# COOKHOUSE II WIND ENERGY FACILITY

## EASTERN CAPE


## AFRICAN CLEAN ENERGY DEVELOPMENTS (PTY) LTD

AVIFAUNAL IMPACT ASSESSMENT

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**EXECUTIVE SUMMARY**

This study assesses the potential interactions between birds and the proposed Cookhouse II Wind Energy Facility (WEF), located between the villages of Cookhouse and Bedford in the Eastern Cape. The following are key characteristics of the receiving environment:

» The site is dominated by rolling grassland, with woodland or thornveld present in the drainage lines and on certain (mostly south facing) slopes. Numerous small drainage lines exist on site, and this has resulted in many farm dams being constructed for livestock watering. Most of these dams are very small, but still represent an important bird micro habitat.
» Up to approximately 233 bird species could occur on site, with 15 of these species being Red Listed by Barnes (2000). Of these species, the following have been selected as the 'target species' for this study, i.e. those species for which there is special concern related to the proposed WEF: Cape Vulture (Griffon) *Gyps Coprotheres;* Martial Eagle *Polemaetus bellicosus;* Blue Crane *Anthropoides paradiseus;* Denham's (Stanley's) Bustard *Neotis denhamii;* Secretarybird *Sagittarius serpentarius;* Black Harrier *Circus maurus;* and Melodious (Latakoo) Lark *Mirafra cheniana.*
» Bird monitoring of the greater area encompassing Cookhouse II and Cookhouse I has begun, and one winter count has been conducted. This monitoring programme has recorded 78 species on site, including all the target species except for Cape Vulture and Melodious Lark. Target species have however not been observed flying in the area, and at this stage data collected represented a zero passage rate (flight through rotor swept zone) for target species.

The expected interactions between birds and the proposed WEF are: disturbance of birds; habitat destruction during construction and maintenance of the facility and associated infrastructure; displacement of birds from the area, or from flying over the area; collision of birds with turbine blades during operation; and collision and electrocution of birds on associated electrical infrastructure. With respect to the assessment of these potential impacts for the Cookhouse II project, the following are key findings:

» In assessing the significance of these impacts for the target species, it must be remembered that the proposed Cookhouse II WEF is adjacent to the much larger Cookhouse I WEF, already authorized. The impacts of Cookhouse II therefore need to be assessed against this background. In addition, the broader Cookhouse area appears to be the site of multiple WEF proposals, with up to 6 or 7 other WEF's currently under application. In particular the area immediately to the south of Cookhouse II and I is relatively densely occupied by wind energy developments.
» The two impacts that are determined to be of medium or higher significance are collision of birds with turbine blades, and with power lines.

- The remaining impacts such as disturbance and habitat destruction have been judged to be of low significance due to the already highly disturbed nature of the study area, and the relatively small amount of habitat destruction that will take place (especially when related to the target species, which mostly have large territories).
- Micro-siting of turbines and other infrastructure within the proposed site remains the foremost means of mitigating impacts on birds. This study has analysed and mapped the avifaunal sensitivity of the study area, and classed it into high, medium and low sensitivity. Construction of infrastructure should be conducted within the low sensitivity areas as far as possible. Since the exact position of turbines and other infrastructure has not yet been finalized, a site specific avifaunal Environmental Management Plan is seen as essential.

The following are key recommendations emanating from the findings of this study:

- It is essential that a pre- and post construction bird monitoring programme be conducted at this site, so the current programme should continue.
- It is important that a site specific Environmental Management Plan be compiled once the position of all infrastructure is almost final, and this stage be used to provide final avifaunal input into infrastructure siting and any other necessary mitigation aspects.
- It is recommended that a strategic evaluation of wind energy and environmental impacts in the greater Cookhouse area be conducted as soon as possible.

**DECLARATION OF CONSULTANTS' INDEPENDENCE & QUALIFICATIONS**

Jon Smallie (Avifaunal Specialist) is an independent consultant to Savannah Environmental Pty (Ltd). Mr Smallie has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work.

Mr. Smallie is registered with The South African Council for Natural Scientific Professionals (400020/06). He has twelve years of experience in the field of bird interactions with electrical and energy infrastructure and has, relevant to this study, conducted avifaunal impact assessments for atleast 15 wind energy projects. He is the founder of the Birds and Wind Energy Specialist Group in South Africa. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information.

27 September 2011

# 1. INTRODUCTION

African Clean Energy Developments Pty (Ltd) (hereafter ACED) plan to construct a wind energy facility (hereafter referred to as Cookhouse II Wind Energy Facility) in the Eastern Cape between the villages of Cookhouse and Bedford. Savannah Environmental Pty (Ltd) was appointed to conduct the Basic Assessment study, and subsequently appointed Jon Smallie to conduct the specialist avifaunal assessment.

This study investigates the potential impacts of the proposed facility on the birds of the area. Typically a wind energy facility of this nature can be expected to impact on avifauna as follows: disturbance of birds; habitat destruction during construction and maintenance of the facility and associated infrastructure; displacement of birds from the area, or from flying over the area; collision of birds with turbine blades during operation; collision and electrocution of birds on associated electrical infrastructure. The likelihood and significance of each of these impacts will be investigated further in this study.

In assessing the significance of these impacts for the target species, it must be remembered that the proposed Cookhouse II WEF is adjacent to the much larger Cookhouse I WEF, already authorized. The impacts of Cookhouse II therefore need to be assessed against this background. In addition, the broader Cookhouse area appears to be the site of multiple WEF proposals, with up to 6 or 7 other WEF's currently under application. In particular the area immediately to the south of Cookhouse II and I is relatively densely occupied by wind energy developments.

Although a full discussion of the potential pros and cons of different forms of energy production are beyond the scope of this study, it is important to view the current proposed development as exactly what it is, a move away from South Africa's inappropriate dependence on fossil fuel based energy production to date. In the long term, a shift towards reducing greenhouse gas emission will benefit all biodiversity, including birds. Whilst the long term effects of our energy choices should be kept in mind whilst compiling this assessment, it is also critical in the shorter term to minimize direct, impacts on our birds, or for some species with small populations the longer term benefits of renewable energy will come too late.

# 2. STUDY METHODOLOGY

## 2.1. Approach

This study followed the following steps:

- An extensive review of available international literature pertaining to bird interactions with wind energy facilities was undertaken in order to fully understand the issues involved and the current level of knowledge in this field. This international knowledge was then adapted to local conditions and species as far as possible in order to identify important or target species for this study.
- The various data sets listed below, and the study area were examined to determine the likelihood of these relevant species on or near the site.
- The potential impacts of the proposed facility on these species were described and evaluated.
- Sensitive areas within the proposed site, where the above impacts are likely to occur, were identified using various GIS (Geographic Information System) layers and Google Earth.
- Recommendations were made for the management and mitigation of impacts.

### 2.2 Data sources used

The following data sources and reports were used in varying levels of detail for this study:

- The Southern African Bird Atlas Project data (SABAP1 - Harrison *et al*, 1997) for the quarter degree squares (3225DB & 3225DD) covering the site. The Southern African Bird Atlas Project 2 data was also consulted at http://sabap2.adu.org.za/v1/index.php
- The Important Bird Areas report (IBA - Barnes 1998) was consulted to determine the location of the nearest IBA's and their importance for this study.
- The conservation status of all relevant bird species was determined using Barnes (2000)
- The latest vegetation classification of South Africa (Mucina & Rutherford, 2005) was consulted in order to determine which vegetation types occur on site.
- Information emanating from the bird pre-construction monitoring programme for Cookhouse I was consulted in order to benefit from this critical experience in the area (unpublished report – Endangered Wildlife Trust, 2011).

### 2.3 Limitations & assumptions

- Any inaccuracies in the above sources of information could limit this study. In particular, the SABAP1s data is now fairly old (Harrison *et al*, 1997), but no reliable more recent data on bird species presence and abundance in the study area exists, since SABAP2 coverage is not yet adequate.
- This study relies entirely upon secondary data sources with regards to bird abundances such as the SABAP1 (Harrison *et al*, 1997). However, primary information on bird habitat was collected during the site visit and is used directly in determining which species are likely to occur where on site.

- The position of associated infrastructure has not yet been finalized. This did not pose a significant limitation, since this study has identified areas up front where this infrastructure cannot be placed.

## 3. BACKGROUND TO THE STUDY

### 3.1 Background to interactions between wind energy facilities and birds

The South African experience of wind energy generation has been extremely limited to date. By necessity, much of what we know about birds and wind energy is based on international literature, primarily from the United States, United Kingdom, European Union, Australia and Canada. Most of the principles that have been learnt internationally can, to a certain extent, be applied locally, with care to adapt existing international knowledge to local bird species and conditions. An additional challenge is that much of the international literature is so called grey literature, i.e. published in proceedings, consultant reports and unpublished reports – not peer reviewed journals. Most literature focuses on the impact of collision of birds with turbines, giving less attention to the impacts of habitat destruction and disturbance or displacement of birds.

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 in the discussion below.

