BIRD IMPACT SCOPING STUDY

Cape Peninsula Strengthening Project

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1 INTRODUCTION & BACKGROUND

Eskom Transmission is proposing to strengthen the Cape Peninsula transmission network by constructing the following infrastructure:

- One 400kV double circuit Transmission power line of approximately 23km from the existing Firgrove substation to a proposed new substation in Mitchell's Plain; and
- One 400kV single circuit Transmission power line of approximately 7km from the same proposed new substation in Mitchell's Plain indicated above to the existing Philippi substation proposed to be upgraded. The upgrade of the Philippi substation will entail the addition of a transformer within the existing site.
- Following a request from an interested and affected party at the Public Open Day, an additional alternative was investigated for the Firgrove-Mitchell's Plain project. It was determined that the connection of Stikland to Mitchell's Plain could provide Eskom with the same result as the connection of Firgrove to Mitchell's Plain. In addition, this would mean a reduced corridor to consider as opposed to the corridor of Firgrove-Mitchell's Plain as an alternative.

Chris van Rooyen Consulting was appointed by BKS to conduct an avifaunal desk top scoping study for this project.

A map of the study area indicating the different route options is attached as Appendix A.

1.2 Terms of reference

The terms of reference for this desk top scoping study are as follows:

- Briefly outline of status quo of the environment from an avifaunal perspective;
- Identify potential impacts on avifauna by the proposed development;
- Briefly outline key issues that will require further investigation in the avifaunal impact specialist study

1.3 Sources of information

The following sources were consulted in order to inform the findings of this study:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP – Harrison *et al.* 1997) were obtained from the Animal Demography Unit at the University of Cape Town for the Quarter-Degree Grid Cells (QDGCs) traversed by the proposed line. In this instance, the combined proposed alignments are situated in 3418BA and 3318DC. The conservation status of all species considered likely to occur in the area was determined as per the most recent iteration of the southern African Red Data list for birds (Barnes 2000), and the most recent and comprehensive summary of southern African bird biology (Hockey *et al.* 2005).
- The SABAP data was supplemented with SABAP2 data for the relevant QDGCs. This data is much more recent, as SABAP2 was only launched in May 2007, and should therefore be more accurate. For SABAP, Quarter-Degree Grid Cells (QDGCs) were the geographical sampling units. QDGCs are grid cells that cover 15 minutes of latitude by 15 minutes of longitude (15. × 15.), which correspond to the area shown on a 1:50 000 map. For SABAP2 the sampling unit has been reduced to pentad grid cells (or pentads); these cover 5 minutes of latitude by 5 minutes of longitude (5. × 5.). Each pentad is approximately 8 × 7.6 km. This finer scale has been selected for SABAP2 to obtain more detailed information on the occurrence of species and to give a clearer and better understanding of bird distributions. There are nine pentads in a QDGC.
- 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 the study area are typically impacted upon by power lines and the extent to which they are impacted on (Van Rooyen 2006).
- A classification of the vegetation types in the quarter degree square was obtained from Harrison *et al.* (1997).
- Information on micro habitat level was obtained by studying high resolution satellite images of the study area on Google Earth and by physically inspecting the terrain on 11 and 12 March and 12 and 13 August 2010.
- Information on the species diversity of avifauna in the Driftsands Nature Reserve was obtained from the Birds in Reserves Project website of the Animal Demography Unit of the University of Cape Town http://birp.adu.org.za/.

1.4 Assumptions & Limitations

- The assumption was made that the above sources of information are adequately reliable. However, there are factors that 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. Fortunately, the new SABAP2 project has so far gathered some data for these QDGCs (83 checklists for 3418BA and 244 for SABAP2) therefore the SABAP data could be supplemented with this more recent dataset, supplemented by general knowledge of the area.
- It is difficult to make comparisons between the two SABAP datasets as far as reporting rates of species are concerned, because of different efforts that went into the data capturing. For example, for 3418BA there were 684 SABAP but only 83 SABAP2 checklists completed (for a full discussion of potential inaccuracies in SABAP data, see Harrison *et al*, 1997).
- Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will hold true under all circumstances. However, power line and substation impacts can be predicted with a fair amount of certainty, based on experience gained by the author through the investigation of hundreds of localities in southern Africa, since 1996, where birds have interacted electrical infrastructure.

