FOSKOR – MERENSKY 275KV POWER LINE

AVIFAUNAL SPECIALIST STUDY

May 2012

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Specialist details

Professional registration

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"Only a registered person may practice in a consulting capacity" – Natural Scientific Professions Act of 2003 (20(1)-pg 14)

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Professional experience

Jon Smallie has been involved in bird interactions with energy infrastructure for 12 years. During this time he has completed impact assessments for at least 70 projects, many of which have been transmission power lines. A full *Curriculum Vitae* can be supplied on request.

Declaration of Independence

The specialist investigator declares that:

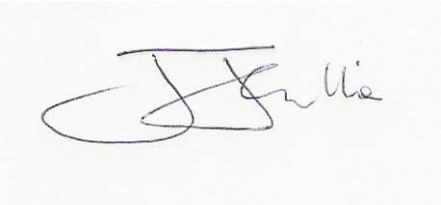
- I act as an independent specialist for this project.
- I consider myself bound by the rules and ethics of the South African Council for Natural Scientific Professions.
- I do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2006.
- I will not be affected by the outcome of the environmental process, of which this report forms part of.
- I do not have any influence over the decisions made by the governing authorities.
- I do not object to or endorse the proposed developments, but aim to present facts and our best scientific and professional opinion with regard to the impacts of the development.
- I undertake to disclose to the relevant authorities any information that has or may have the potential to influence its decision or the objectivity of any report, plan, or document required in terms of the Environmental Impact Assessment Regulations, 2006.
- Should I consider myself to be in conflict with any of the above declarations, I shall formally submit a Notice of Withdrawal to all relevant parties and formally register as an Interested and Affected Party.

Terms and Liabilities

- This report is based on a short term investigation using the available information and data related to the site to be affected. No long term investigation or monitoring was conducted.

- The Precautionary Principle has been applied throughout this investigation.
- Additional information may become known or available during a later stage of the process for which no allowance could have been made at the time of this report.
- The specialist investigator reserves the right to amend this report, recommendations and conclusions at any stage should additional information become available.
- Information, recommendations and conclusions in this report cannot be applied to any other area without proper investigation.
- This report, in its entirety or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of the specialist investigator as specified above.
- Acceptance of this report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

Signed on the 9th May 2012 by Jon Smallie in his capacity as specialist investigator



EXECUTIVE SUMMARY

Eskom have identified a need to strengthen the network between the existing Foskor Substation near Phalaborwa, and the existing Merensky Substation near Steelpoort. The proposed project consists of approximately 140km of new 275kV overhead power line between the above two localities. Eskom appointed Nsovo Environmental Consulting to conduct the necessary Environmental Impact Assessment. Since a project of this type has the potential to impact significantly on birds, WildSkies Ecological Services (Jon Smallie) was appointed to conduct an avifaunal specialist study for the project. Fieldwork was conducted during November 2011.

A project of this nature has the potential to impact on avifauna through: habitat destruction and disturbance of birds (both during construction); and collision of birds with the overhead cables during the operational phase. Birds are also able to cause electrical faults on the power line, through mechanisms explained in this report.

The study area is home to an exceptionally broad diversity of bird species, up to 423 species having been recorded by the first Southern African Bird Atlas Project (Harrison *et al*, 1997). A fair number of these (36 species) are Red Listed species (Barnes 2000), and many of these will in fact be at risk of interaction with the proposed power line. The likelihood and implication of these interactions has been assessed by this study. Most of the vulture and large eagle species identified as key for this study do not have healthy populations in South Africa outside of protected areas. The lowveld protected area complex, adjoining to the Kruger National Park, is therefore an extremely important refuge for these species. The same is true for some of the stork species. This makes it extremely important to protect these species from additional human induced threats within these areas. Presumably these species' ranges have contracted over the years to their current state as a result of anthropogenic threats. If these threats are allowed to occur at high levels within the current ranges we could force even more range contraction and place these species at risk of local extinction. In addition to the lowveld area, the escarpment is also extremely important, due to the presence of breeding Taita Falcons *Falco fasciinucha* and Cape Vultures *Gyps coprotheres*.

The impact of collision of certain bird species with the overhead cables (in particular the earth wires) has been judged to be of medium significance. This can be reduced to low significance with mitigation. In order to implement effective mitigation it will be necessary to conduct an avifaunal walk through as part of the site specific EMP. This will identify those exact spans of the power line that require mitigation. Destruction and alteration of habitat will be of medium significance. Since this is difficult to mitigate for (a certain amount of vegetation has to be removed or altered) it is not possible to reduce this to low significance with mitigation. Disturbance of birds is judged to be of low significance. However, if breeding threatened raptors are found close to the alignment this would change. The risk of electrical faulting caused by birds is judged to be of medium significance. This is however an impact on the business, not the birds, and is best mitigated reactively if a problem is identified once the line is operational.

This proposed power line route passes through an area that is rich in avifauna, due to its varied geology and vegetation, and the protected status of much of the land (by virtue of game farming). This means that the potential interactions of birds with the power line are likely to be significant. However, given that a power line of this size has to be built between these two substations (we assume that effective network planning has been conducted), the proposed routes do collectively provide opportunity to route the line as wisely as possible with respect to avifauna. The preference is to build the proposed

power line adjacent to the existing line. It is also essential that the other recommendations of this report are accepted and implemented, in particular the avifaunal walk through to be done during the site specific Environmental Management Plan for the line.

If the recommendations of this report are adhered to, this project can proceed.

CONTENTS

1. INTRODUCTION & BACKGROUND

Eskom have identified a need to strengthen the network between the existing Foskor Substation near Phalaborwa, and the existing Merensky Substation near Steelpoort. The proposed project consists of approximately 140km of new 275kV overhead power line between the above two localities. Eskom appointed Nsovo Environmental Consulting to conduct the necessary Environmental Impact Assessment. Since a project of this type has potential to impact significantly on birds, WildSkies Ecological Services (Jon Smallie) was appointed to conduct an avifaunal specialist study for the project. Fieldwork was conducted during November 2011.

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1.1 Terms of reference

The following terms of reference were utilized for this study:

- Present the *status quo* of avifauna in the area.
- Identify and discuss avifaunal impacts and rate them according to a specified methodology.
- Identify and provide mitigation measures for each impact.
- Conclude with a recommendation on whether the project should proceed or not and if so to what extent avifauna will be impacted upon.

1.2 Description of proposed project

The proposed power line is approximately 140km in length (depending on which route is selected) and will be 275kV. There are four proposed alternative routes for the power line, as shown in Figure 1. No information has been received on the tower structure to be used for the project. Since a line of this size (voltage) cannot electrocute birds, the only implications that the tower structure has for birds is in determining the risk of electrical faulting caused by birds. If the tower structure provides suitable perching space directly above the live conductors there is a strong likelihood that birds will causes faults on the line, as explained elsewhere in this report.

