# PROPOSED 220kV TRANSMISSION LINE FROM OMBURU TRANSMISSION STATION VIA KHAN SUBSTATION TO THE KUISEB TRANSMISSION STATION

## BIRD IMPACT ASSESSMENT REPORT


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# TABLE OF CONTEST

# FIGURES, TABLES AND BOXES

# APPENDICES

Appendix A: Mitigation Map

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| EWT | Endangered Wildlife Trust |
| SABAP | Southern African Bird Atlas |

# 1 INTRODUCTION AND BACKGROUND

## 1.1 INTRODUCTION

This desk top report deals with potential impacts that a new 220kV transmission line in Namibia could have on birds. The proposed line will originate in Omburu near Omaruru, and will run roughly in a south-westerly direction to terminate a new substation to be called Kuiseb, about 20km east of Walvis Bay. The total length of proposed transmission line will be about 234km. Chris van Rooyen Consulting was requested by Enviro Dynamics Environmental Consultants to a provide desk top assessment of the envisaged bird impacts associated with the new line.

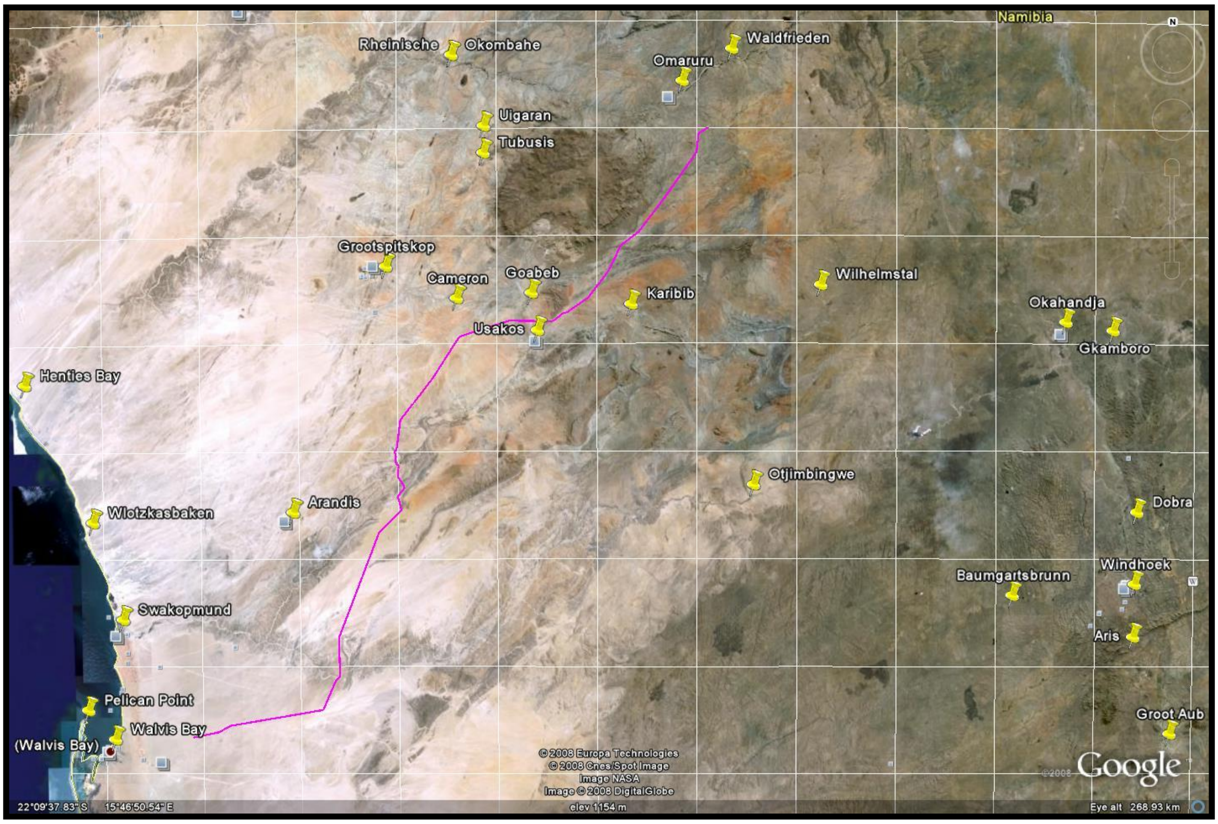


**Figure 1: A satellite image of the proposed line (Google Earth, 2008).**

## 1.2 TERMS OF REFERENCE

The terms of reference were received from Enviro Dynamics as follows:

- Provide a broad description of the bird species that occur in the area;
- Describe the sensitive habitats from a power line interaction point of view; and
- Suggest mitigation measures for potential bird interactions.

## 1.3 PURPOSE OF THIS REPORT

The purpose of this desk report is a high level description and evaluation the potential interactions that the line might have on birds, and to suggest mitigation measures as and where necessary to reduce the significance of the envisaged impacts.

