MERCURY - PERSEUS 400 kV TRANSMISSION LINE

BIRD IMPACT ASSESSMENT STUDY

Prepared by:

CHRIS VAN ROOYEN & JON SMALLIE
ENDANGERED WILDLIFE TRUST
PRIVATE BAG X11
PARKVIEW
2122

Prepared for:

STRATEGIC ENVIRONMENTAL FOCUS
P.O. Box 74785
Lynnwood Ridge
0040

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EXECUTIVE SUMMARY

Bird-powerline interactions can either be direct interactions, in which the bird comes into physical contact with the powerline infrastructure, or indirect in which the powerline infrastructure in some way impacts on the bird without coming into direct contact with it. Typically, direct interactions take the form of birds colliding with or being electrocuted on the infrastructure, or using it for nesting, roosting or perching. Indirect interaction is disturbance or habitat destruction as a result of activities relating to the construction or maintenance of the powerline. Although these activities do not necessarily kill birds, they may impact negatively on birds.

This study area overlaps substantially with six half degree squares. The total number of bird species recorded for each square ranges from 194 to 268, with a total of 39 powerline sensitive Red Data species recorded in the study area.

This study found that the potential exists for direct interaction in the form of collision of birds with the earth wire of the proposed line, as well as indirect interaction in the form of habitat destruction and disturbance. Of the eleven bird micro habitats identified, the above interactions will be most pronounced in three of the untransformed habitats, namely, the wetlands & ephemeral pans, grassland and riparian habitats, and one transformed habitat namely lucerne fields (collisions).

Mitigation for the collision impact will involve the installation of Bird Flappers on the earth wire on sections of line traversing these four habitats. Mitigation for the disturbance and habitat destruction will involve minimising construction and maintenance activities within the three natural habitats as far as possible, and ensuring that activities along the full length of the line conform to stringent environmental management principles.

An analysis of the sensitivity of the three proposed corridors revealed that the least sensitive corridor from a bird impact perspective would be number 1. This means that of the three corridors, number 1 is likely to have the least impact on the Red Data species present, and it is therefore recommended as the proposed servitude.

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1. INTRODUCTION

ESKOM has appointed Strategic Environmental Focus to undertake an Environmental Impact Assessment for the proposed Mercury – Perseus 400kV transmission line between Orkney and Dealsville in the Free State in order to comply with regulatory requirements of the Environmental Conservation Act (Act 73. of 1989 and associated Regulations). Strategic Environmental Focus has appointed the Endangered Wildlife Trust as specialists to investigate the potential bird related impacts associated with proposed line.

2. BACKGROUND AND BRIEF

The terms of reference for the study were stated by Strategic Environmental Focus as follows:

To conduct an assessment of the environment and complete a desk-top investigation of the study area in order to:

- Identify possible effects that the transmission lines may have on the migration of birds.
- Identify the impact that the transmission lines may have on the breeding habits of birds.
- Identify any endangered bird species.

In the course of the study, the brief was elaborated and expanded upon as and when necessary.

3. STUDY APPROACH

3.1 Information base (source)

The study made use of the bird distribution data of The Atlas of southern African birds (Harrison *et al*, 1997), obtained from the Avian Demography Unit of the University of Cape Town, in order to ascertain which species occur in the study area. A separate data set was obtained for each half degree square with which the study area overlaps substantially (marginal overlaps were discounted). The conservation status of all bird species occurring in the aforementioned half degree squares was then determined with the use of The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Barnes, 2000). The powerline bird mortality incident database of the Eskom/Endangered Wildlife Trust Strategic Partnership (1996 to present) was consulted to determine which of the species occurring in the study area are impacted upon by powerlines. A map of the vegetation types and of the land cover found in the study area was obtained from the Department of Environmental Affairs & Tourism, University of Pretoria, GIS Business Solutions, published in July 2000. Information on the micro-habitat level was obtained through visiting the area, and obtaining a first hand perspective.

3.2 Assumptions

This study made the assumption that the above sources of information are reliable, but cognisance was taken of the fact that the ASAB data was collected during a period of below average rainfall. It was assumed

that this have had an effect on the reporting rate of many species associated with ephemeral pans in the study area during the atlas period.