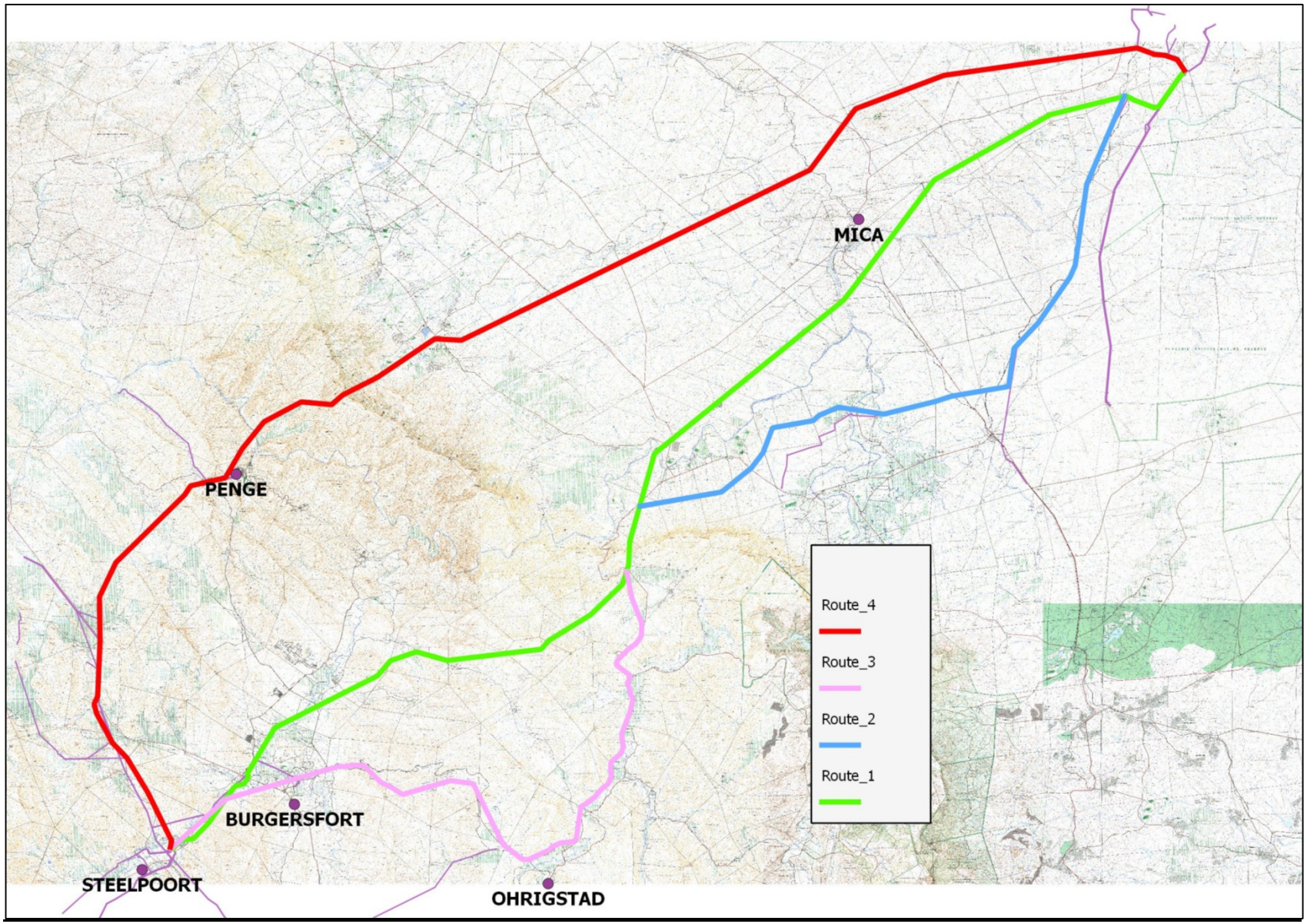

Figure 1. The general study area and proposed routes for the Foskor Merensky 275kV power line.

2. BACKGROUND TO THE POTENTIAL IMPACTS OF THE PROPOSED POWER LINE ON BIRDS

Bird collision with conductors and earth wires

Various bird species are vulnerable to collision with the earth wires or conductors of overhead power lines. This occurs because the birds can't see the cables, particularly against dark backgrounds, or may not be able to take evasive action quickly enough once they do see the cables. Large birds such as cranes, storks, and bustards are particularly vulnerable due to their large wing span and slow flight characteristics. In recent times vultures have also emerged as vulnerable to collision, particularly when congregating at roosts or feeding sites. Collision victims typically die as a result of injuries sustained at impact with the cable, or the subsequent impact with the ground, because they lose control of their flight. Collision is anticipated to be a possible impact on the proposed power line and is discussed in more detail in Section 5.

Habitat destruction

During the construction phase of power lines, a certain amount of habitat destruction and alteration takes place on the site. This happens with the construction of access roads, the clearing of the site itself and any associated infrastructure. The servitude also has to be maintained free of any natural vegetation, amongst other reasons to minimize the risk of fire. The destruction or alteration of natural habitat has an impact on birds breeding, foraging and roosting in close proximity to the site. Since the proposed power line routes pass largely through bushveld, this impact could be significant.

Disturbance

Similarly, the above mentioned construction and maintenance activities impact on birds through disturbance, particularly during breeding activities. The potential exists for the impact of disturbance to influence a greater area than the site itself. This site is relatively un-disturbed by other infrastructure in parts, particularly in the protected areas. There is a strong likelihood of sensitive species such as large eagles and vultures nesting in the vicinity of the proposed power line alignment. This means that the impact of disturbance could be significant for this project.

Electrocution of birds on tower structures

Electrocution refers to the scenario whereby a bird bridges the gap between two phases or a phase and an earthed component thereby causing an electrical short circuit. The larger bird species such as vultures and eagles are particularly vulnerable to this impact, as obviously the larger the wingspan and other dimensions of a bird, the greater the likelihood of it being able to bridge the gap between hardware. On transmission lines such the proposed power line the impact of electrocutions is not possible due to the large clearances between phases and/or phases and earthed structures. This impact is not discussed further.

Electrical faulting due to birds

Birds are able to cause electrical faults on transmission power lines through their faeces and/or nest material. Large birds sitting above live conductors can cause flashovers when they produce long continuous 'streamers' of excrement which bridges the critical air gap, or through buildup of faeces on insulators to the point where the insulation is compromised and a fault occurs. Material used to build nests on towers can also intrude into the air gap and cause short circuits. With the likely abundance of large eagles and vultures in this study area, this interaction is a strong likelihood for the proposed power line. This impact has been described in more detail in Section 5.

