ESKOM TRANSMISSION

PROPOSED THYSPUNT GRASSRIDGE 400KV TRANSMISSION POWER LINES Northern Corridor

AVIFAUNAL SPECIALIST STUDY – EIA Phase

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SPECIALIST INVESTIGATOR

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

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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.
- 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 by the lead consultant should this information be incorrect.

- 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.
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Signed on the **29th November 2010** by Luke Strugnell in his capacity as specialist investigator for the Endangered Wildlife Trust's Wildlife and Energy Programme.

EXECUTIVE SUMMARY

The Endangered Wildlife Trust (EWT) were appointed by SiVEST to conduct a specialist avifaunal impact assessment study as part of the EIA process for the proposed Thyspunt Grassridge 400kV power lines. The proposed lines will run from the High Voltage (HV) Yard associated with the new proposed Thyspunt nuclear power station, located between Cape St Francis and Oyster Bay, to the Grassridge and Dedisa Substations, north of Port Elizabeth.

Interactions between birds and power lines typically take a number of forms. *Electrocution of birds* is unlikely on a line of this size due to the large clearances between live hardware, and live and grounded hardware. *Collision of birds* with the power line conductors and earth wires is a significant negative impact on many species, in particular large terrestrial species such as cranes, storks and bustards. *Habitat destruction* and *disturbance* are inevitable during construction and maintenance activities and affect birds to varying degrees. Certain bird species are *capable of impacting on the quality of supply of power lines* by causing faults (short circuits), through bird streamers, bird pollution (faeces), and nesting. Power line towers in turn provide *nesting substrate* for certain bird species, some of which might benefit through the increased availability of nesting substrates.

This study consists of a corridor running between the proposed Thyspunt Nuclear Power Station HV Yard site and the Grassridge substation that is to accommodate 3x 400kV transmission lines. The preferred corridor was determined primarily by the length of the corridor, presence of IBA's, habitat and topography, rivers and dams and presence of protected areas.

The corridor bisected a total of 9 Quarter degree squares or 1:50000 maps and the dominant vegetation types in the study area included Thicket and Fynbos, with important bird 'micro-habitats' including dams, wetlands, arable/cultivated lands, flats and plains and ridges. Data from the Southern African Bird Atlas Project (SABAP) (Harrison *et al,* 1997), which recorded bird species presence and abundance on a quarter degree square basis across southern Africa, was used for this study, as well as data collected from 1998 to 2008, from four CAR (Coordinated Avifaunal Roadcount) routes in the Humansdorp district. From the SABAP data a total of 149 to 291 bird species were recorded in each of the 9 quarter degree squares, these include 37 Red Data species, comprising 2 'endangered', 11 'Vulnerable' and 22 'near-threatened' according to Barnes (2000). In addition, the White Stork (protected internationally under the Bonn Convention on Migratory Species) is considered as a threatened species for the purpose of this study. Many of these Red Data species are confined to the coastal shores or off shore areas and therefore won't be impacted on by the proposed power lines, however several Red Data species recorded here are extremely vulnerable to collisions with overhead earth wires. They include Blue Crane, Denham's Bustard, White-bellied Korhaan, White Stork, Black Stork and Secretarybird.

The collision impact will be mitigated for in two ways: firstly through correct selection of the final corridor and alignment within this corridor; and secondly through marking sensitive sections of the line with a suitable marking device on

the earth wires. **It is recommended that an avifaunal walk through be conducted as part of the site specific EMP to identify specific spans for marking.**

Habitat destruction and disturbance will be of less direct significance to avifauna, but is still cause for concern. Significant removal of vegetation will only take place in the thicket areas – that are not particularly sensitive in terms of threatened avifauna. Disturbance will only be significant if certain species are breeding on or near the final alignment at the time of construction. The avifaunal walk through will identify specific sensitive areas, and breeding birds as far as possible. Case specific mitigation can then be recommended.

Bird related faulting is possible only on the self-support towers as well as any guyed V towers which are likely to be in the minority if the cross rope suspension tower is used. If the guyed V tower is used, faulting will be possible on all towers as there is adequate perching space. This can be mitigated for by installing Bird Guards on these towers to prevent birds from perching in high risk positions. Likewise, nesting by most species will only be likely on self-support towers, and in the case of some species may have a positive impact on the species populations and local abundance. Species such as the Verreaux's Eagle and Martial Eagle may expand their breeding ranges as a result of the increased nesting substrate provided by the power lines. The avifaunal walk through will identify towers requiring Bird Guards, but is recommended that all towers with perching space above conductors have Bird Guards fitted.

Two levels of input into the final routing of the power lines exist for specialists: 1) placing the three lines adjacent or separate in the landscape; 2) and the selection of the preferred route within the corridor.

1) Placing power lines adjacent to each other has a number of advantages in terms of reducing the impact of collision. **This study therefore recommends that the proposed Thyspunt-Grassridge lines are placed as close as technically possible to each other.**

2) The position of cultivated lands, and secondly dams is recommended as the main criteria in determining areas to avoid with the final alignment. Due to the area being largely thicket, the areas that have been cleared for either cultivation or 'improved grasslands' are favoured by large terrestrial bird species like White stork and Blue crane. Where possible the final alignment should avoid being within 500m (or one span ~ 400m) of any cultivated lads or dams. In addition, congregations of dams, and irrigated lands close to dams should be avoided as birds will fly frequently to and from these areas.

In summary, the proposed power lines will undoubtedly impact on the birds of the study area to varying degrees through the various mechanisms described above. Collision of large terrestrial birds with the earth wires of the lines will be the most significant threat, particularly in the west. It is the EWT's opinion that this threat can be mitigated to acceptable levels by a combination of careful routing, and marking of earth wires in sensitive areas. Monitoring of the direct interactions between birds and the power lines i.e. collision, nesting, impact on quality of supply, will be achieved through Eskom's standard operating procedures, and landowner reporting once the lines are operational. In addition, if required, a detailed monitoring programme for the operational phase of the line will be recommended as part of the Operational EMP. This will allow evaluation of the extent of the impacts, and the success of any mitigation measures.

1 INTRODUCTION

1.1 Background

Eskom Transmission plan to build three 400kV overhead power lines as part of the Thyspunt Nuclear power project. In accordance with environmental legislation, Eskom Transmission has appointed SiVEST as independent consultants to conduct the necessary Environmental Impact Assessment for the proposed project. The Endangered Wildlife Trust (EWT) was subsequently appointed by SiVEST to conduct the specialist avifaunal impact assessment.

An initial site visit as part of the scoping phase was conducted in September 2008 and a further site visit was conducted in January 2010.

Overhead power lines and associated infrastructure such as substations are known to impact significantly on various bird species, both directly through causing mortality of birds, and indirectly through disturbance of birds and destruction of (natural) habitats. This study will identify these impacts, their location and significance, and recommend suitable mitigation measures that can be implemented to minimise these impacts. The study will also determine the preferred route within the proposed corridor from an avifaunal perspective.

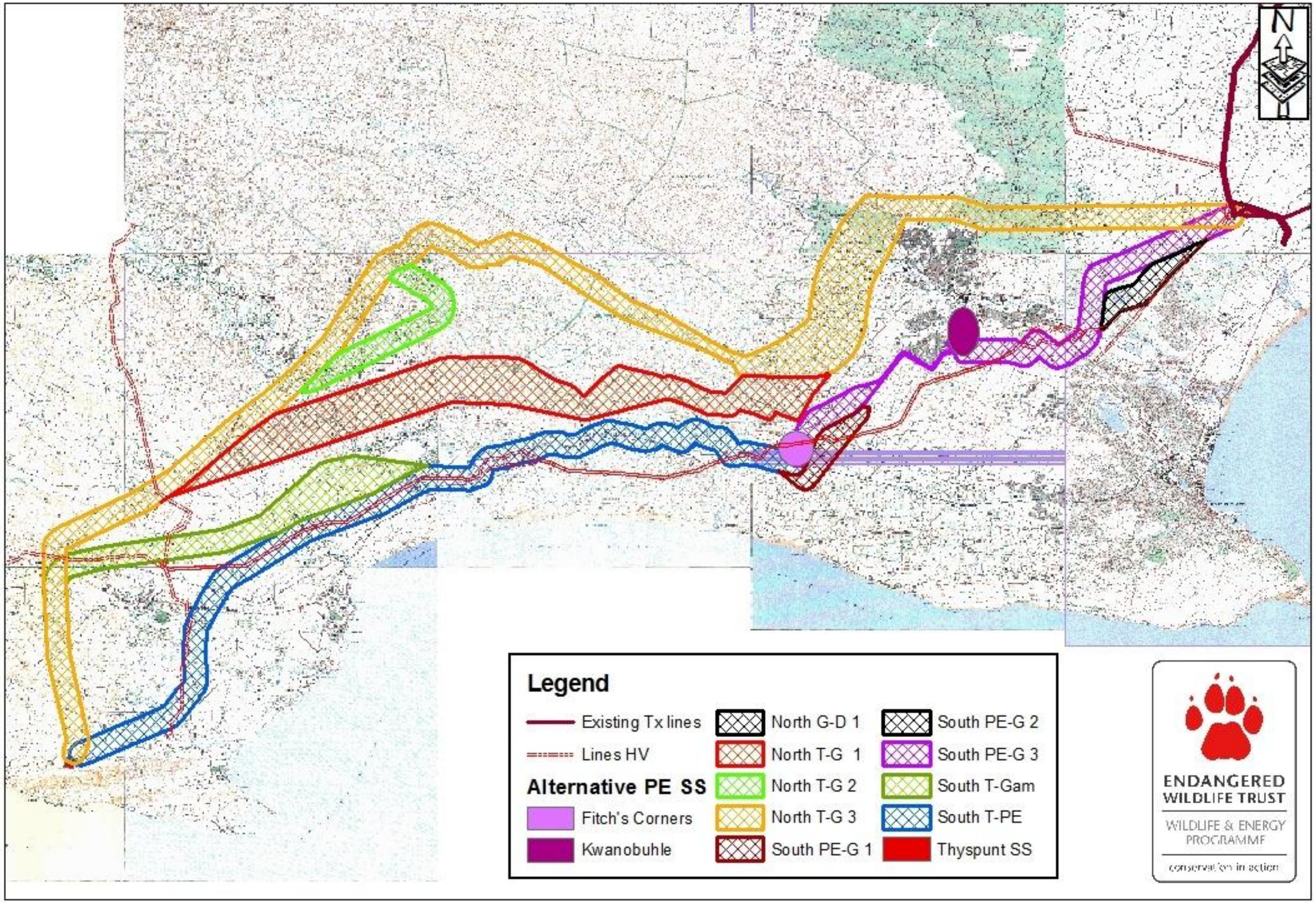

Figure 1. The layout of the northern corridor in relation to all of the routes (Southern Corridor) (Map-EWT).

