EXPANSION OF THE ESKOM BIGHORN SUBSTATION, MARIKANA, NORTH WEST PROVINCE

Avifauna Component

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1. INTRODUCTION

The increase in human demand for space and life-supporting resources resulted in a rapid loss of natural open space in South Africa. When natural systems are rezoned for development, indigenous fauna and flora are replaced by exotic species and converted to sterile landscapes with no dynamic propensity or ecological value (Wood *et al.*, 1994). Additionally, development rarely focussed on decisive planning to conserve natural environments, while little thought was given to the consequences on the ecological processes of development in highly sensitive areas.

Transformation and fragmentation are not the only results of unplanned and intended developments, the loss of ecosystem functioning and ultimately the local extinction of species can also result. Therefore, careful planning will not only preserve rare and endemic fauna and flora, but also the ecological integrity of ecosystems of the landscape level which is imperative for the continuation of natural resources, such as fossil fuels, water and soils with agricultural potential.

In 1992 the Convention of Biological Diversity, a landmark convention, was signed by more than 90 % of all members of the United Nations. The enactment of the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004), together with the abovementioned treaty, focuses on the preservation of all biological diversity in its totality, including genetic variability, natural populations, communities, ecosystems up to the scale of landscapes. Hence, the local and global focus changed to the sustainable utilisation of biological diversity.

1.1 Background

Pachnoda Consulting cc was contracted by Groundwater Consulting Services (GCS) to provide an avifauna impact report for the proposed expansion of the Bighorn substation located north-east of Marikana in the North West Province.

In the Rustenburg area the Customer Load Network (CLN) has come to a point where load shifting cannot provide a medium to longer-term solution. This situation has arisen due to load growth on the entire Eastern Limb of the Bushveld Igneous Complex (BIC) which puts all of Rustenburg CLN's transmission stations at risk in the same period. Hence substations to the west of the Bighorn substation cannot be utilised to deload Bighorn and create capacity for the impending load growth. This has lead Eskom to consider the expansion of Bighorn's transformation capacity.

The proposed expansion project will result in the upgrade of the following infrastructure:

- Relocate the 275kV Feeder-2 to the vacant 275kV Feeder-1.
- Reposition the exit direction of the 400kV Feeder-1.

- Establish 275kV and 400kV Transformer bays in the then vacant 275kV Feeder-2 position.
- Relocate the new 400/275 500MVA to former 275kV Feeder-2 overpass.
- Deviate the 88kV Tailings lines within the proposed 132kV Yard.
- Terrance the remaining 275kV Yard and extend existing fence to the west.
- Establish a 132kV tubular busbar.
- Establish 3x132kV Feeder Bays (plus 1 future spare bay).
- Establish 132kV Bus Coupler.
- Establish 2x132kV Transformer Bays.
- Establish 1x400kV Transformer Bays.
- Install 2x400/132kV 500MVA Transformers.
- Establish 132kV overpass from the 500MVA transformers to 132kV Transformer Bay.
- Swing Makokokwe and Excarbo 1&2 88kV lines to new 132kV Bays.
- Install all necessary Secondary Plant Equipment.

1.2 Terms of Reference

The terms of reference for this assessment are to:

- provide a general description of the affected environment concerning the avifaunal habitat types;
- provide an indication on the occurrence of threatened, "near-threatened" and conservation important bird species likely to be affected by the proposed expansion project;
- provide an indication of sensitive bird areas or habitat types (to be incorporated into a sensitivity map) in the proposed expansion project area; and
- identify negative avifaunal impacts.

1.3 Location

The Bighorn substation expansion area is located 2 km north-west of Marikana in the North West Province. The substation is reached via the district road D 314.

1.4 Land use and existing infrastructure

The proposed expansion area is located on old cultivated land and on areas that was recently cleared of indigenous vegetation. It is surrounded by tribal land consisting of open, stunted woodland (grazed bushveld) with a woody layer comprising of *Acacia tortilis, A. nilotica* and *Dichrostachys cinerea*. The dominant land use in the area consists primarily of platinum mining activities (operated by Lonmin's Western Platinum Mine), residential housing and cattle farming, which is responsible for the stunted and overgrazed condition of the grassy layer (Figure 2).

