TUBATSE STRENGTHENING PHASE 1 SENAKANGWEDI B SUBSTATION & ASSOCIATED POWER LINES

DRAFT EIA PHASE ASSESSMENT AVIFAUNAL SPECIALIST STUDY

October 2014

Prepared by:
WildSkies Ecological Services
Jon Smallie
jon@wildskies.co.za

Prepared for:
Nsovo Environmental Consulting
Masala Mahumela
masala.mahumela@nsovo.co.za

EXECUTIVE SUMMARY

Eskom Holdings SOC Limited (hereinafter referred to as Eskom) is proposing to construct the new Senkangwedi B substation, associated loop in and loop out overhead power lines as well as the construction of the Tubatse-Senkangwedi 400kV and the Senkangwedi-Senkangwedi 275kV overhead power lines located in the Greater Tubatse Local Municipality, Limpopo. This development has the potential to impact on avifauna, and so the environmental practitioner (Nsovo Environmental Consulting) appointed WildSkies Ecological Services to conduct an avifaunal impact assessment.

In bird terms, a fairly wide diversity of species (approximately 295 species) could be found in the broader area within which this site falls. However, most of the site is already relatively highly impacted upon by extensive mining and industrial activity, human settlement, pastoral activities and existing road and power line networks and the likelihood of these species utilizing the site is considered to be low in most cases. This is particularly true of the Red List species, only a handful of which have any chance of frequenting the site itself in our opinion.

The likely impacts of the proposed project on birds are:

- Destruction of habitat, and disturbance of birds (associated with the construction of the substation and power lines) are both likely to be of relatively low significance in this study area, against a background of relatively high existing levels of habitat degradation and disturbance.
- Collision of birds on certain sections of the overhead power lines, particularly in the open bushveld, grassland patches, wetland areas, and at stream crossings. These sections have been identified approximately by this report, but **it is essential that once the exact route is finalized and individual pole positions surveyed and pegged, an avifaunal walk-through be conducted.** This walk through will identify the exact spans of power line posing a collision risk. These spans will need to be fitted with the best available Eskom approved line marking device in order to make the line more visible to birds. These devices must be installed in accordance with Eskom Transmission guidelines on this aspect. The walk through will also enable the identification of any sensitive breeding species within the immediate surrounds that may require special attention during the construction phase of the project. This avifaunal walk through is even more important in light of the approach to this particular study, whereby the exact power line route alternatives have not been provided for assessment.

Taking the above information into account, it is this authors' opinion that given the presence of existing disturbance and habitat degradation, it is anticipated that the proposed substation and associated power line infrastructure can be constructed with acceptable levels of impact on the resident avifauna. **It should be noted that since the power line alignments have not yet been finalised, this report cannot be considered the final avifaunal input into this project. Once alignments are selected this report should be updated to include a more detailed assessment of the alignments and impacts associated with them.** Provided that the recommendations of this report are implemented, this project can proceed with acceptable levels of avifaunal impact.

SPECIALIST DETAILS

Professional registration

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 – University of Natal
	Msc Env Sc – University of Witwatersrand
Affiliation:	South African Council for Natural Scientific Professions
Registration number:	400020/06
Fields of Expertise:	Ecological Science
Registration:	Professional Member

Professional experience

Jon Smallie has been involved in bird interactions with energy infrastructure for 14 years. During this time he has completed impact assessments for at least 100 projects, many of which involved Eskom transmission and distribution power lines and substations. A full *Curriculum Vitae* is available on request.

Declaration of Independence

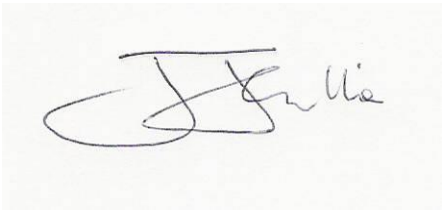
The specialist investigator declares that:

- 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.

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 in October 2014 by Jon Smallie in his capacity as specialist investigator.



1. INTRODUCTION

1.1 Background

In order to provide a high quality supply of electricity to meet the ever increasing needs of its end users and to support annual load growth, particularly the upsurge in demand from the mines in the Greater Tubatse Local Municipality, Eskom Holdings SOC Limited (hereinafter referred to as Eskom) plans to construct and establish an additional node, the new Senkangwedi B substation. The proposed substation with a footprint of approximately 600m x 600m, will be located to the south of the existing Senakangwedi substation. In addition to this, the necessary transmission power line infrastructure needed to integrate the new substation into the existing Transmission network will also be constructed.

In bird terms, a fairly wide diversity of species (approximately 295 species) have been recorded in the broader area within which this site falls. Most of the site is already relatively highly impacted upon by human activities, therefore the likelihood of these species utilizing the site is considered to be low. Typically, a development of this nature could be expected to impact on the birds of the area through: habitat destruction and disturbance as a result of the construction of the proposed Senkangwedi B substation, the associated Arnot – Merensky 400kV loop-in and loop-out power lines as well as the Tubatse – Senakangwedi B 400kV and Senakangwedi – Senakangwedi B 275kV overhead power lines; collision of birds with earth wires and conductors of the proposed transmission power line infrastructure; possible electrocutions of nesting birds within the Senkangwedi B substation and birds causing electrical faulting on the proposed transmission power line infrastructure.

In line with environmental legislation, Eskom has appointed Nsovo Environmental Consulting to conduct the necessary environmental investigations for the proposed development. WildSkies Ecological Services was appointed by Nsovo as avifaunal specialists to investigate the potential bird related impacts associated with the construction of the proposed Senkangwedi B substation and the associated transmission power line infrastructure. Field investigations for this study were conducted in March 2014.

1.2 Terms of Reference

The following terms of reference, typical of a study of this nature, were utilized for this study:

- Provide a description of the current state of avifauna in the study area, outlining important characteristics and components thereof, including species-specific habitats and roosting/nesting sites, which may be influenced by the proposed project or which may influence the proposed project during construction and operation.
- Identify Red List and vulnerable species potentially affected by the proposed project.
- Identify potential impacts (positive and negative, including cumulative impacts) of the proposed project on avifauna during construction and operation.
- Provide recommendations on route alternatives, and additional alternatives should they be identified, to avoid negative impacts.

- Identify mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks (to be implemented during design, construction and operation of the proposed project).
- Address any other sensitivities and important issues from a specialist perspective that are not identified in these terms of reference.

1.3 Description of Proposed Activities

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

- Establish the new Senakangwedi B substation (1 x 800MVA, 400/275kV and 2X500, 400/132kV)
- Loop in and out of Senakangwedi B to the existing Arnot – Merensky 400kV power line.
- Construction of Tubatse – Senakangwedi B 400kV power line.
- Construction of Senakangwedi – Senakangwedi B 275kV power line.