## 1.4 ASSUMPTIONS AND LIMITATIONS

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

- Within the study area, (and generally in arid landscapes in southern Africa) the amount and distribution of seasonal rainfall fluctuates continuously, therefore influxes or dispersal of birds happen in response to these stimuli. A greater variety and number of birds are present during wet cycles (Harrison *et al.*. 1997, Simmons *et al.*. 2001, pers. obs).
- Future changes in habitat as a result of potential increased human and livestock population densities and climatic changes in the study area could influence the species and numbers of birds occurring there. However, it is unlikely that the basic land use patterns (and therefore vegetation structure) in the study area will change dramatically in the foreseeable future, as the area is very sparsely populated.
- The scale of the study is limited to the resolution offered by the satellite imagery. Important micro-habitat may have been overlooked if it was not visible on the satellite image, e.g. a farm dam or small wetland.

- Predictions are based on experience of these and similar species in different parts of southern Africa. Bird behaviour cannot be reduced to formulas that will hold true under all circumstances. However, power line impacts can be predicted with a fair amount of certainty, based on experienced gained through the investigation of more than 900 localities in southern Africa where birds interacted with power lines.
- No long term, verified data of species distribution on micro-habitat level along the proposed power line route is available.
- No verified data on impacts of existing lines (if any) in the study area on birds is available.

## 1.5 APPROACH TO THE STUDY

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 from the Namibian Biodiversity Database website http://www.biodiversity.org.na, in order to ascertain which species occur in the study area. A separate data set was obtained for each quarter degree square within the study area (marginal overlaps were discounted) (see Table 2).
- The conservation status of all bird species occurring in the aforementioned quarter degree squares was determined with the use of the draft Red Data list of birds of Namibia (Simmons & Brown, 2006).
- The power line bird mortality incident database of the Eskom - Endangered Wildlife Trust Strategic Partnership (1996 to 2007) was consulted to determine which of the species occurring in similar arid environments are typically impacted upon by power lines and the extent to which they are impacted on.
- A classification of the vegetation types in each quarter degree square was obtained from Harrison et al. (1997).
- First hand information on the micro habitat level was not obtained as this was purely a desk top exercise. Micro habitats were identified using a combination of ornithological and ecological experience from previous work in the area and by analysing high resolution Google Earth satellite imagery.

- Information on the Lappet-faced Vulture breeding colonies in the Namib Naukluft Park was obtained Mr. Peter Bridgeford from Vultures Namibia.

# 2 DESCRIPTION OF THE BASELINE ENVIRONMENT

The proposed route is approximately 234km long and runs through two biomes – savanna and desert. It is widely accepted that vegetation structure is more critical in determining bird habitat, than the actual plant species composition (Harrison *et al.* 1997). The description of vegetation presented in this study therefore concentrates on factors relevant to the bird species present, and is not an exhaustive list of plant species present. The description of the vegetation types occurring in the study area makes extensive use of information presented in the Atlas of southern African birds (Harrison *et al.* 1997). The criteria used to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. It is important to note that no new vegetation unit boundaries were created, with use being made only of previously published data. Table 3-1 below reflects the vegetation classification of the relevant quarter degree squares.

**Table 2-1: The percentage area of each quarter degree square in the study area classified according to biomes and vegetation types (Harrison et al. 1997).**

| Biome | Vegetation type | 2214 DD | 2215 CC | 2215 CA | 2215 AC | 2215 AD | 2215 AB | 2115 CD | 2115 DC | 2115 DD | 2115 DB |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Savanna | Namibian Escarpment | | | | | 100% | 100% | 100% | 100% | 100% | 100% |
| Desert | Namib | 100% | 100% | 100% | 100% | | | | | | |

The Namibian Escarpment is hilly and supports a varied vegetation cover of grasses, shrubs, and trees, such as *Euphorbia guerichiana* and several species of *Commiphora*. It is a transitional zone between the savanna biome to the east, the Namib to the west and the Nama Karoo to the south; rainfall averages 100-250mm. Due to the transitional status between savanna and desert and variable topography, the escarpment supports diverse vegetation. The altitudinal gradient, isolation, and ecotonal nature have been key factors shaping the escarpment's biological diversity. The extensive network of rivers and stream beds that cross it act as important micro-habitat corridors for species moving across this rugged environment (Simmons *et al.* 2001).