Concern for the avian impacts of wind energy facilities first arose in the 1980's when raptor mortalities were detected in California (Altamont Pass - US) and at Tarifa (Spain). The Altamont Pass and Tarifa sites were the site 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. 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 resulting collision rates have varied significantly across different countries and sites, from as little as zero to as many as 10 birds per turbine per year. It is also important to note that searcher efficiency (and independence) and scavenger removal rates need to be accounted for. Searcher efficiency refers to the percentage of bird mortalities that are detected by searchers, searcher independence refers to whether the person monitoring has certain objectives of their own which may influence the results of monitoring.

In South Africa to date, only eight wind turbines have been constructed, 3 at a demonstration facility at Klipheuwel in the Western Cape, in 2002 and 2003, 4 at a site near Darling (although access to these for the purpose of monitoring bird impacts has been restricted), and 1 at Coega near Port Elizabeth. A monitoring program, conducted by Jacque Kuyler (2004), was put in place once the 3 Klipheuwel turbines were operational, and found two bird collisions with blades, a Horus Swift *Apus Horus* and a Thick-billed Lark *Rhamphocoris clotbey*, equating to 1 bird mortality per turbine per year.

### ***3.1.1. Factors influencing bird collisions with turbines***

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

*Bird related information*

Although only one study has so far shown a direct relationship between numbers 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. Bird behaviour and activity differs between species – with certain hunting behaviours rendering certain species more vulnerable. For example a falcon stooping after prey is (possibly) too focused on its prey to notice the presence of 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. Birds are believed to be capable of learning to avoid obstacles with sufficient time living in an area.

Whilst all birds face some inherent risk of impact by wind turbines, there are definitely certain groups that are more at risk due to their flight behavior or habitat preferences (Jordan & Smallie, 2010). These authors summarized knowledge from the European Union, United Kingdom, United States, Canada and Australia to identify the following taxonomic groups as being affected most by wind energy facilities: Podicipediformes, Pelicaniformes, Ciconiiformes, Anseriformes, Falconiformes, Charadriformes, Strigiformes, Caprimulgiformes, Gruiformes, Galliformes, Psittaciformes, Passeriformes. In determining which species are likely to be at risk at wind energy facilities in South Africa, the above groups form a useful starting point.

*Site information*

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 will attract raptors, increasing the time spent hunting, and as a result reducing the time spent being observant. Certain sites are also vulnerable to poor weather such as mist, which may influence the bird collision risk.

*Facility information*
According to Kingsley & Whittam (2005), "More turbines will result in more collisions". Although only two mortalities have been recorded at Klipheuwel, the difference between the 3 turbines at Klipheuwel and a potential 50 turbines (approximately) at the proposed Cookhouse II Wind Energy Facility is significant and largely renders comparisons and extrapolations meaningless. Larger facilities also have greater potential for disturbance and habitat destruction, and displacement of birds from the area. With newer technology and larger turbines, fewer turbines are needed for the same quantity of power generation, possibly resulting in fewer mortalities per MW of power produced (Erickson *et al*, 1999).

Lighting of turbines and other infrastructure has the potential to attract birds, thereby increasing the risk of collisions with turbines. Erickson *et al* (2001) suggest that lighting is the single most critical attractant leading to collisions with tall structures. Changing constant lighting to intermittent lighting has been shown to reduce attraction (Richardson 2000) and mortality (APLIC, 1994; Jaroslow, 1979; Weir, 1976) and changing white flood light to red flood light resulted in an 80% reduction in mortality (Weir, 1976).

Infrastructure associated with the facility often also impacts on birds. Overhead power lines pose a collision and possibly an electrocution threat to certain bird species. Furthermore, the construction and maintenance of the power lines will result in some disturbance and habitat destruction. New access roads, substations and offices constructed will also have a disturbance and habitat destruction impact.

Collision with power lines is one of the biggest single threats facing birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited maneuverability, 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. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. The collision risk of the proposed power lines has been assessed elsewhere in this study.

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). The larger bird species are most affected since they are most capable of bridging critical clearances on hardware. The electrocution risk of the proposed 132kV and smaller lines has been assessed below subject.

During the construction phase and maintenance of power lines and substations, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the leveling of substation yards. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimise the risk of fire under the line which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, through the modification of habitat.

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, whilst others have argued that these gaps result in more collisions.

### *3.1.2. Potential explanations for collisions of birds with turbines:*

The three main hypotheses proposed for birds not seeing turbine blades are as follows (Hodos, 2002):

» 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.
» 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.

### *3.1.3. Mitigation measures*

Whilst bird mortalities have been comprehensively documented at numerous sites world-wide, very little has been written about the potential methods of reducing the level of mortalities, perhaps because little mitigation has been implemented post construction. Potential mitigation measures include: alternative turbine designs (such as vertical axis turbines); painting turbine blades (tested only in laboratory conditions to date); anti perching devices; construction of shielding pylons; curtailment of turbines during high risk periods; shutdown of certain high risk turbines; and  altering blade height to pose less risk within the birds' preferred height strata.

## 3.2. Description of the proposed wind energy facility

The proposed activity is the establishment of a wind energy facility (WEF) and associated infrastructure. A broader area of approximately 35km is being considered within which the facility is to be constructed. The proposed facility would include:

» Up to 50 wind turbines with foundations to support the turbine towers;
» Cabling between turbines, to be lain underground where practical;
» Up to two substations to facilitate the connection to the grid
» Overhead power lines either feeding into the existing Eskom Poseidon substation or tying into existing overhead transmission lines
» Internal access roads to each wind turbine.
» Workshop area for maintenance and storage if required.

The project is proposed on the following farm portions: Van Wyks Kraal 73 (Portions 0 – remaining extent, 1 and 4), Roberts Kraal 72 (Portion 0 remaining extent), Gallants Kloof 70 (Portion 3), Request 71 (Portion 0 remaining extent, Portion 11, Portion 12) and Farm 75 (Portion 2) (refer to map elsewhere in this report).

At this time there is no alternative site for consideration for the overall wind energy facility. This has been motivated to DEA by ACED. Alternatives exist within the site for the substation and power line positioning. Figure 1 below shows the location of the proposed site for the Cookhouse II Wind Energy Facility. During development of the bird monitoring programme for the Cookhouse I WEF an 'inclusive impact zone' was defined, and this has been used to define the study area for Cookhouse II – see in Figure 2 and subsequent Figures.

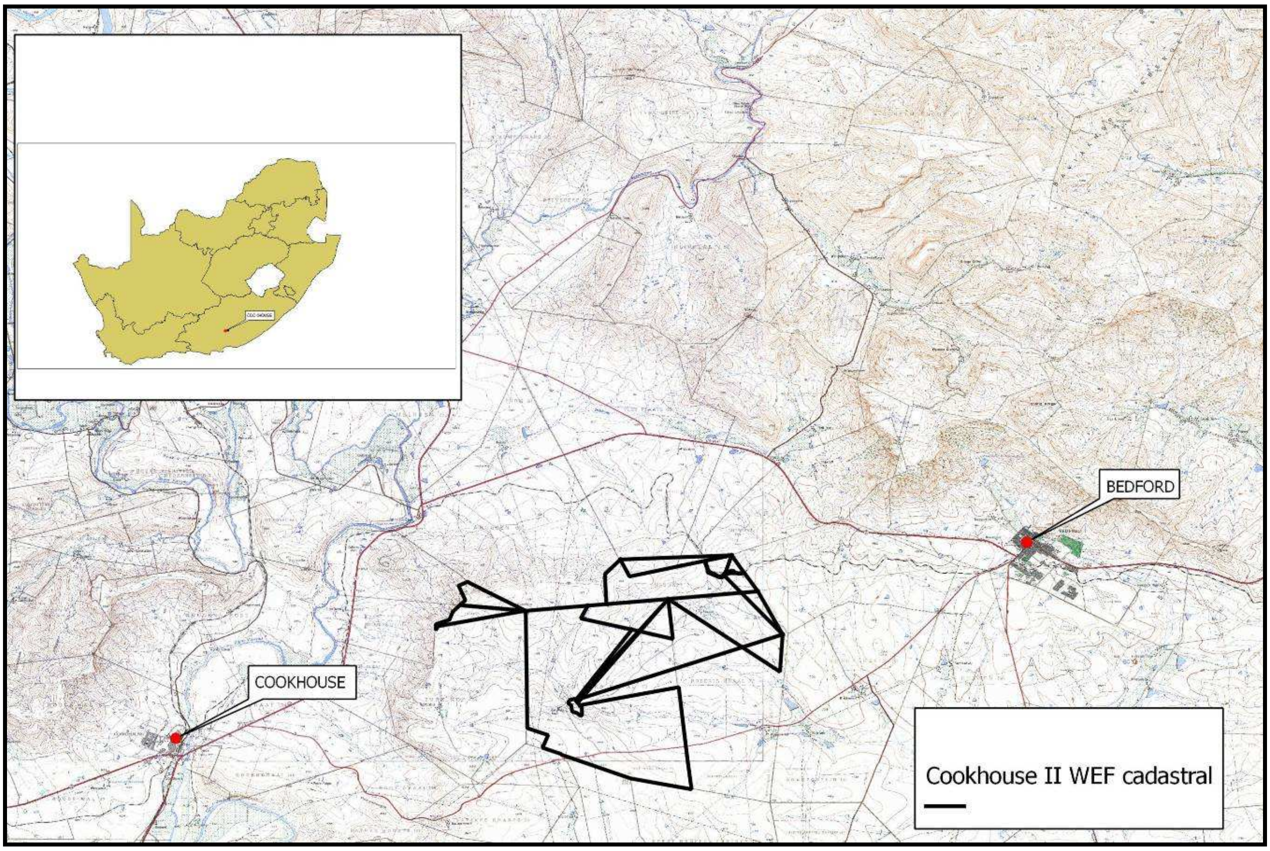

Figure 1. Layout of the study area showing the proposed site for the Cookhouse II Wind Energy Facility.