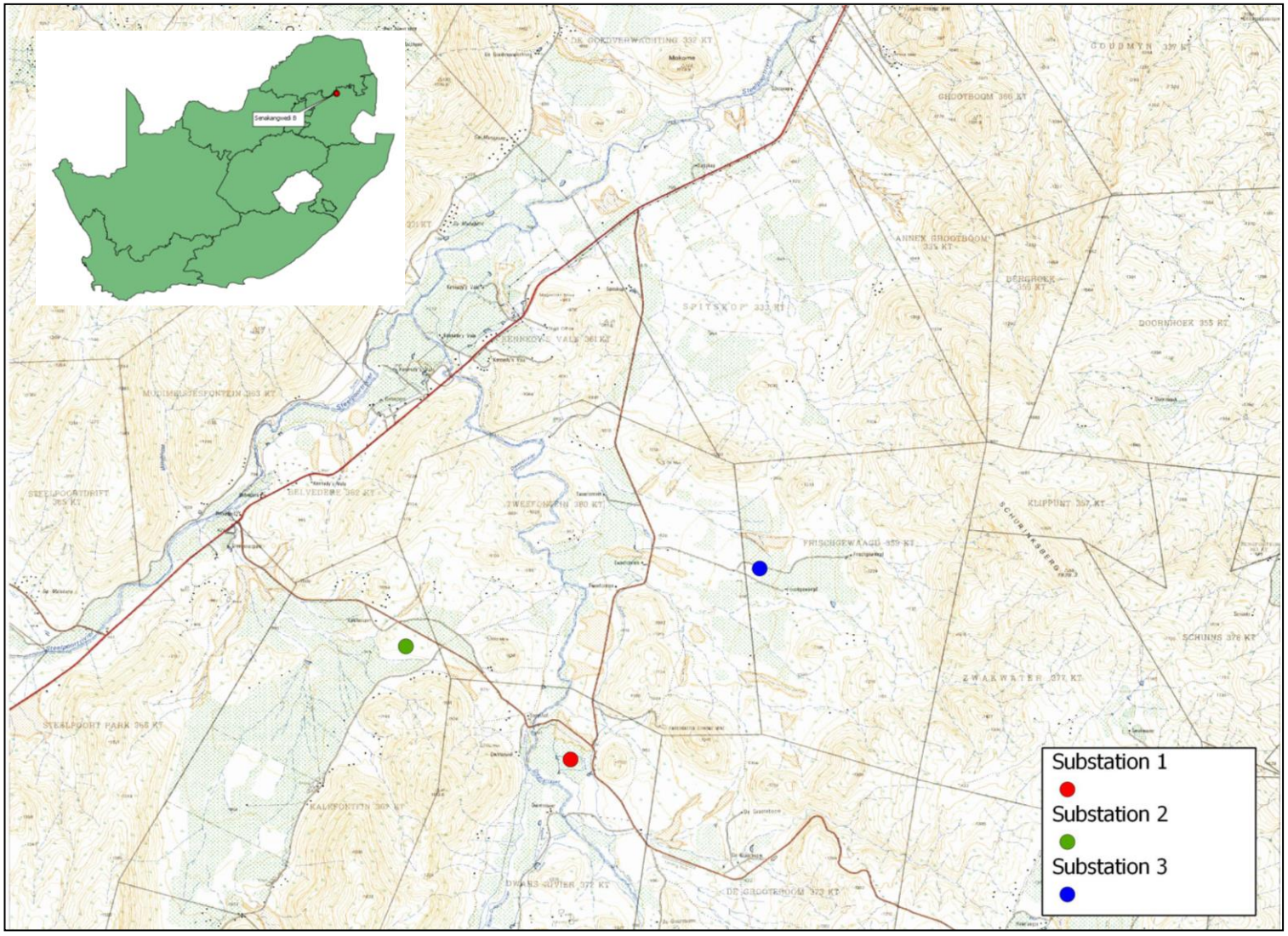


FIGURE 1: Locality map of the Senakangwedi project

2. METHODS

2.1 Methodology

In predicting the 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 avifaunal data sets listed below and the micro habitats within the study area were examined to determine the likelihood of these relevant species occurring on or near the site, and the importance of the study area for these species.
- The potential impacts of the proposed development on these species were described and evaluated.
- Sensitive areas within the proposed site, where the above impacts are likely to occur, were identified using field work, various GIS (Geographic Information System) layers and Google Earth.
- Ranking and identification of most and least suitable substation site alternatives.
- Recommendations were made for the management and mitigation of impacts.

2.2 Sources of Information

The study made use of the following data sources:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP1 – Harrison, Allan, Underhill, Herremans, Tree, Parker & Brown, 1997) obtained from the Avian Demography Unit of the University of Cape Town, in order to ascertain which species occur in the study area. The relevant quarter degree square for this project is 2430CC.
- The more recent SABAP2 data was consulted online (http://sabap2.adu.org.za/v1/gap_analysis.php). The relevant pentads for this project are 2450_3000, 2450_3005 and 2455_3005.
- The conservation status of all bird species occurring in the aforementioned degree square and pentads was then determined with the use of the most recent edition of The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Tylor, 2014), and the IUCN 2013 Red List.
- A classification of the vegetation types in the study area was obtained from Mucina and Rutherford (2006).
- The Important Bird Areas, Co-ordinated Avifaunal Roadcount and Co-ordinated Waterbird Count projects were consulted to determine whether any data is available for the site, but there was none.
- 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.
- Satellite Imagery of the area was studied using Google Earth ©2014.

2.3 Limitations & Assumptions

This study made the assumption that the above sources of information are reliable. The following factors may potentially detract from the accuracy of the predicted results:

- This report is the result of a short term study, no long term studies were conducted on site.
- Unfortunately the SABAP 2 data is not yet readily available with sufficient coverage for areas as remote as the current study area.
- The exact power line route alternatives are not yet available for assessment. The significance of the collision risk associated with each one of the proposed power lines will be assessed during the EIA Phase and avifaunal walk through.
- Due to the approach on this project, whereby a general site visit was conducted, and only then were alignments provided for assessment, field work may not have been as focused as it would have been if alignments were available prior to the site visit.
- Predictions in this study are based on experience of these and similar species in different parts of South Africa, through the authors' experience working in the field of wildlife – energy interaction since 1999. However bird behaviour can't be reduced to formulas that will hold true under all circumstances.

2.4 Relevant legislation and guidelines

The relevant legislation to this specialist field and development are as follows:

The Convention on Biological Diversity: dedicated to promoting sustainable development. The Convention recognizes that biological diversity is about more than plants, animals and micro-organisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. It is an international convention signed by 150 leaders at the Rio 1992 Earth Summit. South Africa is a signatory. An important principle encompassed by the CBD is the precautionary principle which essentially states that where serious threats to the environment exist, lack of full scientific certainty should not be used a reason for delaying management of these risks. The burden of proof that the impact will *not* occur lies with the proponent of the activity posing the threat.

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include 117 (as of 1 June 2012) Parties from Africa, Central and South America, Asia, Europe and Oceania. South Africa is a signatory to this convention.

The African-Eurasian Waterbird Agreement. The Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA) is the largest of its kind developed so far under the CMS. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle, including many species of divers, grebes, pelicans, cormorants, herons, storks, rails, ibises, spoonbills, flamingos,

ducks, swans, geese, cranes, waders, gulls, terns, tropic birds, auks, frigate birds and even the south African penguin. The agreement covers 119 countries and the European Union (EU) from Europe, parts of Asia and Canada, the Middle East and Africa.

National Environmental Management – Biodiversity Act - Threatened Or Protected Species list (TOPS). Several of the species that occur on this site are listed. Various sets of provincial conservation legislation are relevant to this study.

3. DESCRIPTION OF AFFECTED ENVIRONMENT

3.1 Study Area Vegetation Classification

The following description of the vegetation on the site focuses on the vegetation structure and not species composition. It is widely accepted within ornithological circles that vegetation structure and not species composition is most important in determining which bird species will occur there. The most prevalent vegetation type present on the site is "Sekhukhune Mountain Bushveld" (Mucina & Rutherford, 2006). The main relevance of this classification to this study is that bushveld is the dominant vegetation type on site. We can therefore expect the avifaunal community to be dominated by bushveld dependant species. This is described in more detail in Table 1.

The micro habitats identified on, or within close proximity to, the study site include: woodland, grassland patches, arable lands, wetland areas, and a river. Examples of these micro habitats are shown in FIGURE 2 below.

FIGURE 2: Photographs of the micro habitats available to avifauna in the study area

The most sensitive of these micro habitats, from a collision perspective, are the wetland (including the rivers and drainage lines) and open grassland patches. TABLE 1 shows the micro habitats that each Red List 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 of the relevant bird species.

3.2 Relevant Bird Populations

It is necessary to provide a broader perspective on the study area in order to gain some understanding of the importance of the potential bird impacts on a national scale. What needs to be established is the relative importance of the study area for power line sensitive species, especially Red List species, as this will have a bearing both on the expected frequency of the impacts and the significance of those impacts. Various data sources were used in determining the distribution and abundance of bird species in the study area:

Southern African Bird Atlas Project Data (SABAP 1 and 2)

The first atlas data was collected over an 11 year period between 1986 and 1997 (Harrison *et al,* 1997). Although it is now quite old, it remains the best long term data set on bird distribution and abundance available to us at present. This data was collected on the basis of quarter degree squares, which is a relatively large spatial scale. The more recent SABAP2 collected data on the basis of pentads which are roughly 8km x 8km squares, and are hence much smaller than the quarter degree squares used in the first bird atlas project 1. SABAP 2 is ongoing and as more counts are done in each pentad the data becomes available.

