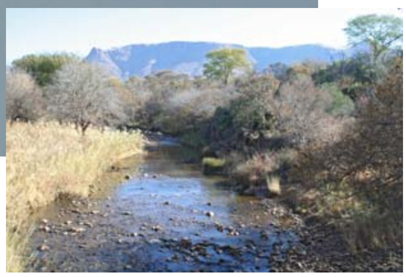
Endangered Wildlife Trust

Steelpoort Integration Project

Bird Impact Scoping Study



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EXECUTIVE SUMMARY

This study deals with the potential impact on birds of a proposed 400kV line and associated infrastructure to be built near Steelpoort in the Limpopo Province, known as the Steelpoort Integration Project. The greater study area contains elements of both grassland and woodland, but the proposed alignments are situated within woodland. The land use is largely mining and commercial farming with a mixture of game, cattle and crop cultivation – both dryland and irrigation. Small sections of the study area contain subsistence farming, with a mixture of cattle and crop cultivation. Electrocutions are not envisaged as an impact on these lines as the clearances are too large for birds to bridge between the live parts. Collisions are envisaged and the risk will be highest where an alignment crosses the Steelpoort River and in close proximity to agricultural activity, specifically irrigated crops. In this respect the Abdim's and White Stork could be at risk if they congregate on agricultural fields in numbers. The De Hoop Dam will have a major influence on the birdlife and, once completed, will increase the likelihood of birds commuting up and down the Steelpoort River to and from the dam. This will in turn increase the risk of collisions with the power line where it crosses the river, due to higher avian traffic. Overall the extent of the collision impacts will be local for most species, for example waterbirds and Secretarybirds, although in the case of migrant species such as the White and Abdim's Stork, the impacts could be regarded as international as these birds are international and intra-African migrants respectively. If the De Hoop Dam attracts species such as flamingos and pelicans, the potential collision impacts will be regional, as these species wander widely in southern Africa in search of suitable conditions. The significance of the collision impacts will depend largely on the species that will be affected; no general statement in this regard can be made at this stage without a more detailed, per species analysis. The habitat at the proposed substation site is not uniquely sensitive as far as birdlife is concerned, therefore the impact on the resident species at this site should be low. During the next phase of the study, the following aspects will be further explored:

- The potential impacts, particularly bird collisions with the proposed line.
- Examples of specific bird micro-habitat will be illustrated.
- Particular attention will be given to the envisaged magnitude of the impacts, and the nature, extent, locality, duration, probability and significance **per species** will be assessed.
- Mitigation measures to reduce potential impacts will be proposed.

1 INTRODUCTION

This study deals with the potential impact on birds as a result of the construction of a proposed 400kV lines and associated infrastructure in the Limpopo Province, known as the Steelpoort Integration Project. The scope of works includes the following:

- Construction of a 400 kV substation at the Pumped Storage Scheme (referred to as the Steelpoort Substation) approximately 50km south of the town of Steelpoort.
- Construction of 2 400 kV transmission power lines looping-in and -out of the Duvha-Leseding 400 kV line into the proposed Steelpoort substation.
- Construction of a 400 kV powerline between the proposed Steelpoort Substation and the existing Merensky Substation.
- Associated works to integrate the station into the Transmission grid (such as access roads and a communication tower at the Steelpoort Substation).