3.3 Limitations

The following factors may potentially detract from the accuracy of the predicted results:

- The ASAB data covers the period 1986-1997. Bird distribution patterns fluctuate continuously according to availability of food and nesting substrate.
- Sources of error in the ASAB database.
  Inadequate coverage of some areas
  Errors in species identification during data capturing stage
  Biases in the reporting process due to several factors

(For a full discussion of potential inaccuracies in ASAB data, see Harrison *et. al.* 1997).

- No long term, verified data of species distribution on **microhabitat** level along the proposed powerline routes, except what was observed during the field visit.

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

3.4 Glossary of terms

Study area: Refers to the entire study area encompassing all the alternative alignments as indicated on the study area map.
Corridor: Refers to a specific alignment as numbered on the study area map (1 – 3)
Alternative alignment: Refers to a specific alignment (1 – 3) with one of the variations (a-b)
Proposed servitude: Refers to the proposed final alignment that the transmission line should follow.
Transmission line: Pylons supporting the 400 kV transmission line consisting of two steel support structures (supported by guy wires). Transmission lines area suspended between the supports.
Sub-station: A distribution point within the local and national network from which electrical current is rerouted along different power lines as well as distributed to local and municipal networks.
Half degree square: A grid cell of 30'x30' (approximately 2 500km²)

3.5 List of abbreviations

ASAB Atlas of southern African Birds

3.6 Methodology

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

- The ASAB (Harrison *et.al.* 1997) species list of the relevant half degree squares, 2825D, 2826A, 2726C, 2726B, 2726D and 2825B within which the study area is located was obtained from the Avian Demography Unit at University of Cape Town.
- This data was examined to identify powerline sensitive Red Data species as well as non-Red Data powerline sensitive species.
- The area was visited to obtain a first-hand perspective of the proposed routes and birdlife and to determine which bird micro-habitats are present and relevant to the study.
- The impacts were predicted on the basis of six years of experience in gathering and analysing data on wildlife impacts with powerlines throughout southern Africa (see van Rooyen & Ledger 1999 for an overview of methodology), supplemented with first hand data.

4. STUDY AREA

The half degree squares that overlap with the study area is first described in broad terms below, and then detailed descriptions of the specific vegetation types are given.

4.1 Broad description of half degree squares

2825D*:*

This area consists mainly of pan turf veld of western Free State, dry C*ymbopogon–Themeda* veld and pan turf veld invaded by karoo (APPENDIX A). The area is still largely untransformed with the above vegetation types largely still present. Limited areas of cultivated land, a few pockets of thicket and bushland exist along with numerous wetlands and ephemeral pans. Limited built up land exists around Dealesville (APPENDIX B). Very few tall trees exist in the landscape except for stands of exotic species such as *Eucalyptus* at homesteads. No significant rivers or watercourses exist in this square.

2825B:

This square is very similar to 2825D above differing only in that patches of thicket and bushland occur in the north east towards the village of Hertzogville.

2826A:

This square consists mainly of dry C*ymbopogon-Themeda* veld, with a pocket of pan turf veld of western Free State situated around the village of Bultfontein (APPENDIX A). In the south east it is very similar to 2825D. From just north of the R708 between Bultfontein and Hertzogville the land is predominantly

transformed by cultivation into arable land, with only small pockets of grassland and wetland present. Limited built up land exists around Bultfontein (APPENDIX B)

2726C:
This square is classified mainly as kalahari thornveld and shrub bushveld and dry C*ymbopogon-Themeda* veld (APPENDIX A). However this has been largely transformed and now consists predominantly of cultivated land with some small areas of cultivated grassland. This square shares the Vetrivier watercourse in the extreme south with 2826A. This is a reasonably large river, flanked by several kilometres of bushveld mixed with wetland and grassland (see APPENDIX D1). A significant concentration of ephemeral pans, wetlands and pockets of grassland is present around the town of Wesselsbron, particularly to the north, west and north-west. A smallish watercourse, the Sandspruit, crosses the square from west to east. Limited built up land exists around Wesselsbron (APPENDIX B). Towards the north of the square, the Sandspruit runs from west to east. This is a fairly minor watercourse but is flanked by wetland (see APPENDIX D2). North of the Sandspruit it opens up into more natural grassland.

2726D:
This square is very similar to 2726C above, except that there is more dry *Cymbopogon-Themeda* veld and there is extensive built up land around Welkom.

