MOKOPANE INTEGRATION PROJECT

Mokopane Substation and associated 400kV loop-in and loop-out power lines

Delta-Medupi, Medupi-Mokopane and Mokopane-Witkop 765kV power lines

Scoping report

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PROFFESSIONAL DECLARATION

This study was conducted by Megan Diamond in her capacity as a field biologist of the Endangered Wildlife Trust (EWT). Ms. Diamond conducts all assessments under the supervision of Mr. Jon Smallie who is registered with The South African Council for Natural Scientific Professions (400020/06). The EWT are independent consultants to Savannah Environmental (for Eskom Holdings Limited). The EWT has no business, financial, personal or other interest in the activity, application or appeal in respect of which they were appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of these specialists performing such work.

The author has two years of experience in the field of bird interactions with electrical infrastructure and has conducted avifaunal impact assessments for four transmission line projects and approximately 25 distribution line projects. 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.

EXECUTIVE SUMMARY

The Endangered Wildlife Trust was appointed by Savannah Environmental as specialists to investigate the potential bird related impacts associated with the construction of the proposed Mokopane Substation and its associated 400kV loop-in and loop-out power lines extending from the existing Matimba-Witkop 400kV power line, the Delta-Medupi, Medupi-Mokopane and Mokopane-Witkop 765kV power lines - components of the larger Mokopane Integration Project).

Various sources of information were consulted during this study, to ascertain bird distribution patterns and densities as well as the conservation status for each bird species prevalent in the study area. The Southern African Bird Atlas Project (Harrison *et al*, 1997) recorded a total of 30 Red-Data bird species across the 18 quarter degree squares within which the study area falls. In addition, the White Stork and Abdim's Stork (Protected internationally under the Bonn Convention on Migratory Species) are considered as a threatened species for the purpose of this study. Several of the Red Data species recorded here are known to be extremely vulnerable to impacts of power lines, through collision. The Blue Crane, Secretarybird, Southern Bald Ibis, Denham's Bustard, Kori Bustard, White-bellied Korhaan, Greater and Lesser Flamingos, the various vulture and stork species are all susceptible to collision and habitat destruction.

The northern part of the study area consists predominantly of degraded woodland and arable lands with the central and southern parts of the study area, consisting largely of densely vegetated mountainous areas.

It is anticipated that habitat destruction and disturbance will be by far the most significant impact of the proposed Mokopane Substation. Areas that will be particularly vulnerable to habitat transformation, as a result of the construction of the substation, will be the riparian habitats (Options 3, 4 and to a much lesser extent Option 2) particularly as a result of the construction and maintenance of the 400kV loop-in and loop-out servitudes relating to this project and future distribution power line developments. Disturbance will be much greater if species are breeding on or near the area earmarked for the development of the proposed Mokopane Substation. The EIA phase of the project will identify specific sensitive areas, and breeding birds as far as possible. With regards to the proposed Delta-Medupi, Medupi-Mokopane and Mokopane-Witkop 765kV power lines, a vast quantity of vegetation will also be lost during their construction particularly in woodland areas, unlike developments in grassland areas, where the area is merely trampled during construction. Habitat destruction within corridor 2, the original corridor 2 alignment and sections of the existing Matimba-Witkop corridor is not anticipated to be significant since much of the study area is already transformed, and disturbed. However the converse is true for the vast tracts of woodland in corridors 1, the original corridor 1 alignment, corridor 3, sections of corridor 4 and corridor 7. Habitat destruction of the natural vegetation remaining in corridors 5 and 6 is likely to be minimal since this area has already been transformed through the construction and maintenance of the two existing power lines.

Collision of large terrestrial Red Data bird species will be a significant impact of the proposed 400kV and 765kV power lines. Species most likely to be affected by this impact are the more heavily–bodied species recorded in the area i.e. Blue Crane, Secretarybird, Southern Bald Ibis, Denham's Bustard, Kori Bustard, White-bellied Korhaan, Greater and Lesser Flamingos and the various vulture and stork species. These species are priority species due to their proven vulnerability to collision with power lines, and their reported occurrence within the study area. Non-Red Data species such as water birds will also be affected. Provided that the correct corridor is chosen, and then the relevant sections of the power line are comprehensively marked with a suitable anti-collision marking device, the EWT are confident that this impact can be reduced to acceptable levels.

1. INTRODUCTION

1.1 Background

In order to evacuate the power generated at the new Medupi Power Station, support the upsurge in demand for the platinum group metals in the Mokopane area and to improve the reliability of electricity supply to the Polokwane area, Eskom Transmission plans to construct and establish an additional node, the new Mokopane Substation, to support the existing Witkop Substation, the only other nodal point in the Polokwane area. The proposed substation, with a footprint of approximately 1000m x 1000m, will be located between Mokopane and Polokwane in the Limpopo Province. The proposed 400kV loop-in and loop-out power lines extending from the existing Matimba-Witkop power line will run parallel to one another and cover a distance of approximately 10 kilometres. 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 i.e. Delta-Medupi, Medupi-Mokopane and Mokopane-Witkop 765kV power lines (FIGURE 1).