A full list of approximately 295 bird species recorded in the broader area within which this site falls, by the above two atlas projects, is shown in APPENDIX 2. TABLE 1 details the Red List bird species (11) amongst these. APPENDIX 2 and TABLE 1 should be viewed as the species that could potentially occur on the site,

provided that conditions and habitat are favourable. Using this information in combination with the above assessment of the habitat on site and various other factors, an assessment can be made of the likelihood of each species occurring on the site itself. This has been presented in TABLE 1.

Red List species face considerable conservation challenges and can ill afford additional mortality factors associated with the construction and operation of electrical infrastructure. In addition to the Red List species, the White Stork has also been included, as they are afforded international protection under the Bonn Convention on Migratory Species. Many species in TABLE 1 are large birds (i.e. the Secretarybird and storks) and could potentially be impacted on directly by the proposed power line, through collision. Those species that are physically smaller, could face disturbance effects and habitat destruction during the construction of the proposed project.

It is important to note that due to the already disturbed nature of most of the site, the likelihood of many of the Red List species in TABLE 1 frequenting the site has been judged to be low. As a result, the impacts of the proposed project could be more important for the common bird species, which are generally more tolerant of human disturbance and hence more likely to regularly make use of this site. These include waterfowl such as ibises, geese, ducks, herons and many others. Although this impact assessment focuses on Red List species, the impact on non-Red List species is also assessed, albeit in less detail. It could be (justifiably) argued that if insufficient attention is given to assessing the impacts of development on common bird species, these may with time make it onto the Red List as threatened species thereby adding to our already significant conservation challenges. However it is this author's opinion that attempting to focus on too many species (remembering that up to 295 could occur on this site) would dilute attention from those species already highly threatened. Furthermore, the mitigation recommended for Red List species is likely to also provide cover for more common species. The non-Red List species that have been considered for this assessment include large eagles, buzzards, kestrels, herons, geese, ibis and various water bird species. They are included as their behaviour and/or morphology makes them likely candidates for interaction with overhead power lines such as that proposed.

TABLE 1 – The Red List bird species for the proposed project, their preferred microhabitats, likely interactions with the proposed development and importance of the site.

Common name	*Species name*	SABAP 1	SABAP 2	BARNES 2000	IUCN 2013	TAYLOR 2014	TOPS	Likelihood of occurrence	Preferred habitat	Likely interactions
Eagle, Tawny	*Aquila rapax*	X	X	VU	LC	EN	-	Possible	Open woodland	D, HD
Eagle, Verreaux's	*Aquila verreauxii*	X		LC	LC	VU	-	Improbable - areas highly impacted, and no cliffs	Mountainous rocky areas, cliffs	
Falcon, Lanner	*Falco biarmicus*	X	X	NT	LC	VU	-	Possible	Grassland	C, D, HD
Kestrel, Lesser	*Falco naumanni*	X	X	VU	LC	-	VU	Probable	Grassland	C, D, HD
Kingfisher, Half-collared	*Alcedo semitorquata*	X		NT	LC	NT	-	Improbable – riverine areas highly impacted	Well vegetated rivers	
Roller, European	*Coracias garrulus*	X	X	LC	NT	NT	-	Probable	Open woodland	
Stork, Abdim's	*Ciconia abdimii*	X	X	LC	LC	NT	-	Possible	Grassland patches	C, D, HD
Stork, Black	*Ciconia nigra*	X	X	NT	LC	VU	VU	Improbable riverine areas highly impacted, and no cliffs	Rivers, mountainous areas	
Stork, White	*Ciconia ciconia*	X	X	BONN	-	-	-	Possible	Wetland, grassland patches	C, D, HD
Secretarybird	*Sagittarius serpentarius*	X	X	NT	VU	VU	-	Possible	Grassland	C, D, HD
Vulture, Cape	*Gyps coprotheres*	X	X	VU	VU	EN	EN	Possible	Large cliffs (breeding & roosting) woodland & grassland (foraging)	C
Vulture, White-backed	*Gyps africanus*	X		VU	EN	EN	EN	Possible	Woodland	C

EN = Endangered; VU = Vulnerable; NT = Near-Threatened, LC = Least Concern (Barnes, 2000; Taylor, 204 and IUCN, 2013); C = Collision with power lines; D = Disturbance; HD = Habitat Destruction; E = Electrocution within the substation yard.

4. ASSESSMENT OF IMPACTS

4.1 General Description of the impacts of Substations and 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). Due to the large size of the clearances on most overhead lines of above 132kV, electrocutions are generally ruled out as even the largest birds cannot physically bridge the gap between dangerous components. In fact, transmission lines have proven to be beneficial to many birds, including species such as Southern Bald Ibis, Martial Eagles, Tawny Eagles, African White-backed Vultures, and even occasionally Verreauxs' Eagles by providing safe nesting and roosting sites in areas where suitable natural alternatives are scarce (van Rooyen 2004). Cape Vultures have also taken to roosting on power lines in certain areas in large numbers, while Lappet-faced Vultures are known to use power lines as roosts, especially in areas where large trees are scarce.

Electrocutions are not envisaged as an impact on the proposed 275kV and 400kV transmission power line nfrastructure as the relevant clearances between live and earthed components exceed the wingspan of any bird.

Electrocutions of certain bird species within the proposed Senakangwedi B substation, during its operation, could potentially have a negative impact on a variety of bird species, particularly those species that regularly utilise the electrical infrastructure within the substation yard on which to breed and nest e.g. crows, herons, sparrows, owls and geese. However the hardware is too complex and the risk of Red List species being affected is too low, to warrant proactive mitigation. It is rather recommended that if ongoing impacts are recorded once operational, site specific mitigation be applied reactively. This is an acceptable approach because Red Listed bird species are unlikely to frequent the substation and be electrocuted.

Collisions

Collisions occur when birds in flight do not see the overhead cables or see them too late to take evasive action. 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 List 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. Collision of certain bird species particularly in the open grassland patches and wetland areas, are anticipated to be an impact of the proposed power lines and should be prevented as far as possible. Species believed to be susceptible to this impact are shown in TABLE 1.

Habitat destruction

During the construction phase and maintenance of substation yards and 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.

The effect of the vegetation clearing will be more marked in the more densely wooded areas within the study area, where the clearing of the servitudes would necessitate the removal of woody plants, and especially large trees. The new substation and transmission power line network will undoubtedly destroy and modify a certain amount of habitat. However at a landscape level, and considering the significant level of land degradation already present in the braoder study area, is it unlikely to have a major impact on the Red List species.

Disturbance

Similarly, the above mentioned construction activities impact on bird through disturbance, particularly during breeding activities. This could lead to breeding failure if the disturbance happens during a critical part of the breeding season. The breeding season for the large raptor species is from March to November. The most critical period within this time span is from April to May in the beginning when the eggs are incubated. Another sensitive period is from October to November at the end when the young birds are almost ready to fledge. Early in the breeding season the risk of desertion by the adults if disturbed are bigger than later, when the young bird is on the nest and being fed by the adults. At the end of the breeding season the young bird may be tempted to jump out of the nest and fly prematurely if disturbed, resulting in injury or even death. If nests are identified during an avifaunal walk down of the power line

prior to construction, every attempt will have to be made to restrict the disturbance of these birds to a minimum during construction. In general the disturbance that will be caused by the construction activities will be temporary and this, coupled with the fact that there is currently considerable disturbance in the area, the construction of the substation and power line should not lead to a species being permanently displaced from the area.

4.2 Description of the impacts of this proposed project

The impacts of the proposed power lines and substation were rated in the TABLES 2 to 5 below. The criteria used for this rating can be seen in APPENDIX 1.

TABLE 2: Assessment of electrocution of birds within the substation yard.