2726B:
This area is classified mainly as dry *Cymbopogon-Themeda* veld with a fair amount of kalahari thornveld and shrub bushveld and *Cymbopogon-Themeda* veld-sandy (APPENDIX A). This square has also been largely transformed into cultivated land, with some grassland around Bothaville and some pockets of grassland and wetland and ephemeral pans within the cultivated areas. Built up land exists around Bothaville itself and in the area of the Mercury Sub-station (APPENDIX B). North of Bothaville numerous stands of exotic tree species such as *Eucalyptus* exist. Many of these appear to be far from human dwellings and so may be significant from a bird point of view.

4.2 Description of vegetation types

Pan turf veld of western Free State, dry *Cymbopogon–Themeda* veld and *Cymbopogon-Themeda* veld – sandy are described by Low and Rebelo (1996) as Dry Clay Highveld Grassland (36). Altitude ranges from 1 500 to 1 600 m and the summer rainfall averages 600 mm per year. Temperatures vary between extremes of -8°C and 39°C, with an average of 17°C. Grass species constantly present are White Buffalograss *Panicum coloratum,* Weeping Lovegrass *Eragrostis curvula,* Fan Lovegrass *E. plana, Setaria nigrirostris and Themeda triandra,* the latter often being dominant, but replaced by the two *Eragrostis* species when overgrazed. An indicator of the clay soil is Three-awn Rolling Grass *Aristida bipartita,* which becomes prominent in severely degraded areas. A prominent feature of a large part of this vegetation type is the presence of species with Karoo affinity, such as the dwarf shrubs Bitterkaroo *Pentzia globosa,* Bloublommetjie *Felicia muricata,* Ghombos F. *filifolia and Lycium cinereum,* the grasses *Eragrostis obtusa,*

Saltpan *Grass Sporobolus ludwigii and* Large Carrotseed Grass *Tragus racemosus,* and the geophyte Yellow Snakehead *Bulbine narcissifolia.* Dry clay soils, coupled with low rainfall in the western Free State, limit the distribution of this vegetation type.

Kalahari thornveld and shrub bushveld is described by Low and Rebelo (1996) as Kimberley Thorn Bushveld (32). Summer rainfall is 400 to 500 mm per year. Temperature varies between -8C and 41C, with an average of 19C. This vegetation is found on deep, predominantly sandy to loamy sands, underlain by calcrete. This is an open savanna, with Umbrella Thorn *Acacia tortilis* and Camel Thorn *A. erioloba* the dominant tree species, and scattered individuals of Shepherd's Tree *Boscia albitrunca* and Sweet Thorn *Acacia karroo.* The shrub layer is poorly to moderately developed in places and individuals of Camphor Tree *Tarchonanthus camphoratus,* Spike-flowered Black Thorn *Acacia mellifera,* Wild Raisin *Grewia flava and Lycium hirsutum* occur widely scattered. The grass layer is fairly well developed and grasses such as Redgrass *Themeda triandra,* Common Nine-awn Grass *Enneapogon cenchroides,* Lehmann's Lovegrass *Eragrostis lehmanniana, Elionurus muticus and Cymbopogon plurinodis* are conspicuous. This vegetation type is confined to the sandy plains underlain by calcrete.

4.3 Description of affected environment

The total number of bird species recorded for each half degree square (Harrison *et.al.* 1997) in the study area can be seen in Table 1.

Table 1: Bird species occurring in each half degree square (Harrison *et al* 1997).

½ degree square	2825D	2825B	2826A	2726C	2726D	2726B
Number of species	233	194	211	214	248	268
Number of species breeding	47	21	76	29	72	69
Number of Red Data species	16	13	12	12	18	14

Although a relatively large number of bird species has been recorded in the study area, most of them have relatively low reporting rates, indicating that they are not common in the area.

The following bird micro-habitats were identified during the site visit:

- Riparian

This consists of thornveld or bushveld, along the edge of a watercourse or wetland

- Wetlands and Ephemeral pans

This consists of either permanent relatively long and thin wetlands, or roughly circular ephemeral pans. Whilst the wetlands receive their water supply from the ground water, the ephemeral pans are rain driven and only contain water after periods of good rain.

- Grassland

Two types of grassland exist, the pan turf veld and the *Cymbopogon-Themeda* veld. In the study area as a whole, apart from in 2825D, natural grassland only exists in small patches in between the extensive arable land. From a bird perspective these two types of grassland are treated as one habitat.

- Exotic stands

These are stands of predominantly *Eucalyptus* species, presumably originally planted as windbreaks. They may be significant for birds in terms of roosting or nesting as few indigenous tall trees exist in the landscape.

