APPENDIX D1

Avifauna Impact Assessment

GIBB Terms of Reference: Avifaunal Assessment

1. Mapping of sensitive sites: The bird sensitive sections of the study area will be mapped and attached as an annexure to the main document.
2. Describe affected environment and determine status quo: The existing environment will described and the bird communities most likely to be impacted will be identified. Different bird micro-habitats will be described as well as the species associated with those habitats.
3. Indicate how a resource or community will be affected. Typical impacts that could be expected from the development will be listed as well as the expected impact on the bird communities. Impacts will be quantified (if possible) and a full description of predicted impacts (direct and indirect) will be provided.
4. Gaps in baseline data. Gaps in baseline data will be highlighted and discussed. An indication of the confidence levels will be given. The best available data sources will be used to predict the impacts, and extensive use will be made of local knowledge.
5. Assessment of impacts: The potential impact on the birds will be assessed and evaluated according to the magnitude, spatial scale, timing, duration, reversibility, probability and significance. Propose and explain mitigation measures. Practical mitigation measures will be recommended and discussed.
6. Summarise residual impacts after mitigation. An impact summary table will be provided, discussing expected impacts before and after mitigation.
7. Indicate a monitoring programme. If a need for a monitoring programme is evident, it will be highlighted and a programme proposed.
8. Draft an impact statement of the proposed development on the identified avifauna communities.

MELKHOUT DIEPRIVIER 132KV

BASIC ASSESSMENT

Avifaunal Impact Assessment

April 2012

J2012-09

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EXECUTIVE SUMMARY

Eskom is proposing to construct a new 132kV overhead power line from the existing Melkhout Substation near Humansdorp, to the new proposed Dieprivier Substation, a distance of approximately 22km. Arcus GIBB was appointed to undertake the necessary Environmental Impact Assessment (EIA) investigations for the planned infrastructure. Indwe Environmental Consulting was subsequently appointed as avifaunal specialists. A site visit was conducted during March 2012.

Up to approximately 220 bird species could be expected in the study area, based on what has been recorded by the Southern African Bird Atlas Project 2(SABAP2 – http://sabap2.adu.org.za) in the six relevant pentads. Across the six pentads a total of 13 Red Listed species were recorded, comprising 6 Vulnerable and 7 Near-threatened. In addition, the White Stork *Ciconia ciconia* is included in Table 1 as it is protected internationally under the Bonn Convention on Migratory Species. The Hamerkop *Scopus umbretta* is also considered as important since recent atlas data points to its range contracting significantly in recent times. The most important of these species for this study are the Blue Crane *Anthropoides paradiseus*, Denham's Bustard *Neotis denhami*, White-bellied Korhaan *Eupodotis senegalensis*, White Stork and Martial Eagle *Polemaetus bellicosus*. These species are all relatively abundant in the area (except for the Martial Eagle which is probably an occasional visitor) and are highly vulnerable to collision (and electrocution in the case of the eagle) with overhead power lines in South Africa. These species are thus the main focus of most of this study.

The nearest Important Bird Area (IBA – Barnes 1998) IBA SA093-Baviaanskloof, lies approximately 20km north of the proposed power line route. This is sufficiently far from the site to have little effect. It is likely that most large threatened raptors (such as Martial Eagle) in particular would use this area as their primary range, perhaps venturing further south towards the site only occasionally.

The broader area within which this project is proposed (from the mountains down to the coast) is particularly well known as a stronghold of the Denham's Bustard and White-bellied Korhaan. The habitats that these species favour are the mixture of pastures, natural vegetation and dams and wetlands. All of these are present on the proposed route, particularly in the areas close to Dieprivier Substation, and in the mid-section of the route, just north of the N2. The Denham's Bustard has proven highly vulnerable to collision with overhead power lines throughout South Africa. Additional mortality due to this unnatural cause should be prevented where possible. Although few records of collisions of White-bellied Korhaan exist, other korhaan species have been recorded colliding with power lines and it stands to reason that White-bellied Korhaan would also be at risk. These are probably then the two most important species for this study. Although not its core range, the Blue Crane is also common in this area, and is probably the species recorded colliding with power lines most frequently in South Africa. This national bird, also a near endemic to South Africa should also be protected from additional mortality as far as possible.

In terms of large raptors in the area, Martial Eagle is probably the most likely Red Listed species to occur, although it is certainly not abundant in the area. This species utilizes massive territories, and so it is possible that just one pair exists in the broader area. This species will certainly utilise power line poles to perch on, and will therefore be at risk of electrocution if incorrect pole structures are used. Although not Red Listed, the Verreaux's and African Fish Eagle are also large raptors likely to occur in the area. Verreaux's Eagle would be more towards the mountainous areas north of the proposed line, whilst African Fish Eagle would frequent the

Krom River and farm dams in the area. The presence of these three large eagles is sufficient grounds to ensure that a bird friendly pole structure is used for the proposed power line, as has been discussed elsewhere in this report.

The impacts of disturbance of birds, and destruction or alteration of habitat are determined to be of relatively low significance for the proposed project, due to the already impacted nature of most of the study area. The impact of collision of birds with certain sections of the proposed line is considered to be of moderate significance and warrants extensive mitigation measures, which have been detailed in the report. This includes the need for an avifaunal walk down to determine the exact spans of line requiring marking. Whilst electrocution is possible on 132kV lines, the proposed tower structures (lattice structure with phase-phase of 2000mm and cross arm of 2550mm) should be safe for the birds in area. Vultures do not occur in the area, so the only species large enough to be at risk of electrocution on a 132kV line are the eagles, which are generally solitary.

Three alternative routes have been proposed for the power line, the preferred option and Alternatives A and B. The preferred route for avifauna is 'Alternative B' for reasons explained in the main report. The preferred option, and Alternative A are not fatally flawed.

DECLARATION OF INDEPENDANCE

Specialist Investigator

The Natural Scientific Professions Act of 2003 aims to "Provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP) and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith."

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

Investigator: Jon Smallie (Pri.Sci.Nat)
Qualification: BSc (hons) Wildlife Science
Affiliation: South African Council for Natural Scientific Professions
Registration number: 400020/06
Fields of Expertise: Ecological Science
Registration: Professional Member

Declaration of Independence

All specialist investigators specified above declare that:

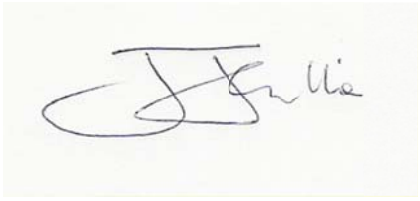
- We act as independent specialists for this project.
- We consider ourselves bound by the rules and ethics of the South African Council for Natural Scientific Professions.
- We do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2006.
- We will not be affected by the outcome of the environmental process, of which this report forms part of.
- We do not have any influence over the decisions made by the governing authorities.
- We 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.
- We 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 we consider ourselves to be in conflict with any of the above declarations, we 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 withholds 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 20 April 2012 by Jon Smallie in his capacity as specialist investigator.



1. INTRODUCTION

1.1 Background

Eskom is proposing to construct a new 132kV overhead power line from the existing Melkhout Substation near Humansdorp, to the new proposed Dieprivier Substation, a distance of approximately 22km. Arcus Gibb has been appointed to undertake the necessary Environmental Impact Assessment (EIA) investigations for the planned infrastructure. Indwe Environmental Consulting was subsequently appointed as avifaunal specialists. A site visit was conducted during March 2012.