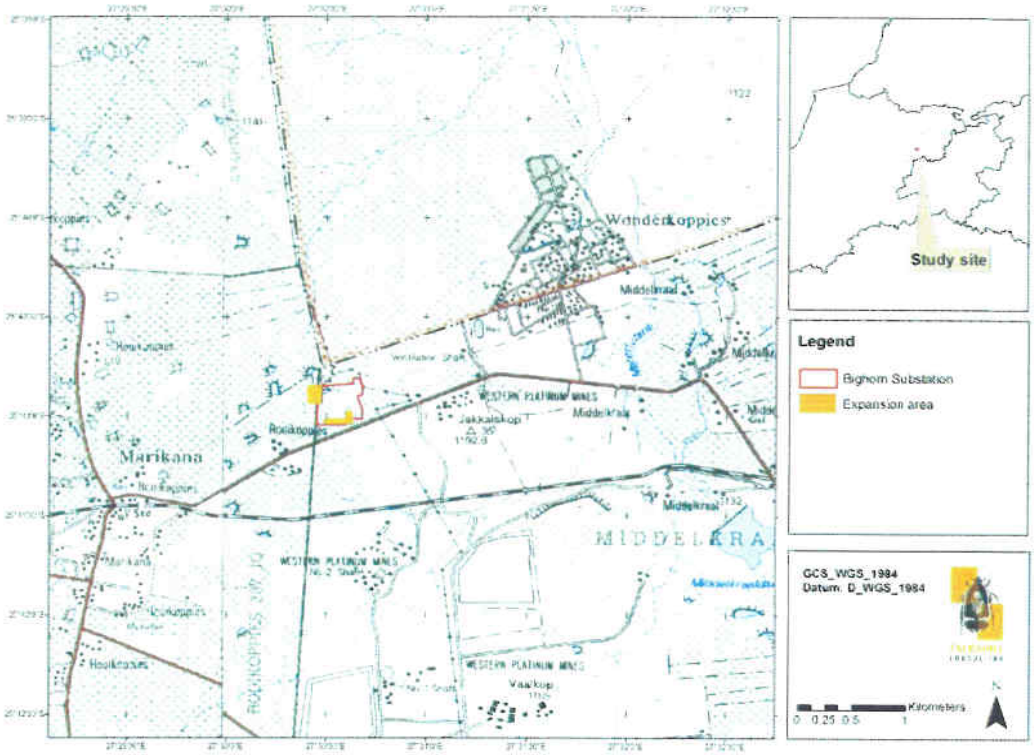


Figure 1: A locality map illustrating the geographic position of the proposed Bighorn substation expansion area.

1.5. Biophysical Description

1.5.1 Geology

The proposed substation location is underlain by ultramafic intrusive rock of the Rustenburg Layered Suite, which forms part of the western limb of the Bushveld Igneous Complex. It is situated on plains corresponding to underlying volcanic rock such as norite and gabbro. The latter lithologies are responsible for the widespread occurrence of deep vertic soils.

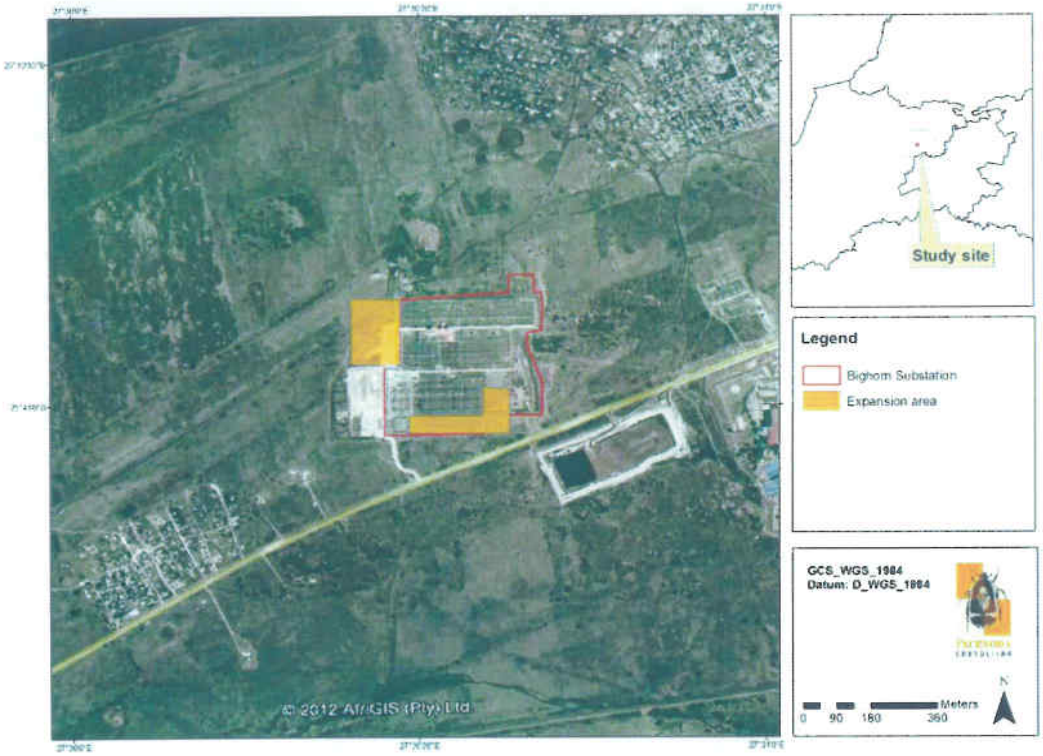


Figure 2: A satellite image illustrating the land cover on the proposed Bighorn substation expansion area (image courtesy of GoogleEarth).