3. METHODOLOGY

3.1. Information sources used

The following information sources were consulted in order to conduct this study:

- Bird distribution data of the first Southern African Bird Atlas Project (Harrison *et al*, 1997) was obtained for the quarter degree squares which cover the study area, from the Avian Demography Unit of the University of Cape Town, as a means to ascertain which species occur within the study area. The more recent second bird atlas project (SABAP2) was also consulted informally for data on a pentad basis. The coverage of the study area to date by this project is very variable though and not suitable for more formal use.
- The conservation status of all bird species occurring in the aforementioned quarter degree squares was determined with the use of The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Barnes, 2000).
- Google Earth was used to examine the study area on a desktop level.
- The location of the project in relation to the Important Bird Areas (IBA's) (Barnes 1998) was examined and is shown in Figure 5.
- The location of Co-ordinated Water bird Counts (CWAC) (Taylor *et al,* 1999) was examined and illustrated in Figure 5.
- A site visit was conducted in November 2011 to examine the micro-habitats available in the area and get an overall idea of what the site looks like. Unfortunately access was not possible to all parts of the study area due to much of it being managed as private game farm, and difficult road access near the escarpment.

4. DESCRIPTION OF RECEIVING ENVIRONMENT

4.1. Vegetation and micro-habitats

This site is comprised of a complex set of vegetation types, particularly in the south. According to Mucina & Rutherford (2006), sixteen separate vegetation types occur on or near the site (Figure 2). The majority of these occur above the escarpment in the south of the study area. In summary, the majority of the study area is classified as bushveld or mopane veld. In the escarpment area grassland, sourveld and even fynbos exist. It is this diversity that gives rise to the diversity of bird species recorded in the area, described elsewhere in this report.

More informative than vegetation type in understanding bird distribution and abundance is the micro habitats available to birds on site. Micro habitats are formed by a number of factors, one of which is vegetation. Others include land use, topography, and other anthropogenic influences.

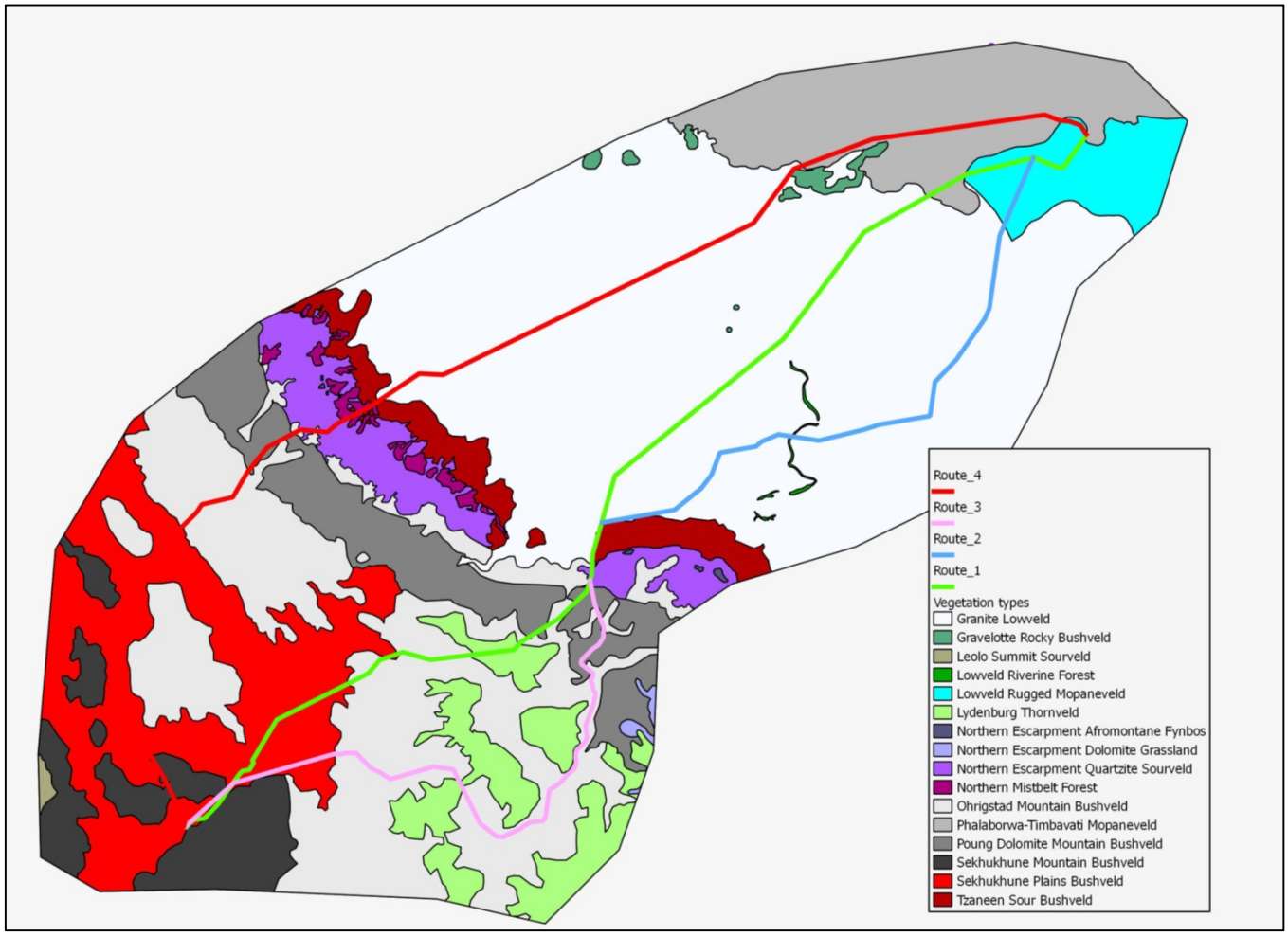

Figure 2. Vegetation classification for the Foskor Merensky 275kV power line study area.

By far the most dominant micro habitat available to birds in the area is woodland or bushveld. Almost all of the natural vegetation remaining in the study area is woodland, and it varies in nature. In the south towards Steelpoort, much of the woodland consists of lower vegetation and appears degraded in places as a result of firewood harvesting and other human impacts (see Figure 3 a, c and i). In the northern lowveld parts of the study area the woodland is taller and appears in better condition, perhaps as a result of being protected in game farms and protected areas (see Figure 3 f). Where reliable water exists, in the form of rivers, some cultivation has taken place. Arable areas are planted to various crops, and in the lowveld to fruit orchards. Orchards are not particularly attractive micro habitats for sensitive bird species, although some crops are, particularly at certain stages of the crop cycle. Several major rivers are crossed by the various power line routes, including the Steelpoort and Olifants Rivers. These areas represent a different vegetation type normally, with riparian species occurring along their banks. This will generally attract slightly different avifauna to the area. River courses also typically form flight paths for various species through the landscape and as such represent high risk areas for bird – power line collision.

a – settlement in the southern section of the study area

b – a typical river crossing in the study area

c – vegetation in the southern parts of the study area

d – an arable land in the Blyde River area

e – the Olifants river close to the base of the escarpment

f – small rocky outcrop, typical woodland in lowveld section

g – a young orchard in the lowveld section

h – the escarpment, near Penge

i – typical low woodland close to Steelpoort

j – the main escarpment close to Strydom tunnel.