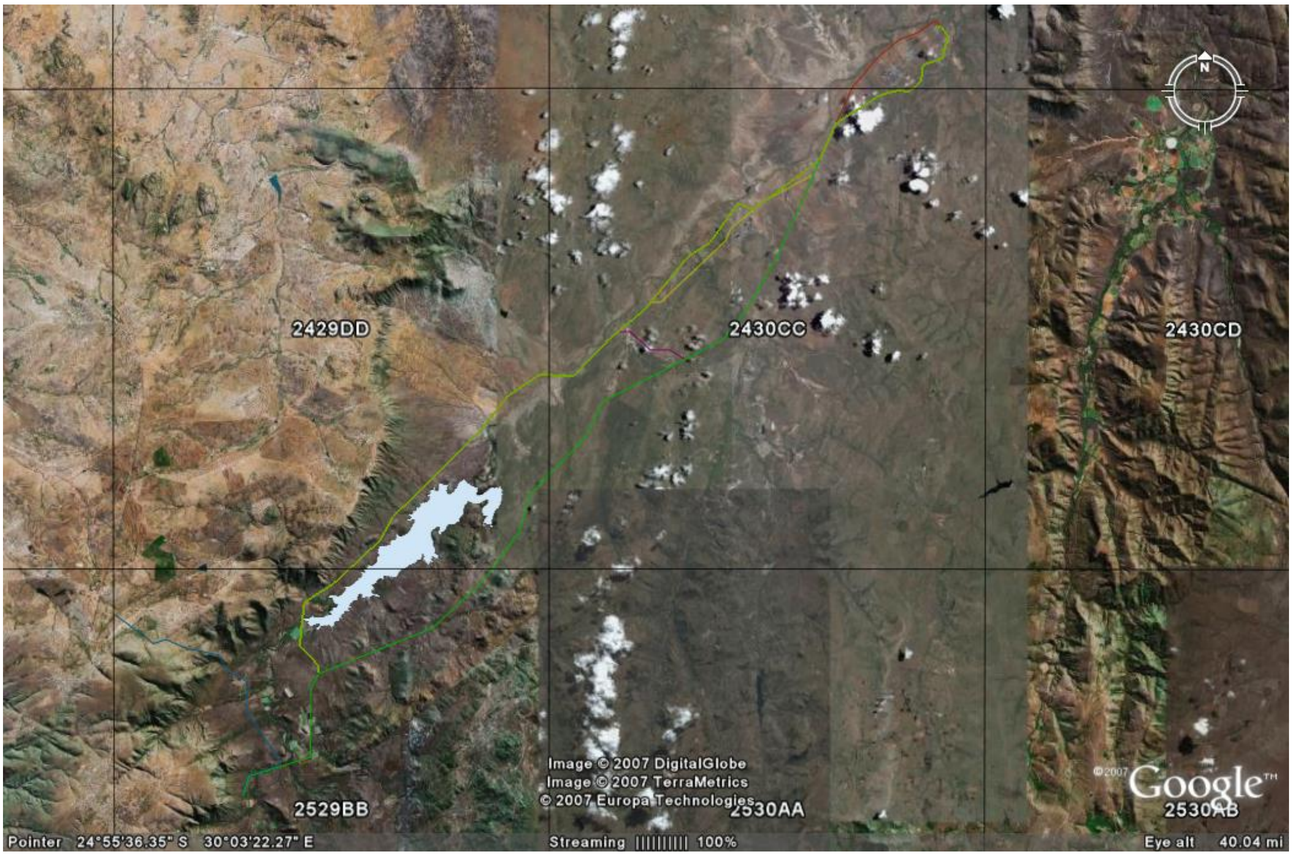

Figure 1: The study area with proposed alignments

2 BACKGROUND AND BRIEF

The Endangered Wildlife Trust was contracted to investigate the potential impacts on birds as a result of the proposed infrastructure. The detailed brief consisted of the following:

- A description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project;
- a description and evaluation of environmental issues and potential impacts that have been identified;
- direct, indirect and cumulative impacts of the identified issues must be evaluated within the Scoping Report in terms of the following criteria:
  - the nature, which shall include a description of what causes the effect, what will be affected and how it will be affected;
  - the extent, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international
- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts;
- a comparative evaluation of the identified feasible alternatives, and nomination of a preferred alternative for consideration in the EIA phase; and
- the identification of potentially significant impacts to be assessed within the EIA phase and details of the methodology to be adopted in assessing these impacts. This should be detailed enough to include within the Plan of Study for EIA and must include a description of the proposed method of assessing the potential environmental impacts associated with the project.

