GUMENI BOSLOOP 132KV POWER LINE

AVIFAUNAL IMPACT ASSESSMENT

FINAL REPORT: OCTOBER 2012

Andrew Pearson
Endangered Wildlife Trust
011 372 3600
andrewp@ewt.org.za

EXECUTIVE SUMMARY

Eskom Holdings Ltd is proposing to construct a new 26km long 132V kingbird line from Gumeni MTS to Bosloop Substation, in Mpumalanga Province. The proposed new line establishment has three proposed corridor alternatives. SSI Engineers and Environmental Consultants (Pty) Ltd were appointed to undertake the Basic Assessment Process for the proposed project and the Endangered Wildlife Trust (EWT) was subsequently appointed as an avifaunal specialist.

The proposed line options pass through and/or alongside four quarter degree squares (QDGS's), 2530CA, 2530CC, 2530CD and 2530CB. Across all squares a total of 32 Red Data species were recorded, comprising 3 Critically Endangered, 1 Endangered, 12 Vulnerable and 16 Near-threatened. The White Stork and Abdim's Stork, which are not listed, but are protected internationally through the Bonn Convention on Migratory species, were also recorded. The focal species for the study were determined to be the following: Wattled Crane, Cape Vulture, African Marsh-Harrier, Martial Eagle, African-Crowned Eagle, Grey-crowned Crane, Blue Crane, Denham's Bustard, White-bellied Korhaan, Southern Bald Ibis, Secretarybird, and White Stork.

This avifaunal study used a set methodology as well as various data sets, and then, by looking at the focal Species which could occur in the area, as well as assessing the availability of bird micro habitats, the possible impacts of the development were then assessed. In general terms, the impacts that could be associated with a project of this nature include: collision of birds with the overhead cables; electrocution; destruction of habitat; and disturbance of birds. Sensitive avifaunal areas of the site were mapped, and were found to be associated with Rivers and Wetlands. These areas will require collision mitigation in the form of bird-flight diverters. To determine the exact spans requiring mitigation, an avifaunal walkthrough during the EMP phase of the project is recommended.

It was concluded that the proposed power line can be built provided that the various mitigation measures recommended in this report are implemented. From an avifaunal perspective, all of the three line options are suitable; however line option 2 is more preferred.

DECLARATION OF INDEPENDANCE

Specialist Investigator

Andrew Pearson is employed by the Endangered Wildlife Trust's Wildlife and Energy Programme as a specialist investigator for conducting avifaunal specific specialist reports. Andrew has a Four Year BSc in Conservation Ecology, certificates in Environmental Law, as well as five years experience in the environmental management field. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information.

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.
- The specialist investigator, and the Endangered Wildlife Trust, for whom he/she works, does not accept any responsibility for the conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from these assessments or requests made to them for the purposes of this assessment.
- 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 and all of the information contained herein remain the intellectual property of the Endangered Wildlife Trust.
- 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 11th October 2012 by Andrew Pearson in his capacity as specialist investigator for the Endangered Wildlife Trust's Wildlife and Energy Programme.

INTRODUCTION

Background

Eskom Holdings Ltd is proposing to construct a newfor a new 26km long 132V kingbird line from Gumeni MTS to Bosloop Substation, in Mpumalanga Province. The proposed new line establishment has three proposed corridor alternatives. SSI Engineers and Environmental Consultants (Pty) Ltd were appointed to undertake the Basic Assessment Process for the proposed project and the Endangered Wildlife Trust (EWT) was subsequently appointed as an avifaunal specialist. An initial site visit was conducted on the 24th August 2011, which resulted in a Draft Report. Following changes to the route options, an additional site visit was conducted on the 19th and 20th September 2012, which resulted in this Final Report. This avifaunal study used a set methodology (discussed elsewhere) as well as various data sets. The focal species for the study were determined, and then, by looking at the focal Species which could occur in the area, as well as assessing the availability of bird micro habitats, the possible impacts of the development were then assessed. In general terms, the impacts that could be associated with a project of this nature include: collision of birds with the overhead cables; electrocution; destruction of habitat; and disturbance of birds.

Terms of reference

The following terms of reference were utilized for this study:

- Provide an assessment of the potential impacts on avifauna associated with the proposed construction of the 132 kV power line.
- 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 Data species potentially affected by the proposed power lines and substation.
- Identify potential impacts (positive and negative, including cumulative impacts if relevant) of the proposed development on avifauna during construction and operation.
- Rate the significance of the impacts as per a standard set of criteria.
- Give a comparative assessment of the environmental impacts related to alternatives proposed.
- Identify mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks.
- Identify and address any other aspects related to avifauna in the study area that should be incorporated into the reports.

METHODS

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 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 Data species as well as non-Red Data power line sensitive species in the study area.
- The area was visited, and thoroughly traversed, to obtain a first-hand perspective of the proposed route and birdlife, and to determine which bird micro-habitats are present and relevant to the study. This involved driving the study area, taking photographs, and walking certain accessible areas, to see as much as possible of the proposed substation sites and routes for the power line.
- A desk top examination, using Google Earth imagery was done to compare alternatives.
- 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.
- The impacts were assed in a table, using pre-determined assessment criteria.
- Recommended mitigation measures for significant impacts were proposed.

Sources of information

The study made use of the following data sources:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP – 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 conservation status of all bird species occurring in the aforementioned degree squares was then determined with the use of The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Barnes, 2000).

- The Southern African Bird Atlas Project 2 data for certain pentads in the study area was examined.
- Data from the Co-ordinated Waterbird Count (CWAC) project was also consulted to determine whether any CWAC sites exist in the study area (Taylor, Navarro, Wren- Sargent, Harrison & Kieswetter, 1999).
- The Important Bird Areas of southern Africa (IBA) project data (Barnes 1998) was consulted to determine its relevance to this project.
- A classification of the vegetation types in the study area was obtained from Mucina and Rutherford (2006).
- Information on the micro-habitat level was obtained through visiting the area and obtaining a firsthand perspective.
- Electronic 1:50 000 maps were obtained from the Surveyor General.
- Satellite Imagery of the area was studied using Google Earth ©2012.

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:

- The SABAP-1 data covers the period 1986-1997. Bird distribution patterns fluctuate continuously according to availability of food and nesting substrate. (For a full discussion of potential inaccuracies in ASAB data, see Harrison, Allan, Underhill, Herremans, Tree, Parker & Brown, 1997).
- The site visit was conducted in late winter, over which time various species may not have been present in the study area.
- During the site visit, it was not possible to access the entire length and all sections of the proposed Alternatives.
- Google Earth ©2010 Imagery may not always reflect the true situation on the ground, as some images may be outdated.
- Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can't 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 authors through the investigation of hundreds of localities in southern Africa where birds have interacted with power lines since 1996.

