AVIFAUNAL SPECIALIST REPORT

PROPOSED NEW OLIFANTSHOEK 10MVA 132/11KV SUBSTATION AND 31KM POWER LINE

February 2017

Prepared by:

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DECLARATION OF CONSULTANT'S INDEPENDENCE

I, Gerhard Botha, as the appointed specialist hereby declare that I:

- » act/ed as the independent specialist in this application;
- » regard the information contained in this report as it relates to my specialist input/study to be true and correct,
- » act as an independent specialist, in line with the definitions in the Regulations;
- » do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- » have and will not have no vested interest in the proposed activity proceeding;
- » have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- » am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- » have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- » am aware that a false declaration is an offence in terms of regulation 48 of GN No. R. 982.

Gerhard Botha Pr.Sci.Nat 400502/14 (Ecological Science)
February 2017

1 INTRODUCTION

1.1 Applicant

Eskom Holdings SOC Limited

1.2 Project

The project will be referred to as Olifantshoek 132kV power line and substation.

1.3 Proposed Activity

The Olifantshoek Substation and power line will be comprised of the following:

- A new 10MVA **on-site substation** (100m X 100m) to be constructed adjacent to the existing 22/11kV Olifantshoek substation.
- A new **overhead** 132 kV **power line** approximately 31 km long to connect the Emil switching station to the new on site substation. The majority of the new power line route will follow the existing Ferrum/Nieuwehoop 400kV and Ferrum/Lewensaar 132kV power lines. The possible development corridor of the new power line is 300m within which the power line will have a servitude of 32 m wide. There are 2 alternative power line routes proposed, both of which transect the Olifantsloop non-perennial river and the Ga-mogara perennial river.
- The decommissioning of the existing 22/11kV Olifantshoek Substation.

The table below (Table 1) provides an overview of the power line components to be constructed:

Table 1: Summary of the different components associated with the proposed power line.

Project Component	Specification	Additional Information
Pylon Type	Steel monopoles and/or self-supporting towers	Poles are established in a vertically staggered configuration, and are kept upright by stays.
Line Capacity	132 kilovolts	
Pylon Height	23m – 28m on average	
Pylon Separation Distance	200m - 400m	Distance can exceed 500m depending on the

Project Component	Specification	Additional Information
		topography and terrain to be spanned.
Pylon foundation footprint	10mx10m (100m²)	
Conductor attachment height	25-28 m	
Conductor Type	Tern Conductor	
Corridor assessed in this BA Report	300m	
Servitude	32m	
Minimal Distances (a) Vertical Distance of structures not forming part of the power line (b) Vertical distance of conductors to the ground (c) Distance between trees and shrubs and the bare phase conductor (d) Minimal clearance to other overhead line conductors (e) Above roads and in towns, proclaimed roads	>3.8m >6.3m >3.8m >2m >7.5m	High voltage power lines require a large clearance area for safety precautions. The Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) provides for statutory clearances.
Access Roads	4m wide access roads	As far as possible, existing tar and gravel roads will be used to gain access to the site during the construction and operational phase (maintenance purposes) of the project. New roads will

Project Component	Specification	Additional Information
		be established in areas where there are no existing roads.

The proposed substation will have a footprint of approximately of 100m x 100m. The footprint of the substation may include a metering station, control building, admin building, workshop and associated infrastructure. The table below provides an overview of the technical details of the substation components to be constructed:

Table 2: Summary of components associated with the proposed substation.

Project Component	Specification
Mega Volt Ampere	10
Size of the substation	71m x 49m within a footprint of 100m x 100m
Distance between equipment	9m
Footprint of the development	100m x 100m
Number of transformers	One 10 MVA transformer

Two alternative locations have been identified for the proposed substation, including;

- Approximately 500m east of the urban area of Olifantshoek and 50m south of the N14. This is considered to be the **preferred substation location**.
- Approximately 30m to the east of the existing Olifantshoek substation. This is considered to be the **alternative substation location**

The existing Olifantshoek substation will be decommissioned on completion of the new proposed substation.

The new substation will be connected to the Emil switching station by approximately 31km of 132kV overhead power line.

Towers associated with the power line are expected to be an average height of 23m – 28m. The pylons are expected to be steel monopole structures.

The construction of the proposed 132kV overhead power line is likely to follow the following sequence:

» Excavation and concrete work for tower foundations. Due to the dispersed nature of the foundations, it is unlikely for concrete to be batched on site. It is likely that concrete will be ready mixed and brought in by concrete trucks as and when required.

» Erection of towers in a progressive manner. It is common for materials for a number of poles to be delivered to site at the same time. Erection requires the use of a mobile crane to hold prefabricated elements in position. This process is relatively rapid as each pole / pylon is prefabricated off site.

» Stringing of cables which also requires the use of cranes and mobile hoists to enable workers to fix insulators and attachments and to pull cables between towers.

The above process is relatively clean, rapid and only affects the area immediately surrounding each tower location as well as the 8m strip along the power line centre line to be cleared (during stringing).

An operating servitude of 32 meters will have to be registered in favour of Eskom to protect the alignment. The servitude provides Eskom with a 'right of way' and will prevent development and any other use that could compromise the overhead line. It will not prevent current agricultural uses or access beneath the line.

The following typical dimensions are likely to apply to the project;

» Tower height: 23-28m subject to tower selection.

» Tower spacing: 200m – 400m subject to terrain.

» Operating servitude: 32m (16m x 2)

1.4 Location

The project is located in the Olifantshoek region, which falls within the Ga-mogara Local Municipality and the John Taolo Gaetsewe District Municipality. The study area extends from the proposed power line connection point at its northern extremity at the existing Transnet Emil switching station and extends for approximately 31km to the south where the proposed new substation will be constructed around the eastern edge of the town of Olifantshoek (Figure 1). Two alternative substation locations and two 132kV power line corridors have been identified for investigation. The majority of the new power line route will follow the existing Ferrum/Nieuwehoop 400kV and Ferrum/Lewensaar 132kV power lines.

The approximate location (farm properties and geographic coordinates) for the proposed project are as follows:

» **Proposed connection point to Emil Switching Station**

Farm Property:

- Portion 1 of the Farm Fritz 540

Geographical Coordinates

- -27.736365; 22.920617

» **132kV Power Line (both alternatives)**

Farm Properties:

- Portion 1 of the Farm Fritz 540
- Portion 2 of the Farm Fritz 540
- Portion 5 of the Farm Fritz 540
- Remaining extent of the Farm Lanham 539
- Portion 1 of the Farm Wright 538
- Remaining extent of the Farm Wright 539
- Remaining extent of the Farm Bredenkamp 567
- Remaining extent of the Farm Brooks 568
- Remaining extent of the Farm Beaumont 569
- Portion 3 of the Farm Beaumont
- Portion 3 of the Farm Murray II 570
- Portion 2 of the Farm Cox 571
- Remaining extent of the Farm Cox 571
- Portion 3 of the Farm Cox 571
- Portion 1 of the Farm Cox 571
- Remaining extent of the Farm Hartley 573
- Remaining extent of the Farm Diergaart' Heuwel 765
- Portion 1 of the Farm Neylan 574
- Erf 155