3 STUDY AREA

The study area is located in the following quarter degree squares (1:50 000 maps):

- 2429DD
- 2529BB
- 2430CC

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

3.1 Vegetation types and bird habitats

It is widely accepted that vegetation structure is more critical in determining bird habitat, than the actual plant species composition (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).

As can be seen in TABLE 1, the three quarter degree squares fall both in the savannah (woodland) and grassland biomes, **but the proposed alignments within the study area fall exclusively within the savannah (woodland) biome.**

TABLE 1. The percentage area of each quarter degree square in the study area that is classified as each biome or vegetation type (Harrison *et.al*. 1997)

Biome	**Vegetation type**	**2429DD**	**2430CC**	**2529BB**	**Average**
Grassland	Sour Grassland	46%	30%	58%	44.6%
Savannah	Moist Woodland	54%	70%	42%	55.4%

Moist woodland comprises predominantly broadleaved, winter deciduous woodland. Grass cover is determined by fire and grazing. Woodland has the most species rich bird community in southern Africa. From a powerline interaction perspective, the species potentially most vulnerable are the large raptors and vultures, as many of these species occur predominantly in woodland. Large terrestrial birds are less well represented, with the Kori Bustard and the Ground Hornbill being notable exceptions. These two powerline sensitive species once occurred throughout the woodland biome, but their numbers have been vastly reduced outside protected areas and they do not occur within the study area anymore (Harrison *et.al*. 1997).

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 is therefore important to visit the study area first hand.

The following bird micro-habitats were identified along the proposed alignments:

Drainage line/wetlands: Wetlands are characterized by slow flowing water and tall emergent vegetation, and provide habitat for many water birds. The high rate of destruction and degradation of wetlands in South Africa in the past has resulted in many of the wetland dependant bird species being allocated Red Data status. The main drainage line in the study area is the Steelpoort River and associated tributaries. The river has been heavily impacted on by agricultural activity. The riparian vegetation that forms important refuges for many birds (e.g. large trees that provide breeding substrate for raptors) have largely been destroyed through agricultural activity, but tall riverine vegetation remains in some areas. Birds that could still be expected along these river courses are several species of egrets and herons, hamerkops, waders, cormorants and ducks. Due to the heavy impacts and general human disturbance, most of river - dependent storks, such as the Saddlebilled Stork, have disappeared. Black Storks might possibly occasionally forage in the river. The African Finfoot would have occurred along the once heavily wooded banks, but these have probably disappeared due to a combination of habitat destruction and disturbance. There are several man-made impoundments in the study area, particularly along the western alignment. Depending on the water levels and the extent of exposed shoreline, these could also attract a number of the species mentioned above.

An important feature of the landscape that has not yet materialised, but will happen in the near future, is the construction of the De Hoop Dam. This will create a vast expanse of open water which will materially influence bird occurrence and distribution in the area. Many waterbirds will potentially be attracted to this dam and its shores, including species such as African Fish Eagle, Yellow-billed Storks and both species of flamingos. It is not possible to predict exactly which species will eventually settle here, but it is safe to say that it will attract a large volume of water bird traffic. The fact that the dam will not be full most of the time, will probably enhance the attractiveness of the dam to most wading species, as it will result in more exposed shorelines and therefore more foraging habitat.

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 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. In this study area, there are significant arable lands, mostly along the Steelpoort River but also in other areas, for example north of the Steelpoort River in communal lands. Many of the commercial agriculture in the area is irrigation based, mostly along the Steelpoort River and some of the associated 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 Blackheaded Heron might follow tractors in the planting season to scoop up insects that have been exposed.

Woodland: Patches of the study area are communal land, especially along the western 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 farming areas, particularly along the eastern alignment, the original woodland vegetation still persists and human population densities are reasonably limited, compared to some of the other areas. In these areas, the presence of cattle carcasses could attract vultures, Marabou Storks and the occasional Tawny Eagle. The open woodland country will also be attractive to snake eagles, particularly Blackbreasted Snake Eagles. In these areas, it could be expected that most of the medium to large raptors will still occur, for example Wahlberg's Eagle, Steppe Buzzard, Brown Snake Eagle and African Hawk Eagle. Martial Eagle might occasionally visit the area, but the level of human disturbance makes it unlikely that they will breed in the area.