- Arable land:

This comprises most of the study area. Since the different crop types in their different stages can represent very different bird habitats, arable land is discussed in sub categories below:

Maize:	The predominant land use in the study area. When past the seedling stage, of little importance to most birds until harvested.
Sunflowers:	Probably the second most common crop. Important to birds just prior to and post harvesting.
Fallow land:	All arable land, whatever the usual crop, must at some time lie fallow. This relatively bare ground can attract certain species if old seed or weeds are present.
Newly ploughed land:	Although simply bare soil, this habitat can represent an important feeding area to many birds, as old seed, weeds and insects abound.
Lucerne:	Although not in much evidence in the study area, this is an important habitat for birds such as White Storks, particularly when being cut for use.
Irrigated land:	Very little irrigated land exists in the study area, however these lands are highly attractive to birds, particularly in this dry landscape, and in particular the White Stork.
Cultivated grassland:	A fairly extensive land use in the study area. Represents important feeding areas for seedeaters at certain times of the year.

Examples of all of the above habitats can be seen in APPENDIX D.

The following table (Table 2) shows the sensitivity of the respective half degree squares in terms of the *powerline sensitive* Red Data species that have been recorded there. Each species is given a score according to its conservation status (Barnes, 2000). A 'critically endangered' (CE) species scores 4 points, an 'endangered' (E) species scores 3 points, a 'vulnerable' (V) species scores 2 points and a 'near threatened' (NT) species scores 1 point. This score is then multiplied by the reporting rate for the species (ASAB Data) for each square (expressed as a decimal) in order to weight its score according to how common it is in that square. These final scores are shown in Table 2 below. The square with the highest total score for all the species will then be the most sensitive in terms of Red Data species.

The squares in order of decreasing sensitivity to Red Data species are: 2826A, 2825D, 2726D, 2825B, 2726B, and 2726C.

Table 2: Sensitivity of the half degree squares in terms of the Red Data species present.

Species	**Conservation Status**	**2825D**	**2825B**	**2826A**	**2726C**	**2726D**	**2726B**
Bittern	CE	-	-	-	-	0.04	-
Pinkbacked Pelican	V	0.04	-	-	-	-	-
Tawny Eagle	V	0.04	-	-	0.04	-	0.02
Martial Eagle	V	0.18	-	-	-	-	0.02
Blue Crane	V	0.06	-	0.14	-	0.04	-
Kori Bustard	V	0.08	0.08	0.18	-	0	0.01
Ludwigs Bustard	V	0.04	-	-	-	-	-
Cape Vulture	V	-	0.04	-	-	-	-
Whitebacked Vulture	V	-	0.08	0.02	0.04	-	0.04
African Marsh Harrier	V	-	-	-	0.04	0.04	0.06
Grass Owl	V	-	-	-	-	0.02	0.02
White Pelican	NT		-	-	-	0.01	-
Yellowbilled Stork	NT	0.05	-	0.02	0.02	0.03	0.02
Greater Flamingo	NT	0.19	0.15	0.31	0.05	0.46	0.11

Species	Conservation Status	2825D	2825B	2826A	2726C	2726D	2726B
Lesser Flamingo	NT	0.11	0.15	0.24	0.04	0.43	0.12
Secretarybird	NT	0.16	0.13	0.29	0.11	0.04	0.06
Black Harrier	NT	0.01		0.01	-	-	-
Peregrine Falcon	NT	-	0.02	-	-	-	-
Lanner Falcon	NT	0.03	0.02	-	-	0.01	0.04
Blue Korhaan	NT	0.22	0.18	0.37	-	0.04	-
Melodious Lark	NT	0.09	-	-	0.02	0.02	-
Black Stork	NT	-	0.04	0.01	0.04	0	0.02
Marabou Stork	NT	-	0.02	-	-	-	-
Pallid Harrier	NT	-	-	0.01	-	-	-
Chestnutbanded Plover	NT	-	-	-	-	0.01	-
Painted Snipe	NT	-		-	0.02	0.01	-
Shortclawed Lark	NT	-	0.04	-	0.04	-	-
Blackwinged Pratincole	NT	0.01	-	-	-	0.01	0.01
TOTAL POINTS		**1.31**	**0.95**	**1.60**	**0.46**	**1.21**	**0.55**

When interpreting these results, it must be borne in mind that the ASAB data was collected during a period of below average rainfall (Harrison et.al. 1997). This must have had an effect on the reporting rate of important waterbirds, particularly the two flamingo species, and is most likely the reason for the surprisingly low reporting rate in the pan turf veld. It should therefore be stated here that the squares with the greatest percentage of this veld type is most likely underrated in terms of sensitivity.