2 DESCRIPTION OF AFFECTED ENVIRONMENT

2.1 Vegetation

TABLE 1 below shows the vegetation composition of the relevant QDGCs (Harrison *et al* 1997). It is generally accepted that vegetation structure, rather than the actual plant species, influences bird species distribution and abundance (in Harrison *et al* 1997). Therefore, the vegetation description below does not focus on lists of plant species, but rather on factors which are relevant to bird distribution. The description makes extensive use of the work of Harrison *et al* (1997).). This source presents a vegetation classification intermediate between that of Acocks' seventy "Veld types" (1953) and Rutherford & Westfall's seven "biomes" (1986). 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 1. Vegetation composition of 3418BA (Harrison *et al* 1997).

Biome	**Vegetation type**	**3418BA**	**3318DC**
Fynbos	Fynbos	100%	100%

The proposed developments are situated in 3418BA and 3318DC which falls 100% within the Fynbos biome (Harrison *et.al*. 1997). The Fynbos biome is characterized by a high diversity in plant species composition and endemism. This diversity is not paralleled in its avifaunal composition, and Fynbos is regarded as relatively poor in avifaunal diversity compared to other southern African biomes. The endemic Fynbos avifauna consists of the Cape Rock-jumper *Chaetops frenatus*, Victorin's Warbler *Cryptillas victorini*, Cape Sugarbird *Promerops cafer*, Orangebreasted Sunbird *Anthobaphes violacea*, Protea Seedeater *Crithagra leucopterus* and Cape Siskin *Crithagra totta*. The Black Harrier *Circus maurus*, a southern African endemic, also uses the Fynbos biome extensively for breeding.

The remaining natural Fynbos habitat along proposed transmission lines and substation sites is highly degraded. The original indigenous vegetation has been invaded by alien woody plants, specifically Port Jackson *Acacia saligna* trees, which have transformed the habitat considerably. In some places, the trees have formed dense, almost impenetrable stands. Very few patches of Fynbos remain relatively intact, the best conserved area is in the Driftsands Nature Reserve. Although the Driftsands Nature Reserve is also subject to extensive impacts such as constant pedestrian traffic, illegal dumping and trampling by cattle, it does serve as a refuge for a variety of non Red Data avifauna, or may at least have done so in the recent past (see TABLE 2 below).

TABLE 2: Avifauna recorded in the Driftsands Nature Reserve (Birds in Reserves Project http://birp.adu.org.za/

Species	**Scientific name**
Black-necked Grebe	*Podiceps nigricollis*
Little Grebe	*Tachybaptus ruficollis*
Reed Cormorant	*Phalacrocorax africanus*
African Darter	*Anhinga rufa*
Grey Heron	*Ardea cinerea*
Little Egret	*Egretta garzetta*
Yellow-billed Egret	*Egretta intermedia*
Cattle Egret	*Bubulcus ibis*
Little Bittern	*Ixobrychus minutus*
African Sacred Ibis	*Threskiornis aethiopicus*
Glossy Ibis	*Plegadis falcinellus*
Hadeda Ibis	*Bostrychia hagedash*
Egyptian Goose	*Alopochen aegyptiacus*
Yellow-billed Duck	*Anas undulata*
Cape Teal	*Anas capensis*
Black-shouldered Kite	*Elanus caeruleus*
Common Moorhen	*Gallinula chloropus*
Red-knobbed Coot	*Fulica cristata*
Blacksmith Lapwing	*Vanellus armatus*
Barn Owl	*Tyto alba*
Red-faced Mousebird	*Urocolius indicus*
Pied Kingfisher	*Ceryle rudis*
Pied Crow	*Corvus albus*
Cape Crow	*Corvus capensis*

White-necked Raven	*Corvus albicollis*
Cape Bulbul	*Pycnonotus capensis*
Cape Robin-Chat	*Cossypha caffra*
Grey-backed Cisticola	*Cisticola subruficapilla*
Cape Wagtail	*Motacilla capensis*
Common Fiscal	*Lanius collaris*
Southern Boubou	*Laniarius ferrugineus*
Common Starling	*Sturnus vulgaris*
Red-winged Starling	*Onychognathus morio*
Malachite Sunbird	*Nectarinia famosa*
Southern Double-collared Sunbird	*Cinnyris chalybeus*
Cape Sparrow	*Passer melanurus*
Cape Weaver	*Ploceus capensis*
Cape Canary	*Serinus canicollis*