Nature: Electrocution – likely to affect large raptors, owls and crows		
	Without mitigation	**With mitigation**
Nature	Negative	Negative
Spatial extent	Medium, birds from surrounding area affected	Medium, birds from surrounding area affected
Duration	High – as long as the substation is operational	Low
Intensity	Low	Low
Irreplaceable loss of resources?	High – yes, birds are killed	Low
Reversibility	Low – birds are killed	Medium
Consequence	High	Low
Probability	Low	Low
Significance	**Low**	**Low**
Can impacts be mitigated?	Yes	
Mitigation: Within the substation yard, the hardware is too complex to warrant any mitigation for electrocution at this stage. It is rather recommended that if ongoing impacts are recorded once operational, site specific mitigation be applied reactively. This is an acceptable approach because Red List bird species are unlikely to frequent the substation and be electrocuted.		
Cumulative impacts: The cumulative impacts of substations and power lines on birds through electrocution are significant nationally. This particular area already has several existing distribution power lines. No effort should be spared to ensure that all new distribution power lines be built using bird friendly infrastructure resulting in no additional impact on birds in the area.		
Residual Impacts: None – if the substation is decommissioned the impact will cease.		

TABLE 3: Assessment of collision of birds with the proposed power lines.

Nature: *Collision of birds* – likely to affect water birds, storks and possibly Secretarybird.		
	Without mitigation	**With mitigation**
Nature	Negative	Negative
Spatial extent	Medium	Medium
Duration	High – as long as the lines are operational	Low
Intensity	Medium	Low
Irreplaceable loss of resources?	High – birds killed	Low
Reversibility	Low – birds killed	Medium
Consequence	Medium	Low
Probability	Medium	Low
Significance	**Medium**	**Low**
Can impacts be mitigated?	Yes	
Mitigation: The primary means of mitigating this impact is through the selection of the optimal route for the lines through this area, explained in Section 5. In addition to routing there will also be a need to install anti bird collision line marking devices on the power lines (earth wires) on certain sections of line identified as posing a high collision risk to birds as per Eskom Transmission guidelines for this aspect. These sections of line have been broadly identified in this report, but exact spans of line will need to be identified during the EIA phase of the project and by an avifaunal walk through as part of the site specific EMP. The above mitigation is extremely important as without it this impact will be of high significance.		
Cumulative impacts: The cumulative impacts of power lines on birds through collision are significant. This area already has several existing distribution power lines. No effort should be spared to ensure that the new power line is built bird friendly and results in no additional impact on birds in the area.		
Residual Impacts: None – if the substation and power lines are decommissioned the impact will cease.		

TABLE 4. Assessment of habitat destruction caused by the construction of the substation and power lines.

Nature: Destruction of bird habitat – likely to affect woodland Red List species		
	Without mitigation	**With mitigation**
Nature	Negative	Negative
Spatial extent	Medium	Medium
Duration	Medium	Low
Intensity	Medium	Low
Irreplaceable loss of resources?	High	Low
Reversibility	Medium	Low
Consequence	Medium	Low
Probability	High	Low
Significance	**Medium**	**Low**
Can impacts be mitigated?	Yes – partially, a certain amount of habitat alteration is unavoidable	
Mitigation: The primary means of mitigating this impact is through the selection of the optimal substation site and route for the power lines through this area (Section 5) to avoid sensitive habitats as far as possible. The avifaunal walk through will also identify any particularly sensitive areas requiring special attention. In addition to this, the normal suite of environmental good practices should be applied, such as ensuring strict control of staff, vehicles and machinery on site and limiting the creation of new roads as far as possible. This is particularly important in the woodland and wetland areas.		
Cumulative impacts: Although the substation and each power line probably affects a relatively small proportion of the landscape, there are already several existing impacts associated with mining and industrial activities and exisiting power line and road networks in this area - additional electrical infrastructure will add further cumulative impact. It is important therefore to try to limit the effects of the new substation and power lines as much as possible, by applying the mitigations described above.		
Residual Impacts: Yes – a certain amount of habitat will remain altered even after the substation and lines are decommissioned		

TABLE 5. Assessment of disturbance of birds by the construction of the proposed power line.

Nature: *Disturbance of birds* – likely to affect breeding birds in particular.		
	Without mitigation	**With mitigation**
Nature	Negative	Negative
Spatial extent	Medium	Medium
Duration	Low	Low
Intensity	Low	Low
Irreplaceable loss of resources?	Low	Low
Reversibility	Low	Low
Consequence	Low	Low
Probability	Medium	Low
Significance	**Low**	**Low**
Can impacts be mitigated?	Yes	
Mitigation: The walk through exercise is particularly important in order to find any sensitive species breeding on or near site. If this is the case, the specialist will make case specific management recommendations.		
Cumulative impacts: Probably relatively low from disturbance specifically.		
Residual Impacts: None – if the substation and power lines are decommissioned the impact will cease.		

5. COMPARISON OF ALTERNATIVES

In general the site has been determined to have **low** sensitivity in terms of avifauna, based on the occurrence of a number of Red List species in the study area, the various micro-habitats available to avifauna and the significant level of degradation and disturbance currently encountered in the study area .

One of the main objectives of this study is to determine a preferred substation site and route alignments for the proposed Senkalngwedi B substation and its associated 275kV and 400kV power line infrastructure. Normally, in order to arrive at a preferred substation site and route alignment, the following factors are taken into account:

- Red Data diversity in the study area.
- Red Data density in the study area.
- The distance of each route alignment in each quarter degree square/pentad that comprises the study area.

In this instance, this method could not be used because although the three proposed substation sites and route alternatives occur within differing pentads, they are located within close proximity to one another, comprised of similar vegetation and micro habitat and are subjected to similar land use practices. With this in mind, a comparison of each substation site has been drawn up using observations (of available micro habitat, land use types and the location of the proposed substation site in relation to existing infrastructure) made during the field visit to the study area as a means of determining the substation site and route alternatives that would have the least impact on the avifauna occurring there. The preference rating that has been assigned to each route alternative is based on a subjective rating of 1 to 5 (1 being the least preferred and 5 being the most highly preferred option), based on the specialists experience with regards to bird and power line interactions (TABLE 6).

5.1 Comparison of substation sites

Through the establishment of the Senakangwedi B substation, future electrical infrastructure in the form of transmission and distribution power lines will undoubtedly be added to the network in and around the substation site. It is therefore essential that the an appropriate substation site location be chosen that not only reduces the anticipated habitat destruction impact, but also avoids avifaunal sensitive areas thereby reducing the likelihood of future power line collisions.

Although proposed substation site 1 (FIGURE 3 and 4) is located within close proximity to a wetland system, it is also located in an area that is heavily impacted upon by the surrounding mines and the existing Uchoba substation. In addition, this site is also surrounded by a well established road network enabling ease of access during construction and operational activities.

Similarly, substation sites 2 and 3 have also undergone some form of transformation and subject to existing disturbance from the surrounding homesteads and pastoral activities respectively. Site 2 is also located adjacent to a heavily utilised district road (FIGURES 5 and 6).

FIGURE 3: Proposed substation site 1

FIGURE 4: Existing Uchoba substation

FIGURE 5: Proposed substation site 2

FIGURE 6: Proposed substation site 3

Based on the abovementioned factors the following preference ratings (TABLE 6) have been assigned to each of the proposed substation sites.

TABLE 6: Preference rating for the three Senakangwedi B substation alternatives.

SUBSTATION ALTERNATIVE	PREFERENCE RATING
Substation 1	4
Substation 2	3
Substation 3	2

From the information provided above, coupled with the knowledge and experience of bird interactions with electrical infrastructure it can be concluded that **Substation Site 1** presents itself as the **preferred substation site.**

5.2 Comparison of power line alignments

Figure 7 below shows the various power line alignments that are under consideration. Due to the substation site not yet being final there are numerous power line alignments, all of which do not display where they overlap each other. Figure 8 does however display generally where power lines would be considered. At this stage it is too complex to compare all of these line alternatives, and they also differ very little.