Geographical Coordinates

- Preferred Route:
  A. -27.736365, 22.920617;
  B. -27.737084°, 22.917166°;
  C. -27.758678°; 22.913190°;
  D. -27.920280°, 22.809912°;
  E. -27.930944°' 22.748212°;
  F. -27.932636°, 22.743314°

G. -27.935117°’ 22.743416°; and
H. -27.936115°; 22.741754°

- Alternative Route:
  I. -27.736365, 22.920617;
  J. -27.748306°, 22.920923°;
  K. -27.920087°, 22.812131°;
  L. -27.930967°, 22.748236°;
  M. -27.932630°, 22.743341°;
  N. -27.935137°, 22.743448° and
  O. -27.936115°; 22.741754°

» **Proposed location of substation**

Farm Property:

- Preferred Location: Portion 1 of the Farm Neylan 574
- Alternative Location: Erf 155

Geographical Coordinates

- Preferred Location: -27.931425°; 22.748489°
- Alternative Location: -27.936425°; 22.741388°

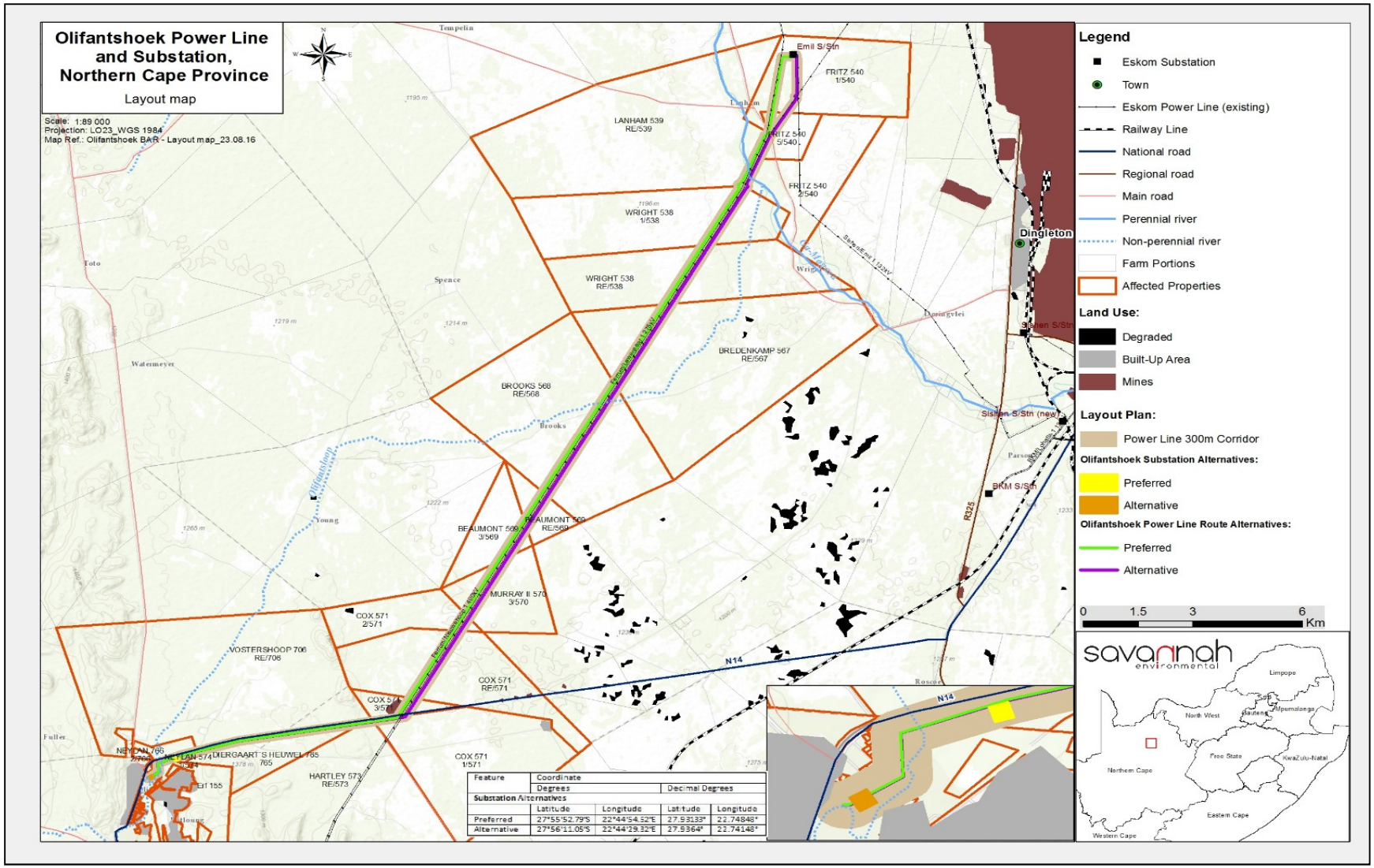

Figure 1: Layout of the power line and substation alternatives.

1.5 Terms of reference

The most important objective of this avifaunal impact assessment is to determine the impacts that the proposed activity may have on avifauna species. The following are the tasks/objectives of the study:

» Field visit to identify important avian habitats associated with the proposed development as well as avian micro-habitats and species that will potentially use these niches;
» A description of the current avifauna within the study area and the identification of Red Data Species potentially affected by the proposed development and associated infrastructure;
» Integration of the site data collected within avian atlases and counts within the area to develop a comprehensive avifaunal database likely to be present within the development footprint;
» Identify potential negative impacts on the avifaunal diversity and species composition at the site of the proposed development and assess the significance of these impacts;
» To provide recommended mitigation measures for the potential impacts in order to avert or lower the significance of the negative impacts on avifauna.

All avifaunal data was collected throughout all identified habitats using various methods including (see Section 2.2 for a description of methodology used):
» Walked-transects,
» Vehicles drive surveys,
» Power Line inspection, and
» Fixed point surveys

1.6 Conditions of this report

Findings, recommendations and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of compilation. This report may not be amended or extended without the prior written consent of the author. Any recommendations, statements or conclusions drawn from or based on this report must clearly cite or make reference to this report. Whenever such recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety.

1.7 Assumptions and Limitations

It is difficult to apply pure scientific methods within a natural environment without limitations, and consequential assumptions need to be made. The following constraints may have affected this assessment:

» In this instance, the 2722DC & DD QDGCs are covered by South African Bird Atlas Project (SABAP2), with data recorded on 20 (DC) and 15 (DD) data cards. This means that the species diversity and densities recorded by SABAP2 provides a limited interpretation of the avifauna potentially occurring in the study area;
» Conclusions of this report were based on experience of these recorded species and other species in different parts of South Africa. Bird behaviour cannot be entirely reduced to formulas that will hold true under all circumstances. By virtue of their mobility, avian species can rapidly adapt and relocate;
» It is important to note that, although the predicted impacts are mostly concerned with Red Data species, the non-Red Data species will also benefit from the proposed mitigation measures as they share the same habitat and face the same potential impacts; and
» Limited time in the field means that important components of the local avifauna (i.e. nest sites or localised areas of key habitats for rare or threatened species) could have been missed. The full length of the proposed power line was however surveyed and no nest sites were recorded to the best of this specialist's capabilities, given the time and extent of such a task.