2.2 Bird micro habitats

Whilst much of the distribution and abundance of the bird species in the study area can be explained by the description of the broad vegetation type above, it is even more important to examine the micro habitats available to birds, given the high level of transformation in the study area. 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. It must emphasised that large sections of the habitat along both proposed transmission lines, but particularly between both the existing Philippi and Stikland substations and the proposed Mitchells Plain substation, have been completely transformed through dense human settlements, industrial development and massive stands of alien vegetation, particularly Port Jackson trees, leaving only isolated areas which can be utilised by birds.

The most important bird micro-habitats that were identified via a combination of Google Earth satellite imagery and field inspections are the following:

- *Arable lands*: Arable or cultivated land may at times represent a significant feeding area for some bird species in any landscape. Through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds. The crop or pasture plants cultivated are often eaten themselves by birds, or attract insects which are in turn eaten by birds. During the dry season arable lands sometimes represent the only green or attractive food sources in an otherwise dry landscape. The study area does contain a few areas of cultivated lands, mostly vegetable growing, between Philippi and the proposed Mitchells Plain substation. Red Data species that might occasionally use this habitat are Lanner Falcon and (possibly) Peregrine Falcon, when hunting birds feeding in the agricultural fields. Probably more important are several areas of old lands which have reverted back to a form of grassland. These areas are mostly found on both sides of the N2 highway between the Firgrove substation and the R310 off-ramp, along the first 7km of proposed alignments for the Firgrove-Mitchells Plain double circuit transmission line. These "grasslands" could be used by Red Data species such as Lesser Kestrel *Falco naumanni*, Lanner Falcon *Falco biarmicus*, Peregrine Falcon *Falco peregrinus* and Black Harrier *Circus maurus* as hunting grounds, as well as non-threatened raptors for example Black-shouldered Kite *Elanus caeruleus*, Steppe Buzzard *Buteo vulpinus* and Jackal Buzzard *Buteo rufofuscus*. Red Data species recorded by SABAP also include Blue Crane *Anthropoides paradiseus,* Secretarybird *Sagittarius serpentarius*, Martial Eagle *Polemaetus bellicosus* and

Marabou Stork *Leptoptilos crumeniferus* but these species are likely only to occur as occasional vagrants.

- *Pans, dams and drainage lines*: The most important drainage line in the study area is the Kuils River and its associated wetlands which are bisected by the proposed Firgrove-Mitchells Plain and Stikland-Mitchells Plain alignments. There are also several other large dams and pans in the study area, also between Philippi Sub and the new proposed Mitchells Plain Substation. Red Data species that could potentially make use of this habitat are Greater Painted-Snipe *Rostratula benghalensis*, Half-collared Kingfisher *Alcedo semitorquata*, Greater Flamingo *Phoenicopterus ruber*, Lesser Flamingo *Phoenicopterus minor*, African Marsh-Harrier *Circus ranivorus*, Great White Pelican *Pelecanus onocrotalus*, Black Stork *Ciconia nigra* and many non-Red Data species of waterbirds. This importance of habitat will have to be further investigated during the EIR phase, especially in terms of potential flight paths to and from it.

Areas that are regarded as sensitive from an avifaunal perspective have been mapped in Appendix B

2.3 Relevant bird populations

TABLE 3 below shows the reporting rates for the Red Data species that have been recorded in 3418BA and 3318DC where the study area is situated (Harrison *et al* 1997; http://sabap2.adu.org.za/). For 3418BA the total number of species recorded by SABAP was 254, while SABAP2 recorded 182 species. For 3318DC the total number of species recorded by SABAP was 217, while SABAP2 recorded 190 species. In 3418B a total of 10 Red Data species were recorded by SABAP, and 7 by SABAP2 (excluding marine species). In 3318 DC, 16 Red Data species were recorded by SABAP, and 12 by SABAP2 (excluding marine species). It is important to note that these species could have been recorded anywhere within the relevant QDGC, not necessarily along the proposed alignments. Report rates are essentially the number of times a species was recorded in a QDGC as a percentage of the number of times that cell was counted. As mentioned earlier, the QDGCs in the study area were not equally well covered by the two atlas projects, which mean that comparison between the two datasets should be done with caution. For 3418BA, a total of 684 and 83 checklists were completed respectively for SABAP and SABAP2. For 3318DC, 686 and 244 checklists were completed respectively for SABAP and SABAP2.