Sensitive areas along these alignments are likely to be the open bushveld, grassland patches, wetland areas, and at stream crossings.

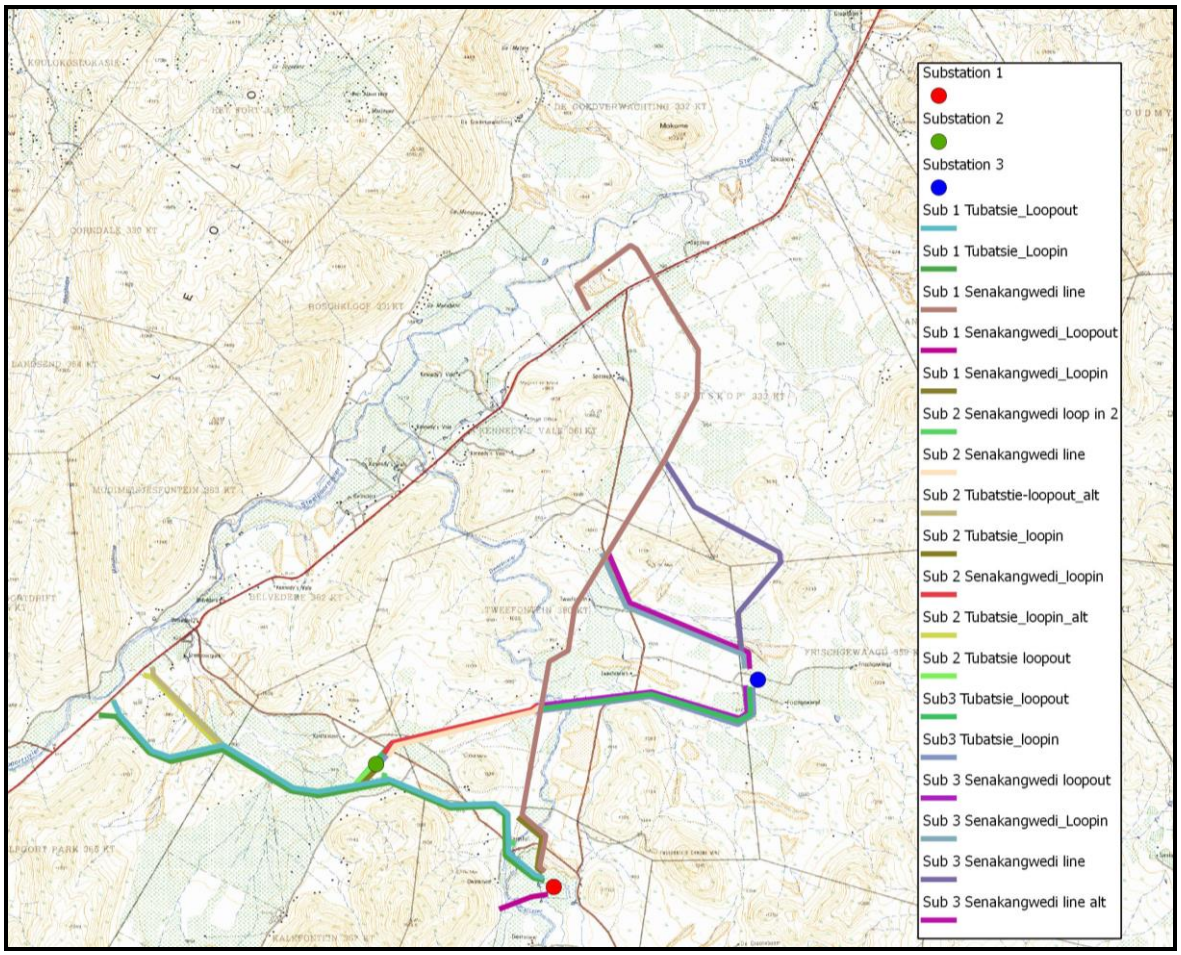


Figure 7. Power line alignments under consideration.

It should be noted that since the power line alignments have not yet been finalised, this report cannot be considered the final avifaunal input into this project. Once alignments are selected this report should be updated to include a more detailed assessment of the alignments and impacts associated with them.

6. MITIGATION FOR THE IMPACT OF BIRD COLLISION

As described in TABLE 3, there is a need for certain sections of the proposed power lines to be fitted with line marking devices in order to mitigate for bird collision. This report has identified those areas generically at this preliminary stage. It is however essential that once the final corridors are identified this report be updated, and that an avifaunal walk through be conducted once the exact pole positions are finalised and pegged, in order to identify the exact spans of line requiring this mitigation.

7. IMPACT STATEMENT

The proposed Senakangwedi B substation and associated 275kV and 400kV power lines can be built with acceptable levels of impact on avifauna should the recommendations in this report be followed. Of particular importance are: **a detailed assessment of the power line route alternatives during the EIA phase of this project,** the installation of the collision mitigation recommended in this report, and the implementation of the avifaunal walk through study to identify the exact sections of line requiring this mitigation.

8. REFERENCES

Avian Power Line Interaction Committee (APLIC). 1994. *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994*. Edison Electric Institute. Washington D.C.

Anderson, M.D. 2001. The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Draft report to Eskom Resources and Strategy Division. Johannesburg. South Africa.

Barnes, K.N. (ed.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa: Johannesburg.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1&2. BirdLife South Africa: Johannesburg.

Hobbs, J.C.A. & Ledger J.A. 1986a. The Environmental Impact of Linear Developments; Power lines and Avifauna. (Third International Conference on Environmental Quality and Ecosystem Stability. Israel, June 1986).

Hobbs, J.C.A. & Ledger J.A. 1986b. "Power lines, Birdlife and the Golden Mean." Fauna and Flora, 44, pp 23-27.

Kruger, R. & Van Rooyen, C.S. 1998. Evaluating the risk that existing power lines pose to large raptors by using risk assessment methodology: the Molopo Case Study. (5th World Conference on Birds of Prey and Owls: 4 - 8 August 1998. Midrand, South Africa.)

Kruger, R. 1999. Towards solving raptor electrocutions on Eskom Distribution Structures in South Africa. M. Phil. Mini-thesis. University of the Orange Free State. Bloemfontein. South Africa.

Ledger, J. 1983. Guidelines for Dealing with Bird Problems of Transmission Lines and Towers. Escom Test and Research Division Technical Note TRR/N83/005.

Ledger, J.A. & Annegarn H.J. 1981. "Electrocution Hazards to the Cape Vulture (Gyps coprotheres) in South Africa". Biological Conservation, 20, pp15-24.

Ledger, J.A. 1984. "Engineering Solutions to the problem of Vulture Electrocutions on Electricity Towers." The Certificated Engineer, 57, pp 92-95.

Ledger, J.A., J.C.A. Hobbs & Smith T.V. 1992. Avian Interactions with Utility Structures: Southern African Experiences. (Proceedings of the International Workshop on Avian Interactions with Utility Structures, Miami, Florida, 13-15 September 1992. Electric Power Research Institute.)

Mucina & Rutherford. 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Taylor, M.R. (ed.) 2014. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg. In press.

Van Rooyen, C.S. & Ledger, J.A. 1999. "Birds and utility structures: Developments in southern Africa" in Ferrer, M. & G..F.M. Janns. (eds.) Birds and Power lines. Quercus: Madrid, Spain, pp 205-230

Van Rooyen, C.S. 1998. Raptor mortality on power lines in South Africa. (5th World Conference on Birds of Prey and Owls: 4 - 8 August 1998. Midrand, South Africa.)

Van Rooyen, C.S. 1999. An overview of the Eskom - EWT Strategic Partnership in South Africa. (EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999, Charleston, South Carolina.)

Van Rooyen, C.S. 2000. "An overview of Vulture Electrocutions in South Africa." Vulture News, 43, pp 5-22. Vulture Study Group: Johannesburg, South Africa.

Van Rooyen, C.S. 2003. Mitigation programme for Avian Collisions with Eskom Transmission Lines. Unpublished Progress Report, September 2003. Endangered Wildlife Trust, Johannesburg, South Africa.