## 4. DESCRIPTION OF AFFECTED ENVIRONMENT

### 4.1 Vegetation of the study area

The following description of the vegetation on the site focuses on the vegetation structure and not species composition. It is widely accepted within ornithological circles that vegetation structure and not species composition is most important in determining which bird species will occur there. The classification of vegetation types below is from Mucina & Rutherford (2005).

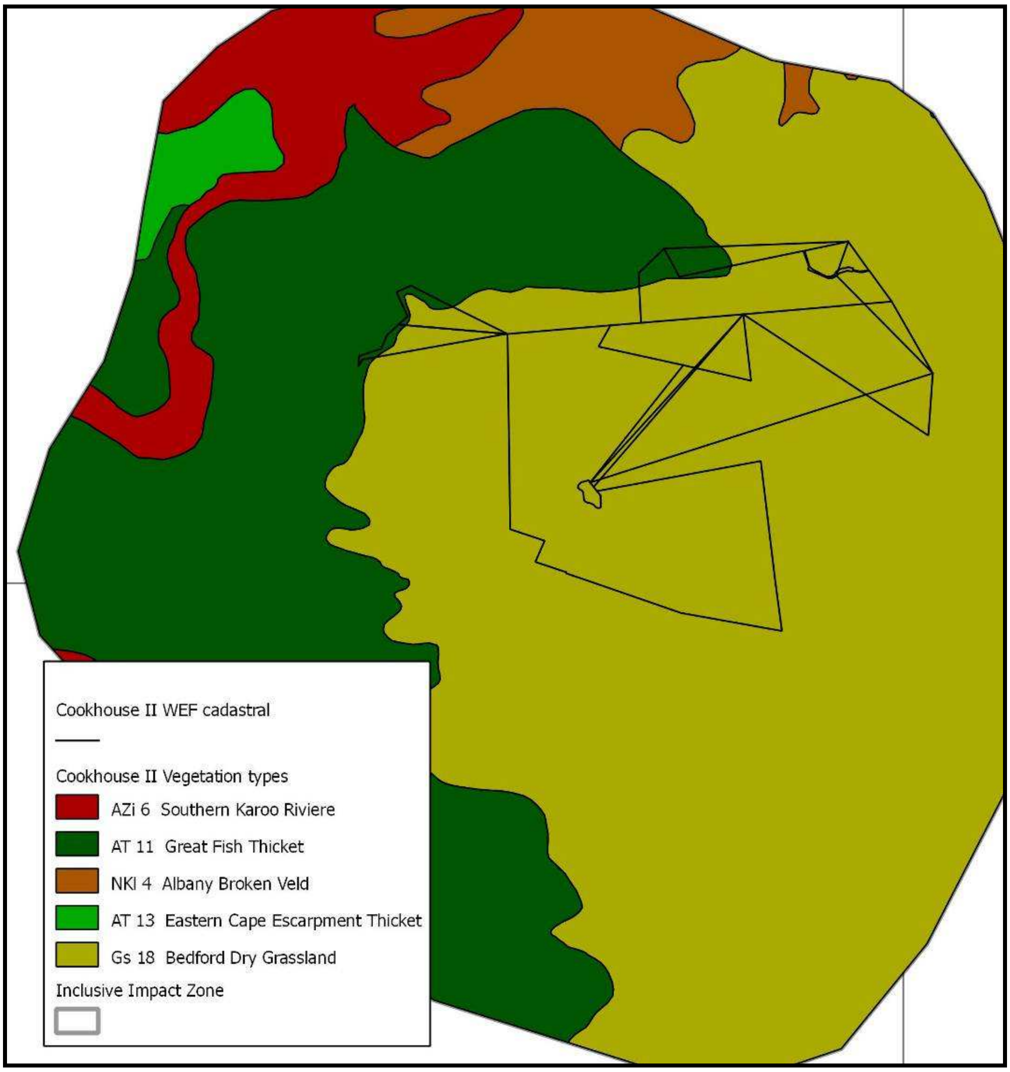


Figure 2. Vegetation classification (Mucina & Rutherford, 2005) for the Cookhouse II Wind Energy Facility study area, including the 'inclusive impact zone' as defined previously for the Cookhouse I project, and for the bird monitoring programme.

The majority of the affected area is classified as "Bedford Dry Grassland", followed by "Great Fish Thicket", predominantly situated on the mini escarpment to the west of the study area. The relevance of this vegetation classification to the avifauna of the area is that a variety of habitat is provided, which can accommodate both the species mostly dependant on grassland, and those dependant on thicket and woodland. This is reflected in the species composition for the study area, shown in Table 1 below. Woodland species such as Martial Eagle *Polamaetus bellicosus*, Secretarybird *Sagittarius serpentarius*, and African Crowned Eagle *Stephanoaetus coronatus*, and grassland species such as Lesser Kestrel *Falco naumanni*, Blue Crane *Anthropoides paradiseus*, Denham's Bustard *Neotis denhamii*, Black Harrier *Circus maurus* and Melodious Lark *Mirafra cheniana* have been recorded in the broader area.

## 4.2 Bird micro habitats

The above vegetation description partially describes the habitat available and hence the species likely to occur in the study area. However, more detail is required in order to understand exactly where within the study area certain species will occur and how suitable these areas are for the relevant species. The habitats available to birds at a small spatial scale are known as micro habitats. These micro habitats are formed by a combination of factors such as vegetation, land use, anthropogenic factors, topography and others. These micro habitats will be critically important in siting the proposed turbines within the affected farms. The species most likely to use each micro habitat within this study area are shown in Table 2. The following micro habitats were observed from the site visit:

**Natural grassland:** This is the dominant micro habitat available to birds in the study area. The dominant plants in this biome are grass species, with geophytes and herbs also well represented (Low & Rebelo 1996). Grasslands are maintained mainly by a combination of relatively high summer rainfall, frequent fires, frost and grazing. These factors generally preclude the growth of trees and shrubs in any abundance. This biome has been largely transformed in SA already through various land uses such as afforestation and crop cultivation. However in the current study area, most grassland is still intact, with relatively little transformation.

**Rivers and drainage lines:** A number of small drainage lines and streams bisect the affected farms, and represent an important bird micro habitat. Several bird species are restricted to riverine habitat in southern Africa. This dependence is borne out by these species' distribution correlating with the position of river courses in southern Africa. In the study area although many of these water courses seldom contain much water, these systems are important as they have a different vegetation composition to the remainder of the plains, often including woody species such as *Acacia Karoo* and woodland as described below. Furthermore any river, stream or drainage line represents an important flight path for many bird species. These areas have been assigned medium sensitivity in the analysis elsewhere in this report.

**Wetland:** Several small patches of wetland are associated with the various drainage lines in the study area, but no wetlands of significant size exist. Wetlands are characterised by slow flowing water and tall emergent vegetation, and provide habitat for many water birds. The conservation status of many of the bird species that are dependant on wetlands reflects the critical status of wetlands nationally, with many having already been destroyed. Species likely to make use of wetlands in this area include the Blue Crane, the harriers, and various others.

**Dams:** Many thousands of earthen and other dams exist in the southern African landscape and have altered flow patterns of streams and rivers. Several small dams are present on and adjacent to the site. Whilst this has been a detrimental effect for certain bird species through flooding their natural habitat, a number of species have benefited from their construction. The construction of these dams has probably resulted in a range expansion for many water bird species that were formerly restricted to areas of higher rainfall. These include species such as the pelicans, darters and cormorants and many other waterfowl. Most importantly though in this landscape, dams are used as roost sites by flocks of Blue Cranes. This has serious implications for Blue Crane interaction with vertical structures such as wind turbines and power lines, as they leave the roost in the early morning during low light conditions, and arrive at the roost in the late evening, again during low light conditions. These areas have been identified as high sensitivity in the analysis elsewhere in this report.

Figure 3. Representative examples of micro habitats on site - from top left: woodland; grassland; arable land; ridge line.

**Woodland:** The woodland biome covers most of the northern and eastern parts of southern Africa and is defined as having a grassy under-storey and a woody upper-storey of trees and shrubs. Woodland can be divided into two types: the fine leaved arid, often Acacia dominated woodlands in the drier parts of the country, and the predominantly broadleaved woodlands in the wetter regions. The Woodland bird community is the most species rich community in southern Africa. Complex differences in bird species distribution and abundance are seen between the different woodland types. Relatively small amounts of arid woodland exist in this study area, mainly on the south facing slopes and in the valleys and drainage lines.