DESCRIPTION OF AFFECTED ENVIRONMENT

Study area vegetation and land use

While this report is an avifaunal specialist report, vegetation and micro habitats are very important in determining avifaunal abundances and likelihood of occurrences. As such a map has been produced below (Figures 1 and 2) showing the vegetation classification of the broader area (Mucina & Rutherford, 2006). The dominant vegetation types in the study area are "Lydenburg Montane Grassland" and "KaNgwane Montane Grassland". Although not on the site itself, there are elements of "Eastern Highveld Grassland", "Northern Mistbelt Forest" and "Legogote Sour Bushveld" in the broader area. "Lydenburg Montane Grassland" falls within the Grassland Biome, and is found from just above Pilgrim's Rest in the north, southwards and westwards skirting Lydenburg, extending to Dullstroom, to Belfast and Waterval Boven in the south, at an altitude of 1260–2 160 m. "KaNgwane Montane Grassland" also falls within the Grassland Biome, and occurs along the gentle slopes of the Escarpment, from the Phongolo Valley in the south, northwards to the Usutu Valley and to the uppermost Lomati Valley near Carolina, including the western grassland areas of Swaziland, at altitudes ranging from 880m to 1 740 m.

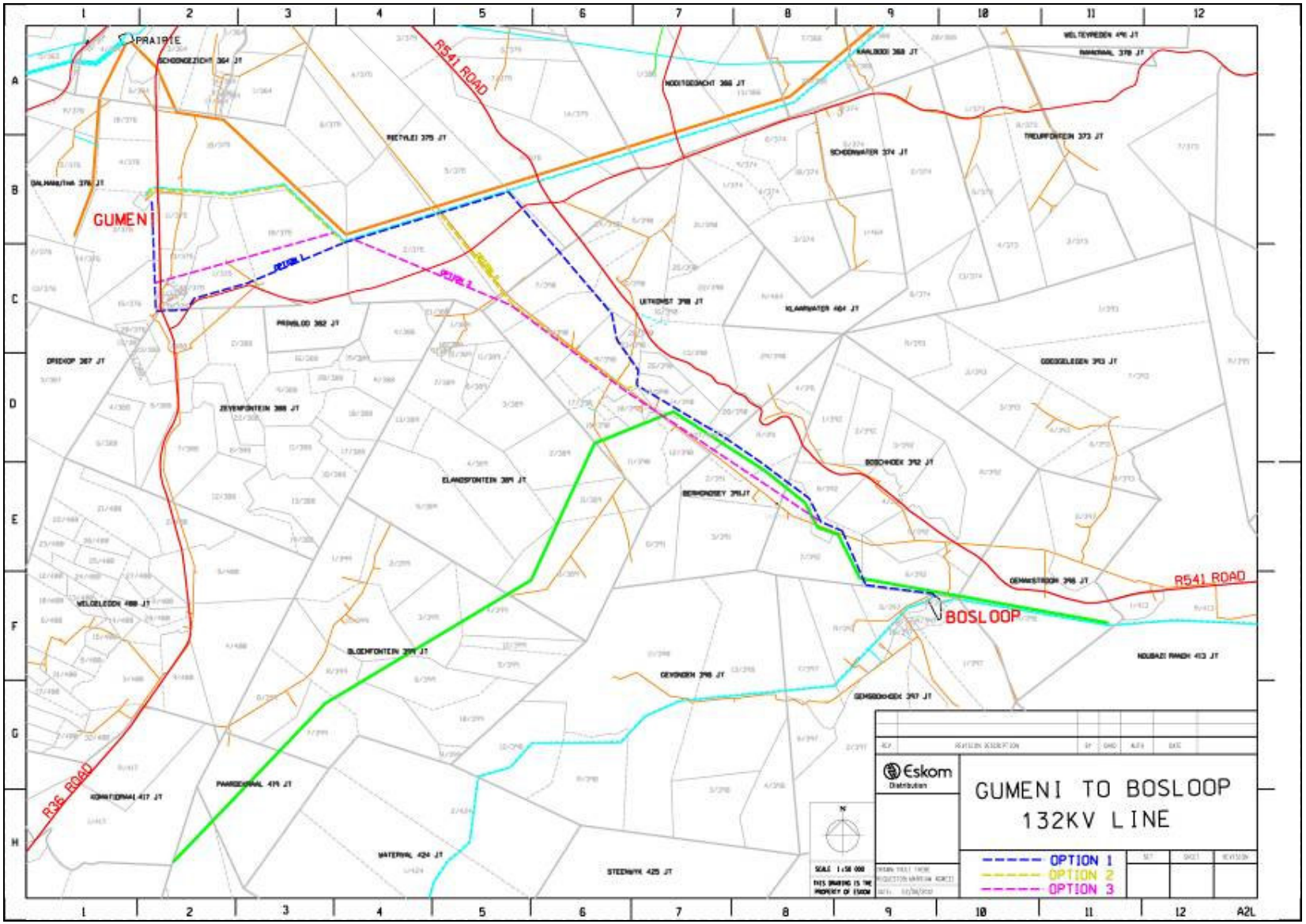

Figure 1: Map indicating the various line alternatives, existing high voltage lines (green), as well as Gumeni and Bosloop Substations (Source: SSI