Van Rooyen, C.S. 2004a. The Management of Wildlife Interactions with overhead lines. In The fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.

Van Rooyen, C.S. 2004b. Investigations into vulture electrocutions on the Edwardsdam-Mareetsane 88kV feeder, Unpublished report, Endangered Wildlife Trust, Johannesburg.

Van Rooyen, C.S. & Taylor, P.V. 1999. Bird Streamers as probable cause of electrocutions in South Africa. (EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999. Charleston, South Carolina)

Van Rooyen, C.S. & Smallie, J. 2006. The Eskom-Endangered Willdife Trust Strategic Partnership: a brief summary. Nature & Faune, Volume 21, p25

Verdoorn, G.H. 1996. Mortality of Cape Griffons Gyps coprotheres and African Whitebacked Vultures Pseudogyps africanus on 88kV and 132kV power lines in Western Transvaal, South Africa, and mitigation measures to prevent future problems. (2nd International Conference on Raptors: 2-5 October 1996. Urbino, Italy.)

APPENDIX 1. CRITERIA USED FOR FORMAL IMPACT ASSESSMENT

CRITERIA	RATING SCALES	NOTES
Nature	Positive	This is an evaluation of the overall impact of the construction, operation and management that the proposed power line would have on the affected environment (social, biophysical and economic)
	Negative	
	Neutral	
Spatial Extent	Low	Site-specific, affects only the development footprint
	Medium	Local (<2 km from site)
	High	Regional (within 30 km of site) to national
Duration	Very Low	Temporary (less than 1 year)
	Low	Short term (1-4 years, i.e. duration of construction phase)
	Medium	Medium term (5-10 years)
	High	Long term (impact will only cease after the operational life of the activity) to permanent
Intensity	Low	Negligible alteration of natural systems, patterns or processes
	Medium	Noticeable alteration of natural systems, patterns or processes
	High	Severe alteration of natural systems, patterns or processes
Irreplaceability of resource caused by impact	Low	No irreplaceable resources will be impacted (the affected resource is easy to replace/rehabilitate)
	Medium	Resources that will be impacted can be replaced, with effort
	High	Project will destroy unique resources that cannot be replaced
Reversibility of impacts	Low	Low reversibility to non-reversible
	Medium	Moderate reversibility of impacts
	High	High reversibility of impacts
Consequence (a combination of spatial extent, duration, intensity and irreplaceability of impact on resources)	Low	A combination of any of the following: Intensity, duration, extent and impact on irreplaceable resources are all rated low; Intensity is low and up to two of the other criteria are rated medium; or Intensity is medium and all three other criteria are rated low
	Medium	Intensity is medium and at least two of the other criteria are rated medium

	High	Intensity and impact on irreplaceable resources are rated high, with any combination of extent and duration; or Intensity is rated high, with all of the other criteria being rated medium or high
Probability (the likelihood of the impact occurring)	Low	It is highly unlikely or there is a less than 50%chance that the impact will occur
	Medium	It is between 50 and 70%cetain that the impact will occur
	High	It is more than 75% certain that the impact will occur or it is definite that the impact will occur.
Significance (all impacts including potential cumulative impacts)	Low	Low consequence and low probability Low consequence and medium probability Low consequence and high probability
	Medium	Medium consequence and low probability Medium consequence and medium probability Medium consequence and high probability High consequence and low probability
	High	High consequence and medium probability High consequence and high probability

APPENDIX 2. BIRD SPECIES RECORDED IN THE BROADER AREA WITHIN WHICH THE SITE FALLS (SABAP 1 AND 2).

Red List species are shown in red and non-Red List species vulnerable to collision with the power lines and electrocution (within the substation) are shown in blue.

COMMON NAME	*SPECIES NAME*	SABAP 1	SABAP 2	Regional Red List Status_2000	Global Red List Status_2013	Regional Red List Status_2014	TOPS
Apalis, Bar-throated	*Apalis thoracica*	X	X				
Apalis, Yellow-breasted	*Apalis flavida*	X	X				
Babbler, Arrow-marked	*Turdoides jardineii*	X	X				
Barbet, Acacia Pied	*Tricholaema leucomelas*	X	X				
Barbet, Black-collared	*Lybius torquatus*	X	X				
Barbet, Crested	*Trachyphonus vaillantii*	X	X				
Batis, Cape	*Batis capensis*	X					
Batis, Chinspot	*Batis molitor*	X	X				
Bee-eater, European	*Merops apiaster*	X	X				
Bee-eater, Little	*Merops pusillus*	X	X				
Bee-eater, White-fronted	*Merops bullockoides*	X	X				
Bishop, Southern Red	*Euplectes orix*	X	X				
Bishop, Yellow-crowned	*Euplectes afer*	X					
Bokmakierie	*Telophorus zeylonus*	X					
Boubou, Southern	*Laniarius ferrugineus*	X	X				
Brubru	*Nilaus afer*	X	X				
Buffalo-Weaver, Red-billed	*Bubalornis niger*		X				
Bulbul, Dark-capped	*Pycnonotus tricolor*	X	X				
Bunting, Cape	*Emberiza capensis*	X					
Bunting, Cinnamon-breasted	*Emberiza tahapisi*	X	X				
Bunting, Golden-breasted	*Emberiza flaviventris*	X	X				
Bush-Shrike, Grey-headed	*Malaconotus blanchoti*	X	X				
Bush-Shrike, Olive	*Telophorus olivaceus*	X					
Bush-Shrike, Orange-breasted	*Telophorus sulfureopectus*	X	X				
Buttonquail, Kurrichane	*Turnix sylvaticus*		X				
Buzzard, Jackal	*Buteo rufofuscus*	X	X				
Buzzard, Lizard	*Kaupifalco monogrammicus*	X	X				
Buzzard, Steppe	*Buteo vulpinus*	X	X				
Camaroptera, Green-backed	*Camaroptera brachyura*	X	X				
Canary, Black-throated	*Crithagra atrogularis*	X					

Canary, Brimstone	*Crithagra sulphuratus*	X	X				
Canary, Cape	*Serinus canicollis*	X	X				
Canary, Yellow-fronted	*Crithagra mozambicus*	X	X				
Chat, Buff-streaked	*Oenanthe bifasciata*	X					
Chat, Familiar	*Cercomela familiaris*	X	X				
Cisticola, Lazy	*Cisticola aberrans*	X	X				
Cisticola, Le Vaillant's	*Cisticola tinniens*	X	X				
Cisticola, Rattling	*Cisticola chiniana*	X	X				
Cisticola, Red-faced	*Cisticola erythrops*	X	X				
Cisticola, Wailing	*Cisticola lais*	X					
Cisticola, Zitting	*Cisticola juncidis*	X	X				
Cliff-Chat, Mocking	*Thamnolaea cinnamomeiventris*	X	X				
Cliff-Swallow, South African	*Hirundo spilodera*	X					
Coot, Red-knobbed	*Fulica cristata*	X	X				
Cormorant, Reed	*Phalacrocorax africanus*	X	X				
Cormorant, White-breasted	*Phalacrocorax carbo*	X					
Coucal, Burchell's	*Centropus burchelli*	X	X				
Crake, Black	*Amaurornis flavirostris*		X				
Crombec, Long-billed	*Sylvietta rufescens*	X	X				
Crow, Cape	*Corvus capensis*	X					
Crow, Pied	*Corvus albus*	X	X				
Cuckoo, African	*Cuculus gularis*	X	X				
Cuckoo, Black	*Cuculus clamosus*	X	X				
Cuckoo, Diderick	*Chrysococcyx caprius*	X	X				
Cuckoo, Jacobin	*Clamator jacobinus*	X	X				
Cuckoo, Klaas's	*Chrysococcyx klaas*	X	X				
Cuckoo, Levaillant's	*Clamator levaillantii*		X				
Cuckoo, Red-chested	*Cuculus solitarius*	X	X				
Cuckooshrike, Black	*Campephaga flava*	X	X				
Darter, African	*Anhinga rufa*	X	X				
Dove, Laughing	*Streptopelia senegalensis*	X	X				
Dove, Namaqua	*Oena capensis*	X					
Dove, Red-eyed	*Streptopelia semitorquata*	X	X				
Dove, Rock	*Columba livia*	X					
Dove, Tambourine	*Turtur tympanistria*	X					
Drongo, Fork-tailed	*Dicrurus adsimilis*	X	X				
Duck, African Black	*Anas sparsa*	X	X				