**Arable or cultivated land:** These areas represent significant feeding areas for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds and other predators; the crop or pasture plants cultivated are often eaten themselves by birds, or attract insects which are in turn eaten by birds; during the dry season arable lands often represent the only green or attractive food sources in an otherwise dry landscape. In this study area there are some small arable lands situated close to the Request homestead. If lands are irrigated, they can also represent almost the only source of "green" and moisture in this landscape for much of the year. This attracts certain species as shown in Table 1. In particular the White Stork has a high affinity with arable lands, with 86% of sightings in South Africa recorded on arable lands (Allan 1985, Allan 1989, Allan 1997 in Hockey, Dean & Ryan 2005).

**Ridges:** Ridges represent important habitat for a number of species, and there is a ridge in the far west of the proposed site. Most relevant to this study are the aerial species such as raptors and swifts/swallows – which favour flying along ridges where there are favourable air currents, termed 'ridge lift' (or orographic lift). Wind that is perpendicular to the ridge line is forced upwards when it meets the ridge, thereby creating lift, long continuous ridges resulting in greater lift. In addition, the air is heated differently by the sun on either side of a ridge, resulting in thermal lift. Birds use this lift to gain altitude, forage or move between locations – all with less effort than would be required elsewhere. Larger soaring species such as storks and vultures will also circle over ridges as they gain height and exploit the conditions. On the lee side of the ridge, several 'waves' may form. Whilst these waves can potentially also favour bird flight, it is probably more likely that the turbulence in this area would be detrimental to birds and probably avoided, particularly by smaller species. Various studies internationally have found higher wind turbine bird mortality rates close to steep ground (including Orloff & Flannery 1992; Howell & Noone, 1992; Thelander & Rugge, 2001). The increased wind speed in these ridge areas may also mean that birds have less control of their own flight and are less able to adjust to avoid obstacles such as wind turbines. It is important to avoid the edge of the ridge when turbines are placed. This has been shown in the sensitivity map elsewhere in this report. Ridge areas have been identified as high sensitivity areas in the analysis elsewhere in this report.

## 4.3 Bird presence in the study area

Table 1 lists the Red Data bird species recorded by the SABAP1 (Harrison *et al*, 1997) in the two quarter degree squares covering the study area, i.e. 3225DB and 3225DD (there is a marginal overlap with 3226CA but this data has not been included). The total number of all species recorded and the number of cards (counts) submitted per square is also shown. An approximate total of 233 species could occur in the area, based on what has been recorded by Harrison *et al* (1997). The number of cards can be used as an indicator of our confidence in that particular report rate. If lots of cards have been submitted our confidence in the data is higher, and vice versa. In this study, both squares have been relatively thoroughly counted (117 and 35 cards). Report rates are essentially percentages of the number of times a species was recorded in the square, divided by the number of times that square was counted. It is important to note that this data provides an indication of which species *could* occur on the proposed site. The species in Table 1 were recorded in the entire quarter degree square in each case, and may not actually have been recorded on the proposed site for this study.

In total 15 Red Data species were recorded across the two squares, comprising 6 Vulnerable and 9 Near-threatened species. In addition, the White Stork *Ciconia ciconia* was included here as it is afforded protection internationally under the Bonn Convention on Migratory Species.

Table 1. Red Data species recorded in the two quarter degree squares (3225DB & 3225DD) covering the study area during the Southern African Bird Atlas Project (Harrison *et al,* 1997)

| | | | | | | |
|---|---|---|---|---|---|---|
| **Total Cards** | | 117 | 35 | | | |
| **Total Species** | | 233 | 156 | | | |
| **Total Breeding Species** | | 102 | 19 | | | |
| **Name** | **Cons. status** | **322 5DB** | **322 5DD** | **Preferred micro habitat** | **Likelihood of occurrence** | **Relative importance of study area for species** |
| **Cape Vulture (Griffon) *Gyps Coprotheres*** | **VU** | **5** | **-** | **Mostly mountainous country, or open country with inselbergs and escarpments; less commonly in savanna or desert** | **High** | **Low to medium – although this species is not seen throughout the year in this area according to landowners, and there are no known breeding colonies in the vicinity – based on experience in Spain with Eurasian Griffons, this species is extremely vulnerable to collision with turbine blades** |
| **Martial Eagle *Polemaetus bellicosus*** | **VU** | **24** | **-** | **Woodland, savanna or grassland with clumps of large trees or power pylons for nest sites** | **High** | **Medium – since this species has such large territories, any occupied area is important** |
| Lesser Kestrel *Falco naumanni* | VU | 1 | - | Open grassveld, mainly on highveld, usually near towns or farms | Medium | Low |
| **Blue Crane *Anthropoides paradiseus*** | **VU** | **21** | **20** | **Midland and highland grassveld, edge of karoo, cultivated land, edges of vleis** | **Very high** | **Low to medium – although the species does use the area, large flocks or large numbers of breeding pairs do not appear present** |
| **Denham's (Stanley's) Bustard *Neotis denhamii*** | **VU** | **1** | **9** | **Montane and highland grassveld, savanna, karoo scrub** | **High** | **Low to medium – several birds have been recorded in the area** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Ludwig's Bustard *Neotis ludwigii* | VU | 2 | | Semi-arid dwarf shrubland of succulent Karoo, Nama Karooand Namib | Medium | Low – this site is in the far eastern extremity of this species range |
| Great White Pelican *Pelecanus onocrotalus* | NT | 1 | | Coastal bays, estuaries, lakes, larger pans and dams | Low | - |
| Black Stork *Ciconia nigra* | NT | 9 | 3 | Feeds in or around marshes, dams, rivers and estuaries; breeds in mountainous regions | Medium | Low |
| Yellow-billed Stork *Mycteria ibis* | NT | 2 | | Mainly inland waters; rivers, dams, pans, floodplains, marshes; less often estuaries | Low | - |
| **Secretarybird *Sagittarius serpentarius*** | **NT** | **9** | **14** | **Semidesert, grassland, savanna, open woodland, farmland, mountain slopes** | **High** | **Medium – this species has large territories and any suitable area is important for them** |
| African Crowned (Crowned) Eagle *Stephanoaetus coronatus* | NT | 22 | | Dense indigenous forest, including riverine gallery forest; may range far from forest to hunt | Low to medium | Low – most of the suitable habitat is off site, below the mini escarpment |
| **Black Harrier *Circus maurus*** | **NT** | **2** | | **Grassveld, karoo scrub, mountain fynbos, cultivated lands, subalpine vegetation, semidesert** | **Medium to high** | **Medium – this species has very specific habitat requirements, and so any area occupied by them is important. In general true grassland habitat appears to support less of these birds than fynbos, west coast areas** |
| Lanner Falcon *Falco biarmicus* | NT | 4 | | Mountains or open country from semidesert to woodland and agricultural land; also cities (Durban, Harare). | Medium to high | Low |
| Knysna Woodpecker *Campethera notata* | NT | 11 | | Coastal and riverine bush, evergreen forest, denser thornveld, *Euphorbia* scrub | Low to medium | Low – there is not enough suitable habitat on site |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Melodious (Latakoo) Lark *Mirafra cheniana*** | **NT** | | **6** | **Open climax grassland, especially Red Grass (Rooigras) *Themeda triandra*, sometimes with rocky outcrops, termite mounds or sparse bushes** | **High** | **Low to medium** |
| White Stork *Ciconia ciconia* | Bonn | 21 | 20 | Highveld grasslands, mountain meadows, cultivated lands, marshes, karoo | Medium | Low – this species is more abundant in transformed habitats such as close to the Great Fish River |

VU = Vulnerable; NT = Near-threatened; Bonn = Protected under the Bonn Convention on migratory species

The likelihood of each species actually occurring on or close to the proposed site has also been specified in Table 1, based on ornithological experience and assessment of available habitat on site. Many of the species recorded in the two quarter degree squares have at least a medium likelihood of occurrence, potentially making this study area relatively sensitive in general avifauna terms. The importance of this study area for each species has also been described, since this places any likely impacts in context. Those species with medium or higher 'importance of study area' have been displayed in bold in Table 1.

Importantly, the species in Table 1 represent many of the broad groupings of bird species i.e. large terrestrial birds (Blue Crane, Denham's & Ludwig's Bustards and Secretarybird), raptors (Martial and African Crowned Eagles, Lesser Kestrel, Lanner Falcon, Black Harrier), small grassland/shrubland species (Melodious Lark). Assessing the impacts on the species in Table 2 therefore potentially covers impacts on other species from these groupings that were not recorded but may occur on the site. This study concentrates on assessing the impacts on the Red Data species as these are the species of most conservation concern, and are often the species most sensitive to any artificial impacts. However, impacts on non Red Data species that are believed to be relevant to this study are also considered. In particular, non Red Data species groups such as raptors, owls, lapwings, waterfowl, and thick-knees. Swallows, swifts and martins will also be relevant to this study due to the amount of time they spend in the air, which increases the chances of collisions.

