dams in the study area.

- Other habitats

The study area contains other micro-habitats which are not important for Red Data species e.g. stands of *Eucalyptus*. Copses of exotic *Eucalyptus* do create attractive habitat for raptors such as Black Sparrowhawk *Accipiter melanoleucus*, Rufous-chested Sparrowhawk *Accipiter rufiventris* and Forest Buzzard *Buteo trizonatus*, none of which are presently Red listed.
2.3 132 kV Sub-Transmission Line and Associated Infrastructure

The wind facility will be connected to the national transmission grid via a 132kV power line. The habitat description in 2.2.1 above is also applicable to the sub-transmission line, as it will be situated in close proximity to the turbines itself.
3 IMPACTS AND ISSUES IDENTIFICATION

One of the main functions of a scoping study is to identify the various impacts associated with the development that will need further investigation during the impact assessment phase. These impacts are discussed below. The significance of impacts will be explored in more detail in a subsequent report in the EIA phase.

3.1 300 MW Wind facility

3.1.1 Disturbance of breeding birds during the construction phase

The activities and noise associated with the construction of the proposed wind facility (including access roads) has the potential to disturb breeding birds, which in turn could lead to breeding failure.

The Renosterveld in the study area is utilised by the Red listed Denham’s Bustard and Black Harrier for breeding purposes (Harrison et al. 1997). Bustards are very sensitive to anthropogenic disturbances and will readily take flight at the sight of humans (pers.obs.).

The Red listed Blue Crane has very specific site selection criteria, which was well analysed in a recent study by Bidwell (2004). He identified the following criteria:

- Cranes prefer pastures over cereal crops, and generally avoid nesting in natural vegetation.
- They select fields that are far from buildings and tar roads, and closer to natural vegetation.
- They also choose fields that are larger and contain more natural vegetation.
- Within fields containing nests, cranes select nest sites that are significantly further from buildings and farm tracks and closer to natural vegetation, horizons and sources of water than are random sites.
- They choose north-facing and upslope sites.
- Cranes did not appear to choose fields or nest sites with respect to the distance to the nearest fence, dirt road, or power line.

Actual breeding data for Blue Cranes in the study area was not available at the time of writing, but it is known that several pairs could be breeding in the area. At least one pair was observed during the field visit, breeding in a wind row in a cereal crop field. More information on actual breeding pairs will be required to properly assess the potential impact of the construction activity. Important though is the finding of Bidwell (2004) that they actively avoid buildings and roads, indicating their sensitivity to human disturbance.

3.1.2 Sterilisation of breeding and foraging habitat by the operation of the wind facility

The activities and noise associated with the operation of the proposed wind facility has the potential to sterilise otherwise suitable habitat for certain species. As was pointed out above in 3.1.1, Blue Cranes actively avoid areas of human activity when selecting for breeding areas. Bustards are also very sensitive to human disturbance.
and readily take flight at the sight of humans (pers. obs.). It is highly unlikely that these species would continue to breed or even forage in the area that is occupied by the wind turbines. This would amount to habitat loss for these species. No studies have been done in this regard in South Africa, therefore this statement is admittedly speculative, but it has been found that at a wind facility in the Germany the Great Bustard *Otis tarda* avoids the wind facility in a radius of up to 1km around the facility (Langgemach 2008). Presumably, similar behaviour could be expected from a related species such as the Denham’s Bustard. Cranes do not feature prominently as wind facility collision victims in literature, presumably for the same reason, i.e. that they avoid the area entirely.

### 3.1.3 Collisions with the wind turbines during the operational phase

The following section provides a background to the interactions between wind energy facilities and birds and describes the issues that are likely to be encountered with the proposed project. It is critical to understand the various issues and factors at play, before an accurate assessment of the impacts of the proposed wind energy facility on the birds of the area can be conducted. By necessity, the following description is based almost entirely on international literature, primarily from the United States. The reality is that the South African experience of wind energy generation has been extremely limited to date. Most of the principles that have been learnt internationally can be applied locally to a certain extent. However, care will be taken in this study to adapt the existing international knowledge to the local bird species and conditions. Much of the work cited below has also been published in proceedings of meetings and conferences. Very little has been published in formal peer reviewed journals. The implication of this is that the information needs to be used with some degree of caution, particularly when drawing comparisons, as the methodologies used are not standardised. The discussion below focuses largely on the impact of collision of birds with wind turbines. It is important to remember that wind facilities also impact on birds through disturbance and habitat destruction, and by means of their associated infrastructure. Assessment of the impacts of the proposed wind facility will take all of these factors into account.