5. IDENTIFICATION OF RISK SOURCES

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds and other animals and birds colliding with powerlines. (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs & Ledger 1986a; Hobbs & Ledger 1986b; Hobbs *et al.* 1990; Ledger 1992; Ledger *et al.* 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, and disturbance and habitat destruction during construction and maintenance activities.

5.1 Electrocutions

Large birds of prey are the most commonly electrocuted on powerlines. The large transmission lines from 220 kV to 765 kV structures are usually not a threat to large raptors, because the pylons are designed in such a manner that the birds do not perch in close proximity the potentially lethal conductors. In fact, these powerlines have proved to be beneficial to birds such as Martial Eagles, Tawny Eagles, African Whitebacked Vultures, and even occasionally Black Eagles by providing safe nesting and roosting sites in areas where suitable natural alternatives are scarce (pers.obs). Cape Vultures have also taken to roosting on powerlines in certain areas in large numbers, while Lappetfaced Vultures are increasingly using powerlines as roosts, especially in the Northern Cape (pers.obs.). Electrocutions on these structures are virtually unknown.

The same can not be said of the smaller sub-transmission and reticulation lines (Van Rooyen 1998; 2000). Raptors and vultures instinctively seek out the highest vantage point as suitable perches from where they scan the surrounding area for prey or carrion. In flat, treeless habitat power pylons often provide ideal vantage points (from a raptor's perspective) for this purpose. The vast majority of electrical structures were designed and constructed at a time when the awareness of the danger that they pose for raptors was very limited or totally absent. Depending on the design of the pole, a large raptor can potentially touch two live components or a live and earthed component simultaneously, almost inevitably resulting in instant electrocution and a concomitant disruption in the electrical supply (Van Rooyen 1998). Electrocution *via* the bird streamer mechanism has also been identified as a potential source of mortality among large raptors (Van Rooyen & Taylor 1999) even where the clearances make conventional electrocution impossible. Electrocution through the bird streamer mechanism is however a very rare event.

5.2 Collisions

Up to 1996, it was generally believed that collisions are not a major problem in South Africa, with the exception of the three crane species. This may have been the case because collisions with powerlines are seldom recorded through the internal systems of electricity networks (except on reticulation lines), as it seldom impacts on the electricity supply. However, a disturbing new picture has since started to emerge from data gathered over the past six years, pointing to the fact that collisions are indeed a major cause of unnatural mortality for several threatened birds (Van Rooyen 1999). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which make it very difficult for them to take the necessary evasive action to avoid colliding with powerlines. Recent studies in the Karoo found a correlation between voltage size and collision risk, with 400 kV lines posing the highest collision risk for large terrestrial birds (Anderson 2001).

5.3 Habitat destruction and disturbance

During the construction phase and maintenance of powerlines, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes.

Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers.

These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude, both through alteration of habitat and disturbance caused by human activity. It can also beneficial in that it creates corridors where bush encroachment is kept in check, therefore making the servitudes corridors for grassland species that could otherwise abandon the area. It also enhances the visibility of prey for raptors utilizing the powerline.

5.4 Particulars of line design

The proposed powerline is a 400kV cross rope suspension structure (see APPENDIX G). Important aspects from a bird interaction perspective are the following:

- The design has no inherent electrocution risk for large birds because the clearances between live parts and live and earthed components exceed the wingspan of any bird.

- The structure stands 44 metres high at its highest point. The mid-span height of the earthwire will be about 36 metres. The earthwire will be the biggest risk from a bird interaction perspective. Birds in flight tend to see the bundled conductors, and then gain height to avoid them. In the process, the much thinner earthwire is not noticed and the birds may then collide with it.
- The design is such that bird streamers are unlikely to be a source of faulting on the line. Birds tend to perch on the highest points first, in this instance the earth peaks. The perching space above the conductors is uncomfortable and restricted. This type of tower has never had suspected bird streamer faulting (Eskom Transmission Engineering pers.comm).