TABLE 3. Red Data species report rates (%) for 3418BA (Harrison *et al* 1997; http://sabap2.adu.org.za)

Species	**Conservation status**	**SABAP reporting rate 3418BA**	**SABAP2 reporting rate 3418BA**	**SABAP reporting rate 3318DC**	**SABAP2 reporting rate 3318DC**	**Habitat requirements (Barnes 2000; Hockey *et al* 2005; Harrison *et al* 1997; personal observations)**
Great White Pelican *Pelecanus onocrotalus*	Vulnerable	69.2	75.9	26.5	21.3	Large water bodies, both inland and at the coast.
Black Stork *Ciconia nigra*	Near threatened	0.7	-	1.3	-	Cliffs for roosting and breeding, and rivers and dams for foraging.

Lanner Falcon *Falco biarmicus*	Near threatened	2.2	1.2	5.8	2.9	Generally prefers open habitat, but exploits a wide range of habitats. Will nest in wooded areas if suitable cliffs are present.
Greater Flamingo *Phoenicopterus ruber*	Near threatened	61.7	77.1	1.3	0.4	Open shallow, euthropic wetlands.
Lesser Flamingo *Phoenicopterus minor*	Near threatened	20.2	1.2	0.9	-	Open shallow, euthropic wetlands. Can tolerate more saline and alkaline conditions than the Greater Flamingo.
African Marsh-Harrier *Circus ranivorus*	Vulnerable	42.8	44.6	3.5	1.6	Large permanent wetlands with dense reed beds. Sometimes forages over smaller wetlands and grassland.
Black Harrier *Circus maurus*	Near threatened	0.1	-	1.7	1.6	In the study area most likely to be found in fynbos and old lands.
Peregrine Falcon *Falco peregrinus*	Near threatened	0.4	12.0	0.1	36.0	A wide range of habitats, but cliffs (or tall buildings) are a prerequisite for breeding.
Greater Painted-snipe *Rostratula benghalensis*	Near threatened	2	1.2	0.3	4.1	Usually found close to the fringes of reed beds along shorelines of marshes, swamps, ponds and streams. Rather shy and retiring, skulking close to the vegetation so that it can retreat to cover if disturbed.
Aghulhas Long-billed Lark *Certhilauda brevirostris*	Near threatened	0.1	-	0.6	-	Fallow and recently ploughed fields, sparse shrubland dominated by renosterveld

Secretarybird *Sagittarius serpentarius*	Near threatened	-	-	0.6	Vagrant	Grassland, old lands, open woodland.
Caspian Tern *Sterna caspia*	Near threatened	-	-	1.2	0.4	Mainly estuaries, but also large inland water bodies.
Martial Eagle *Polemaetus bellicosus*	Vulnerable	-	-	-	0.8	Wide range of habitats, ranging from open woodland to semi-desert.
Half-collared Kingfisher *Alcedo semitorquata*	Near threatened	-	-	0.1	-	Fast-flowing streams with clear water and well-wooded banks.
Barlow's Lark *Calendulauda barlowi*	Near threatened	-	-	0.1	-	Sparse shrubland and well-grassed dunes.
Lesser Kestrel *Falco naumanni*	Vulnerable	-	-	0.9	-	Grassland and agricultural fields
Blue Crane *Anthropoides paradiseus*	Vulnerable	-	-	2.0	16.4	Grassland and agricultural fields
Marabou Stork *Leptoptilos crumeniferus*	Vulnerable	-	-	-	0.4	Rare outside game reserves, mostly in the semi-arid areas

Although this study focuses on the impact of the proposed power line on the above Red Data species, the non Red Data species occurring in the study area are also taken into account. Power line sensitive non Red Data species recorded in the study area include various raptors, terrestrial species and waterbirds.