Mountains/escarpment: The study area contains a range of mountains north-west of the future De Hoop Dam. Dense woodland is evident in the south-east facing kloofs and valleys. Depending on the availability of cliff faces, this area could be utilised by a range of powerline sensitive species, particularly raptors such as Lanner Falcon, Verreaux's Eagles and possibly Crowned Eagle (which was recorded in 2529BB during the Atlas period). The proposed turn-in crosses a part of this habitat.

Urban development: Both of the proposed alignments and the northern sub-alternative pass some residential/urban developments in the vicinity of the Merensky substation. There is also a significant urban development planned to the north of Steelpoort (basically in the area where the northern sub-alternative is proposed). The only powerline relevant species that benefits greatly from these developments is the Pied Crow, and to a lesser extent Yellowbilled Kites.

4 STUDY APPROACH

4.1 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 was obtained for each quarter degree square within the study area (marginal overlaps were discounted).
- Data from the Co-ordinated Waterbird Count (CWAC) project was also used to determine whether any important waterbird sites are located in study area (Taylor, Navarro, Wren-Sargent, Harrison and Kieswetter, 1999).
- The Important Bird Areas 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 through visits to the area in a vehicle and through observation from a helicopter.
- The CSIR Land Cover Project was used to identify the land cover in the study area.
- High resolution imagery from Google Earth was used to further identify sensitive bird habitat.

4.2 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.
- Sources of error in the SABAP database, particularly inadequate coverage of some quarter degree squares. This means that the report rates of species may not be an accurate reflection of true densities in quarter degree squares that were sparsely covered (for a full discussion of potential inaccuracies in ASAB data, see Harrison, Allan, Underhill, Herremans, Tree, Parker and Brown, 1997). Unfortunately, some squares were very poorly covered and that data was interpreted with caution (e.g. 2529DD Nebo with only 25 data cards completed).
- Difficult road access made examination of the study area from the ground exceptionally difficult in some areas, which means that important micro habitat along the alignments, may have been overlooked by the author.
- 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.

5 POWER LINE SENSITIVE SPECIES OCCURRING IN THE STUDY AREA

TABLE 2 below lists the **powerline sensitive** Red Data (Barnes 2000) bird species recorded in 2429DD, 2430CC and 2529BB (Harrison *et.al.* 1997). In total, 15 species have been recorded, 9 of which are 'vulnerable', 4 of which are 'near threatened' and two of which are 'endangered'. Two species, the White and Abdim's Stork, are protected under the Bonn Convention on Migratory Species. Those species for which suitable habitat exists along the alignments (and that could therefore potentially be recorded along the proposed alignments) are highlighted in grey. The remaining species are unlikely to occur along the alignment due to unsuitable habitat.

TABLE 2. Red Data species recorded in 2429DD, 2430CC and 2529BB (Harrison *et.al.* 1997).

Species	Red Data status	Preferred habitat
White Stork	Bonn	Agricultural fields, pastures, natural grassland
Black Stork	NT	Rivers, dams, cliffs
Abdim's Stork	Bonn	Agricultural fields, pastures, natural grassland
Secretarybird	NT	Old lands, grasslands, open woodland
Crowned Eagle	NT	Indigenous forest
Lanner Falcon	NT	Open woodland, cliffs
Bald Ibis	V	Grasslands, especially freshly burnt
Cape Vulture	V	Woodland, cliffs
Whitebacked Vulture	V	Woodland
Tawny Eagle	V	Woodland
African Marsh Harrier	V	Wetlands with dense reeds
Lesser Kestrel	V	Grasslands, old lands
Blue Crane	V	Grasslands, old lands
White-bellied Korhaan	V	Grasslands

V = Vulnerable; NT = Near threatened; Bonn = Bonn Convention on Migratory Species;

6 COMPARISON OF CORRIDORS

One of the objectives of this study is to arrive at a preferred corridor for the proposed power line in terms of impacts on avifauna. Normally, in order to arrive at a preferred corridor, the following factors are taken into account:

- Red Data diversity in the study area.
- Red Data density in the study area.
- The distance of each corridor in each quarter degree square that comprises the study area.