A relatively recent summary of the available literature entitled “Wind Turbines and Birds, a background review for environmental assessment” by Kingsley & Whittam (2005) and the Avian Literature Database of the National Renewable Energy Laboratory (www.nrel.gov) have been used extensively.

Concern for the avian impacts of wind facilities first arose in the 1980’s when raptor mortalities were detected in California (US) and at Tarifa (Spain). The Altamont Pass site in California, and Tarifa in Spain were the sites of some extremely high levels of bird mortalities. These mortalities focused attention on the impact of wind energy on birds, and subsequently a large amount of monitoring at various sites has been undertaken. According to Kingsley & Whittam (2005), “With a few important exceptions, studies that have been completed to date suggest very low numbers of bird fatalities at wind energy facilities. The observed mortality caused by wind energy facilities is also very low compared to other existing sources of human caused avian mortality on a per structure basis”. Curry and Kerlinger (www.currykerlinger.com) also state that it appears now that the situation at Altamont Pass is an anomaly. Documents comparing wind energy mortalities to other forms of human induced mortality are numerous (for example Crockford 1992, Colson & Associates 1995, Gill *et al* 1996 and Erickson *et al* 2001) and all point towards the relatively low numbers of birds killed by wind turbines. It must be stressed that the purpose of this report is to assess the impacts of the proposed wind facility on birds, not to compare the effects to other sources of mortality. In some threatened species, any additional causes of
mortality should be avoided at all costs. Naturally, as more monitoring was conducted at different sites, a need arose for a standard means of expressing the levels of bird mortalities – in this case, number of mortalities per turbine per year. The following is a brief summary of some data that has emerged internationally. When examining mortality rates at wind energy facilities, it is important to note that searcher efficiency (and independence) and scavenger removal rates need to be accounted for. Additionally, although the rates may appear relatively low – it is important to note that it is the cumulative effect of a wind farm that is really important. In other words, the absolute number of birds killed by a wind farm in a year is far more meaningful, than an average per turbine. In addition, for some species, even a minute increase in mortality rates could be significant (e.g. for long living, slow reproducing species such as many of our South African Red listed species).

• USA
The National Wind Co-ordinating Committee (NWCC) estimates that 2.3 birds are killed per turbine per year in the US outside of California – correcting for searcher efficiency and scavenger rates. However, this index ranges from as low as 0.63 in Oregon to as high as 10 in Tennessee (NWCC 2004) illustrating the wide variance in mortality rate between sites. Curry & Kerlinger (2000) found that 13% of turbines at Altamont Pass, California were responsible for all Golden Eagle and Red-tailed Hawk collisions.

• Australia
In Australia the recorded collision rates range from 0.23 to 2.7 birds per turbine per year (Australian Wind Energy Association webpage – Wind Turbines). However, the monitoring site for this data consisted of only three wind turbines and one wind mast, so the results must be viewed with caution.

• New Zealand
It seems that wind power in New Zealand is relatively new, and the only reference to bird mortalities is that there are no reports of rare, threatened or endangered species mortalities (New Zealand Wind Energy Association webpage – Climate change and the environment Fact sheet)

• Spain
At the Tarifa site, Janss (2000) estimated 0.03 birds killed per turbine per year. At the same site, collisions have also been found to be non-randomly distributed between turbines, a study by Acha (1997) found that 28 of the 190 turbines killed 57% of vultures at Tarifa.

• Germany
The German Wind Energy Association (BWE) reports that German Friends of the Earth (BUND) estimates an average of 0.5 bird deaths per turbine or a total of 8000 per year. The German Society for Nature Conservation (NABU) collated information from 127 case studies and concluded that only 269 birds were found to be killed by turbines across Germany since 1989. By extrapolating, they estimate approximately 10 000 birds and bats dying per year.

• South Africa
To date, only three wind turbines have been constructed at a demonstration facility at Klipheuwel in the Western Cape. These turbines were only installed in 2002 and 2003. A monitoring program was put in place once the turbines were operational and conducted by Jacque Kuyler (2004) – this report was obtained from Eskom Peaking Generation. This involved site visits twice a month to monitor birds flying in the vicinity
of the site, and bird mortalities. Important findings of his monitoring conducted from June 2003 to January 2004 are as follows:

- Between 9 and 57% of birds observed within 500m of the turbines were at blade height – there was great variation between months.
- Between 0 and 32% of birds sighted were close to the turbines defined as “between turbines or within outer router arc” and again showed great variation between months.
- Five bird carcasses were found on the site during this period. Two of these, a Helmeted Guineafowl and a Spotted Dikkop were determined to be killed by predators. A Horus Swift and a Thick-billed Lark were determined to have been killed by collision with turbine blades. A Cattle Egret was found with no visible injuries and was allocated to natural causes.
- If these two mortalities in eight months are expressed as number of mortalities/turbine/year, the result is 1.00 mortalities per turbine per year.
- Experimental assessment of the searcher efficiency revealed that 7 out of 9 (77%) carcasses placed in the study area were detected by the searcher.
- These nine carcasses were scavenged at between 12 and 117 days after their placement.