**Figure 2: An example of the vegetation in the Namibian Escarpment.**

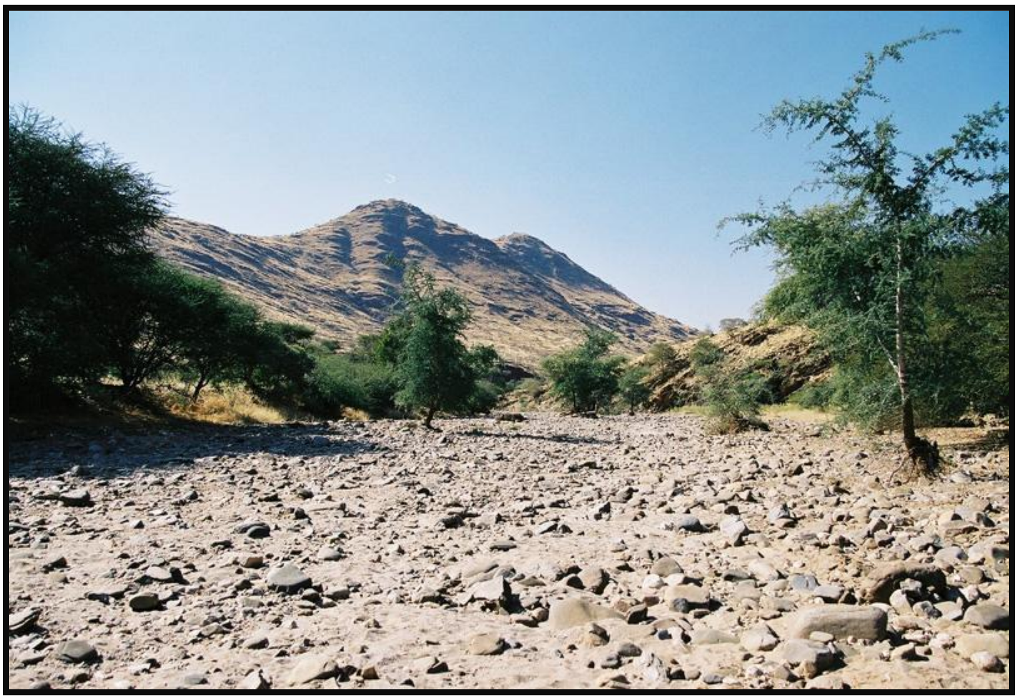

**Figure 3: An example of a dry river course in the Namibian Escarpment.**

The Namib is the coastal plain of Namibia and is 100 – 150km wide. It is an extremely arid desert with a mean annual rainfall below 85mm, with a high annual variability (>50%), and annual evaporation far exceeding precipitation. The Namib contains three distinct bird habitats: rolling sand dunes (not relevant to this study), gravel plains, and watercourses (both relevant to this study). The watercourses are normally dry drainage lines which are dileneated by trees, the most impressive of which is the Camel Thorn *Acacia erioloba*. Away from the watercourses, vegetation is sparse and consist primarily of grasses, e.g. *Stipagrostis* spp., and low shrubs. The Namib supports several endemic species; including the Rüppell's Korhaan *Eupodotis rueppellii* and Gray's Lark *Ammomanopsis grayi* in the gravel plains. Sporadic rainfall events result in explosive growth and seeding of annual plants, which attract huge flocks of seed-eating birds, such as finch-larks and Larklike Buntings *Emberiza impetuani*). The Namib also offers a regional stronghold for the threatened Lappet-faced Vulture *Torgos tracheliotis* (Simmons *et al.* 2001).

The rainfall patterns and associated vegetation types have a major influence on the birdlife, both in terms of diversity of species and numbers. More than 80% of the rain is recorded between November and March. Rainfall increases from west to east and from south to north. The Namib can be divided into three sections: coastal, central and inland. Coastal zones receive less than 5-20mm rainfall per year, the central Namib (40 – 80km from the shoreline) receive about 20 – 50mm, and inland (80km – 120km from the shoreline) the rainfall varies from about 50 – 85mm. The vegetation reflects the gradual increase in rainfall from west to east, with most vegetation in the coastal zone consisting of clustered shrubs dependent on thick fog, while the gravel plains of the central Namib can support vast grasslands, especially after good rains. In the central Namib tree and shrub species are largely contracted in river courses and drainage lines, which occasionally flow after heavy rains. The escarpment and its foothills are defined as semi-desert and savanna transition. An unique woodland -type grows along and in most ephemeral desert rivers, including rivers such as the Omaruru, Swakop and Kuiseb. Hardy, drought-resistant species growing on the river banks include *Acacia, Faidherbia, Tamarix, Salix,* and *Ziziphus*. These linear oases form corridors suitable for the migration of woodland species in an otherwise unsuitable desert environment (Simmons *et al.* 2001).

**Figure 4: An example of the vegetation in the gravel plains of the central Namib.**

**Figure 5: An example of a dry river course in the central Namib.**

It is widely agreed that the Namibian deserts and escarpment are evolutionary nodes holding many endemic taxa, including a suite of endemic and near-endemic birds that have individual ranges exceeding 50,000km²; their conservation is almost entirely Namibia's responsibility. Key species include Hartlaub's Francolin *Francolinus hartlaubi*, Rueppell's Korhaan *Eupodotis rueppellii*, Rüppell's Parrot *Poicephalus rueppellii,* Rosy-faced Lovebird *Agapornis roseicollis,* Monteiro's Hornbill *Tockus monteiri,* Gray's Lark *Ammomanopsis grayi,* Bare-cheecked Babbler *Turdoides gymnogenys,* Herero chat *Namibornis herero,* Rock-runner *Achaetops pycnopygius, and* White-tailed Shrike *Lanioturdus torquatus.* Two other species the Violet Wood-hoopoe *Phoeniculus damarensis, and* Carp's Tit *Parus carpi,* are almost certainly endemics (Simmons *et al.* 2001).

Generally speaking, it is unavoidable that birds get killed through interaction with electricity infrastructure, including power lines, 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. In accordance with this principle, the risk assessment is primarily aimed at assessing the potential threat to Red listed species (see the discussion of biological significance under 4.3.1 “collisions” below).

The table that follows lists the **powerline sensitive** Red listed species (Simmons & Brown 2006) that have been recorded in the relevant quarter degree squares during the Bird Atlas period from 1970 – 1993 (Harrison *et al.* 2007).