1.2 Terms of reference

The terms of reference for the avifaunal study, as supplied by SiVEST were as follows:

- 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 transmission lines
- Identify potential impacts (positive or negative, including cumulative impacts if relevant) of the proposed development on avifauna during construction and operation. Particular attention should be paid to bird collisions and preventative measures.
- Pay particular attention must be paid to wetlands (this will require close interaction with the wetland specialist)
- Identify mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks (to be implemented during design, construction and operation of the proposed transmission lines).
- Formulate a simple system to monitor impacts, and their management, based on key indicators
- Identify and address any other aspects related to avifauna in the study area that should be incorporated into baseline study reports.

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 & 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 Avifaunal Road count project (CAR – Young, Harrison, Navarro, Anderson & Colahan, 1997) for the "Humansdorp precinct" was used, the data was taken from counts conducted between 1998 and 2003.
- The Important Bird Areas project data (Barnes 1998) was consulted to determine its relevance to this project.
- The conservation status of all bird species occurring in the study area were then 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, and the extent of the impact.
- Information on the micro habitat level was obtained through visiting the area and obtaining a first hand perspective.
- The National Land Cover database was consulted for information on biomes and vegetation type (CSIR, 2000).
- Electronic 1:50 000 maps were obtained from the Surveyor General.

1.3.2 Methodology

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

- The various abovementioned data sets were collected.
- This 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 to obtain a first-hand perspective of the proposed corridor and birdlife and to determine which bird micro habitats are present and relevant to the study.
- 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.

1.3.3 Limitations & assumptions

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

- The SABAP 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).
- Difficult road access in some sections of the study area limited the effectiveness of examination of the study area from the ground.

General comment: Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour cannot be reduced to formulas that will hold true under all circumstances. However, power line impacts can be predicted with a fair amount of certainty, based on experience gained by the authors through the investigation of more than 400 localities in southern Africa where birds have interacted with power lines since 1996.

2 DESCRIPTION OF PROPOSED ACTIVITIES

2.1 Description of the proposed power lines and aspects relevant to avifauna

The tower structures most commonly used by Eskom Transmission at present are shown in Figure 2. i.e. the cross rope suspension tower. Important aspects of the tower design in Figure 2 for birds are as follows:

- The earth wires will pose the greatest collision risk, they are higher, thinner and less visible than the bundled conductors
- The cross rope suspension towers have no suitable perching space above the conductors, so impact on quality of supply by birds is not anticipated
- The clearances between phase-phase and phase-earth are far to great for birds to be electrocuted through conventional mechanisms
- The self-support tower has proven a very suitable nesting structure for certain bird species. This may have implications for quality of supply on these lines. The cross rope suspension tower has much less suitable nesting space, and may be used by smaller species such as crows which may nest within the vertical columns. This will pose no risk to quality of supply.

It is strongly recommended that the cross rope suspension tower is used on the proposed power line as it removes the threat of bird related faulting on the lines. However, if there are reasons that the Guyed suspension type tower structure is required then it is strongly recommended that the avifaunal walk through recommended elsewhere in this study determines which structures will need bird guards in order to prevent bird related faulting through streamers, bird pollution and nest material.

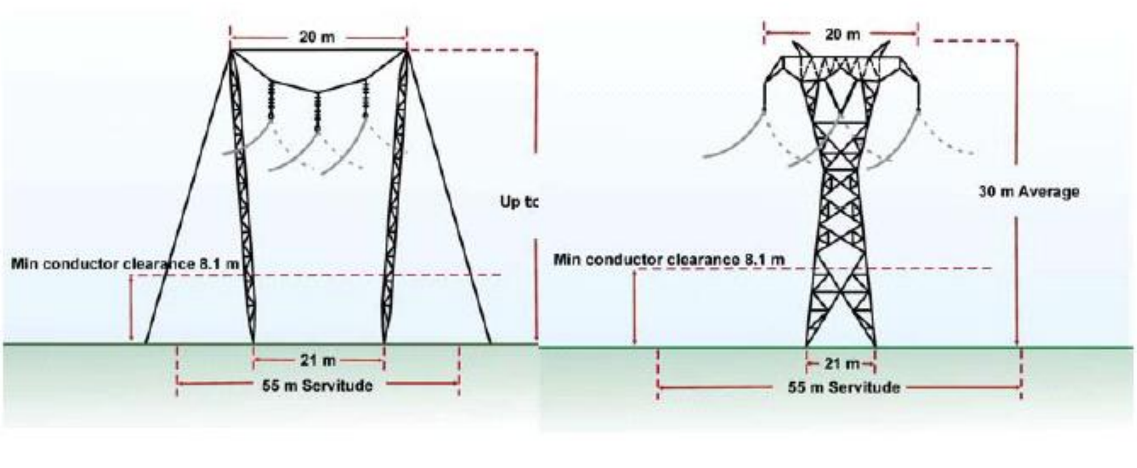

FIGURE 2. The two types of tower structures that could be used. The cross rope suspension tower on the left would be the dominant tower type. The self-support

tower on the right will be used where extra strength is required such as bends and difficult terrain

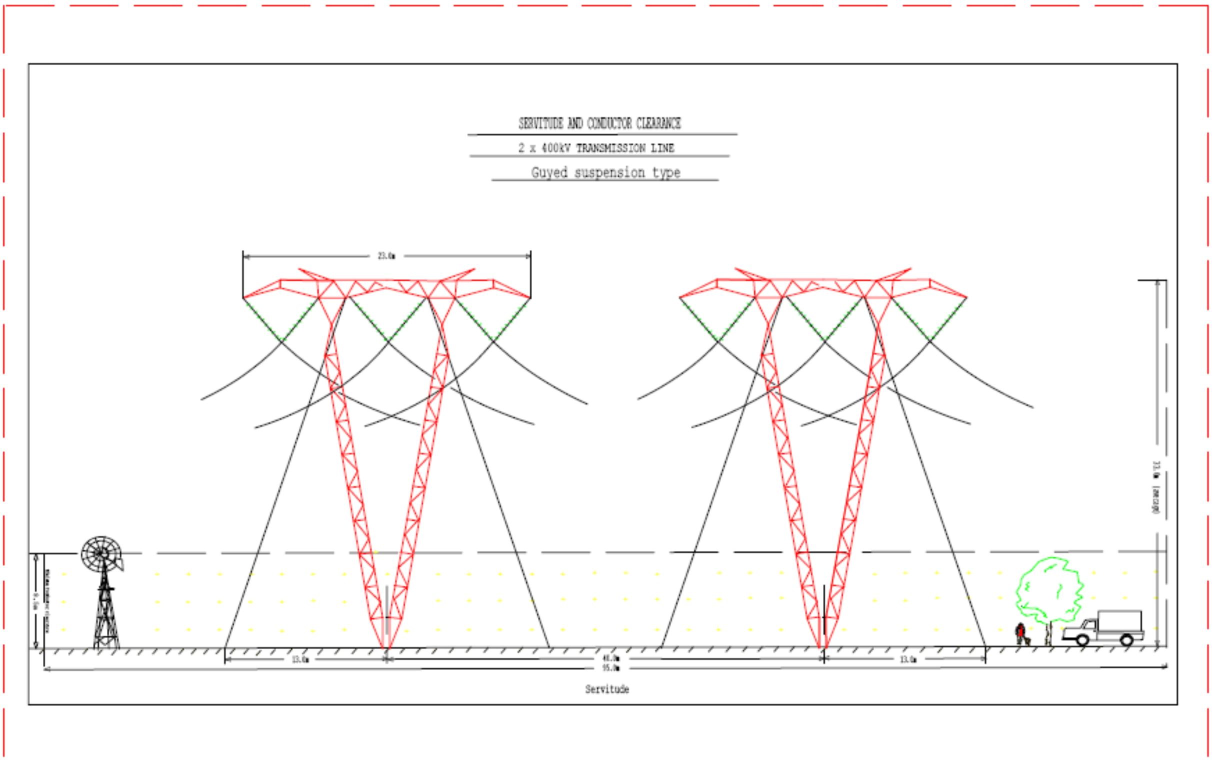

FIGURE 3: Example of the second potential proposed structure to be used, Guyed Suspension Tower

2.2 Description of the proposed corridors

The following is a brief description of the proposed corridor that will accommodate three 400kV lines running from the proposed Thyspunt Nuclear Power Station to the Grassridge substation and from Grassridge to Dedisa.