2 METHODOLOGY

The main objective of the Avifauna Report is to provide a description of the avifaunal, their interactions with their surrounding environment and how activities associated with the proposed development could potentially impact on the immediate as well as surrounding avifaunal character. To obtain the achieved results the following methodology was implemented.

2.1 Data scouring and review

Data sources from the literature were consulted and used where necessary in the study and include the following:

» Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006) as well as the National List of Threatened Ecosystems (2011), where relevant.

» Bird distribution data of the Southern African Bird Atlas Project obtained from the Animal Demography Unit of the University of Cape Town, in order to ascertain species occurrence within the study area (Harrison et al. 1997);
» The Birds in Reserves Project database was used to augment bird counts data (Animal Demographic Unit 2015).
» The conservation status of all bird species occurring within the quarter degree square determined with the use of The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Taylor 2014);
» The Important Bird Areas (IBA) programme according to BirdLife South Africa;
» The conservation status, endemism and biology of all species considered likely to occur within the study area was then determined from Hockey et al. (2005) and Taylor et al. (2015).
» Similar Avifaunal studies that have been undertaken within the region of the study area where also consulted including the survey done for the Solar Park Integration Project (Van Rooyen, 2013) which included a 400kV transmission line stretching from Upington to the Elim switching station as well as numerous 132kV transmission lines.

2.2 Field sampling and assessment methodology

Prior to the site visit a review of all available published and unpublished literature pertaining to bird interactions with plants, substations and power lines was undertaken, summarising the issues involved and the current level of knowledge in the field. Various information sources including data on the local avifauna of the area and previous studies of bird interactions with plants, substations and power lines were examined.

A site visit was conducted from the 24th to the 26th of January 2017 to determine the *in situ* local avifauna and avian habitats present on site. Walked transects, vehicle transects and vantage point surveys were conducted in various habitats across the site. During the survey, not only the development footprint area was surveyed, but a broader area was inspected. The site was thoroughly traversed to obtain a first-hand perspective of the proposed project and birdlife and to:

» Quantify aspects of the local avifauna (such as species diversity and abundance);
» Identify important avian features present on site (such as nesting and roosting sites);
» Confirm the presence, abundance, habitat preference and movements of priority species;
» Identify important flyways across the site; and

» Delineate any obvious, highly sensitive, no-go areas to be avoided by the development.

Data collection methods included the following:

» Vehicle drive surveys: Vehicle surveys were predominantly done along the service road of the Ferrum/Lewensaar Power Line. Some farm twin tracks traversing the study area where also utilised.
» Power Line inspection: The existing Ferrum/Lewensaar 400kV power line was surveyed twice daily for the duration of the survey period for any possible raptors or other avifaunal species utilizing the line and pylons for perching. All nests located within the pylons were identified and monitored for a period of time during sunrise and sunset to determine if the nests are active and which species utilized these nests.
» Walked-transects: Walk-throughs were conducted within both power line servitudes as well as immediate surroundings. These were done along pre-defined areas as well as along random selected areas.
» Fixed point surveys: During the last day of the survey period areas deemed potentially high in avifaunal species diversity was closely monitored for periods of 2 hours each. These areas included:
    - The riparian fringe (ticket type of growth of *A. karroo* in some areas) vegetation associated with the banks and flooding area of the Olifantsloop non-perennial river, just south of the proposed alternative substation site;
    - Olifantshoek Sewage Works;
    - Small depression wetland located in close proximity to the proposed power line.

The flowing equipment were utilized during field work.

» Canon EOS 450D Camera,
» Swarovski SLC 10X42 WB Binoculars,
» Roberts VII Multimedia Android Edition for Data Capturing and Bird Identification,
» Sasol's The Larger Illustrated Guide to Birds of Southern Africa (2005), and
» Roberts Bird Guide (2016)
» A simplified adaption of the Braun-Blanquet Data Form to capture habitat and other environmental data

The survey was primarily conducted by means of a Checklist survey supplemented with some notes on avifaunal movement (especially regarding the larger avifaunal species as well identified nesting species and activities with the patches of higher

tree covering). The surveys normally started just before sunrise and ended just after sunset in order to record all possible bird activities throughout the day.

Using the data collected during the desktop phase as well as during the site visit, avian micro-habitats and sensitive habitats for avifaunal communities were identified and mapped.

3 STUDY AREA

3.1 Climate and rainfall

The Olifantshoek/Kathu area is characterized by an arid summer rainfall climate with an average annual temperature of 18.6°C and an average rainfall of 395mm falling predominantly in late summer (highest in March: 74mm). The driest month is July with only 3mm of precipitation. With an average temperature of 25.3°C, January is the warmest month, whilst July is the coldest month with an average of 10.8°C (https://en.climate-data.org/location/27075/).

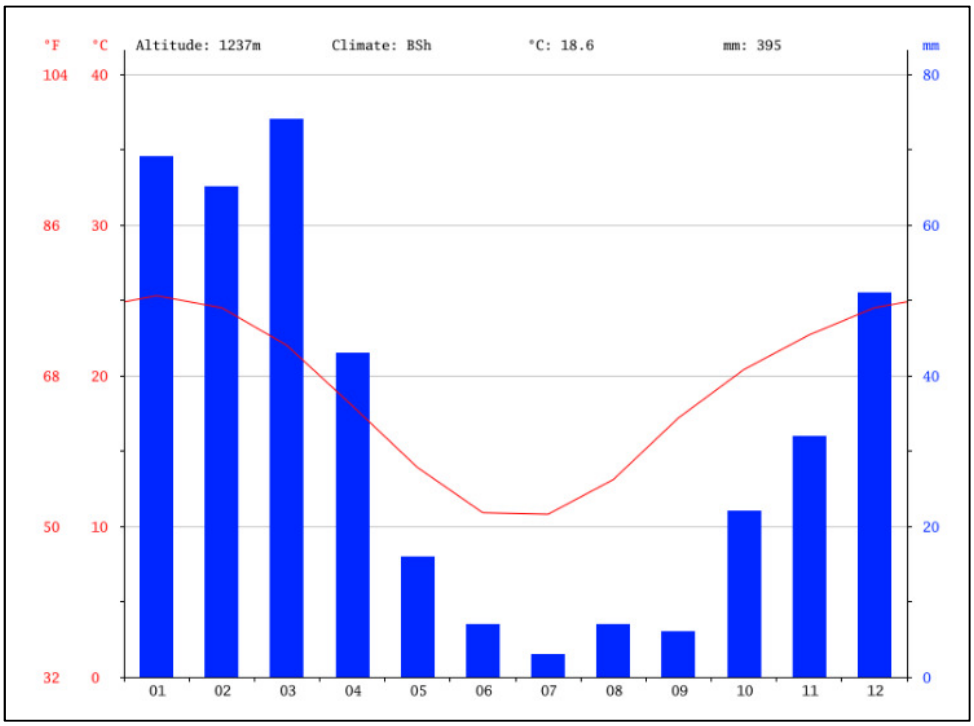

Figure 2: Climate graph of Olifantshoek/Kathu region (https://en.climate-data.org/location/27075/).