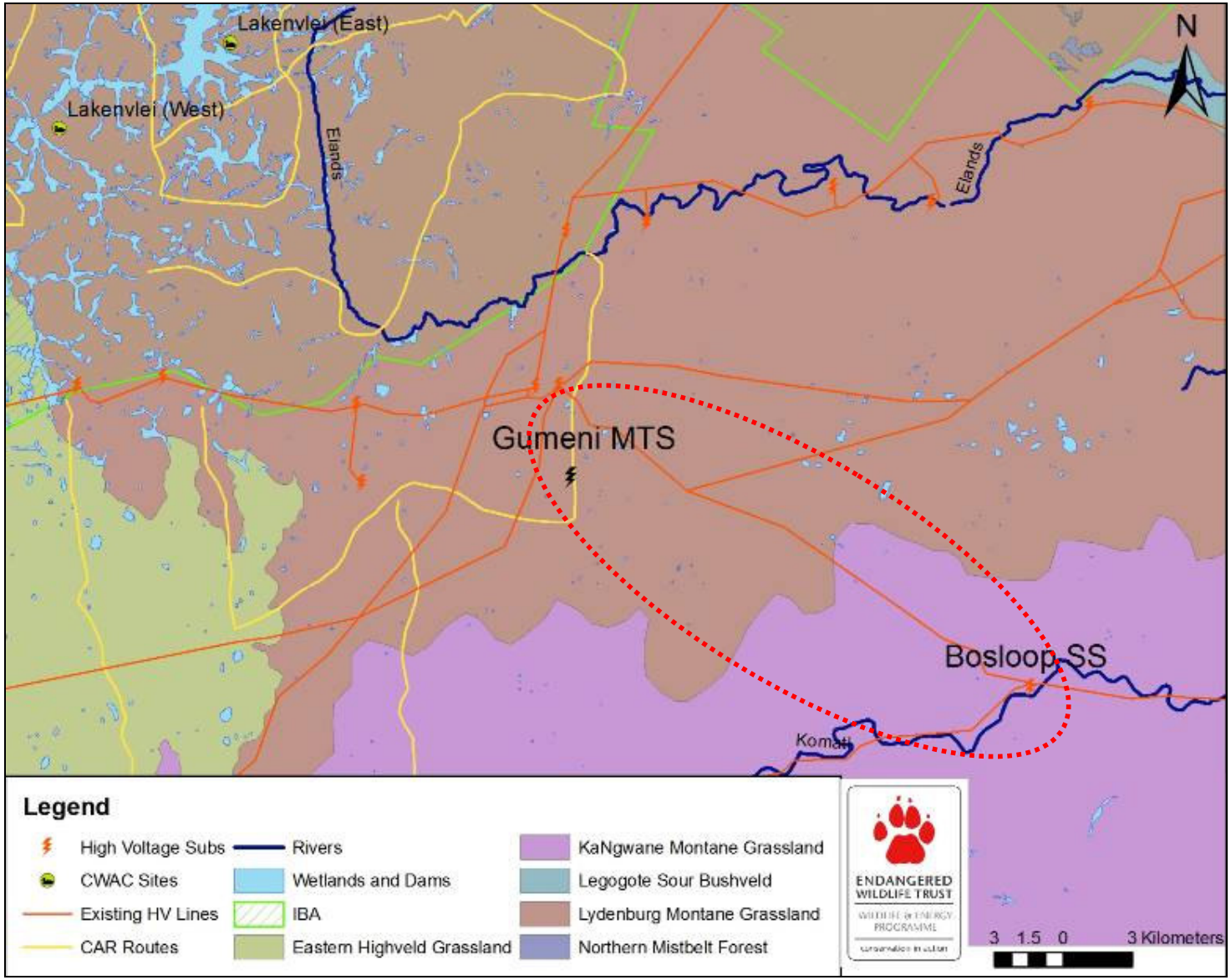

Figure 2: Map indicating existing high voltage electrical infrastructure, CWAC sites, IBA's, CAR routes, as well as major rivers and the vegetation classification for the study area according to Mucina & Rutherford, 2006. The red polygon indicates the approximate study area visited.

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. Additional microhabitat photographs taken on the second site visit in October 2012, are shown in Appendix 2. Investigation of this study area revealed the following bird micro habitats.

Arable and/or cultivated lands

Arable or cultivated lands can represent a significant feeding areas for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources 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 sparsely in this study area, mainly in the form of maize or "mielie" fields. Relevant bird species that may be attracted to these areas include most importantly the Blue Crane, Southern Bald Ibis, Abdim's Stork and White Stork.

Figure 3: Some arable lands (possibly maize) in the study area, which appeared to have been recently harvested.

Open Grasslands:

Grasslands represent a significant foraging and/or hunting area for many bird species.

The more prevalent vegetation types present (discussed earlier) both represent part of the Grassland Biome, and therefore this micro-habitat was found to be the most prolific habitat on the site, albeit in varying forms of transformation. Pristine, healthy grasslands were observed in the more isolated parts of the site while grassland appeared to be somewhat disturbed, especially from grazing of cattle, and human infrastructure. Important bird species that may be found in the grassland areas of the study site are: Blue Crane, Grey-crowned Crane, Secretarybird, Southern Bald Ibis, Denham's Bustard, White-bellied and Blue Korhaans, and White Stork. The grassland patches are also a favourite foraging area for game birds such as francolins and Helmeted Guineafowl, as well as being hunting habitat for raptors such as Martial Eagle, African Marsh Harrier, Lesser Kestrel and Black-shouldered kite.

Figure 4: Relatively undisturbed, open grasslands, in the north west of the study area.

Figure 5: Grasslands, interspersed with patches of trees.

Dams:

Dams have become important attractants to various bird species in the South African landscape. Various waterfowl, such as Spur-winged geese, Egyptian geese, and numerous duck species, may frequent these areas and are vulnerable to collision with power lines. More importantly, Blue Cranes use dams to roost in communally, and Flamingos may use these areas as stop over points while moving between larger water bodies. Various Storks may also frequent these water bodies. Of particular concern are the Blue Cranes which regularly fly at dusk and in low light, when electrical infrastructure may be more difficult for them to see.

Figure 6: One of the few man-made dams observed on site.

Rivers or drainage lines:

Rivers in their true form represent important habitat for many species, including Black Stork, Yellow-billed Stork, Saddle-billed Stork, Ducks, Geese and a variety of other water birds. The wooded riparian habitat alongside a river may provide habitat for various species such as the Hamerkop, African Darter, various cormorants, kingfishers, bee-eaters, robin-chats and numerous smaller species. Slow flowing sections of river with overhanging vegetation supply habitat for African Finfoot, while rivers also represent feeding areas for fish eating raptors such as the African Fish Eagle. Sandbanks associated with large rivers provide habitat for various wading species including, Lapwings, Plovers, Stilts, and Sandpipers. Rivers and drainage lines also represent important flight paths for many species.

Figure 7: The Komati River, in the south east of the study area, near to Bosloop substation.

Figure 8: A small stream observed in the grasslands of the western part of the study area.

The only major river on the site is the Komati River (see figure 7), which runs a few meters south of Bosloop substation, however only line option 3 will traverse this area. In the Broader study area, there is another major river, the Elands River, approximately 10km north of Gumeni MTS. There are also many smaller streams, especially in the more mountainous south-eastern areas, some of which are associated with waterfalls. Numerous

smaller drainage lines, some of which do not always carry water are also present on site. However, these drainage lines may still serve as flight paths for several bird species. Cliffs, Ridges and hills (discussed below) are often associated with these Rivers and their river valleys.