The Northern Corridors

The Northern Corridor exits the High Voltage (HV) yard associated with the proposed Thyspunt Power Station to the north of the transverse dunes and moves in a northerly direction towards Humansdorp. The corridor crosses the unsurfaced road between Oyster Bay and Humansdorp in the vicinity of the Farm Kleinrivier. The corridor crosses the steeply incised Krom River Valley at the Farm Elandsjagt (downstream of the Impofu Dam) and then crosses the Geelhoutboom River at the Farm Platjesdrift. The corridor crosses R102 and then the Seekoei River and in the vicinity of the farm Geelhoutboom and a small portion of the farm Platjesdrift to the west of Humansdorp. The corridor continues in a northerly direction further traversing the farm Geelhoutboom and across N2 and some hilly terrain to the north of the highway on the farm Pampoensland Rivier. At the farm Pampoensland Rivier, the Corridor turns in a north-easterly direction crossing R332 and some hilly ground at the farm Honeyville. From this section (around Honeyville farm) up to the area around Rocklands, there are three alternatives within the Northern Corridor:

- Alternative 1 – This alternative splits from Alternative 3 in the area of farms Weltevreden and Zuurbron. Alternative 1 traverses the R330 Provincial Road on the farm Weltevreden. It continues through the farm Zuurbron where it crosses the upper reaches of the Kabeljous River. The route alternative then traverses the Gamtoos River Valley in the vicinity of the farms Rooidraai, Bosch Bok Hoek and Spitsbak Estate. It continues in an easterly direction through hilly incised terrain on farms Buffels Hoek and Loerie River where it crosses the R331 Provincial Road. The alternative then traverses the area around Loerie Dam and the Loerie Dam Nature Reserve to the north of the town of Loerie, crossing the farms Loerie River, Geelhoutboom and Jagersfontein. Most of this portion of the route runs to the south of the boundary of Otterford State Forest and the Longmore State Forest, traversing the Longmore Forest offices, housing and saw mill (the Longmore Forest Station). To the east the alternative crosses the farms Platberg, Klaarefontein and before entering the Longmore State Forest to the north of the Van Stadens River Mountains. The corridor traverses forestry land (plantations) through this section, crossing the Van Stadens River. The alternative exits the Longmore area to the north of Van Stadensberg Natural Heritage Site Nature Reserve through the farm Boschfontein where it reconnects to Northern Corridor - Thyspunt (HV Yard) to Grassridge alternative 3 (described below).

- *(Please note – Alternative 2 is a deviation off Alternative 3)* Alternative 2 splits from Alternative 3 south-east of the town of Hankey. The route alternative continues in a north-easterly direction traversing the R331 on the farm Roodefontein and continuing through very hilly, natural terrain on the forms Limebank and Klein Rivier, running parallel with the valley of the Klein River. In the vicinity of the Otterford and Forest Reserve (to the west of the old Otterford Forest Station), the route curves towards the northwest through a very steeply incised area. It continues north-westwards through plantations until it re-joins Alternative 3.

- Alternative 3 splits from Alternative 1 in the vicinity of the R332 Provincial Road and the Diep River at the farms Honeyville, Weltevreden and Zuurbron. To the east of this point the alternative runs roughly parallel to the R330 provincial road down the Hankey Pass into the Gamtoos River Valley. The alternative crosses the Gamtoos Valley to the south of the hamlet of Weston, traversing the farms Rooidraai, Gamtous Riviers and Wagendrift. The alternative passes to the east of Hankey, continuing in a north-easterly direction traversing the R331 Provincial Road. The alternative crosses hilly, incised terrain crossing the Klein River valley on the farms Klein Rivier and Kleinfontein. The alternative continues across very hilly, incised terrain across a l portion of the Stinkhoutberg Nature Reserve, entering the Otterford Forest as the route curves to the south-east through a very steep area within Otterford State Forest, crossing the Hankey Forest reserve and the farm Sand River Heights. The alternative crosses the Sand River upstream of the Sand River Dam through forestry land. The alternative continues in a south-easterly direction, following the southern side of the Elands River valley across the farms Palmiet River and Peneheale, and running parallel to the Elands River Road. The alternative enters the Longmore State Forest, crossing the Bulk River Dam and running through the farm Uplands before linking up with Alternative 1 in the vicinity of the farm Boschfontein.

From the point at which alternative 1 and 3 join, the corridor runs in a north-easterly direction, crossing the farms Boschfontein, Brakkefontein, Ruigteveli and Burghley Hills through an un-inhabited hilly area to the north of Rocklands. The corridor heads north-eastwards along the eastern boundary of Groendal Wilderness Area, traversing the Elands River valley through the Wincanton Estate, Kruisrivier and Mimosadale West. The Corridor then crosses the Swartkops River in the Kruisrivier area west of Uitenhage, crossing a number of small farms in the valley. The corridor then climbs into uninhabited land to the west and north of Rosedale, turning to the east. The Corridor traverses uninhabited farm land to the north of Uitenhage, crossing a minor roads as well as the R75 Provincial Road, running between Levydale and the Springs Nature Reserve and Resort. To the east of the R75, the corridor then crosses farming land on the farms Sandfontein, Gras Rug, Longwood, Rietheuwel and Papenkuils Vley. The corridor crosses the farm Welbedachsfontein, crossing the R335 provincial road before feeding into the Grassridge Substation.

East of the Grassridge Substation the Northern Corridor (existing Servitude) Grassridge to Dedisa runs eastwards across largely natural thicket vegetation on the farm Brak River, then south-eastwards and finally southwards until it terminates at the Dedisa Substation which is located to the north of the R334 and R102.

3 DESCRIPTION OF AFFECTED ENVIRONMENTTopography and vegetation

The western part of the Thyspunt-Grassridge corridor runs over undulating ridges and valleys dominated by fynbos, 'improved grasslands' and large areas under cultivation (pastures and Wheat). The corridor moves north from the Thyspunt High Voltage Yard site towards Humansdorp, where it crosses fairly large ridges with flat plateaus dominated by fynbos and 'improved grassland' that are mowed for bailing, as well as large cultivated land under irrigation. As the line runs east it enters wilderness and forest reserve areas that are dominated by rugged mountains with pristine thicket and forest patches. Below is a map (figure 4) of the various vegetation types followed by a more general discussion on the biomes of the area.

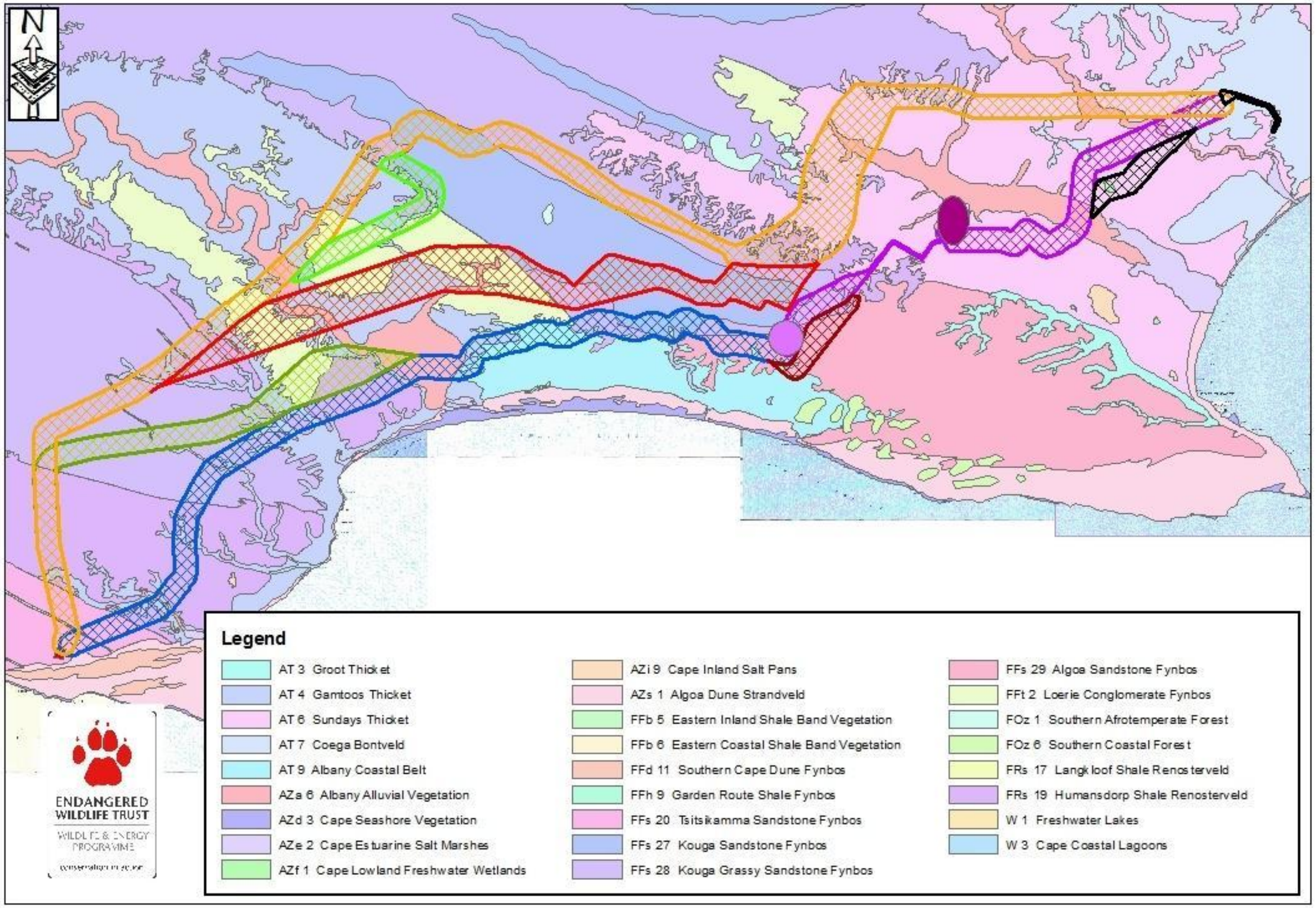

FIGURE 4-Vegetation map of the various corridors (Map-EWT)

3.1.1 Fynbos Biome

Fynbos is dominated by low shrubs and can be divided into two categories, fynbos proper and renosterveld. Despite having a high diversity of plant species, fynbos has a relatively low diversity of bird species, in particular the larger species most relevant to power line impacts. The only Red Data species in this study area that is associated with fynbos is the Black Harrier (which may breed in fynbos).