**Table 2-2: Power line sensitive species recorded in the quarter degree squares bisected by the proposed power line.**

| Scientific name | Species | Status | 2214 DD | 2215 CC | 2215 CA | 2215 AC | 2215 AD | 2215 AB | 2115 CD | 2115 DC | 2115 DD | 2115 DB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Terathopius ecaudatus* | Bateleur | E | | | | | | | | | x | |
| *Aquila verreauxii* | Verreauxs ' eagle | NT | | x | | x | x | | x | x | x | x |
| *Ciconia nigra* | Black stork | E | | | | | | | | x | | |
| *Hieraaetus pennatus* | Booted eagle | E | | | | x | x | | x | x | x | x |
| *Bubo capensis* | Cape eagle-owl | NT | | | x | | | | | | | |
| *Phoenicopterus ruber* | Greater flamingo | V | x | | | x | | | | | | |
| *Phoenicopterus minor* | Lesser flamingo | V | x | | | x | | | | | | |
| *Torgos tracheliotus* | Lappet-faced vulture | V | | x | x | | x | | | x | x | |
| *Leptoptilos crumeniferus* | Marabou stork | NT | | | | | | | | | x | |
| *Polemaetus bellicosus* | Martial eagle | E | | | | | | | x | x | x | x |

| Scientific name | Species | Status | 2214 DD | 2215 CC | 2215 CA | 2215 AC | 2215 AD | 2215 AB | 2115 CD | 2115 DC | 2115 DD | 2115 DB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Falco peregrinus* | Peregrine falcon | NT | | x | | | | | | x | | |
| *Ephippiorhynchus senegalensis* | Saddle-billed stork | E | | | | | | | | | x | |
| *Aquila rapax* | Tawny eagle | E | | | | | x | | x | | x | |
| *Gyps africanus* | White-backed vulture | NT | | | | | | | | x | x | |
| *Pelecanus onocrotalus* | Great white pelican | V | x | | x | x | | | | | x | |

Bateleur: Recorded only from one square, i.e. 2115DD. In Namibia found most often over tall woodland near drainage lines and dry rivers in the north and east (Simmons & Brown 2006). May be susceptible to collisions with transmission lines, although this has not been recorded to date. The species should not be significantly threatened by the proposed power line, as it poses no electrocution threat and will run through habitat that is only marginally suitable.

Verreauxs' Eagle: This species is classified as *Near Threatened* because of the threat from the high incidence of poisoning that occurs in Namibia, and its population size of about 1000 breeding pairs. The reasonable widespread population in areas of low human density, the relative immunity from human-induced mortality in Namibia and a lack of evidence of any decline keep it from being classified as *Vulnerable* (Simmons & Brown 2006). It was recorded from several squares bisected by the proposed power line. It is vulnerable to collisions with power lines, especially where the line runs up a steep slope close to a breeding area, as the species often hunt at low altitudes along mountain slopes (pers. obs). Several such collisions have been recorded in South Africa, often in association with cell-phone towers (EWT unpublished data).

Black Stork: In Namibia it is confined to the Namib Desert's perennial and ephemeral rivers such as Orange, Cunene, Fish, Kuiseb and Hoanib, with scattered records from inland dams and the one perennial river in the central Namibia that runs through the Daan Viljoen Reserve, Windhoek. They occur singly or in pairs in most observations, and are resident in the gorges and canyons of ephemeral rivers such as the Kuiseb year-round (Simmons & Brown 2006). It was recorded from 2115DC, but conceivably be encountered in other quarter degree squares as well with substantial ephemeral rivers such as the Kahn and Swakop, especially if cliffs are also present e.g. 2115DB. It could be susceptible to collisions with the power line where the alignment crosses these river courses.

Booted Eagle: Occurs in a wide variety of arid open habitats largely associated with mountainous country and adjacent plains (Simmons & Brown 2006). In Namibia it is associated with inselbergs in western parts. Recorded from several squares bisected by the proposed power line. Often come down to pools in ephemeral rivers to drink and bath (pers. obs). It could be susceptible to collisions with the power line where the alignment crosses these river courses, as well as in rocky gorges and canyons.

Cape Eagle Owl: Recorded only from 2215CA, but probably occurs wider as suitable habitat is present in several squares. It is found in very arid areas of the Namib Desert in areas associated with river valleys. The owl shows a preference for rocky or mountainous terrain with cliffs, gorges, canyons, and boulder strewn hillsides, similar to the Verreauxs' Eagle (Simmons & Brown 2006). It could be susceptible to collisions with the power line where the alignment crosses these river courses, as well as in rocky gorges and canyons.

Greater Flamingo: Recorded from two squares, 2214DD, and 2215AC. Prefers less saline habitat than Lesser Flamingo, including recently flooded salt pans (southern Africa), alkaline Lakes (Rift Valley), coastal bays and river mouths, sewage works and inland dams (Namibia) (Simmons & Brown 2006). It occupies an area of 61 290 km$^2$ in Namibia mainly in coastal regions (Simmons & Brown 2006). Move around widely in response to environmental conditions. Movement between the coast and Etosha Pan happens regularly. Could be at risk if flight paths cross the line between Walvis Bay and inland waterbodies. The alignment seems to lie south of the major flight movement between Etosha and Walvis Bay.

Lesser Flamingo: Prefers more saline habitat than Greater Flamingos, especially salt pans, salt works evaporation ponds, and brackish rivers (Simmons & Brown 2006). Risks and distribution the same as for the Greater Flamingo.