Figure 3. Examples of the micro habitats available to avifauna in the Foskor Merensky 275kV power line study area

4.2. Relevant bird populations

The data source for bird distribution and abundance used for this study is the Southern African Bird Atlas Project (SABAP1 – Harrison *et al*, 1997). Although this data source is quite old it remains the most reliable source of data of this type. Since it was collected over a ten year period, it has covered a far greater range of conditions and seasons than could ever be expected of the field work under the scope of this current impact assessment. Although a more recent second bird atlas project (SABAP2 – http://sapap2.adu.org.za) is underway, it has not covered the current study area with sufficient counting throughout the relevant pentads in order to be useful for the purposes of this study, particularly in the escarpment area (see Figure 4). Those cards that have been submitted have been studied informally to determine whether any significant change in the distribution or abundance of key species has occurred in recent times.

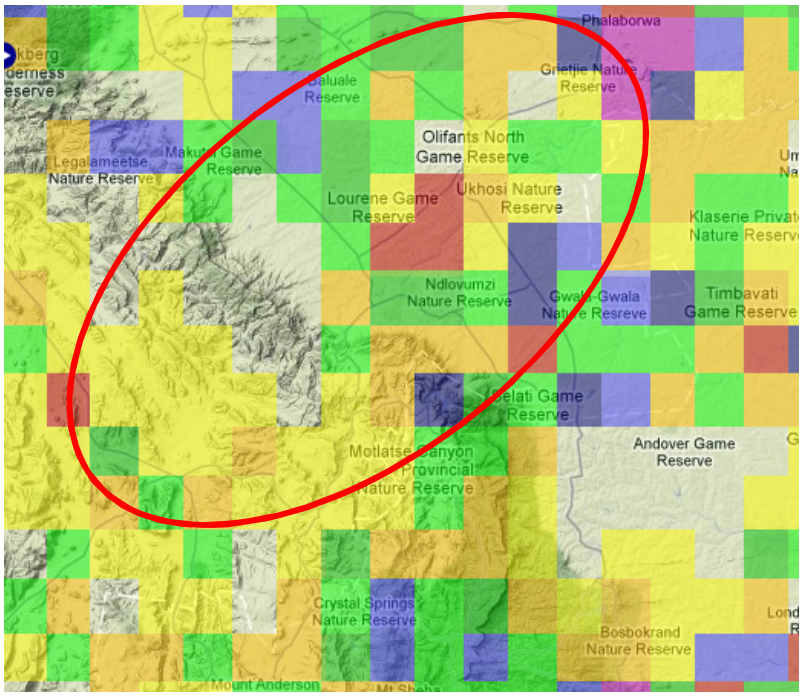

Figure 4. The coverage of the study area by the Southern African Bird Atlas Project 2 (http://sabap2.adu.org.za). Darker colours illustrate more coverage by the atlas, i.e. more counts.

Up to approximately 423 bird species have been recorded across the ten relevant quarter degree squares by the Southern African Bird Atlas Project (Harrison *et al,* 1997). It is important to note that these species could have been recorded anywhere in the relevant quarter degree square, and not necessarily in the exact study area. It does however mean that these species could occur in the proposed study area. Report rates are essentially an expression of the number of times a species was recorded in a square, as a percentage of the number of times that square was counted. The number of cards (shown in Table 1) represents the degree to which the square was counted, the more cards the more times it was counted. In this study area the number of cards ranges from 6 to 124, which is a significant variation and should give us cause to use some of the data with caution, particularly when making comparisons between squares.

Table 1 below shows only the Red Listed species recorded by Harrison *et al* (1997). A total of 36 Red Listed species have been recorded, of which 1 is "Endangered" (the Saddle-billed Stork *Ephippiorhynchus senegalensis*), 18 are "Vulnerable" and 17 are "Near-threatened". In addition, the White Stork *Ciconia ciconia* and Abdim's Stork *Ciconia abdimii* are treated as threatened species since they are protected internationally under the Bonn Convention on Migratory Species. The Hamerkop *Scopus umbretta* has also been treated as important since it has shown a range contraction in recent times (SABAP2 – http://sabap2.adu.org.za).

Table 2 shows how important this proposed site is for the Red Listed species. This will ultimately determine the significance of any likely impacts of the proposed power line on these species. Those species for which this proposed site is of medium or higher importance have been shaded in grey, totaling nineteen of the 36 Red Listed species. These are the species that will form the main focus of this study. This group of species includes: woodland species, such as vultures and large eagles; riverine species, such as African Finfoot *Podica senegalensis* and storks; and open woodland large terrestrials such as Kori

Bustard *Neotis kori* and Secretarybird *Sagittarius serpentarius*. The vultures and eagles are anticipated to interact with the power line predominantly through perching, nesting and roosting on the infrastructure. This may place them at risk of collision with the earth wires. The storks and large terrestrials will be at risk of collision with the power line. In the region of the escarpment, the Taita Falcon *Falco fasciinucha* could also be at risk of collision, and disturbance. Most of the species mentioned above are physically large species. These are the species most at risk of direct interaction with the proposed power line. However all species, including the small passerines, could be affected by the power line, particularly through disturbance and habitat destruction. This impact assessment also focuses by necessity on the Red Listed species. This does not mean that the impacts on non-Red Listed species are totally ignored. It is believed that the mitigation proposed for Red Listed species will also provide protection for non-Red Listed species in many cases.

Most of the vulture and large eagle species identified as key for this study do not have healthy populations in South Africa outside of protected areas. The lowveld protected area complex, adjoining to the Kruger National Park, is an extremely important refuge for these species. The same is true to some extent for some of the stork species. This makes it extremely important to protect these species from additional human induced threats within these areas. Presumably these species' ranges have contracted over the years to their current state as a result of anthropogenic threats. If these threats are allowed to occur at high levels within the current ranges we could force even more range contraction and place these species at risk of local extinction.

Several key avifaunal features exist in the proposed study area. These features affect the significance of possible impacts of the proposed power line and influence the selection of the route on which to build the line. These features are described in more detail below:

Kruger National Park – Important Bird Area (IBA) – SA002:
The Kruger National Park is approximately 320km long on its north-south axis, and 65km wide on its east-west axis. The IBA includes the private game reserves on its western boundary, such as Klaserie, Timbavati, Sabi Sand and several others. At its closest point the IBA western boundary is 1.5km from the nearest alternative route for the proposed power line (see Figure 5). Approximately 40km of proposed power line route lies within 10km of the IBA boundary. The IBA consists predominantly of undulating flats, with a wide geological diversity giving rise to a diversity of habitats and bird species. The park supports approximately 55% of the bird species recorded in southern Africa (over 490 species). As mentioned elsewhere in this report, the park forms a refuge for various bird species which have suffered from various threats elsewhere in the region. This includes species such as Marabou Stork *Leptoptilus crumeniferus*, Hooded Vulture *Necrosyrtes monachus*, White-backed Vulture *Gyps africanus*, Lappet-faced Vulture *Torgos tracheliotus*, White-headed Vulture *Aegypius occipitalis*, Martial Eagle *Polemaaetus bellicosus*, Bateleur *Terathopius ecaudatus*, Tawny Eagle *Aquila rapax*, Kori Bustard *Neotis kori* and Ground Hornbill *Bucorvus leadbeteri* (Barnes, 1998). Several Drakensberg forest species also migrate down into the park during winter, often along river courses draining off the escarpment.