In this instance this method could not be used as the alternative corridors for the Steelpoort-Merensky line are basically equal in length and run through the same quarter degree squares. An additional method had to be designed to measure the relative risk associated with the two corridors, which is detailed below.

6.1 Relevant factors in selecting a preferred corridor

The following factors were incorporated in the formula, using the CSIR Land Cover Database and high resolution Google satellite imagery as the main source of data:

- Wetlands and dams: Wetlands and dams are of particular importance for birds in the study area, as the area is relatively arid. Currently the study area does not contain many large wetlands and dams, but a few have been identified from the satellite imagery. This will of course change with the construction of the large De Hoop Dam. The presence of wetlands and dams is therefore and indicator of a higher collision risk.
- Rivers: The study area contains the important Steelpoort River and tributaries. Rivers are obviously important for birds and many waterbird species occur only along the rivers. The rivers are particularly important for stork species such as Black Stork and Yellow-billed Stork and are an indication of a higher collision risk.
- Other transmission lines: It is a proven fact that placing a new line next to an existing line reduces the risk of collisions to birds. The reasons for that are two-fold namely it creates a more visible obstacle to birds and the resident birds, particularly breeding adults, are used to an obstacle in that geographic location and have learnt to avoid it (APLIC 1994; Chundar & Choudhury 2005). Other transmission lines running parallel to the proposed alignments were therefore treated as a risk reducing factor.
- Roads: These were taken as an indication of human activity and particularly vehicle and pedestrian traffic. It was assumed that the birds will avoid the immediate vicinity of roads due to the presence of traffic and pedestrians, and therefore it will reduce the risk of collision with lines running next to roads.
- Towns: Towns are obvious centres of human activity and are generally avoided by large power line sensitive species. The presence of towns and settlements is therefore a risk reducing factor.
- Irrigation: Irrigation crops, especially lucerne, are important draw cards for species such as cranes and storks, especially in an arid landscape and increase the risk of collisions.
- Fallow lands: Fallow lands create artificial open areas in woodland, which are much favoured by species such as Kori Bustards and Secretarybirds.

6.2 Designing an index to calculate the collision risk in each corridor

The factors mentioned in 6.1 were incorporated into a formula to arrive at a risk rating for each corridor. The formula was designed as follows:

- Wetlands and dams: The length of alignment running within 500m of a dam or wetland was measured.
- The number of rivers crossed by each alignment was counted.
- The total length of primary and secondary roads within 500m of an alignment was measured in kilometres.
- The number of settlements/mining activity located within 1km of each alignment was counted.

- The distance that the proposed alignments are directly parallel to other lines was measured.
- The length of alignment running parallel with or across irrigated crops and fallow lands was measured in kilometres.

In order to facilitate the analysis, the alignments were further divided into sections (see figure 2 below).