The more recent Southern African Bird Atlas 2 data was also consulted to shed light on more recently recorded bird abundance in the area. Unfortunately the coverage by counters in this area has not been good to date. Within the 3 quarter degree squares, 3225DB, 3225DD, and 3226CA, there are only a total of 9 pentads (out of 27) that have been counted at all. Most of these are not situated close to the Cookhouse II site, and are therefore not useful. There is 1 exception, Pentad 3240_2600, which covers parts of the eastern part of Cookhouse II. The single count conducted in this pentad recorded 41 species, none of which are Red Listed or target species for this study.

**Target species for this study**

Determining the target species for this study, i.e. the most important species to be considered, is a three step process. The above data represents the first step, i.e. which species occur or could occur in the area at significant abundances, and the importance of the study area for those species. Secondly, the recent document "A briefing document on best practice for pre-construction assessment of the impacts of onshore wind farms on birds" (Jordan & Smallie, 2010) was consulted to determine which groups of species could possibly be impacted on by wind farms. This document summarises which taxonomic groups of species have been found to be vulnerable to collision with wind turbines in the USA, UK, EU, Australia and Canada. The taxonomic groups that have been found to be vulnerable in two or more of these regions are as follows: Pelicaniformes (pelicans, gannets, cormorants); Ciconiiformes (storks, herons, ibises, spoonbills); Anseriformes (swans, ducks, geese); Falconiformes (birds of prey); Charadriiformes (gulls, terns, waders); Strigiformes (owls); Caprimulgiformes (nightjars); Gruiformes (cranes, bustards, rails); Galliformes (pheasants, grouse, francolins); and Passeriformes (songbirds). The third step is to consider the species conservation status or other reasons for protecting the species. This involved primarily consulting the Red List bird species (Barnes 2000) as in Table 1.

**The resultant list of 'target species' for this study is as follows: Cape Vulture; Martial Eagle; Blue Crane, Denham's Bustard, Secretarybird, Black Harrier and Melodious Lark.**

As discussed elsewhere in this report, the impact of most concern for these species is that of collision with turbines, based on the fact that this study area is already relatively disturbed by other activities, in particular overhead power lines. In judging the potential significance of this impact it is essential to understand the flight characteristics of the species, i.e. how often and how high does the bird fly. This data is only obtained through observation of the relevant area and species. Fortunately, pre-construction bird monitoring for the ACED Cookhouse I site has recently been started and one 15 day site visit has been conducted. The preliminary observations from that exercise can therefore be used for the purposes of this assessment. The main relevant observations emerging from that work are as follows:

» A total of 78 species have been recorded on site to date by the monitoring team, including all of the above target species except for Cape Vulture and Melodious Lark.
» Most of these species have not been observed in flight more than once in a total of 60 hours of observation. In all cases these flights have been recorded as below 30m above ground. Since the proposed turbine blades for Cookhouse II would likely extend to approximately 35 to 45m above the ground – these recorded flights are therefore too low to place the bird at risk. Of the target species listed above the following observations have been made: 2 Blue Cranes have been seen twice walking from VP1; and 1 Black Harrier has been seen flying 5m above the ground at VP2. In addition to these target species, a species of interest is the Lanner Falcon, one of which has been seen flying twice 5 and 3m above the ground at VP4. Although it is early days still in terms of this monitoring programme, what this data means in terms of ultimate collision risk modeling for the turbines at Cookhouse II is as follows: Passage rates through turbine zone for target species is zero. This means theoretically that zero collisions of these species with turbine blades once constructed could be expected. This preliminary finding should not be taken too seriously though until more data has been collected and our confidence in the finding is greater.
» The only species consistently observed to fly above 35m are the Pied Crow and White-necked Raven – which are species of relatively low conservation priority. Since these are not target species, passage rates and likely collision risk has not been estimated.
» To date no sensitive species' breeding sites have been identified on site.

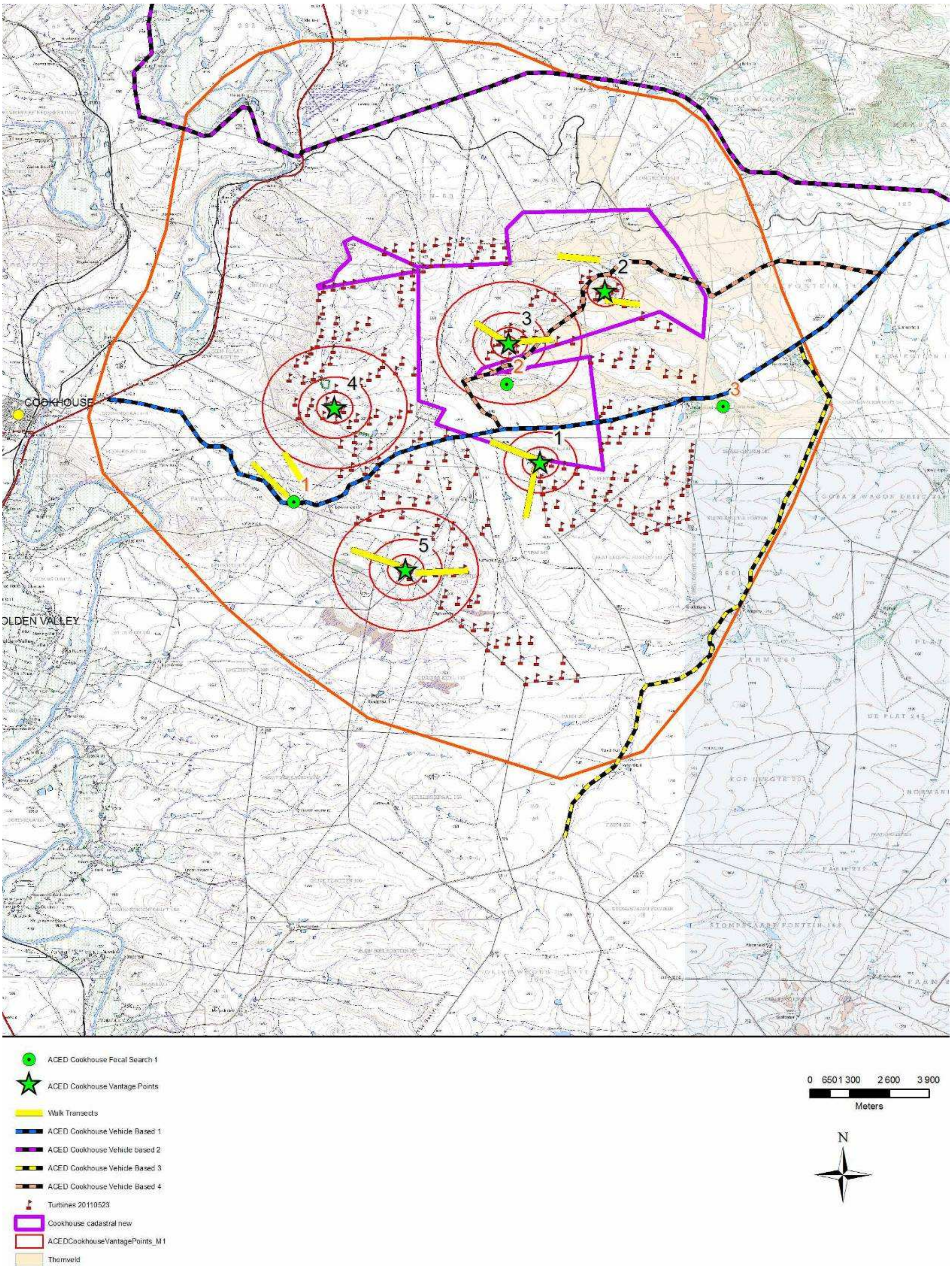


Figure 4. The layout of the proposed Cookhouse II project, relative to the current ongoing bird monitoring activities (map from unpublished report – Endangered Wildlife Trust).

## 5. ASSESSMENT OF IMPACTS OF PROPOSED FACILITY

The potential impacts of the proposed Cookhouse II WEF and associated infrastructure have been assessed and rated in the tables below. APPENDIX 1 describes the criteria (supplied by Savannah Environmental Pty (Ltd) applied for this assessment.

### *5.1.1. Wind energy facility*

No alternative sites were considered, although there is opportunity to influence the micro siting of turbines within the proposed site.