3.1.2 Thicket Biome

'Thicket' ranges from a closed shrubland to low forest dominated by evergreen, sclerophyllous or succulent trees, shrubs and vines, many of which have stem spines. It is often almost impenetrable, is generally not divided into strata, and has very little grass understory. In terms of the bird species most impacted on by power lines, thicket is not particularly significant, with the possible exception of certain raptor species.

3.1.3 Forest Biome

Insufficient forest exists in the corridor to warrant any further explanation in this study.

3.2 Bird micro habitats

Although much of the distribution and abundance of bird species within the study area can be explained by vegetation type, it is necessary to look at the habitats available to birds to determine where the relevant species will most likely occur within the study area. These "micro habitats" do not always correspond to vegetation types and are determined by a combination of vegetation type, topography, land use, food sources and other factors.

Much of the fynbos in the study area, mostly in the west, has been transformed for agriculture and to promote livestock grazing, making the above vegetation classification less valuable than the discussion of existing microhabitats below. Whilst this obviously resulted in a loss of natural habitat, several species have adapted rather well to this transformation, these species include Blue Crane and White Stork. The wheat lands in the west have had a positive impact on Blue Crane numbers in the area.

Investigation of this study area revealed the bird micro habitats described below. Species likely to make use of the various micro habitats can be seen in Table 1.

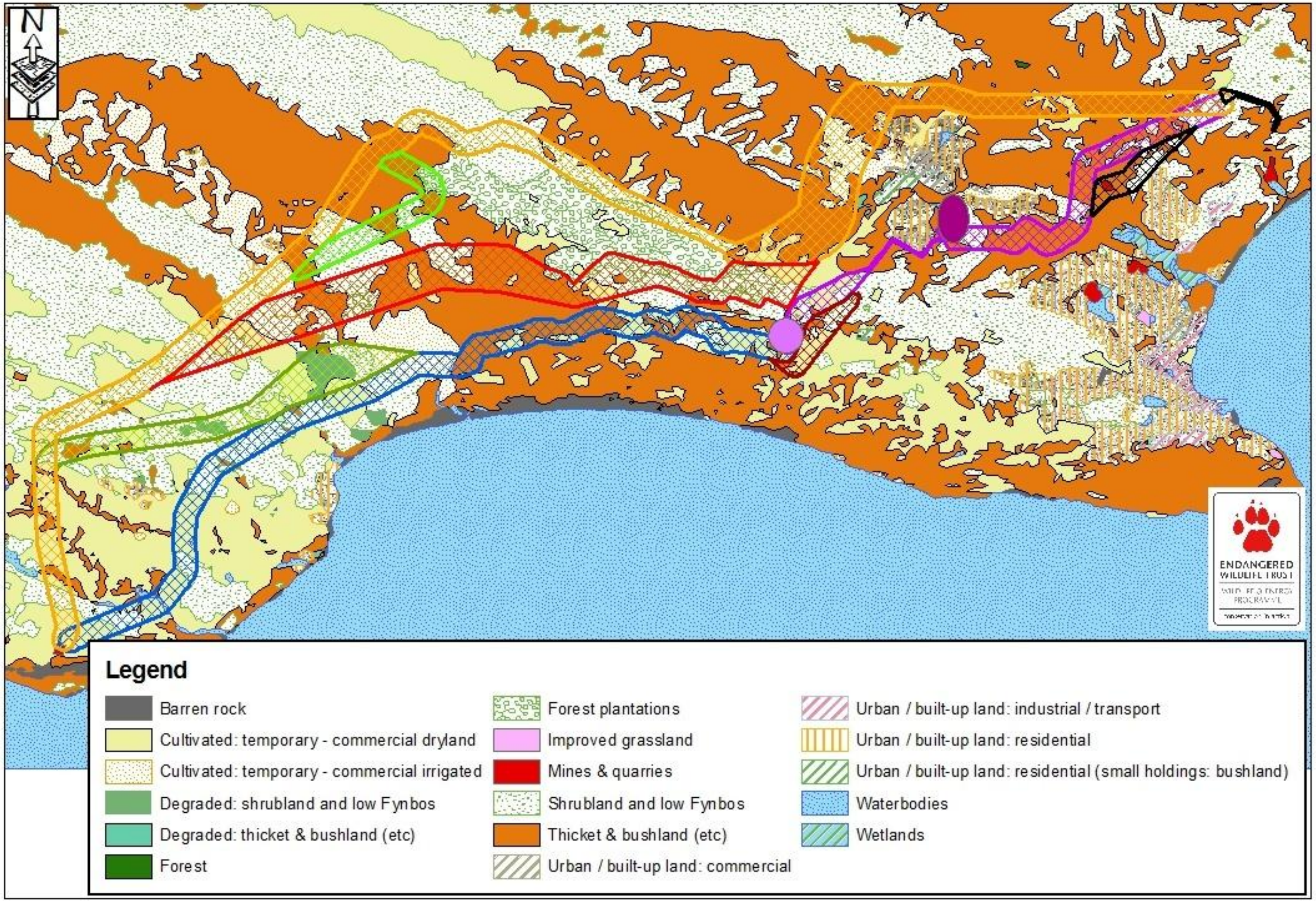

FIGURE 5: Map showing the land use found within the 5km corridor, taken from NLC2000 shape file.

- **Arable or cultivated lands:**

Arable or cultivated land represents a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources 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 arable lands are either pastures under irrigation, wheat fields under irrigation or 'improved grasslands' that are mowed for bailing. These lands attract certain species as shown in Table 1. In particular the White Stork has a high affinity with arable lands, with 86% of sightings in South Africa recorded on arable lands (Allan 1985, Allan 1989, Allan 1997 in Hockey, Dean & Ryan 2005). Blue Cranes and Bustards are also attracted to the 'short' grassland after it's mowed, as was evident during the site visit.

- **Wetland:**

Wetlands are characterized by slow flowing water and tall emergent vegetation, and provide habitat for many water birds. The conservation status of many of the bird species that are dependant on wetlands reflects the critical status of wetlands nationally, with many having already been destroyed.

In this study area, several true wetland areas were observed, mostly being fairly small. Wetlands hold water for much of the year and may represent attractive areas for certain species year round –

not only after rainfall. However, the top six collision species are not dependant on wetlands, although could use them from time to time. Less obvious wetlands exist in the form of pans, and flat areas or plains as described below. These are extremely important to many of the top six collision species.

- **Rivers:**

Most rivers in southern Africa are in the east and extreme south, in the higher rainfall areas. Various water associated bird species are mostly restricted to riverine habitat in southern Africa. The map distribution of these species correlates with the river courses in southern Africa.

There are several important rivers crossed at least once by the proposed corridor, they include the Gamtoos River and Krom River. The corridor also crosses smaller rivers that are dominated by thicket, suitable habitat for several Red Data species like the Half-collared Kingfisher, Knysna Woodpecker and Knysna Warbler.

- **Flats or plains:**

These areas are conspicuously flat and may hold surface water for longer after rainfall events. Drainage lines and river courses generally bisect the plains, and in some places these drainage lines have been dammed. Vegetation in these areas has either been transformed for cultivation or are mixed open fynbos/grassland areas. Species commonly found are most of the large terrestrial species such as Blue Cranes, bustards, and korhaans.

- **Koppies or ridges:**

  Koppies or ridges are usually extremely rocky and comprise a relatively small proportion of this study area. Raptor species prefer to fly in the vicinity of the ridges as air currents are favourable, however these areas are not preferred habitat for most large terrestrial species sensitive to collision with the proposed power lines.

- **Dams:**

  Many thousands of earthen and other dams exist in the southern African landscape. 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.

  Even more importantly dams are used as roost sites by flocks of Blue Cranes, as well as other species like Spur-winged and Egyptian geese. This has serious implications for Blue Crane interaction with power lines, as they leave the roost in the early morning during low light conditions, and arrive at the roost in the late evening, again during low light conditions. During these conditions, the earth wires of power lines are almost invisible thereby increasing the chance of collision. As of 2004, a total of 32 separate collision incidents involving Blue Cranes had been reported to EWT from Eskom Distributions Southern Region (largely the Eastern Cape). A minimum of 72% of the Blue Cranes killed in these 32 incidents were found close to dams (Smallie 2004, unpublished report to Eskom Resources & Strategy)

  Dams are also used by storks and flamingos as foraging areas.