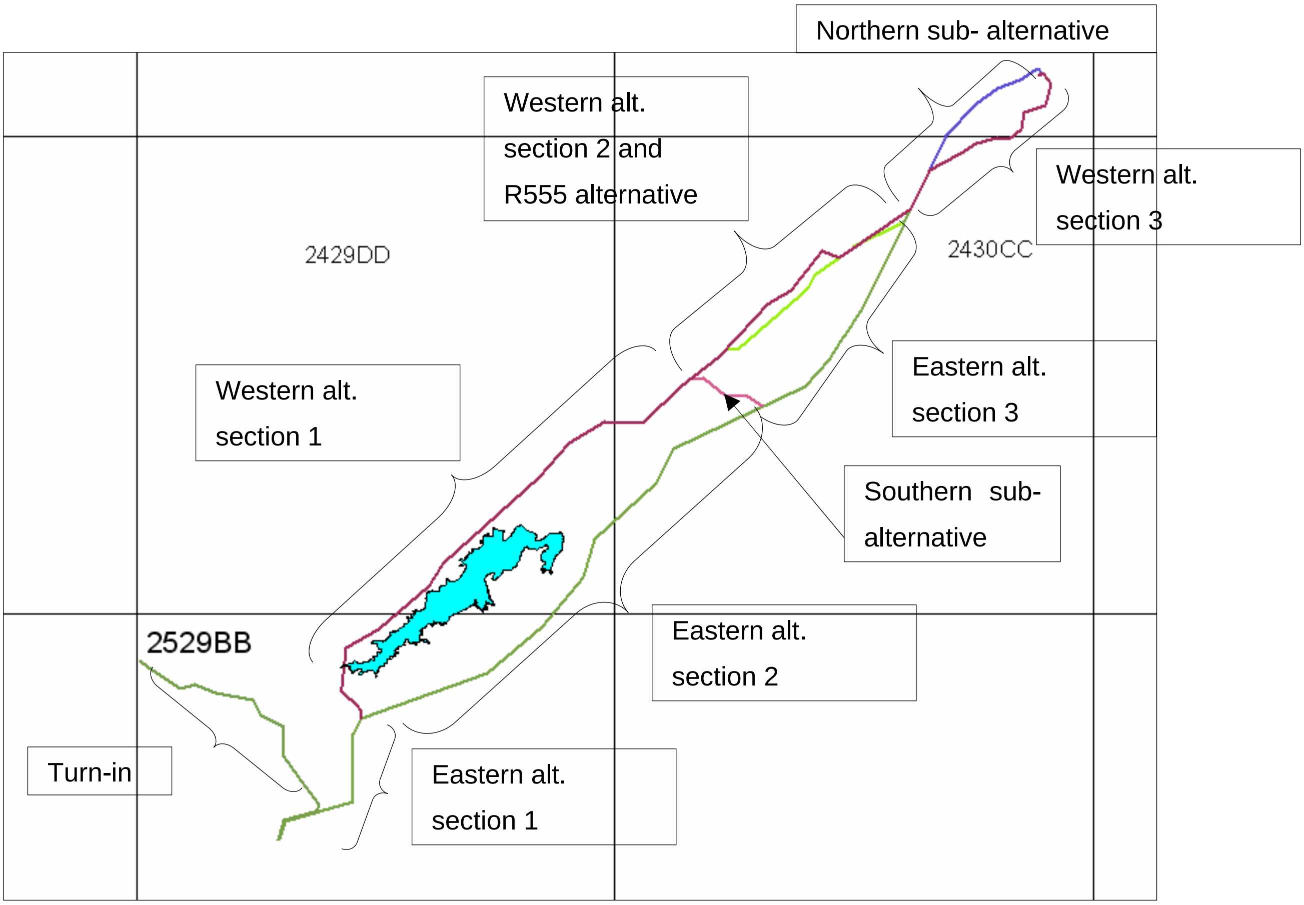

Figure 2: The alignments were divided into sections for purposes of the analysis below.

The results of measurements and counts for both alternatives are as follows:

Risk Factor	Eastern alt. section 1	Eastern alt. section 2	Eastern alt. section 3	Western alt. section 3	North sub-alt.	West alt. section 2	R555 sub-alt	West alt. section 1	South sub-alt.
Dams/wetlands	0.35	1.1	4			1.71	2.34	23.3	0.6
River crossings	15		9			3	3	6	
Existing TX lines	-1.18		-10.27	-8.68		-1.82	-0.89		
Roads	-9.84			-10.04	-11.56	-14.52	-24.3	-35.9	-8.74
Suburban/industrial				-15	-15	-5	-5	-10	
Irrigation/fallow lands	4.72		1.04	2.14		13.06	4.72	10.48	
Total	**9.05**	**1.1**	**3.77**	**-31.58**	**-26.56**	**-3.57**	**-20.13**	**-6.12**	**-8.14**

Obviously all these factors do not have an equal impact on the size of the risk, therefore a weighting was assigned to each factor, based on the author's judgment on how important the factor is within the total equation.