1.5.2 Regional Vegetation Description

Bird diversity is positively correlated with vegetation structure, while floristic richness is not regarded as an important contributor of observed patterns in bird abundances and distributions. In general, grasslands are poorly represented in woody plant species and are subsequently also poor in bird richness values, although an important habitat for many terrestrial and cryptic bird species such as larks, pipits, korhaans and cisticolas. On the other hand, woodlands are rich in woody plant species and are an important constituent of the Savanna Biome that provides habitat for a number of bushveld bird species that are absent from grassland habitat types (notably birds of prey).

However, in contrast to the Grassland Biome, the bird assemblages of the Savanna Biome are generally poorly represented by threatened species, although they often hold a variety of charismatic Accipitriform and Falconiform taxa such as the Tawny Eagle (*Aquila rapax*), African White-backed Vulture (*Gyps africanus*), Brown Snake-eagle (*Circaetus cinereus*), Black-chested Snake-eagle (*Circaetus pectoralis*), African Harrier-hawk (*Polyboroides typus*), African Hawk Eagle (*Aquila spilogaster*) and Wahlberg's Eagle (*Aquila wahlbergi*). Nevertheless, woodland stands are often colonised and utilised as foraging habitat by large terrestrial bird species where the woody layer was removed or disturbed (e.g. old agricultural land) while the graminoid

layer is maintained. These species (e.g. Kori Bustard *Ardeotis kori* and Secretarybird *Sagittarius serpentarius*) are often threatened.

The proposed expansion project corresponds to the Savanna Biome and more particularly to the Central Bushveld Bioregion as defined by Mucina & Rutherford (2006). It comprehends an ecological type known as Marikana Thornveld (Figure 3).

Marikana Thornveld occurs from Rustenburg through Brits to the Pretoria area, and is invariably associated to deep vertisols (Mucina & Rutherford, 2006). It is described as an open *Acacia karroo* woodland.

This vegetation type is currently classified as "Endangered" with 48 % already transformed by agriculture, urbanisation and mining activities.

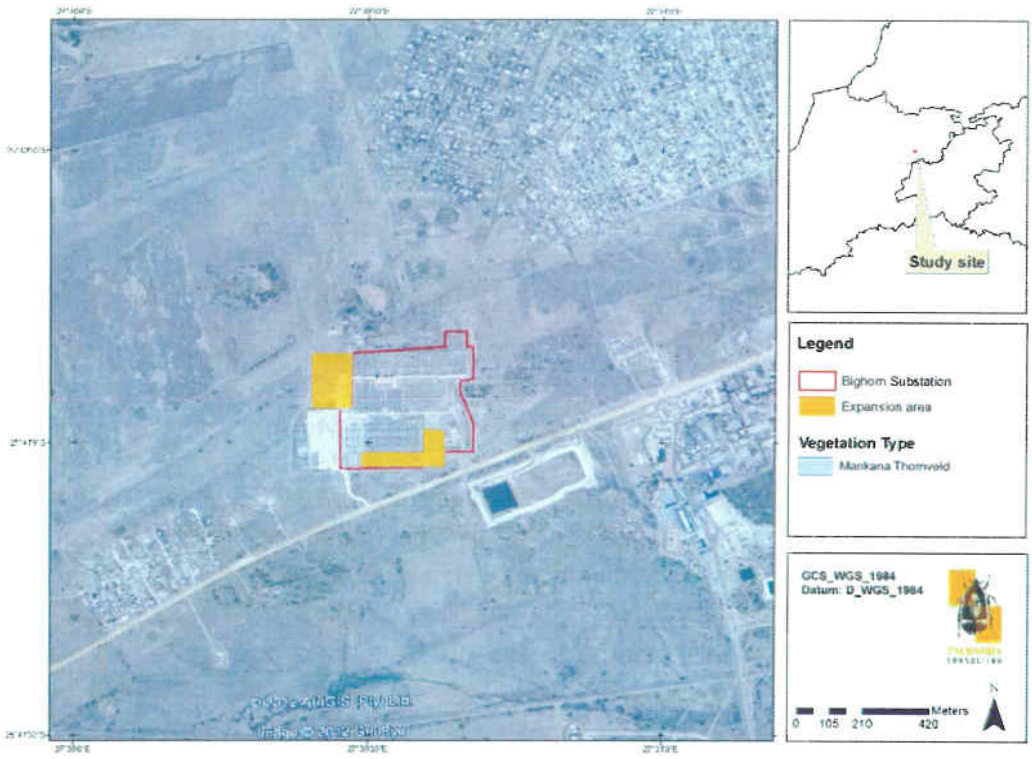


Figure 3: The spatial position of the proposed Bighorn substation and the regional vegetation types as defined by Mucina & Rutherford (2006).