Lappet-faced Vulture: Lappet-faced Vultures prefer to breed in trees in the dry rivers washes that flow from east to west across Namibia's vast gravel plains in the pro-Namib, and they are particularly fond of the mature *Acacia erioloba* trees that line the southern rivers Tsondab, Tsauchab (that flows into the famous Sossusvlei) and the Koichab in the far south (Simmons & Brown). The main concentration of known nests in the Namib-Naukluft Park is situated outside the influence of the proposed line (P Bridgeford pers.comm). However, birds are known to breed north of the Swakop River on farm land (P. Bridgeford pers.comm). The biggest risk that the power line could pose is disturbance of breeding birds in dry river courses in the Namib, and collisions near breeding areas, particularly recently fledged juveniles. If large trees are removed during the construction of the power line, it can potentially impact on breeding as well.

Marabou Stork: Reported from only one square, 2115DD, more common in the north and east of Namibia. This species feeds by both scavenging and depredating prey such as fish, nestling quelea and flamingos, but it is also found commonly at human refuse dumps where large numbers may congregate to feed and socialize (Simmons & Brown 2006). The line is unlikely to pose a major threat to the species, as the species only occurs marginally in the area.

Martial Eagle: Martial Eagles inhabit a wide range of habitats including open grassland where large trees occur, and scrubby Karoo areas to wooded savanna (Simmons & Brown 2006). In modern times it has become more common in otherwise tree-less habitat such as the Nama Karoo where it nests on pylons (van Rooyen pers. obs). This has yet to be reported in Namibia. It avoids closed-canopy forests and hyper-arid desert but it penetrates the Namib along suitable major ephemeral rivers that flow intermittently and harbour large trees (Simmons & Brown 2006). Greatest risk would be disturbance of breeding birds in dry river courses, as well as collision with the power line near temporary water e.g. pools in ephemeral rivers. If large trees are removed during the construction of the power line, it can potentially impact on breeding as well.

Peregrine Falcon: The resident African species prefers any areas where sheer cliff-habitat occurs, particularly where it overlooks suitable bird habitat such as woodlands or wetlands. Vegetation types are relatively unimportant if suitable cliffs are available, and the linear oasis effect of desert rivers may be sufficient to concentrate bird prey (Simmons & Brown 2006). Could be encountered in any of the arid river courses overlooked by cliffs. At risk of collisions where the line crosses such habitat. Recorded in 2215CC and 2115DC.

Saddle-billed Stork: Recorded from 2115DD. Not ideal habitat for the species, found in a variety of often fairly dry areas with aquatic habitat nearby, including woodlands with pans, and marshes, also rivers and floodplains (Simmons & Brown 2006). Not expected to interact with the line due to unsuitable habitat, but sporadic occurrence is possible when pools of water with fish is present in ephemeral rivers in the east of the study area.

Tawny Eagle: Prefers open savanna with large trees to breed in. Recorded from three squares namely 2215AD, 2115CD, and 2115DD. Greatest risk would be disturbance of breeding birds in dry river courses, as well as collision with the power line near temporary water e.g. pools in ephemeral rivers in the Namibian Escarpment. If large trees are removed during the construction of the power line, it can potentially impact on breeding as well.

White-backed Vulture: In Namibia it is found most abundantly in Etosha and regions to the north-east where prey populations of large ungulates are intact in Etosha NP. The tallest trees are used for breeding and roosting purposes (Simmons & Brown 2006). Recorded from two squares in the Namibian Escarpment namely 2115DC and 2115DD. Greatest risk would be disturbance of breeding birds in dry river courses, as well as collision with the power line near temporary water e.g. pools in ephemeral rivers in the Namibian Escarpment. If large trees are removed during the construction of the power line, it can potentially impact on breeding as well.

Great White Pelican: Recorded from the west of the study area, in 2214DD, 2215CA, 2215AC. Prefers coastal islands (and platforms) to breed but more birds are found inland in Namibia than at the coast. These breeding colonies occur (regularly) on Namibia's largest dam at Hardap where about 150 to 202 nests occur on one or two small islands when water levels are appropriate. Small breeding numbers are also present at the Walvis Bay bird platform where 100 - 200 pairs breed regularly. More recently (2000-2004), pelicans have begun breeding in small numbers on the jackal-free islands at Sandwich Harbour in numbers not exceeding 20 nests (Simmons & Brown 2006). Movement between the coast and inland water bodies must be taking place, as is evidenced by records in quarter degree squares in the central desert. Long distance flights are undertaken by high altitude soaring, no impacts are expected on the line as it is not situated near water bodies where low altitude flight is likely to take place.

Other species: Other species that might be impacted upon by the proposed power line also occur along the alignment, although they are not necessarily regarded as threatened in Namibia. Three species that have been recorded from many squares are Ludwig's Bustard, Kori Bustard, and the endemic Rueppell's Korhaan. Ludwig's Bustard are common both on the gravel plains of the central Namib and the dry savanna of the Namibian Escarpment. The two bustard species are very susceptible to power line collisions (EWT unpublished data). Kori Bustards are likely to be found close to dry river courses in the Namibian Escarpment where they take cover during the heat of the day (Harrison *et al.* 1997). The Ludwig's Bustard occurs both in the Namibian Escarpment and the central Namib in large numbers. It has been established that seasonal movement occurs between the escarpment and the desert (Harrison *et al.* 1997). The Rueppell's Korhaan is an endemic of the gravel plains of the central Namib. No records exist of power line collisions for this species, but that might be only because of its remote habitat. It certainly seems plausible that it shares some of the vulnerability as its larger relatives, the bustards, to power line collisions, although it probably flies less often and shorter distances.