The following weights were assigned. Risk reducing factors were assigned a negative weight:

Risk weighting	
Dams/wetlands	5
River crossings	3
Existing TX lines	-1
Roads	-2
Sub-urban/industrial	-5
Irrigation/fallow lands	2

The final risk score for a **factor** was calculated as follows: measurements/counts x weighting. The final risk rating for an **alignment** was calculated as the sum the risk scores of the individual factors:

Alternatives	**Score**
Eastern alt. 1,2,3 + western alt.3	-17.66
Eastern alt. 1,2,3+northern sub-alt	-12.64
Eastern alt.1+western 1,2,3	-32.22
Eastern alt.1+western 1+R555 sub-alt.+ Western 3	-48.78
Eastern alt.1+western 1,2,+ Northern sub-alt.	-27.2
Eastern alt.1+western 1+ R555 sub-alt.+ Northern sub-alt.	-43.76
Eastern alt.1+ western 1+southern sub+eastern 3 +western 3	-33.02
Eastern alt.1+ western 1+southern sub+eastern 3 + northern sub.alt	-28

From the analysis it is clear that the combination of the **eastern alternative section 1 + western alternative section 1 + R555 sub-alternative + western alternative section 3** probably holds the least risk of bird interactions, and it is therefore recommended as the preferred alternative from a bird interaction perspective. The prevalence of roads and suburban development in the proximity of the western alignment played a major role in the outcome of the scores, despite the relatively large amount of wetlands and fallow lands.

As far as the turn-ins are concerned, only one alignment is proposed, but the alternative of considering a double-circuit line (rather than 2 lines in parallel) need to be considered. On top of the escarpment, the alignment goes through heavily degraded grassland with dense human and livestock populations, which means fewer birds all round. Below the escarpment the proposed alignment goes through relatively intact woodland.

The question whether two lines or one double-circuit line will be used is not of material importance, as neither of the two options will pose a significantly bigger or smaller risk of collisions to birds. Both options might result in some risk to large soaring birds such as vultures and storks along the escarpment. However, if self-supporting double circuit towers are used, it will result in more perching space for birds on the towers. This in turn could result in a bigger risk of streamer-induced faulting on these towers. Vultures and other large raptors might use towers along the escarpment as roosting substrate as they often choose such towers for roosting, presumably due to the good visibility all round and the constant presence of wind along the escarpment, which facilitates take-off and soaring. These potential impacts will need to be further investigated in the next phase of the study.

Lastly it must be mentioned that there is a significant urban development planned to the north of Steelpoort (basically in the area where the northern sub-alternative is proposed). If this is approved and implemented, it will have a negative impact on birds occurring along the northern sub-alternative. This might influence the outcome of the analysis of the different alternatives above, but it should not materially influence the overall conclusion, namely that western alternative is more preferred from bird impact perspective then the eastern alternative.

7 PARTICULARS OF LINE DESIGN

At the time of writing, the type of structure to be used had not been finalised, although it is likely to be the cross-rope suspension structure (Savannah Environmental pers.comm 12/06/07). Self-supporting strain towers will be used at bend points along the line.

Important aspects from a bird interaction perspective are the following:

- The design has no inherent electrocution risk for large birds because the clearances between live parts and live and earthed components exceed the wingspan of any bird.
- The earth wire will be the biggest risk from a bird interaction 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 design of the suspension towers is such that bird streamers are unlikely to be a source of faulting on the line. Birds tend to perch on the highest points first, in this instance the earth peaks. The perching space above the conductors is uncomfortable

and restricted. This type of tower has never had suspected bird streamer faulting (Eskom Transmission Engineering pers.comm).

- There is a possibility that birds will perch on the strain towers, as these are self-supporting towers with ample perching space above the conductors. This could lead to streamer faults which will have to be investigated in the next phase of the study.
- The design of the possible double-circuit towers for the turn-ins has not been finalised at this stage. It will however most likely have more perching space for large birds, which could in turn lead to the risk of streamer-induced faulting. The earth wires could pose a similar risk of collision to flying birds as those on the cross-rope suspension structures. Both these issues will have to be investigated in the next phase of the study.