month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Okt	Nov	Dec
mm	69	65	74	43	16	7	3	7	6	22	32	51
°C	25.3	24.5	22.0	18.0	13.9	10.9	10.8	13.1	17.2	20.4	22.7	24.5
°C (min)	18.0	17.4	15.2	10.5	5.8	2.4	2.1	4.2	8.4	12.1	14.8	16.9
°C (max)	32.6	31.6	28.9	25.6	22.1	19.5	19.5	22.0	26.0	28.7	30.7	32.2
°F	77.5	76.1	71.6	64.4	57.0	51.6	51.4	55.6	63.0	68.7	72.9	76.1
°F (min)	64.4	63.3	59.4	50.9	42.4	36.3	35.8	39.6	47.1	53.8	58.6	62.4
°F (max)	90.7	88.9	84.0	78.1	71.8	67.1	67.1	71.6	78.8	83.7	87.3	90.0

Figure 3: Climate table of Olifantshoek/Kathu region (https://en.climate-data.org/location/27075/).

3.2 Existing Land Use

Land use within the study area is mostly for farming. Farming practises consist mainly of cattle and game farming and to a lesser extent farming with sheep and goats. North of the N14 the power line will traverse, for approximately 4km, degraded land, mainly due to grazing pressure from cattle and game and the gravel pit located just north of the N14. Approximately 500m south of the Ga-mogara River, stretching approximately 3.4km south, is a grazing camp which has been severely degraded though overgrazing, to an extent where little of the ground cover is present. Historically some areas have been ploughed and irrigated, mainly for the cultivation of lucern, ranging in size between 2ha to 16ha on some farms that had high yielding boreholes. The northern portion of the proposed power line will traverse such a historically cultivated area. Apart from agricultural practices, mining forms the largest industrial activity in the area (e.g. Sishen to the west of the study area).

The proposed power line will be located parallel to the existing servitude of the 275kV power line and new 400kV power line. The servitudes of the 275kV & 400kV power lines have been cleared of all tall trees and shrub species. The power line will cross the gravel road to Dingleton in the north after which it will connect to the existing Emil Eskom switching station. To the south, the power line will cross the N14, after which it will run parallel to the N14 until reaching the urban are of Olifantshoek where it will connect to the proposed new Olifantshoek substation (2 options).

3.3 Vegetation overview

The study area falls within the Eastern Kalahari Bushveld Bioregion (Savannah biome). Several vegetation types characterise the larger area (Mucina & Rutherford, 2006) although the footprint of the proposed development traverses only two vegetation types namely:

- » Olifantshoek Plains Thornveld (SVk13) – the bulk of the footprint falls within this vegetation type.
- » Kathu Bushveld (SVk12) – Only the northernmost portion of the footprint falls within this vegetation type.

Olifantshoek Plains Thornveld mostly occupies plains including most of the pediment areas of the Korannaberg, Langeberg and Asbestos Mountains as well as those of some ridges to the west of the Langeberg. This vegetation type overlies mostly red aeolian sand with silcrete and calcrete and some andesitic and basaltic lava of Griqualand West Supergroup. Hutton soil form forms the dominant soil form. This is a very wide and diverse unit characterised mostly by open tree and shrub layers with, for example, *Acacia luederitzii, Boscia albitrunca* and *Searsia tenuinervis* and with a usually sparse grass layer (Mucina & Rutherford, 2006).

Kathu Bushveld covers the plains around Kathu and Dibeng in the south, through Hotazel, vicinity of Frylinckspan to the Botswana border roughly between Van Zylsrus and McCarthysrus. This vegetation type overlies mostly aeolian red sand with some surface calcrete present in localised areas. Deep sandy soils of Hutton and Clovelly soil forms characterise most of the area. These sandy plains are covered mostly by an open medium tree layer with *Boscia albitrunca* as the prominent tree, although in some places a medium-tall tree layer, with *Acacia erioloba*, may become dominant. Shrubs layer generally most important with, for example *A mellifera, Diospyros lycioides*, and *Lycium hirsutum*. Grass layer is variable in cover (Mucina & Rutherford, 2006).

Both of the above described vegetation types are regarded as least threatened. The Olifantshoek Plains Thornveld vegetation is regarded as least threatened due to the fact that very little of the vegetation has been transformed (only about 1%). This vegetation type is however very poorly conserved with less 0.5% statutorily conserved (within the Witsand Nature Reserve). Kathu Bushveld is also regarded as least threatened due to the fact that most of vegetation type is still intact (less than 2% being transformed, mostly through mining activities). As in the case of Olifantshoek Plains Thornveld this vegetation type is also very poorly conserved (Mucina & Rutherford, 2006).

3.4 Topography and drainage

The study area (including the larger surrounding landscape) can be described as a largely flat (to very slightly undulating) sandy plain. Small irregularities within the landscape can be attributed to small localised depressions, vegetated low dunes, calcrete patches, a low ridge to the south and the two non-perennial watercourses (Ga-Mogara and Olifantsloop) that drain the valley towards the north. The

Olifantsloop River (42.492km in length terminates into the Ga-mogara River (88.037km in length) which in turns flows into the term Kuruman River, an important tributary of the Molopo. Due to micro-topography of the underlying substrates (shallower soils over calcrete), small ephemeral pans have formed in isolated areas within this flat valley.

3.5 Avian micro-habitats

Most of the abundance and distribution of avian species can usually be attributed to the vegetation types and bioregions within an area. In determining the suitability of the study area for avian species, it is necessary to look at the habitats available to determine where the relevant species will most likely occur within the study area. These "micro habitats" do not always correspond to vegetation types and are determined by a combination of vegetation type, topography, land use, food sources and other various intrinsic factors.

Investigation of the study area revealed the following important avian micro-habitats.

- *Acacia erioloba* Woodland
- *Tarchonanthus camphoratus – Acacia mellifera* Woodland
- *Acacia tortilis – Acacia mellifera* Ridge
- Non-perennial watercourses
- Small depression wetlands
- *Acacia karroo* Thicket
- Artificial landscapes including:
  a) Cleared servitude underneath the 275kV and 400kV power lines
  b) The 275kV and 400kV power lines
  c) Olifantshoek sewage works

In each case, some of the species likely to make use of the various micro-habitats have been described. It must be emphasised that birds will, by virtue of their mobility, utilise almost any area in a landscape from time to time.