Up to approximately 220 bird species could be expected in the study area, based on what has been recorded by the Southern African Bird Atlas Project 2(SABAP2 – http://sabap2.adu.org.za) in the six relevant pentads. Across the six pentads that cover the study area a total of 13 Red Listed species were recorded, comprising 6 Vulnerable and 7 Near-threatened. In addition, the White Stork *Ciconia ciconia* is included in Table 1 as it is protected internationally under the Bonn Convention on Migratory Species. The Hamerkop *Scopus umbretta* is also considered as important since recent atlas data points to its range contracting significantly. The most important of these species for this study are the Blue Crane *Anthropoides paradiseus*, Denham's Bustard *Neotis denhami*, White-bellied Korhaan *Eupodotis senegalensis*, White Stork and Martial Eagle *Polemaetus bellicosus*. These species are all relatively abundant in the area (except for the Martial Eagle which is probably an occasional visitor) and are highly vulnerable to collision (and electrocution in the case of the eagle) with overhead power lines in South Africa.

In general terms, the impacts that could be associated with a project of this nature include: collision of birds with the overhead cables; electrocution of birds whilst perched on the tower structures or in the substation; destruction of habitat; and disturbance of birds.

1.2 Terms of reference

The following terms of reference were utilized for this study:

- A desktop review of all existing literature.
- Describe the current state of avifauna in the study area, outlining important characteristics which may be influenced by the proposed infrastructure or which may influence the proposed infrastructure during construction and operation.
- Identify Red Listed species potentially affected by the proposed power lines and substation.
- Assess the avifaunal status of the study area with the view to identifying sensitive areas and areas that may be considered as "no-go". If appropriate deviations can be suggested, please do so, and provide supporting reasons for the choice.
- Map all relevant aspects.
- Identify potential impacts (positive and negative, including cumulative impacts if relevant) of the proposed development on avifauna during construction and operation. Particular attention should be paid to bird collisions and preventative measures.
- Pay particular attention to wetlands.

- Identify mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks (to be implemented during design, construction and operation of proposed distribution lines.
- Identify and address any other aspects related to avifauna in the study area that should be incorporated into the reports.

1.3 Description of proposed activities

The following are the proposed project activities (see Figure 1):

- Construction of a 132kV overhead power line from the existing Melkhout Substation near Humansdorp to the new Dieprivier Substation on the R62, a distance of approximately 22km.
- Three alternative routes have been provided for assessment.

Whilst electrocution is possible on 132kV lines, the proposed tower structures (lattice structure with phase-phase of 2000mm and cross arm of 2550mm) should be safe for the birds in area. Vultures do not occur in the area, so the only species large enough to be at risk of electrocution on a 132kV line are the eagles, which are generally solitary.

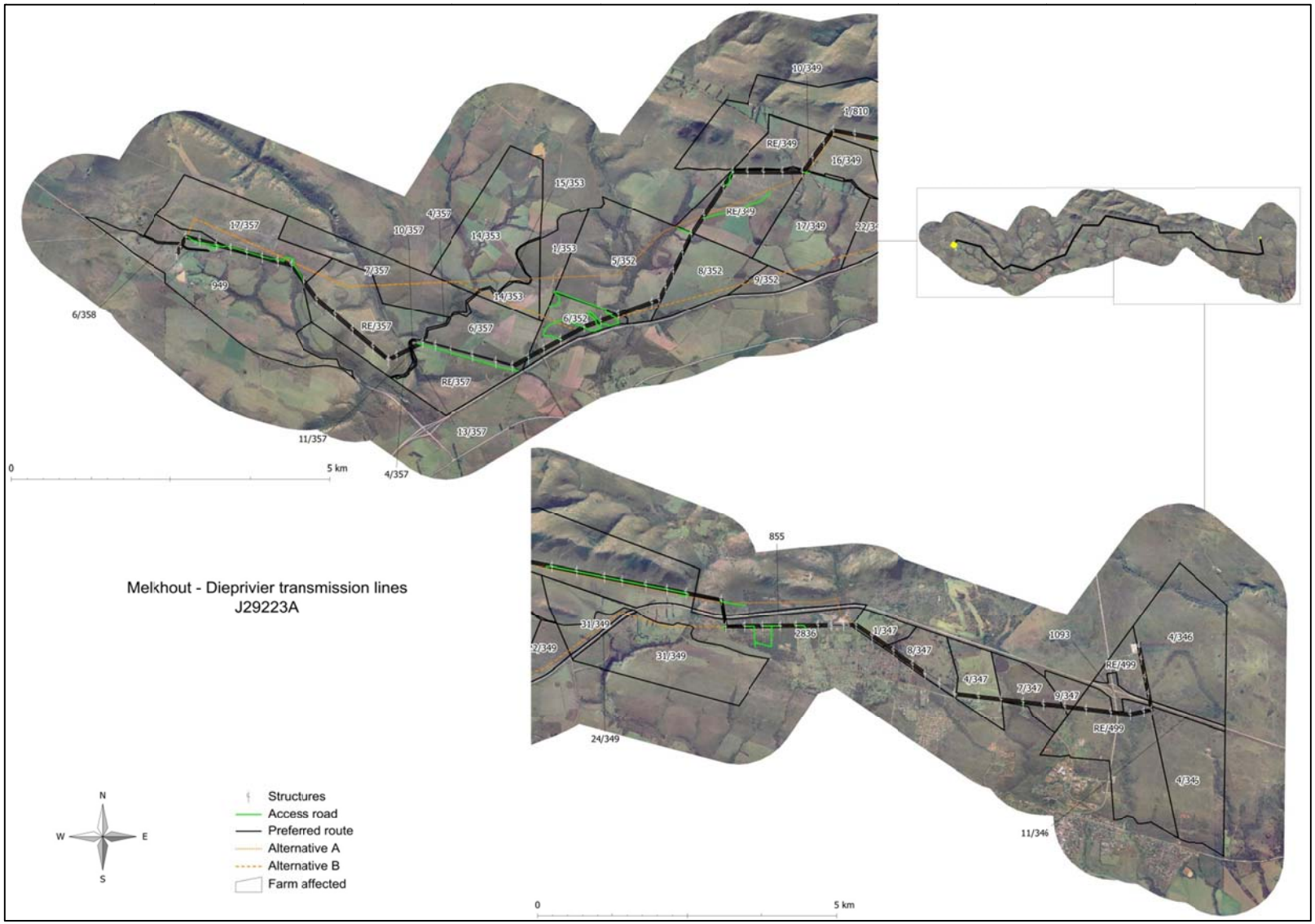


Figure 1. The layout of the Melkhout Dieprivier 132kV line. Map supplied by Arcus Gibb.

2. METHODS

2.1. Methodology

In predicting impacts of a proposed power line on birds, a combination of science, field experience and common sense is required. More specifically the methodology used to predict impacts in the current study was as follows:

- The various data sets discussed below under "sources of information" were collected and examined.
- The data was examined to determine the location and abundance of power line sensitive Red Listed species as well as non-Red Listed power line sensitive species in the study area.
- The area was visited to obtain a first-hand perspective of the proposed route (and substation site) and birdlife and to determine which bird micro-habitats are present and relevant to the study. This involved driving the study area to see as much as possible of the proposed routes for the power line.
- The impacts of the proposed power line on birds were predicted on the basis of experience in gathering and analysing data on wildlife impacts with power lines throughout southern Africa since 1996 (see van Rooyen & Ledger 1999 for an overview of methodology), supplemented with first hand data.

2.2 Sources of information

The study made use of the following data sources:

- Bird distribution data of the second Southern African Bird Atlas Project (SABAP2 – http://sabap2.adu.org.za) for the relevant pentads 3400_2430; 3400_2435; 3400_2440; 3400_2445; 3355_2430; & 3355_2435.
- The conservation status of all bird species occurring in the aforementioned degree squares was then determined with the use of The Eskom Red Listed book of birds of South Africa, Lesotho and Swaziland (Barnes, 2000).
- A classification of the vegetation types in the study area was obtained from Mucina et al (2006).
- Information on the micro-habitat level was obtained through visiting the area and obtaining a first-hand perspective.
- Electronic 1:50 000 maps were obtained from the Surveyor General.

2.3 Limitations & assumptions

This study made the assumption that the above sources of information are reliable. Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour cannot be reduced to formulas that will hold true under all circumstances. However, power line impacts can be predicted with a fair amount of certainty, based on experience gained by the author through the investigation of hundreds of localities in southern Africa where birds have interacted with power lines since 1999.