In line with environmental legislation, Eskom Transmission has appointed Savannah Environmental (Pty) Ltd to conduct the necessary environmental investigations for the proposed development. The Endangered Wildlife Trust (EWT) was appointed by Savannah Environmental (Pty) Ltd as specialists to investigate the potential bird related impacts associated with the construction of the proposed Mokopane substation, Delta-Medupi, Medupi-Mokopane and Mokopane-Witkop 765kV power lines.

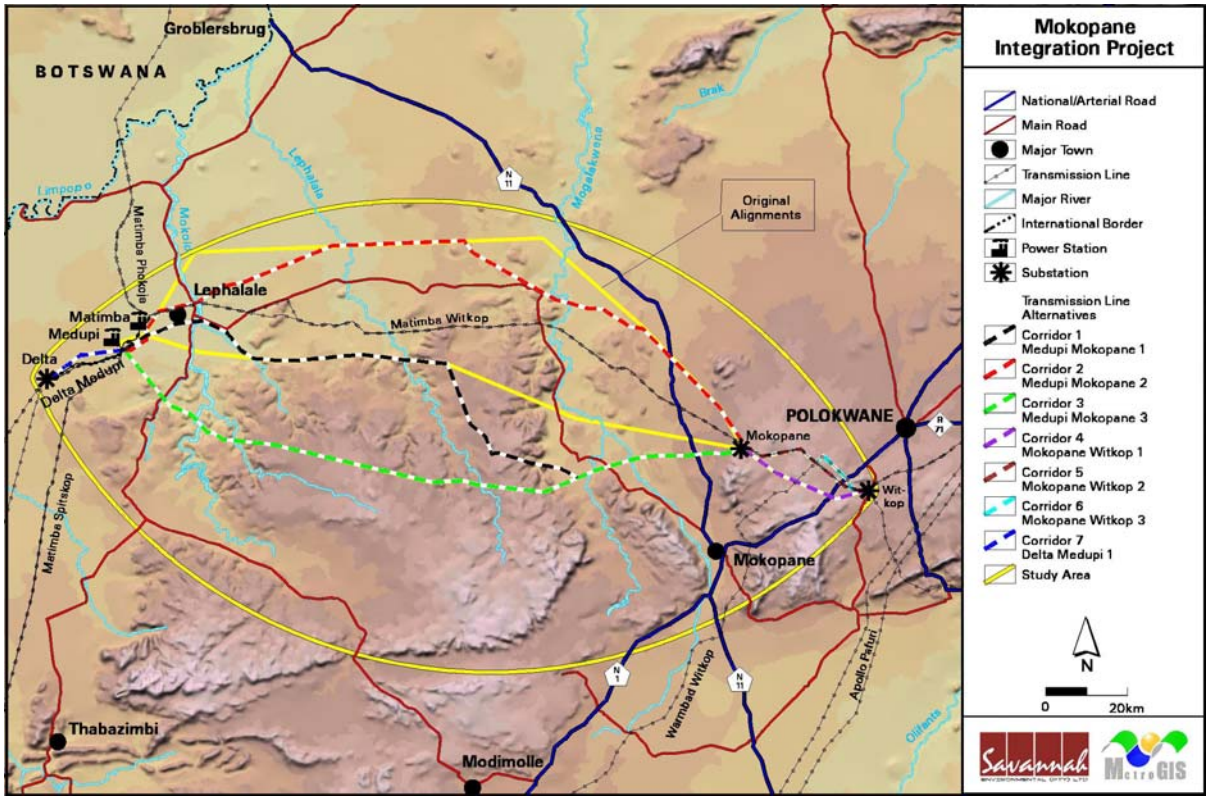

FIGURE 1: Map indicating the proposed Mokopane substation site and corridor alternatives for the Delta-Medupi, Medupi-Mokopane and Mokopane-Witkop 765kV power lines (map supplied by Savannah Environmental).

Typically, a development of this type 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 Mokopane Substation and associated 400kV loop-in and loop-out power lines and the Delta-Medupi, Medupi-Mokopane and Mokopane-Witkop 765kV power lines; collision of birds with earth wires and conductors of the proposed 400kV loop-in and loop-out and 765kV power lines; possible electrocutions of nesting birds within the substation and birds causing electrical faulting on the proposed 400kV loop-in and loop-out power lines.

Field investigations for this study were conducted during June 2008 (fly-over) and December 2008 (field investigation).

1.2 Terms of Reference

The terms of reference for the EWT scoping study are the standard terms of reference, comprising of the following:

- Describe the environment in terms of the applicable specialist focus.
- Listing and describing the expected impacts.
- Identify and briefly discuss those issues that would need to be addressed in detail in the EIA study.
- Explain the methodology to be applied in investigating these issues during the EIA study.