A number of factors influence the number of birds killed at wind farms and these can be classified into three broad groupings: bird related factors; site related factors and facility related factors.

- **Bird related factors**

Bird species and number present in the area has an influence on the risk. Although only one study has so far shown a direct relationship between number of birds present in an area and number of collisions (Everaert 2003, Belgium) it stands to reason that the more birds flying through the area of the turbines, the more chance of collisions occurring. The particular bird species present in the area is also very important as some species are more vulnerable to collision with turbines than others. This is examined further below. Bird behaviour and activity differs between species – with certain hunting behaviour rendering the species more vulnerable. For example a falcon stooping after prey is too focused to notice other infrastructure. There may also be seasonal and temporal differences in behaviour, for example breeding males displaying may be particularly at risk. These factors can all influence the birds' vulnerability.

A controlled experiment with homing pigeons was undertaken to examine their flight behaviour in the proximity of turbines (Cade 1994). Pigeons released near turbines clearly recognize the turbines and adjust their flight as required – of about 2270 pigeon flights near turbines, three collisions occurred. In a radar study of the movement of ducks and geese in the vicinity of an off shore wind facility in Denmark, less than 1% of bird flights were close enough to the turbines to be at risk. This is graphically shown in figure 1, where it is clear that the birds avoided the turbines effectively (Desholm & Kahlert, 2005).
International experiences in terms of the different broad groupings of species, and their vulnerability, reveals that water birds i.e. species such as herons, ibises and waders are not very vulnerable to collisions. The same goes for waterfowl. Diurnal raptors on the other hand are a class of birds that shows definite vulnerability to collisions with wind turbines under certain conditions. At Altamont Pass in California, six seasons of monitoring of 16% of the turbines (approximately 5000 total) revealed 183 mortalities, 119 or 65% of which were raptors. Fifty five percent of the raptors killed were killed through collision with turbines, the remainder dying on associated infrastructure (Orloff & Flannery 1992). At the same site, from 1998 to 2000, 256 birds were found killed, 139 or 54% of which were raptors (Erickson et al 2002, Hunt 2002). However, in the US outside of California, raptors only accounted for 2.7% of mortalities (Erickson et al 2001, Kerlinger 2001). It seems then the situation varies drastically between different sites, and even in different seasons. At Tarifa in Spain, 106 raptors were found in one year, almost all collided with turbines on high visibility days (Marti & Barrios 1995). At the same site Janss (2000) found only two raptors killed in two migration seasons worth of monitoring. The situation clearly also varies from year to year. No data is available on nocturnal raptors. Songbirds comprise 78% of fatalities in US (Erickson et al 2001). A group of species particularly at risk is grassland species with aerial courtship displays – such as the Horned Lark (Kerlinger & Dowdell 2003). It can therefore be speculated that the Agulhas Long-billed Lark could be at risk of collisions with the blades in the study area (interestingly, Kuyler reported a Large-billed Lark Galerida magnirostris as one of only two collision victims at the Klipheuwel experimental facility). Notably, at the Klipheuwel demonstration facility, a pair of Blue Cranes has bred successfully within close proximity to the facility for several years now (Ian Smith pers comm.).

- Site related factors
Landscape features can potentially channel or funnel birds towards a certain area, and in the case of raptors, influence their flight and foraging behaviour. Elevation, ridges and slopes are all important factors in determining the extent to which an area is used by birds in flight. High levels of prey with favourable wind conditions will

Figure 3.1. Radar tracked movement of ducks and geese relative to an offshore wind facility in Denmark. Scale bar = 1000m. (Desholm & Kahlert 2005)
attract raptors, increasing the time spent hunting on the wing, and as a result reducing the time spent still hunting from a perch. Weather patterns on site can have a decisive influence on the risk. If, for example, if fog moves in off the sea at night and early morning it could be an important factor. At Mountaineer Wind Energy Centre in Tucker County (US), 30 songbirds collided unexpectedly with a turbine, during thick fog conditions in May 2003 (Cumberland Times). Very few collisions had been recorded prior to this weather incident. Birds fly lower during strong headwinds (Hanowski & Hawrot 2000; Richardson 2000; pers.obs.). This means that, when the turbines are functioning at their maximum speed, birds are likely to be flying at their lowest – a perilous combination. Strong winds are common in the study area, which could increase the risk of collisions.