3. DESCRIPTION OF AFFECTED ENVIRONMENT

3.1 Study area vegetation

The study area is relatively complex in terms of vegetation. The two alternative routes pass predominantly through "Humansdorp Shale Renosterveld" in the west and "Kouga Grassy Sandstone Fynbos" in the east. Close to the proposed Dieprivier Substation, the route also passes through "Langkloof Shale Renosterveld" for a short distance. It is widely agreed in ornithological circles that vegetation structure is more important than species composition, in determining bird species presence and abundance. Taking this into account then the most important aspect of the above mentioned vegetation types for avifauna is that they are all short, Fynbos type vegetation types. This means that we can expect bird species associated with Fynbos. Interestingly, the botanical diversity of Fynbos is not matched by the avifauna associated with it. The diversity of avifauna associated with Fynbos is normally relatively low. In addition, due to its dense nature most the species that are attracted to Fynbos are physically small species, for which predator detection at long distances is not as important as for large terrestrial species such as cranes and bustards. Various raptors also utilise Fynbos, such as harriers and Verreaux's Eagle *Aquila verreaux*.

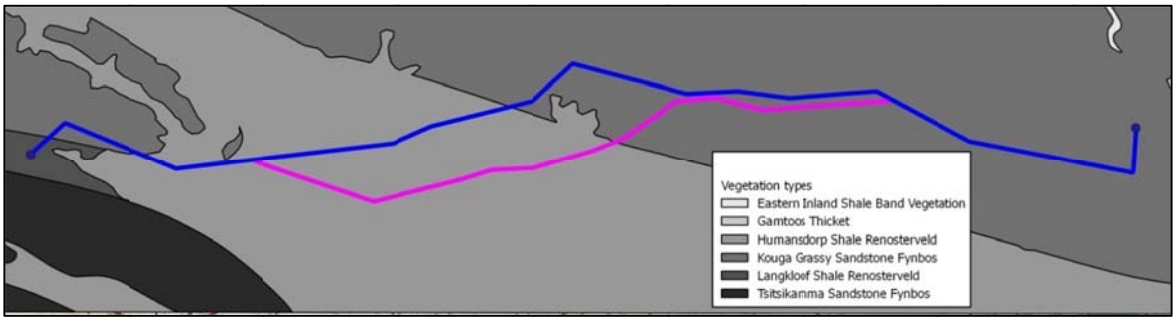


Figure 2. The vegetation classification for the Melkhout Dieprivier 132kV power line study area (Mucina & Rutherford, 2006). Alternative 1 is indicated by a blue line and Alternative 2 by a purple line.

3.2 Bird micro habitats

In addition to the description of vegetation, it is important to understand the habitats available to birds at a smaller spatial scale, i.e. micro habitats. Micro habitats are shaped by factors other than vegetation, such as topography, land use, food sources and man-made factors.

Investigation of this study area revealed the following bird micro habitats.

Arable lands:
Arable or cultivated land represents a significant feeding area 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 readily 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. Arable lands exist in this study area, mostly planted to pasture at the time of site visit. Relevant bird species that will be attracted to these areas include most importantly the Blue Crane, Denham's Bustard and White Stork.

Dams:

Artificially constructed dams have become important attractants to various bird species in the South African landscape. Several small dams exist in the broader study area. Various waterfowl frequent these areas and are vulnerable to collision with power lines. More importantly, one of the main focus species of this study, the Blue Crane, uses dams as roost sites, roosting communally in the shallows. This means that large numbers of these birds enter the roost at last light and exit it at first light, both times when power lines are even less visible and the chances of collisions is greater. Therefore dams are a key element of this study, and power line passing close to them will require mitigation as detailed elsewhere in this report.

Rivers or drainage lines:

Most rivers in southern Africa are in the east and extreme south, in the higher rainfall areas. Various species of water bird are mostly restricted to riverine habitat in southern Africa. The map distribution of these species correlates with the river courses in southern Africa. Many of these species, particularly the larger ones, are known to interact with power lines through collision. These rivers also form significant flight paths for many of these species. The proposed power line runs reasonably close to the large Krom River valley for parts of its route, and also crosses several other small drainage lines.

Fynbos:

This micro habitat has been described adequately above under the vegetation description. This is the only natural micro habitat available in the study area.

Thicket:

Thicket remains in the valleys in this study area, and would attract a certain set of species. Fortunately these areas will mostly be spanned by the line and should not be impacted on.

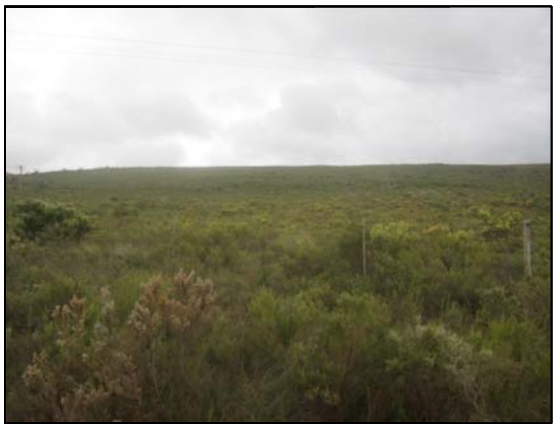
Exotic species:

In the far east of this study area close to Humansdorp the line passes through extensive wattle jungle. This is a very unattractive micro habitat for most bird species and is hence not very sensitive at all.

(a)

(b)

(c)



(d)

(e)

(f)

Figure 3. Examples of available micro habitats in the study area. a – wetland; b – wattle forest, c – thicket, d – fynbos, e – arable lands, f - dam.

Table 1 shows the micro habitats that each Red Listed bird species typically frequents in the study area. It must be stressed that birds can and will, by virtue of their mobility, utilise almost any areas in a landscape from time to time. However, the analysis below represents each species' most preferred or normal habitats. These locations are where most of the birds of that species will spend most of their time – so logically that is where impacts on those species will be most significant.

Table 1 makes use of the authors' extensive experience gained through personal observations.

3.3 Relevant bird populations

The data source used to determine the distribution and abundance of bird species in the study area was the Southern African Bird Atlas Project 2 data (SABAP2 – http://sabap2.adu.org.za). Fortunately for this study area, reasonable coverage by counters has already been achieved. This is shown with the number of cards in Table 1, ranging from 3 to 18 for the six relevant pentads. This data was collected on the basis of pentads. The species recorded in the relevant pentads could have been recorded anywhere within these pentads and not necessarily in the exact study area for the proposed developments. It does however provide a good indication of what could be found in the study area. Reporting rates (as per Table 1) are an expression (%) of the number of times a species was seen in a pentad divided by the number of times that pentad was counted.

Up to approximately 220 bird species could be expected in the study area, based on what has been recorded by the SABAP2 project so far. Across the six pentads that cover the study area a total of 13 Red Listed species were recorded, comprising 6 Vulnerable and 7 Near-threatened. In addition, the White Stork *Ciconia ciconia* is included in Table 1 as it is protected internationally under the Bonn Convention on Migratory Species. The Hamerkop *Scopus umbretta* is also considered as important since recent atlas data points to its range contracting significantly. The most important of these species for this study are the Blue Crane *Anthropoides paradiseus*, Denham's Bustard *Neotis denhami*, White-bellied Korhaan *Eupodotis senegalensis*, White Stork and Martial Eagle *Polemaetus bellicosus*. These species are all abundant in the area and are highly vulnerable to collision (and electrocution in the case of the eagle) with overhead power lines in South Africa. One exception to this is the Martial Eagle, which is probably an occasional visitor to the site. These species are thus the main focus of most of this study. Although not a Red Listed species, the Verreaux's Eagle *Aquila verreaux* is a large eagle also likely to occur in the area and worth considering. Large raptors such as the Martial Eagle *Polemaeetus bellicosus* could also be affected by electrocution on the proposed power line. Fortunately as explained elsewhere in this report, electrocution is easily mitigated by using bird friendly pole structures for the power line.