2. METHODS

A site visit was conducted in February 2013 whereby the physical environment of the study area was inspected following an evaluation of GIS based information on the biotic and biophysical attributes of the area.

Visual observations of the proposed expansion area were conducted during the site visit. The objectives of the study were to:

- obtain a basic overview of the variation and general status of habitat types likely to be affected by the proposed expansion project;
- obtain an indication of the relative structure and ecological condition of habitat types in the area; and
- inspect transmission lines within the proximity of the proposed expansion area to obtain an overview of the range of potential impacts and likely effects of long-term management activities on the bird community.

2.1 Literature Survey & Information Base

- Hockey *et al.* (2005) was consulted for general information on the life history attributes of bird species;
- The Southern African Bird Atlas Project (Harrison *et al*, 1997) was consulted to obtain information regarding the distribution patterns of bird species. The information was based on each quarter degree square within the expansion area;
- Additional distributional data was also sourced from the SABAP2 database (www.sabap2.adu.org.za). Since bird distributions are dynamic (based on landscape changes affected by fragmentation and climate change), SABAP2 was born (and launched in 2007) from SABAP1 with the main difference being that all sampling is done at a finer scale known as pentad grids (5 min lat x 5 min long, equating to 9 pentads within a QDGC). This implies that the data is recent, site-specific, and more comparable with observations made during the site visit;
- The conservation status of bird species and their respective biogeographic affinities were sourced from the IUCN Red List of Threatened Species (IUCN, 2012) and Barnes (2000); and
- The regional vegetation classification was based on Mucina & Rutherford (2006).

2.2 Limitations

In order to obtain a comprehensive understanding of the dynamics of avifaunal communities in the expansion area, as well as the status of endemic, rare or threatened species in any area, impact assessments should consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints such long-term studies are not feasible and are mostly based on instantaneous sampling bouts.

It should be realised that bird distribution patterns fluctuate widely in response to environmental conditions. Therefore, it should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

This company, the consultants and/or specialist investigators do not accept any responsibility for conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from the surveys or requests made to them at the time of this report.

3. RESULTS & DISCUSSION

3.1 Habitat Description: Bighorn Substation

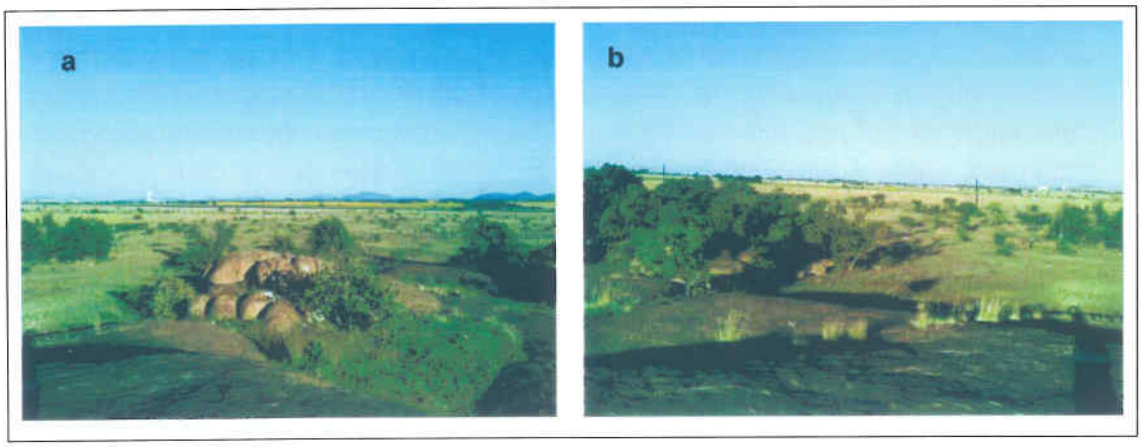
The area surrounding the Bighorn substation is represented by open grazed *Acacia tortilis - A. nilotica* savannoid grassland (Figure 4). It is described as an open grassland comprising of scattered thorny shrub pertaining to *Acacia tortilis, A. nilotica* and *Dichrostachys cinerea* of which the floristic composition and structure was shaped by persistent livestock activities (grazing and trampling). The dominant graminoid species are represented by secondary taxa such as *Bothriochloa insculpta*, *Cynodon dactylon, Urochloa oligotricha* and *Eragrostis rigidior*. This habitat type is synonymous with anthropogenic modified landscapes and is classified as transformed.

3.2 Habitat Description: Surrounding Area

The area to the south of the Bighorn substation is earmarked by mining operations, while the area to the north consists of open grazed grassland and old agricultural land, and scattered norite outcrops (Figure 5). Despite disturbances caused by cattle, the open structure of these grasslands provide ephemeral foraging habitat for variety of large terrestrial bird species (e.g. Kori Bustard *A. kori* and Secretarybird *S. serpentarius*, White Stork *Ciconia ciconia*, Abdim's Stork *C. abdimii*) in the region. The old agricultural land also provides habitat for the Yellow-throated Sandgrouse (*Pterocles gutturalis*), a locally common species with a very restricted distribution range in South Africa. Many of these species are also prone to power line collisions.