  If construction takes place too close to dams and wetlands certain other Red Data species associated with them may be impacted on through disturbance and habitat destruction, they include the African Marsh Harrier, Black Harrier and the Greater-painted Snipe.

- **Thicket**

  This vegetation type has been adequately described above. This vegetation type attracts Red Data species like Knysna Woodpecker and Knysna Warbler.

- **Grassland**

  This area has small amounts of true grassland, but through the clearing of thicket and fynbos much of the Western area of the corridor is dominated by improved or pioneer grasslands that have opened up the habitat making it more favourable for Blue Crane and Bustard species.

Birds will, by virtue of their mobility, utilise almost any area 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 – and hence where impacts on those species will be most significant. The top six most sensitive collision vulnerable species (the most significant impact of the proposed power lines) have been shown in **bold**.

Table 1 makes use of the authors' extensive experience, supported in the case of some species by data from the CAR project (Young, Harrison, Navarro, Anderson & Colahan, 2003).

Species	Cons. Status	Arable lands	Wetlands	Rivers	Flats or Plains	Koppies or ridges	Dams	Thicket/ Valley Bushveld	Grassland
White-backed Night-Heron	VU		X	X			X		
Cape Vulture	VU					X	X		
Martial Eagle	VU				X	X		X	
African Marsh-Harrier	VU		X		X		X		
Blue Crane	**VU**	**X**	**X**		**X**		**X**		**X**
Denham's Bustard	**VU**	**X**			**X**				**X**
Knysna Warbler	VU							X	
White-bellied Korhaan	**VU**				**X**				**X**
Greater Painted Snipe	NT		X	X			**X**		
Black Harrier	NT	X	X		X	X	X		X
Peregrine Falcon	NT	X	X		X	X	X		
Lanner Falcon	NT	X	X		X	X	X		
African Crowned Eagle	NT				X	X		X	
Black Stork	**NT**		**X**	**X**		**X**	**X**		
Yellow-billed Stork	NT	X	X	X			X		
Greater Flamingo	NT			X					
Lesser Flamingo	NT			X					
Secretarybird	**NT**				**X**				**X**
Great White Pelican	NT			X					
Chestnut-banded Plover	NT		X						
Black-winged Lapwing	NT				X				**X**
Half-collared Kingfisher	NT			X					
Knysna Woodpecker	NT							X	
Bush Blackcap	NT							X	
White Stork	**Bonn**	**X**	**X**		**X**		**X**		**X**

Table 1: The 'micro-habitats' preferred by the Red Data species recorded (Harrison *et al*, 1997) in the quarter degree squares bisected by the corridors, and likely to occur in the study area, i.e. not offshore species.

VU = Vulnerable; NT = near-threatened; Bonn = protected internationally under the 'Bonn Convention on Migratory Species'

3.3 Relevant bird populations

Various data sources were used in determining the distribution and abundance of bird species in the study area:

- SABAP Data
- Important Bird Area (IBA) data was considered and described below
- CAR (Co-ordinated Avifaunal Road count) Data- there were only small sections relevant to the corridors and thus this data was not used.
- Sightings of relevant species during fieldwork.
- Cognizance was taken of the comments of Interested and Affected Parties relating to birds.

Table 2 below shows the report rates for the Red Data species recorded in the 11 quarter degree squares covering the project area(Figure 6) (Harrison *et al*, 1997). These species could have been recorded anywhere in each square, and not necessarily within the exact corridors, but provides a useful idea of what could occur in the study area. Report rates are an expression of the number of times a species was recorded in a square as a percentage of the number of times that square was counted and are essentially an expression of abundance.

Many of the species are coastal and off shore species and will not be relevant to this study.

As described elsewhere in this report, the primary anticipated impact of the proposed power lines will be that of collision. A number of collision prone species are reflected in Table 2. The top 6 most important collision vulnerable species for the purpose of this study are: Blue Crane; Denham's Bustard; White-bellied Korhaan; White Stork, Black Stork and Secretarybird. Although this impact assessment focuses on Red Data bird species, the impacts on non Red Data species are also assessed. In addition, the mitigation measures recommended will in many cases mitigate for various species other than those that are the focus of this study.

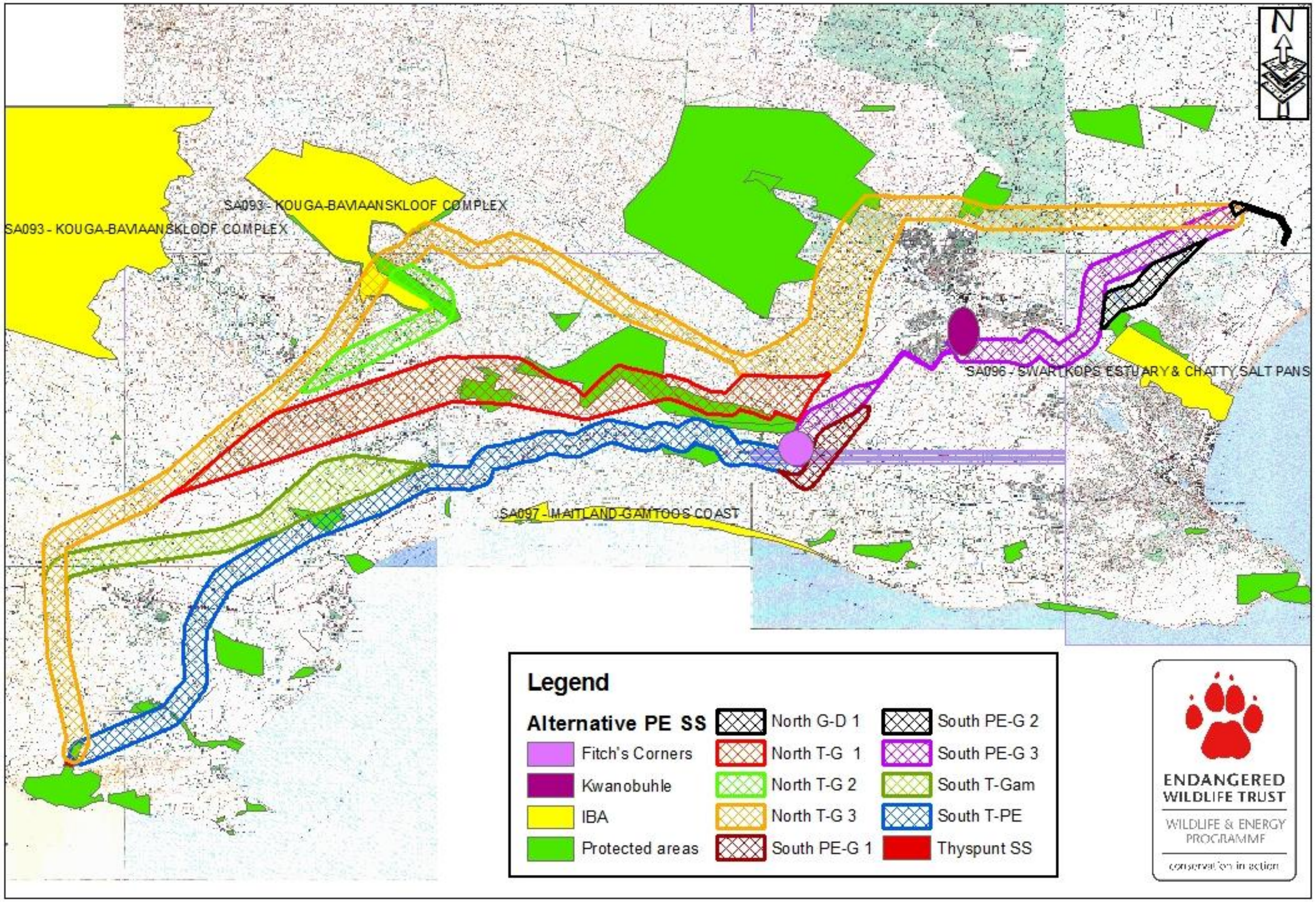

FIGURE 6- Location of the IBA's and protected areas.