- **Facility related factors**

  The scale of the facility will have an influence on the risk. According to Kingsley & Whittam (2005), “More turbines will result in more collisions”. Although only two mortalities have been recorded at the experimental site at Klipheuwel, the difference between the 3 turbines at Klipheuwel and the 150 turbines at the proposed site is significant. Larger facilities also have greater potential for disturbance and habitat destruction. The rotor design and dimensions also play a role. To date it has been shown that large turbines kill the same number of birds as smaller ones (Howell 1995, Erickson et al 1999). This means that with newer technology and larger turbines, fewer turbines are needed for the same power generation, possibly resulting in less mortalities altogether (Erickson et al 1999). Tubular towers have less perch space than the lattice type. Figure 2 below shows the development of turbine size since the 1980’s (European Wind Energy Association - EWEA).

<table>
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<tr>
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<th>Rotor Diameter</th>
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<td>50 kW</td>
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<td>100 kW</td>
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<td>500 kW</td>
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<tr>
<td>2,000 kW</td>
<td>Ø 80m</td>
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<tr>
<td>5,000 kW</td>
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**Figure 1: Growth in Size of Commercial Wind Turbine Designs**

- **Figure 3.2.** The development of turbine size since the 1980’s – European Wind Energy Association (EWEA)

  One of the reasons suggested for bird collisions with turbine blades is ‘motion smear’, a term used to describe the phenomenon whereby rapidly moving objects become less visible the closer the eye is to them. Another name for it is retinal blur. The retinal image can only be processed up to a certain speed, after which the image cannot be
perceived. It stands to reason then that the slower the blades move, the less motion smear – and this should translate into less collisions. Painting patterns on the blades has been tested to reduce motion smear and this is discussed further below. Interestingly, it is believed that at night there is no difference between a moving blade and a stationary one in terms of number of collisions (Kingsley & Whittam 2005).

Spacing between turbines at a wind facility can have an effect on the number of collisions. Some authors have suggested that paths need to be left between turbines so that birds can move along these paths. For optimal wind generation, relatively large spaces are generally required between turbines in order to avoid wake and turbulence effects.

The three main hypotheses proposed for birds not seeing turbine blades are as follows (Hodos et al 2001):

- An inability to divide attention between prey and obstacles. This seems an unlikely explanation as birds have been found to maintain good acuity in the peripheral vision, have different foveal region in the eye for frontal and ground vision and they have various other optical methods for keeping objects at different distances simultaneously in focus.
- The phenomenon of motion smear or retinal blur, explained earlier in this report.
- The angle of approach. If a bird approaches from side on to the turbine, the blades present a very small profile and are even more difficult to detect.

Mitigation measures should therefore focus on solving the problem of motion smear both from front and side angles.

Coming back to the site in question, the species that are most likely to be impacted are raptors that use the current favourable wind conditions on the ridges to forage. Species most likely to be impacted are rodent “specialists” namely Rock Kestrels *Falco rupicolas*, Black-shouldered Kites *Elanus caeruleus*, Steppe Buzzards *Buteo vulpinus*, Jackal Buzzards *Buteo rufodorsus* and occasionally Lanner Falcons *Falco biarmicus*. The Red listed Black Harrier might also be at risk, particularly in renosterveld areas. Small species such as larks (e.g. Red-capped Lark *Calandrella cinerea* and Large-billed Lark *Galerida magnirostris*) and seed-eaters which are likely to continue to use the area in between the turbines, might also be at risk, particularly in renosterveld areas. Small species such as Helmeted Guinea-fowl *Numida meleagris* could also be at risk, as well as soaring, non-raptors such as the migratory White Stork. It is not envisaged that the Blue Crane and Denham’s Bustard will be particularly at risk of collisions, as it both species are likely to avoid the turbine area completely.

### 3.2 Associated Infrastructure for the wind facility

Some of the associated infrastructure that is required for the wind facility includes navigation lights (for aircraft) mounted on the top of the wind turbines, and a temporary wind mast which has already been erected to measure the wind speed.
3.2.1 Potential impacts of the temporary wind mast

There is a Vodacom communications mast (approx 30m in height) and a wind mast (50m in height) adjacent to each other on site. The Vodacom mast is lit permanently with a red light. The wind mast does not have a light, but it does have guy wires.

Tall towers with guy wires are a well known source of avian mortality (Erickson et al. 2001). In the USA, communication towers have been responsible for mass nocturnal mortality events of migrant birds, with up to 10 000 birds killed in a single night (Evans 1998). The single biggest attractant seems to be the lighting on the towers, with taller, better lighted towers responsible for more fatalities. It is speculated that the birds are attracted to the lighted towers, become disoriented and fly around them in a spiral, colliding with the tower, the guy wires, other birds, or falling to the ground in exhaustion (Erickson et al. 2001).