Duck, White-faced	*Dendrocygna viduata*	X	X				
Eagle, Booted	*Aquila pennatus*		X				
Eagle, Tawny	*Aquila rapax*	X		VU	LC	EN	
Eagle, Verreaux's	*Aquila verreauxii*	X		LC	LC	VU	
Eagle, Wahlberg's	*Aquila wahlbergi*	X	X				
Eagle-Owl, Spotted	*Bubo africanus*	X					
Egret, Cattle	*Bubulcus ibis*	X	X				
Egret, Little	*Egretta garzetta*		X				
Eremomela, Burnt-necked	*Eremomela usticollis*		X				
Falcon, Amur	*Falco amurensis*	X	X				
Falcon, Lanner	*Falco biarmicus*	X	X	NT	LC	VU	
Finch, Cut-throat	*Amadina fasciata*	X	X				
Finch, Red-headed	*Amadina erythrocephala*	X					
Finch, Scaly-feathered	*Sporopipes squamifrons*	X	X				
Firefinch, African	*Lagonosticta rubricata*	X	X				
Firefinch, Jameson's	*Lagonosticta rhodopareia*	X	X				
Firefinch, Red-billed	*Lagonosticta senegala*	X	X				
Fiscal, Common	*Lanius collaris*	X	X				
Fish-Eagle, African	*Haliaeetus vocifer*	X	X				
Flycatcher, Ashy	*Muscicapa caerulescens*	X	X				
Flycatcher, Fairy	*Stenostira scita*	X					
Flycatcher, Fiscal	*Sigelus silens*	X					
Flycatcher, Marico	*Bradornis mariquensis*	X	X				
Flycatcher, Southern Black	*Melaenornis pammelaina*	X	X				
Flycatcher, Spotted	*Muscicapa striata*	X	X				
Flycatcher,Pale	*Bradornis pallidus*	X	X				
Francolin, Coqui	*Peliperdix coqui*	X					
Francolin, Crested	*Dendroperdix sephaena*	X	X				
Francolin, Red-winged	*Scleroptila levaillantii*	X					
Francolin, Shelley's	*Scleroptila shelleyi*	X					
Go-away-bird, Grey	*Corythaixoides concolor*	X	X				
Goose, Egyptian	*Alopochen aegyptiacus*	X	X				
Goose, Spur-winged	*Plectropterus gambensis*	X					
Goshawk, African	*Accipiter tachiro*	X					
Goshawk, Gabar	*Melierax gabar*	X	X				
Grassbird, Cape	*Sphenoeacus afer*	X	X				
Grebe, Little	*Tachybaptus ruficollis*	X					

Greenbul, Sombre	*Andropadus importunus*	X					
Green-Pigeon, African	*Treron calvus*	X					
Guineafowl, Helmeted	*Numida meleagris*	X	X				
Hamerkop	*Scopus umbretta*	X	X				
Harrier-Hawk, African	*Polyboroides typus*	X	X				
Hawk, African Cuckoo	*Aviceda cucloides*	X					
Helmet-Shrike, Retz's	*Prionops retzii*	X					
Helmet-Shrike, White-crested	*Prionops plumatus*	X	X				
Heron, Black-headed	*Ardea melanocephala*	X	X				
Heron, Goliath	*Ardea goliath*	X					
Heron, Green-backed	*Butorides striata*	X	X				
Heron, Grey	*Ardea cinerea*	X					
Heron, Purple	*Ardea purpurea*	X	X				
Heron, Squacco	*Ardeola ralloides*	X	X				
Honeybird, Brown-backed	*Prodotiscus regulus*		X				
Honeyguide, Greater	*Indicator indicator*	X					
Honeyguide, Lesser	*Indicator minor*	X	X				
Hoopoe, African	*Upupa africana*	X	X				
Hornbill, African Grey	*Tockus nasutus*	X	X				
Hornbill, Southern Yellow-billed	*Tockus leucomelas*	X	X				
House-Martin, Common	*Delichon urbicum*	X					
Ibis, African Sacred	*Threskiornis aethiopicus*	X					
Ibis, Hadeda	*Bostrychia hagedash*	X	X				
Indigobird, Dusky	*Vidua funerea*	X					
Indigobird, Village	*Vidua chalybeata*	X	X				
Jacana, African	*Actophilornis africanus*		X				
Kestrel, Greater	*Falco rupicoloides*	X					
Kestrel, Lesser	*Falco naumanni*	X	X	VU	LC	-	VU
Kestrel, Rock	*Falco rupicolus*	X	X				
Kingfisher, Brown-hooded	*Halcyon albiventris*	X	X				
Kingfisher, Giant	*Megaceryle maximus*	X	X				
Kingfisher, Half-collared	*Alcedo semitorquata*	X	X	NT	LC	NT	
Kingfisher, Malachite	*Alcedo cristata*	X	X				
Kingfisher, Pied	*Ceryle rudis*	X	X				
Kingfisher, Striped	*Halcyon chlicuti*	X					
Kingfisher, Woodland	*Halcyon senegalensis*	X	X				
Kite, Black	*Milvus migrans*	X	X				

Kite, Black-shouldered	*Elanus caeruleus*	X	X				
Kite, Yellow-billed	*Milvus migrans*	X	X				
Lapwing, African Wattled	*Vanellus senegallus*		X				
Lapwing, Blacksmith	*Vanellus armatus*	X	X				
Lapwing, Crowned	*Vanellus coronatus*	X					
Lark, Flappet	*Mirafra rufocinnamomea*		X				
Lark, Rufous-naped	*Mirafra africana*	X	X				
Lark, Sabota	*Calendulauda sabota*	X					
Mannikin, Bronze	*Spermestes cucullatus*	X	X				
Martin, Brown-throated	*Riparia paludicola*	X					
Martin, Rock	*Hirundo fuligula*	X	X				
Masked-Weaver, Lesser	*Ploceus intermedius*	X	X				
Masked-Weaver, Southern	*Ploceus velatus*	X	X				
Moorhen, Common	*Gallinula chloropus*		X				
Mousebird, Red-faced	*Urocolius indicus*	X	X				
Mousebird, Speckled	*Colius striatus*	X	X				
Myna, Common	*Acridotheres tristis*		X				
Neddicky	*Cisticola fulvicapilla*	X	X				
Nightjar, Fiery-necked	*Caprimulgus pectoralis*	X	X				
Nightjar, Freckled	*Caprimulgus tristigma*	X					
Olive-Pigeon, African	*Columba arquatrix*	X					
Oriole, Black-headed	*Oriolus larvatus*	X	X				
Ostrich, Common	*Struthio camelus*	X	X				
Owl, Barn	*Tyto alba*	X	X				
Owlet, Pearl-spotted	*Glaucidium perlatum*	X	X				
Oxpecker, Red-billed	*Buphagus erythrorhynchus*		X				
Palm-Swift, African	*Cypsiurus parvus*	X	X				
Paradise-Flycatcher, African	*Terpsiphone viridis*	X	X				
Paradise-Whydah, Long-tailed	*Vidua paradisaea*	X	X				
Penduline-Tit, Grey	*Anthoscopus minutus*	X	X				
Petronia, Yellow-throated	*Petronia superciliaris*	X	X				
Pigeon, Speckled	*Columba guinea*	X	X				
Pipit, African	*Anthus cinnamomeus*	X	X				
Pipit, Bushveld	*Anthus caffer*		X				
Pipit, Long-billed	*Anthus similis*		X				
Pipit, Striped	*Anthus lineiventris*	X	X				
Plover, Three-banded	*Charadrius tricollaris*	X	X				