These factors make this an extremely important IBA in the national context. It is good that the current proposed power line routes avoid the IBA to the west. However in reality, the areas immediately west of the western boundary of Kruger and the IBA are probably almost as important for birds. Every attempt should therefore be made to place the power line as far as possible away from these areas. Unfortunately due to the location of the Foskor Substation, the line has to cross some lowveld bushveld. Given the need for strengthening, that is unavoidable. This will be discussed in more detail in Section 5.2.

Table 1. Red Listed bird species abundance in the study area for the relevant quarter degree squares as per the Southern African Bird Atlas Project 1 data Harrison *et al,* 1997). Report rates are expressed in decimals, i.e. 0.06 equates to a 6% report rate.

				Report rates									
Roberts #	**Common Name**	***Scientific Name***	**Cons status**	**2431AA (124)**	**2430AC (6)**	**2430AD (17)**	**2430BA (19)**	**2430BB (85)**	**2430BC (25)**	**2430BD (112)**	**2430CA (18)**	**2430CB (40)**	**2430DA(38)**
88	Saddle-billed Stork	*Ephippiorhynchus senegalensis*	E	0.06	0.00	0.00	0.00	0.11	0.04	0.18	0.00	0.00	0.00
77	White-backed Night-Heron	*Gorsachius leuconotus*	V	0.01	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00
92	Southern Bald Ibis	*Geronticus calvus*	V	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.06	0.00	0.00
121	Hooded Vulture	*Necrosyrtes monachus*	V	0.09	0.00	0.00	0.05	0.02	0.04	0.08	0.00	0.00	0.00
122	Cape Vulture	*Gyps coprotheres*	V	0.08	0.00	0.00	0.26	0.13	0.36	0.59	0.00	0.13	0.03
123	White-backed Vulture	*Gyps africanus*	V	0.29	0.17	0.06	0.42	0.39	0.08	0.40	0.11	0.00	0.00
124	Lappet-faced Vulture	*Aegypius tracheliotos*	V	0.08	0.00	0.00	0.26	0.08	0.04	0.14	0.00	0.00	0.00
125	White-headed Vulture	*Aegypius occipitalis*	V	0.06	0.00	0.00	0.00	0.05	0.00	0.08	0.00	0.00	0.00
132	Tawny Eagle	*Aquila rapax*	V	0.13	0.00	0.00	0.21	0.02	0.12	0.18	0.06	0.00	0.00
140	Martial Eagle	*Polemaetus bellicosus*	V	0.10	0.00	0.00	0.16	0.11	0.04	0.41	0.00	0.00	0.00
146	Bateleur	*Terathopius ecaudatus*	V	0.36	0.00	0.00	0.26	0.41	0.08	0.62	0.00	0.00	0.00
183	Lesser Kestrel	*Falco naumanni*	V	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00
208	Blue Crane	*Anthropoides paradiseus*	V	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.11
229	African Finfoot	*Podica senegalensis*	V	0.04	0.00	0.00	0.00	0.02	0.00	0.45	0.00	0.00	0.03
230	Kori Bustard	*Ardeotis kori*	V	0.01	0.00	0.00	0.05	0.00	0.00	0.02	0.00	0.00	0.00
233	White-bellied Korhaan	*Eupodotis senegalensis*	V	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
393	African Grass-Owl	*Tyto capensis*	V	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
403	Pel's Fishing Owl	*Scotopelia peli*	V	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
463	Southern Ground-Hornbill	*Bucorvus leadbeateri*	V	0.10	0.00	0.00	0.00	0.04	0.04	0.04	0.00	0.00	0.00
84	Black Stork	*Ciconia nigra*	NT	0.02	0.00	0.00	0.00	0.05	0.00	0.41	0.00	0.00	0.05
86	Woolly-necked Stork	*Ciconia episcopus*	NT	0.01	0.00	0.00	0.00	0.00	0.04	0.03	0.00	0.00	0.00
87	African Openbill	*Anastomus lamelligerus*	NT	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00
89	Marabou Stork	*Leptoptilos crumeniferus*	NT	0.07	0.00	0.06	0.00	0.02	0.04	0.26	0.00	0.00	0.00
90	Yellow-billed Stork	*Mycteria ibis*	NT	0.06	0.00	0.00	0.00	0.02	0.00	0.03	0.00	0.00	0.00
96	Greater Flamingo	*Phoenicopterus ruber*	NT	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
114	African Pygmy-Goose	*Nettapus auritus*	NT	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00

118	Secretarybird	*Sagittarius serpentarius*	NT	0.02	0.00	0.00	0.00	0.02	0.08	0.41	0.06	0.00	0.05
129	Bat Hawk	*Macheiramphus alcinus*	NT	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
141	African Crowned Eagle	*Stephanoaetus coronatus*	NT	0.01	0.00	0.00	0.00	0.00	0.00	0.15	0.06	0.00	0.00
171	Peregrine Falcon	*Falco peregrinus*	NT	0.00	0.00	0.00	0.00	0.00	0.04	0.15	0.00	0.00	0.00
172	Lanner Falcon	*Falco biarmicus*	NT	0.00	0.17	0.00	0.00	0.01	0.04	0.34	0.11	0.00	0.00
238	Black-bellied Bustard	*Lissotis melanogaster*	NT	0.02	0.00	0.00	0.05	0.02	0.04	0.24	0.00	0.00	0.00
259	White-crowned Lapwing	*Vanellus albiceps*	NT	0.00	0.00	0.00	0.00	0.40	0.00	0.02	0.00	0.00	0.00
304	Collared Pratincole	*Glareola pratincola*	NT	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00
430	Half-collared Kingfisher	*Alcedo semitorquata*	NT	0.00	0.00	0.00	0.00	0.00	0.04	0.46	0.00	0.00	0.05
772	Red-billed Oxpecker	*Buphagus erythrorhynchus*	NT	0.34	0.33	0.53	0.21	0.21	0.04	0.25	0.00	0.38	0.13
81	Hamerkop	*Scopus umbretta*	**	0.56	0.00	0.24	0.37	0.47	0.12	0.66	0.28	0.33	0.55
83	White Stork	*Ciconia ciconia*	BONN	0.08	0.17	0.00	0.00	0.01	0.04	0.22	0.00	0.25	0.42
85	Abdim's Stork	*Ciconia abdimii*	BONN	0.02	0.33	0.00	0.05	0.01	0.04	0.08	0.00	0.10	0.05

Table 2. Red Listed bird species' preferred micro habitats, likelihood of occurring and importance of the site.