The situation with regard to the wind mast in the study area differs in some important aspects from the scenario described above. Firstly the mast in the study area is only 50 metres tall, as opposed to the towers in the USA studies that were generally taller than 250 metres. Secondly, the phenomenon of mass nocturnal migrations at the scale observed in the USA is not known here, primarily because South Africa, and particularly the southern coastline, is at the end of the migratory route for most species. Thirdly, the mast will be a temporary phenomenon; it will only be in place for a year.

No studies have been conducted on bird fatalities at communication or similar masts in this country, but fatalities are known to have occurred, for example Cape Vultures at the large communications tower on top of Kransberg in the Marikele National Park, which is situated directly above a large Cape Vulture breeding colony (Pat Benson pers.comm). Again, the situation differs materially from the one in question in that the Marikele tower is much bigger and situated at a known concentration spot for soaring birds.

The wind mast in question could be a source of mortality in that birds could collide with the guy wires. It cannot be stated for sure what influence the red light on the adjacent Vodacom tower will have on nocturnal birds, but it is not envisaged that it will have the dramatic effect recorded in the studies quoted earlier, for the reasons already stated. The species most likely to be impacted will be the same ones most at risk with the wind turbines, namely rodent “specialists” such as Rock Kestrels, Black-shouldered Kites, Common Buzzards, Jackal Buzzards and occasionally Lanner Falcons, using the lift on the hill for low altitude hunting on the wing. It must also be stated that the tower will provide an excellent hunting perch for all of these species, which could put them at risk when attacking prey from that position, if their flight path takes them through the guy wires. Lastly, nocturnal species such as Spotted Eagle Owl and Barn Owl might be also be tempted to use the wind mast as a hunting perch, and may be subject to the same risks as the diurnal raptors.

3.2.2 Potential impacts of the lighting on the wind turbines

According to the proponent, the wind turbines will be lit with a constant red light at the top. Lighting of turbines and other infrastructure has the potential to attract birds,
thereby increasing the risk of collisions with turbines. In Sweden a large number of collisions were recorded with one turbine in one night. The turbine was not operational, but was lit (Karlsson 1983). At the Mountaineer site mentioned above, all collisions occurred on the three turbines closest the substation (which was lit with a solid white light). No collisions occurred on any of the other 12 turbines which were lit with red strobe lights.

The theory behind the relationship between lights and the number of collisions is that nocturnal migrants navigate using stars, and mistake lights for stars (Kemper 1964). Another partial explanation may be that lights attract insects which in turn attract birds. Changing constant lighting to intermittent lighting has been shown to reduce attraction (Richardson 2000) and mortality (APDIC 1994, Jaroslow 1979, Weir 1976) and changing white flood light to red flood light resulted in an 80% reduction in mortality (Weir 1976). Erickson et al (2001) suggest that lighting is the single most critical attractant leading to collisions with tall structures.

The potential for collisions with the wind turbines due to presence of lights is not envisaged to be significant, primarily because the phenomenon of mass nocturnal migrations is not a feature of the study area, and secondly because the type of light, namely a constant red light, is not known to be a high risk attractant to birds.

3.3 Sub-transmission Line

3.3.1 Potential impacts of sub-transmission line

A proposed 132kV power line that will link the wind facility to the grid could pose a collision risk, depending on the final alignment of the line.

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs & Ledger 1986a; Hobbs & Ledger 1986b; Ledger et.al. 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Electrocutions are not envisaged to be a problem on the proposed 132kV line. Collisions, on the other hand, could be a major potential problem.

Collisions kill far more birds annually in southern Africa than electrocutions (Van Rooyen 2007). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of the collision sensitive species are considered threatened in southern Africa - of the 2369 avian mortalities on distribution lines recorded by the EWT since August 1996, 1512 (63.8%) were Red listed species (Van Rooyen 2007).

In the Overberg, power line collisions have long been recorded as a major source of avian mortality (Van Rooyen 2007). Most numerous amongst power line collision victims are Blue Crane and Ludwig’s Bustard (Shaw 2007). It has been estimated that as many as 10% of the Blue Crane population in the Overberg are killed annually on
power lines, and figure for Denham’s Bustard might be as high as 30% of the Overberg population (Shaw 2007). These figures are extremely concerning, as it represents a possible unsustainable source of unnatural mortality.