5.5 Summary of potential risks

The following two tables provide a summary of the potential risks posed to birs by the proposed powerline.

Table 3: Identified potential risks during construction phase

Possible Risks	Source of the risk
Destruction of habitat	Clearing of servitudes, construction of access roads, contractor camps
Disturbance of sensitive species	Construction activities, contractor camps

Table 4: Identified potential risks during operation phase

Possible Risks	Source of the risk
Mortality of birds	Collision with earth wire
Destruction of habitat	Maintenance of servitudes, maintenance of roads
Disturbance of sensitive species	Maintenance activities

6. IMPACT DESCRIPTION AND ASSESSMENT

Generally speaking, it is unavoidable that birds get killed through interaction with infrastructure, including powerlines, despite the best possible mitigation measures. It is therefore important to direct risk assessments and mitigation efforts towards species that have a high biological significance, in order to achieve maximum results with the available resources at hand. However, a pure scientific approach would only consider the effects of deaths on the sustainability of the population, but society places other values on certain species, e.g. aesthetic or commercial, which can not be accounted for in a pure scientific approach.

In accordance with this principle, the risk assessment is primarily aimed at assessing the potential threat to threatened or Red Data species (biological significance) that occur or potentially occur along the proposed powerline routes. In addition, the impacts on non-threatened powerline sensitive species recorded in the study were also assessed, albeit in less detail. The identified impacts on the Red Data species have been assessed and are presented in APPENDIX E. The criteria against which these impacts were evaluated are explained in Table 5 below.

Table 5: Explanation of the criteria against which the impacts were evaluated

Nature	Description of impact
General susceptibility to expected impact	Very high, high, low, very low
Probability	• Improbable, where the possibility of the impact to materialise is very low • Probable, where there is a distinct possibility that the impact will occur • Highly probable, where it is most likely that the impact will occur • Definite, where the impact will definitely occur
Expected locality	Description of localities/micro bird habitats where impact is expected to occur
Frequency	Very high, high, low, very low
Timing	Time of day/year
Duration	• Short term (0-5 years)

	• Medium term (5-15 years) • Long term (for the life-time of the infrastructure)
Intensity	• Low: The impact alters the affected environment in such a way that the natural processes or functions are not affected. • Medium: The affected environment is altered, but function and process continue, albeit in a modified way. • High: Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Permanence	Permanent, semi-reversible or reversible
Extent	• Local (the site and immediate surroundings) • Regional • National • International
Significance	• Low, where it will not have an impact on the decision • Medium, where it should have an impact on the decision unless mitigated • High, where it will influence the decision regardless of possible mitigation

(Adapted from Guideline Document, EIA Regulations, Implementation of sections 21, 22 and 26 of the Environment Conservation Act, April 1998, DEAT)

The identified impacts on the Non Red Data species can be viewed in APPENDIX F.

To highlight important findings presented in the two tables in APPENDIX E and F:

Red Data species

- Habitat destruction: Any destruction of Wetland/ephemeral pan habitat along the route during construction and maintenance will have a negative impact on the species present, including the following species: Bittern, Greater and Lesser Flamingo, Pinkbacked Pelican, White Pelican, Black Harrier and African Marsh Harrier. The ephemeral pans are of particular concern as they represent 'bird rich' areas in this landscape, during periods of high rainfall.
- Habitat Destruction: Any destruction of Grassland and thornveld habitat along the route during construction and maintenance will have a negative impact on the resident species, including the following species: Blue Crane, Kori Bustard, Secretarybird, Blue Korhaan, Melodious Lark and Shortclawed Lark.

- Disturbance: Disturbance of sensitive species may occur during construction and maintenance activities in any of the habitats along the powerline route. The majority of the more sensitive species are associated with water and so disturbance around pans and wetlands is of particular concern. Generally speaking, disturbance is a short term, temporary impact. The one exception in this case is the Bittern that has been marginally recorded in the area. The secretive nature of the bird make the assessment of impacts difficult, and the species could be underreported as well for the same reason. This highly sensitive species could permanently abandon suitable habitat if it is disturbed.
- Collisions: Several species occurring particularly in the Grassland and Wetland habitats are vulnerable to collision with the earth wire. The areas surrounding Ephemeral pans are of particular concern as this is where waterbirds may congregate when conditions are favourable. This could include the following species: Pinkbacked Pelican, Greater and Lesser Flamingos. These species, as well as Grassland species such as Blue Cranes use the pans as roosts; hence much flying takes place at low light intensities at dawn and dusk, making collision with earth wire an even greater potential threat. Extensive local movement between pans are likely when conditions are good.