Roberts #	**Common Name**	***Scientific Name***	**Cons status**	**Preferred micro habitat**	**Likelihood of occurring on the proposed site**	**Relative importance of site for national populations of species**
88	Saddle-billed Stork	*Ephippiorhynchus senegalensis*	E	Riverine, floodplain	Probable in the north	Medium in lowveld in north
77	White-backed Night-Heron	*Gorsachius leuconotus*	V	Riverine	Possible	Low
92	Southern Bald Ibis	*Geronticus calvus*	V	Grassland, cliff	Possible on escarpment particularly	Low
121	Hooded Vulture	*Necrosyrtes monachus*	V	Woodland	Probable	Medium in lowveld in north
122	Cape Vulture	*Gyps coprotheres*	V	Woodland, grassland	Probable in the north	Medium in lowveld in north
123	White-backed Vulture	*Gyps africanus*	V	Woodland	Probable in the north	Medium in lowveld in north
124	Lappet-faced Vulture	*Aegypius tracheliotos*	V	Woodland	Probable in the north	Medium in lowveld in north
125	White-headed Vulture	*Aegypius occipitalis*	V	Woodland	Probable in the north	Medium in lowveld in north
132	Tawny Eagle	*Aquila rapax*	V	Woodland	Probable in the north	Medium in lowveld in north
140	Martial Eagle	*Polemaetus bellicosus*	V	Woodland	Probable in the north	Medium in lowveld in north
146	Bateleur	*Terathopius ecaudatus*	V	Woodland	Probable in the north	Medium in lowveld in north
183	Lesser Kestrel	*Falco naumanni*	V	Grassland, arable land	Possible on higher ground in south	Low
208	Blue Crane	*Anthropoides paradiseus*	V	Grassland, arable land, wetland, dam	Possible on higher ground in south	Low – much larger populations elsewhere in SA

229	African Finfoot	*Podica senegalensis*	V	Riverine	Probable	Medium
230	Kori Bustard	*Ardeotis kori*	V	Open woodland, grassland	Possible	Medium
233	White-bellied Korhaan	*Eupodotis senegalensis*	V	Grassland	Possible but unlikely	Low
393	African Grass-Owl	*Tyto capensis*	V	Grassland, wetland	Possible, particularly in south-east of study area	Low
403	Pel's Fishing Owl	*Scotopelia peli*	V	Riverine	Possible in lowveld in north	Low
463	Southern Ground-Hornbill	*Bucorvus leadbeateri*	V	Open woodland	Possible	Low
84	Black Stork	*Ciconia nigra*	NT	Riverine, cliff	Possible	Medium
86	Woolly-necked Stork	*Ciconia episcopus*	NT	Riverine, floodplain, dam, wetland	Probable in the north	Medium
87	African Openbill	*Anastomus lamelligerus*	NT	Riverine, floodplain, dam, wetland	Probable in the north	Medium
89	Marabou Stork	*Leptoptilos crumeniferus*	NT	Riverine, floodplain, dam, wetland, waste disposal sites	Probable in the north	Medium
90	Yellow-billed Stork	*Mycteria ibis*	NT	Riverine, floodplain, dam, wetland	Probable in the north	Medium
96	Greater Flamingo	*Phoenicopterus ruber*	NT	Dam, floodplain	Possible	Low
114	African Pygmy-Goose	*Nettapus auritus*	NT	Riverine	Possible	Low
118	Secretarybird	*Sagittarius serpentarius*	NT	Open woodland	Probable	Medium
129	Bat Hawk	*Macheiramphus alcinus*	NT	Woodland	Unlikely	
141	African Crowned Eagle	*Stephanoaetus coronatus*	NT	Indigenous forest	Possible in forest on escarpment	Low
171	Peregrine Falcon	*Falco peregrinus*	NT	Cliff, grassland	Possible	Low
172	Lanner Falcon	*Falco biarmicus*	NT	General	Probable	Low
238	Black-bellied Bustard	*Lissotis melanogaster*	NT	Open woodland, grassland	Possible	Low
259	White-crowned Lapwing	*Vanellus albiceps*	NT	Riverine	Possible	Low
304	Collared Pratincole	*Glareola pratincola*	NT	Wetlands, water sources	Unlikely	
430	Half-collared Kingfisher	*Alcedo semitorquata*	NT	Riverine	Possible	Low
772	Red-billed Oxpecker	*Buphagus erythrorhynchus*	NT	Woodland	Possible in woodland areas	Medium
81	Hamerkop	*Scopus umbretta*	**	Riverine, water	Probable throughout	Low – medium
83	White Stork	*Ciconia ciconia*	BONN	Arable land, wetland, dam	Probable throughout	Medium
85	Abdim's Stork	*Ciconia abdimii*	BONN	Arable land, grassland, wetland	Probable throughout	Medium

Wolkberg Forest Belt – Important Bird Area – SA005

This IBA consists of hills and forests in the vicinity of Tzaneen. The eastern route or Route 4 is approximately 1.6km from the IBA's eastern boundary, and runs within 5km of the IBA for approximately 10km. The IBA consists of escarpment, cliffs and gorges, with high altitude mist belt on top, at approximately 1500m above sea level. Despite the area having been targeted for commercial forestry in the past, large patches of good quality indigenous forest still remain. The IBA is home to species such as Bat Hawk *Macheiramphus alcinus*, Martial Eagle, African Crowned Eagle *Stephanoaetus coronatus*, Peregrine Falcon *Falco peregrinus* and Cape Parrot *Poicephalus robustus (*Barnes 1998*)*.

As with Kruger, this area would best be avoided by as far as possible by the proposed power line.

Blyde River Canyon – Important Bird Area – SA010

The Blyde River Canyon is approximately 20km long and up to 700m deep. Routes 1, 2 and 3 all pass through the IBA, for distances of approximately 18, 22 and 16 kilometres respectively. The gorge is flanked by a number of spectacular peaks and sheer cliff faces. Key features include the Blydepoort Dam, patches of indigenous forest, the cliff faces and patches of montane grassland. This is the only known breeding area for Taita Falcon *Falco fasciinucha* - arguably now one of South Africa' most rare species. Blue Swallow *Hirundo atrocaerulea* also breed in the grasslands, and a large (the worlds 4th largest) breeding colony of Cape Vulture (up to 660 pairs) is found at the cliffs at Manoutsa. Black Stork *Ciconia nigra* and Peregrine Falcon also breed in the area.

It is far from ideal for a power line of this nature to be built through this IBA. This is discussed in more detail in Section 5.2.