Unfortunately, the dynamics of the collision problem is poorly understood. In the most recent study on this problem in the Overberg, Shaw (2007) identified cultivated land and region as the significant factors influencing power line collision risk. Lines that cross cultivated land pose a higher risk, as expected, as this is the preferred habitat of Blue Cranes in the Overberg. Interestingly, she also found that collision rates in the Bredasdorp region are much higher than those around Caledon, which might be a function of the higher proportion of flocks, and a greater number of large flocks (50+ birds) in Bredasdorp, as opposed to Caledon in the winter. Collision rates are higher for birds in flocks, as they may panic, or lack visibility and room for manoeuvre because of the close proximity of other birds (APLIC, 1994). Other factors, such as proximity to dams, wind direction and proximity to roads and dwellings did not emerge as significant factors, but she readily admits that her broad-scale analysis may have been too crude to demonstrate their effects. It is for example a well known fact that cranes are particularly vulnerable to power lines skirting water bodies used as roosts, as they often arrive there or leave again in low light conditions (pers. obs.).

The impact of power line collisions is potentially a much bigger than that of the wind facility itself, and will require further investigation during the EIA phase of the project.
The impact assessment methodology for the avifaunal impacts that will be adopted for the EIA phase of the project is detailed in Appendix 3.
5 PRELIMINARY CONCLUSIONS

The following section provides a summary of the preliminary conclusions and details the aspects that require further investigation during the EIA phase of the project.

5.1 300 MW Wind facility

The following impacts are potentially associated with the wind facility itself:

- Disturbance of breeding birds during the construction phase, particularly Red listed Blue Crane and possibly Denham's Bustard.
- Sterilisation of breeding and foraging habitat by the operation of the wind facility, particularly for Blue Crane and Denham's Bustard.
- Collisions with the wind turbines during the operational phase, particularly raptors of several species and possibly Red listed Agulhas Long-billed Lark.

These aspects will be further explored in the EIA phase report, and appropriate mitigation measures will be suggested, where and if necessary/possible.

5.2 Associated Infrastructure for the wind facility

The following impacts could potentially be caused by the associated infrastructure:

- Collisions with the guy wires of the wind mast. This impact is not envisaged to be significant. Firstly the mast in the study area is only 50 metres tall, as opposed to the towers in the USA studies that were generally taller than 250 metres (where mass mortalities have been recorded). Secondly, the phenomenon of mass nocturnal migrations at the scale observed in the USA is not known here, primarily because South Africa, and particularly the southern coast line, is at the end of the migratory route for most species. Thirdly, the mast will be a temporary phenomenon; it will only be in place for a year.
- Potential impacts of the lighting on the wind turbines. The potential for collisions with the wind turbines due to presence of lights is not envisaged to be significant, primarily because the phenomenon of mass nocturnal migrations is not a feature of the study area, and secondly because the type of light, namely a constant red light, is not known to be a high risk attractant to birds.
5.3 Transmission Line

In the Overberg, power line collisions have long been recorded as a major source of avian mortality (Van Rooyen 2007). Most numerous amongst power line collision victims are Blue Crane and Ludwig’s Bustard (Shaw 2007). It has been estimated that as many as 10% of the Blue Crane population in the Overberg are killed annually on power lines, and figure for Denham’s Bustard might be as high as 30% of the Overberg population (Shaw 2007). These figures are extremely concerning, as it represents a possible unsustainable source of unnatural mortality.

The impact of power line collisions is potentially a much bigger than that of the wind facility itself, and will require further investigation during the EIA phase of the project.
REFERENCES


Australian Wind Energy Association www.auswea.com.au


Curry & Kerlinger, LCC www.currykerlinger.com


Erickson, W.P., Johnson, G.D., Strickland, M.D., Young, D.P., Sernka, K.J.,


European Wind Energy Association [www.ewea.org](http://www.ewea.org)


German Wind Energy Association – [www.wind-energie.de](http://www.wind-energie.de)


Appendix 1: Satellite image of the study area
Appendix 2: Bird micro-habitats

Figure 1: Example of dry land cereal crop in the study area.

Figure 2: Example of a pasture in the study area.
Appendix 2: Bird micro-habitats

Figure 3: Blue Cranes in pastures in the study area

Figure 4: A clump of *Eucalyptus* in the study area
Appendix 2: Bird micro-habitats

Figure 5: A dam in the study area. Note how the power lines has been marked with bird flappers to prevent cranes roosting in the dam from colliding with the conductors.

Figure 6: A breeding pair of Blue Cranes in the study area, in a wind row in a cereal crop field.
Appendix 2: Bird micro-habitats

Figure 7: A patch of renosterveld in the study area, typically on a steep slope not suitable for agricultural activity.
IMPACT ASSESSMENT METHODOLOGY

Impact Assessment Methodology - Instructions to Specialists

To ensure consistency in the assessment of impacts, all specialists are required to make use of the impact assessment methodology described in this Appendix. Deviations from this methodology must be discussed and agreed with ARCUS GIBB prior to the commencement of the specialist study.