3 DESCRIPTION OF THE PROPOSED INFRASTRUCTURE

The following infrastructure will be constructed by Eskom:

- The building of the Mitchells Plain substation which will entail the clearing of approximately one hectare of vegetation.
- The upgrade of the Philippi substation will entail the addition of a transformer within the existing site.
- One 400kV double circuit Transmission power line of approximately 23km from the existing Firgrove substation to a proposed new substation in Mitchell's Plain; and
- One 400kV single circuit Transmission power line of approximately 7km from the same proposed new substation in Mitchell's Plain indicated above to the existing Philippi substation proposed to be upgraded.
- An additional alternative was investigated for the Firgrove-Mitchell's Plain project. It was determined that the connection of Stikland to Mitchell's Plain could provide Eskom with the same result as the connection of Firgrove to Mitchell's Plain. In addition, this would mean a reduced corridor to consider as opposed to the corridor of Firgrove-Mitchell's Plain as an alternative.

4 POTENTIAL IMPACTS

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; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000, Anderson 2001; Van Rooyen 2004). 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.

4.1 Collision with conductors and earth wires

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

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 this country 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 maneuverability (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 if one Wattled 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 is a limited collision threat that will be posed by the proposed power lines. From a biological significance perspective, the biggest threat will be in the wetland and arable lands (particularly old lands that have reverted to grassland), as those areas are most likely to attract any of the remaining power line sensitive Red Data species. Arable lands might attract Lanner Falcon, Peregrine Falcon, Black Harrier and (possibly) Blue Crane and Secretarybird, but the latter two species are likely to be vagrants. There is also a possibility of collisions at wetlands and water bodies, which may potentially affect flamingos, pelicans, Black Stork, African Marsh-Harrier and various non-Red data species.

4.2 Habitat destruction

During the construction phase of power lines and particularly substations, habitat destruction and alteration inevitably takes place on the site. This happens with the construction of access roads, the clearing of the site itself and any associated infrastructure. The power line servitude has to be maintained free of any intruding vegetation, to minimize the risk of fire amongst other reasons. These activities have an impact on birds using the servitude and substation site for breeding, foraging and roosting. The proposed substation site will also entail the clearing of vegetation, which could have an impact on birds occurring there.

Due to the heavy existing impacts in the study area (even in officially protected areas such as Driftsands Nature Reserve), namely urbanisation (both formal and informal), industrialisation, agriculture, alien infestation and illegal dumping in open spaces, the clearing of vegetation is likely to have a limited effect on bird habitat. All the proposed substation sites show evidence of the above impacts to a greater or lesser degree. This issue will be further investigated in the next phase of the study.

4.2 Disturbance

Similarly, the above mentioned construction and maintenance activities impact on birds through disturbance, particularly during breeding activities. The potential exists for the impact of disturbance to influence a greater area than the site itself, in that it could result in breeding failure of birds breeding close to the construction activities. It is however foreseen that disturbance will be a temporary impact. This impact will be further investigated during the next phase of the study.

4.3 Electrocution of birds on tower structures

Electrocution refers to the scenario whereby a bird bridges the gap between two phases or a phase and an earthed component thereby causing an electrical short circuit. The larger bird species such as vultures and eagles are particularly vulnerable to this impact, as obviously the larger the wingspan and other dimensions of a bird, the greater the likelihood of it being able to bridge the gap between hardware. Since the proposed power line towers will be higher than the average vegetation, the towers may be the most preferred perching substrate in the area for a number of bird species. However, in this instance, electrocutions are not an envisaged impact because the clearances on 400kV transmission lines are too big for any bird to bridge. Electrocutions need therefore not be further investigated.

5 ISSUES TO BE INVESTIGATED IN THE NEXT PHASE OF THE STUDY

During the next phase of the study, the following issues will be addressed:

- The alternative alignments will be evaluated from a potential bird impact perspective to arrive at a preferred alignment;
- Potential impacts will be discussed in more detail;
- Mitigation measures will be suggested if and where appropriate.