Mountains, Ridges and Cliffs:

The study area is characterised by a higher elevation, plateau area to the north and west. Here, the topography is hilly with rolling grasslands. This "escarpment area" gives way quite dramatically, as moves south east and down towards the Komati River Valley. Mountainous habitats are associated with this south eastern part of the study area. Here, many rocky cliff areas and ravines are also present, especially associated with the river and various tributaries. Waterfalls are also present, and the valleys and ravines have patches of forest (discussed below). The Mountainous areas represent a very distinct habitat type, most likely to be used by species such as the Black Stork, Southern Bald Ibis, Verreaux's Eagle, Jackal Buzzard, Rock Kestrel, and Cape Vulture.

Figure 9: A mountainous region of the study area, with cliffs and Ridges present.

Figure 10: The view as one descends down towards the Komati River. Note the patches of woodland and forest on the mountain slopes.

Figure 11: A Cliff face with a waterfall.

Woodland/Thicket and Savanna:

Numerous woodland patches are present. These are primarily associated with the Rivers, streams and drainage lines, as well as around human habitation and areas of overgrazing. There is some Savanna elements (areas of woodland and grassland), to the south east of the study area. Various species may occur in this micro-habitat type including Martial Eagle, African Crowned Eagle, and Lanner Falcon. This habitat type, however, is more important to

physically smaller bird species, which are less likely to interact directly with the proposed power lines.

Forest and Dense Woodland:

Areas of indigenous forest appear to be present on site, although these may be referred to by some as woodland area. This overlaps with the woodland areas described above. These forest/woodland patches are primarily found on mountain slopes and within ravines and "Kloofs" on site. This micro-habitat type will mostly be important to physically smaller bird species, which are less likely to interact directly with the proposed power lines, such as Doves, Cuckoos, Wood-peckers, Barbets, Fly-catchers, Wattle Eyes, Robin-chats, and Shrikes. The red-listed Orange ground thrush may also be found in this micro-habitat. Of more concern to the project are larger species that may frequent indigenous forest patches, such as Martial and African Crowned Eagle.

Figure 12: Patches of woodland and forest on the mountain slopes, and within a valley.

Stands of Alien vegetation:

Patches of alien trees were observed throughout the study area. These areas will mostly be important to physically smaller bird species, which are less likely to interact directly with the proposed power lines. They may, however, provide perching, roosting and nesting habitat for various raptor species, as well as larger birds such as francolins, Guineafowl, Herons and Hadeda Ibises

Figure 13: Large stands of exotic trees are present throughout the study area.

Rocky Hill-slopes

A few rocky "koppies" (see figure 14) are present in the west of the study area, while the higher altitude grassland areas are often scattered with boulders and rocks (Figure 15). These rocky areas provide distinct foraging, nesting and perching habitats for various species, as well as prominent points for display's singing and courtship. This habitat will most likely be frequented by smaller species such as Chats, Pipits and Larks.

Figure 14: A small rocky "koppie" observed on site.

Figure 15: Rocky outcrops, amongst high altitude grasslands, on the plateau areas of the study site.

Table 1 below shows the micro habitats that each Red Data 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 in Table 1 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.

Relevant bird populations

Southern African Bird Atlas Project 1

The primary data source used to determine the distribution and abundance of bird species in the study area was the Southern African Bird Atlas Project data (Harrison *et al*, 1997). This data was collected over an 11 year period between 1986 and 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 also a relatively large spatial scale. The proposed line options pass through and/or alongside four quarter degree squares (QDGS's), 2530CA, 2530CC, 2530CD and 2530CB. However, the majority of the project area falls within 2530CD. The species recorded in the relevant quarter degree squares could have been recorded anywhere within these squares 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.

Many species however, in table 1 below, are unlikely to be found on site for a variety of reasons including low abundance and lack of suitable habitat. The likelihood of occurrence of each species, along of any of the proposed line options, is also predicted in the table below. Using this data in combination with the assessment of the micro habitats available to birds in the area – an effective assessment of potential impacts of the proposed developments has been made as described elsewhere in the report.

Table 1: Red Listed species recorded in the quarter degree squares covering the study area (Harrison *et al* 1997)

Species	Cons. status	Report rate (%)				Preferred micro habitat	Likelihood of occurrence
		2530 CA	2530 CC	2530 CD	2530 CB		
Total species		*222*	*219*	*202*	*282*		
Number of cards		*105*	*75*	*55*	*53*		
Wattled Crane	CR	15	-	-	19	Shallow wetland, grassland alongside pans	Possible
White-winged Flufftail	CR	5	-	-	-	Dense sedges in permanent marshes	Unlikely
Rudd's Lark	CR	-	-	-	4	High altitude short grasslands	Possible
Saddle-billed Stork	EN	2	-	-	-	Rivers, Lakes, Wetlands	Unlikely
Cape Vulture	VU	4	-	-	8	Grassland, Savanna, Mountains	Possible
Martial Eagle	VU	-	-	4	2	Savanna, woodlands, semi-arid shrubland	Possible
African Marsh-Harrier	VU	6	7	-	4	Wetlands, grasslands	Possible
Lesser Kestrel	VU	-	1	-	6	Savanna, grassland, arable land	Possible
Grey Crowned Crane	VU	25	7	29	-	Marshes, pans, grasslands, wetlands	Likely
Blue Crane	VU	34	24	47	21	Grassland, Cultivated lands, Shrublands	Likely
Denham's Bustard	VU	10	4	29	8	Grassland, Cultivated lands, Shrublands	Possible
White-bellied Korhaan	VU	2	17	5	2	Grasslands, Open Savanna	Possible
African Finfoot	VU	1	-	-	-	Slow-flowing streams	Unlikely
African Grass Owl	VU	1	-	-	4	Grasslands near water.	Possible
Southern Bald Ibis	VU	11	29	67	28	High altitude short grasslands	Highly Likely
Yellow-breasted Pipit	VU	1	-	2	6	Montane grasslands.	Possible
Black Stork	NT	1	-	9	-	Rivers and Kloofs	Possible
Yellow-billed Stork	NT	-	3	-	4	Rivers, Lakes, Estuaries	Possible
Greater Flamingo	NT	-	3	-	-	Shallow lakes, Salt Pans, Estuaries	Unlikely
Lesser Flamingo	NT	-	4	-	-	Shallow lakes, Salt Pans, Estuaries	Unlikely
Secretarybird	NT	12	21	45	17	Grassland, arable lands	Highly Likely
Blue Korhaan	NT	2	11	-	-	Grasslands, Grassy Karoo	Possible
Black-bellied Bustard	NT	1	-	-	2	Open Grassland	Unlikely
Black Harrier	NT	-	-	-	2	Fynbos, Renosterveld, Shrublands	Unlikely
African Crowned Eagle	NT	-	-	4	11	Forest, Dense Woodland	Possible
Lanner Falcon	NT	3	1	-	-	Open grassland, woodland	Unlikely
Greater Painted-snipe	NT	1		-	-	Vegetated Wetlands	Unlikely
Black-winged Lapwing	NT	3	3	-	4	Short grasslands, Pastures	Possible
Half-collared Kingfisher	NT	2	3	-	8	Coastal lagoons, Wooded streams	Possible
Broad-tailed Warbler	NT	2		-	-	Tall grass along drainage lines	Unlikely
Red-billed Oxpecker	NT	-		22	-	Open woodland	Unlikely
Orange Ground-Thrush	NT	-		-	2	Afromontane evergreen forest	Unlikely
White Stork	Bonn	16	11	40	17	Grassland, arable lands, wetlands	Very Likely
Abdim's Stork	Bonn	-	1	-	2	Grasslands, Cultivated lands, Savanna woodland	Possible