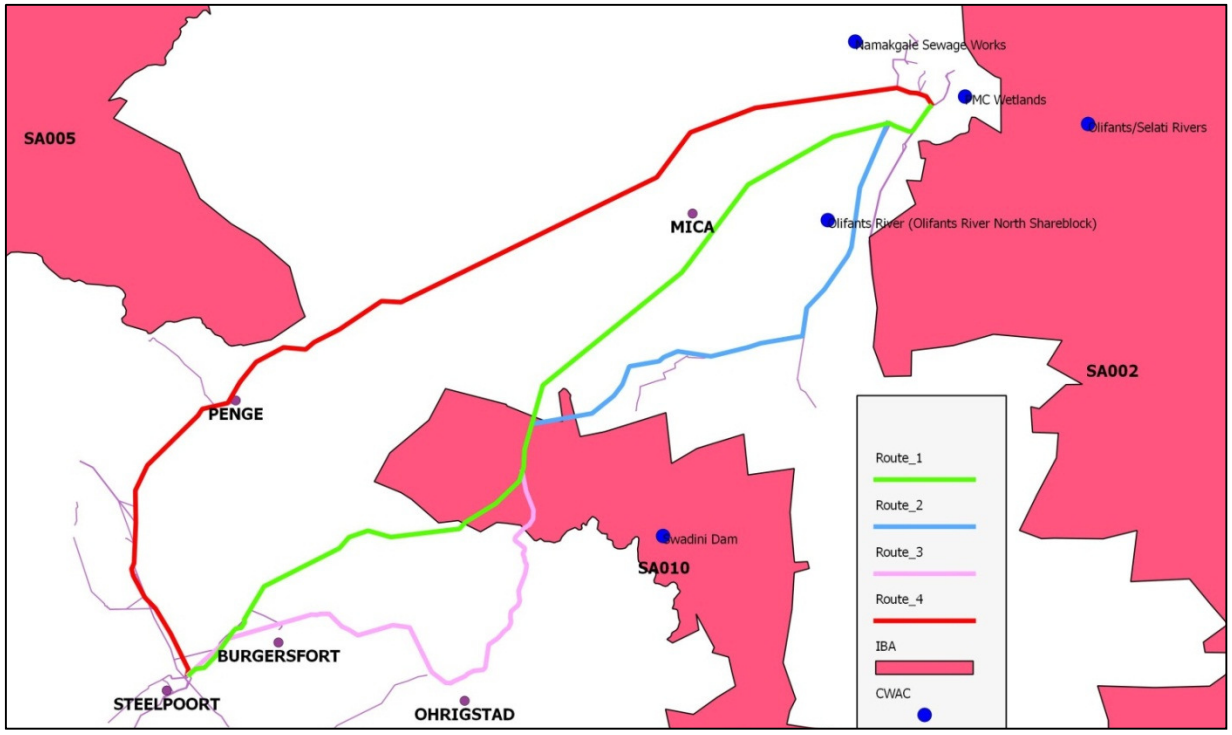

Figure 5. Avifaunal features in the Foskor Merensky 275kV power line study area. Important Bird Areas (IBA) and Co-ordinated Water bird Count (CWAC) locations are shown.

Figure 5 also shows the position of Co-ordinated Water bird Count (CWAC) sites close to or in the study area. These are sites where water birds are regularly counted. Although they are not necessarily sensitive features, and are often man made (such as the Namakgale Sewage Works site) they give a good indication of which water associated bird species can be expected in the area. Three such sites exist close to the proposed routes in the north: Namakgale Sewage Works; Olifants River; and PMC Wetlands. The Namakgale Sewage Works site has records for most of the more common water birds, and also Yellow-billed and Marabou Storks, both key species for this study. The Olifants River site has records for African Fish Eagle and Pels Fishing Owl, and the PMC Wetlands site has records for African Fish Eagle, Pels Fishing Owl, Pink-backed Pelican, Marabou Stork, Saddle-billed Stork, Woolly-necked Stork, Yellow-billed Stork, and Greater and Lesser Flamingo. Although these sites are all some distance from the proposed alignments, the data does bear relevance in terms of which bird species can be expected in the broader area.

5. EVALUATION OF IMPACTS AND CHOICE OF ALTERNATIVE

5.1. Evaluation of impacts

The impacts of the proposed development have been assessed and rated using the tables below and the criteria found in Appendix 1 (standard criteria for a study of this nature):

Table 3. Assessment of the impact of Bird collisions on the overhead cables, in particular the earth wires

Nature: **Bird collisions on the overhead cables, in particular the earth wires**		
	Without mitigation	With mitigation
Extent	2	2
Duration	4	4
Magnitude	4	4
Probability	4	2
Significance	**40 (medium)**	**20 (low)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	Yes birds killed	Yes birds killed
Can impacts be mitigated	Yes – through marking relevant sections of power line	
Mitigation: High risk sections of power line will need to be marked with a suitable, effective Eskom approved line marking device on the earth wires as per Eskom standards. These high risk sections of line need to be identified once the final route is available and tower positions have been surveyed and finalized. This will need to be done through an avifaunal walk through as part of the site specific EMP. It will be Eskom's responsibility to monitor the effectiveness of this mitigation and add further mitigation if it is not effective enough or if the materials do not last. At this stage it is possible to say that all river crossings, the escarpment, and all line close to dams will need to be mitigated.		
Cumulative impacts: The cumulative impacts of power lines on the relevant species (listed elsewhere in this report) will be significant if not managed, since these species mostly already suffer from significant power line mortalities.		

Residual impacts: Low – if lines were removed, impact would cease

Table 4. Assessment of the impact of habitat destruction and alteration on birds

Nature: **Habitat destruction and alteration during construction**		
	Without mitigation	With mitigation
Extent	1	1
Duration	4	4
Magnitude	3	3
Probability	4	4
Significance	**32 (medium)**	**32 (medium)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	Yes- bird habitat	Yes-Bird habitat
Can impacts be mitigated	Yes – but only partially, a certain amount of habitat destruction is inevitable	
Mitigation: Standard construction best practices must be followed. A construction EMP must be developed and implemented by an on-site environmental control officer during construction. In this way the impact can be mitigated to an acceptable level. Key issues are location of construction camp, access of large vehicles and heavy machinery to sensitive areas, and control of labour (i.e. preventing firewood harvesting etc). Key sensitive areas include the IBA, the escarpment, river crossings and natural bushveld.		
Cumulative impacts: for the more sensitive habitats near the escarpment this could be quite significant		
Residual impacts: High – if lines were removed, impact would persist		

Table 5. Assessment of the impact of disturbance of birds during construction

Nature: **Disturbance of birds during construction**		
	Without mitigation	With mitigation
Extent	1	1
Duration	2	2
Magnitude	4	4
Probability	3	3
Significance	**21 (Low)**	**21 (Low)**
Status	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources	Possible loss of breeding success	Possible loss of breeding success
Can impacts be mitigated	Yes -partially	
Mitigation: A standard construction EMP must be compiled and implemented by an on site environmental control officer. Care must be taken if any breeding sensitive species are encountered close to the servitude. Case specific advice can be sought from the avifaunal consultant should such sites be found.		