1.3 Study approach

1.3.1 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 and 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. A separate data set is obtained for each of the 18 quarter degree squares i.e. 2327DA, 2327DB, 2327DC, 2327DD, 2328CA, 2328CB, 2328CC, 2328CD 2328DA, 2328DB, 2328DC, 2328DD, 2428AB, 2428BA, 2329CC, 2329CD, 2429AA and 2429AB.
- Data from the Co-ordinated Avifaunal Road count project (CAR – Young, Harrison, Navarro, Anderson & Colahan, 2003) was consulted to determine whether any CAR routes exist in the study area.
- Data from the Co-ordinated Waterbird Count (CWAC) project was also used to determine whether any important water bird sites are located in study area (Taylor, Navarro, Wren-Sargent, Harrison and Kieswetter, 1999).
- Environmental Potential Atlas (ENPAT) data for the Limpopo province was consulted to determine environmental sensitivity. (ENPAT 2000 version. DEAT, University of Pretoria and GISBS).
- The Important Bird Areas (IBA) project data was consulted to establish if any bird areas are located in the study area (Barnes 1998).
- The conservation status of all bird species occurring in the aforementioned quarter degree squares was determined with the use of The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Barnes 2000).

- The power line bird mortality incident database of the Eskom/Endangered Wildlife Trust Strategic Partnership (1996 to present) was consulted to determine which of the species occurring in the study area are typically impacted upon by power lines.
- A classification of the vegetation types in each quarter degree square was obtained from the Southern African Bird Atlas Project (Harrison, Allan, Underhill, Herremans, Tree, Parker and Brown (1997).
- Information on the micro-habitat level was obtained during a flyover and field investigation of the study area in June and December 2008 respectively.
- High resolution imagery from Google Earth was used to further informally examine the study area.

1.3.2 Limitations & assumptions

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

- The SABAP data covers the period 1986-1997, which means that some of the data is now more than a decade old. 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 and Brown, 1997).
- Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird interactions with power lines cannot be reduced to formulas that will hold true under all circumstances; at most impacts can be predicted with a fair amount of confidence based on field experience.
- Corridors for the proposed loop-in and loop-out 400kV power lines associated with the Mokopane substation were not indicated on the maps provided and could therefore not be assessed in detail.
- Only two of the four proposed Mokopane substation sites were 'visited' during the flyover. The assessment of Option 3 and 4 of the substation sites was conducted using high resolution Google Earth imagery.
- Only three of the six proposed Medupi-Mokopane corridors were 'visited' during the flyover. The remaining two Medupi-Mokopane corridors were assessed during an additional field visit to the area. The assessment of the existing Matimba-Witkop corridor was conducted using high resolution Google Earth imagery.

2. DESCRIPTION OF THE RECEIVING ENVIRONMENT

The greater study area contains elements of both grassland and woodland, but the proposed substation sites and alignments are situated largely within woodland. The land use is largely mining, commercial farming with a mixture of game, cattle and crop cultivation – both dryland and irrigation. Other sections of the study area contain subsistence farming, with a mixture of cattle and crop cultivation and numerous settlements.

2.1 Vegetation types and bird habitats

TABLE 1 below shows the average historical vegetation composition of the 18 quarter degree squares within the study area (Harrison *et al,* 1997). It is widely accepted within the ornithological community that vegetation structure, rather than the actual plant species,

influences bird species distribution and abundance (in Harrison *et al,* 1997). The description of vegetation presented in this study therefore concentrates on factors relevant to the bird species present, and is not an exhaustive list of plant species present. The description of the vegetation types occurring in the study area makes extensive use of information presented in the Atlas of southern African birds (Harrison *et al,* 1997). The criteria used to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations (Harrison *et al,* 1997).

TABLE 1. Vegetation composition of the study area (Harrison *et al,* 1997).

Vegetation Type	Moist Woodland	Arid Woodland	Sour Grassland
Average Percentage	81%	17%	2%

It is evident from the table above that the dominant vegetation type found within the study area is woodland of one type or another, i.e. Arid or Moist woodland. It must however be noted that the majority of the northern and eastern parts of this study area are in a state of transformation, with a number of settlements (FIGURE 2) scattered throughout the immediate surrounds intermingled with mining areas and both commercial and subsistence forms of cultivation. As a result, a large portion of the vegetation within the most northern corridor (corridor 2 and the original northern corridor) of study area has and is being transformed. The habitat in the area has been subjected to severe pressure from the neighbouring communities and the various land use types.

FIGURE 2: Settlements can be found scattered throughout the greater study area.

2.1.1 Woodland biome

The woodland biome covers most of the northern and eastern sections of southern Africa. Canopy cover ranges from sparse – such as Kalahari woodland, to an almost closed canopy such as Miombo woodland. Woodland is defined as having a grassy under-storey and a distinct woody upper-storey of trees and tall shrubs.

- Arid woodland comprises predominantly fine-leaved, semi-deciduous *Acacia*- dominated woodlands on rich soils. This vegetation type occurs where there is intermediate, though variable, rainfall with hot, wet summers and cool, dry winters.
- Moist woodland comprises predominantly broadleaved, winter deciduous woodland. Soil types are varied but are generally nutrient poor.

Woodland habitat, in its undisturbed state, is suitable for a wide range of birds – in fact the woodland species are the most species rich community.