CR = Critically Endangered; EN = Endangered; V = Vulnerable; NT = Near-threatened; Bonn = Protected Internationally under the Bonn Convention on Migratory Species. Report rates are essentially percentages of the number of times a species was recorded in the square, divided by the number of times that square was counted. It is important to note that these species were recorded in the entire quarter degree square in each case and may not actually have been recorded on the proposed site for this study.

Across all squares a total of 32 Red Data species were recorded, comprising 3 Critically Endangered, 1 Endangered, 12 Vulnerable and 16 Near-threatened. The White Stork and Abdim's Stork, which are not listed, but are protected internationally through the Bonn Convention on Migratory species, were also recorded. The most important of these species for this study are the Wattled Crane, Cape Vulture, African Marsh-Harrier, Martial Eagle, African-Crowned Eagle, Grey-crowned Crane, Blue Crane, Denham's Bustard, White-bellied Korhaan, Southern Bald Ibis, Secretarybird, and White Stork. These species are all reasonably abundant in the area and/or are hugely vulnerable to collision with overhead power lines in South Africa. These species are thus the main focus of most of this study, and are added to the **Focal Species List** discussed below. Two of the Critically Endangered species (White-winged Fluff-tail and Rudd's lark), are not a focus of this study as the proposed power line is likely to have little, to no affect on them. Furthermore, the Saddle-billed Stork, is not included as a focal species, due to its low abundance (i.e. 2% report rate in only one QDGS). Additionally, mitigation measures considered for the other Stork Species will also apply to this species.

Southern African Bird Atlas Project 2

SABAP 2 data for the pentads in the study area which had been counted more than two times was examined. The table below shows report rates, based on the number of cards submitted, for the relevant (i.e. larger species vulnerable to collision and/or electrocution) red data species identified in table 1.

Table 2: Report rates from Southern African Bird Atlas Project 2 (as of 11/10/2012), for relevant species.

	Pentad Report Rate (%)				
	2550_3015	**2545_3020**	**2540_3020**	**2540_3010**	**2540_3015**
No Cards	*4*	*3*	*5*	*3*	*3*
Total Species	*145*	*107*	*92*	*90*	*56*
Wattled Crane	-	-	-	-	-
Saddle-billed Stork	-	-	-	-	-
Cape Vulture	-		-	33.3	-
Martial Eagle	-	-	-	-	-
African Marsh-Harrier	-	-	-	-	-
Lesser Kestrel	-	-	-	-	-
Grey Crowned Crane	-	-	-	-	-
Blue Crane	-	-	20	-	-
Denham's Bustard	-	-	-	-	-
White-bellied Korhaan	-	-	20	-	33.3
African Grass-owl	-	-	-	-	-
Southern Bald Ibis	75	-	20	33.3	-
Black Stork	-	-	-	-	-
Yellow-billed Stork	-	-	-	-	-
Greater Flamingo	-	-	-	-	-
Lesser Flamingo	-	-	-	-	-
Secretarybird	25	-	40	-	-
Blue Korhaan	-	-	-	-	-
Black Harrier	-	-	-	-	-
African Crowned Eagle	-	-	-	-	-
Lanner Falcon	-	-	-	*incidental*	-
White Stork	-	-	-	-	-
Abdim's Stork	-	-	-	*incidental*	-

Interestingly, 16 of the relevant species identified in the SABAP 1 data (i.e. Table 2), have not been recorded in the SABAP 2 data for the pentads examined. This however, does not necessarily mean that these species do not occur here, or that they have moved from the area, post SABAP1, but may merely be due to the low counting effort of the pentads, or selective micro habitat counting by the SABAP2 field counters. Furthermore, only three species, Secretary bird, White-bellied Korhaan and Southern Bald Ibis had been observed in more than one pentad. It also interesting to note, that when a species was recorded in a pentad, the report rates are relatively high, possibly indicating reasonably high abundance, but most likely being a factor of the low counting effort.

Coordinated Avifaunal Road-count (CAR) data

Large and conspicuous birds offer the opportunity to monitor their populations by means of a relatively simple technique known as the "road count", in which observations are made from vehicles covering fixed routes. In 2003, the Avian Demography Unit (ADU) published a major 200-page report, Big birds on farms: Mazda CAR Report 1993-2001, summarising the information collected over the first eight years of this project. This report has accounts for 15 species and 17 precincts, and is the source of the following information.

Two CAR routes have relevance to the study. Route MS08 passes directly by the Gumeni MTS, while route MS09 is a little further to the south west. Both routes are found in the greater Mpumalanga Precinct, but fall within the smaller Steenkampsberg (MS) precinct.

The Steenkampsberg district is one of the few areas in the country where all three crane species have been seen at a single locality. However, only Blue Crane has been recorded on MS08 and only Grey-crowned Crane on MS09, with neither route having recorded Wattled Crane. Other species that were not recorded on either route are Denham's Bustard and White-bellied Korhaan. Both routes have recorded Southern Bald Ibis, Secretarybird, Spur-winged Goose and Black-headed heron.

