TSHWANE STRENGTHENING PROJECT SPECIALIST AVIFAUNAL ASSESSMENT PHASE 1

DRAFT EIA
VOLUME 2- KWAGGA PHOEBUS 400KV LINES (12/12/20/1471)

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PROFFESSIONAL DECLARATION

This study was conducted by Jon Smallie and Luke Strugnell in their capacity as biologists for the Endangered Wildlife Trust (EWT). The EWT are independent consultants to Savannah Environmental (for Eskom Transmission). The EWT has no business, financial, personal or other interest in the activity, application or appeal in respect of which they were appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of these specialists performing such work.

Mr. Strugnell and Mr Smallie are registered with The South African Council for Natural Scientific Professionals (400181/09) (400020/06) respectively. They have ten years of experience in the field of bird interactions with electrical infrastructure and have conducted avifaunal impact assessments for ten Eskom Transmission projects and approximately thirty Eskom Distribution projects. The findings, results, observations, conclusions and recommendations given in this report are based on the author’s best scientific and professional knowledge as well as available information.

EXECUTIVE SUMMARY

Eskom Transmission Plan to erect new lines and Substations as part of a strengthening program to strengthen electricity supply to Pretoria. The proposed solution, which is known as the **City of Tshwane Electricity Supply Plan Scheme Phase 1** proposed to build four new substations in the Tshwane area. Three will be built by Eskom and one will be built by Tshwane municipality. These four substations are: Eskom Phoebus substation; Eskom Verwoerdburg substation; Eskom Anderson substation and Tshwane Wildebees substation. Eskom furthermore propose to erect new lines to service these substations. The project has been broken into 3 volumes, of which this report forms volume 2- Kwagga Phoebus 400KV power lines.

The Endangered Wildlife Trust (EWT) were appointed by Savannah Environmental to provide an avifaunal specialist report at both the scoping and EIA phase of this project. During the scoping phase the broad impacts were assessed. During this phase of the project (the EIA phase) these routes were further assessed, the impacts quantified and mitigation recommended.

The results show that two of the alternatives are equal in avifaunal impact and as such either may be used. These are alternative 1 and 3. It must be stressed that neither of these alternatives are ideal as they both cross ridges and because of this their impact on avifauna is increased. Alternative 2 should be discarded.

It is therefore necessary to mark certain sections of the proposed line and a map has been drawn in the report to highlight the exact areas to be marked. These anti-collision marking devices will help to mitigate for the impact of collision around the ridges and as such the impact will be acceptable to avifauna. Habitat destruction and disturbance are two further impacts that are expected and special care must be taken in and around the ridges to follow environmental best practice and mitigate for these impacts.

1. INTRODUCTION & BACKGROUND

Eskom Transmission Plan to erect new lines and Substations as part of a strengthening program to strengthen electricity supply to Pretoria. The proposed solution, which is known as the **City of Tshwane Electricity Supply Plan Scheme Phase 1** proposed to build or upgrade four new substations in the Tshwane area. Three will be built by Eskom and one will be built by Tshwane municipality. These four substations are: Eskom Phoebus substation; Eskom Verwoerdburg substation; Eskom Anderson substation and Tshwane Wildebees substation. Eskom furthermore propose to erect new lines to service these substations.

The Endangered Wildlife Trust (EWT) was contracted by Savannah Environmental to conduct the Avifaunal Specialist study on the above project. A site visit was conducted on the 12^{th} and 13^{th} of May 2009 and the 18^{th} of November 2009.

In general terms, the impacts that could be associated with a project of this nature include: collision of birds with the overhead cables; electrocution of birds whilst perched on the tower structures; destruction of habitat; disturbance of birds; impact of birds on the power line performance through the streamer and pollution mechanisms and nesting on tower structures.

1.1 Terms of reference

The following terms of reference were utilized for this study:

- A description of 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
- The identification of Red Data species potentially affected by the proposed transmission lines
- The identification of 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.
- The identification of 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).
- The formulation of a simple system to monitor impacts, and their management, based on key indicators

1.2 Description of proposed activities

- Construction of 400KV line from the proposed Phoebus substation to Kwagga substation (a distance of approximately 30km)

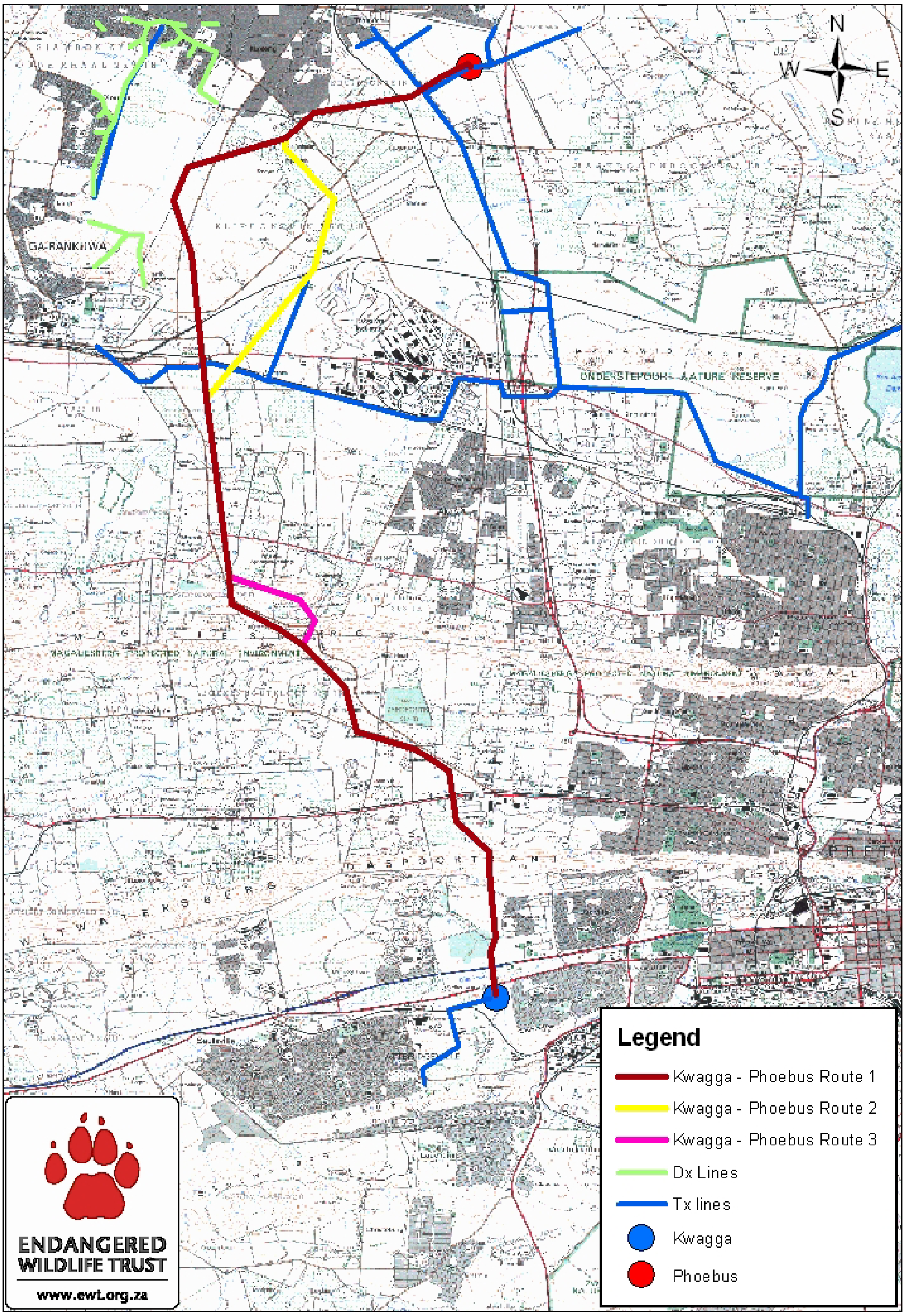

Figure 1. Study area layout showing existing infrastructure and line options (Map-EWT).

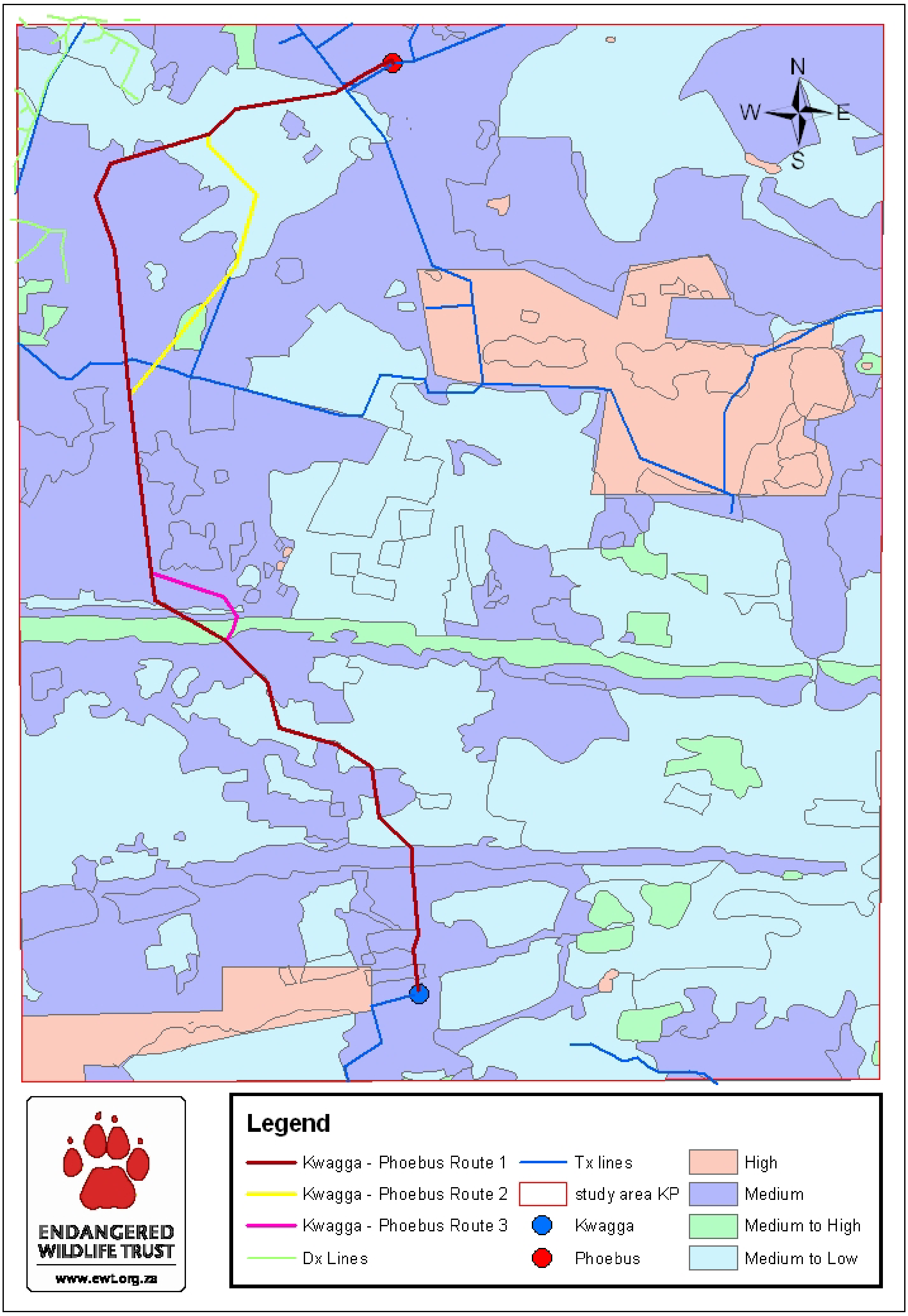

Figure 2- Study area showing Avifaunal sensitive areas as identified in the Pretoria Strategic Environmental Assessment conducted previously by EWT (Map –EWT)

2 GENERAL DESCRIPTION OF AVIAN INTERACTIONS WITH ELECTRICAL INFRASTRUCTURE

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 the electrocution of birds (and other animals) and birds colliding with power lines. Other problems include: electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure; and disturbance and habitat destruction during the construction and maintenance activities associated with electrical infrastructure.

2.1 Electrocution

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 132kV, electrocutions are not of major concern. 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 above 132kV, electrocutions are generally ruled out as even the largest birds cannot physically bridge the gap between dangerous components.

2.2 Collision

Collision is the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Collision refers to the scenario where a bird collides with the conductors or earth wires of overhead power lines. This occurs because the birds cannot see the cables whilst in flight. Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited maneuverability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines. Unfortunately, many of the collision sensitive species are considered threatened (Red Data status) in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. These species have not evolved to cope with high adult mortality, with the result that consistently high adult mortalities over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. 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.

2.3 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 leveling 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 to the servitude, through the modification of habitat.

2.4 Disturbance

During the construction and maintenance of electrical infrastructure, a certain amount of disturbance results. For shy, sensitive species this can impact on their usual daily activities, particularly whilst breeding. In general terms, one would expect that any species already existing in the study area must surely have adapted to relatively high levels of disturbance.

2.5 Impact of the birds on the proposed power line

There are a number of mechanisms through which birds are able to cause electrical faults on power lines. In the case of a bird streamer induced fault, the fault is caused by the bird releasing a "streamer" of faeces which can constitute an air gap intrusion between the conductor and the earthed structure. The fault appears to flash across the air gap (i.e. between the live conductor and the tower steelwork which is earthed) and *does not* follow an insulator creepage path as observed on pollution faults (See Van Rooyen & Taylor 1999 for an exhaustive analysis of the propagation characteristics of the bird streamer mechanism). Bird species capable of producing large or long streamers are more likely to cause streamer faults. Bird stomach volume is important in this respect. Larger birds such as vultures and eagles are capable of holding larger quantities of food and therefore defecating larger volumes. Bird pollution is a form of pre-deposit pollution. A flashover occurs when an insulator string gets coated with pollutant, which compromises the insulation properties of the string. When the pollutant is wetted, the coating becomes conductive, insulation breakdown occurs and a flashover results. Since this involves a build-up of bird faeces or bird pollution and not a once off event such as a streamer, the size of the bird is less important, although still a factor. Obviously the more an insulator string becomes coated with faeces, the more likely that a fault will occur. Larger birds and congregations of birds are likely to result in heavy pollution of insulator strings. Bird nests may also cause faults through nest material protruding and constituting an air gap intrusion. Crows in particular often incorporate wire and other conductive material into their nests. When nests cause flashovers, the nesting material may catch fire. This in turn can lead to equipment damage or a general veld fire. Apart from the cost of replacing damaged equipment, the resultant veld fire can lead to claims for damages from landowners.

3 METHODOLOGY

3.1 Information sources used

The following information sources were consulted in order to conduct this study:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP – Harrison *et al,* 1997) was obtained for the two quarter degree squares which cover the study area, from the Avian Demography Unit of the University of Cape Town, as a means to ascertain which species occur within the study area.
- 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).
- A classification of the vegetation types in the study area was obtained from (Mucina and Rutherford, 2006)
- The likelihood of occurrence of bird species reported using the SABAP data was compiles using the vegetation data above and by examining bird micro-habitats in the study area.
- Google Earth was used to examine the study area.
- The Strategic Environmental Assessment for the Pretoria Field Service Area Electrification Master Plan, Diamond, M. 2008

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 SABAP data, see Harrison *et al,* 1997.

3.2 Strategic Environmental Assessment

The Strategic Environmental Assessment (SEA) was compiled in April 2008 for avian sensitivity zones for the Pretoria Field Service Area network master plan. The study area extends from the Midrand area in the south to Pylkom and Klipvoorstad in the north, Ekangala and Bronkhorstspruit in the east and Tantana in the west and includes the current study site.

The study area was classified according to five sensitivity ratings (sensitivity ratings indicated in brackets):

- HIGH SENSITIVITY - conservation areas, CWAC sites, IBA’s, wetlands, dams and pans (5)

- MEDIUM-HIGH SENSITIVITY – rivers, grassland (4)
- MEDIUM SENSITIVITY – woodland, thicket and cultivated fields (3)
- MEDIUM-LOW SENSITIVITY - urbanised areas, mines and quarries, dongas, eroded areas (2)
- LOW SENSITIVITY – no areas were classified under this category (1)

The results of this SEA were used to analyse the current study site and proposed alignments.

4. DESCRIPTION OF RECEIVING ENVIRONMENT

4.1. Vegetation and land use

A map was plotted with the three proposed route alternatives and the vegetation of the area. This is useful when used in conjunction with the bird data presented in table 1 below to estimate the likelihood of occurrence of these birds in this area.

As can be seen in the map below, Figure 4, the predominant vegetation type is a variety of bushveld vegetation types and some thornveld. It is thus expected that the bushveld birds will be most prevalent, for example White-bellied Khoraan, Marabou Stork, Tawny Eagle and Martial Eagle.

Having said this however the study area is predominantly urbanized, disturbed and degraded to a large extent and the vegetation data is not very meaningful when it comes to predicting what species of bird will occur in the study area.

Perhaps more important then, is an examination of the micro habitats available to birds. These are generally evident at a much smaller spatial scale than the vegetation types, and are determined by a host of factors such as vegetation type, topography, land use and man-made infrastructure. These have been described below.

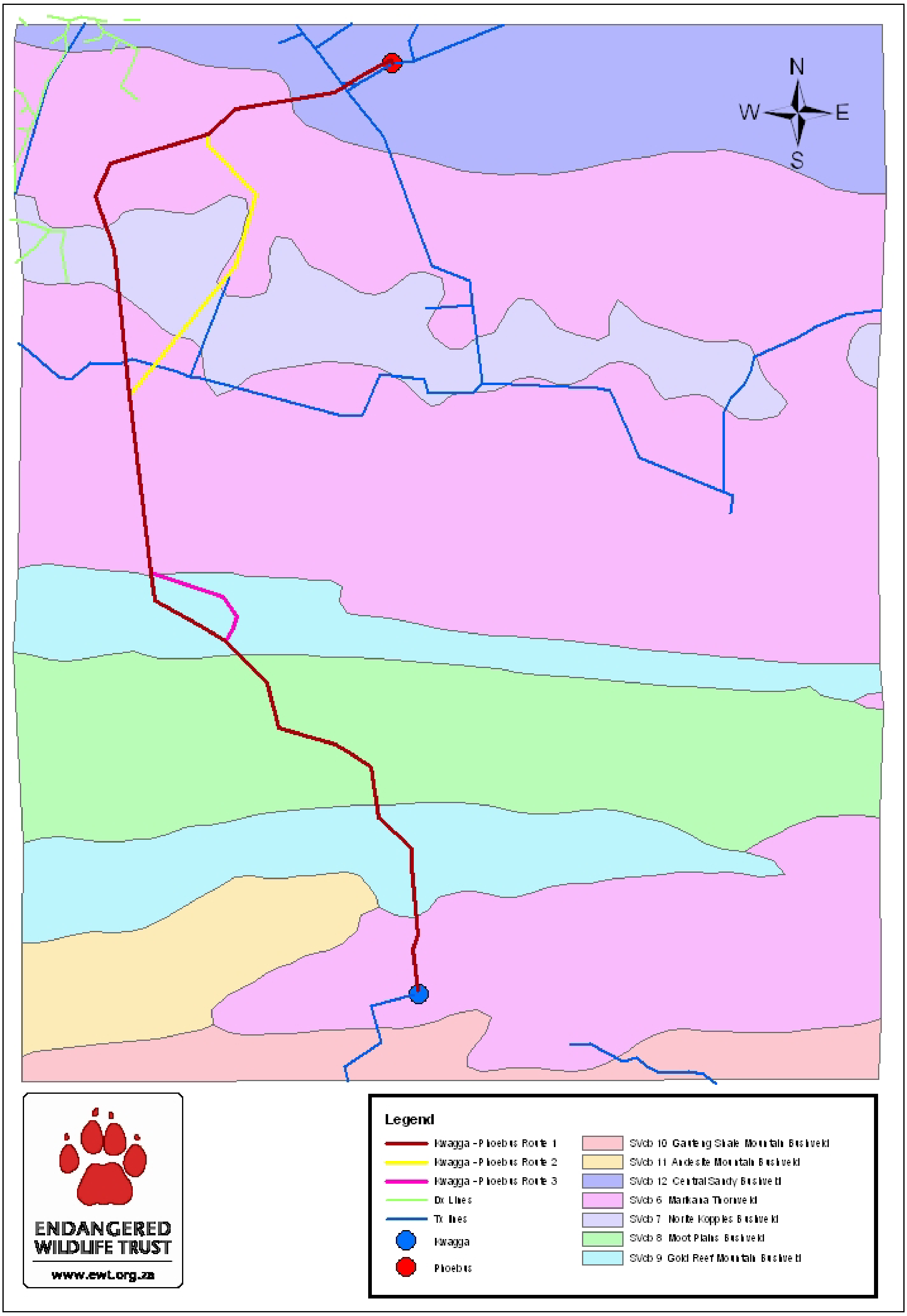

Figure 4- Vegetation classification according to (Mucina and Rutherford, 2006) (Map –EWT)

The micro habitats identified in this study area are described below and have been taken into account in identifying the sensitive areas within this study area.

Grassland Patches: These open areas represent a significant feeding area for many bird species in densely populated areas. Specifically, these open grassland patches typically attract korhaans, storks, and many other power line sensitive species (Secretarybird, Blue Crane and Lanner Falcon). The low reporting rate for these species (TABLE 1 - Harrison *et al* 1997) is evidence of the impact that the surrounding developments are having on the birds that would, under optimum conditions, inhabit these open areas.

Figure 5- Typical grassland patches in the study area with the ridge in the background

Wetlands, rivers and drainage lines: Wetlands are of particular importance for birds in the study area, as the area is largely urbanized and these represent fragmented habitat "islands" available to the water birds in this area. Examples of the birds that may use this micro-habitat include Greater Flamingoes, Half-collared Kingfisher and African Marsh harrier. Again the low report rates is evidence of how disturbed and degraded the area is.

Figure 6- Degraded stream

Stands of Eucalyptus trees: Although stands of Eucalyptus are strictly speaking invader species, these stands have become important refuges for certain species of raptors. In particular, large Eucalyptus trees are used by the migratory Lesser Kestrels for roosting purposes, although no known roost sites exist in the study area.

Figure 7- Stands of exotic trees

Figure 8- Route of lines to Kwagga Substation (visible in the distance)

4.2. Relevant bird populations

Total Cards		574	627		
Total Species		348	313		
Total Breeding Species		116	123		
Name	**Conservation status**	**2528CA**	**2528CC**	**Habitat**	**Likelihood of occurrence**
Cape Vulture	VU	2	0	Mostly mountainous country, or open country with inselbergs and escarpments; less commonly in savanna or desert	Unlikely
Tawny Eagle	VU	0		Woodland and savanna to semi-arid savanna or grassland with scattered Acacia trees	Unlikely
Martial Eagle	VU		0	Woodland, savanna or grassland with clumps of large trees or power pylons for nest sites	Unlikely
African Marsh-Harrier	VU	1	0	Marsh, vlei, grassland (usually near water); may hunt over grassland, cultivated lands and open savanna	Unlikely
Lesser Kestrel	VU	1	1	Open grassveld, mainly on highveld, usually near towns or farms	Unlikely
Blue Crane	VU	1	3	Midland and highland grassveld, edge of karoo, cultivated land, edges of vleis	Unlikely
African Finfoot	VU		0	Quiet reaches of streams, rivers, pans and lakes, fringed with dense trees and bush drooping into water	Highly Unlikely
White-bellied Korhaan	VU		0	Open grassland; sometimes in sparse *Acacia* thornveld	Unlikely
African Grass-Owl	VU		2	Long grass, usually near water, vleis, marshes	Unlikely
Black Stork	NT	1	0	Feeds in or around marshes, dams, rivers and estuaries; breeds in mountainous regions	Unlikely
Marabou Stork	NT	0		Open to semi-arid woodland, bushveld, fishing villages, rubbish tips, lake shores	Possible
Yellow-billed Stork	NT	1	0	Mainly inland waters; rivers, dams, pans, floodplains, marshes; less often estuaries	Unlikely
Greater Flamingo	NT	0		Large bodies of shallow water, both inland and coastal; saline and brackish waters preferred	Unlikely
Secretarybird	NT	0		Semidesert, grassland, savanna, open woodland, farmland, mountain slopes	Unlikely
Ayres Hawk-Eagle	NT	3	0	Dense woodland, forest edge, *Eucalyptus* groves in towns; avoids arid zones	Unlikely
Lanner Falcon	NT	1	1	Mountains or open country from semidesert to woodland and agricultural land; also cities	Unlikely
Greater Painted-snipe	NT	0		Marshes, swamps, edges of lakes, dams, ponds and streams, with marginal vegetation.	Unlikely
Half-collared Kingfisher	NT	0	1	Fast-flowing perennial streams, rivers and estuaries, usually with dense marginal vegetation	Unlikely
Melodious Lark	NT		0	Open climax grassland,sometimes with rocky outcrops, termite mounds or sparse bushes; also cultivated fields	Unlikely
White Stork	Bonn	1	2	Highveld grasslands, mountain meadows, cultivated lands, marshes, karoo	Unlikely
Abdims Stork	Bonn	3	5	Mainly highveld grassland; also semi-arid Kalahari (especially after rain), cultivated lands, inland waters	Unlikely

VU=Vulnerable; NT= Near Threatened; Bonn= Protected under the Bonn Convention, (Habitat data from Roberts 7)

TABLE 1- Red Data species report rates for the two quarter degree squares which cover the study area (Harrison *et al*, 1997)

Report rates are essentially 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. A report rate of 0 means that the species was recorded in the square, but at a very low frequency. It is important to note that these species could have been recorded anywhere in each square, and not necessarily in the exact study area.

Table 1 shows the recorded red data species. In the study area, and their habitat requirements and likelihood of occurrence. Most of these species will probably not occur in the study area due to the large amount of disturbance and habitat degradation. The only exception is the Marabou Stork, which maybe attracted by such conditions. One area where the habitat is still undisturbed would be the ridge and this area will thus be of greater concern.

5 EVALUATION OF IMPACTS

The impacts of this proposed development have been evaluated in the tables in APPENDIX 1 according to the criteria presented in APPENDIX 2 and are discussed in general below.

Electrocutions

Electrocutions are not possible on the larger transmission lines such as this line as the relevant clearances between live parts and live and earthed components exceed the wingspan of any bird. Thus this impact will not exist and is not discussed any further.

Collisions

Collisions will be one of the major impacts of the transmission lines. Collisions will mainly impact on the larger slower flying birds, the flamingoes and storks for example as well as raptors flying in and around the ridges. This impact will not be significant in most of the study area as the area is heavily degraded and the likelihood of finding these species within close proximity to the line will be slight as shown in last column in table 1. Furthermore the report rates of the collision sensitive species are low.

One exception would be the ridges as these are often flight paths for raptors and are relatively undisturbed. It is expected that these ridges will have a higher likelihood of collisions and as such it has been recommended that the two ridges within this study area be marked with suitable anti-collision marking devices (APPENDIX 4) in the location where the proposed line crosses the ridge. A map of these two areas can be seen below in figure 9.

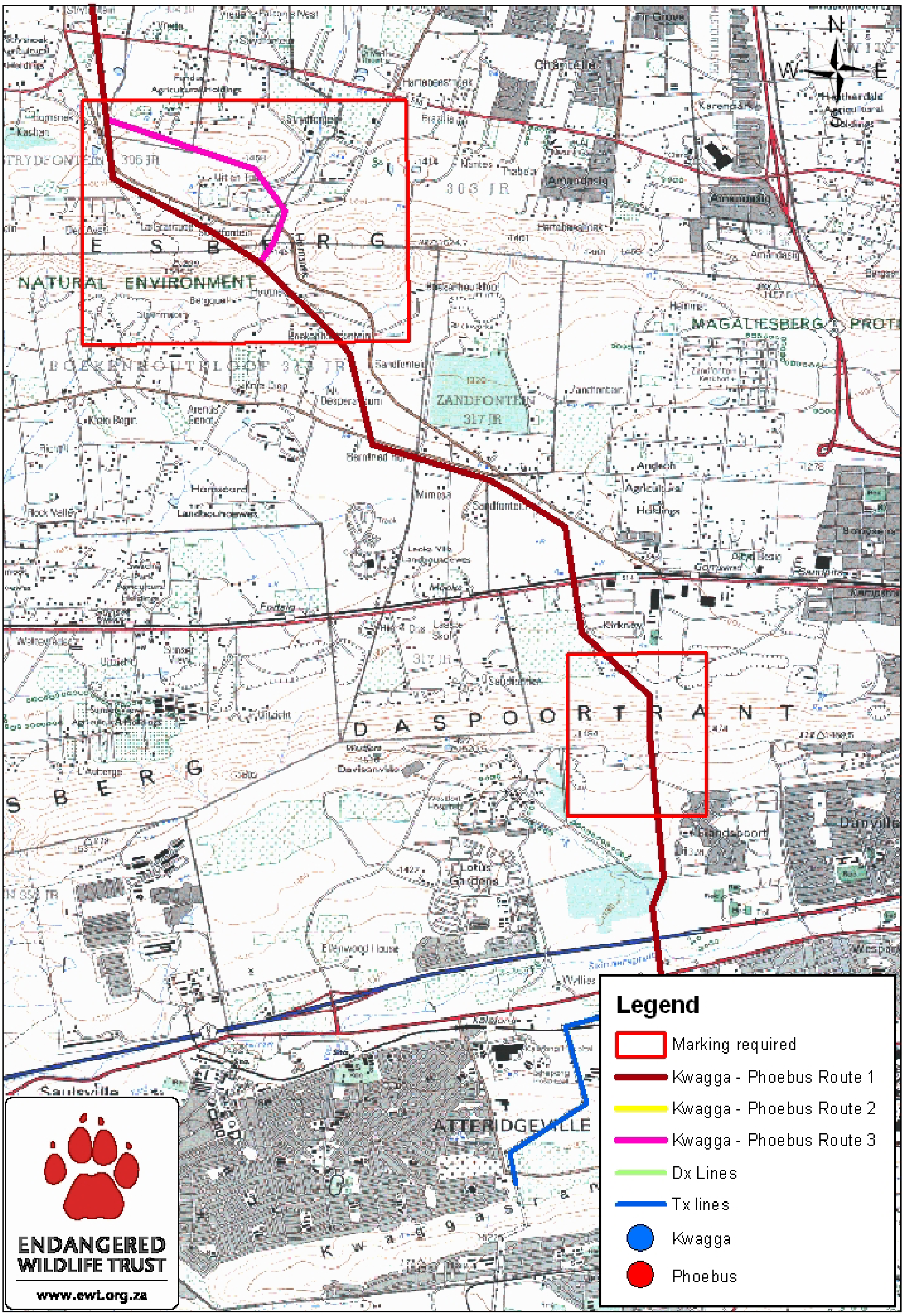

Figure 9- Locations of the two ridges to be marked with anti-collision marking devices.

Habitat destruction

Most of the area is disturbed and degraded and as such this is not seen as a significant impact. Should the preferred route be followed this impact should be very low. The one exception is the ridge which is likely to still be in relatively pristine condition, and is unavoidable. The utmost care should be taken on the ridge and environmental best practice must be followed to keep the impact of habitat destruction to a minimum.

Disturbance

Again this impact is likely to be very low considering the area and the level of disturbance already present and as long as environmental best practice is followed the impact will be negligible.

Faulting caused by birds

Birds that could cause faulting are in very low abundance in this area and thus this would not be a very significant impact. Although the towers will be higher than the surrounding vegetation and therefore an attractive roost and perch site for certain species, the disturbance of the area and low abundance of these larger species means this impact would be improbable.

Should faulting ever become an issue bird guards can be fitted reactively to the self support and guyed V towers.

6 COMPARISON OF ALTERNATIVES

Transmission Line Evaluation:

Alternative 1:

- Starts at Phoebus Substation and heads south west for approximately 6.5km
- Heads south crossing the N4 highway
- Then heads south east for approximately 8km
- Runs into Kwagga Substation for 3km in a southerly direction
- Northern section of this route is between informal settlements, which is an advantage for avifauna as sensitive species are unlikely to occur here
- After crossing the N4 this route follows the road for the majority of the route, which is also an advantage for avifauna as the disturbance from the road makes it less likely that sensitive species would frequent the area.
- Crosses a ridge 7km north of Kwagga Substation, which is negative for avifauna as it is a relatively undisturbed area with un-spoilt vegetation, and may serve as a flight path for raptors along the ridge.
- The majority of the route has been classified as medium sensitivity in the SEA with some medium to low areas as well as one medium to high area (the ridge). This is an advantage

to avifauna in that most of the route is only medium sensitivity and those areas of higher sensitivity are very small.

Alternative 2:

- Splits off from alternative 1 approximately 4km south west of Phoebus Substation
- Makes an easterly loop and joins back onto alternative 1 just south of the R566 road
- Runs between the informal settlement for the majority of the route, which is an advantage to avifauna as sensitive species are unlikely to occur here
- Follows a stream for the majority of the route, which is negative for avifauna as certain species may occur here.
- The majority of this route has been classified as medium to low and medium sensitivity in the SEA. This route, however, does have an additional area classified as medium to high in the SEA and this is a disadvantage to avifauna.

Alternative 3:

- Splits off from alternative 1 just south of the Brits road
- Makes an easterly loop and joins back onto alternative 1 just south west of the M17 road
- Crosses a ridge and some agricultural land which is negative for avifauna as it may serve as a flight path for raptors along the ridge.
- As this alternative is very small the avifaunal sensitivity as identified in the SEA is the same as alternative 1.

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

Alternative	**Preference Rating**
1	3
2	2
3	3

Table 2- Preference rating for the 3 route alternatives

It is clear from the above table that alternative 1 and 3 are the two preferred options although neither is ideal as they both cross the ridge. There is no significant difference between the two as alternative 3 is very short and crosses the ridge in almost the same place, and has the same sensitivity rating in the SEA. Alternative 2 is least preferred and should be discarded.

7 CONCLUSION

In conclusion the proposed power line can be built with acceptable impact on avifauna should the recommendations in this report be followed. It must be noted that crossing the ridges, as this alignment does, is far from ideal and increases the impact of the proposed line. From an avifaunal point of view these sections must be marked with suitable anti-collision marking devices to mitigate for collisions. Habitat destruction and disturbance also increases on the ridges and care must be taken in these areas to mitigate for these impacts.

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APPENDIX 1- IMPACT TABLES

Nature: **Electrocutions on the Transmission lines**		
	Without mitigation	With mitigation
Extent	1	1
Duration	4	4
Magnitude	0	0
Probability	0	0
Significance	**0**	**0**
Status	Not possible	Not Possible
Reversibility	-	-
Irreplaceable loss of resources	-	-
Can impacts be mitigated	-	-
Mitigation: -		
Cumulative impacts:-		
Residual impacts: -		

Nature: **Collisions with the Transmission lines**		
	Without mitigation	With mitigation
Extent	1	1
Duration	4	4
Magnitude	3	2
Probability	3	2
Significance	**39 (medium)**	**24 (low)**
Status	Negative	Negative
Reversibility	5	5
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	Yes
Mitigation: Mark identified spans with suitable anti-collision marking devices in areas specified above in figure 9.		
Cumulative impacts: Marginal		
Residual impacts: Medium		

Nature: **Habitat Destruction**		
	Without mitigation	With mitigation
Extent	1	1
Duration	2	2
Magnitude	3	2
Probability	3	2
Significance	**27 (low)**	**16 (low)**
Status	Negative	Negative
Reversibility	3	3
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	Yes
Mitigation: Environmental best practice must be followed and enforced, existing roads should be used and minimal habitat destruction must occur in or near any water courses and the ridge.		
Cumulative impacts: Marginal		
Residual impacts: Medium		

Nature: **Disturbance**		
	Without mitigation	With mitigation
Extent	1	1
Duration	2	2
Magnitude	2	1
Probability	3	2
Significance	**18 (low)**	**10 (low)**
Status	Negative	Negative
Reversibility	1	1
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	Yes
Mitigation: Environmental best practice must be followed and enforced, existing roads should be used and minimal disturbance must occur in or near any water courses and the ridge.		
Cumulative impacts: Marginal		
Residual impacts: Low		

Nature: **Faulting-business impact**		
	Without mitigation	With mitigation
Extent	1	1
Duration	4	4
Magnitude	2	1
Probability	2	1
Significance	**20 (low)**	**9 (low)**
Status	Negative for business	Negative for business
Reversibility	3	3
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	Yes
Mitigation: Fit bird guards on self support and guyed V towers only if required.		
Cumulative impacts: Negligable		
Residual impacts: Low		

Ranking of significance of impacts before and after mitigation

Note: The highest significance is at the top of the table

Without mitigation	**With Mitigation**
Collision	Collision
Habitat Destruction	Habitat Destruction
Faulting	Disturbance
Disturbance	Faulting
Electrocutions	Electrocutions

APPENDIX 2- CRITERIA FOR EVALUATION OF IMPACTS

Direct, indirect and cumulative impacts of the above issues, as well as all other issues identified will be assessed 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) or regional

» The **duration**, wherein it will be indicated whether:

- the lifetime of the impact will be of a very short duration
- the lifetime of the impact will be of a short duration (2-5 years)
- medium-term (5–15 years);
- long term (> 15 years); or
- permanent;

» The **magnitude**, quantified as small (will have no effect on the environment), minor (will not result in an impact on processes), low (will cause a slight impact on processes), moderate (will result in processes continuing but in a modified way), high (processes are altered to the extent that they temporarily cease), and very high (results in complete destruction of patterns and permanent cessation of processes).

» The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring and will be rated very improbable (probably will not happen), improbable (some possibility, but low likelihood), probable (distinct possibility), highly probable (most likely) and definite (impact will occur regardless of any prevention measures).

» the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high.

» the **status**, which will be described as either positive, negative or neutral.

» the degree to which the impact can be reversed (**reversibility**).

» the degree to which the impact may cause irreplaceable loss of resources.

» the *degree* to which the impact can be *mitigated.*

The potential **significance** of identified impacts will be determined using the significance rating system described below.

Significance of environmental impact = Consequence x Probability

The consequence of an impact can be derived from the following factors:

» Extent of impact
» Duration of impact
» Magnitude
» Reversibility

The above criteria will be rated using the criteria indicated in the table below.

Significance ranking

Magnitude	**Reversibility**	**Duration**	**Spatial extent**	**Probability**
5- Very high/don't know	1- Reversible (Regenerates naturally)	5- Permanent	5- International	5- Definite/don't know
4- High		4- Long term (Impact ceases after operational life)	4- National	4-High probability
3- Moderate	3- Recoverable (needs human input)	3- Medium term (5-15 years)	3- Regional	3- Medium probability
2- Low		2- Short term (0-5 years)	2- Local	2- Low probability
1- Minor	5- Irreversible	1- Immediate	1- Site only	1- Improbable
0-None				0-none

The overall consequence of an impact must be determined by the sum of the individual scores for magnitude, reversibility, duration and extent of an impact, multiplied by the probability of the impact occurring.

Consequence (severity + reversibility + duration + spatial scale) X Probability = Significance

The significance is then characterised as follows:

» **More than 60 significance points** indicate **High** environmental significance

» **Between 30 and 60 significance points** indicate **Moderate** environmental Significance

» **Less than 30 significance points** indicate **Low** environmental significance. The impacts must be ranked according to the significance rating results obtained. The relevant mitigation measures recommended must then be considered and the significance of the impacts after mitigation determined. The impacts must then be ranked again according to the significance results after mitigation.

APPENDIX 3- GENERIC EMP INPUT

Collision

OBJECTIVE: Minimise the Impact of collision with the power line.

Project component/s	Earth wire of the Transmission line.
Potential Impact	Bird collisions with the line.
Activity/risk source	Erection of the power line.
Mitigation: Target/Objective	No reported bird collisions on the new line.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Line patrols should be undertaken to report any collision of bird species with the new line.	ECO	Post Construction

Performance Indicator	Monthly line patrol.
Monitoring	ECO to monitor the new line for bird collisions.

Habitat Destruction

OBJECTIVE: Minimise the Impact of habitat destruction while building and maintaining new line.

Project component/s	Tower foundations, servitudes and substation yard.
Potential Impact	Habitat destruction.
Activity/risk source	Building of tower foundations, clearing of servitude, expanding substation.
Mitigation: Target/Objective	No unnecessary habitat destruction and avoidance of sensitive areas.

Mitigation: Action/control	**Responsibility**	**Timeframe**
All construction and maintenance activities must be undertaken using environmental best practice. Sensitive areas such as wetlands, rivers etc must be avoided and special care must be taken in and around the ridge areas.	ECO Eskom contractor	Construction and maintenance of new line.

Performance Indicator	Environmental audit.
Monitoring	ECO to monitor the construction and maintenance being undertaken by the contractor.

Disturbance

OBJECTIVE: Minimise the Impact of disturbance during construction and maintenance.

Project component/s	Tower foundations, servitudes and substation yard.
Potential Impact	Disturbance.
Activity/risk source	Building of tower foundations, clearing of servitude, expanding substation.
Mitigation: Target/Objective	No unnecessary disturbance during construction and maintenance.

Mitigation: Action/control	Responsibility	Timeframe
All construction and maintenance activities must be undertaken using environmental best practice. Sensitive areas such as wetlands, rivers etc must be avoided. Care must be taken in and around any water sources and the ridges as not to disturb any sensitive bird species.	ECO Eskom contractor	Construction and maintenance of new line.

Performance Indicator	Environmental audit
Monitoring	ECO to monitor the construction and maintenance being undertaken by the contractor.

Faulting

OBJECTIVE: Minimise the Impact of bird induced faulting on the new line.

Project component/s	Towers and new line
Potential Impact	Faulting.
Activity/risk source	Birds perching on tower and causing faulting on line by pollution or streamer mechanisms.
Mitigation: Target/Objective	No bird induced faulting recorded on line.

Mitigation: Action/control	Responsibility	Timeframe
Monitor the performance of the new line and if necessary fit bird guards to stop faulting.	Eskom Transmission	Operational life span of line.

Performance Indicator	Faulting reports
Monitoring	Eskom Transmission to monitor performance of the line.

APPENDIX 4- TX LINE MARKING GUIDELINES

Specifications for Bird Flight Diverters installation on a Transmission line

1. <u>Background:</u>

Where it has been found during an EIA that there is a potential for bird collisions (specially rare or endangered species) with new overhead lines or there are actual collisions on existing lines it is advisable to install bird flappers or bird flight diverters on the earth wires.

It has been found in South Africa and overseas that the majority of collisions happen with the earth wires, as they are less visible than the conductors. The reason is that they are thinner than the conductors and also fewer of them on a line.

Typically big birds with less manoeuvrability, when flying horizontally to the ground, will see the conductors and when taking evasive action collide with the earth wires above.

The bird devices are installed either using "bicycles" along the earth wires or from a chair hanging from a helicopter.

2. <u>Specifications - *Bird Flight Diverters*:</u>

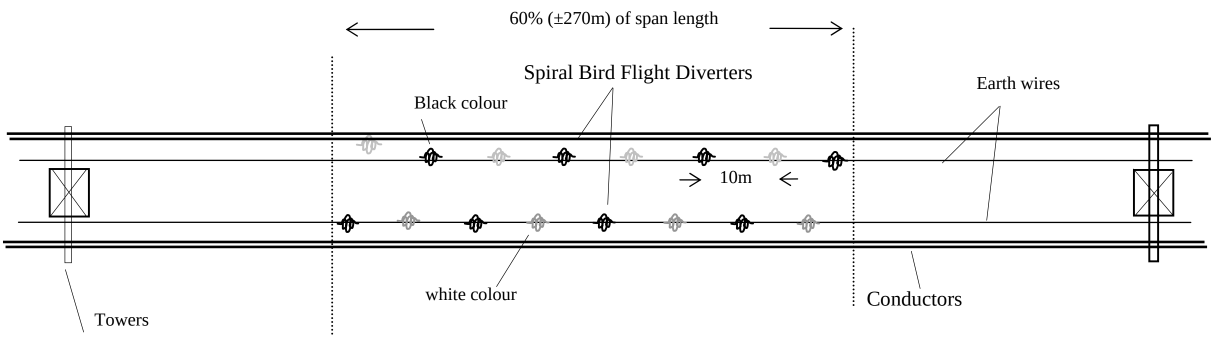
As per recommendations from Chris van Rooyen of the Endangered Wildlife Trust (EWT), Transmission should use the <u>spiral type</u> until all flapper types are tested by Eskom..

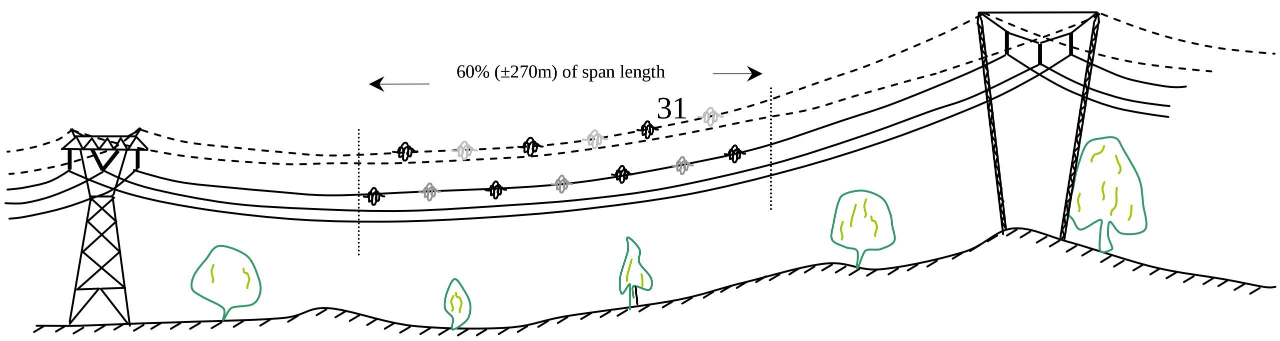
- Black and white spirals are of preformed 14mm diameter PVC UV stabilised rod.

Half of the spirals to be of <u>white colour</u> and the other half to be of <u>black colour</u>.

Installation of the bird flight diverters to be:

- To be installed on both earth wires (19/2,65), staggered;
- To be installed only on 60% of the span and in the <u>middle of the span</u> (Chris van Rooyen of the Endangered Wildlife Trust). Typical 400 kV line spans length=450m-60%=270m.
- On the lower middle lower span, spirals be installed at <u>10 metre intervals</u> on each earth wire and with alternating colours on each side (as per sketch below).





TSHWANE STRENGTHENING PROJECT SPECIALIST AVIFAUNAL ASSESSMENT PHASE 1

DRAFT EIA
VOLUME 3- KWAGGA PHOEBUS SUBSTATIONS (12/12/20/1524)

January 2010

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PROFFESSIONAL DECLARATION

This study was conducted by Jon Smallie and Luke Strugnell in their capacity as biologists for the Endangered Wildlife Trust (EWT). The EWT are independent consultants to Savannah Environmental (for Eskom Transmission). The EWT has no business, financial, personal or other interest in the activity, application or appeal in respect of which they were appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of these specialists performing such work.

Mr. Strugnell and Mr Smallie are registered with The South African Council for Natural Scientific Professionals (400181/09) (400020/06) respectively. They have ten years of experience in the field of bird interactions with electrical infrastructure and have conducted avifaunal impact assessments for ten Eskom Transmission projects and approximately thirty Eskom Distribution projects. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information.

EXECUTIVE SUMMARY

Eskom Transmission Plan to erect new lines and Substations as part of a strengthening program to strengthen electricity supply to Pretoria. The proposed solution, which is known as the **City of Tshwane Electricity Supply Plan Scheme Phase 1** proposed to build four new substations in the Tshwane area. Three will be built by Eskom and one will be built by the City of Tshwane Metropolitan Municipality (CoT). These four substations are: Eskom Phoebus substation; Eskom Verwoerdburg substation; Eskom Anderson substation and Tshwane Wildebees substation. Eskom furthermore propose to erect new lines to service these substations. The project has been broken into 3 volumes, of which this report forms volume 3- Kwagga and Phoebus Substations.

The Endangered Wildlife Trust (EWT) were appointed by Savannah Environmental to provide an avifaunal specialist report at both the scoping and EIA phase of this project. During the scoping phase the broad impacts were assessed. During this phase of the project (the EIA phase) these routes were further assessed, the impacts quantified and mitigation recommended.

The proposed building and upgrade of the substation will have no significant impact on avifauna as the general area is already degraded and disturbed to a large extent. No mitigation is necessary at this stage.

1. INTRODUCTION & BACKGROUND

Eskom Transmission Plan to erect new lines and Substations as part of a strengthening program to strengthen electricity supply to Pretoria. The proposed solution, which is known as the **City of Tshwane Electricity Supply Plan Scheme Phase 1** proposed to build or upgrade four new substations in the Tshwane area. Three will be built by Eskom and one will be built by the City of Tshwane Metropolitan Municipality. These four substations are: Eskom Phoebus substation; Eskom Verwoerdburg substation; Eskom Anderson substation and Tshwane Wildebees substation. Eskom furthermore propose to erect new lines to service these substations.

The Endangered Wildlife Trust (EWT) was contracted by Savannah Environmental to conduct the Avifaunal Specialist study on the above project. A site visit was conducted on the 12th and 13th of May 2009 and the 18th of November 2009.

In general terms, the impacts that could be associated with a project of this nature include: electrocution of birds in the substation yards; destruction of habitat; disturbance of birds.

1.1 Terms of reference

The following terms of reference were utilised for this study:

- A description of 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
- The identification of Red Data species potentially affected by the proposed transmission lines
- The identification of 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.
- The identification of 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).
- The formulation of a simple system to monitor impacts, and their management, based on key indicators

1.2 Description of proposed activities

- Upgrade the existing Kwagga Substation and establish the Phoebus Substation

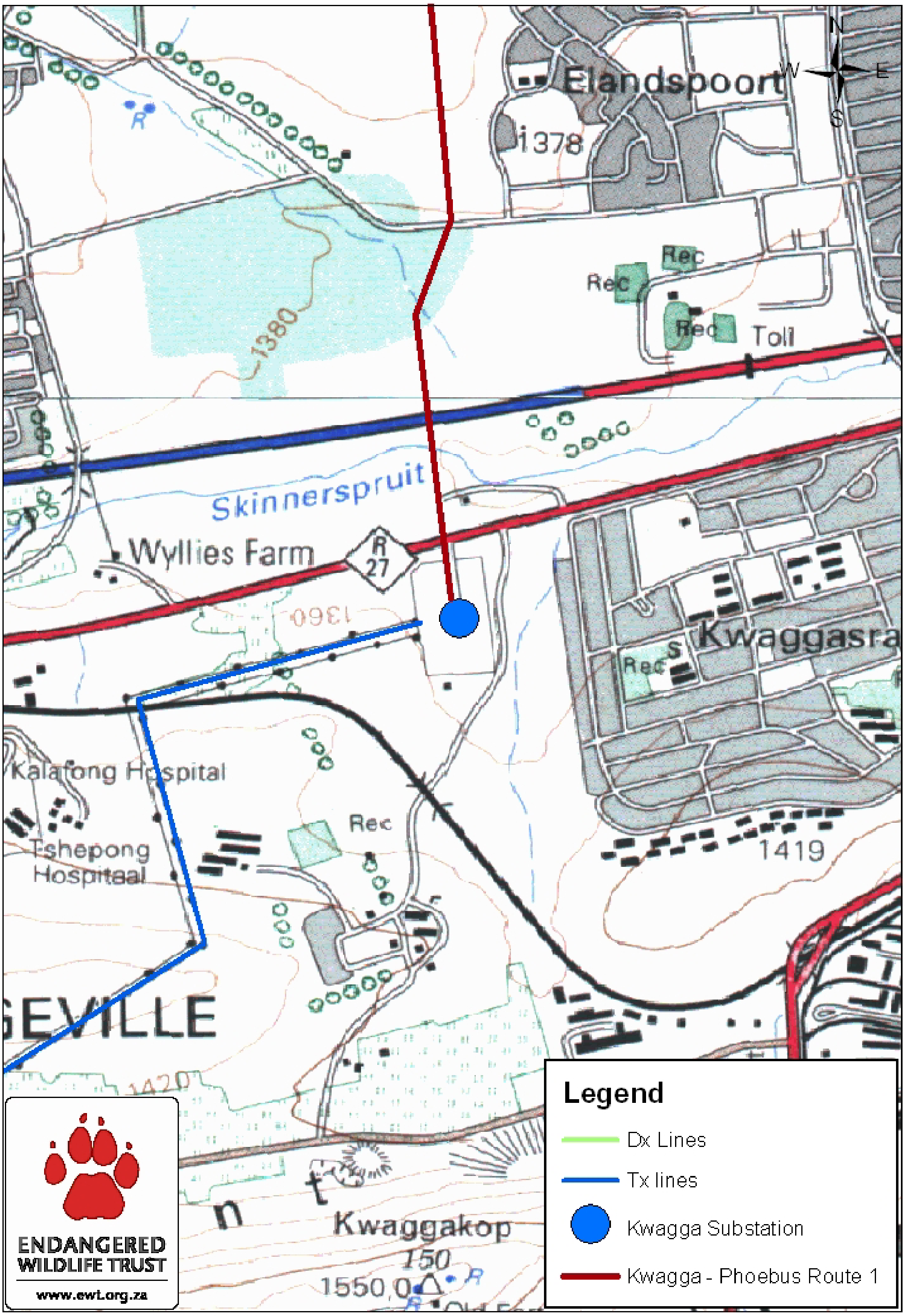

Figure 1. Location of Kwagga Substation (Map-EWT).

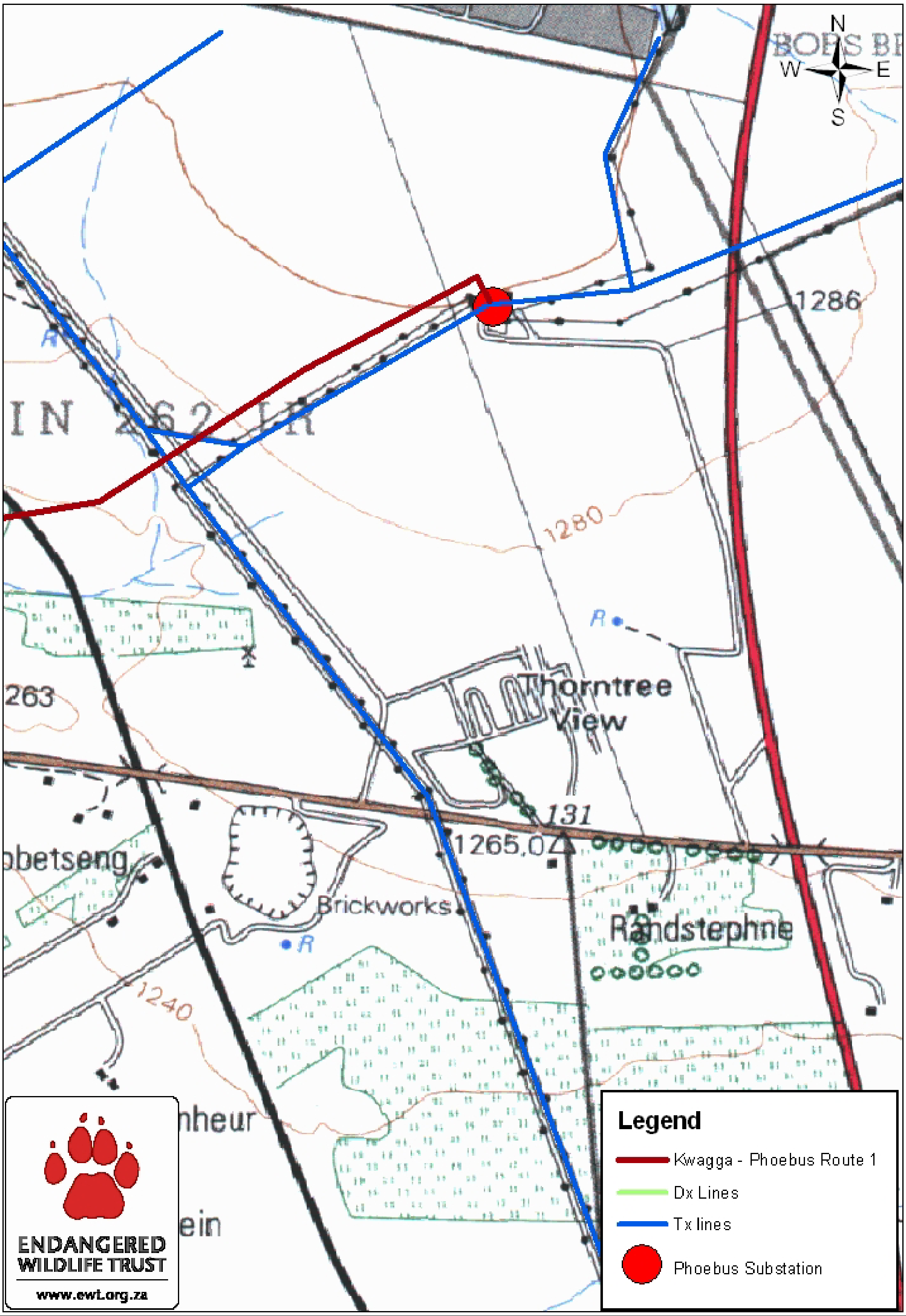

Figure 2- Location of Phoebus Substation (Map-EWT).

2 GENERAL DESCRIPTION OF AVIAN INTERACTIONS WITH ELECTRICAL INFRASTRUCTURE

Substations can impact avifauna through electrocutions, habitat destruction or disturbace.

2.1 Electrocution

Electrocutions are possible within the substation yard during operation and this is caused by live phases that are close together being bridged by a birds extremities. Substations are generally lit and this can attract certain species however most species impacted on by substations are the less sensitive species and therefore of less concern.

2.2 Habitat destruction

During the construction phase and maintenance of substations, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads and the leveling of substation yards. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, through the modification of habitat.

2.3 Disturbance

During the construction and maintenance of electrical infrastructure, a certain amount of disturbance results. For shy, sensitive species this can impact on their usual daily activities, particularly whilst breeding. In general terms, one would expect that any species already existing in the study area must surely have adapted to relatively high levels of disturbance.

3 METHODOLOGY

3.1 Information sources used

The following information sources were consulted in order to conduct this study:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP – Harrison *et al,* 1997) was obtained for the two quarter degree squares which cover the study area, from the Avian Demography Unit of the University of Cape Town, as a means to ascertain which species occur within the study area.
- 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).

- A classification of the vegetation types in the study area was obtained from (Mucina and Rutherford, 2006)
- The likelihood of occurrence of bird species reported using the SABAP data was compiled using the vegetation data above and by examining bird micro-habitats in the study area.
- Google Earth was used to examine the study area.

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 SABAP data, see Harrison *et al,* 1997.

4. DESCRIPTION OF RECEIVING ENVIRONMENT

4.1. Vegetation and land use

A map was plotted with the two sites and the vegetation of the area. This is useful when used in conjunction with the bird data presented in table 1 below to estimate the likelihood of occurrence of these birds in this area.

As can be seen in the map below, figure 4, the predominant vegetation type is a variety of bushveld vegetation types and some thornveld. It is thus expected that the bushveld birds will be most prevalent, for example White-bellied Khoraan, Marabou Stork, Tawny Eagle and Martial Eagle.

Having said this however the study area is predominantly urbanized, disturbed and degraded to a large extent and the vegetation data is not very meaningful when it comes to predicting what species of bird will occur in the study area.

Perhaps more important then, is an examination of the micro habitats available to birds. These are generally evident at a much smaller spatial scale than the vegetation types, and are determined by a host of factors such as vegetation type, topography, land use and man-made infrastructure. These have been described below.

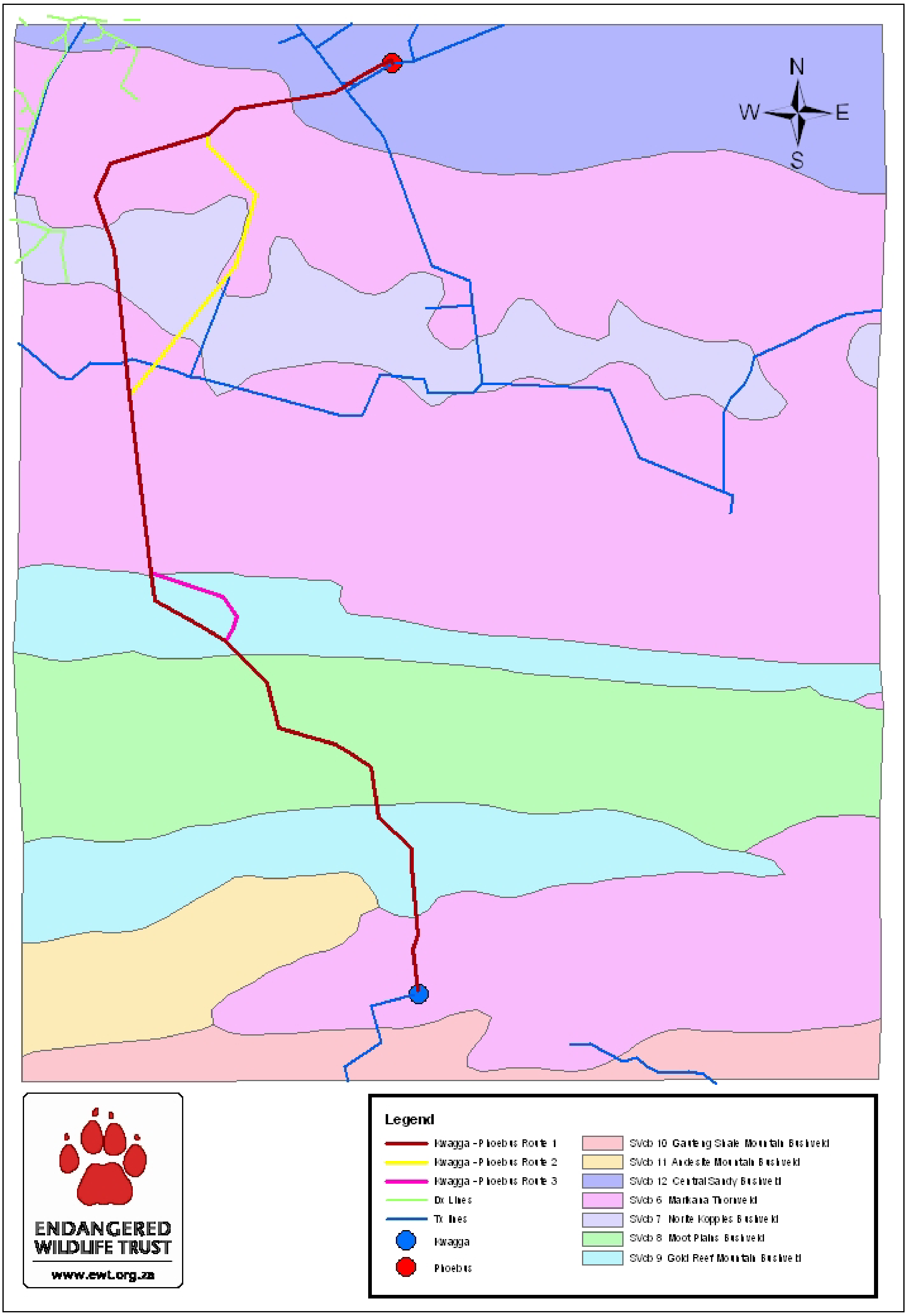

Figure 4- Vegetation classification according to (Mucina and Rutherford, 2006) (Map –EWT)

The micro habitats identified in this study area are described below and have been taken into account in identifying the sensitive areas within this study area.

Grassland Patches: These open areas represent a significant feeding area for many bird species in densely populated areas. Specifically, these open grassland patches typically attract korhaans, storks, and many other power line sensitive species (Secretarybird, Blue Crane and Lanner Falcon). The low reporting rate for these species (TABLE 1 - Harrison *et al* 1997) is evidence of the impact that the surrounding developments are having on the birds that would, under optimum conditions, inhabit these open areas.

Figure 5- Typical grassland patches in the study area with the ridge in the background

Wetlands, rivers and drainage lines: Wetlands are of particular importance for birds in the study area, as the area is largely urbanized and these represent fragmented habitat “islands” available to the water birds in this area. Examples of the birds that may use this micro-habitat include Greater Flamingoes, Half-collared Kingfisher and African Marsh harrier. Again the low report rates are evidence of how disturbed and degraded the area is.

Figure 6- Degraded stream

Stands of Eucalyptus trees: Although stands of Eucalyptus are strictly speaking invader species, these stands have become important refuges for certain species of raptors. In particular, large Eucalyptus trees are used by the migratory Lesser Kestrels for roosting purposes, although no known roost sites exist in the study area.

Figure 7- Stands of exotic trees

Figure 8- Route of lines to Kwagga Substation (visible in the distance)

4.2. Relevant bird populations

Total Cards		574	627		
Total Species		348	313		
Total Breeding Species		116	123		
Name	**Conservation status**	**2528CA**	**2528CC**	**Habitat**	**Likelihood of occurrence**
Cape Vulture	VU	2	0	Mostly mountainous country, or open country with inselbergs and escarpments; less commonly in savanna or desert	Unlikely
Tawny Eagle	VU	0		Woodland and savanna to semi-arid savanna or grassland with scattered Acacia trees	Unlikely
Martial Eagle	VU		0	Woodland, savanna or grassland with clumps of large trees or power pylons for nest sites	Unlikely
African Marsh-Harrier	VU	1	0	Marsh, vlei, grassland (usually near water); may hunt over grassland, cultivated lands and open savanna	Unlikely
Lesser Kestrel	VU	1	1	Open grassveld, mainly on highveld, usually near towns or farms	Unlikely
Blue Crane	VU	1	3	Midland and highland grassveld, edge of karoo, cultivated land, edges of vleis	Unlikely
African Finfoot	VU		0	Quiet reaches of streams, rivers, pans and lakes, fringed with dense trees and bush drooping into water	Highly Unlikely
White-bellied Korhaan	VU		0	Open grassland; sometimes in sparse *Acacia* thornveld	Unlikely
African Grass-Owl	VU		2	Long grass, usually near water, vleis, marshes	Unlikely
Black Stork	NT	1	0	Feeds in or around marshes, dams, rivers and estuaries; breeds in mountainous regions	Unlikely
Marabou Stork	NT	0		Open to semi-arid woodland, bushveld, fishing villages, rubbish tips, lake shores	Possible
Yellow-billed Stork	NT	1	0	Mainly inland waters; rivers, dams, pans, floodplains, marshes; less often estuaries	Unlikely
Greater Flamingo	NT	0		Large bodies of shallow water, both inland and coastal; saline and brackish waters preferred	Unlikely
Secretarybird	NT	0		Semidesert, grassland, savanna, open woodland, farmland, mountain slopes	Unlikely
Ayres Hawk-Eagle	NT	3	0	Dense woodland, forest edge, *Eucalyptus* groves in towns; avoids arid zones	Unlikely
Lanner Falcon	NT	1	1	Mountains or open country from semidesert to woodland and agricultural land; also cities	Unlikely
Greater Painted-snipe	NT	0		Marshes, swamps, edges of lakes, dams, ponds and streams, with marginal vegetation.	Unlikely
Half-collared Kingfisher	NT	0	1	Fast-flowing perennial streams, rivers and estuaries, usually with dense marginal vegetation	Unlikely
Melodious Lark	NT		0	Open climax grassland,sometimes with rocky outcrops, termite mounds or sparse bushes; also cultivated fields	Unlikely
White Stork	Bonn	1	2	Highveld grasslands, mountain meadows, cultivated lands, marshes, karoo	Unlikely
Abdims Stork	Bonn	3	5	Mainly highveld grassland; also semi-arid Kalahari (especially after rain), cultivated lands, inland waters	Unlikely

VU=Vulnerable; NT= Near Threatened; Bonn= Protected under the Bonn Convention, (Habitat data from Roberts 7)

TABLE 1- Red Data species report rates for the two quarter degree squares which cover the study area (Harrison *et al*, 1997)

Report rates are essentially 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. A report rate of 0 means that the species was recorded in the square, but at a very low frequency. It is important to note that these species could have been recorded anywhere in each square, and not necessarily in the exact study area.

Table 1 shows the recorded red data species in the study area, and their habitat requirements and likelihood of occurrence. Most of these species will probably not occur in the study area due to the large amount of disturbance and habitat degradation. The only exception is the Marabou Stork, which maybe attracted by such conditions.

5 EVALUATION OF IMPACTS

The impacts of this proposed development have been evaluated in the tables in APPENDIX 1 according to the criteria presented in APPENDIX 2 and are discussed in general below.

Electrocutions

Electrocutions can have a negative impact on avifauna within the substation yards, however this negative impact will almost certainly be limited to non sensitive species and thus will be of little concern. Should it be found during operation that this is not the case the EWT can be approached for solutions in dealing with this impact. As such electrocutions are not seen as a significant impact for the two substations.

Habitat destruction

As most of the area is disturbed and degraded this is not seen as a significant impact.

Disturbance

Again this impact is likely to be very low considering the area and the level of disturbance already present and as long as environmental best practice is followed the impact will be negligible.

6 CONCLUSION

In conclusion the proposed substations can be built and upgraded with minimal impact on avifauna. The area is already disturbed and degraded and as such the proposed activities will have no significant impact.

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APPENDIX 1- IMPACT TABLES

Nature: **Electrocutions in the substation yard**		
	Without mitigation	With mitigation
Extent	1	1
Duration	4	4
Magnitude	2	1
Probability	2	1
Significance	**24 (low)**	**11 (low)**
Status	Negative	Negative
Reversibility	5	5
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Not required	Not required
Mitigation: Not required at this stage		
Cumulative impacts: Negligible		
Residual impacts: Low		

Nature: **Habitat Destruction**		
	Without mitigation	With mitigation
Extent	1	1
Duration	5	5
Magnitude	2	1
Probability	4	4
Significance	**44 (medium)**	**40 (medium)**
Status	Negative	Negative
Reversibility	3	3
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	Yes
Mitigation: Environmental best practice must be followed and enforced, existing roads should be used and minimal habitat destruction must occur.		
Cumulative impacts: Negligible		
Residual impacts: High		

Nature: **Disturbance**		
	Without mitigation	With mitigation
Extent	1	1
Duration	2	2
Magnitude	2	1
Probability	3	2
Significance	**18 (low)**	**10 (low)**
Status	Negative	Negative
Reversibility	1	1
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	Yes
Mitigation: Environmental best practice must be followed and enforced, existing roads should be used and minimal disturbance must occur.		
Cumulative impacts: Negligible		
Residual impacts: Low		

Ranking of significance of impacts before and after mitigation

Note: The highest significance is at the top of the table

Without mitigation	**With Mitigation**
Habitat	Habitat
Electrocutions	Electrocutions
Disturbance	Disturbance

APPENDIX 2- CRITERIA FOR EVALUATION OF IMPACTS

Direct, indirect and cumulative impacts of the above issues, as well as all other issues identified will be assessed 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) or regional

» The **duration**, wherein it will be indicated whether:

- the lifetime of the impact will be of a very short duration
- the lifetime of the impact will be of a short duration (2-5 years)
- medium-term (5–15 years);
- long term (> 15 years); or
- permanent;

» The **magnitude**, quantified as small (will have no effect on the environment), minor (will not result in an impact on processes), low (will cause a slight impact on processes), moderate (will result in processes continuing but in a modified way), high (processes are altered to the extent that they temporarily cease), and very high (results in complete destruction of patterns and permanent cessation of processes).

» The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring and will be rated very improbable (probably will not happen), improbable (some possibility, but low likelihood), probable (distinct possibility), highly probable (most likely) and definite (impact will occur regardless of any prevention measures).

» the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high.

» the **status**, which will be described as either positive, negative or neutral.

» the degree to which the impact can be reversed (**reversibility**).

» the degree to which the impact may cause irreplaceable loss of resources.

» the *degree* to which the impact can be *mitigated.*

The potential **significance** of identified impacts will be determined using the significance rating system described below.

Significance of environmental impact = Consequence x Probability

The consequence of an impact can be derived from the following factors:

» Extent of impact
» Duration of impact
» Magnitude
» Reversibility

The above criteria will be rated using the criteria indicated in the table below.

Significance ranking

Magnitude	**Reversibility**	**Duration**	**Spatial extent**	**Probability**
5- Very high/don't know	1- Reversible (Regenerates naturally)	5- Permanent	5- International	5- Definite/don't know
4- High		4- Long term (Impact ceases after operational life)	4- National	4-High probability
3- Moderate	3- Recoverable (needs human input)	3- Medium term (5-15 years)	3- Regional	3- Medium probability
2- Low		2- Short term (0-5 years)	2- Local	2- Low probability
1- Minor	5- Irreversible	1- Immediate	1- Site only	1- Improbable
0-None				0-none

The overall consequence of an impact must be determined by the sum of the individual scores for magnitude, reversibility, duration and extent of an impact, multiplied by the probability of the impact occurring.

Consequence (severity + reversibility + duration + spatial scale) X Probability = Significance

The significance is then characterised as follows:

» **More than 60 significance points** indicate **High** environmental significance

» **Between 30 and 60 significance points** indicate **Moderate** environmental Significance

» **Less than 30 significance points** indicate **Low** environmental significance. The impacts must be ranked according to the significance rating results obtained. The relevant mitigation measures recommended must then be considered and the significance of the impacts after mitigation determined. The impacts must then be ranked again according to the significance results after mitigation.

APPENDIX 3- GENERIC EMP INPUT

Electrocutions

OBJECTIVE: Minimise the Impact of Electrocutions in the substation yard

Project component/s	Substation yard.
Potential Impact	Electrocutions of birds
Activity/risk source	Operation of substation
Mitigation: Target/Objective	No electrocution of sensitive bird species.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Substation yard to be monitored for electrocutions	ECO	Operation of substation

Performance Indicator	No electrocutions of sensitive species
Monitoring	ECO to monitor the substation yard

Habitat Destruction

OBJECTIVE: Minimise the Impact of habitat destruction while building and maintaining Substations.

Project component/s	Substation yard.
Potential Impact	Habitat destruction.
Activity/risk source	Expanding and building substation.
Mitigation: Target/Objective	No unnecessary habitat destruction

Mitigation: Action/control	**Responsibility**	**Timeframe**
All construction and maintenance activities must be undertaken using environmental best practice.	ECO Eskom contractor	Construction and maintenance of new line.

Performance Indicator	Environmental audit.
Monitoring	ECO to monitor the construction and maintenance being undertaken by the contractor.

Disturbance

OBJECTIVE: Minimise the Impact of disturbance during construction and maintenance.	
Project component/s	Substation yard.
Potential Impact	Disturbance.
Activity/risk source	Expanding and building substation.
Mitigation: Target/Objective	No unnecessary disturbance during construction and maintenance.

Mitigation: Action/control	Responsibility	Timeframe
All construction and maintenance activities must be undertaken using environmental best practice.	ECO Eskom contractor	Construction and maintenance of new line.

Performance Indicator	Environmental audit
Monitoring	ECO to monitor the construction and maintenance being undertaken by the contractor.