2.1.2 Grassland biome

This biome encompasses the open grassland regions of the eastern interior plateau of South Africa. Grasslands are maintained largely by a combination of relatively high summer rainfall, frequent fires, frost and grazing, which preclude the presence of shrubs and trees.

- Sour grasslands occur in the higher rainfall regions on acidic soils. They are characterised by being shorter and denser in structure when compared to Sweet grasslands.

Relevant to this study area, much of the grassland biome has been transformed predominantly by crop farming, afforestation and human settlement. The grassland patches that are found in isolated patches within the study area are more than likely old fallow fields that have long since been abandoned.

2.2. Bird Micro Habitats

Whilst much of the bird species distribution in the study area can be explained in terms of the above broad vegetation description (based on the quarter degree squares), there are many differences in bird species distribution and density that correspond to differences in habitat at the micro level. These “bird micro-habitats” are evident at a much smaller spatial scale than the broader vegetation types or biomes, and can largely only be identified through a combination of field investigation and experience. The habitat that is relevant to the birds may also be broader than merely the vegetation type and structure and may include abiotic elements such as man-made infrastructure. It was therefore important to visit the study area and examine these characteristics first hand.

The following bird micro-habitats were identified within the immediate surrounds of the four proposed substation sites and the ten proposed corridors:

2.2.1 Dams

There are several small man-made impoundments within the study area (FIGURE 3). Whilst dams have altered flow patterns of streams and rivers, and affected many bird species detrimentally, a number of species have benefited from their construction. The construction of these dams has probably resulted in a range expansion for many water bird species that were formerly restricted to areas of higher rainfall. These include the pelicans, darters and cormorants. Many species from these families occur in this study area including Yellow-billed,

Black, Woolly-necked and White Storks, flamingos and a variety of non-Red Data species such as ducks, geese and herons.

FIGURE 3: An example of a dam located in the study area

2.2.2 Arable land

Arable or cultivated land represents a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds and other predators; the crop or pasture plants cultivated are often eaten by birds, or attract insects which are in turn eaten by birds; during the dry season arable lands often represent the only green or attractive food sources in an otherwise dry landscape. In this study area, there are significant arable lands, both commercial and subsistence varieties. Much of the commercial agriculture in the area is irrigation based (FIGURE 4), mostly along the Lephalale, Mokolo and Moglakwena rivers and some of the associated tributaries and drainage lines. White Storks might visit some of the irrigated crops in summer, mostly patches of lucerne which comprises most of the irrigated crops. Cattle Egrets, Abdim's Stork and Black-headed Heron might follow tractors in the planting season to scoop up insects that have been exposed. Relevant to this study, a great deal of agriculture can be found within close proximity to Option 1 of the proposed substation sites and along corridor 2 and the original corridor 2 alignment.

FIGURE 4: An example of an irrigated land occurring along corridor 2 within the study area

2.2.3 Rivers, pans and wetlands

There are at least three major rivers that occur within the study area – the Lephalale, Mokolo and Mogalakwena Rivers (FIGURE 5) as well as a number of smaller rivers or associated tributaries. Riparian vegetation is characterised by tall, fringing riverine forest and well developed woodland quite distinct from the surrounding dryland vegetation. These well vegetated areas usually support a diverse and distinct forest and woodland avifauna (Taylor *et al.* 1999). These are areas of particular importance for birds, with riparian vegetation being extremely important to threatened riverine bird species and waterbird communities. Options 2 and 3 of the proposed substation sites, are located a short distance (0.3km) from the Groot-Sandsloot river and Witrivier respectively (FIGURE 5) with Option 4 located approximately 1km from the Witrivier. Corridor 1, the original corridor 1 alignment, corridor 2, the original corridor 2 alignment, corridor 3 and the existing Matimba-Witkop corridor all cross the Lephalale, Mokolo and Mogalakwena Rivers at least once.

FIGURE 5: An example of the numerous river crossings occurring within the study area.

Some other small perennial wetlands and seasonal pan examples (see FIGURE 6 and 7) are also scattered throughout the study area. Ordinarily, of the bird species highlighted in TABLE 2, the most likely of those to be associated with these rivers, pans and wetlands are the flamingos, the various stork species and a variety of non Red Data species such as ducks and geese. In this area, wetlands are extremely important sources of water for most bird species and will be regularly utilised not only as a source of drinking water and food, but also for bathing.

FIGURE 6: An example of a pan occurring within the study area.

FIGURE 7: An example of a wetland system

2.2.4 Escarpment areas

The mountainous areas along study corridors 1 and the original corridor 1 alignment, corridor 3 and the existing Matimba-Witkop corridor represent a very distinct habitat type (FIGURE 8). This is most likely to be used by species such as the Cape Griffon Vulture, various raptors, Black Stork and Bald Ibis. Corridor 7 is also comprised of similar, but smaller, rocky outcrops.