6 REFERENCES

ANDERSON, M.D. (2001). The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Karoo Large Terrestrial Bird Powerline Project. Eskom Report No. 1. Kimberley: Directorate Conservation & Environment (Northern Cape).

BARNES, K.N. (ed.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

http://birp.adu.org.za Birds in Reserves Project. Accessed on 16 May 2010.

HARRISON, J.A., ALLAN, D.G., UNDERHILL, L.G., HERREMANS, M., TREE, A.J., PARKER, V & BROWN, C.J. (eds). 1997. The atlas of southern African birds. Vol 1 & 2. BirdLife South Africa, Johannesburg.

HOCKEY P.A.R., DEAN W.R.J., AND RYAN P.G. 2005. Robert's Birds of Southern Africa, seventh edition. Trustees of the John Voelcker Bird Book Fund, Cape Town.

http://sabap2.adu.org.za. Southern African Bird Atlas Project 2. Accessed on 2 - 7 September 2009.

HOBBS, J.C.A. & LEDGER J.A. 1986A. The Environmental Impact of Linear Developments; Powerlines and Avifauna. Paper presented at the Third International Conference on Environmental Quality and Ecosystem Stability, Israel.

HOBBS, J.C.A. & LEDGER J.A. 1986B. Powerlines, Birdlife and the Golden Mean. Fauna and Flora 44:23-27.

KRUGER, R. & VAN ROOYEN, C.S. 1998. Evaluating the risk that existing powerlines pose to large raptors by using risk assessment methodology: the Molopo Case Study. Paper presented at the 5th World Conference on Birds of Prey and Owls: 4 - 8 August 1998. Midrand, South Africa.

KRUGER, R. 1999. Towards solving raptor electrocutions on Eskom Distribution Structures in South Africa. M. Phil. Unpublished mini-thesis. Bloemfontein: University of the Orange Free State.

LEDGER, J. 1983. Guidelines for Dealing with Bird Problems of Transmission Lines and Towers. Technical Note TRR/N83/005. Johannesburg: Escom Test and Research Division.

LEDGER, J.A. 1984. Engineering Solutions to the Problem of Vulture Electrocutions on Electricity Towers. The Certificated Engineer 57:92-95.

LEDGER, J.A. & ANNEGARN H.J. 1981. Electrocution Hazards to the Cape Vulture *(Gyps coprotheres)* in South Africa. Biological Conservation 20:15-24.

LEDGER, J.A., HOBBS J.C.A. & SMITH T.V. 1992. Avian Interactions with Utility Structures: Southern African Experiences. Workshop Proceedings of the International Workshop on Avian Interactions with Utility Structures, Miami: Electric Power Research Institute.

VAN ROOYEN, C.S. 1998. Raptor mortality on power lines in South Africa. (5th World Conference on Birds of Prey and Owls: 4 - 8 August 1998. Midrand, South Africa.

VAN ROOYEN, C.S. 1999. An overview of the Eskom-EWT Strategic Partnership in South Africa. Paper presented at the EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999, Charleston, South Carolina.