Non Red Data species

- Collisions: The only impact of concern is that of collision with the earth wire. This will probably involve predominantly the storks, ibises and spoonbills, waterbirds and Black Korhaans. This will be particularly pronounced around the Ephemeral pans and wetlands in the area, but may also occur in the arable lands, grasslands and riparian habitat depending on the time of year and food availability. The White Stork is a species for concern as it has a relatively high reporting rate for the study area and will feed wherever its food source (insects) is plentiful. It is known to be particularly attracted to lucerne fields (Barkhuyzen 2002).

7. RECOMMENDED MITIGATION / MANAGEMENT MEASURES

7.1 Collisions

- On all sections of line passing through Grassland, the earth wire should be fitted with Bird Flappers
- Every effort must be made to avoid Wetlands and Ephemeral pans. If that is not feasible, all sections of line passing through or within 500 metres of Wetlands and Ephemeral pans should be fitted with Bird Flappers on the earthwire.
- All sections of line crossing rivers and the adjacent Riparian habitat should be fitted with Bird Flappers on the earthwire.
- All sections of line passing through or within 500 metres of lucerne fields should be fitted with Bird Flappers on the earthwire.

7.2 Habitat destruction

- Destruction of grassland during construction and operation should be kept to a minimum.
- No destruction of Wetlands and Ephemeral pans during construction and operation should be allowed. In particular no vehicles should be allowed to drive through or across wetlands or pans.

7.3 Disturbance

- The activities of the construction and operations staff must be restricted to the servitude and immediate surrounds. Under no circumstances must birds be exposed to more disturbance than is inevitably brought about by construction and operations activities. Potential trapping and hunting of wild birds by construction crews must be strictly forbidden.

8. ALTERNATIVES

In order to determine which of the three corridors would pass through areas least sensitive in terms of powerline sensitive Red Data species, Table 6 below was created. Each corridor is assigned the Red Data species sensitivity score (Table 2) for each square that contains a substantial portion of the route (marginal overlap was ignored). These scores are then totalled to give an overall sensitivity score for each corridor. The corridor with the lowest overall score should have the least impact on powerline sensitive Red Data species. From Table 6 it can be seen that the corridor with the lowest score is corridor 1. From a bird perspective then, it is suggested that corridor 1 is selected as it will have less impact on the birds present than the other two corridors.

Table 6: Sensitivity of corridors 1 to 3 in terms of Red Data species

	Corridor 1	**Corridor 2**	**Corridor 3**
2825D	1.31	1.31	1.31
2826A	1.6	1.6	-
2726C	0.46	0.46	0.46
2726B	0.55	0.55	0.55
2825B	-	-	0.95
2726D	-	1.21	1.21
TOTAL SCORE	**3.92**	**5.13**	**4.48**

9. DISCUSSION

The impacts have already been extensively discussed under section 6 above, therefore unnecessary repetition will be avoided. In summary, the most important micro bird habitats in the study area are Ephemeral pans, Wetlands, Grasslands and river crossings and associated Riparian habitat. Lucerne fields, to a lesser extent, are also important due to their attractiveness for White Storks.

The most important impact of the powerline will be the collision risk to certain bird species in these micro habitats. This impact can be effectively mitigated through fitting Bird Flappers to the earth wire on sections of line passing through any of the above areas.

A second impact will be the disturbance of sensitive species during the construction and maintenance activities. This is a much more difficult impact to observe and measure as it represents an indirect threat to the bird, not a direct threat that leaves the bird dead, as in collision above. It will be most pronounced in the micro habitats discussed above. Mitigation will involve avoiding particularly sensitive areas and ensuring that all activities are regulated by sound general environmental management.

A third impact will be that of habitat destruction, again an indirect threat to the bird concerned. Of most concern are the 'natural' or untransformed micro habitats discussed above. Mitigation will again involve avoiding sensitive areas as far as possible during construction and operations.

Corridor 1 is the proposed servitude as it passes through areas that are the least sensitive in terms of powerline sensitive Red Data species.

10. CONCLUSION

This powerline will undoubtedly have an impact on the bird species in the area. However, by selecting the proposed servitude and implementing the mitigation measures discussed in this study, this impact can be reduced to an acceptable level.

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