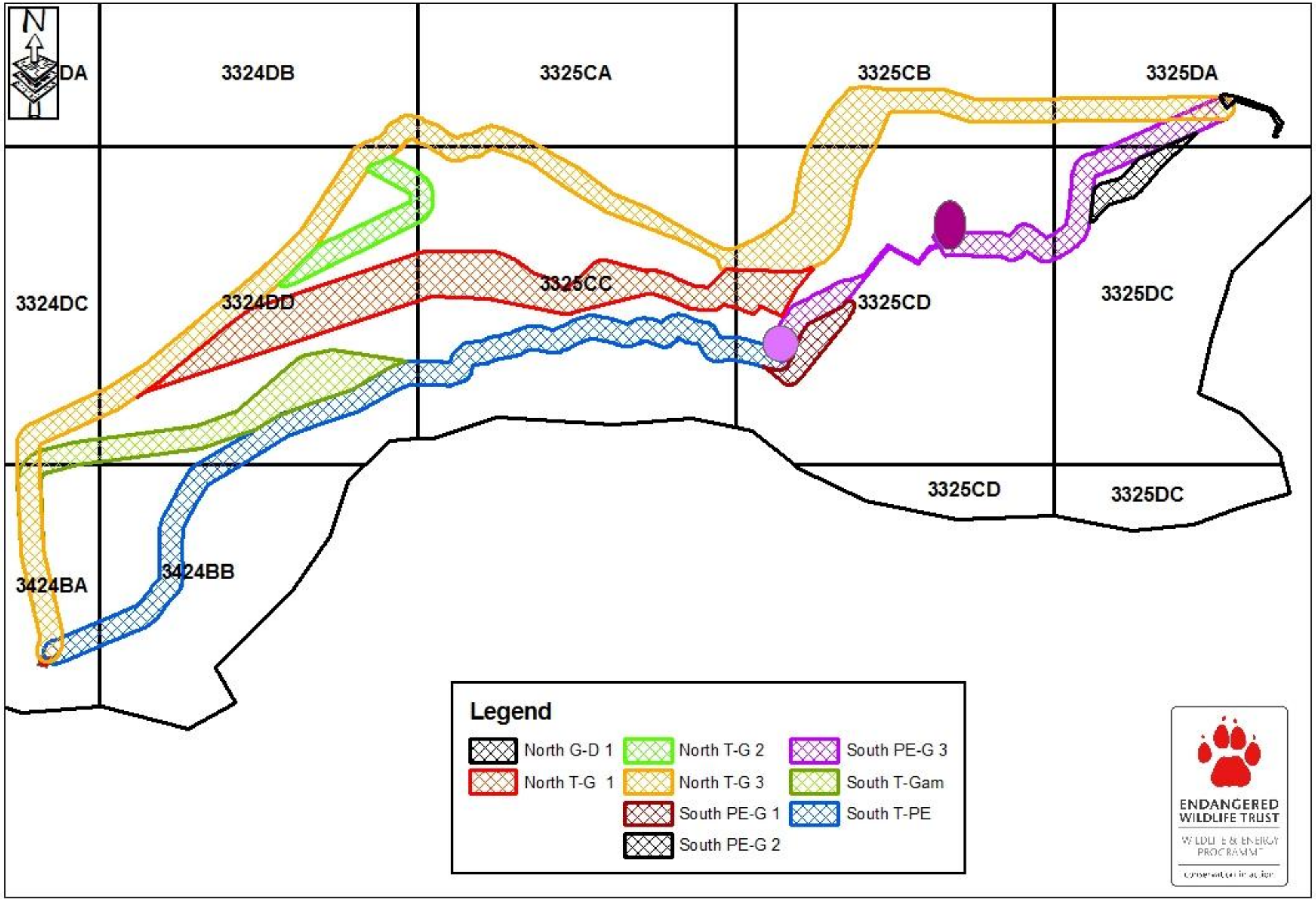

FIGURE 7: Quarter degree squares and the various power line routes (Map-EWT

Total Cards		149	843	350	137	238	56	179	44	81	366	51	
Total Species		250	325	291	228	272	170	272	187	205	282	205	
Total Breeding Species		68	133	93	71	64	12	51	14	42	88	31	
Name	**Conservation status**	3325DA	3325DC	3325CD	3325CB	3325CC	3325CA	3324DD	3324DC	3324DB	3424BB	3424BA	**Habitat**
African (Jackass) Penguin	EN		5	0		0					13	6	Marine
Black-browed Albatross (Mollymawk)	EN		0										Open ocean
Roseate Tern	EN		3	1		1					2		Coastal waters and offshore islands
Damara Tern	EN		1								0		Sandy marine shores, sheltered bays, lagoons, estuaries, open sandy flats inland from beach
Martial Eagle	VU	2	0	0	1	4		1	2	7	3	2	Woodland, savanna or grassland with clumps of large trees or power pylons for nest sites
African Marsh-Harrier	VU	2	2	4		1		18	2		36	20	Marsh, vlei, grassland (usually near water); may hunt over grassland, cultivated lands and open savanna
Blue Crane	VU	6	2	1	1	0	13	7	14	5	33	14	Midland and highland grassveld, edge of karoo, cultivated land, edges of vleis
Denham's (Stanley's) Bustard	VU	8		3	1	2	4	4	9	1	11	16	Montane and highland grassveld, savanna, karoo scrub
Cape Gannet	VU		18	13		3		1			19	31	Offshore coastal waters, especially in Benguela and Agulhas Currents, seldom beyond continental shelf
Cape Vulture (Griffon)	VU		0										Mostly mountainous country, or open country with inselbergs and escarpments; less commonly in savanna or desert
Lesser Kestrel	VU		0							1			Open grassveld, mainly on highveld, usually near towns or farms
Knysna Warbler	VU			2		1						2	Lowland and coastal evergreen forest with dense tangled undergrowth; also thickets in gullies and in riverine forest
Ludwig's Bustard	VU						2			2			Dry open plains, from grassland to desert
White-bellied Korhaan	VU							1			3	4	Open grassland; sometimes in sparse *Acacia* thornveld
White-backed Night-Heron	VU										0		Quiet tree-lined rivers and streams, mangroves; less commonly in reedbeds along rivers and in marshes
Black Stork	NT	1	8	1	4	3		1		4	1		Feeds in or around marshes, dams, rivers and estuaries; breeds in mountainous regions
Yellow-billed Stork	NT	1	2					3			1		Mainly inland waters; rivers, dams, pans, floodplains, marshes; less often estuaries
Secretarybird	NT	5	0	2	1	2	4	1	5	4	4	4	Semidesert, grassland, savanna, open woodland, farmland, mountain slopes
Black Harrier	NT	1	1	3		5		2		1	2	4	Grassveld, karoo scrub, mountain fynbos, cultivated lands, subalpine vegetation, semidesert
Lanner Falcon	NT	5	9	1		1		4		1	1	2	Mountains or open country from semidesert to woodland and agricultural land
Lapwing (Plover)	NT	2	0	3		0		2	2		5	20	Open short grassland, fallow lands, pastures, airfields, playing fields, race courses
Caspian Tern	NT	7	19	5	1	3		11	2		22	2	Estuaries, marine shores, larger inland dams and pans
Half-collared Kingfisher	NT	5	5	1	1	8	4	6	2	2	7	6	Fast-flowing perennial streams, rivers and estuaries, usually with dense marginal vegetation
Knysna Woodpecker	NT	3	5	2	3	5	4	3		1	4		Coastal and riverine bush, evergreen forest, denser thornveld, *Euphorbia* scrub
Northern Giant-Petrel	NT		0								0		Open ocean and inshore near harbours
Great White Pelican	NT		0										Coastal bays, estuaries, lakes, larger pans and dams

Cape Cormorant	NT		26	13		3		4			39	22	Coastal waters usually within 10 km of shore; also brackish estuaries
Greater Flamingo	NT		22	0	1			2			4		Large bodies of shallow water, both inland and coastal; saline and brackish waters preferred
Lesser Flamingo	NT		14					1			1		Larger brackish or saline inland and coastal waters
Peregrine Falcon	NT		2	0		3	2	1					Cliffs, mountains, steep gorges; may hunt over open grassland, farmland and forests; rarely enters cities to hunt pigeons
Greater Painted-snipe	NT		0					1					Marshes, swamps, edges of lakes, dams, ponds and streams, with marginal vegetation
African Black Oystercatcher	NT		29	22		14		5			58	35	Rocky and sandy shores of mainland and coastal islands; less often coastal vleis and lagoons
Chestnut-banded Plover	NT		0					1					Saline lagoons, saline and brackish pans, saltworks; occasionally estuaries and sandy lagoons
Bush Blackcap	NT		0										Evergreen mistbelt and montane forest and adjacent scrubby hillsides, especially with *Leucosidea*
Crowned (Crowned) Eagle	NT			1	7	21	5	1		15	1		Dense indigenous forest, including riverine gallery forest; may range far from forest to hunt
Pallid Harrier	NT			0									Open grassveld, cultivated fields; less commonly in open to semi-arid savanna
Chestnut-banded Plover	NT					0							Saline lagoons, saline and brackish pans, saltworks; occasionally estuaries and sandy lagoons
White Stork	Bonn	5	2	5		11	2	11	5	4			Highveld grasslands, mountain meadows, cultivated lands, marshes, karoo

Table 2. Report rates for Red Data species in the quarter degree squares covering the study area (Harrison *et al*, 1997)

En = Endangered, VU = Vulnerable, NT = Near threatened, Bonn = Protected internationally under the "Bonn Convention on Migratory Species".

Many "non Red Data" bird species also occur in the study area and will also be impacted on by the power line, particularly species such as assorted water birds, large raptors, large terrestrial species such as korhaans. Although this impact assessment focuses on Red Data species, the impact on non Red Data species will be similar. Additionally, a number of smaller bird species such as Knysna Woodpecker and Knysna Warbler can be considered local endemics. This means that any impacts on these species should be minimised as far as possible. Although each and every endemic species has not been listed in this study, nor assessed individually, the recommended mitigation for disturbance and habitat destruction will mitigate for any impact on these species.

3.4 Important Bird Area's

The SA093- Kouga-Baviaanskloof complex IBA is directly affected by the northern corridor. This IBA is important for the following reasons:

This IBA holds a remarkable number of avian habitats, making it home to approximately 300 bird species. The mountain ranges hold the Fynbos restricted species, the forest patches hold several forest restricted species and the Great Karoo plains hold several Namib-Karoo restricted species. Red list species include: Blue crane, Lesser Kestrel, African Marsh Harrier, Striped Flufftail, Stanleys Bustard, etc. For a full discussion on this IBA see Barnes, 1998 pg 208.

4 GENERAL DESCRIPTION OF BIRD INTERACTIONS WITH POWER LINES

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 & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs & Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen & Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities.