FIGURE 8: Mountainous areas located within corridors 1, 1a, 3 and the existing Matimba-Witkop corridor

2.2.5 Woodland

Patches of the study area are communal land, especially along the northern alignment, and are heavily grazed by livestock. In these areas, the tree cover has been drastically reduced, and the vegetation is generally in a severe state of degradation. In the commercial game farming areas, particularly along the central and southern corridors, the original woodland vegetation

still persists (FIGURE 9) and human population densities are reasonably limited, compared to some of the other areas. In these areas, the presence of cattle and game carcasses could attract vultures, Marabou Storks and the occasional Tawny Eagle. The open woodland country will also be attractive to snake eagles, particularly Black-breasted Snake Eagles. In these areas, it could be expected that most of the medium to large raptors will still occur, for example Martial Eagle, Bateleur, Wahlberg's Eagle, Steppe Buzzard, Jackal Buzzard and Brown Snake Eagle.

FIGURE 9: Pristine woodland habitat within corridors 1 and 3

2.2 Bird Sensitive Areas

2.3.1 *CAR Data*

Cranes, bustards, storks and other large birds that spend most of their time on the ground, need wide, open spaces and are certainly not restricted to protected areas. Agricultural habitats are used extensively for feeding, roosting and breeding, often because no natural, pristine habitats are available, and sometimes because the agricultural habitats are especially attractive to birds. The Co-ordinated Avifaunal Roadcounts (CAR) project monitors the populations of 21 species of large 'terrestrial' birds in agricultural habitats (Young *et.al.* 2003). Although CAR road counts do not give an absolute count of the all the individuals in a population, they do provide a measure of relative abundance in a particular area.

There are no CAR routes within the confines of the study area.

2.3.2 CWAC Data

A CWAC site is any body of water, other than the oceans, which supports a significant number (set at approximately 500 individual waterbirds, irrespective of the number of species) of birds which use the site for feeding, and/or breeding and roosting (Harrison and Harebottle, 2002). This definition includes natural pans, vleis, marshes, lakes, rivers, as well as a range of manmade impoundments (i.e. sewage works). The presence of a CWAC site within the study

area is an indication of a large number of bird species occurring there and the overall sensitivity of the area.

A number of CWAC sites (Doorndraai Dam, Moorddrift Dam, Rondepan Farm Dams, Kalkfontein Irrigation Dams, Doornbult Farm Dam, Polokwane Bird Sanctaury, Polokwane Nature Reserve, Turfloop Dam and Deloskop Farm Dam) exist within the immediate surrounds of the proposed corridors. However it is worth noting that none of proposed substation sites and ten corridors traverse across any of the abovementioned CAWC sites.

2.3.3 IBA Data

Some sites are exceptionally important for maintaining the taxa dependent upon the habitats and ecosystems in which they occur. Vigorous protection of the most critical sites is one important approach to conservation. Many species may be effectively conserved by this means. Patterns of bird distribution are such that, in most cases, it is possible to select sites that support many species. These sites, carefully identified on the basis of the bird numbers and species complements they hold, are termed Important Bird Areas (IBA's). IBA's are selected such that, taken together, they form a network throughout the species' biogeographic distributions.

IBA's are key sites for conservation – small enough to be conserved in their entirety and often already part of a protected-area network. They are responsible for one (or more) of three things:

- Hold significant numbers of one or more globally threatened species
- Are one of a set of sites that together hold a suite of restricted-range species or biome-restricted species
- Have exceptionally large numbers of migratory or congregatory species

None of the ten proposed corridors or substation sites fall within an Important Bird Area. The closest IBA's to the proposed corridors are the Waterberg and Nyl River Floodplain systems, Blouberg Vulture Colony, Wolkberg Forest Belt and Pietersburg Nature Reserve.

2.3.4 ENPAT Data

Relevant to this study ENPAT data reveals that all areas of faunal and conservation significance occur outside of the study area and pertain specifically to mammals. This data will therefore not be assessed further.

2.4 Power line sensitive bird species occurring in the study area

TABLE 2 below lists the Red Data (Barnes 2000) bird species recorded in the 2327DA, 2327DB, 2327DC, 2327DD, 2328CA, 2328CB, 2328CC, 2328CD 2328DA, 2328DB, 2328DC, 2328DD, 2428AB, 2428BA, 2329CC, 2329CD, 2429AA and 2429AB quarter degree squares. A total of 30 Red-Data bird species were recorded across the 18 squares during the atlas period (Harrison *et al*, 1997). One of these is classified as 'endangered', 14 of these species are classified as 'vulnerable' and 15 as 'near threatened' (Barnes, 2000). In addition to the Red Data species, the White Stork and Abdim's Stork are included in TABLE 2 as both are protected internationally

under 'The Bonn Convention on Migratory Species'. As mentioned elsewhere in this report, the atlas data is now relatively old, having been collected during the period leading up to 1997. The spatial scale of the atlas data is relatively large i.e. the quarter degree square. This means that certain species could have been recorded in a square but not necessarily in this study area. This emphasises the importance of the approach taken by this study, in which the micro habitats available along the proposed corridors are evaluated for their potential to be used by Red Data and other species. This "potential for occurrence" of a species, in conjunction with the Atlas data on distribution and abundance provides a strong basis for the assessment on the impact of the proposed developments. Furthermore, despite its shortcomings, the atlas data remains our best formal, scientifically presented data source for the study area.