# 3 IMPACT ASSESSMENT

## 3.1 INTRODUCTION

The potential impact on the birdlife by the proposed line was identified and assessed from experience elsewhere in southern Africa and from on the ground observations of bird habitat and occurrence in the Namibian Escarpment and Namib for a previous power line project between Windhoek and Walvis Bay. As mentioned before, this is a desk top exercise and therefore ample use was made of high resolution imagery from Google Earth to identify potential high risk areas.

## 3.2 METHODOLOGY EMPLOYED FOR THE IMPACT ASSESSMENT

The following criteria were used to describe and determine the significance of the impacts identified for the Project.

**Table 3-1: Criteria used to describe impacts.**

| | **Description** |
|---|---|
| **Nature** | Reviews the type of effect that the proposed activity will have on the relevant component of the environment and includes "what will be affected and how?" |
| **Extent** | Indicates whether the impact will be site specific; local (limited to within 15 km of the area); regional (limited to ~100 km radius); national (limited to the coastline of Namibia); or international (extending beyond Namibia's borders). |
| **Duration** | Reviews the lifetime of the impact, as being short (days, <1 month), medium (months, <1 year), long (years, <10 years), or permanent (generations, or >10 years). |
| **Intensity** | Establishes whether the magnitude of the impact is destructive or innocuous and whether or not it exceeds set standards, and is described as none (no impact); low (where natural/ social |

| | Description |
|---|---|
| | environmental functions and processes are negligibly affected); medium (where the environment continues to function but in a noticeably modified manner); or high (where environmental functions and processes are altered such that they temporarily or permanently cease and/or exceed legal standards/ requirements). |
| **Probability** | Considers the likelihood of the impact occurring and is described as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will occur regardless of prevention measures). |
| **Degree of Confidence in Predictions** | Is based on the availability of specialist knowledge and other information. |

The application of the above criteria to determine the significance of potential impacts uses a balanced combination of duration, extent and intensity/magnitude, modified by probability, cumulative effects and confidence. Significance is described as follows:

**Table 3-2: Significance Criteria.**

| Significance Rating | Criteria |
|---|---|
| **Low** | Where the impact will have a negligible influence on the environment and no modifications or mitigations are necessary for the given project description. This would be allocated to impacts of any severity/ magnitude, if at a local scale/ extent and of temporary duration/time. |
| **Medium** | Where the impact could have an influence on the environment, which will require modification of the project design and/or alternative mitigation. This would be allocated to impacts of moderate severity/magnitude, locally to regionally, and in the short term. |
| **High** | Where the impact could have a significant influence on the environment and, in the event of a negative impact the activity(ies) causing it, should not be permitted (i.e. there could |

| Significance Rating | Criteria |
|---|---|
| | be a 'no-go' implication for the project, regardless of any possible mitigation). This would be allocated to impacts of high magnitude, locally for longer than a month, and/or of high magnitude regionally and beyond. |

## 3.3 ASSESSMENT OF IMPACTS ON BIRDS

### 3.3.1 Introduction

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds and other animals and birds colliding with power lines. (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs & Ledger 1986a; Hobbs & Ledger 1986b; Ledger et al.. 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000, Anderson 2001). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure (Van Rooyen *et al*.. 2002), and disturbance and habitat destruction during construction and maintenance activities.

### 3.3.2 Impacts related to birds

***Electrocutions***

Large birds of prey are the most commonly electrocuted on power lines. The large transmission lines from 220 kV to the massive 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 power lines have proved to be beneficial to birds such as Martial Eagles, Tawny Eagles, White-backed Vultures, and even occasionally Verreauxs' 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 power lines in certain areas in large numbers, while Lappet-faced Vultures also use power lines as roosts, especially in the Northern Cape (pers.obs.).

Unfortunately, the same cannot be said of the smaller sub-transmission and reticulation lines of 11kV to 132kV (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 for this purpose. The vast majority of electrical structures in southern Africa 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).

The proposed Omburu 220kV line should not pose an electrocution risk to birds as the clearances are too large to be bridged by even the largest raptors.

***Collisions***

Anderson (2001) summarizes collisions as a source of avian mortality as follows:

"The collision of large terrestrial birds with the wires of utility structures, and especially power lines, has been determined to be one of the most important mortality factors for this group of birds in South Africa (Herholdt 1988; Johnsgard 1991; Allan 1997). It is possible that the populations of two southern African endemic bird species, the Ludwig's Bustard *Neotis ludwigii* and Blue Crane *Anthropoides paradiseus*, may be in decline because of this single mortality factor (Anderson 2000; McCann 2000). The Ludwig's Bustard (Anderson 2000) and Blue Crane (McCann 2000) are both listed as "vulnerable" in The Eskom Red Data Book of Birds of South Africa, Lesotho & Swaziland (Barnes 2000) and it has been suggested that power line collisions is one of the factors which is responsible for these birds' present precarious conservation status. The Blue Crane is listed as Critically Endangered in the Namibian Red list of birds (Simmons and Brown 2006).