The nearest Important Bird Area (IBA – Barnes 1998) IBA SA093-Baviaanskloof, lies approximately 20km north of the proposed power line route. This is sufficiently far from the site to have little effect. It is likely that most large threatened raptors (such as Martial Eagle) in particular would use this area as their primary range, perhaps venturing further south towards the site only occasionally.

The broader area within which the project is situated (from the mountains down to the coast) is particularly well known as a stronghold of the Denham's Bustard and White-bellied Korhaan, and this is reflected in the report rates in Table 1. The Co-ordinated Avifaunal Roadcount (CAR – Young *et al,* 2003) project has several routes in this area, and has recorded the highest density of these two species of any routes in South Africa. The proposed power line route passes through the north of this core area. The habitats that these species favour are the mixture of pastures, natural vegetation and dams and wetlands. All of these are present on the proposed route, particularly in the areas close to Dieprivier Substation, and in the mid-section of the route, just north of the N2. The Denham's Bustard has proven highly vulnerable to collision with overhead power lines throughout South Africa. Additional mortality due to this unnatural cause should be prevented where possible. Although few records of collisions of White-bellied Korhaan exist, other korhaan species have been recorded colliding with power lines and it stands to reason that White-bellied Korhaan would also be at risk. These are probably then the two most important species

for this study. Although not its core range, the Blue Crane is also common in this area, and is probably the species recorded colliding with power lines most frequently in South Africa. This national bird, also a near endemic to South Africa should also be protected from additional mortality as far as possible.

In terms of large raptors in the area, Martial Eagle is probably the most likely Red Listed species to occur, although it is certainly not abundant in the area. This species utilizes massive territories, and so it is possible that just one pair exists in the broader area. This species will certainly utilise power line poles to perch on, and will therefore be at risk of electrocution if incorrect pole structures are used. Although not Red Listed, the Verreaux's and African Fish Eagle are also large raptors likely to occur in the area. Verreaux's Eagle would be more towards the mountainous areas north of the proposed line, whilst African Fish Eagle would frequent the Krom River and farm dams in the area. The presence of these three large eagles is sufficient grounds to ensure that a bird friendly pole structure is used for the proposed power line, as has been discussed elsewhere in this report.

It must be noted that many "non-Red Listed" bird species also occur in the study area and could be impacted on by the power line. Although this impact assessment focuses on Red Listed species, the impact on non-Red Listed species is also assessed, albeit in less detail. Furthermore, much of the mitigation recommended for Red Listed species will also protect non Red Listed species in the study area. It could be argued that if impact assessment does not focus on non-threatened species these species will make their way onto threatened status thus making our list of species to conserve even greater. Whilst this argument does hold some merit, the limited resources available for most impact assessments make it necessary to prioritise species on the basis of their conservation status.

Table 1. Data from the Southern African Bird Atlas Project 2 (http://sabap2.adu.org.za) for the Red Listed species likely to occur in the study area.

Common name	Scientific name	Conservation status	3400_ 2430	3355_ 2435	3400_ 2435	3355_ 2440	3400_ 2440	3400_ 2445	Preferred micro habitat	Likelihood of occurring on site	Relative importance of site for national population of species
	Total species		154	77	87	104	125	179			
	Number of cards submitted		17	5	3	8	4	18			
African Marsh-Harrier	*Circus ranivorus*	V	11.80%	33.30%			25.00%	38.90%	Wetland, grassland, fynbos	Possible	Low
Black Harrier	*Circus maurus*	V				11.10%			Wetland, grassland, fynbos	Possible	Low
Blue Crane	*Anthropoides paradiseus*	V	58.80%	66.70%	50.00%	33.30%	75.00%	88.90%	Grassland, fynbos, arable land, wetland, dam	Definite – recorded during site visit	Medium
Denham's Bustard	*Neotis denhami*	V	64.70%	66.70%	16.70%	33.30%	50.00%	33.30%	Grassland, fynbos, arable land	Probable	Medium
Martial Eagle	*Polemaetus bellicosus*	V	11.80%		16.70%	11.10%			All – generalist, natural vegetation	Possible	Low
White-bellied Korhaan	*Eupodotis senegalensis*	V	23.50%					33.30%	Grassland, arable land	Possible	Medium
African Black Oystercatcher	*Haematopus moquini*	NT	5.60%						Marine	Impossible	Low
Black-winged Lapwing	*Vanellus melanopterus*	NT	17.60%	66.70%			75.00%	16.70%	Short grassland	Possible	Low
Greater Flamingo	*Phoenicopterus ruber*	NT	5.60%						Dam, pan, floodplain	Unlikely	Low
Knysna Woodpecker	*Campethera notata*	NT			16.70%			5.60%	Forest	Possible in valleys	Low
Lanner Falcon	*Falco biarmicus*	NT	11.80%						Arable land, grassland, fynbos	Possible	Low
Pallid Harrier	*Circus macrourus*	NT	25.00%					5.60%	Wetland, grassland, fynbos	Possible	Low
Secretarybird	*Sagittarius serpentarius*	NT						5.60%	Grassland, fynbos, arable land	Possible	Low
Hamerkop	*Scopus umbretta*	**	11.80%	33.30%				5.60%	Riverine	Probable	Low
White Stork	*Ciconia ciconia*	Bonn	29.40%	33.30%		11.10%	25.00%	11.10%	Wetland, arable land, fynbos	Probable	Low

V = Vulnerable; NT = Near-threatened; Bonn = Protected Internationally under the Bonn Convention on Migratory Species; ** Species of recent conservation concern.

4. ASSESSMENT OF IMPACTS

4.1 General description of impacts of power lines on birds

Because of its' size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines. (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs & Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen & Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities.

Electrocutions

Electrocution of birds on overhead lines is an important cause of unnatural mortality of raptors and storks. It has attracted plenty of attention in Europe, USA and South Africa (APLIC 1994; van Rooyen & Ledger 1999). 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).

Collisions

Collisions are the biggest single threat posed by transmission lines to 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 manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001).

Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Listed species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term.

Habitat destruction

During the construction phase and maintenance of power lines some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes. 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 minimize 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 of the servitude through modification of habitat.

Disturbance

Similarly, the above mentioned construction and maintenance activities impact on bird through disturbance, particularly during bird breeding activities. Disturbance of birds is anticipated to be of low significance in this study area since it is already fairly impacted particularly in the eastern half closer to the N2, railway line and town.

4.2 Description of impacts of this proposed project

The impacts of the proposed power lines and substation were rated in the tables below. The criteria used for this rating can be seen in Appendix 1.

Electrocutions

Whilst electrocution is possible on 132kV lines, the proposed tower structures (lattice structure with phase-phase of 2000mm and cross arm of 2550mm) should be safe for the birds in area. Vultures do not occur in the area, so the only species large enough to be at risk of electrocution on a 132kV line are the eagles, which are generally solitary. The impact of electrocution is likely to be of low significance for the proposed power line. Electrocution is also possible in the new substation. However this is unlikely to affect sensitive bird species as they are not likely to frequent the substation yard.

Mitigation:

If the above mentioned tower structure is used no further mitigation will be required. If birds are electrocuted in the substation regularly once operational it is recommended that case specific recommendations are developed for mitigation. The exact positions within a substation whereon birds can be electrocuted are too numerous to warrant proactive mitigation.

Collisions

Collision of certain bird species, particularly Blue Crane, Denham's Bustard, White-bellied Korhaan and White Stork is highly probable and has been rated as a moderate negative impact.

Mitigation:

High risk sections of the power line will need to be installed with a suitable anti bird collision marking device approved by Eskom, and as per Eskom standards. This report has identified approximate sections of line that are anticipated to be of high collision risk, but this is at a coarse scale. It is essential that an avifaunal walk-through be conducted as part of the site specific EMP (Environmental Management Plan) before construction, when the exact final pole positions are finalised. This walk through will identify the exact spans of line requiring marking.