Table 2. Assessment of disturbance of birds during construction, maintenance and operation of the WEF

| ***Nature:*** *Disturbance of birds during construction, maintenance and operation.* | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | 2 | 2 |
| ***Duration*** | 4 | 4 |
| ***Magnitude*** | 4 | 3 |
| ***Probability*** | 3 | 3 |
| ***Significance*** | **30 (medium)** | **27 (low)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Low | Low |
| ***Irreplaceable loss of resources?*** | Yes – particularly for breeding sensitive species, breeding attempts may fail thereby losing recruitment to population | Yes |
| ***Can impacts be mitigated?*** | Yes – partially | |
| ***Mitigation:*** All activities should be designed to ensure as little impact through disturbance as possible. For example, existing roads must be used wherever possible, sensitive habitats must be avoided with machinery and vehicles, and labour teams must be strictly managed. Equipment batching plants and construction camps must also be situated away from sensitive areas, preferably in habitats that are already impacted on or in town. If any sensitive species are identified (during the site specific avifaunal EMP) to be nesting in close proximity to the construction site, case specific recommendations on managing the situation will be made, and could include minor changes to construction timing in order to minimize interference during breeding season. | | |
| ***Cumulative impacts:*** The existing transmission and substation infrastructure in the area represents a significant source of disturbance and impact already. In particular it is suspected that the impact of transmission lines on large terrestrial birds on this plateau, through collision, has been significant to date, perhaps reducing the populations of large terrestrial species such as cranes and bustards to far lower levels than prior to this infrastructure. The impacts of the proposed Cookhouse II facility should therefore be evaluated against the background of these existing impacts.<br><br>In addition, the greater Cookhouse area is currently the target of numerous wind energy facilities. The | | |

| |
|---|
| cumulative impact of these facilities on birds in the greater area is therefore of concern. It is recommended that some type of strategic evaluation of the potential cumulative effects on birds (and other components) in the area be undertaken, as such a study is beyond the scope of this project. |
| ***Residual Impacts*** Low – if the facility were decommissioned many bird species would recover quickly and resume normal activities |

Table 3. Assessment of displacement of birds from the site and surrounds – during construction, maintenance and operation of the WEF

| ***Nature:*** *Displacement of birds from the site and surrounds - during construction, maintenance and operation.* | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | 2 | 2 |
| ***Duration*** | 4 | 4 |
| ***Magnitude*** | 4 | 4 |
| ***Probability*** | 3 | 3 |
| ***Significance*** | **30 (medium)** | **30 (medium)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Low | Low |
| ***Irreplaceable loss of resources?*** | Yes – loss of habitat for those species displaced | Yes |
| ***Can impacts be mitigated?*** | No - by definition it is the turbine presence and operating that would/could displace birds | |
| ***Mitigation:*** See above | | |
| ***Cumulative impacts:*** See explanation in Table 2. | | |
| ***Residual Impacts*** Medium – if species are displaced from the site and surrounds for the full project duration they may not return after decommissioning | | |

Table 4. Assessment of habitat destruction during construction, maintenance and operation of the WEF

| ***Nature:*** *Habitat destruction during construction, maintenance and operation.* | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | 1 | 1 |
| ***Duration*** | 2 | 2 |
| ***Magnitude*** | 4 | 2 |
| ***Probability*** | 3 | 2 |
| ***Significance*** | **21 (low)** | **10 (low)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Low – habitat removed cannot really be restored | Low |
| ***Irreplaceable loss of resources?*** | Yes – habitat | Yes |
| ***Can impacts be mitigated?*** | Yes – partially | |

| |
|---|
| ***Mitigation:*** All activities should be designed to ensure as little impact on habitat as possible. For example, existing roads must be used wherever possible, sensitive habitats must be avoided with machinery and vehicles, and labour teams must be strictly managed. Equipment batching plants and construction labour camps must also be situated away from sensitive areas, preferably in habitats that are already impacted on. |
| ***Cumulative impacts:*** See explanation in Table 2. |
| ***Residual Impacts*** Medium – even after decommissioning, habitat would not regenerate fully or immediately |

Table 5. Assessment of collision of birds with the turbine blades of the WEF

| ***Nature:*** *Collision of birds with the turbine blades* | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | 1 | 1 |
| ***Duration*** | 4 | 4 |
| ***Magnitude*** | 8 | 8 |
| ***Probability*** | 3 | 2 |
| ***Significance*** | **39 (medium)** | **26 (low)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Low – birds are killed | Low |
| ***Irreplaceable loss of resources?*** | Yes – birds are killed | Yes |
| ***Can impacts be mitigated?*** | Yes – only partially | |
| ***Mitigation:*** Since effective mitigation of this impact post construction seems to be particularly difficult, it is critical that turbines are positioned correctly from the start, avoiding red "High sensitivity" areas as in Figure 3. An avifaunal site specific EMP is strongly recommended to position turbines optimally in terms of avifauna. If impacts are detected post construction, management options such as shutting down turbines during high risk times should be implemented. | | |
| ***Cumulative impacts:*** See explanation in Table 2 | | |
| ***Residual Impacts*** Low – if facility were decommissioned collisions would stop | | |

### *5.1.2 Associated infrastructure*

Table 6. Assessment of collision of birds with the 132kV power lines connecting the wind energy facility substation to the grid, and with the 11/22kV lines servicing individual turbines

| ***Nature:*** *Collision of birds with the 132kV power lines connecting the wind energy facility substation to the grid, and with the 11/22kV lines servicing individual turbines* | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | 1 | 1 |
| ***Duration*** | 4 | 4 |
| ***Magnitude*** | 5 | 3 |
| ***Probability*** | 3 | 2 |

| | | |
|---|---|---|
| ***Significance*** | **30 (medium)** | **16 (low)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Low – birds killed | Low |
| ***Irreplaceable loss of resources?*** | Yes - birds killed | Yes |
| ***Can impacts be mitigated?*** | Yes - partially | |
| ***Mitigation:*** Correct siting of infrastructure, avoiding high and medium sensitivity areas, and where possible placing adjacent to existing lines. Thereafter, mark high risk sections of line with anti collision marking devices. This final micro siting would best be achieved by the specialist and the developer on site during a site specific EMP, when all relevant information on infrastructure is available. | | |
| ***Cumulative impacts:*** There is already a significant amount of overhead power line in some parts of the study area. The cumulative impact of adding more will therefore be of moderate significance.<br>See explanation in Table 2. | | |
| ***Residual Impacts*** Low – if power lines were removed, collisions would stop | | |

Table 7. Assessment of electrocution of birds on the 132kV power lines connecting the wind energy facility substation to the grid, and on the 11/22kV lines servicing individual turbines

| ***Nature:*** *Electrocution of birds on the 132KV power lines connecting the wind energy facility substation to the grid, and on the 11/22kV lines servicing individual turbines* | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | 1 | 1 |
| ***Duration*** | 4 | 4 |
| ***Magnitude*** | 4 | 2 |
| ***Probability*** | 3 | 1 |
| ***Significance*** | **27 (low)** | **7 (low)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Low – birds are killed | Low |
| ***Irreplaceable loss of resources?*** | Yes – birds are killed | Yes |
| ***Can impacts be mitigated?*** | Yes – totally | |
| ***Mitigation:*** Correct siting of infrastructure, avoiding high and medium sensitivity areas, and where possible placing adjacent to existing lines. This final micro siting would best be achieved by the specialist and the developer on site during a site specific EMP, when all relevant information on infrastructure is available.<br><br>For the 132kV line, the use of the steel monopole structure fitted with the standard bird perch or an alternative structure with a minimum phase-phase and phase-earth clearance of 1.8m is strongly recommended (see APPENDIX 2). For the smaller 11 or 22kV line, a bird friendly intermediate or inverted T structure must be used as per Eskom standards.<br><br>Within substations there are numerous places where birds can be electrocuted, and it is not worth mitigating at construction. It would be better to monitor and detect any problem areas in substation yard and then the specialist can provide case specific mitigation advice. | | |

| | |
|---|---|
| ***Cumulative impacts:*** See explanation in Table 2. | |
| ***Residual Impacts:*** Low – if power lines are removed, electrocutions will not be possible. | |

Table 8. Assessment of habitat destruction during construction and maintenance for 132kV lines, substations and the access roads

| ***Nature:*** *Habitat destruction during construction and maintenance for 132kV lines, substations and the access roads* | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | 1 | 1 |
| ***Duration*** | 2 | 2 |
| ***Magnitude*** | 4 | 4 |
| ***Probability*** | 3 | 3 |
| ***Significance*** | **21 (low)** | **21 (low)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Low – habitat is removed | Low |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | Only partially | |
| ***Mitigation:*** Correct siting of infrastructure, avoiding high and medium sensitivity areas, and where possible placing adjacent to existing lines. This final micro siting would best be achieved by the specialist and the developer on site during a site specific EMP, when all relevant information on infrastructure is available.<br><br>All activities should be designed to ensure as little impact on habitat as possible. For example, existing roads must be used wherever possible, sensitive habitats must be avoided with machinery and vehicles, and labour teams must be strictly managed. Equipment batching plants and construction camps must also be situated away from sensitive areas, preferably in habitats that are already impacted on. | | |
| ***Cumulative impacts:*** See explanation in Table 2 | | |
| ***Residual Impacts*** High - habitat will not necessarily recover if lines removed | | |

Table 9. Assessment of disturbance during construction and maintenance for 132kV and 11/22kV lines, substations and access roads

| ***Nature:*** *Disturbance during construction and maintenance for 132kV and 11/22kV lines, substations and access roads* | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | 1 | 1 |
| ***Duration*** | 2 | 2 |
| ***Magnitude*** | 4 | 2 |
| ***Probability*** | 3 | 2 |
| ***Significance*** | **21 (low)** | **10 (low)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Low | Low |
| ***Irreplaceable loss of*** | Yes | Yes |

| | | |
|---|---|---|
| ***resources?*** | | |
| ***Can impacts be mitigated?*** | Yes - partially | |
| ***Mitigation:*** Correct siting of infrastructure, avoiding high and medium sensitivity areas, and where possible placing adjacent to existing lines. This final micro siting would best be achieved by the specialist and the developer on site during a site specific EMP, when all relevant information on infrastructure is available.<br>All activities should be designed to ensure as little impact on habitat as possible. For example, existing roads must be used wherever possible, sensitive habitats must be avoided with machinery and vehicles, and labour teams must be strictly managed. Equipment batching plants and construction camps must also be situated away from sensitive areas, preferably in habitats that are already impacted on. | | |
| ***Cumulative impacts:*** See explanation in Table 2. | | |
| ***Residual Impact:*** Low – if activities cease, impact will cease. | | |

## 6. SENSITIVITY MAPPING FOR THE PROPOSED SITE

Avoiding areas of high bird use or sensitivity is the most important means of mitigating the effects of wind turbines (and associated infrastructure) on birds. This section of this study focused on identifying these areas. The sensitive areas for avifauna have been mapped using field observations from the site visit as well as GIS layers and Google earth (see Figure 3).