Acacia erioloba Woodland

This is a highly variable woodland in terms of density of Acacia erioloba. To the far north most of the larger *A. erioloba* species have been removed to accommodate for agricultural practices (pivot) although numerous species have started to resettle. Moving further southwards towards the Dibeng gravel road these species increase in size and density although upon crossing the Dibeng road the density

decreases again. Between the Ga-magara River and the Olifantsloop River, *A. erioloba* woodlands occur as patchy units (open moderate-tall woodland) within a *Tarchonanthus camphoratus – Acacia erioloba* dominated habitat. The densest *A. erioloba* woodland occurs just south of the Olifantsloop River. A small patch of this woodland occurs (south of the N14) between two low ridge systems. Also, associated with this woodland is tree species such as *Ziziphus mucronata, Grewia flava, Tarchonanthus camphoratus, Diospyros lycioides* as well as *Acacia mellifera.* The northern areas which is characterised by less dense A. erioloba woodland can be described as a more open type of woodland with a well-developed grass layer comprising of species such as *Schmidtia pappophoroides, Stipagrostis uniplumis, Aristida meridionalis, Eragrostis* spp. and *S. ciliata*. This woodland is probably the most significant avifaunal habitat present within the study area, although some portions are more significant than others. The dense woodland located south of the Olifantsloop River being the most significant, comprising a wide diversity of species, with the shorter more open woodland to the north (old ploughed area and area south of the Dibeng gravel road) being lower in diversity and subsequently less important. The highly overgrazed (almost barren area apart from the A. erioloba trees) portion with this woodland, located approximately 1.5km south of the Ga-magara River was extremely low in diversity and subsequently very low in terms of avifaunal habitat significance.

As mentioned, this habitat provides a niche for a relatively high diversity (when compared to the other habitats) of avifaunal species and includes ground-dwelling species such as Helmeted Guineafowl (*Numida meleagris*), Red-billed Spurfowl (*Pternistis adspersus*), Northern Black Korhaan (*Afrotis afraoides*) as well as the two Sandgrouse species found in the region (Namaqua Sandgrouse – *Pterocles namaqua* and Burchell's Sandgrouse – *P. burchelli*). This habitat is also well represented by passerine and near passerine birds and includes species such as Chats, Scrub-Robbins various Larks (Family: Alaudidae), Robin-Chats, Thrushes, Warblers, Bee-eaters, Yellow-bellied Eremomelas (*Eremomela ictyropygialis*), Scaly-feathered Weaver (*Philetairus socius*), Black-chested Prinias (*Prinia flavicans*), Pririt Batis (*Batis pririt*), Chestnut-vented Tit-Babbler (*Parisoma subcaeruleum*), Bokmakierie (*Telophorus zeylonus*), Crimson-breasted Shrike (*Laniarius atroccineus*), Sociable Weaver (*Philetairus socius*), African Grey Hornbill (*Lophoceros nasutus*), Fork-tailed Drongo (*Dicrurus adsimilis*), Southern Pied Babbler (*Turdoides bicolor*), Lilac-breasted Roller (*Coracias caudatus*), and Marico Sunbird (*Cinnyris mariquensis*). Raptors found within this woodland included Black-winged Kite (*Elanus caeruleus*), Gabar Goshawk (*Micronisus gabar*), Pygmy Falcon (*Polihierax semitorquatus*) and Greater Kestrel (*Falco rupicoloides*). Other noteworthy species noted included: Namaqua Dove (*Oena capensis*), Ring-neck Dove (*Streptopelia capicola*), Common Cuckoo (*Cuculus canorus*), Pearl-spotted Owlet (*Glaucidium perlatum*), Golden-tailed Woodpecker (*Compethera abingoni*) and Shaft-tailed Whydah (*Vidua regia*).

Current land use within this habitat includes predominantly stock and game farming.

The potential impacts associated with the mentioned infrastructure within this micro-habitat, include moderate displacement due to habitat loss and disturbance, as well as potential collision with the power line (Bustards, Korhaans and Sandgrouse species).

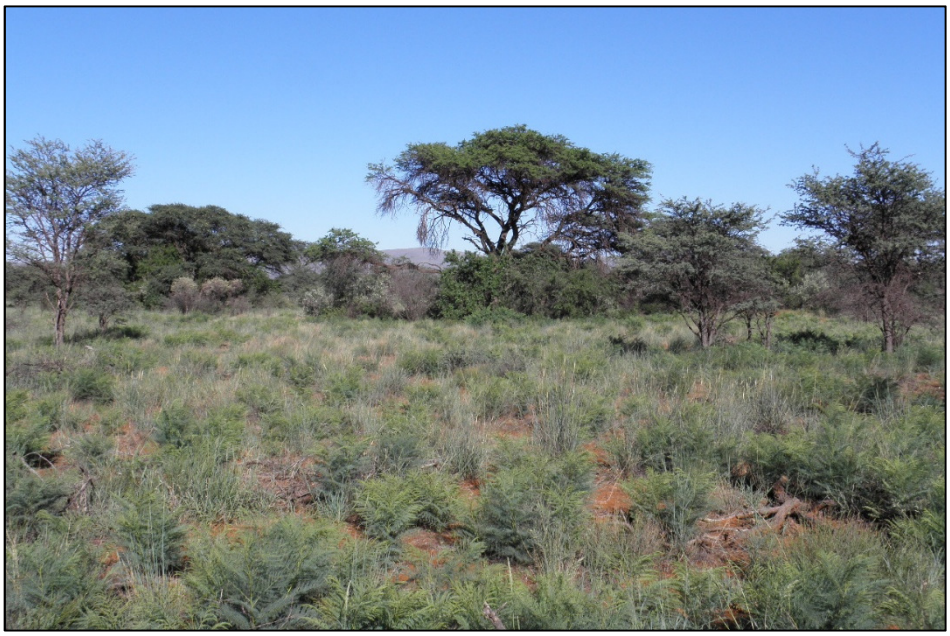

Figure 4: *Acacia erioloba* woodland.

Tarchonanthus camphoratus – Acacia mellifera Woodland

This micro-habitat is more open and characterised by medium sized trees and shrubs such as *T. camphoratus, A. mellifera, A. hebaclada, Grewia flava, Searsia tenuinervis* and *Rhigozum obovatum*. Even though still present within this habitat, *A. erioloba* is more scarcely scattered between the above-mentioned tree/shrub species. The density of this tree/shrub layer varies from relatively dense (almost thicket like) *A. mellifera* dominated woodland to a more open *T. camphoratus* woodland comprising of a moderate to well-developed grass layer (where not overgrazed). The grass layer is characterised by *Aristida meridionalis, A. adscensionis, A. congesta, Enneapogon spp., Eragrosits lehmanniana, E. chloromelas, E. pallens, Stipagrostis ciliate, S. uniplumis, Tragus racemosa* and *Melinis repens*. This micro-habitat is mostly found between the Olifantsloop River and Ga-magara River as well as a patch just south of the dense *A. erioloba* woodland. This habitat also covers the shallower soils characterising the southern portion of the preferred power line route is also found with the shallower soils found along the southern portion of the power line options (approximately 800m north of the N14). This section has been severely overgrazed with little grass cover present.

Although avifaunal activity within this unit is lower, with a lower abundance and diversity of avifaunal species, this micro-habitat is utilised, more or less, by the same key species as in the case of the *A. erioloba* woodland. Key species include Northern Black Korhaan (*Afrotis afraoides*), Lark species (Family: Alaudidae); species such as Chats, Thrushes and Scrub-Robbin will move around within the taller shrubby areas. Probably the most abundant species recorded within this habitat was Chestnut-vented Warbler (*Sylvia subcaerulea*), Kalahari Scrub Robin (*Cercotrichas paean*), Sociable Weaver (*Philetairus socius*) and Scaly-feathered Weaver (*Sporopipes squamifrons*) The denser encroached *Acacia mellifera* veld also provide nesting habitat for smaller species such Yellow-bellied Eremomela (*Eremomela ictyropygialis*), Black-chested Prinia (*Prinia flavicans*), Rufous-eared Warbler (*Malcorus pectoralis*) and also Pririt Batis (*Batis pririt*)

Current land use within this habitat includes predominantly stock and game farming. As mentioned, some portions of land have been somewhat encroached by *Acacia mellifera* impacting the grazing potential of the land.