Habitat destruction

Habitat destruction is not anticipated to be a significant impact in this study area, as most of the natural vegetation has been removed already.

Mitigation:

Mitigation measures are simply to ensure that construction takes place according to environmental best practice standards. Key issues to manage include vehicle and machinery control in sensitive habitats, road construction (minimise where possible), and control of construction staff activities.

Disturbance

Similarly, the above mentioned construction and maintenance activities impact on bird through disturbance, particularly during bird breeding activities. Disturbance of birds is anticipated to be of low significance in this study area since it is already fairly impacted particularly in the eastern half closer to the N2, railway line and town.

Mitigation:

Mitigation measures are the same as for habitat destruction above.

Table 2. Assessment of the operational phase impacts of the proposed project.

GENERAL AND SPECIALIST STUDY IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE AFTER MITIGATION
ISSUE: Avifauna							
IMPACT: Bird collision with overhead power line, particularly earth wire, Impact on Red Listed and other species							
DIRECT IMPACTS							
	National – populations of Red Listed species affected	Permanent	Probable	Severe	Moderate negative	Mark certain sections of the line with anti-collision marking devices on the earth wire (as per Eskom guidelines) to increase the visibility of the line and reduce likelihood of collisions. These sections of line will need to be identified by an avifaunal walk through/site specific EMP once the final route is selected and tower positions are finalised. A preliminary indication of the areas of the line that pose a concern is shown in Figure 4.	Low negative
IMPACT: Bird electrocution, Impact on Red Listed and other species							
DIRECT IMPACT							
	National – populations of Red Listed species affected	Permanent	Possible	Slight	Moderate negative	Whilst electrocution is possible on 132kV lines, the proposed tower structures (lattice structure with phase-phase of 2000mm and cross arm of 2550mm) should be safe for the birds in area. Vultures do not occur in the area, so the only species large	Insignificant

GENERAL AND SPECIALIST STUDY IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE AFTER MITIGATION
						enough to be at risk of electrocution on a 132kV line are the eagles, which are generally solitary.	

Table 3. Assessment of the construction phase impacts of the project.

GENERAL AND SPECIALIST STUDY IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
ISSUE: Avifauna							
IMPACT: Disturbance of birds, Impact on Red Listed and other species							
DIRECT IMPACTS							
	Localised	Short term	Possible	Slight	Low negative	Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff. It is difficult to mitigate properly for this as some disturbance is inevitable. The Krom River and associated riparian habitat is particularly sensitive in this regard	Low negative
IMPACT: Destruction or alteration of bird habitat, Impact on Red Listed and other species							
INDIRECT IMPACTS:							
	Localised	permanent	probable	Slight – area already highly impacted on	Low negative	Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff. It is difficult to mitigate properly for this as some habitat destruction is inevitable	Low negative

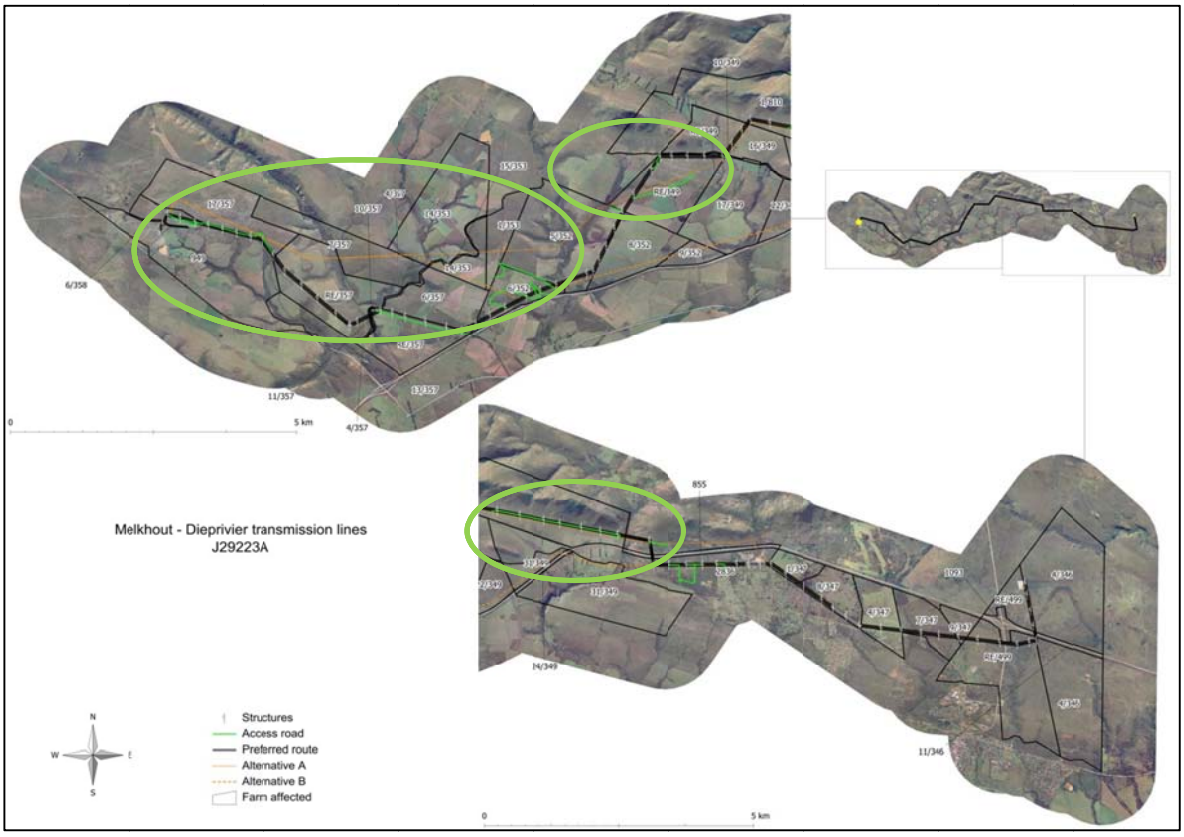


Figure 4. Preliminary high collision risk sections of power line (green).

The high risk sections of the route are shown in Figure 4 by green circles. In order from left to right these are as follows: a flat area close to the substation that will attract cranes and bustards; the Krom River valley crossing; a small drainage line crossing; a flat area of pastures and small dams that will attract cranes and bustards; another small drainage line crossing.

5. COMPARISON OF ALTERNATIVES

Alternative B is preferred from an avifaunal perspective for the following reasons:

- It runs further from the mountain in the eastern half of its route. This is an advantage, as raptors are likely to frequent the mountain range and would therefore be at greater risk of interacting with the power line.
- It runs adjacent to the N2 for much of its length. This is an advantage as the road is believed to be an existing source of disturbance to avifauna and so the impacts of the new power line are likely to be less significant in comparison to existing impacts. Also it is believed that birds tend to gain altitude in flight when they approach a road, to avoid the disturbance. This would mean they would be less at risk of collision with the power line.

It must be noted however that the preferred option and Alternative A are not fatally flawed, and should the power line be constructed on this route it would not result in unacceptably high levels of impacts on birds.

6. IMPACT STATEMENT

In conclusion, the proposed power line can be built provided that the various mitigation measures recommended in this report are implemented. Of particular concern is the collision mitigation. Provided that an avifaunal walk down is done to identify the exact spans requiring collision mitigation in the form of marking devices installed on the earth wires, this impact should hopefully be contained.