**High sensitivity areas:** The portions of this study area that have been identified as high sensitivity for avifauna are a 300m buffer around the ridge line in the west, and a 300m buffer around all identifiable dams. The reason for these areas being sensitive has been explained elsewhere in this report. No construction of turbines or associated infrastructure should be allowed in these areas.

**Medium sensitivity areas**: The portions of the study area that have been classed as medium sensitivity are the drainage lines, and a 100m buffer around them. The importance of drainage lines and streams has been explained elsewhere in this report. Construction of turbines or other infrastructure in these areas should be avoided as far as possible.

**Low sensitivity areas**: The remainder of the study area has been classed as low sensitivity, and construction may proceed subject to the other recommendations in this study.

Due to the variation in the ridge, dam and drainage line characteristics throughout the study area – the buffer delineations could be refined in certain instances if it is absolutely necessary for infrastructure to be built within these areas. This will however need to be done in consultation between the developer and specialist during the site specific avifaunal EMP. In the case of the high sensitivity areas, an extremely strong motivation would be required to enter the buffer zone for construction.

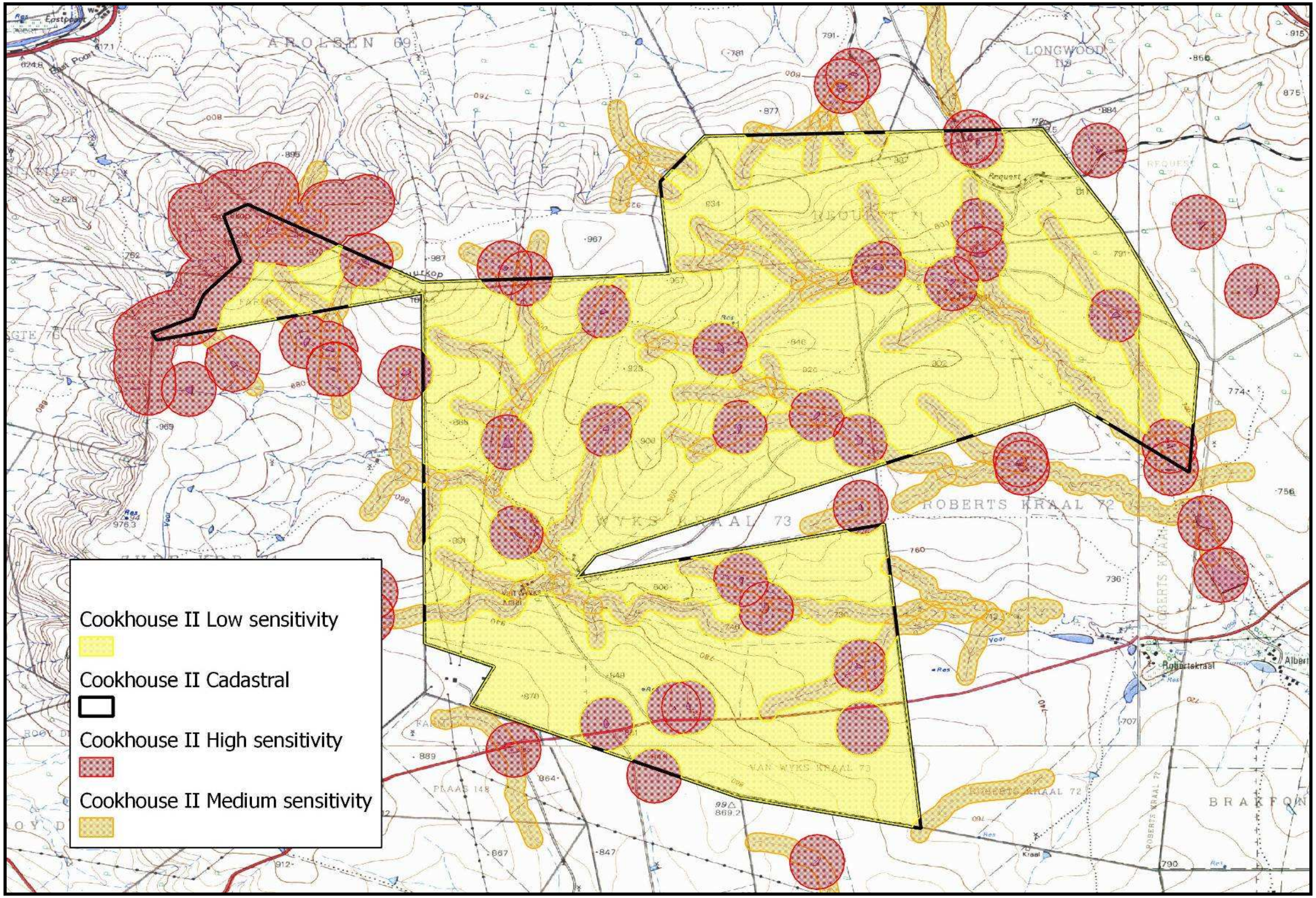


Figure 3. Sensitivity map for the Cookhouse II WEF study area.

## 7. ENVIRONMENTAL MANAGEMENT PLAN

### 7.1 Construction and Maintenance

The tables below detail generic recommendations for inclusion in the Environmental Management Plan (EMP). Without exact positions of infrastructure, these recommendations cannot be more specific.

**OBJECTIVE**: Minimise impact on the natural vegetation and disturbance of birds during the construction and maintenance activities of the project.

| | |
|---|---|
| **Project component/s** | Leveling and foundations for turbine positions, leveling and construction of substation yards, roads and clearing of servitudes for construction and maintenance of power lines. |
| **Potential Impact** | Loss of natural habitat for certain key species |
| **Activity/risk source** | Indiscriminate bush or grassland clearing for turbine sites, substation yards and servitudes. Construction of unnecessary new roads. |
| **Mitigation: Target/Objective** | All construction and maintenance activities should be carried out according to generally accepted environmental best practices. The construction of new roads in particular should be kept to an absolute minimum, and where possible roads and compacted areas that are not needed post construction should be closed and rehabilitated. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| All construction and maintenance activities should be carried out according to generally accepted environmental best practices. New road construction must be kept to a minimum and all vehicle and machinery movement must be restricted to roads. Erosion control measures must be implemented wherever vegetation and top soil is disturbed. Strict control must be maintained over labour teams and their movement, in order to restrict all impacts to the infrastructure footprint. | Eskom Contractor Environmental Control Officer (ECO) | Construction and maintenance |

| | |
|---|---|
| **Performance Indicator** | No additional habitat destruction or disturbance beyond the infrastructure positions, no additional habitat destruction beyond the substation site and power line servitude. |
| **Monitoring** | ECO to monitor the extent of disturbance and habitat destruction |

### 7.2 Operations

**OBJECTIVE**: Minimise impact of bird collisions with the wind turbines during operations

| | |
|---|---|
| **Project component/s** | Turbine blades |
| **Potential Impact** | Collision of sensitive bird species |
| **Activity/risk source** | Turbine blades rotating |
| **Mitigation: Target/Objective** | No reported collisions of sensitive bird species with the turbines |

| **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
|---|---|---|
| If bird collisions are detected through the post construction bird monitoring programme recommended elsewhere in this report, consideration will need to be given to shutting down certain turbines in high risk periods in order to mitigate for this impact. See site monitoring programme. | ACED Plant Environmental Manager | Operational lifespan |

| | |
|---|---|
| **Performance Indicator** | No avian fatalities caused by wind turbines in operation |
| **Monitoring** | Bird monitoring programme to monitor situation |

**OBJECTIVE**: Minimise impact of bird collisions with the 132kV power lines feeding into the grid, and any above ground power lines linking turbines.

| | |
|---|---|
| **Project component/s** | Earth wire of power lines >132kv, and conductors of smaller voltage lines |
| **Potential Impact** | Collision of sensitive bird species |
| **Activity/risk source** | Collision with the earth wire/conductor |
| **Mitigation: Target/Objective** | No reported collisions of sensitive bird species with the earth wires |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Once the exact position of the power lines is determined, the sections of power line requiring anti collision marking devices (to make the cables more visible to birds) will be identified – as part of the site specific EMP. | Plant Environmental Manager | Operational lifespan |

| | |
|---|---|
| **Performance Indicator** | No avian fatalities caused by the new power lines. |
| **Monitoring** | This associated infrastructure will be monitored as part of the post construction bird monitoring programme recommended elsewhere in this report. |