4.1 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 & 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 Martial Eagles *Polemaetus bellicosus*, Tawny Eagles *Aquila rapax*, African White-backed Vultures *Gyps africanus*, and even occasionally Verreaux's Eagles *Aquila verreauxii* 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 (van Rooyen 2004a), while Lappet-faced Vultures are known to using power lines as roosts, especially in areas where large trees are scarce (pers.obs.).

In summary, electrocutions on the proposed size power lines will not be possible through conventional mechanisms.

4.2 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 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. Most of the heavily affected species are Red Data species. 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 result 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.

Power lines are 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.

It is anticipated that the most significant threat of the proposed power lines to birds will be collision. This is assessed in more detail below.

4.3 Habitat destruction

During the construction phase and maintenance of power lines and substations, some habitat destruction and alteration 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.

4.4 Disturbance

Similarly, the above mentioned construction and maintenance activities impact on bird through disturbance, particularly during breeding activities.

4.5 Nesting on towers (positive impact for birds)

Power lines very often represent suitable nesting substrate for many bird species, in particular in arid regions, where large trees may be absent. On the proposed power lines, the self-support towers will be the most suitable towers for nesting. Large eagles such as Martial and Verreauxs' Eagle have been recorded nesting on transmission lines in the Karoo region for several years now. A helicopter survey in August 2006, revealed 132 eagle nests, 44 of which were active, on 1400km of transmission line in predominantly Karoo biome (Jenkins, de Goede & van Rooyen 2007). The nesting species were Martial Eagle, Tawny Eagle and Verreauxs' Eagle. For both Martial and Verreauxs' Eagles, the proposed power lines may present an opportunity for a range expansion, or an increase in density of breeding pairs in the study area.

4.6 Impact of birds on quality of supply

Through the mechanisms described below, birds are able to cause electrical faults on power lines. The more faults that occur on a line, the lower the quality of electrical supply to the end customers and this impacts on Eskom's business.

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 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 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.

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.

Both bird streamers and bird pollution occurs as a result of birds perching on pylons or towers, often directly above live conductors. In the current study area where suitable trees are largely absent, birds are highly likely to perch on towers. However, the cross rope suspension tower does not have suitable perching space above conductors and so should be unaffected. Self-support towers will be vulnerable as there is a cross arm which provides suitable perching space. These towers should make up a very small proportion of the total number of towers on the proposed lines.

5 ASSESSMENT OF THE CORRIDORS

It must be stated at the outset that the Northern Corridor is potentially associated with impacts on birds due to its position through extensive undeveloped areas, and the likely requirement for extensive vegetation clearing during construction of the proposed power lines and associated disturbance. There is also an overall lack of existing infrastructure (particularly linear) in extensive parts of the route. If the three proposed power lines are built here, they will be the first large infrastructure in these areas. The following assessment should be viewed against this background and due to the fact that there are no material alternative corridors there is very little opportunity for route selection, which is the most important means of mitigating avifaunal impacts.

5.1 Preferred Alternative

There are essentially 3 alternatives within the Northern Corridor from Thyspunt to Grassridge, TG1 (alternative following the Longmore Forest *Southern Firebreak*), TG2 (alternative section avoiding the Stinkhoutberg Nature Reserve) and TG3 (alternative following the Longmore Forest *Northern Firebreak*). These must be evaluated against each other for this report and a preferred alternative must be chosen. Since no transmission lines run through this area none of the alternatives has an advantage of being placed next to an existing line. The main factors to consider from an avifaunal perspective therefore include: Habitat and terrain, IBA's, Protected areas, major rivers/dams and length of the various alternatives.

Length of the 3 alternatives- All three alternatives have a very similar length with the TG1 corridor being the shortest. This is hardly significant however and only differs from the longest alternative by approximately 14km. This represents approximately a 10% difference between the longest and shortest. Length is a factor but has been weighted low. The preferred corridor from a length perspective is thus TG1.

Habitat and terrain- All three alternatives follow the same route and thus affect the same habitat for the first 30 kilometres (approximately) of the Northern Corridor (i.e. from the Thyspunt HV Yard to the point south of Hankey where the alternatives split), and for the last 42 kilometres of the Northern Corridor (i.e. from the point at which the alternatives rejoin in the area around Rocklands to the Grassridge Substation). The alternatives have been presented for assessment in the middle section of the Northern Corridor (around the Longmore Forest and the Elands River Valley to the north) but both TG1 and TG3 affect very similar land uses and vegetation types. Both alternatives would be built over forest plantations, thicket and bushland, shrubland and low fynbos, commercial dryland and some commercially irrigated cropland. TG2 would be built over very similar land uses as it is simply a deviation of TG3 (to avoid the Stinkhoutberg Nature Reserve). Thus it is very difficult to have a preference for one corridor based on habitat. From a terrain perspective however TG1 (southern) is preferred. TG2 and TG3 are both quite mountainous and spanning valleys with transmission lines increases the collision risk as these valleys are used as flight paths by birds. The habitat of mountainous regions also tends to be more pristine as it is less accessible and thus less disturbed and degraded. From a terrain perspective TG1 is the most preferred.

IBA's- A very clear advantage for TG1 is apparent when we examine the locations of the IBA's. TG2 and TG3 both affect the SA093- Kouga-Bavianskloof complex IBA, which is described above. As such the clear favourite from an IBA perspective would be TG1.

Protected areas- All three of the corridors will affect protected areas. TG1 will affect the Loerie Dam Nature Reserve as well as the Longmore state forest and the Van Stadensberg Natural Heritage Site. TG2 will affect Hankey Forest Reserve, while TG3 will affect Hankey Forest Reserve as well as the Stinkhoutsberg Nature Reserve. The preferred corridor from a protected area perspective will be TG3 as the corridor will cross Hankey Forest reserve and a small section of Stinkhoutsberg nature reserve (can possibly avoid if lines placed in southern section of corridor). This is preferable to the other two corridors which will affect a greater number or proportion of protected areas.

Rivers and dams- TG1 has the Loerie Dam in the middle of the corridor. It will be very difficult to miss this dam with 3x 400KV lines and as such this is a large disadvantage to avifauna. Dams and rivers are known to attract many bird species and placing transmission lines near these dams and rivers is not an ideal situation. As such TG1 is the least preferred from a river and dam perspective. TG2 and TG3 both cross rivers and some small dams but there are no large dams that are comparable to Loerie Dam. As such either of these two alternatives is preferred over TG1.

In order to combine the various factors discussed above into 1 preferred alternative the various factors were used to give each corridor a ranking of 1 to 3, 3 being the highest score and as such the most preferred and 1 being the least preferred. A weighting was also assigned because some factors are more important than others. The below table shows the scores and the weightings assigned using our specialist avifaunal knowledge and experience. The total score out of 3 indicates the most preferred corridor.

Factor	**TG1**	**Weighting**	**TG2**	**Weighting**	**TG3**	**Weighting**
Length	3	5%	1	5%	2	5%
Habitat &Terrain	3	20%	1.5	20%	1.5	20%
IBA's	3	20%	1.5	20%	1.5	20%
Protected areas	1	20%	2	20%	3	20%
Rivers & dams	1	35%	1.5	35%	1.5	35%
Total	**1.9**		**1.58**		**1.83**	

TABLE 3- Preference rating for the 3 main alternatives.

As can be seen in the above table corridor TG1 is the most preferred corridor followed closely by corridor TG3. The problem with TG1 is the presence of Loerie Dam that will be a challenge to get past. If the northern most section of corridor TG1 is used this should be possible.

The transmission lines from Grassridge to Dedisa also need to be considered and there is only one corridor for these. As such the alternative assessment for this will be 1: to build a line and 2: no go option. It is not felt that this section warrants a no go and as such the lines may be built as long as an avifaunal specific "walk down" is done. The impacts of this section will be very similar to the other alternatives assessed above and have been included in the impact tables.

5.2 Placement of the lines

From a bird impact perspective, a strong argument is made for placing the proposed lines adjacent to each other as far as possible:

- The more overhead power lines there are together, the more visible they would be to the birds in the area (Avian Power Line Interaction Committee - 1994)
- Resident birds in an area become accustomed to a power line that crosses their flight paths, and learn to avoid it during their everyday activities. Birds would therefore become accustomed to the first line to some extent, thereby hopefully slightly reducing the impact of the second line when built.
- Spatially, it makes more sense to have all the threats to birds (in particular through collision) in one relatively confined area, rather than spread out across the landscape.
- Building the new lines adjacent to each other should in theory reduce the need for access roads and gates etc, and therefore reduce the levels of disturbance and habitat destruction.

5.3 Position of the final alignment within the corridor

Providing input into the exact alignment of the line within the corridor (which can be up to 5km wide) does not necessarily mean that marking devices will not be needed on the sections that will be of high risk. Marking lines to reduce collisions is rarely a complete solution. First prize is therefore to route the line optimally in terms of sensitive features, with marking as a supplementary mitigation measure.

The best way to route the line within the proposed corridor is to complete an avifaunal specific walk down of the line. It is suggested that once the preferred alternative has been chosen, Eskom propose an alignment within the corridor attempting to miss as many sensitive areas as possible. This should then be made available to the various specialists and a site specific walk down should be completed where each proposed tower position is visited and small scale movements proposed to avoid any sensitive features. In this way the best route can be chosen within the corridor.

6 IDENTIFICATION OF RISK SOURCES

6.1 Collision with overhead cables during operations

The following species will be affected by collision with the proposed power line.