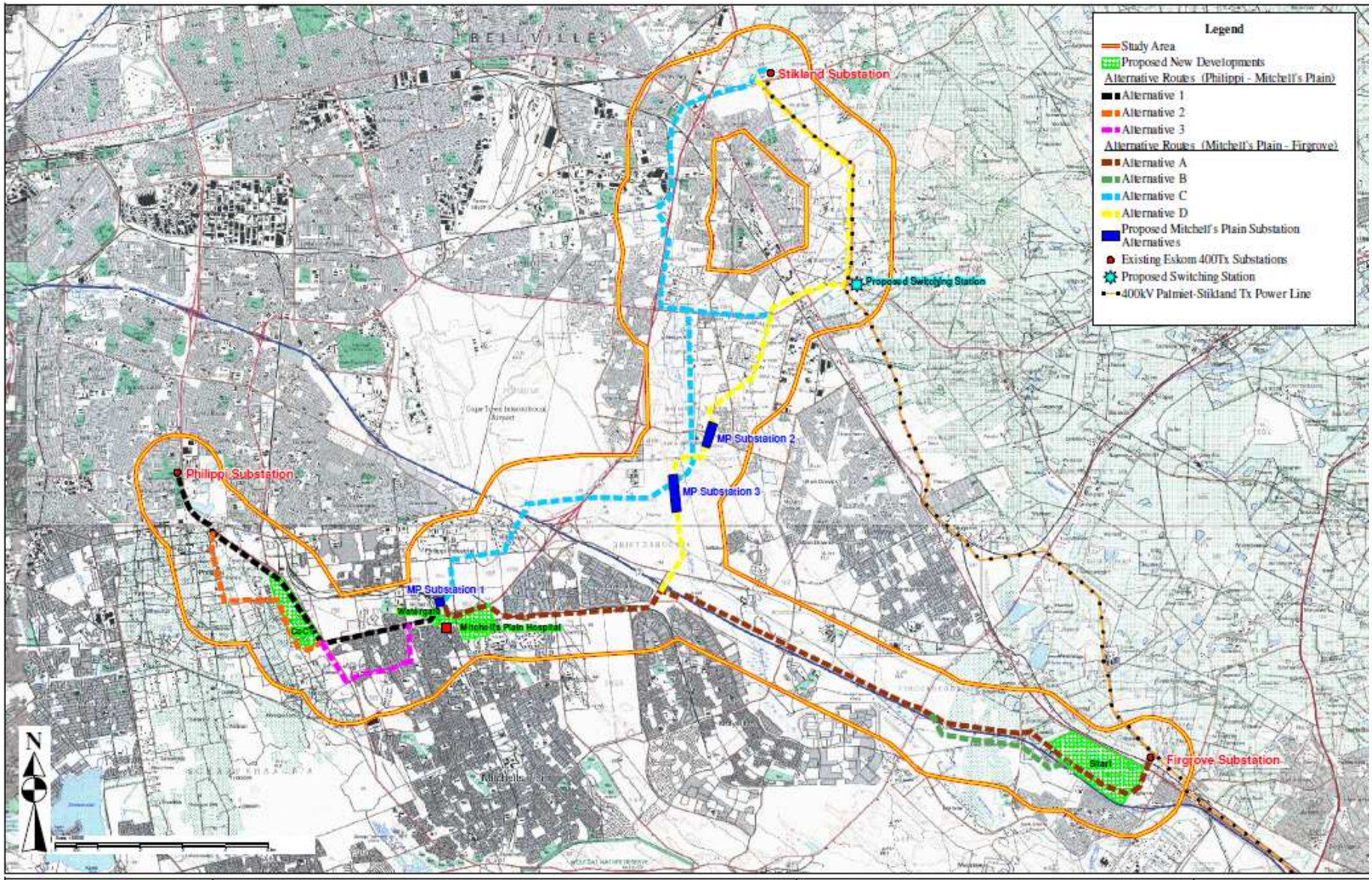
VAN ROOYEN, C.S. & LEDGER, J.A. 1999. Birds and utility structures: Developments in southern Africa. In *Birds and Powerlines* Edited *by* Ferrer. M. & G..F.M. Janns. (eds.) Madrid: Quercus, Spain, pp 205-230.

VAN ROOYEN, C.S. 2000. An overview of Vulture Electrocutions in South Africa. Vulture News 43: 5-22.