7 REFERENCES

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APPENDIX 1

Description of criteria

Table 1. **Significance Rating Table**

Significance Rating Table	
Temporal Scale (The duration of the impact)	
Short term	Less than 5 years (Many construction phase impacts are of a short duration).
Medium term	Between 5 and 20 years.
Long term	Between 20 and 40 years (From a human perspective almost permanent).
Permanent	Over 40 years or resulting in a permanent and lasting change that will always be there.
Spatial Scale (The area in which any impact will have an affect)	
Individual	Impacts affect an individual.
Localized	Impacts affect a small area of a few hectares in extent. Often only a portion of the project area.
Project Level	Impacts affect the entire project area.
Surrounding Areas	Impacts that affect the area surrounding the development
Municipal	Impacts affect either BCM, or any towns within them.
Regional	Impacts affect the wider district municipality or the province as a whole.
National	Impacts affect the entire country.
International/Global	Impacts affect other countries or have a global influence.
Will definitely occur	Impacts will definitely occur.
Degree of Confidence or Certainty (The confidence with which one has predicted the significance of an impact)	
Definite	More than 90% sure of a particular fact. Should have substantial supportive data.
Probable	Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Only over 40% sure of a particular fact or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or of the likelihood of an impact occurring.

Table 2. **Impact Severity Rating**

Impact severity **(The severity of negative impacts, or how beneficial positive impacts would be on a particular affected system or affected party**)	
Very severe	Very beneficial
An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.
Severe	Beneficial
Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.
Moderately severe	Moderately beneficial
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing the sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.
Slight	Slightly beneficial
Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.
No effect	Don't know/Can't know
The system(s) or party(ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.

Table 3. **Overall Significance Rating**

Overall Significance (The combination of all the above criteria as an overall significance)	
VERY HIGH NEGATIVE	**VERY BENEFICIAL**
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in **severe** or **very severe** effects, or **beneficial** or **very beneficial** effects. **Example:** The loss of a species would be viewed by informed society as being of VERY HIGH significance. **Example:** The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.	
HIGH NEGATIVE	**BENEFICIAL**
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light. **Example:** The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated. **Example:** The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.	
MODERATE NEGATIVE	**SOME BENEFITS**
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. **Example:** The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.	
LOW NEGATIVE	**FEW BENEFITS**
These impacts will usually result in medium to short term effects on the social and/or natural environment.	

Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. **Example:** The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels. **Example:** The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.
NO SIGNIFICANCE
There are no primary or secondary effects at all that are important to scientists or the public. **Example:** A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.
DON'T KNOW
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. **Example:** The effect of a particular development on people's psychological perspective of the environment.

Appendix 2. Data from the second bird atlas project (SABAP2 – http://sabap2.adu.org.za)

Common name	Scientific name	Conservation status	3400_ 2430	3355_ 2435	3400_ 2435	3355_ 2440	3400_ 2440	3400_ 2445
African Black Duck	*Anas sparsa*		5.90%				25.00%	5.60%
African Black Oystercatcher	*Haematopus moquini*	NT	5.60%					
African Black Swift	*Apus barbatus*		5.90%			11.10%	25.00%	5.60%
African Darter	*Anhinga rufa*		11.80%	33.30%			50.00%	66.70%
African Dusky Flycatcher	*Muscicapa adusta*				33.30%		25.00%	11.10%
African Firefinch	*Lagonosticta rubricata*		5.60%					
African Fish-Eagle	*Haliaeetus vocifer*				16.70%		25.00%	33.30%
African Goshawk	*Accipiter tachiro*						25.00%	
African Harrier-Hawk	*Polyboroides typus*		17.60%					
African Hoopoe	*Upupa africana*		52.90%	66.70%	66.70%	44.40%	50.00%	38.90%
African Jacana	*Actophilornis africanus*		5.90%					16.70%
African Marsh-Harrier	*Circus ranivorus*	V	11.80%	33.30%			25.00%	38.90%
African Olive-Pigeon	*Columba arquatrix*		17.60%					
African Palm-Swift	*Cypsiurus parvus*							16.70%
African Paradise-Flycatcher	*Terpsiphone viridis*		11.80%		16.70%	11.10%	25.00%	16.70%
African Pied Wagtail	*Motacilla aguimp*		5.90%					
African Pipit	*Anthus cinnamomeus*		82.40%	66.70%	66.70%	33.30%	75.00%	66.70%
African Pygmy-Kingfisher	*Ispidina picta*							11.10%
African Sacred Ibis	*Threskiornis aethiopicus*		47.10%	66.70%	33.30%	11.10%	50.00%	72.20%
African Snipe	*Gallinago nigripennis*		11.80%					
African Spoonbill	*Platalea alba*		17.60%	33.30%	16.70%		25.00%	33.30%
African Stonechat	*Saxicola torquatus*		88.20%	66.70%	100.00%	77.80%	50.00%	72.20%
Alpine Swift	*Tachymarptis melba*		23.50%		16.70%	11.10%	25.00%	5.60%
Amethyst Sunbird	*Chalcomitra amethystina*		41.20%		16.70%	66.70%	25.00%	33.30%
Amur Falcon	*Falco amurensis*		17.60%					11.10%
Ant-eating Chat	*Myrmecocichla formicivora*		11.80%		50.00%			
Banded Martin	*Riparia cincta*		17.60%	33.30%			25.00%	16.70%
Barn Owl	*Tyto alba*							5.60%
Barn Swallow	*Hirundo rustica*		35.30%	33.30%	33.30%	66.70%	75.00%	38.90%
Bar-throated Apalis	*Apalis thoracica*		47.10%	66.70%	100.00%	55.60%	75.00%	77.80%
Black Crake	*Amaurornis flavirostris*		5.90%				25.00%	22.20%
Black Cuckoo	*Cuculus clamosus*						50.00%	11.10%
Black Cuckooshrike	*Campephaga flava*							11.10%
Black Harrier	*Circus maurus*	V				11.10%		
Black Saw-wing	*Psalidoprocne holomelaena*		23.50%		66.70%	33.30%		38.90%
Black Sparrowhawk	*Accipiter melanoleucus*		5.90%					
Black-backed Puffback	*Dryoscopus cubla*		5.90%				50.00%	
Black-bellied Starling	*Lamprotornis corruscus*			33.30%			50.00%	11.10%
Black-collared Barbet	*Lybius torquatus*		11.80%		66.70%	22.20%	50.00%	50.00%
Black-crowned Night-Heron	*Nycticorax nycticorax*							11.10%
Black-headed Heron	*Ardea melanocephala*		64.70%	100.00%	33.30%	22.20%	50.00%	55.60%