TABLE 2: Red Data species recorded across 18 quarter degree squares (Harrison *et.al.* 1997).

Species	**Cons. status**	**Preferred habitat**
Saddle-billed Stork	E	Rivers
Southern Bald Ibis	V	Heavily grazed pastures, cultivated lands
African White-backed Vulture	V	Woodland
Cape Griffon	V	Woodland, cliffs
Tawny Eagle	V	Woodland
Martial Eagle	V	Anywhere within the study area
Bateleur	V	Woodland
White-backed Night-Heron	V	Rivers with dams with overhanging vegetation
African Finfoot	V	Rivers with thick riparian vegetation
Blue Crane	V	Grassland, old lands
Kori Bustard	V	Grasslands, open woodland
Denham's Bustard	V	Grasslands, occasionally in cultivated fields
White-bellied Korhaan	V	Grassland, old lands
Lesser Kestrel	V	Fallow fields
African Grass Owl	V	Tall, dense grassland
Black Stork	NT	Rivers, dams and cliffs
Marabou Stork	NT	Anywhere in the study area
Woolly-necked Stork	NT	Rivers, pans and dams
Yellow-billed Stork	NT	Rivers and dams
Greater Flamingo	NT	Rivers and dams
Lesser Flamingo	NT	Rivers and dams
Secretarybird	NT	Old lands, open grassland patches, open woodland
Pallid Harrier	NT	Grasslands, occasionally in cultivated fields
Lanner Falcon	NT	Grassland and cultivated fields
Half-collared Kingfisher	NT	Rivers
Greater Painted Snipe	NT	Dams and pans
Black-winged Pranticole	NT	Fallow fields devoid of vegetation
Short-clawed Lark	NT	Sparsely vegetated woodland
Melodious Lark	NT	Grasslands, occasionally in planted pastures
Red-billed Oxpecker	NT	Open woodland
White Stork	Bonn	Cultivated land, fallow fields and dams
Abdim's Stork	Bonn	Grassland patches, cultivated and fallow fields

The majority of the Red Data species listed above are physically large species, meaning that they are capable of interacting directly with electrical infrastructure through collision, nesting, and electrical faulting. All bird species, including even the smaller ones are vulnerable to indirect impact by the proposed development through factors such as disturbance and habitat destruction.

Although this assessment focuses on the impacts on Red Data species as these are the species of highest conservation concern, the impact on the more common species has also been taken into account, although not on an individual species basis. Certain key species known to interact with power lines were assessed, rather than an exhaustive list of all species. It should also be noted that since the impacts are usually the same across various species, the Red Data species can often be used as surrogate species for the others in terms of impacts and the necessary mitigation.

3. DESCRIPTION OF THE PROPOSED ACTIVITIES

3.1. Description of the potential substation sites

This component of the Mokopane Integration Project considers four alternative sites for the placement of the proposed Mokopane Substation

Option 1:

This option is located on the farm Doornfontein, portion 721 LS, with co-ordinates
S 23°56.819 and E 029°04.219

Option 2:

This option is located on the farm Aaronsfontein, portion 772 LS, with co-ordinates
S 23°57.192 and E 029°03.852

Option 3:

This option is located on the farm Zuid Holland, portion 773 LR, with co-ordinates
S 23°52.659 and E 028°56.520

Option 4:

This option is located on the farm Noord Braband, portion 774 LR, with co-ordinates
S 23°53.905 and E 028°58.752

3.2 Description of the potential corridors

This component of the Mokopane Integration Project considers six alternative corridors for the Medupi-Mokopane 765kV power lines, an additional three alternative corridors for the Mokopane-Witkop 765kV power line and a single corridor for the Delta-Medupi 765kV power line.

Original 'Corridor 1' Alignment (Medupi-Mokopane):

The central corridor, south of the existing Matimba-Witkop 400kV power line. This corridor traverses directly through the Waterberg Biosphere Reserve.

Corridor 1 (Medupi-Mokopane):
A permutation of the central corridor.

Original 'Corridor 2' Alignment (Medupi-Mokopane):
The most northerly of the three corridors

Corridor 2 (Medupi-Mokopane):
A permutation of the most northerly corridor.

Corridor 3 (Medupi-Mokopane):
The southern corridor, that traverses directly through the escarpment.

Existing Matimba-Witkop Corridor (Medupi-Mokopane):
The corridor that runs parallel to the existing Matimba-Witkop 400kV power line

Corridor 4 (Mokopane-Witkop):
The southern alternative

Corridor 5 (Mokopane-Witkop):
The northern corridor that follows the existing Matimba-Witkop 400kV power line.

Corridor 6 (Mokopane-Witkop):
An adaptation of the northern corridor that follows the existing Matimba-Witkop 400kV power line and then also the Warmbad-Wikop power line.

Corridor 7 (Delta–Medupi):
A single corridor connecting the new Delta substation to the Medupi substation.

4. ASSESSMENT OF IMPACTS

4.1 Description of generic avifaunal impacts

Because of their size and prominence, electrical infrastructures constitute 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 and Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs and Ledger 1986b; Ledger, Hobbs and Smith, 1992; Verdoorn 1996; Kruger and 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 and Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities.