Coordinated Waterbird count (CWAC) data

There are no CWAC sites within the immediate site. However, two CWAC sites are present in the broader area. Avifaunal data from these sites is useful in providing a better understanding of the species present in the broader vicinity of the study site, and they are therefore discussed briefly below.

<u>Lakenvlei (West)</u>

A reserve in an area of commercial afforestation consisting of three dams, and a palustrine wetland dominated by dense reed beds which make counting difficult. The winter 1997 count produced a reasonable selection of the commoner waterbird species, including good numbers of Dabchick and Red- knobbed Coot. The July 1998 count was excellent: 2174 birds, including 270 White-backed Duck and 1525 coot. Moorhen is widespread and Purple Heron and Red-chested Flufftail occur. African Rail and Purple Gallinule occur locally in the area, but Black Crake is infrequent and localised at this altitude. Grass and Marsh Owls, Grey Crowned Crane and Wattled Crane, also occur in the area, and Ethiopian Snipe is locally common.

Lakenvlei (East)

No site description was available for this site. Grey-crowned Crane has been recorded sporadically in flocks of up to 54 individuals. Importantly, Wattled Crane has been recorded at this site on 8 different occasions between 1999 and 2004, varying in numbers from 1 to 4 individuals. African Marsh Harrier as well as large numbers of Red-knobbed Coot, Little Grebe, Spur-winged Goose and Yellow-billed Duck occurs here.

Important Bird Areas (IBA's)

The selection of Important Bird Areas (IBAs) is achieved through the application of quantitative ornithological criteria, grounded in up-to-date knowledge of the sizes and trends of bird populations (BirdLife International, 2011). The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations, and provide a common currency that all IBAs adhere to, thus creating consistency among, and enabling comparability between, sites at national, continental and global levels. There is only one IBA within the broader study site, namely Steenkampsberg (SA0160, which lies between 10 to 15km north of the study site. This large IBA (10 000ha), lies on the central South African plateau, and it consists primarily of rolling high-altitude grassland, interspersed with rocky outcrops. Within the Steenkampsberg area, two wetland systems are particularly important: Lakensvleispruit and; Verloren Valei. These wetlands have mainly short vegetation, predominantly grasses, forbs and short sedges. Moist, sandy highveld grassland is found to the south-west of Belfast. The table below shows the trigger species (species listed globally by the IUCN), and the presence of endangered and vulnerable species puts this IBA in to the highest A1 ("Globally Threatened Species") classification. This means the site is known, estimated or thought to hold a population of a species categorized by the IUCN Red List as Critically Endangered, Endangered or Vulnerable.

Table 3: Populations of IBA trigger species in the Steenkampsberg IBA (BirdLife International, 2011).

Species	Season	Population estimate	IUCN Category
Southern Bald Ibis	resident	30-40 breeding pairs	Vulnerable
Southern Bald Ibis	winter	100-350 individuals	Vulnerable
Lesser Kestrel	winter	1,000-3,000 individuals	Least Concern
Striped Flufftail	resident	-	Least Concern
White-winged Flufftail	winter	6-12 individuals	Endangered
Blue Crane	resident	-	Vulnerable
Wattled Crane	resident	max 4 breeding pairs	Vulnerable
Ground Woodpecker	resident	-	Least Concern
Rudd's Lark	resident	-	Vulnerable
Kurrichane Thrush	resident	-	Least Concern
Buff-streaked Chat	resident	-	Least Concern
White-breasted Sunbird	resident	-	Least Concern
Gurney's Sugarbird	resident	-	Least Concern
Yellow-breasted Pipit	resident	-	Vulnerable

Personal observations

Appendix 1 shows the sightings list of birds observed on site, during both site visits. This list is merely for indicative purposes, and this list represents incidental observations (which could be positively identified). Data from this table needs to be used with caution, as observations over such a short periods, in only two seasons, and in fairly similar weather conditions cannot be taken as a true indication of the presence of bird species in the area. In particular, the target species for this study are threatened, rare species, so the likelihood of seeing one during a two day period is limited. This study has therefore attached far more weight to the secondary data sources such as the bird atlas projects (SABAP1 and SABAP2) which collected data over a far longer period, and more diverse conditions. It must be noted that many "non Red Data" bird species also occur in the study area and could be impacted on by the power line. Although this impact assessment focuses on Red Data species, the impact on non Red Data species is also assessed, albeit in less detail. Furthermore, much of the mitigation recommended for Red Data species will also protect non Red Data species in the study area.

Focal Species List

Determining the focal species for this study, i.e. the most important species to be considered, is a four step process. Firstly, the micro-habitats available on site were identified. An analysis of the above existing avifaunal data represents the second step, i.e. which species occur in the area at significant abundances. The third step is to identify those species (which may be present based on the above two steps), and are more likely to be impacted upon by the power-line. This step called on the vast experience of the EWT in evaluated and investigating electrical infrastructure impacts on birds (these impacts are discussed in more detail below). In general, large, heavy flying birds are more vulnerable to collision with over-head powerlines, while perching Raptors are more vulnerable to electrocution. The fourth and final step was to consider the species conservation status or other reasons for protecting the species. This involved primarily consulting the Red List bird species (Barnes 2000) as in Table 1.

The resultant list of 'target/focal species' for this study is as follows: Wattled Crane, Cape Vulture, African Marsh-Harrier, Martial Eagle, African-Crowned Eagle, Grey-crowned Crane, Blue Crane, Denham's Bustard, White-bellied Korhaan, Southern Bald Ibis, Secretarybird, and White Stork. In some cases, these species serve as surrogates for other similar species (as mitigation will be effective for both), examples being White Stork for Abdims Stork and Saddle-billed Stork, and White-bellied Korhaan for Blue Korhaan. Assorted more common species will also be relevant to this study, but it is believed that the above target species will to a large extent serve as surrogates for these in terms of impact assessment and management.

ASSESSMENT OF IMPACTS

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 1983; Verdoorn 1996; 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). Electrocution is possible on 132kV lines, depending on the exact pole structure used. For this study, it is assumed that a bird friendly structure will be used, and the detailed impact assessment below, is based on this assumption. Therefore, the impact of electrocution is likely to be of low significance for the proposed power line.

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 Data 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 with the proposed line of certain large flying bird species such as Blue Crane, Grey-Crowned Crane, Black Stork, and Southern Bald Ibis is a possibility.

Habitat destruction

During the construction phase and maintenance of substations and power lines some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes, as well as clearing vegetation at the substation site. 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. Habitat destruction is anticipated to be of moderate significance in this study area.