Collisions with power lines and especially overhead earth-wires have been documented as a source of mortality for a large number of avian species (e.g. Beaulaurier et al.. 1982; Bevanger 1994, 1998). In southern Africa, this problem has until recently received only limited attention. Several studies however have identified bird collisions with power lines as a potentially important mortality factor (for example, Brown & Lawson 1989; Longridge 1989). Ledger *et al.*.(1993), Ledger (1994) and Van Rooyen & Ledger (1999) have provided overviews of bird interactions with power lines in South Africa. Bird collisions in southern Africa have been mainly limited to Greater and Lesser Flamingos, various species of waterbirds (ducks, geese, and waders), Stanley's *Neotis denhami* and Ludwig's Bustards, White Storks *Ciconia ciconia*, and Wattled *Grus carunculatus*, Grey Crowned *Balearica regulorum* and Blue Cranes (for example, Jarvis 1974; Johnson 1984; Hobbs 1987; Longridge 1989; Van Rooyen & Ledger (1999)). Certain groups of birds are more susceptible to collisions, namely the species which are slow fliers and which have limited manoeuvrability (as a result of high wing loading) (Bevanger 1994). Birds which regularly fly between roosting and feeding grounds, undertake regular migratory or nomadic movements, fly in flocks, or fly during low-light conditions are also vulnerable. Other factors which can influence collision frequency include the age of the bird (younger birds are less experienced fliers), weather factors (decreased visibility, strong winds, etc.), terrain characteristics and power line placement (lines that cross the flight paths of birds), power line configuration (the larger structures are more hazardous [for collisions, with electrocutions the opposite is the case]), human activity (which may cause birds to panic and fly into the overhead lines), and familiarity of the birds with the area (therefore nomadic Ludwig's Bustards would be more susceptible) (Anderson 1978; APLIC 1994).

Although collision mortality rarely affects healthy populations with good reproductive success, collisions can be biologically significant to local populations (Beer & Ogilvie 1972) and endangered species (Thompson 1978; Faanes 1987). The loss of hundreds of Northern Black Korhaans *Eupodotis afraoides* due to power line collisions would probably not affect the success of the total population of this species and would probably not be biologically significant, but, in a Namibian context, if one Blue Crane was killed due to a collision, that event could have an effect on the population that would be considered biologically significant. Biological significance is an important factor that should be considered when prioritising mitigation measures. Biological significance is the effect of collision mortality upon a bird population's ability to sustain or increase its numbers locally and throughout the range of the species.

There are many methods that can be used to mitigate avian power line interactions (for example, APLIC 1994) and several investigations dealing with the collision problem have recently focused on finding suitable mitigation measures (see APLIC 1994 for an overview). The most proactive measures are power line route planning (and the subsequent avoidance of areas with a high potential for bird strikes) and the modification of power line designs (this option includes line relocations, underground burial of lines, removal of over-head ground wires, and the marking of ground wires to make them more visible to birds in flight). In many instances, decisions on power line placement and possible mitigation measures are however eventually based on economic factors. The relocation of an existing line is the last option that is usually considered when trying to mitigate avian collisions. The huge expense of creating a new line and servitude usually cannot be justified unless there are biologically significant mortalities. Underground burial of power lines is another option available to managers in areas of high collision risk. This will obviously eliminate collisions, but the method has many drawbacks. The costs of burying lines can be from 20 – 30 times (or more) higher than constructing overhead lines (Hobbs 1987), and such costs are related to the line voltage, type and length of cable, cable insulation, soil conditions, local regulations, reliability requirements, and requirement of termination areas. Limitations of cable burial include: no economically feasible methods of burying extra high voltage lines have been developed, there is a potential to contaminate underground water supplies if leakage of oil used in insulating the lines occurs, and extended outage risks due to the difficulty in locating cable failures (APLIC 1994). Since most strikes involve earth-wires (more than 80% of observed bird collisions) (e.g. Beaulaurier 1981; Faanes 1987; Longridge 1989), the removal of these wires would decrease the number of collisions (Beaulaurier 1981; Brown et al.. 1987). Faanes (1987) has argued that the large number of earth-wire collisions is because birds react to the more visible conductors by flaring and climbing and then collide with the thinner earth-wires. Earth-wire removal is, however, not a simple matter. Due to the need for lightning protection and other types of electricity overload, it is only possible on lower-voltage power lines (where polymer lightning arresters can be used). The marking of overhead earth-wires to increase their visibility is usually considered to be the most economical mitigation option for reducing collision mortality (Morkill & Anderson 1991; Brown & Drewien 1995). This is particular so for the thousands of kilometres of established power lines through areas of high potential for avian interaction which cannot be rerouted."

The proposed line will pose a collision hazard for several species, particularly certain raptors, waterbirds and bustards. These species and the threat that the power line could pose to them are discussed above under "3. Description of the baseline environment".

***Habitat destruction***

During the construction phase and maintenance of power lines, 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 could have an impact on birds breeding, foraging, and roosting in or in close proximity of the servitude, through destruction of habitat. The potential removal of large trees in river courses could impact on several raptor species (see discussion under "3. Description of the baseline environment").