In addition, the area also provides rangeland habitat for foraging vultures species (e.g. African White-backed Vulture *Gyps africanus*, Cape Vulture *G. coprotheres* and to a lesser degree Lapped-faced Vulture *Torgos tracheliotus*) owing to an anticipated high mortality rate of free-roaming cattle in the tribal land.

Figure 4: A collage of images illustrating the structure of the dominant vegetation near the Bighorn substation: Open grazed *Acacia tortilis* grassland.



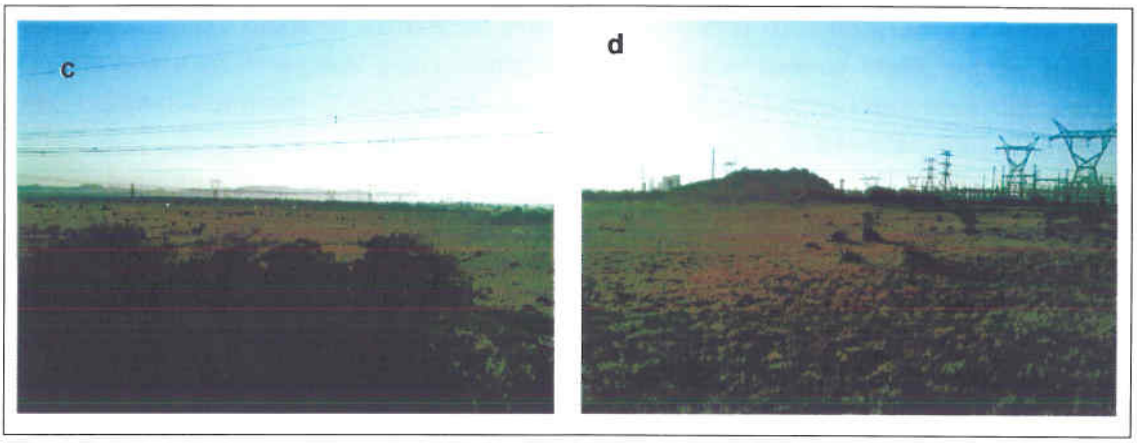


Figure 5: A collage of images illustrating the structure of the dominant vegetation units north of the Bighorn substation: (a-b) Norite outcrops and (c-d) open secondary grassland.

3.3 Impacts associated with the electrical infrastructure

3.3.1 An overview of bird interactions with electrical infrastructure

Birds are impacted in three ways by the infrastructure associated with power lines and substations. These include electrocution, collision and habitat loss. Bird electrocution and collision are not generally associated with the substations, although the loss of key bird habitat and the displacement of bird species (due to disturbances such as noise) are probably the most significant impacts associated with the construction or expansion of substations.

- *Electrocution (including power lines that feed into substations)*

Electrocution happens when a bird bridges the gap between the live components or a combination between the live and earth components of a power line, thereby creating a short circuit. This happens when a bird, mainly a species with a fairly large wingspan attempts to perch on a pylon or attempts to fly-off a pylon. Many of these species include vultures (of the genera *Gyps, Torgos* and *Trigonoceps*) as well as other large birds of prey such as the Martial Eagle (*Polemaetus bellicosus*) (Ledger & Annegarn, 1981; Kruger, 1999; Van Rooyen, 2000). These species will attempt to roost and even breed on tower structures if available nesting platforms (trees) are a scarce commodity. Other types of electrocutions happen by means of so-called "bird-streamers", often referred to as bird pollution. This happens when a bird, especially when taking off, excretes and thereby causing a short-circuit or electrical fault through its fluidity excreta (Van Rooyen & Taylor, 1999). Other species also likely to be affected include those prone towards roosting on pylons such as the Black-headed Heron (*Ardea melanocephala*), Black Stork (*Ciconia nigra*) and vultures of the genus *Gyps*.

- *Collision*

Collisions with power lines have probably accounted for most "bird-and-power line" interactions in South Africa. In general, the earth wires are much thinner in diameter when compared to the live components, and therefore less visible to approaching birds. Many of the species likely to be affected include heavy, large-bodied terrestrial species such as stork species, Kori Bustard (*Ardeotis kori*), korhaan species and a variety of waterbirds that are not very agile or manoeuvrable once airborne. These species, especially those with the habit of flying with outstretched necks (e.g. storks and cranes) find it difficult to make a sudden change in direction while flying – resulting in the bird flying into the earth wires.

Areas where bird collisions are likely to be high could be ameliorated by marking the lines with devices such as static "bird diverters" to increase the visibility of the lines (APLIC, 1994; Alonso & Alonso, 1999).