Step 1: Identify all possible impacts

The specialists are required to identify all the possible impacts associated with the proposed development. Through the Public Participation Process, additional impacts may be identified, which may require specialist consideration and therefore must be addressed by the relevant specialist. The impacts identified must be applicable to all phases of the proposed development, i.e. construction and operation.

Step 2: Prediction of impacts

Identified impacts must be assessed in terms of the following criteria and rating scales:

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<th>Criteria</th>
<th>Rating Scales</th>
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| Cumulative impacts (incremental impacts of the activity and other past, present and future activities on a common resource) | • Low (there is still significant capacity of the environmental resources within the geographic area to respond to change and withstand further stress)  
  • Medium (the capacity of the environmental resources within the geographic area to respond to change and withstand further stress is reduced)  
  • High (the capacity of the environmental resources within the geographic area to respond to change and withstand further stress has been or is close to being exceeded) |
| Nature                                         | • Positive  
  • Negative  
  • Neutral |
| Extent (the spatial limit of the impact)        | • Local (site-specific and/or immediate surrounding areas)  
  • Regional (Gauteng)  
  • National |
| Intensity (the severity of the impact)          | • Low - where the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected  
  • Medium - where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are negatively affected  
  • High - where natural, cultural or social functions and processes are altered to the extent that it will temporarily or permanently cease; and valued, important, sensitive or vulnerable systems or communities are substantially affected |
| Duration (the predicted lifetime of the impact) | • Short-term (0 to 5 years)  
  • Medium term (6 to 15 years)  
  • Long term (16 to 30 years) - where the impact will cease after the operational life of the activity either because of natural processes or by human intervention |
| Probability (the likelihood of the impact occurring) | • Improbable – where the possibility of the impact occurring is very low  
  • Probable – where there is a good possibility (<50 % chance) that the impact will occur  
  • Highly probable – where it is most likely (50-90 % chance) that the impact will occur  
  • Definite – where the impact will occur regardless of any... |
The result of the impact prediction must be summarised in a table as per Example 1. The criteria for cumulative impacts, non-reversibility and irreplaceable resources must be considered as part of the impact **Intensity** criterion.

**Example 1: Prediction of Impacts (before mitigation)**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature</th>
<th>Intensity</th>
<th>Extent</th>
<th>Duration</th>
<th>Probability</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 1: Soil Erosion</td>
<td>-</td>
<td>Low</td>
<td>Local</td>
<td>Short-term</td>
<td>Probable</td>
<td>High</td>
</tr>
</tbody>
</table>

**Example 2: Prediction of Impacts (after mitigation)**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature</th>
<th>Intensity</th>
<th>Extent</th>
<th>Duration</th>
<th>Probability</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 1: Soil Erosion</td>
<td>-</td>
<td>Low</td>
<td>Local</td>
<td>Short-term</td>
<td>Probable</td>
<td>High</td>
</tr>
<tr>
<td>With Mitigation</td>
<td>-</td>
<td>Negligible</td>
<td>Local</td>
<td>Short-term</td>
<td>Improbable</td>
<td>High</td>
</tr>
</tbody>
</table>

**Step 4: Assign a consequence rating**

The consequence of the potential impacts will be determined according to the main criteria for determining the consequence of impacts, namely the extent, duration and intensity of the impacts.

Using the consequence rating below, assign a consequence to the impacts for both the pre-mitigation and post-mitigation scenario (Example 3):

---

1 A resource for which no reasonable substitute exists, such as Red Data species and their habitat requirements
### Consequence Rating

#### HIGH Consequence
- High intensity at a regional level and endure in the long term
- High intensity at a national level and endure in the medium term
- Medium intensity at a national level and endure in the long term
- High intensity at a regional level and endure in the medium term
- High intensity at a national level and endure in the short term
- Medium intensity at a national level and endure in the medium term
- Low intensity at a national level and endure in the long term
- High intensity at a local level and endure in the long term
- Medium intensity at a regional level and endure in the long term

#### MEDIUM Consequence
- High intensity at a local level and endure in the medium term
- Medium intensity at a regional level and endure in the medium term
- High intensity at a regional level and endure in the short term
- Medium intensity at a national level and endure in the short term
- Medium intensity at a local level and endure in the long term
- Low intensity at a national level and endure in the medium term
- Low intensity at a regional level and endure in the long term
- Medium intensity at a local level and endure in the medium term

#### LOW Consequence
- Low intensity at a regional level and endure in the medium term
- Low intensity at a national level and endure in the short term
- High intensity at a local level and endure in the short term
- Medium intensity at a regional level and endure in the short term
- Low intensity at a local level and endure in the long term
- Low intensity at a regional level and endure in the short term
- Low to medium intensity at a local level and endure in the short term