**OBJECTIVE**: Minimise the impact of electrocutions on the power lines and in the substation yard

| | |
|---|---|
| **Project component/s** | Live phases on power lines and in substations |
| **Potential Impact** | Electrocution of sensitive bird species |
| **Activity/risk source** | Electrocution caused by the live components |
| **Mitigation: Target/Objective** | No reported avian fatalities from electrocutions. |

| Mitigation: Action/control | Responsibility | Timeframe |
|---|---|---|
| Both the 132kV power line and the 11 or 22kV line should be built using bird friendly structures as per Eskom standards. The substation is too complex to mitigate at the outset and should rather be monitored to identify any specific problems, and the specialist can then be contacted for case specific mitigation measures should the need arise | Plant Environmental Manager | Operational lifespan |

| | |
|---|---|
| **Performance Indicator** | No avian fatalities caused by electrocutions. |
| **Monitoring** | Bird monitoring programme to incorporate this. |

**Site monitoring programme**

As discussed elsewhere in this report, it is essential that a thorough independent bird monitoring programme be implemented on site as per the "Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa" (Jenkins, van Rooyen, Smallie, Anderson & Smit; 2011). Since this Cookhouse II site is adjacent to ACED's Cookhouse I site, when bird monitoring was initiated at that site, care was taken to include Cookhouse II in the study area. Monitoring is therefore already underway for Cookhouse II, with the first data collection site visit having been completed during July 2011. It is imperative that this is continued during (if possible) and post construction.

The above mentioned guidelines require 12 months of data to be collected by the monitoring programme prior to environmental authorization of projects. It is therefore important that this avifaunal assessment for Cookhouse II include as close as possible to 12 months of data. It is therefore recommended that this report be updated by the specialist using all available monitoring data (made available to the specialist by ACED), as late in the Basic Assessment process as possible.

## 8. IMPACT STATEMENT

In conclusion, the proposed development, viewed against the background of the neighbouring much larger Cookhouse I, is likely to pose potential impacts on birds predominantly through collision with turbines, and collision with associated power lines.

It is essential that the preconstruction bird monitoring program that is already underway be continued by the project developers in order to begin the process of collecting relevant and accurate data on the numbers of birds affected by wind energy facilities in South African conditions. This is seen as critical to the long term expansion of wind energy facilities in this country. It is furthermore expected that the cumulative impacts of multiple developments of this nature would be huge for avifauna and this is important to keep in mind for projects in and around this study area.

It is strongly recommended that DEA consider commissioning a strategic assessment of the cumulative impact of wind energy on the environment in the greater Cookhouse area.

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**APPENDIX 1- Environmental Impact Assessment Report: Assessment of Impacts**

Direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified in the EIA phase must be assessed in terms of the following criteria:

» The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
» The **duration**, wherein it will be indicated whether:
   * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
   * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
   * medium-term (5–15 years) – assigned a score of 3;
   * long term (> 15 years) - assigned a score of 4; or
   * permanent - assigned a score of 5;

» The **magnitude**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
» The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
» the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
» the **status**, which will be described as either positive, negative or neutral.
» the degree to which the impact can be reversed.
» the degree to which the impact may cause irreplaceable loss of resources.
» the *degree* to which the impact can be *mitigated.*

The **significance** is calculated by combining the criteria in the following formula:

$S=(E+D+M)P$

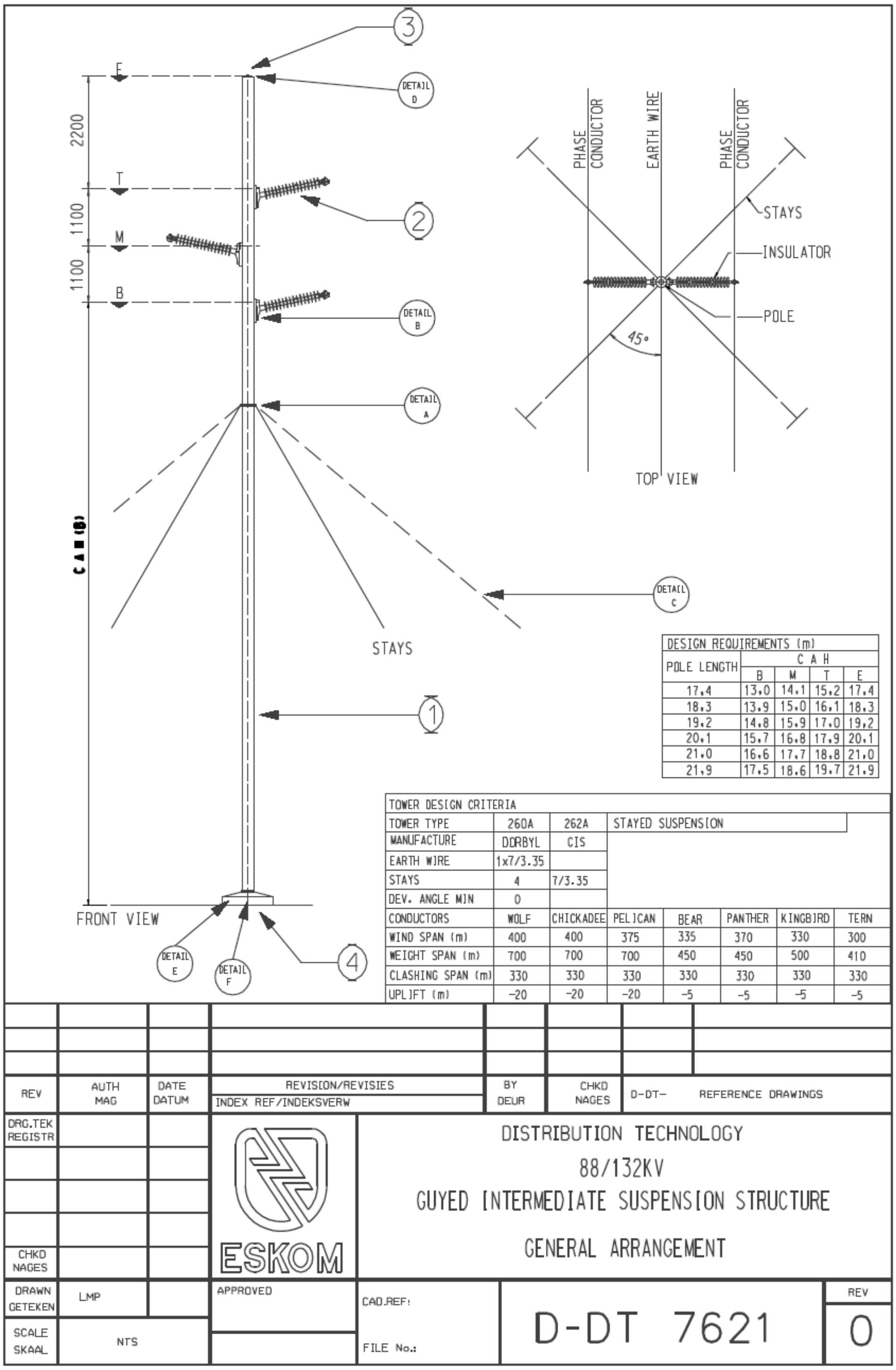
S = Significance weighting
E = Extent

D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

## APPENDIX 2. Bird friendly 132kV monopole structure




| DESIGN REQUIREMENTS (m) | | | | |
|---|---|---|---|---|
| POLE LENGTH | C A H | | | |
| | B | M | T | E |
| 17.4 | 13.0 | 14.1 | 15.2 | 17.4 |
| 18.3 | 13.9 | 15.0 | 16.1 | 18.3 |
| 19.2 | 14.8 | 15.9 | 17.0 | 19.2 |
| 20.1 | 15.7 | 16.8 | 17.9 | 20.1 |
| 21.0 | 16.6 | 17.7 | 18.8 | 21.0 |
| 21.9 | 17.5 | 18.6 | 19.7 | 21.9 |

| TOWER DESIGN CRITERIA | | | | | | | |
|---|---|---|---|---|---|---|---|
| TOWER TYPE | 260A | 262A | STAYED SUSPENSION | | | | |
| MANUFACTURE | DORBYL | CIS | | | | | |
| EARTH WIRE | 1x7/3.35 | | | | | | |
| STAYS | 4 | 7/3.35 | | | | | |
| DEV. ANGLE MIN | 0 | | | | | | |
| CONDUCTORS | WOLF | CHICKADEE | PELICAN | BEAR | PANTHER | KINGBIRD | TERN |
| WIND SPAN (m) | 400 | 400 | 375 | 335 | 370 | 330 | 300 |
| WEIGHT SPAN (m) | 700 | 700 | 700 | 450 | 450 | 500 | 410 |
| CLASHING SPAN (m) | 330 | 330 | 330 | 330 | 330 | 330 | 330 |
| UPLIFT (m) | -20 | -20 | -20 | -5 | -5 | -5 | -5 |