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 moderate significance.

Description of impacts of this proposed project

The possible impacts of the proposed power line include Collision, Electrocution, Habitat Destruction and Disturbance. These impacts were rated in the tables below, according to a fixed set of criteria as supplied by SSI. The rating is applicable to all alternatives.

Table 4: Assessment of operational phase impacts.

GENERAL AND SPECIALIST STUDY IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCEAFTER MITIGATION
ISSUE: Avifauna							
IMPACT: Bird collision with overhead power line, Impact on Red Data and other species							
DIRECT IMPACTS							
	Localised	Long-term	May occur	Moderately Severe	Moderately negative	Mark the identified sections of line with anti collision marking devices on the earth wire to increase the visibility of the line and reduce likelihood of collisions. Marking devices should be spaced 10m apart. **The sections of line that pose a concern and require marking should be finalised in a site "walkthrough" by EWT once final route is decided and towers/pylons pegged.**	Low negative
IMPACT: Bird electrocution, Impact on Red Data and other species							
DIRECT IMPACT							
	Localised	Lon-term	May Occur	Severe	High Negative	A "Bird Friendly" steel lattice structure (248 series type), or a bird friendly monopole, should be used for the tower structures. **Any deviation should be reported to EWT as it will alter this impact rating.**	Low negative

Table 5: Assessment of impacts during construction phase.

GENERAL AND SPECIALIST STUDY IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCEAFTER MITIGATION
ISSUE: Avifauna							
IMPACT: Disturbance of birds, Impact on Red Data and other species							
DIRECT IMPACTS							
	Localised	Short term	May Occur	Moderately severe	Moderate Negative	Strict control should be maintained over all activities during construction. It is difficult to mitigate properly for this as some disturbance is inevitable. **During Construction, if any of the "Focal Species" identified in this report are observed to be roosting and/or breeding in the vicinity, the EWT is to be contacted for further instruction.**	Low negative
IMPACT: Destruction or alteration of bird habitat, Impact on Red Data and other species							
INDIRECT IMPACTS:							
	Localised	Long-term	Definitely	Moderately severe	Moderate 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

COMPARISON OF ALTERNATIVES

Three Line options have been proposed for consideration and can be seen in the Map in Figure 1 above.

Line Option 1:

- From Bosloop, it follows the same corridor up the mountains as Option 2 for approximately 9km.
- From Bosloop SS, it follows an existing HV line north, up a steep ridge, and along the plateau, running slightly to the north east of this line.
- It then takes a more northerly routing than the other two options, before turning west, following another existing line for approximately 3.5km.
- Turns north at a regional tar road, and follows this road to Gumeni SS.

Line Option 2:

- From Bosloop, it follows the same corridor up the mountains as Option 1 for approximately 9km.
- It then keeps a slightly more southerly routing than option 1, sharing approximately 3km of corridor with option 3.
- In the north, it meets up with an existing line, and deviates to the west, following this line for approximately 7km all the way to Gumeni SS.
- Option that follows existing power lines for the longest length.

Line Option 3:

- From Bosloop SS it will follow an existing HV line north, up a steep ridge, and along the plateau, running slightly to the south west of this line.
- It then runs for approximately 3 km alongside option 2.
- In the North, it cuts through relatively large open areas, without following existing infrastructure.

In order to rank these alternatives a table was compiled and the corridors were given a rating on a scale of 1 to 5, with 1 being the least preferred and 5 being the most highly preferred option.

Table 5: Preference rating for the 3 alternatives.

Line Option	**Preference Rating**
1	3
2	4
3	2

As can be seen from the discussions and table above, **line option 2 is preferred**, while alternative 3 is least preferred. However, all of the options are suitable from an avifaunal perspective, as long as the mitigations and recommendations of this report are adhered to. Although option 2, is preferred, it is still not ideal as it passes over ridge areas as well as montane grassland on the plateau. A better option would be to adjust option 2, so that it follows the regional tar road from Bosloop SS, up the Skurwebergpas, and does not climb the ridge following the existing HV line.