***Disturbance***

The construction of a power line can be highly disturbing to birds breeding in the vicinity of the construction activities. Many birds are highly susceptible to disturbance, and should this disturbance take place during a critical time in the breeding cycle, for example when the eggs have not hatched or just prior to the chick fledging, it could lead to temporary or permanent abandonment of the nest or premature fledging. In both instances, the consequences are almost invariably fatal for the eggs or the fledgling. Such a sequence of events can have far reaching implications for certain large, rare species that only breed once a year or once every two years. The dry river courses are important micro-breeding habitat for several species of raptors and disturbance during the construction phase could have a negative effect on breeding success (see discussion under "3. Description of the baseline environment").

### 3.3.3 Mitigation

***Electrocutions***

No mitigation is required for electrocutions as the proposed power line does not pose any electrocution risk to birds.

***Collisions***

The power line will pose substantial risk of collision in several areas to several species. The following areas will have to be mitigated by putting Bird Flight Diverters onto the earth wire of the proposed power line:

- Where dry river beds are crossed, particularly the Kahn River and the Swakop River;
- Where the line skirts or crosses near high cliffs, koppies and inselbergs; and
- Where the line crosses certain topographical features e.g. valleys or a neck between mountains.

Please see the attached mitigation map indicating where the mitigation should happen, as well as Table 4-3 below.

***Disturbance***

Every effort should be taken to restrict the construction activities to the immediate servitude and immediate surroundings. If an active large raptor nest is encountered, it must immediately be reported to the Environmental Control Officer, who must immediately inform Raptors Namibia. An appropriate course of action will then be decided upon between the parties to minimise the risk of disturbance tot the birds.

***Habitat destruction***

Every effort must be made to restrict the habitat destruction to a minimum. Large trees in particular must not be removed. Existing tracks and roads should be used as much as possible.

### 3.3.4 Summary

**Table 3-3: Impact Summary.**

| **BIRD IMPACTS** | |
|---|---|
| **Nature** | Potential collisions could potentially occur at sensitive bird habitats. Sensitive areas are the following:<br>• 2115DB: Kahn River crossing.<br>• 2115DD: Erongo complex.<br>• 2115DC: Groot Rooiberg area.<br>• 2215AB: Kahn River crossing and associated rugged area.<br>• 2215AA: Kahn River crossing and associated rugged area.<br>• 2215AD: Kahn River crossing and associated rugged area.<br>• 2215AC: Kahn River crossing and associated rugged area.<br>• 2215CA: Gravel plain/natural east-west flight path for bustards.<br>• 2215CC: Swakop River crossing.<br>See appendix A for a mitigation map |
| **Extent** | Local |
| **Duration** | Long term in terms of the duration of the project, but permanent and fatal if birds are killed. |
| **Intensity** | High |
| **Probability** | Highly probable |
| **Degree of confidence in predictions** | High. |
| **Significance before mitigation** | High |

| | |
|---|---|
| **Significance after mitigation** | Moderate |
| **Mitigation options** | Bird Flight Diverters to increase visibility of the line. |

| **BIRD IMPACTS** | |
|---|---|
| **Nature** | Disturbance of breeding birds during construction activities. |
| **Extent** | Local |
| **Duration** | Short term in terms of the duration of the project, but permanent if birds abandon their breeding attempts and desert the area. |
| **Intensity** | High |
| **Probability** | Probable |
| **Degree of confidence in predictions** | Medium |
| **Significance before mitigation** | High |
| **Significance after mitigation** | Moderate |
| **Mitigation options** | Every effort should be taken to restrict the construction activities to the immediate servitude and immediate surroundings. If an active large raptor nest is encountered, it must immediately be reported to the Environmental Control Officer, who must immediately inform Raptors Namibia. An appropriate course of action will then be decided upon between the parties to minimise the risk of disturbance tot the birds. |

| BIRD IMPACTS | |
|---|---|
| **Nature** | Habitat destruction, especially the removal of large trees in dry water courses birds during construction activities |
| **Extent** | Local |
| **Duration** | Short term in terms of the duration of the project, but permanent in terms of nesting substrate being lost. |
| **Intensity** | Medium |
| **Probability** | Probable |
| **Degree of confidence in predictions** | Medium |
| **Significance before mitigation** | Medium |
| **Significance after mitigation** | Moderate |
| **Mitigation options** | Every very effort must be made to restrict the habitat destruction to a minimum. Large trees in particular must not be removed. Existing tracks and roads should be used as much as possible. |

# 4 CONCLUSIONS AND RECOMMENDATIONS

In conclusion it can be stated that the proposed power line could potentially have certain impacts on birds. These potential impacts are collisions with the earth wire of the line, disturbance of breeding birds, particularly in the dry river courses, and finally destruction of sensitive woodland habitat, also in the dry river courses. These impacts are discussed in detail in the report and appropriate mitigation measures are suggested, which are as follows:

- The fitting of Bird Flight Diverters to increase visibility of the line on specific sections detailed under 4.3.4 above and in Appendix A (Mitigation Plan).
- Every effort should be taken to restrict the construction activities to the immediate servitude and immediate surroundings. If an active large raptor nest is encountered, it must immediately be reported to the Environmental Control Officer, who must immediately inform Raptors Namibia. An appropriate course of action will then be decided upon between the parties to minimise the risk of disturbance tot the birds.
- Every very effort must be made to restrict the habitat destruction to a minimum. Large trees in particular must not be removed. Existing tracks and roads should be used as much as possible.

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