The impacts associated with the development within this micro-habitat are displacement due to habitat loss and disturbance, as well as collision with the power line (Bustards, Korhaans and Sandgrouse species).

Figure 5: *Acacia mellifera – Tarchonanthus camphoratus* shrub veld.

Acacia tortilis – Acacia mellifera Woodland

This micro-habitat covers the area just south of the N14 which is characterised by a low ridge and shallower soils. The vegetation structure of this habitat can be described as a short to medium open tree layer with a mixture of dwarf shrubs and grasses forming the ground layer. Diagnostic tree species include *A. mellifera, A. tortilis, Boscia albitrunca, Grewia flava, Euclea undulata, and Lycium hirsutum*. Dwarf shrubs found with this area included; *Monechma divaricatum, Hermannia comosa, Pentzia* spp. and *Lycium* spp. Grasses included; *Aristida stipitata, A. diffusa, Eragrostis lehmanniana, Melenis repens, Cenchrus ciliaris and Stipagrostis uniplumis.*

This micro-habitat is utilised primarily by the same passerine species utilising the *Tarchonanthus camphoratus – Acacia mellifera* Woodland habitat namely Lark species (Family: Alaudidae) Chats, Thrushes and Scrub-Robbins. *Acacia mellifera* may encroach some areas forming denser patches, providing nesting habitat for smaller species such Yellow-bellied Eremomela (*Eremomela ictyropygialis*), Black-chested Prinia (*Prinia flavicans*), Rufous-eared Warbler (*Malcorus pectoralis*) and possibly also Pririt Batis (*Batis pririt*)

Current land use within this habitat includes predominantly stock farming.

The impacts associated with the development within this micro-habitat are displacement due to habitat loss and disturbance, as well as potential collision with the power line.

Figure 6: *Acacia tortilis – Acacia mellifera* habitat

Non-perennial watercourses

Two non-perennial watercourses (Olifantsloop River and Ga-magara River) will be crossed by the proposed power line (both options).

The Ga-magara River is a more prominent feature with an open grassy/herbaceous channel bed and a bank comprising of relatively large *A. erioloba* trees. Dominant species found within the channel include; *Cyperus laevigatus, C. congestus, Panicum schinzii, P. coloratum, Urochloa panicoides, Brachiaria nigropedata, Asparagus* spp., *Chrysocoma obtusa, Pentzia cacarea, Crasual natans* and *Salvia runcinata*. The banks are characterized by medium to large *Acacia erioloba* trees as well as *Ziziphus mucronata* with lower growing *A. hebaclada* forming the shrub layer.

The grassy channel bed is characterised by avifaunal species such as Eastern Clapper Lark (*Mirafra fasciolata*), Spike-healed Lark (*Chersomanes albofasciata*),

Capped Wheatear (*Oenanthe pileata*), Crowned Lapwing (*Vanellus coronatus*) and African Pipit (*Anthus cinnamoneus*).

The Olifantsloop River is a narrower, more inconspicuous channel consisting of a mixture of dwarf shrubs and grasses with scattered medium sized trees. Key species include; Dwarf shrubs such as *Pentzia cacarea, Chrysocoma obtusa, Lycium cinereum*; Shrubs such as *Acacia hebaclada* and *Tarchonanthus camphoratus*; small to medium sized *Acacia erioloba*. Grasses form the dominant layer and include species such as *Chloris virgata, Eragrostis echinochloidea, E. chloromelas, E. curvula, E. porosa* and *Aristida congesta*. Also found within the channel is the sedge, *Kylinga alba* and the aromatic herb *Salvia runcinata.*

The open grassy areas contain a similar avifaunal species composition as that of the Ga-magara River. Due to the presence of larger shrubs and trees within this channel species such as Namaqua Dove (*Oena capensis*), Bokmakierie (*Telophorus zeylonus*), Lesser Grey Shrike (*Lanius minor*), Fork-tailed Drongo (*Dicrurus adsimilis*), Chestnut-vented Warbler (*Sylvia subcaerulea*), Kalahari Scrub Robin (*Cercotrichas paena*) frequently move between the denser *A. erioloba* woodland and these patches of trees within the channel.

Current land use within this habitat includes predominantly stock farming.

The impacts associated with the development within this micro-habitat are displacement due to habitat loss and disturbance, as well as potential collision with the power line (especially potential species using these systems as migratory routes).

Figure 7: The Olifantsloop river (above) and the Ga-magara River (below)

Small depressions

Throughout the greater landscape a series of small depressions are present. Small topographical variations within the landscape have created small depression-like features of which some have been filled up over time with sand. Such a depression wetland has been noted in close proximity to the preferred power line option (approximately 230m west). During the time of the inspection this depression was inundated with water. This depression is characterised by low growing vegetation layer, mainly grasses and dwarf shrubs such as *Cynodon dactylon, Aristida congesta, A. adscensionis, Enneapogon desvauxii, Eragrostis echinochloidea, E. lehmanniana, Chrysocoma ciliata* and *Pentzia ciliata*. These grassy depressions are typically surrounded by a fringe of small to medium sized trees such as *A. mellifera, Zizphus mucronata, Grewia flava* and *Diospyros lycioides*.

Avifaunal species noted within this depression included Egyptian Goose (*Alopechen aegyptiaca*), Black-winged Stilt (*Himantopus himantopus*) and Southern Masked Weaver (*Ploceus velatus*). Even though few species have been recorded within this habitat, it has the potential to provide an important source of water and food in the form of protozoans and small branchiopods which become active during sufficient inundation. Species attracted periodically to such a water source may include South African Shelduck (*Tadorna cana*), Crowned Lapwing (*Vanellus coronatus*),

Three-banded Plover (*Charadrius ticollaris*), Namaqua Sandgrouse (*Pterocles namaqua*) and Burchell's Sandgrouse (*Pterocles burchelli*)

Current land use within this habitat includes predominantly game and stock farming

The major impacts associated with this habitat include potential collisions with the power line (larger species such as Egyptian Goose, South African Shelduck and the Sandgrouse species).

Figure 8: The depression wetland inundated with water following recent rainfall events.

Acacia karroo Thicket

This micro-habitat will only potentially be affected by the alternative substation option. This habitat is characterised by tall *Acacia karroo* specimens forming a dense thicket type of structure fringing this part of the Olifantsloop River. Other tree species found within this area included *Ziziphus mucronata, Grewia flava, Diospyros lycioides* and the invasive alien tree *Eucalyptus camaldulensis*.