Common name	Scientific name	Conservation status	3400_2430	3355_2435	3400_2435	3355_2440	3400_2440	3400_2445
Black-headed Oriole	*Oriolus larvatus*		58.80%	33.30%	16.70%	55.60%	25.00%	44.40%
Black-shouldered Kite	*Elanus caeruleus*		47.10%					
Blacksmith Lapwing	*Vanellus armatus*		64.70%	100.00%			50.00%	77.80%
Black-winged Lapwing	*Vanellus melanopterus*	NT	17.60%	66.70%			75.00%	16.70%
Black-winged Stilt	*Himantopus himantopus*						25.00%	33.30%
Blue Crane	*Anthropoides paradiseus*	V	58.80%	66.70%	50.00%	33.30%	75.00%	88.90%
Blue-mantled Crested-Flycatcher	*Trochocercus cyanomelas*					11.10%	25.00%	11.10%
Bokmakierie	*Telophorus zeylonus*		100.00%	100.00%	83.30%	77.80%	100.00%	77.80%
Brimstone Canary	*Crithagra sulphuratus*			66.70%	16.70%		50.00%	33.30%
Brown-hooded Kingfisher	*Halcyon albiventris*		23.50%		83.30%	22.20%	75.00%	16.70%
Brown-throated Martin	*Riparia paludicola*		11.80%		33.30%	11.10%	50.00%	33.30%
Burchell's Coucal	*Centropus burchellii*		17.60%		50.00%		75.00%	38.90%
Cape Batis	*Batis capensis*					11.10%	100.00%	22.20%
Cape Bulbul	*Pycnonotus capensis*		35.30%	33.30%	100.00%	33.30%	50.00%	44.40%
Cape Canary	*Serinus canicollis*		52.90%	100.00%	66.70%	11.10%		11.10%
Cape Clapper Lark	*Mirafra apiata*		35.30%		16.70%	11.10%		16.70%
Cape Crow	*Corvus capensis*		64.70%	100.00%	83.30%	55.60%	100.00%	83.30%
Cape Glossy Starling	*Lamprotornis nitens*		35.30%	100.00%	66.70%	22.20%	50.00%	55.60%
Cape Grassbird	*Sphenoeacus afer*		82.40%	33.30%	83.30%	55.60%	25.00%	5.60%
Cape Longclaw	*Macronyx capensis*		76.50%	100.00%	66.70%	55.60%	75.00%	66.70%
Cape Robin-Chat	*Cossypha caffra*		70.60%	66.70%	66.70%	77.80%	100.00%	83.30%
Cape Rock-Thrush	*Monticola rupestris*		5.90%		16.70%			
Cape Shoveler	*Anas smithii*		23.50%	66.70%		11.10%		61.10%
Cape Sparrow	*Passer melanurus*		11.80%					
Cape Sugarbird	*Promerops cafer*		23.50%	66.70%	50.00%	11.10%		
Cape Teal	*Anas capensis*		5.90%			11.10%	25.00%	33.30%
Cape Turtle-Dove	*Streptopelia capicola*		82.40%	100.00%	83.30%	88.90%	75.00%	66.70%
Cape Wagtail	*Motacilla capensis*		82.40%	66.70%	100.00%	11.10%	75.00%	72.20%
Cape Weaver	*Ploceus capensis*		88.20%	100.00%	83.30%	33.30%	75.00%	83.30%
Cape White-eye	*Zosterops virens*		41.20%		66.70%	55.60%	75.00%	72.20%
Caspian Tern	*Sterna caspia*							5.60%
Cattle Egret	*Bubulcus ibis*		64.70%	100.00%		33.30%		77.80%
Cinnamon-breasted Bunting	*Emberiza tahapisi*		5.90%					
Cloud Cisticola	*Cisticola textrix*		82.40%		66.70%	11.10%	50.00%	55.60%
Collared Sunbird	*Hedydipna collaris*		16.70%					
Common Fiscal	*Lanius collaris*		100.00%	100.00%	66.70%	88.90%	100.00%	88.90%
Common Greenshank	*Tringa nebularia*		27.80%					
Common House-Martin	*Delichon urbicum*		11.10%					
Common Moorhen	*Gallinula chloropus*		17.60%				25.00%	22.20%
Common Ostrich	*Struthio camelus*		11.80%		33.30%	11.10%	50.00%	
Common Quail	*Coturnix coturnix*		29.40%	33.30%			25.00%	5.60%
Common Ringed Plover	*Charadrius hiaticula*						25.00%	11.10%
Common Sandpiper	*Actitis hypoleucos*						25.00%	

Common name	Scientific name	Conservation status	3400_2430	3355_2435	3400_2435	3355_2440	3400_2440	3400_2445
Common Starling	*Sturnus vulgaris*		52.90%	100.00%	66.70%	22.20%	100.00%	88.90%
Common Swift	*Apus apus*		11.10%					
Common Waxbill	*Estrilda astrild*		64.70%		83.30%	11.10%	50.00%	11.10%
Crowned Lapwing	*Vanellus coronatus*		64.70%	100.00%		11.10%	75.00%	66.70%
Curlew Sandpiper	*Calidris ferruginea*		5.60%					
Denham's Bustard	*Neotis denhami*	V	64.70%	66.70%	16.70%	33.30%	50.00%	33.30%
Diderick Cuckoo	*Chrysococcyx caprius*		17.60%	33.30%	16.70%	11.10%	25.00%	11.10%
Eastern Clapper Lark	*Mirafra fasciolata*				16.70%			5.60%
Egyptian Goose	*Alopochen aegyptiacus*		88.20%	100.00%	100.00%	55.60%	100.00%	94.40%
Emerald-spotted Wood-Dove	*Turtur chalcospilos*						25.00%	11.10%
Familiar Chat	*Cercomela familiaris*		17.60%		50.00%			
Fiscal Flycatcher	*Sigelus silens*		35.30%					
Forest Buzzard	*Buteo trizonatus*						25.00%	
Forest Canary	*Crithagra scotops*							5.60%
Fork-tailed Drongo	*Dicrurus adsimilis*		88.20%	100.00%	100.00%	77.80%	100.00%	83.30%
Gabar Goshawk	*Melierax gabar*				33.30%			
Giant Kingfisher	*Megaceryle maximus*							5.60%
Golden-breasted Bunting	*Emberiza flaviventris*		17.60%					
Goliath Heron	*Ardea goliath*							5.60%
Great Egret	*Egretta alba*		5.90%					5.60%
Greater Double-collared Sunbird	*Cinnyris afer*		64.70%	66.70%	33.30%	55.60%	25.00%	50.00%
Greater Flamingo	*Phoenicopterus ruber*	NT	5.60%					
Greater Striped Swallow	*Hirundo cucullata*		82.40%	33.30%	66.70%	33.30%	50.00%	44.40%
Green Wood-Hoopoe	*Phoeniculus purpureus*						50.00%	11.10%
Green-backed Camaroptera	*Camaroptera brachyura*				16.70%		50.00%	
Grey Heron	*Ardea cinerea*		11.80%		16.70%		50.00%	38.90%
Grey Plover	*Pluvialis squatarola*		5.60%					
Grey Sunbird	*Cyanomitra veroxii*		5.90%					11.10%
Grey-backed Cisticola	*Cisticola subruficapilla*		47.10%	33.30%	50.00%	66.70%	50.00%	27.80%
Grey-headed Gull	*Larus cirrocephalus*		5.60%					
Hadeda Ibis	*Bostrychia hagedash*		70.60%	100.00%	100.00%	66.70%	75.00%	88.90%
Hamerkop	*Scopus umbretta*	**	11.80%	33.30%				5.60%
Helmeted Guineafowl	*Numida meleagris*		82.40%	66.70%	100.00%	44.40%	25.00%	61.10%
Horus Swift	*Apus horus*		11.80%			33.30%		
House Sparrow	*Passer domesticus*		41.20%					55.60%
Jackal Buzzard	*Buteo rufofuscus*		58.80%	100.00%	100.00%	33.30%	50.00%	61.10%
Jacobin Cuckoo	*Clamator jacobinus*		25.00%					
Karoo Prinia	*Prinia maculosa*		29.40%	66.70%	83.30%	66.70%	50.00%	38.90%
Karoo Scrub-Robin	*Cercotrichas coryphoeus*		11.80%					5.60%
Kelp Gull	*Larus dominicanus*		5.90%	66.70%			50.00%	72.20%
Kittlitz's Plover	*Charadrius pecuarius*		11.80%				25.00%	38.90%
Klaas's Cuckoo	*Chrysococcyx klaas*					11.10%		11.10%
Knysna Woodpecker	*Campethera notata*	NT			16.70%			5.60%