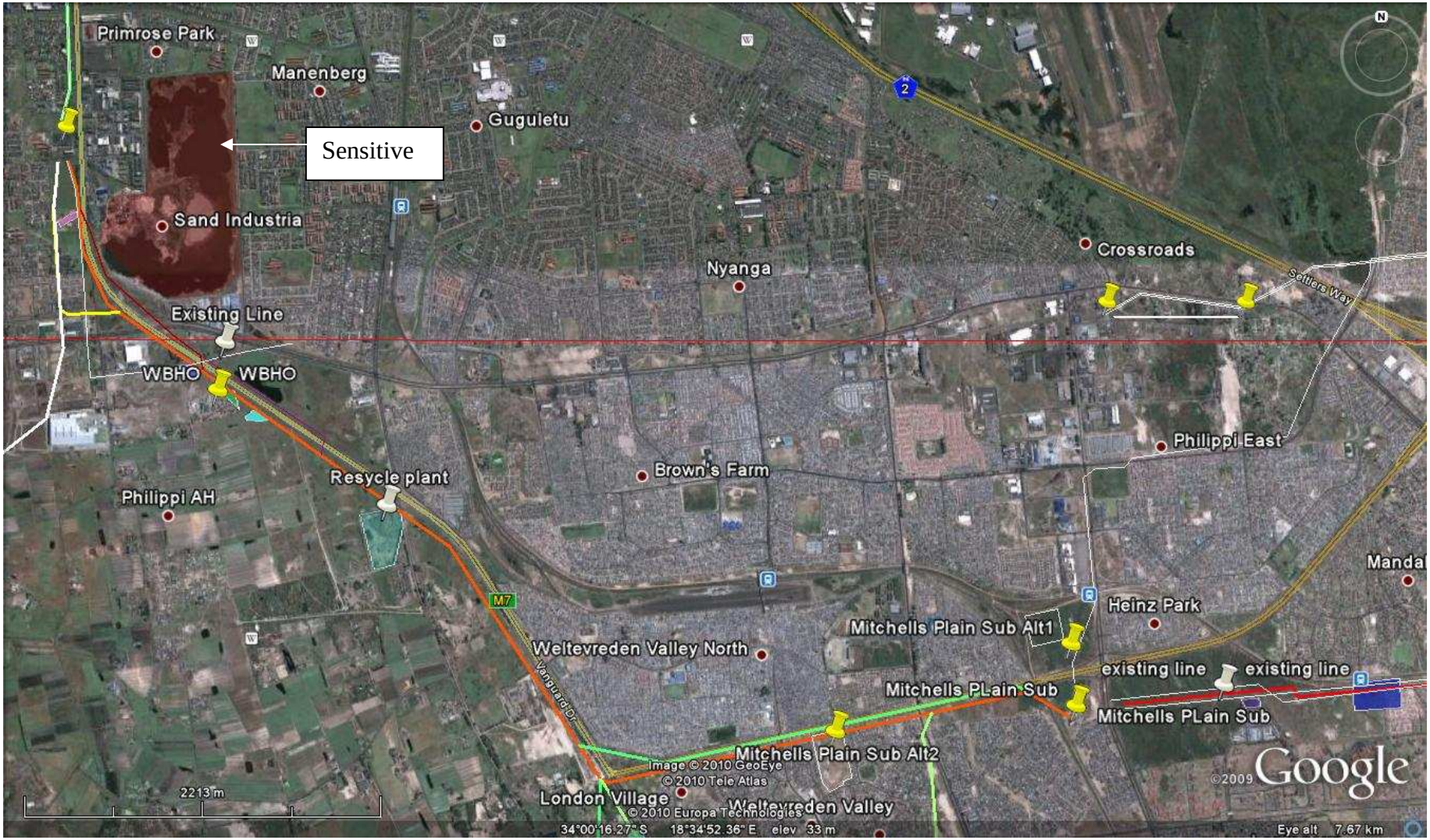
VAN ROOYEN, C.S. 2004. The Management of Wildlife Interactions with overhead lines. In The fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.

VAN ROOYEN, C.S. 2006. Eskom-EWT Strategic Partnership: Progress Report April-September 2007. Endangered Wildlife Trust, Johannesburg.

APPENDIX A


Legend
Study Area
Proposed New Developments
Alternative Routes (Philippi - Mitchell's Plain)
Alternative 1
Alternative 2
Alternative 3
Alternative Routes (Mitchell's Plain - Firgrove)
Alternative A
Alternative B
Alternative C
Alternative D
Proposed Mitchell's Plain Substation Alternatives
Existing Eskom 400Tx Substations
Proposed Switching Station
400kV Palmiet-Stikland Tx Power Line
Stikland Substation
Proposed Switching Station
MP Substation 2
MP Substation 3
Philippi Substation
MP Substation 1
Mitchell's Plain Hospital
Start
Firgrove Substation
N
FIRGROVE - MITCHELL'S PLAIN AND MITCHELL'S PLAIN - PHILLIPI
ESKOM TRANSMISSION POWERLINES
COMBINED LOCALITY MAP
SCOPING PHASE
Figure

APPENDIX B: SENSITIVE AVIFAUNAL AREAS



APPENIDIX B: SENSITIVITE AVIFAUNAL AREAS

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