8 NATURE OF EXPECTED 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 discussion of the issues that need to be investigated in the next phase of the study.

8.1 Electrocutions

Electrocution of birds on overhead lines is an emotional issue as well as 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 132 kV, 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 using power lines as roosts, especially in areas where large trees are scarce (pers.obs.).

Electrocutions are not envisaged as an impact on these proposed lines.

8.2 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). Of the top five most affected species the White Stork and Cape Vulture are present in this study area. It should be noted that these are only the reported mortalities, it is suspected that a large number of mortalities go unreported. In one instance, where bi-monthly monitoring took place, a single 10 km section of 132kV distribution line killed 59 Blue Cranes, 29 Ludwig's Bustard, and 13 White Storks in a three year period (van Rooyen unpubl. data). In 2004, fifty-four Blue Crane carcasses were discovered near Graaf-Reinett in the Northern Cape province under 3.7km of distribution line.

Data collected in the Northern Cape Province between 1997 and 1999 provides further evidence of the gravity of the problem. During an initial clearing of transects, a total of 194 large bird carcasses were found under 40km of Transmission line (220 and 400kV) near De Aar in the Northern Cape. Subsequent monitoring of 140 km of power lines (transects of 10km each from 22kV up to 400kV) in the same area over a period of 12 months produced another 196 carcasses (mostly cranes and bustards) the majority under transmission lines (Anderson 2001).

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. A good example of this is the two flamingo species that occur in southern Africa, which have experienced hardly any successful breeding attempts at Etosha Pan in Namibia for several decades. Another example is the Great White Pelican that only breeds successfully at Dassen Island in the Western Cape. 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.

From the figures quoted above, it is clear that power lines can be a major cause of avian mortality among power line sensitive species, especially Red Data species. Furthermore, the cumulative effects of power lines and other sources of unnatural mortality might only manifest itself decades later, when it might be too late to reverse the trend. It is therefore imperative to reduce any form of unnatural mortality in these species, regardless of how insignificant it might seem at the present moment in time.

In the context of the current study, the risk of collisions will be highest where an alignment crosses the Steelpoort River and in close proximity to agricultural activity, specifically irrigated crops. In this respect the Abdim's and White Stork could be at risk if they congregate on agricultural fields in numbers. As mentioned earlier, the De Hoop Dam will have a major influence on the birdlife and will increase the likelihood of birds commuting up and down the Steelpoort River to and from the dam. This will in turn increase the risk of collisions with the power line where it crosses the river, due to higher avian traffic. Overall the extent of the collision impacts will be local for most species, for example waterbirds and Secretarybirds, although in the case of migrant species such as the White and Abdim's Stork, the impacts could be regarded as international as these birds are international and intra-African migrants respectively. If the De Hoop Dam attracts species such as flamingos and pelicans, the potential collision impacts will be regional, as these species wander widely in southern Africa in search of suitable conditions. The significance of the collision impacts will depend largely on the species that will be affected, no general statement in this regard can be made at this stage without a more detailed, per species analysis. The possibility of African Crowned Eagles being threatened by the turn-in lines where it crosses a slope next to a valley will require further investigation in the next phase of the study.

8.3 Habitat destruction and disturbance

During the construction phase and maintenance of power lines and substations, some 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 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. 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. The habitat at the proposed substation site is not uniquely sensitive as far as birdlife is concerned, therefore the impact on the resident species should be low.

9 CONCLUSION

During the next phase of the study, the following aspects will be further explored:

- The potential impacts, particularly bird collisions with the proposed line.
- Examples of specific bird micro-habitat will be illustrated.

- Particular attention will be given to the envisaged magnitude of the impacts, and the nature, extent, locality, duration, probability and significance **per species** will be assessed.
- Mitigation measures to reduce potential impacts will be proposed.

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