- *Physical disturbances, displacement and habitat loss*

The construction and maintenance of power line servitudes, access roads and substations are likely causes of bird displacement from the surrounding landscape. In addition, the transformation and loss of habitat during the construction of a substation are considered permanent and it is unlikely that these bird species will return to the area. In addition, construction activities also go hand in hand with high ambient noise levels. Although construction is considered temporary, many species will vacate the study area during the construction phase and will become temporarily displaced.

3.4 Bird species likely to be impacted

In general, the bird species richness in the expansion area was poor (2527DA: 185 species; Harrison *et al.*, 1997) when compared to bushveld areas east of the Bighorn substation (2527CB: 297 species; Harrison *et al.*, 1997). This discrepancy is best explained by the high spatial heterogeneity provided by the different habitat and vegetation types in the Rustenburg area as opposed to the transformed bushveld in the Marikana region.

3.4.1 Threatened and Near-threatened Species

Table 1 provides an overview of the threatened and near-threatened bird species that are known to occur in the study area. It also includes bird species that were previously recorded in the area based on their known distribution range (based on the quarter degree squares 2527DA and 2527CB) and the presence of suitable habitat. According to Table 1, a total of 17 species could occur in the study area, of which three species (Red-billed Oxpecker *Buphagus erythrorhynchus,* Lesser Kestrel *Falco naumanni* and European Roller *Coracias garrulous*) are likely to occur in the expansion area of the Bighorn substation. However, these species are unlikely to be impacted by the proposed development. The Red-billed Oxpecker is not confined to

any specific habitat type, nor was any natural breeding habitat observed in the expansion area (e.g. large dead trees). The European Roller and Lesser Kestrel are both tolerant of transformed habitat, and is often seen perched on electrical wires or stunted trees where it forage in open or cleared areas (both species are threatened in their breeding habitat corresponding to the northern hemisphere).

The remaining species, many being birds of prey, storks and bustard species are believed to be irregular visitors to the region depending on the presence of favourable conditions (e.g. inundated wetlands and floodplains or presence of carcasses). In addition, many of the raptor species occupy large home ranges, and will travel immense distances in search of food and are thus regarded as occasional visitors. However, the expansion area was found to be unsuitable for these species to occur.

3.4.2 Non-threatened bird species

Non-threatened bird species with a high susceptibility towards power line interactions that could occur in the project area include the White Stork (*Ciconia ciconia*), Abdim's Stork (*Ciconia abdimii*), Jackal Buzzard (*Buteo rufofuscus*), African Fish Eagle (*Haliaeetus vocifer*) and a number of waterbird species pertaining to the Anatidae (ducks and geese), Ardeidae (herons and egrets), Threskiornithidae (ibises) and Cerylidae (large aquatic kingfishers). However, these species are unlikely to occur in the expansion area.

Table 1: Threatened and near-threatened bird species recorded in the area based on their known distribution range and the presence of suitable habitat. Conservation categories according to the IUCN (2012)* and Barnes (2000)**. Species highlighted in bold are power line sensitive species (e.g. species prone towards power line collisions or electrocutions).

Species	Global Conservation Status*	Regional Conservation Status**	Recorded during SABAP1	Recorded during SABAP2	Preferred Habitat	Occurrence in expansion area
Anthropoides paradiseus **(Blue Crane)**	Vulnerable	Vulnerable	Yes	No	Open grassland and agricultural land. Breeds in pristine grassland.	Unlikely to occur.
Alcedo semitorquata (Half-collared Kingfisher)	-	Near-threatened	No	Yes	Fast-flowing perennial rivers and streams with dense overhanging vegetation.	Unlikely to occur - known to occur along the nearby Maretlwane and Sterk Rivers.
Ardeotis kori **(Kori Bustard)**	-	Vulnerable	No	No	Arid open lowland savanna and karroid shrub.	Unlikely to occur in the expansion area - an uncommon foraging visitor to the open grasslands north of the Bighorn substation.
Buphagus erythrorhynchus (Red-billed Oxpecker)	-	Near-threatened	Yes	No	Restricted to game and rural livestock farming areas within the savanna region.	A common resident - unlikely to be impacted by the proposed expansion project.
Ciconia nigra **(Black Stork)**	-	Near-threatened	Yes	No	Breeds on steep cliffs within mountain ranges; forages on ephemeral wetlands.	Unlikely to occur.
Circus ranivorus (African Marsh-harrier)	-	Vulnerable	Yes	No	Breeds in dense *Phragmites* and *Typha* stands. Forage over extensive wetland systems.	Unlikely to occur.
Coracias garrulous (European Roller)	Near-threatened	-	Yes	No	Open woodland and bushveld.	A fairly common summer visitor to the area - unlikely to be impacted by the proposed expansion project