Cumulative impacts: Negligible
Residual impacts: Low – temporary impact

Table 6. Assessment of the impact of electrical faulting on the power lines

Nature: **Electrical faulting on the power lines**		
	Without mitigation	With mitigation
Extent	1	1
Duration	4	4
Magnitude	4	3
Probability	4	2
Significance	**36 (Medium)**	**16 (Low)**
Status	Negative-for business	Negative-for business
Reversibility	Reversible	Reversible
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes – quite straight forward	
Mitigation: It is recommended that this issue be assessed when the tower structure is available and appropriate mitigation measures developed at that stage.		
Cumulative impacts: n/a		
Residual impacts: Low		

5.2. Evaluation of alternatives

Table 7 below summarises key facts pertaining to each alternative route. For each route, a score was assigned for each factor based on the alternatives' rank out of the four. For example, Alternatives 1, 2 and 3 pass through the Blyde River Canyon IBA, which is a big disadvantage in terms of avifauna. This particular factor has been weighted with three times the importance of the other factors. The length of each alternative that is adjacent to existing large power lines is also a relevant factor. Placing the new power line adjacent to these existing infrastructures is an advantage in terms of avifaunal impacts, since these are already disturbed areas. In the case of bird collision, it is believed that placing more power lines next to each other makes them more visible to birds, and easier to avoid. The length of line adjacent to 275kV line has also been weighted with three times the importance. When these scores are summed for each alternative, a total score for the route is obtained. The alternative with the lowest total score is then the most preferred alternative from an avifaunal perspective.

Table 7. Scoring of the key avifaunal factors for the four alternative routes proposed for the Foskor Merensky 275kV power line.

Feature	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Length (approximate – kilometres)	131 **(1)**	138 **(2)**	154 **(4)**	145 **(3)**
Distance through Important Bird Areas (Blyde River Canyon) (approximate – kilometres)	18 **(9)**	22 **(12)**	16 **(6)**	0 **(3)**

Distance from Kruger National Park Important Bird Area (approximate – kilometres)	1.6 **(2)**	1.8 **(4)**	1.6 **(2)**	5.2 **(1)**
Length of line within 10km of Kruger National Park Important Bird Area (approximate – kilometres)	13.4 **(2)**	40 **(4)**	13.4 **(2)**	10.3 **(1)**
Length of line adjacent to existing 132kV or greater power line	131 **(1)**	110.6 **(2)**	76 **(3)**	49.3 **(4)**
Length of line adjacent to existing 275kV or greater power line	131 **(3)**	69 **(6)**	76 **(9)**	0 **(12)**
Major river courses crossed	9 (Olifants x 3, Ga-Selati, Steelpoort x 5) **(4)**	8 (Steelpoort x 5, Blyde, Sand, Olifants) **(2)**	6 (Steelpoort x 4, Spekboom, Olifants) **(1)**	8 (Steelpoort, Kubjaname, Makhutswi x 2, Olifants, Ga-Selati x 3) **(2)**
Total score	**22**	**32**	**27**	**26**

Table 7 shows that based on final total scores, the preferred route for avifauna would be Alternative 1, with a total score of 22, followed by Alternative 4, with a total score of 26. This preference arises predominantly out of the fact that Alternative 1 is adjacent to an existing 275kV power line for its entire route. This is seen as a significant advantage for avifauna, and outweighs the disadvantage of passing through the Blyde River Canyon IBA. One could argue that since a similar size power line already passes through the IBA, the addition of one more line would not have a significant effect. Although in terms of the above scores, Alternatives 2 and 3 appear to differ little from 1 and 4, it is recommended that these two alternatives are not considered further, since they both pass through the IBA, but are not adjacent to a 275kV line for their entire length.

6. CONCLUSION

This proposed power line route passes through an area that is rich in avifauna, due to its varied geology and vegetation, and the protected status of much of the land (by virtue of game farming). This means that the potential interactions of birds with the power line are likely to be of relatively high significance. However, given that a power line of this size has to be built between these two substations (we assume that effective network planning has been conducted), the proposed routes do collectively provide opportunity to route the line as wisely as possible with respect to avifauna. The preference is to build the proposed power line adjacent to the existing line. It is also essential that the other recommendations of this report are accepted and implemented, in particular the avifaunal walk through to be done during the site specific Environmental Management Plan for the line. This walk through will identify sensitive sections of the routes for collision mitigation, and will as far as possible identify any large breeding raptors close to the alignment.

If the recommendations of this report are adhered to, this project can proceed.

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Appendix 1- Criteria for assessment of the impacts

The following criteria were used to evaluate the significance of the anticipated impacts:

Extent of the impact:
The extent of the impact was assessed accordingly:

- (**1**) Limited to the site and its immediate surroundings
- (**2**) Local/Municipal extending only as far as the local community or urban area
- (**3**) Provincial/Regional
- (**4**) National i.e. South Africa
- (**5**) Across International borders

Duration of the impact:
The lifespan of the impact was assessed to be:

- (**1**) Immediate (less than 1 year)
- (**2**) Short term (1-5 years)
- (**3**) Medium term (6-15 years)
- (**4**) Long term (the impact will cease after the operational life span of the project)
- (**5**) Permanent (no mitigation measures of natural process will reduce the impact after construction)

Magnitude of the impact:
The magnitude or severity of the impacts is indicated as either:

- (**0**) None (where the aspect will have no impact on the environment)
- (**1**) Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
- (**2**) Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
- (**3**) Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
- (**4**) High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
- (**5**) Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).

Probability of occurrence:
The likelihood of the impact actually occurring was indicated as either:

- (**0**) None (impact will not occur)
- (**1**) Improbable (the possibility of the impact materializing is very low as a result of design, historic experience or implementation of adequate mitigation measures)
- (**2**) Low probability (there is a possibility that the impact will occur)
- (**3**) Medium probability (the impact may occur)
- (**4**) High probability (it is most likely that the impact will occur)
- (**5**) Definite / do not know (the impact will occur regardless of the implementation of any prevention or corrective actions or it the specialist does not know what the probability will be based on too little published information)

Status of the Impact:

The impacts are assessed as either having a:

- Negative effect (i.e. at a cost to the environment)
- Positive effect (i.e. at a benefit to the environment)
- Neutral effect on the environment.

Accumulative Impact:

The impact of the development is considered together with additional developments of the same or similar nature and magnitude. The combined impacts may be:

- Negligible (i.e. the net effect is the same as a single development)
- Marginal (i.e. the impact of the two developments of a similar nature is less than twice the impact of a single development. This implies it is better to place the two developments in the same environment rather than in separate environments.
- Compounding (i.e. the impact of the two developments is more than twice the impact of two single developments. This implies that it is better to split the two developments into separate environments.

Significance of the Impact:

Based on a synthesis of the information contained in the points above, the potential impacts were assigned a significance weighting (S). The weighting is formulated by adding the sum of the numbers assigned to extent (E), duration (D) and magnitude (M) and multiplying this sum by the probability (P) of the impact hence S=(E+D+M)P.

- *Low (less than 30 points)*: the impact does not have a direct influence on the decision to develop the area

- *Medium (30-60 points)*: the impact could influence the decision to develop in the area unless it is effectively mitigated

- *High (above 60 points)*: where the impact must have an influence on the decision to proceed to develop in the area