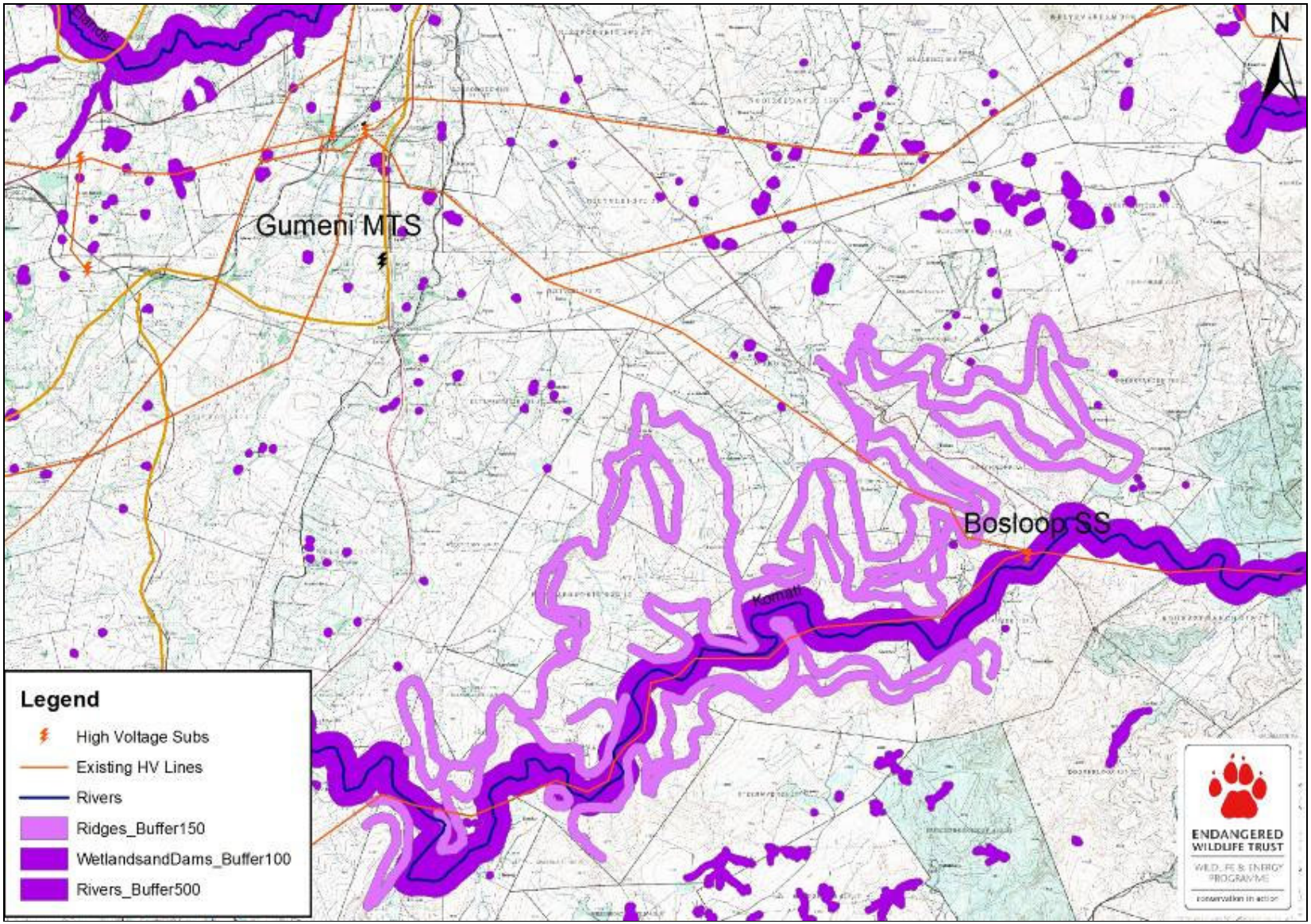

Figure 16: Map showing the sensitive areas of the study site, associated with dams, wetlands, ridges and rivers.

Identification of sensitive areas within the proposed site.

In general the site is moderately to highly sensitive in terms of avifauna, based on the occurrence of a number of listed species in the study area, as well as the various micro-habitats available to avifauna. It is noted however, that certain areas are more attractive for certain bird species and therefore more sensitive, while others (e.g. over grazed areas, and areas closer to human habitation) are less attractive. The sensitive avifaunal zones are described and explained below.

The above map (Figure 16) shows the major rivers, which have been buffered by 500m. The map also shows the various wetlands and/or dams in the study area, which have been buffered by 100m. The importance of these micro-habitats to avifauna has been discussed in earlier sections of this report. Therefore, these wetland/dams buffer zones, as well as the buffer around the Rivers, are all regarded as ***High Sensitivity*** areas, and collision mitigation (as detailed in table 4), is recommended for any power lines running through these areas.

The south eastern portion of the study area is mountainous with many ridges and cliffs. Prominent cliffs were identified (from a desk-top level as well as whilst on site), and digitised. These areas were then buffered by 150m as can be seen in figure 16 above, and these zones are regarded as ***Medium–High Sensitivity*** areas. Collision mitigation is also recommended for any lines passing through these zones.

Unknown Sensitivity: These are all the remaining areas, where no obvious avifaunal features or patterns could be identified during the study, and it is likely that the majority of these areas could be designated as Low- Medium sensitivity. The majority of these areas will not require collision mitigation on lines passing through them. However, some areas could be designated as Medium to High sensitivity, in the future upon availability of new data and/or after additional site analysis. This is especially true for areas of pristine grasslands, which could not be accurately assessed and mapped at this stage. These areas will be identified in the "avifaunal site walkthrough", once the final line option has been decided upon.

IMPACT STATEMENT

In conclusion, the proposed power line can be built provided that the various mitigation measures recommended in this report are implemented. From an avifaunal perspective, line option 2, which follows an existing infrastructure for the majority of its length and appears to pass through less sensitive areas, is more preferred. Line option 3 is least preferred, as it appears to bisect large open areas in the north. Collisions are expected to be the largest impact of this project and thorough line marking is required to mitigate for this, regardless of which line option is chosen. Sensitive areas (i.e. in the vicinity of Rivers, Dams, Wetlands and Ridges) have been mapped, within which the abovementioned collision mitigation must be implemented. An avifaunal walk through is recommended in order to, "fine tune" these sensitive zones, and to identify the exact spans of line for marking to mitigate for bird collisions. Provided that the high risk sections of line are mitigated in the form of marking, the impact should be contained. The EWT, through its partnership with Eskom and ongoing international networking, is well aware of the room for improvement on the effectiveness of line marking devices. However, it is our view that currently available devices, although not 100 % effective, would provide an acceptable level of mitigation for this project. Provided that a bird-friendly monopole structure is used for all pylon structures in the project, as discussed elsewhere in the report, the impact of electrocution should be contained.

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APPENDIX 1: List of species observed during the two site visits.

Seq	Common name
49	Longclaw, Cape
48	Crow, Cape
47	Sunbird, Marico
46	Coot, Redknobbed
45	Flycatcher, Southern Black
44	Quelea, Redbilled
43	Cisticola, Lazy
42	Warbler, Yellow
41	Woodpecker, Olive
40	Swallow, Whitethroated
39	Darter, African
38	Bokmakierie
37	Sunbird, Amethyst
36	Chat, Familiar
35	Prinia, Tawny-flanked
34	Kite, Yellow-billed
33	Kite, Black-shouldered
32	Cliff-chat, Mocking
31	Starling, Redwinged
30	Thrush, Ground-scraper
29	Hoopoe, African
28	Spurfowl, Natal
27	Swallow, Greater Striped
26	Stonechat, African
25	Pigeon, Speckled
24	Goose, Egyptian
23	Fiscal, Common
22	Egret, Cattle
21	Drongo, Fork-tailed
20	Dove, Laughing

19	Cormorant, Reed
18	Waxbill, Common
17	Chat, Anteating
16	Kestrel, Rock
15	Crow, Pied
14	Bunting, Cinnamon-breasted
13	Chat, Buff-streaked
12	Heron, Grey
11	Ibis, Hadeda
10	Secretarybird, Secretarybird
9	Guineafowl, Helmeted
8	Lapwing, Blacksmith
7	Lapwing, Crowned
6	Scrub-Robin, White-browed
5	Bee-eater, White-fronted
4	Cisticola, Levaillant's
3	Bulbul, Dark-capped
2	Barbet, Crested
1	Barbet, Acacia Pied

APPENDIX 2: Additional photographs taken during the second site visit.

An existing HV line running along a ridge above Bosloop SS. All options are proposed to follow this line up the mountain from Bosloop SS, heading north.

New lines being constructed with monopoles in the north of the study area. Much of the grasslands were burnt.

A view from a district dirt road, looking north to Gumeni SS in the distance. Note the agricultural fields and pastures.

An agricultural field (which appears to be maize), with a stand of alien trees in the background.