Species	Global Conservation Status*	Regional Conservation Status**	Recorded during SABAP1	Recorded during SABAP2	Preferred Habitat	Occurrence in expansion area
Falco biarmicus (Lanner Falcon)	-	Near-threatened	No	Yes	Varied, but prefers to breed in mountainous areas.	An occasional foraging visitor in the area - confined to large norite outcrops.
Falco naumanni (Lesser Kestrel)	Delisted	Vulnerable	No	Yes	Open grassland patches.	An uncommon summer visitor to the area.
***Gyps africanus* (White-backed Vulture)**	Endangered	Vulnerable	Yes	No	Breed on tall, flat-topped trees. Mainly restricted to large rural or game farming areas.	An irregular foraging visitor to the area.
***Gyps coprotheres* (Cape Vulture)**	Vulnerable	Vulnerable	Yes	No	Varied, but breeds on steep south or east facing cliffs.	An occasional foraging visitor to the area - could soar overhead. Not likely to roost/perch in the expansion area.
***Mycteria ibis* (Yellow-billed Stork)**	-	Near-threatened	Yes	No	Wetlands, pans and flooded grassland.	Unlikely to occur - an uncommon foraging visitor to the ephemeral pans and dams in the region when inundated.
***Pelecanus rufescens* (Pink-backed Pelican)**	-	Vulnerable	Yes	No	Large impoundments.	Unlikely to occur - vagrant.
***Pterocles gutturalis* (Yellow-throated Sandgrouse)**	-	Near-threatened	Yes	No	Open grazed grassland and agricultural land, especially on black vertic soils.	Unlikely to occur in the expansion area - probably an uncommon visitor to the open grasslands north of the Bighorn substation.
***Polemaetus bellicosus* (Martial Eagle)**	Near-threatened	Vulnerable	No	No	Varied, from open karroid shrub to lowland savanna.	Unlikely to occur in the expansion area - an irregular

Species	Global Conservation Status*	Regional Conservation Status**	Recorded during SABAP1	Recorded during SABAP2	Preferred Habitat	Occurrence in expansion area
						foraging visitor in the region.
Sagittarius serpentarius **(Secretarybird)**	Vulnerable	Near-threatened	Yes	No	Prefers open grassland or lightly wooded habitat.	Unlikely to occur - an uncommon foraging visitor to the open grassland patches to the north of the Bighorn substation.
Tyto capensis (African Grass-owl)	-	Vulnerable	Yes	No	Moist, dense grassland along vleis and drainage lines.	Unlikely to occur.

3.5 Expected bird impacts related to the expansion of the substation

3.5.1 Electrocution

Bird electrocution is not normally associated with substations (see Appendix 1), although it is highly recommended to place metal spikes above insulator strings to discourage birds from perching or roosting on electrical infrastructure that is associated with the substation.

3.5.2 Collision

Bird collision is not normally associated with substations (see Appendix 1). The number of power lines that feed into the substation, (including the infrastructure as part of the substation) will greatly improve the visibility of that infrastructure and minimize possible collisions.

3.5.3 Physical disturbances, loss of habitat and displacement of bird species

The Bighorn substation is located on land that was severely modified by grazing and human activities, hence the expansion impact (e.g. displacement of bird species and loss of habitat) associated with the levelling and clearing of vegetation is considered to be *minimal* on the local bird community (see Appendix 1). Despite the abovementioned impacts, it was also evident that the area experienced a constant volume of human pedestrians, which will deter any large-bodied and power line sensitive bird species from utilising the expansion area. Nevertheless, it is of the opinion that the transmission lines in the area pose a much higher risk of collision to birds owing to the open grasslands and agricultural land located to north of the substation.

In addition, the displacement of power line sensitive bird species, including threatened and near-threatened bird species, is *highly unlikely* since none of the expansion areas occur on or in close proximity to pans, dams, drainage lines or large open grassland and agricultural field where such species are likely to occur.

3.6 Recommended mitigation measures

There are many ways to ameliorate or mitigate bird impacts imposed by power line interactions. Probably the best way is to proactively avoid areas where the potential for bird interaction is evident by means of subsequent route deviations, modifications or alternative localities. However, habitat clearance and disturbance at the expansion area is unavoidable, and the best practice is to contain all impacts related to the construction phase to the expansion area.

The following recommendations are applicable and mandatory during the construction phase:

- Construction disturbance should be kept to a minimum and should be restricted to the actual expansion location. An overspill of construction activities into adjacent areas should be prohibited;
- Construction personnel or vehicles may not leave the demarcated construction site except those authorised to do so. Those areas surrounding the construction sites, especially north of the Bighorn substation that are not part of the demarcated development area should be considered as "no-go" areas for employees and machinery;
- Where possible, the use of existing roads is encouraged;
- Open fires is strictly prohibited and only allowed at designated areas; and
- Killing or poaching of any bird species should be avoided by means of awareness programmes presented to the cconstruction personnel. The cconstruction personnel should be made aware of the conservation issues pertaining to the bird taxa occurring on the study area. Any person found deliberately harassing any bird species in any way should face disciplinary measures, following the possible dismissal from the construction site.