Avifaunal diversity within this habitat can be regarded as moderate-low Key species noted within this unit included: Speckled Pigeon (*Coluba guinea*), various pigeon species, Swallow-tailed Bee-eater (*Merops hirundineus*) European Bee-Eater (*Merops apiaster*), Southern Yellow-billed Hornbill (*Tockus leucomelas*), Acacia Pied Barbet (*Tricholaema leucomelas*), Golden-tailed Woodpecker (*Compethera abingani*), Bokmakierie (*Telophorus zeylonus*), Chestnut-vented Warbler (*Sylvia*

subcaerulea), Blue Waxbill (*Uraeginthus angolensis*), Village Indigobird (*Viclua chalybeata*) and Golden Breasted Bunting (*Emberiza flaviventris*).

Current land use within this habitat includes the existing substation and the residential development to the west and the informal settlement to the east. Numerous footpaths traverse the site and the area is used to walk between the informal settlement and the main street where most of the businesses are situated. Livestock from the informal settlement is also allowed to graze these areas. Illegal dumping of general waste and building rubble have also occurred within this area.

The impacts associated with the development within this micro-habitat are displacement due to habitat loss and disturbance, as well as potential collision with the power line.

Figure 9: The dense *Acacia karroo* thicket.

a) The 275kV & 400kV lines as well as
b) the associated servitude

Artificial habitats are provided by the existing overhead power line (275kV line) as well as the cleared servitude. The pylons along the central portion of this line (area traversing the dense *A. erioloba* woodland) are used as perching and roosting sites by White-backed Vultures (*Gyps africanus*), Martial Eagle (*Polemaetus bellicosus*), Common Buzzard (*Buteo buteo*), Greater Kestrel (*Falco rupicoloides*), Red-footed

Falcon (*Falco vespertinus*) and Pied Crow (*Corvus albus*). The southern half of the 275kV line (between the N14 and the Olifantsloop River) contains numerous Sociable Weaver Nests (*Philetairus socius*). The only large raptor nest noted during the survey was very old and abandoned with no active nests noted.

The cleared servitude is dominated by an open grassland with a sparse covering of low growing shrubs such as *Tarchonanthus camphoratus*, *Grewia flava* and small *A. erioloba* trees resettling in these areas. Grass species dominant within the servitude include *Aristida adscensionis, A. meridionalis, A. congesta, Enneapogon cenchroides, Eragrostis lehmanniana, E. echinochloidea, E. trichophora, Schmidtia kalihariensis, Stipagrostis ciliate* and *S. uniplumis*. The servitude is characterised by species such as Spike-heeled Lark (*Chersomanes albofasciata*), Monotonous Lark (*Mirafra passerine*), Goundscraper Thrush (*Turdus litsitsirupa*), Kalahari Scrub Robin (*Cercotrichas paena*), Ant-eating Chat (*Myrmecocichla formicivora*), Scaly-feathered Weaver (*Sporopipes squamifrons*), Capped Wheatear (*Oenanthe pileata*) and Rufous-cheeked Nightjar (*Caprimulgus rufigena*).

The risk of birds colliding with the overhead power lines is not expected to exponentially increase as a result of this development as the proposed power line runs parallel to and in close proximity to the existing 275kV line as well as the new 400kV line (under construction) and therefore will not pose an altogether new risk to avifauna in the area. Having said this, it is still regarded as good practice to improve visibility of the line for especially the larger raptors such as the Martial Eagles (*Polemaetus bellicosus*), Secretary birds (*Sagittarius serpentarius*), vulture species and larger ground species such as Korhaans and Kori Bustards (*Ardeotis kori*) as well as for Sandgrouse species, especially in areas where these species are abundant and mobile. The dense *A. erioloba* woodland is regarded as such an area and subsequently it is recommended that mitigation measures, such as bird flappers, are implemented in this area to make the line more visible.

c) Olifantshoek sewage works

Even though this area is located outside of the servitude area it is still important to take this artificial habitat into account it is a permanent source of water creating a habitat for water fowls, waders, herons and other bird species associated with such habitats. These species' route between this water source and the gravel dam located to the south of the town may cross the proposed power line. Species noted within this artificial habitat included: Egyptian Goose (*Alopechen aegyptianca*), South African Shelduck (*Tadorna cana*), Yellow-Billed Duck (*Anas undulata*), Cape Shoveler (*Anas smithii*), Red-billed Teal (*Anas erythrorhyncha*), Little Grebe (*Tachybaptus ruficollis*), Crowned Lapwing (*Vanellus coronatus*), Kittlitz's Plover (*Charadrius pecuarius*) and Three-banded Plover (*Charadrius ticollaris*).

The impacts associated with the development regarding this micro-habitat are potential collision with the power line. This can be mitigated by implementing visibility measures (bird flappers) along the power line section potentially falling within the flight path of these mentioned bird species.

Figure 10: The 275kV power line as well as service road crossing the Ga-magara river.

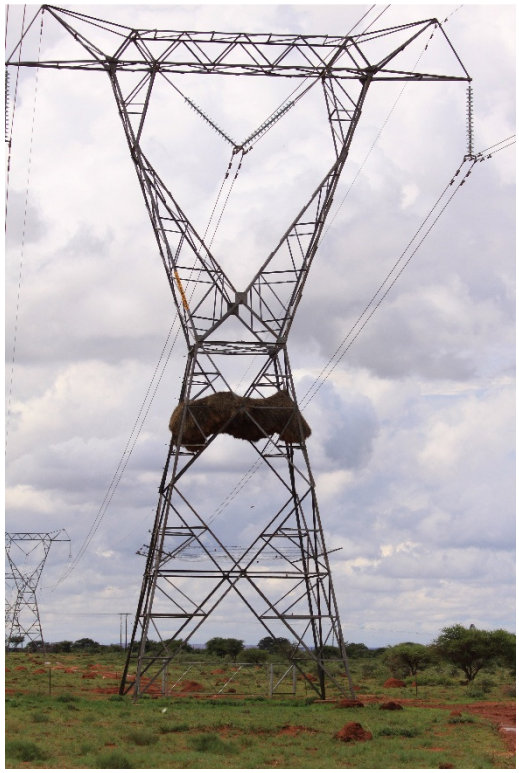

Figure 11: Sociable weavers utilizing the power line tower structures for the construction of their nest.

Figure 12: White-backed Vultures using the tower for perching as well as roosting.

Figure 13: Martial Eagle that was disturbed from its perching site (275kV power line).

3.6 Important Bird Areas (IBA)

The proposed power line and substation are not located within close proximity to any Bird Area and will thus have no impact in this regard.

3.7 Avifauna species composition

A total of 228 species were recorded in 2722DD and DC by SABAP1 & 2, with 11 species classified as Red Data species (Barnes 2014). These include Near Threatened Species such as; Black Stork (*Ciconia nigra*), Secretarybird (*Sagittarius serpentarius*) and Black Harrier (*Circus maurus*) and Vulnerable species such as; Cape Vulture (*Gyps coprotheres*), White-backed Vulture (*Gyps africanus*), Lappet-faced Vulture (*Torgos tracheliotus*), Tawny Eagle (*Aquila rapas*), Martial Eagle (*Polemaetus bellicosus*), Corn Crake (*Crex crex*), Kori Bustard (*Ardeotis kori*) and Ludwig's Bustard (*Neotis ludwigii*). Furthermore, 22 species are southern African endemics and 38 are near-endemics (26%).