- Blue Crane, Denham's Bustard, Black Stork, Secretarybird, White Stork, White-bellied Korhaan
- Assorted non Red Data species associated with water

Mitigation: All sections of line passing through or adjacent to (within one span of) the following areas must be fitted with a suitable marking device on the earth wires as per the existing Eskom Transmission technical guidelines. Marking transmission lines has been shown to significantly reduce the number of bird collisions. If the recommendations made here are comprehensively implemented, the threat of collision will be mitigated to a LOW negative significance.

- Dams
- Irrigated arable lands
- Rivers and river crossings
- Flats or plains
- Pans
- Wetlands

Whilst some of the above areas are easy to identify on the ground, one of the most important micro habitats i.e. flats or plains is much less easily recognised. Furthermore the various micro habitats often interact to produce a high risk situation. EWT have extensive experience on existing transmission lines and are capable of identifying the areas for marking. **It is recommended that an avifaunal "walk through" be conducted once the exact tower positions have been surveyed and pegged. The exact spans requiring marking will then be identified.** In addition, the standard Eskom line patrols (annual) will be used as a monitoring system to detect any collision with the line once operational. The avifaunal input into the Construction and Operational EMP, will specify any detailed monitoring required for the operational phase of the line.

IMPACT TABLE FORMAT	
Environmental Parameter	*Avifauna*
Issue/Impact/Environmental Effect/Nature	*Collisions of birds with the earth wire*
Extent	*Local/district- although collisions will occur on site the population will be affected locally*
Probability	*Probable- From past experience the impact of collisions on a transmission line is judged to be probable*

Reversibility	*Partly reversible- It is possible to mitigate for collisions but not fully*	
Irreplaceable loss of resources	*Significant- Birds die and thus this is a loss of resources*	
Duration	*Long term- the impact of collisions will continue for the lifetime of the project.*	
Cumulative effect	*Low- lines placed together actually held mitigate for collisions instead of compounding the impact*	
Intensity/magnitude	*Medium- The intensity of collisions is judged to be medium from past experience on transmission lines.*	
Significance Rating	*Medium negative before mitigation*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	3	3
Duration	3	3
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-30 (Medium negative)	-13 (low negative)
Mitigation measures	*Mitigation measures for collisions will include fitting anti-collision marking devices onto spans that will be identified during the avifaunal specific walk down. This will be done once a preferred corridor has been chosen.*	

Table 4. Assessment of collision impact

6.2 Habitat destruction during the construction and maintenance activities

The following species will be affected by habitat destruction:

- Half-collared Kingfisher and Knysna Woodpecker

Mitigation: In the case of the Half-collared Kingfisher, riverine habitat is most important, and in the case of Knysna Woodpecker riverine and valley bushveld/thicket vegetation is important. Destruction of or impact on vegetation in these areas should be kept to an absolute minimum. The avifaunal walk through will identify specific sensitive areas and provide site specific recommendations if necessary. If the recommendations made here are implemented correctly, this impact could be reduced to LOW-MEDIUM significance.

IMPACT TABLE FORMAT

Environmental Parameter	*Avifauna*	
Issue/Impact/Environmental Effect/Nature	*Habitat destruction*	
Extent	*Site- habitat destruction will be confined to the site of the towers and substations*	
Probability	*Definite- habitat destruction will definitely take place*	
Reversibility	*Irreversible should no mitigation be put in place during construction*	
Irreplaceable loss of resources	*Complete loss should no mitigation be implemented*	
Duration	*Medium term- habitat will eventually recover*	
Cumulative effect	*High- multiple lines will mean a high cumulative impact*	
Intensity/magnitude	*High intensity should no mitigation be implemented*	
Significance Rating	*Mitigation can successfully reduce the impact of habitat destruction to an acceptable level.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	3
Reversibility	4	2
Irreplaceable loss	4	2
Duration	2	1
Cumulative effect	4	3
Intensity/magnitude	3	2
Significance rating	-57 (High negative)	-24 (Low negative)
Mitigation measures	*Mitigation measures for habitat destruction will mainly focus on minimizing the impact of habitat destruction during the construction phase. Exact measures will be highlighted in the site specific EMP and will include measures such as using all existing roads, not clearing vegetation under the power lines as and when possible, etc.*	

Table 5. Assessment of habitat destruction impact

6.3 Disturbance during the construction and maintenance activities

The following species will be affected by disturbance:

- Martial Eagle, Black Stork, Secretarybird, Black Harrier, African Crowned Eagle if breeding
- Half-collared Kingfisher, Knysna Woodpecker
- Assorted non Red Data large to medium raptors such as Verreauxs' Eagle

Mitigation: During the avifaunal "walk through" prior to construction, any nesting sites of the species mentioned above will be identified and case specific recommendations provided. The Environmental Control Officer should also identify any breeding birds along the servitude. These breeding sites can then be managed appropriately. As a general principle, construction and maintenance activities should take care to disturb the receiving environment as little as possible. Through implementation of the above it is envisaged that the disturbance impact of the proposed lines can be kept to LOW significance.

IMPACT TABLE FORMAT		
Environmental Parameter	*Avifauna*	
Issue/Impact/Environmental Effect/Nature	*Disturbance*	
Extent	*Site- disturbance should not affect further than the site*	
Probability	*Probable- it is likely that some avifauna will be disturbed*	
Reversibility	*Partly- once the construction stops the disturbance will be reduced a great deal*	
Irreplaceable loss of resources	*Marginal- possible loss of resources due to nest abandonment etc*	
Duration	*Short term- during construction*	
Cumulative effect	*Medium- multiple power lines will result in an increase in disturbance during construction.*	
Intensity/magnitude	*Medium- unless mitigation measures are followed*	
Significance Rating	*Low- disturbance should not be a high impact on this project, provided mitigation is effective*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	-24 (Low negative)	-8 (Low negative)
Mitigation measures	*Any nesting sites of the species mentioned above will be identified during the emp and case specific recommendations provided. The Environmental Control Officer should also identify any breeding birds along the servitude. These breeding sites can then be managed appropriately.*	

Table 6. Assessment of disturbance impact

6.4 Impact of birds on quality of electrical supply

The following species could potentially impact on the proposed power lines quality of supply:

- Martial Eagle on self-support towers (streamer)
- Non Red Data herons & ibises on self-support towers (streamer & pollution)
- Assorted non Red Data large to medium raptors such as Verreauxs' Eagle on self-support towers (streamer)
- Pied Crow, Black Crow & White-necked Raven on self-support towers (nesting)

Mitigation: All towers with available perching space (Self support and guyed v) above conductors, along the lines should be comprehensively fitted with Bird Guards as per the existing Eskom Transmission specifications. This will prevent birds from perching and roosting in the critical areas above live conductors and reduce this impact to LOW significance. In the case of nests, if problem nests are identified on the line once built, these should be managed according to the existing EWT Nest Management Guidelines. Eskom Transmissions standard monitoring of line performance will detect whether any bird related faulting is occurring once the line is operational.

IMPACT TABLE FORMAT		
Environmental Parameter	*Avifauna*	
Issue/Impact/Environmental Effect/Nature	*Faulting-bird induced*	
Extent	*Site- will occur only on tower affected*	
Probability	*Possible- past experience has shown faulting is possible on 400KV*	
Reversibility	*Reversible- fit bird guards will solve the problem*	
Irreplaceable loss of resources	*No- impact is a business quality of supply issue*	
Duration	*Life span of the power line*	
Cumulative effect	*Negligible*	
Intensity/magnitude	*Medium from a business case*	
Significance Rating	*Low and easy to mitigate*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1

Intensity/magnitude	2	1
Significance rating	-18 (Low negative)	-8 (Low negative)
Mitigation measures	Fit bird guards to any self support or guyed v towers, can also be done reactively if faults are picked up.	

Table 7. Assessment of impact of birds on the quality of supply

6.5 Nesting of bird on towers (positive impact on birds)

The following species could potentially nest on the proposed power lines:

- Martial Eagle on self-support towers
- Assorted non Red Data raptors such as Verreauxs' Eagle on self-support towers
- Pied Crow, Black Crow & White-necked Raven

Mitigation: None required

IMPACT TABLE FORMAT		
Environmental Parameter	Avifauna	
Issue/Impact/Environmental Effect/Nature	Nesting	
Extent	Site- confined to each tower	
Probability	Probable- from past experience	
Reversibility	Not required	
Irreplaceable loss of resources	No	
Duration	Life time of project	
Cumulative effect	Negligible	
Intensity/magnitude	Low	
Significance Rating	Not a significant problem, positive impact for birds	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	3
Reversibility	2	2
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	11 (Low positive)	11 (Low positive)
Mitigation measures	None required this is a positive impact for birds and does not affect the line performance.	

Table 8. Assessment of impact of nesting of birds

Environmental parameter	Issues	Rating prior to mitigation	Rating post mitigation	Average
Avifauna	Collision	-30	-13	-21.5
	Habitat destruction	-57	-24	-40.5
	Disturbance	-24	-8	-16
	Quality of supply	-18	-8	-26
	Nesting on towers	11	11	11

Table 9- Summary of impacts

7. CONCLUSION

In conclusion the proposed project can proceed with acceptable impacts on avifauna should the recommendations in this report be followed. In particular these are that a site specific “walk down” be conducted once the preferred alternative has been chosen and that in this document small scale movements of the power line route be considered to further reduce the impact on avifauna. Anti-collision marking devices need to be installed on relevant sections of line and these will be specified during the walk down phase.

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