### Example 3: Assign a consequence rating

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature</th>
<th>Consequence</th>
<th>Probability</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 1: Soil Erosion</td>
<td>-</td>
<td>Low</td>
<td>Probable</td>
<td>High</td>
</tr>
<tr>
<td>With Mitigation</td>
<td>-</td>
<td>Low</td>
<td>Improbable</td>
<td>High</td>
</tr>
</tbody>
</table>

### Step 5: Assign a significance rating

The **significance** of an impact is defined as a combination of the consequence of the impact occurring and the **probability** that the impact will occur. The significance of each identified impact must be rated according to the methodology set out below:

- **LOW** – will not have an influence on the decision to proceed with the proposed project, provided that recommended mitigation measures to mitigate impacts are implemented;

---

2 This does not apply to minor impacts which can be logically grouped into a single assessment.
• **MEDIUM** – should influence the decision to proceed with the proposed project, provided that recommended measures to mitigate impacts are implemented; and
• **HIGH** – would strongly influence the decision to proceed with the proposed project.

<table>
<thead>
<tr>
<th>Consequence Rating</th>
<th>Consequence x Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH Significance</td>
<td>• High x Definite</td>
</tr>
<tr>
<td></td>
<td>• High x Highly Probable</td>
</tr>
<tr>
<td></td>
<td>• High x Probable</td>
</tr>
<tr>
<td></td>
<td>• High x Improbable</td>
</tr>
<tr>
<td></td>
<td>• Medium x Definite</td>
</tr>
<tr>
<td>MEDIUM Significance</td>
<td>• Medium x Highly Probable</td>
</tr>
<tr>
<td></td>
<td>• Medium x Probable</td>
</tr>
<tr>
<td>LOW Significance</td>
<td>• Medium x Improbable</td>
</tr>
<tr>
<td></td>
<td>• Low x Definite</td>
</tr>
<tr>
<td></td>
<td>• Low x Highly Probable</td>
</tr>
<tr>
<td></td>
<td>• Low x Probable</td>
</tr>
<tr>
<td></td>
<td>• Low x Improbable</td>
</tr>
</tbody>
</table>

**Example 4: Assigning a significance rating**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Consequence</th>
<th>Probability</th>
<th>Significance</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 1: Soil Erosion</td>
<td>Low</td>
<td>Probable</td>
<td>LOW</td>
<td>High</td>
</tr>
<tr>
<td>With Mitigation</td>
<td>Low</td>
<td>Improbable</td>
<td>LOW</td>
<td>High</td>
</tr>
</tbody>
</table>
CHRIS VAN ROOYEN

Curriculum Vitae

Date of birth: 30 April 1964

Qualifications: BA LLB (Rand Afrikaans University)
Advocate of the High Court of South Africa

Occupation: Specialist Consultant:

Duties: Overall co-ordination and management of the Endangered Wildlife Trust's national programme to eliminate negative wildlife interactions with electrical utility structures in southern Africa

Bird Impact Assessment Studies for proposed powerlines:

- Athene - Umfolozi 400kV
- Beta-Delphi 400kV
- Cape Strengthening Scheme 765kV
- Flurian-Louis-Trichardt 132kV
- Ghanzi 132kV
- Ikaros 400kV
- Matimba-Witkop 400kV
- Naboomspruit 132kV
- Tabor-Flurian 132kV
- Windhoek - Walvisbaai 220 kV
- Witkop-Overyssel 132kV
- Breyten 88kV
- Adis-Phoebus 400kV
- Dhuva-Janus 400kV
- Perseus-Mercury 400kV
- Gravelotte 132kV
- Ikaros 400 kV
- Khanye 132kV
- Moropule – Thamaga 220 kV
- Parys 132kV
- Simplon – Everest 132kV
- Tutuka-Alpha 400kV
- Simplon-Der Brochen 132kV
Bird Risk Assessments on existing powerlines:

- Amandel 132kV
- Atlanta 22kV
- Butterworth-Ncora 66kV
- Debswana Jwaneng 66kV
- Edwardsdam – Mareetsane 88kV
- Gaberone 132kV
- Lydenburg-Merensky 132kV
- Tabor-Dendron 132kV
- Vryheid-Bredasdorp 66kV
- Vygeboom 132kV
- Watershed-Mmabatho 88kV
- Welgevonden 22kV network

Bird Impact Assessment Studies for residential developments:

- Lizard Point Golf Estate
- Lever Creek Estates
- Leloko Lifestyle Estates
- Vaaloewers Residential Development

Papers and Conference Presentations:


