THSWANE STRENGTHENING PROJECT SPECIALIST AVIFAUNAL ASSESSMENT PHASE 1

DRAFT EIA
VOLUME 1- APOLLO-VERWOERDBURG SUBSTATION UPGRADE AND CONSTRUCTION OF 400KV TURN IN LINES (12/12/20/1470)

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PROFESSIONAL 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 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 project has been broken into 3 volumes, of which this report forms volume 1- Apollo-Verwoerdburg.

The Endangered Wildlife Trust (EWT) was 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 identified and described and a new alternative line route was proposed for this project in order to minimse impacts on avifauna. During this detailed phase of the project (the EIA phase) these routes were assessed and the impacts quantified. Mitigation measures are proposed for identified significant impacts.

The results of this study show that two preferred route alternatives exist. The first and most preferred alternative is alternative 3. This alternative follows existing lines for the entire length and thus the impact on avifauna in terms of collisions, habitat destruction and disturbance will be significantly less. The next most preferred alternative is alternative 3a which was introduced during the integration meeting on request from Eskom. While this alternative will have slightly higher impacts than alternative 3 these are seen as insignificant and thus this alternative may also be used with minimal impact on avifauna.

1. INTRODUCTION & BACKGROUND

Eskom Transmission propose the erection of 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 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: 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

- 2 x 400 kV turn in & out of existing Apollo-Pluto Transmission lines.

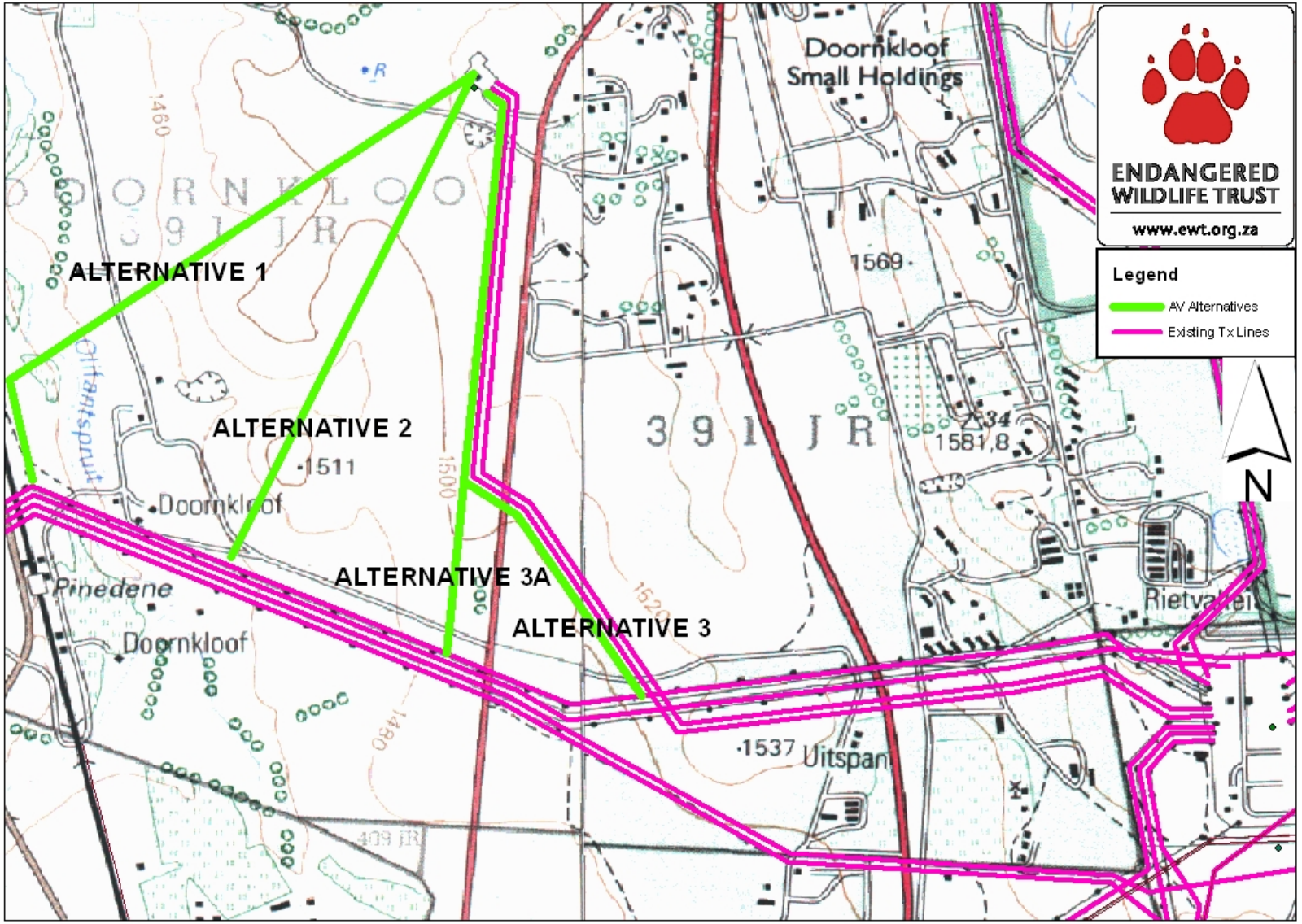

Figure 1. Study area layout showing existing infrastructure and line options (Map-EWT).

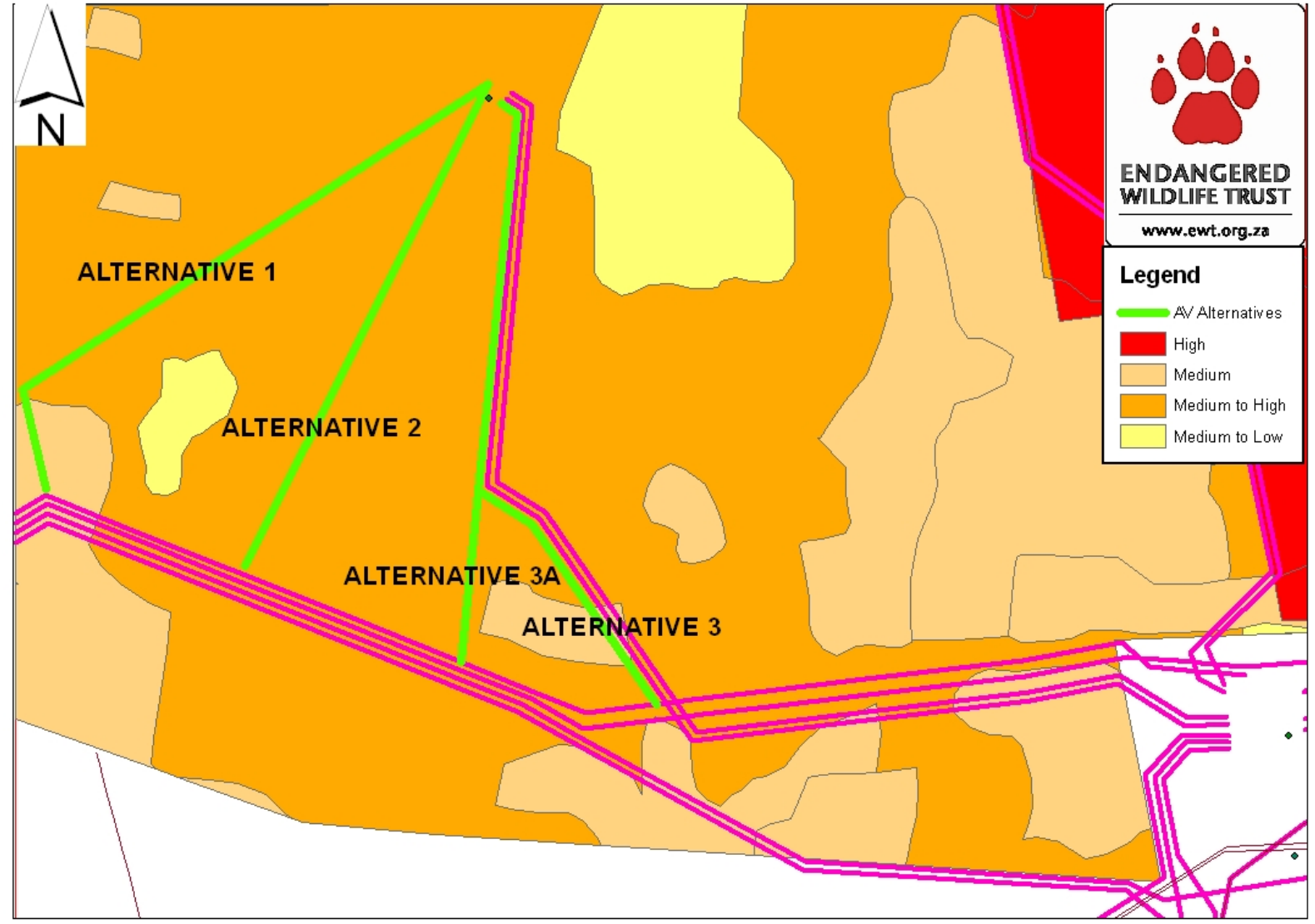

Figure 2- Study area showing Avifaunal sensitive areas as identified in the Pretoria Strategic Environmental Assessment conducted previously by EWT (Map –EWT)

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. This impact has therefore not been assessed in detail in this report.

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, all three routes occur on Carltonville Dolomite Grassland and as such it is expected that the grassland birds would be most well represented in this immediate area. Examples of these birds include the Blue Crane, African Grass Owl, White-bellied Khoraan, Secretarybird, White Stork and Abdims Stork.

Having said this however the study area is predominantly urbanised, 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.

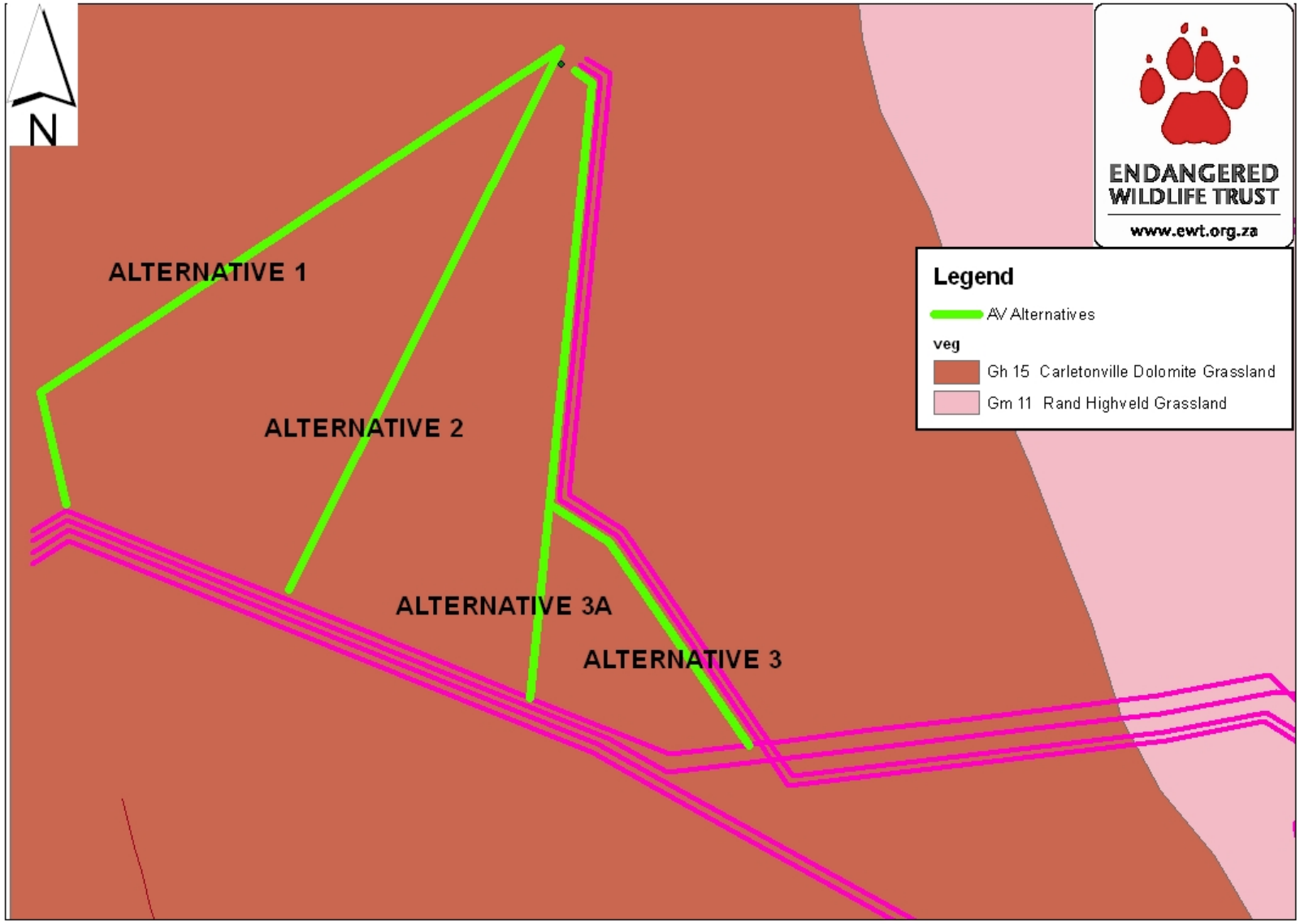

Figure 4- Vegetation classification according to Mucina and Rutherford (2006)

The micro habitats identified in this study area are described below.

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

Wetlands, rivers and drainage lines: Wetlands are of particular importance for birds in the study area, as the area is largely urbanised 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- Railway line and stream in the background, bordered by trees

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.

These micro habitats have been taken into account in identifying the sensitive areas within this study area.

4.2. Relevant bird populations

Total Cards		534	627		
Total Species		338	313		
Total Breeding Species		131	123		
Name	**Conservation status**	**2528CD**	**2528CC**	**Habitat**	**Likely hood of occurrence**
Cape Vulture	VU		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		0	Marsh, vlei, grassland (usually near water); may hunt over grassland, cultivated lands and open savanna	Possible
Lesser Kestrel	VU	1	1	Open grassveld, mainly on highveld, usually near towns or farms	Unlikely
Blue Crane	VU	3	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	0	Open grassland; sometimes in sparse *Acacia* thornveld	Unlikely
African Grass-Owl	VU	1	2	Long grass, usually near water, vleis, marshes	Possible
Black Stork	NT	0	0	Feeds in or around marshes, dams, rivers and estuaries; breeds in mountainous regions	Unlikely
Yellow-billed Stork	NT		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	Highly Unlikely
Secretarybird	NT	2		Semidesert, grassland, savanna, open woodland, farmland, mountain slopes	Unlikely
Ayres Hawk-Eagle	NT	0	0	Dense woodland, forest edge, *Eucalyptus* groves in towns; avoids arid zones	Unlikely
Peregrine Falcon	NT	0		Cliffs, mountains, steep gorges; may hunt over open grassland, farmland and forests; rarely enters cities to hunt	Unlikely
Lanner Falcon	NT	1	1	Mountains or open country from semidesert to woodland and agricultural land; also cities	Unlikely
Corn Crake	NT	0		Rank grasslands, fallow fields, grassy edges of streams and vleis, growing crops	Unlikely
Blue Korhaan	NT	0		Open grassveld, karoo scrub, cultivated lands	Unlikely
Greater Painted-snipe	NT	0		Marshes, swamps, edges of lakes, dams, ponds and streams, with marginal vegetation.	Possible
Black-winged Pratincole	NT	0		Open grassland	Unlikely
Caspian Tern	NT	0		Estuaries, marine shores, larger inland dams and pans	Highly Unlikely
Half-collared Kingfisher	NT	0	1	Fast-flowing perennial streams, rivers and estuaries, usually with dense marginal vegetation	Possible
Melodious Lark	NT		0	Open climax grassland,sometimes with rocky outcrops, termite mounds or sparse bushes; also cultivated fields	Unlikely
White Stork	Bonn	3	2	Highveld grasslands, mountain meadows, cultivated lands, marshes, karoo	Likely
Abdims Stork	Bonn	2	5	Mainly highveld grassland; also semi-arid Kalahari (especially after rain), cultivated lands, inland waters	Likely

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 may have been 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 quarter degree square, and not necessarily in the exact study area.

As can be seen in the table above most of the species are unlikely to occur in this area with the exception of the White Stork and Abdims Stork, which are considered likely to occur on site.

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 these proposed lines 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 as such is not discussed any further.

Electrocutions in the substation yard are possible but generally only effect the non-red data species (e.g. geese, Ibises, doves), as these sensitive red data species are not known to frequent substations.

Collisions

Collisions will be one of the major impacts of the transmission lines. Collisions will mainly impact on the larger slower flying birds, such as flamingoes and storks. This impact is not expected to be significant as the study area is heavily degraded and the likelihood of finding these species within close proximity to the line will be slight. Furthermore the report rates of these species in the study area are low.

It is strongly suggested that Alternative 3 or 3a be used as placing the new lines adjacent to an existing line will, to some extent, mitigate for the impact of collisions.

This fact together with the general status of the area will mean collisions are not expected to be a significant impact.

Habitat destruction

The entire area is disturbed and degraded and as such this is not seen as a significant impact. Should Alternative 3 or 3a, be followed this impact should be very low as the route would follow an existing servitude, where habitat has already been disturbed.

Disturbance
Again this impact is likely to be very low considering the area and the level of disturbance already present.

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.

The self-support towers and guyed V towers would be the only towers susceptible to faulting and should this be an issue bird guards can be fitted reactively to the effected towers.

6 COMPARISON OF ALTERNATIVES

Transmission Line Evaluation:

Alternative 1:

- Starts at Verwoerdburg Substation and runs south west for two kilometers to the Glen Avenue road
- Turns south from here and joins into the existing Apollo-Pluto lines
- Crosses some open grassland and a small stream, which is negative for avifauna as these are both habitats that are attractive to certain species
- Crosses a small section identified as medium sensitivity in the SEA, which results in less impact on avifauna when compared to alternative 2

Alternative 2:

- Starts at Verwoerdburg Substation and runs south-south west for 2.3 kilometers in a straight line
- Joins into the existing Apollo-Pluto lines
- Crosses some open grassland and a small koppie, which is negative for avifauna as this is a potentially undisturbed area and as such good habitat for a variety of bird species
- Passes over both medium and medium to high areas as identified in the SEA and as such has a higher impact than alternative 1 and 3, which passes over an area of less sensitivity.

Alternative 3:

- Starts at Verwoerdburg Substation and follows existing transmission lines for the entire length, which is an advantage to avifauna as it partially mitigates the collision risk
- Follows the road for the majority of the route, this is positive for avifauna as the disturbance of the road will mean sensitive bird species are unlikely to occur in this area.

- Does not cross any streams or koppies, which is an advantage to avifauna
- Passes over a small area identified as medium in the SEA, which results in less impact on avifauna when compared to alternative 2

Alternative 3a:

- This is an additional alternative that was introduced in the integration meeting on request from Eskom.
- It follows Alternative 3 until Alternative 3 turns south east. At this point this alternative carries on straight and joins up with the existing lines to the south.
- Follows the existing linesfor the majority of te route, which is advantageous for avifauna as this will reduce the collision risk.
- Runs independently from existing lines for a very short section, this is a disadvantage to avifauna as the collision risk would be increased.
- Passes over more "medium to high" sensitivity according to the SEA than Alternative 3, this is a disadvantage to avifauna as it increases the impact slightly.

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	2
2	2
3	5
3a	4

Table 2- Preference rating for the 4 route alternatives

It is clear from the above table that alternative 3 is the preferred option. This route follows existing lines for its entire length and as such the risk of collision will be significantly lowered. This route does not pass over any streams or koppies and thus is the most highly preferred from an avifauna perspective. The disturbance and habitat degradation will also be lower adjacent to an existing line due to the disturbance associated with the existing servitude. Alternative 3a is the second most preferred alternative from an avifaunal perspective. This is due to the fact that it follows existing lines for the majority of the route. Where it deviates from these existing lines the length of line is very short and thus no significant increase in the impacts is foreseen.

7 CONCLUSION

In conclusion the proposed new power line can be built with minimal impact on avifauna should Alternative 3 or 3a be followed. These preferred routes follow existing lines for the majority of the route and as such all of the impacts associated with power lines will be significantly less. If these

routes are followed no mitigation is required to minimise the risk of collisions. Even though the area is considered to be disturbed and degraded, care should be taken during construction and maintenance activities to follow environmental best practice and thus reduce the impact of habitat destruction and disturbance. It is furthermore not envisaged that bird induced faulting will be an issue and thus bird guards are not required, should faulting be an issue at a later date bird guards can be fitted reactively.

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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	None	None
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	2	2
Significance	**26 (Low)**	**24 (Low)**
Status	Negative	Negative
Reversibility	5	5
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes-but not required	Yes-but not required
Mitigation: Not required if alternative 3 or 3a is selected		
Cumulative impacts: Marginal if placed next to existing lines (Alternative 3 and 3a)		
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. Minimal habitat destruction must occur during the building of the towers and clearing of the servitudes and substation yards. Where possible servitudes should be left uncleared and as natural as possible.		
Cumulative impacts: Marginal if placed next to existing lines (Alternative 3)		
Residual impacts: Medium		

Nature: **Disturbance**		
	Without mitigation	With mitigation
Extent	1	1
Duration	2	2
Magnitude	2	1
Probability	2	1
Significance	**12 (low)**	**5 (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. The minimum amount of vehicles and machines must be used on site and specific care should be taken with these vehicles and machines in and around water courses.		
Cumulative impacts: Marginal if placed next to existing lines (Alternative 3 and 3a)		
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**
Habitat Destruction	Collision
Collision	Habitat Destruction
Faulting	Faulting
Disturbance	Disturbance
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 the 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. The minimum amount of vegetation must be cleared.	ECO Eskom contractor	Construction and maintenance of new line.

Performance Indicator	Environmental audit.
Monitoring	ECO to monitor the construction 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 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 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.