3.7 Conclusion

Given the locality of the proposed expansion area and the ecological condition of the habitat types corresponding to the substation area, it is unlikely that the proposed construction activities will have a detrimental effect on the local bird community. Similarly, given the habitat preferences of the threatened and near-threatened bird species that occur in the area, it is unlikely that the proposed development will have a negative effect on these species.

In addition, the expansion area does not overlap nor occur in close proximity to any critical habitat that are likely to support power line sensitive bird species (e.g. pans, dams, extensive grassland and agricultural lands and drainage lines).

Lastly, the floristic structure and ecological conditions of the habitat on the expansion area is secondary, and is widespread in the Marikana region.

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www.sabap2.adu.org.za

5. APPENDICES

Appendix 1: Bird impact table and description of impact ratings.

The overall bird impacts associated with the proposed expansion of the Bighorn substation:

Impact	Magnitude	Scale	Duration	Probability	Significance	
Electrocution (operational only)	Low	Local	Long term	Probable		
	2	1	4	2	14	Negligible
Collision (operational only)	Low	Local	Long term	Probable		
	2	1	4	2	14	Negligible
Loss of important bird habitat & disturbance (construction & operational)	Low	Local	Permanent	Probable		
	2	1	5	2	16	Negligible

Impact Assessment Methodology

The impact methodology will concentrate on addressing key issues. Activities within the framework of the proposed project give rise to certain impacts. For the purposes of assessing these impacts, the project has been divided into three phases from which impact activities can be identified, namely:

Construction phase

This phase is concerned with all the construction and construction related activities on site, until the contractor leaves the site. Thus, the main activities will be the establishment of construction camp sites, access routes, clearance of servitude to facilitate access, digging the foundations for towers, excavation of pits for transformer foundation, erection of transformer and associated structures, movement of construction

workforce, equipment, construction vehicles and materials, etc. The above-mentioned activities result in different types of impacts and some contribute to cumulative impacts.

Operational phase

This phase involve activities that are post construction, i.e. the transmission of power between substations. This phase often requires a rehabilitation plan and monitoring system that will ensure the impacts of construction, such as, erosion, colonisation of area by alien species, pollution caused by nesting birds (mainly passerine birds), etc. are monitored and inspected as an ongoing process. This involves the maintenance of the facilities to ensure continuous proper functioning of the equipment or resource

The impact rating enables the analysis of the impact results, in terms of:

- The severity criteria applicable as an indicator of influence/ severity;
- The changes in number of low, moderate and high ratings before and after mitigation, and
- The changes in quantitative/weighted magnitude before and after mitigation.

Assessment Criteria

An impact can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need.

The significance of the aspects/impacts of the process will be rated by using a matrix. These matrixes use the consequence and the likelihood of the different aspects and associated impacts to determine the significance of the impacts.

The significance of the impacts will be determined through a synthesis of the criteria below:

Probability: This describes the likelihood of the impact actually occurring.

- **Improbable:** The possibility of the impact occurring is very low, due to the circumstances, design or experience.
- **Probable:** There is a probability that the impact will occur to the extent that provision must be made therefore.

- **Highly Probable:** It is most likely that the impact will occur at some stage of the development.
- **Definite:** The impact will take place regardless of any prevention plans and there can only be relied on mitigatory measures or contingency plans to contain the effect.

Duration: The lifetime of the impact

- **Short Term:** The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
- **Medium Term:** The impact will last up to the end of the phases, where after it will be negated.
- **Long Term:** The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
- **Permanent:** The impact is non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.

Scale: The physical and spatial size of the impact

- **Local:** The impacted area extends only as far as the activity, e.g. footprint
- **Site:** The impact could affect the whole, or a measurable portion of the above mentioned properties.
- **Regional:** The impact could affect the area including the neighbouring residential areas.

Magnitude/ Severity: Does the impact destroy the environment, or alter its function

- **Low:** The impact alters the affected environment in such a way that natural processes are not affected.

- **Medium:** The affected environment is altered, but functions and processes continue in a modified way.
- **High:** Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Significance: This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.

- **Negligible:** The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.
- **Low:** The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.
- **Moderate:** The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
- **High:** The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

The following weights were assigned to each attribute:

Aspect	Description	Weight
Probability	**Improbable**	**1**
	Probable	**2**
	Highly Probable	**4**
	Definite	**5**
Duration	**Short term**	**1**
	Medium term	**3**
	Long term	**4**
	Permanent	**5**
Scale	**Local**	**1**
	Site	**2**
	Regional	**3**
Magnitude/Severity	**Low**	**2**
	Medium	**6**
	High	**8**
Significance	**Sum (Duration, Scale, Magnitude) x Probability**	
	Negligible	**≤20**
	Low	**>20 ≤40**
	Moderate	**>40 ≤60**
	High	**>60**