Below follows a short background discussion of the above impacts.

4.1.1 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 and Ledger 1999). However, in the context of overhead lines above 132kV, electrocutions are not a major issue. 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 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 (pers.obs.).

Electrocutions are not envisaged as an impact on the proposed 400kV transmission loop-in and loop-out line emanating from the new Mokopane substation as well as the proposed Delta-Medupi, Medupi-Mokopane and Mokopane-Witkop 765kV power lines as the relevant clearances between live parts and live and earthed components exceed the wingspan of any bird.

Electrocutions of certain bird species Electrocutions within the 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 more sensitive eagle species recorded in the area do not utilise substation yards extensively and therefore the significance of the impact is considered to be negligible. This impact will therefore not be discussed further.

4.1.2 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 waterbirds. 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. Many of the heavily affected species are Red Data species (EWT unpublished data).

The Red Data species vulnerable to power line collisions are generally long-lived, 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 result that consistent high adult mortality over an extended 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 existing 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.

Relevant to this study, the earth wire of the 400kV loop in and loop out power lines and the 765kV power lines will be the biggest risk from a bird collision perspective. Birds in flight tend to see the bundled conductors, and then gain height to avoid them. In the process, the much thinner earth wire is not noticed and the birds may then collide with it (APLIC 1994). The species most likely to be impacted upon include the Blue Crane, Secretarybird, Southern Bald Ibis, Denham's Bustard, Kori Bustard, White-bellied Korhaan, Greater and Lesser Flamingos, the various vulture and stork species. The dams, rivers, pans, wetlands and arable lands identified, during the field investigations, will undoubtedly attract most of these species and since these habitats feature along each of the proposed corridors, it is likely that significant mitigation will have to be employed regardless of the corridor chosen. However, large sections of corridor 1, the original corridor 1 alignment, corridor 3, corridor 4 and corridor 7 are comprised of dense woodland, habitat that is not suited to the large terrestrial species listed above; therefore the collision risk associated with these corridors is significantly reduced.

4.1.3 Habitat destruction

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

In general, much of the proposed study area surrounding all four of the substation site options is disturbed and degraded to some extent already. In this context, habitat destruction associated with construction of the proposed 400kV lines and substation at any of the sites is not anticipated to be significant. However the proximity of the Groot-Sandsloot and Witrivier and river systems relative to Options 2, 3 and 4 must be considered, particularly with regards to future electrical development (i.e. distribution power lines) which will inevitably extend from the new Mokopane Substation. Future construction of power lines in the areas surrounding Options 2, 3 and 4 could potentially impact negatively on the riparian vegetation and resident bird species occurring in there through habitat destruction.

Similarly, much of the proposed study area for corridor 2 and the original corridor 2 alignment is disturbed and degraded to some extent already. Again, habitat destruction associated with

construction of the proposed line is not anticipated to be significant. The exception to this statement is the pristine woodland vegetation within corridor 1, the original corridor 1 alignment and corridor 3.

4.1.4 Disturbance

Similarly, the above-mentioned construction and maintenance activities impact on birds through disturbance, particularly during breeding activities. This could lead to breeding failure if the disturbance happens during a critical part of the breeding season.

Disturbance is not anticipated to be a significant impact on avifauna at the proposed substation sites and along corridor 2 and the original corridor 2 alignment, since existing disturbance levels are high emanating from the existing settlements, agricultural practices and mining operations in the immediate study area.

4.1.5 Impact of birds on quality of supply

A number of mechanisms exist through which birds are able to cause electrical faults on transmission lines. Frequent faulting affects the quality of electrical supply to the end customers. Power utilities aim to maximise the quality of supply to customers at all times.

In the case of a bird streamer induced fault, the fault is caused by the bird releasing a "streamer" of faeces which can constitute an air gap intrusion between the conductor and the earthed structure. The fault appears to flash across the air gap (i.e. between the live conductor and the tower steelwork which is earthed) and *does not* follow an insulator creepage path as observed on pollution faults (See Taylor *et al* 1999 for an exhaustive analysis of the propagation characteristics of the bird streamer mechanism). Bird species capable of producing large or long streamers are more likely to cause streamer faults. Bird stomach volume is important in this respect. Larger birds such as vultures and eagles are capable of holding larger quantities of food and therefore defecating larger volumes.

Bird pollution is a form of pre-deposit pollution. A flashover occurs when an insulator string gets coated with pollutant, which compromises the insulation properties of the string. When the pollutant is wetted, the coating becomes conductive, insulation breakdown occurs and a flashover results. Since this involves a build up of bird faeces or bird pollution and not a once off event such as a streamer, the size of the bird is less important, although still a factor. Obviously the more an insulator string becomes coated with faeces, the more likely a fault. Larger birds and congregations of many birds are likely to result in heavy pollution of insulator strings.

Bird nests may also cause faults through nest material protruding and constituting an air gap intrusion. Crows in particular often incorporate wire and other conductive material into their nests. When nests cause flashovers, the nesting material may catch fire. This in turn can lead to equipment damage or a general veld fire. Apart from the cost of replacing damaged equipment, the resultant veld fire can lead to claims for damages from landowners. Certain

species such as crows and large eagles are likely to nest on power line towers such as the proposed power line.