Prinia, Black-chested	*Prinia flavicans*	X	X				
Prinia, Tawny-flanked	*Prinia subflava*	X	X				
Puffback, Black-backed	*Dryoscopus cubla*	X	X				
Pygmy-Kingfisher, African	*Ispidina picta*	X					
Pytilia, Green-winged	*Pytilia melba*	X	X				
Quailfinch, African	*Ortygospiza atricollis*		X				
Quelea, Red-billed	*Quelea quelea*	X	X				
Raven, White-necked	*Corvus albicollis*	X	X				
Reed-Warbler, African	*Acrocephalus baeticatus*	X	X				
Robin-Chat, Cape	*Cossypha caffra*	X	X				
Robin-Chat, Red-capped	*Cossypha natalensis*		X				
Robin-Chat, White-browed	*Cossypha heuglini*	X					
Robin-Chat, White-throated	*Cossypha humeralis*	X	X				
Rock-Thrush, Cape	*Monticola rupestris*	X	X				
Rock-Thrush, Sentinel	*Monticola explorator*	X					
Rock-Thrush, Short-toed	*Monticola brevipes*	X					
Roller, European	*Coracias garrulus*	X	X	LC	NT	NT	
Roller, Lilac-breasted	*Coracias caudatus*	X					
Roller, Purple	*Coracias naevius*	X					
Rush-Warbler, Little	*Bradypterus baboecala*	X	X				
Sandpiper, Common	*Actitis hypoleucos*	X	X				
Saw-wing, Black	*Psalidoprocne holomelaena*		X				
Scimitarbill, Common	*Rhinopomastus cyanomelas*	X	X				
Scops-Owl, African	*Otus senegalensis*	X					
Scrub-Robin, Kalahari	*Cercotrichas paena*	X					
Scrub-Robin, White-browed	*Cercotrichas leucophrys*	X	X				
Secretarybird	*Sagittarius serpentarius*	X		NT	VU	VU	
Seedeater, Streaky-headed	*Crithagra gularis*	X	X				
Shrike, Crimson-breasted	*Laniarius atrococcineus*	X	X				
Shrike, Lesser Grey	*Lanius minor*	X					
Shrike, Magpie	*Corvinella melanoleuca*	X					
Shrike, Red-backed	*Lanius collurio*	X	X				
Shrike, Southern White-crowned	*Eurocephalus anguitimens*	X					
Snake-Eagle, Brown	*Circaetus cinereus*	X					
Sparrow, Cape	*Passer melanurus*	X					
Sparrow, Great	*Passer motitensis*		X				
Sparrow, House	*Passer domesticus*	X	X				

Sparrow, Southern Greyheaded	*Passer diffusus*	X	X				
Sparrow-Weaver, White-browed	*Plocepasser mahali*	X	X				
Sparrowhawk, Little	*Accipiter minullus*		X				
Spoonbill, African	*Platalea alba*	X					
Spurfowl, Natal	*Pternistis natalensis*	X	X				
Spurfowl, Swainson's	*Pternistis swainsonii*	X	X				
Starling, Cape Glossy	*Lamprotornis nitens*	X	X				
Starling, Pied	*Spreo bicolor*		X				
Starling, Red-winged	*Onychognathus morio*	X	X				
Starling, Violet-backed	*Cinnyricinclus leucogaster*	X	X				
Stint, Little	*Calidris minuta*	X					
Stonechat, African	*Saxicola torquatus*	X					
Stork, Abdim's	*Ciconia abdimii*	X	X	LC	LC	NT	
Stork, Black	*Ciconia nigra*	X		NT	LC	VU	VU
Stork, White	*Ciconia ciconia*	X		BONN			
Sunbird, Amethyst	*Chalcomitra amethystina*	X	X				
Sunbird, Greater Double-collared	*Cinnyris afer*	X	X				
Sunbird, Southern Double-collared	*Cinnyris chalybeus*	X					
Sunbird, Malachite	*Nectarinia famosa*		X				
Sunbird, White-bellied	*Cinnyris talatala*	X	X				
Swallow, Barn	*Hirundo rustica*	X	X				
Swallow, Greater Striped	*Hirundo cucullata*	X	X				
Swallow, Lesser Striped	*Hirundo abyssinica*	X	X				
Swallow, Pearl-breasted	*Hirundo dimidiata*	X	X				
Swallow, Red-breasted	*Hirundo semirufa*	X	X				
Swallow, White-throated	*Hirundo albigularis*	X	X				
Swallow, Wiretailed	*Hirundo smithii*		X				
Swamp-Warbler, Lesser	*Acrocephalus gracilirostris*	X	X				
Swift, African Black	*Apus barbatus*	X	X				
Swift, Alpine	*Tachymarptis melba*	X	X				
Swift, Common	*Apus apus*	X					
Swift, Horus	*Apus horus*	X					
Swift, Little	*Apus affinis*	X	X				
Swift, White-rumped	*Apus caffer*	X	X				
Tchagra, Black-crowned	*Tchagra senegalus*	X	X				
Tchagra, Brown-crowned	*Tchagra australis*	X	X				
Teal, Red-billed	*Anas erythrorhyncha*	X	X				

Thick-knee, Spotted	*Burhinus capensis*	X					
Thick-knee, Water	*Burhinus vermiculatus*		X				
Thrush, Groundscraper	*Psophocichla litsipsirupa*	X					
Thrush, Kurrichane	*Turdus libonyanus*	X	X				
Thrush, Olive	*Turdus olivaceus*	X					
Tinkerbird, Yellow-fronted	*Pogoniulus chrysoconus*	X	X				
Tit, Southern Black	*Parus niger*	X	X				
Tit-Babbler, Chestnut-vented	*Parisoma subcaeruleum*	X	X				
Turaco, Purple-crested	*Gallirex porphyreolophus*	X	X				
Turtle-Dove, Cape	*Streptopelia capicola*	X	X				
Vulture, Cape	*Gyps coprotheres*	X	X	VU	VU	EN	EN
Vulture, White-backed	*Gyps africanus*	X		VU	EN	EN	EN
Wagtail, African Pied	*Motacilla aguimp*	X	X				
Wagtail, Cape	*Motacilla capensis*	X	X				
Wagtail, Mountain	*Motacilla clara*	X	X				
Warbler, Dark-capped Yellow	*Chloropeta natalensis*	X					
Warbler, Icterine	*Hippolais icterina*		X				
Warbler, Marsh	*Acrocephalus palustris*		X				
Warbler, Willow	*Phylloscopus trochilus*	X	X				
Waxbill, Black-faced	*Estrilda erythronotos*	X	X				
Waxbill, Blue	*Uraeginthus angolensis*	X	X				
Waxbill, Common	*Estrilda astrild*	X	X				
Waxbill, Orange-breasted	*Amandava subflava*	X	X				
Waxbill, Swee	*Coccopygia melanotis*	X	X				
Waxbill, Violet-eared	*Granatina granatina*	X	X				
Weaver, Cape	*Ploceus capensis*	X					
Weaver, Spectacled	*Ploceus ocularis*	X	X				
Weaver, Thick-billed	*Amblyospiza albifrons*	X	X				
Weaver, Village	*Ploceus cucullatus*	X	X				
Wheatear, Mountain	*Oenanthe monticola*	X					
White-eye, Cape	*Zosterops pallidus*	X	X				
Whydah, Pin-tailed	*Vidua macroura*	X	X				
Whydah, Shaft-tailed	*Vidua regia*	X	X				
Widowbird, Fan-tailed	*Euplectes axillaris*	X	X				
Widowbird, Long-tailed	*Euplectes progne*	X					
Widowbird, Red-collared	*Euplectes ardens*	X	X				
Widowbird, White-winged	*Euplectes albonotatus*	X	X				

Wood-Dove, Emerald-spotted	*Turtur chalcospilos*	X	X				
Wood-hoopoe, Green	*Phoeniculus purpureus*	X					
Woodpecker, Bearded	*Dendropicos namaquus*	X	X				
Woodpecker, Bennett's	*Campethera bennettii*	X					
Woodpecker, Cardinal	*Dendropicos fuscescens*	X	X				
Woodpecker, Golden-tailed	*Campethera abingoni*	X	X				