Common name	Scientific name	Conservation status	3400_2430	3355_2435	3400_2435	3355_2440	3400_2440	3400_2445
Lanner Falcon	*Falco biarmicus*	NT	11.80%					
Large-billed Lark	*Galerida magnirostris*		23.50%					
Lark-like Bunting	*Emberiza impetuani*		11.10%					
Laughing Dove	*Streptopelia senegalensis*		70.60%	66.70%		11.10%	25.00%	77.80%
Lazy Cisticola	*Cisticola aberrans*		5.90%					
Lesser Striped Swallow	*Hirundo abyssinica*		5.90%		50.00%	22.20%		16.70%
Lesser Swamp-Warbler	*Acrocephalus gracilirostris*		17.60%			11.10%		5.60%
Levaillant's Cisticola	*Cisticola tinniens*		29.40%		33.30%	22.20%		44.40%
Little Egret	*Egretta garzetta*		11.10%					
Little Grebe	*Tachybaptus ruficollis*		23.50%	100.00%		11.10%	50.00%	66.70%
Little Rush-Warbler	*Bradypterus baboecala*		17.60%		66.70%	11.10%	25.00%	22.20%
Little Sparrowhawk	*Accipiter minullus*						25.00%	
Little Stint	*Calidris minuta*		16.70%					
Little Swift	*Apus affinis*		11.80%	33.30%		11.10%	25.00%	27.80%
Long-tailed Widowbird	*Euplectes progne*		17.60%				50.00%	11.10%
Maccoa Duck	*Oxyura maccoa*		5.60%					
Malachite Kingfisher	*Alcedo cristata*		5.90%					
Malachite Sunbird	*Nectarinia famosa*		64.70%	66.70%	66.70%	44.40%	25.00%	5.60%
Mallard Duck	*Anas platyrhynchos*		11.10%					
Marsh Sandpiper	*Tringa stagnatilis*		5.60%					
Martial Eagle	*Polemaetus bellicosus*	V	11.80%		16.70%	11.10%		
Neddicky	*Cisticola fulvicapilla*		94.10%	100.00%	100.00%	77.80%	100.00%	77.80%
Olive Bush-Shrike	*Telophorus olivaceus*		11.80%			11.10%	50.00%	44.40%
Olive Thrush	*Turdus olivaceus*		29.40%		33.30%		50.00%	22.20%
Olive Woodpecker	*Dendropicos griseocephalus*		11.10%					
Orange-breasted Sunbird	*Anthobaphes violacea*		5.90%			11.10%		
Osprey	*Pandion haliaetus*		25.00%					
Pallid Harrier	*Circus macrourus*	NT	25.00%					5.60%
Pearl-breasted Swallow	*Hirundo dimidiata*		5.90%					
Pied Crow	*Corvus albus*		5.90%					22.20%
Pied Kingfisher	*Ceryle rudis*		11.80%					5.60%
Pied Starling	*Spreo bicolor*		5.90%		16.70%		25.00%	5.60%
Pin-tailed Whydah	*Vidua macroura*		47.10%			11.10%	25.00%	27.80%
Plain-backed Pipit	*Anthus leucophrys*		5.90%			11.10%	25.00%	11.10%
Purple Heron	*Ardea purpurea*		5.90%					5.60%
Red-billed Quelea	*Quelea quelea*		11.80%					22.20%
Red-billed Teal	*Anas erythrorhyncha*		47.10%	33.30%	16.70%	11.10%	25.00%	61.10%
Red-capped Lark	*Calandrella cinerea*		41.20%	66.70%	16.70%	11.10%	25.00%	66.70%
Red-chested Cuckoo	*Cuculus solitarius*		5.90%	33.30%		11.10%		5.60%
Red-eyed Dove	*Streptopelia semitorquata*		82.40%	66.70%	66.70%	33.30%	75.00%	72.20%
Red-faced Mousebird	*Urocolius indicus*		25.00%					5.60%
Red-knobbed Coot	*Fulica cristata*		66.70%			11.10%		50.00%
Red-necked Spurfowl	*Pternistis afer*		11.80%			11.10%	50.00%	38.90%

Common name	Scientific name	Conservation status	3400_2430	3355_2435	3400_2435	3355_2440	3400_2440	3400_2445
Red-winged Starling	*Onychognathus morio*		23.50%		33.30%	11.10%	25.00%	16.70%
Reed Cormorant	*Phalacrocorax africanus*		58.80%	33.30%	50.00%	11.10%	50.00%	77.80%
Rock Dove	*Columba livia*		5.90%					11.10%
Rock Martin	*Hirundo fuligula*		29.40%	100.00%	16.70%	22.20%	25.00%	22.20%
Ruff	*Philomachus pugnax*		25.00%					11.10%
Rufous-naped Lark	*Mirafra africana*		82.40%	33.30%	83.30%	33.30%	100.00%	66.70%
Secretarybird	*Sagittarius serpentarius*	NT						5.60%
Sombre Greenbul	*Andropadus importunus*		29.40%		66.70%	55.60%	75.00%	77.80%
South African Shelduck	*Tadorna cana*					11.10%	25.00%	33.30%
Southern Black Korhaan	*Afrotis afra*		5.90%					
Southern Boubou	*Laniarius ferrugineus*		47.10%		83.30%	55.60%	100.00%	72.20%
Southern Double-collared Sunbird	*Cinnyris chalybeus*		5.90%					
Southern Grey-headed Sparrow	*Passer diffusus*		41.20%	33.30%		11.10%	25.00%	5.60%
Southern Masked-Weaver	*Ploceus velatus*		17.60%		16.70%			33.30%
Southern Red Bishop	*Euplectes orix*							33.30%
Southern Tchagra	*Tchagra tchagra*							16.70%
Speckled Mousebird	*Colius striatus*		58.80%				50.00%	27.80%
Speckled Pigeon	*Columba guinea*		76.50%	33.30%	33.30%	22.20%	50.00%	61.10%
Spectacled Weaver	*Ploceus ocularis*		5.90%				25.00%	16.70%
Spotted Eagle-Owl	*Bubo africanus*		11.10%					
Spotted Thick-knee	*Burhinus capensis*		11.80%		16.70%			11.10%
Spur-winged Goose	*Plectropterus gambensis*		100.00%	66.70%	16.70%	44.40%	75.00%	77.80%
Steppe Buzzard	*Buteo vulpinus*		35.30%	33.30%		33.30%	75.00%	22.20%
Streaky-headed Seedeater	*Crithagra gularis*		5.90%	33.30%		11.10%		27.80%
Swee Waxbill	*Coccopygia melanotis*		17.60%					11.10%
Swift Tern	*Sterna bergii*							5.60%
Tambourine Dove	*Turtur tympanistria*						50.00%	11.10%
Terrestrial Brownbul	*Phyllastrephus terrestris*						75.00%	38.90%
Three-banded Plover	*Charadrius tricollaris*		41.20%	66.70%		11.10%	25.00%	44.40%
Village Weaver	*Ploceus cucullatus*		5.90%					
Wailing Cisticola	*Cisticola lais*				16.70%	11.10%		
Water Thick-knee	*Burhinus vermiculatus*							5.60%
Wattled Starling	*Creatophora cinerea*		5.90%					
Whiskered Tern	*Chlidonias hybrida*					11.10%	25.00%	16.70%
White Stork	*Ciconia ciconia*	Bonn	29.40%	33.30%		11.10%	25.00%	11.10%
White-backed Duck	*Thalassornis leuconotus*		66.70%					
White-bellied Korhaan	*Eupodotis senegalensis*	V	23.50%					33.30%
White-breasted Cormorant	*Phalacrocorax carbo*		33.30%					50.00%
White-browed Scrub-Robin	*Cercotrichas leucophrys*		5.60%					
White-faced Duck	*Dendrocygna viduata*		11.80%			11.10%	25.00%	44.40%
White-necked Raven	*Corvus albicollis*		29.40%		33.30%	44.40%	25.00%	27.80%
White-rumped Swift	*Apus caffer*		52.90%	33.30%	16.70%	44.40%	25.00%	27.80%

Common name	Scientific name	Conservation status	3400_ 2430	3355_ 2435	3400_ 2435	3355_ 2440	3400_ 2440	3400_ 2445
White-throated Swallow	*Hirundo albigularis*		35.30%	33.30%			25.00%	11.10%
White-winged Tern	*Chlidonias leucopterus*		11.10%					
Willow Warbler	*Phylloscopus trochilus*					11.10%	25.00%	
Wood Sandpiper	*Tringa glareola*		11.80%					16.70%
Yellow Bishop	*Euplectes capensis*		94.10%	33.30%	100.00%	22.20%	50.00%	16.70%
Yellow-billed Duck	*Anas undulata*		52.90%	100.00%	33.30%	22.20%	25.00%	100.00%
Yellow-billed Kite	*Milvus aegyptius*		17.60%	33.30%				5.60%
Zitting Cisticola	*Cisticola juncidis*		52.90%		16.70%	11.10%	50.00%	44.40%