Relevant to this study, streamer induced faulting is only possible on the self support towers along the proposed 400kV power lines, as the cross rope suspension tower does not provide suitable space in the relevant positions. It is unlikely that this form of faulting will occur on the new 765kV power lines, owing to the large size of the clearances. This voltage size has to EWT's knowledge never had suspected bird streamer faulting.

4.2 Assessment of impacts of the proposed development on avifauna and proposed mitigation measures

APPENDIX A shows a summary assessment of the significance of each impact on avifauna according to the criteria supplied by Savannah Environmental. Those impacts identified as being of medium or higher significance will be investigated in more detail during the EIA Phase of the project.

5. ISSUES THAT NEED TO BE ADDRESSED DURING THE EIA

The most important issue that needs to be addressed during the EIA phase would be to find an acceptable substation site and route corridor for the Delta-Medupi, Medupi-Mokopane and Mokopane-Witkop that will be both technically feasible and environmentally the least damaging. An area that avoids as much as possible, the relatively intact woodland areas, riparian vegetation, wetland, pans, dams and river systems. The identified impacts, detailed above, will be assessed in more detail with particular emphasis being placed on habitat destruction and the impact of collision of birds with the earth wire, as these have been identified as potentially being of high significance. Mitigation measures for the mitigation of the identified significant impacts will also be recommended and explained. In addition to this the potential for negative impacts on this habitat through the construction of the proposed substation site and 765kV power lines will be investigated as well as the likelihood of disturbance of breeding pairs of Red-Data birds during the construction period.

6. METHODOLOGY TO BE APPLIED TO THE EIA STUDY

The following methodology will be applied to EIA study:

- Bird sensitive areas will be identified as far as possible using a combination of the following methods:
  - Detailed field investigations
  - Google Earth satellite imagery
  - Interviews with field workers of the EWT
  - Comments received from Interested and Affected Parties via the Public Participation process
  - The CSIR Land Cover Project
  - Reporting rates in the Atlas of southern African birds
  - Field observations conducted in June and December 2008.

Based on the above, a preferred substation site and route alignment will be selected. Recommendations for the appropriate mitigation of potential impacts associated with the construction of the Mokopane substation and associated 400kV and 765kV power lines will also be formulated.

7. CONCLUSION

With the presence of river systems and numerous agricultural fields, this area is particularly attractive to many species of birds and as a result the proposed development will undoubtedly have an impact on the birdlife occurring there, as their habitat will effectively be transformed to accommodate the electrical infrastructure. This report forms the basis of a more detailed assessment, to follow during the EIA phase of the project, that will discuss each of the potential impacts of the Mokopane substation, Delta-Medupi, Medupi-Mokopane, and Mokopane-Witkop power lines on the local bird communities and on the habitat that supports them. It is hoped that through these assessments and the provision of preferred substation site and route alignment with the inclusion of recommendations for mitigation, that a mutually beneficial coexistence between the natural environment and the electrical infrastructure can be achieved.

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APPENDIX A: A summarised evaluation of the impacts of the proposed development on the avifauna of the area.

Nature of the impact	**Extent of impact**	**Original Corridor 1**	**Corridor 1**	**Original Corridor 2**	**Corridor 2**	**Corridor 3**	**Matimba-Witkop Corridor**	**Corridor 4**	**Corridor 5**	**Corridor 6**	**Corridor 7 Delta-Medupi**
Habitat destruction through construction & maintenance of the proposed power lines	Local	High	High	Low	Low	High	Medium	Medium	Low	Low	Medium
Disturbance during construction & maintenance of the proposed power lines	Local	Medium	Medium	Low	Low	Medium	Medium	Medium	Low	Low	Medium
Collision of birds with earth wires of the 765kV power lines Particularly Red Data species such as Blue Crane, Secretarybird, Southern Bald Ibis, Denham's Bustard, Kori Bustard, White-bellied Korhaan, Greater and Lesser Flamingos, the various vulture and stork species	Local	Medium	Medium	High	High	Medium	Medium	Medium	Medium	Medium	Medium
Electrocution of birds on power lines	N/A	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact

APPENDIX A: A summarised evaluation of the impacts of the proposed development on the avifauna of the area.

Impact of birds on quality of supply	Local	**Low** *cross rope suspension towers* **Medium** *self support towers*	**Low** *cross rope suspension towers* **Medium** *self support towers*	**Low** *cross rope suspension towers* **Medium** *self support towers*	**Low** *cross rope suspension towers* **Medium** *self support towers*	**Low** *cross rope suspension towers* **Medium** *self support towers*	**Low** *cross rope suspension towers* **Medium** *self support towers*	**Low** *cross rope suspension towers* **Medium** *self support towers*	**Low** *cross rope suspension towers* **Medium** *self support towers*	**Low** *cross rope suspension towers* **Medium** *self support towers*	**Low** *cross rope suspension towers* **Medium** *self support towers*
Nesting of birds on towers	Local	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low