Reporting rates are an indication of the relative density of a species on the ground in that it reflects the number of times that a species was recorded relative to the total number of cards that were completed for the pentad 1.

During the site survey a total of 92 bird species were recorded within the study area with 9 species being endemic and 19 being near-endemic.

The most commonly recorded species within the study area were passerine and near passerine species of which Bokmakierie (*Telophorus zeylonus*), Crimson-breasted Shrike (*Laniarius atroccineus*), Lesser Grey Shrike (*Lanius minor*), Fork-tailed Drongo (*Dicrurus adsimilis*), Monotonous Lark (*Mirafra passerine*), Black-chested Prinia (*Prinia flavicans*), Yellow-bellied Eremomela (*Eremomela icteropygialis*), Southern Pied Babbler (*Turdoides bicolor*), Kalahari Scrub Robin (*Cercotrichas coryphoeus*), Ant-eating Chat (*Myrmecocichla formicivora*), Sociable Weaver (*Philetairus socius*), Scaly-feathered Weaver (*Sporopipes squamifrons*), and Chestnut-vented Warbler (*Sylvia subcaerulea*).

Endemic species recorded during the site survey included South African Shelduck (*Tadorna cana*), White-backed Mousebird (*Colius colius*), Ant-eating Chat (*Myrmecocichla formicivora*), Rufous-eared Warbler (*Malcorus pectoralis*), Southern Pied Barbet (*Turdoides bicolor*), Karoo Scrub Robin (*Cercotrichas caryphoeus*), Sickle-winged Chat (*Emarginata sinuata*), Marico Flycatcher (*Melaenornis mariquensis*), Bokmakierie (*Telophorus zeylonys*) and Sociable weaver (*Philetairus socius*).

Red listed species recorded within and around the development footprint area included White-backed Vulture - *Gyps africanus* (Endangered), Martial Eagle – *Polemaetus bellicosus* (Endangered), Red-footed Falcon – *Falco vespertinus* (Global: Near Threatened). Listed avifaunal species not recorded within the site although highly likely to occur within the area include Kori Bustard - *Ardeotis kori* (Near Threatened), Secretary Bird - *Sagittarius serpentarius* (Vulnerable), Lanner

Falcon – *Falco biarmicus* (Vulnerable) and Peregrine Falcon - *Falco peregrinus* (Near Threatened).

3.8 Avifauna species composition

Table 1 provides a guideline of the Red Data species that have and could potentially be encountered anywhere within the pentad where suitable habitat is available. This was based on observations of avifauna and micro-habitats during the site survey, in combination with documented records within the study area.

Report rates are the likelihood of a particular species occurring within the study site represented as a percentage. Due to the lack of atlas records and subsequent inaccuracies with regards to reporting rates within the proposed study site, these were not included in the analysis.

The specific habitat requirements for each species as well as the most likely associated impacts due to the development were recorded. Species that are in bold were recorded during the site survey.

Table 3: Red listed as well as one species that is not listed that has been recorded either within the relevant quarter degree squares, on site during survey or has a possibility of occurring within the area and which will potentially be affected by the proposed development (NT = Near Threatened; VU = Vulnerable; EN = Endangered; LC = Least Concern) (Species that are in bold were recorded during the site survey; X=impact is relevant to this species)

Name	Conservation Status	Habitat	Likelihood of Occurence	Habitat Destruction	Disturbance	Collision with Power Line	Electrocution	Endemic
Secretary Birds *Sagittarius serpentarius*	VU	Grassland/Open Woodland	Likely	X	X	X		
Martial Eagle *Polemaetus bellicosus*	EN	Woodland/Savannah	Present	X	X	X	X	
Kori Bustard *Ardeotis kori*	NT	Grassland/Thornveld	Highly Likely	X	X	X		
White-backed Vulture *Gyps africanus*	EN	Woodland/Savannah	Present	X	X	X	X	Near-Endemic
Red-footed Falcon *Falco vespertinus*	NT	Woodland/Savannah	Present		X		X	Endemic
Lanner Falcon *Falco biarmicus*	VU	Woodland/Savannah	Likely		X		X	
Peregrine Falcon *Falco peregrinus*	NT	Woodland/Savannah	Likely		X		X	

4 SENSITVITY ASSESSMENT

It is important to delineate sensitive avian habitats within the study area in order to ensure the development does not have a long term negative impact on these habitats. Important avian habitats play an integral role in their persistence within a landscape providing nesting, foraging and reproductive benefits.

A sensitivity map was compiled for the study area by making use of the results of the avifaunal micro-habitat assessment (refer to Figure 14).

A large portion of the study area has been assessed as being of **LOW** sensitivity from an avifaunal perspective. The majority of the development footprint falls within the *Acacia erioloba* woodland with a moderate tree density or the *Tarchonanthus camphoratus – Acacia mellifera* woodland and is considered to be of **LOW** avifaunal sensitivity as the homogenous nature of the vegetation does not provide a wide variety of avifaunal habitats, furthermore this habitat type has an extensive distribution outside of the study area and thus does not represent a specific niche habitat. The encroachment of *A. mellifera* also contributes to the relatively low diversity of avifaunal species as the encroaching bush has resulted in some of the lark species moving out of the denser areas. The larger *A. mellifera* species still none-the-less provide protective nesting areas for some smaller bird species such as Black-chested Prinia and possibly Pririt Batis. Acceptable change includes the alteration of habitat within the development footprint and servitude and some loss of potential nesting sites within these areas due to the clearing of large shrubs and tree species, however most of these species will move into the surrounding unaffected habitats.

The dense *Acacia erioloba* woodland located just south of the Olifantsloop River is regarded as **MEDIUM** sensitivity due to the high diversity of avifauna associated with this habitat including species known as being vulnerable to collisions such as korhaans and sandgrouse species. Furthermore, this section of the existing 275kV power line is used for roosting by White-backed Vultures and Martial Eagles, both of whom are classified as vulnerable. Furthermore, this woodland is a preferred habitat for Secretary birds (Vulnerable) as well as Kori Bustards (Near Threatened), both of whom are vulnerable to collisions with power lines. By implementing mitigations measures to ensure the visibility of the power line (e.g. bird flappers) this risk can be reduced to unlikely. Acceptable change includes the alteration of habitat within the development footprint and servitude and some loss of potential tree nesting sites within these areas due to the clearing of large shrubs and tree species, however most of these species will move into the surrounding unaffected habitats. No loss of potential active nests belonging to Secretary birds (unlikely to occur) and Kori Bustards (likely to occur although no species were recorded during the survey) may be allowed. If such nests are observed during the pre-construction

walk through or during construction mitigation measures should be implemented as specified within Section 5 (Impact Assessment).

The southern portion of the power line options are classified as **MEDIUM** sensitivity due to its proximity (less than 550m) to the town's sewage works. This artificial habitat provides a permanent waterbody inhabited by various water fowl and waders. These species likely move between the sewage works and the dam located at the southern point of the town and their flight path most likely crosses this section of the proposed power line. By implementing mitigation measures to ensure the visibility of the power line (e.g. bird flappers) this risk can be significantly reduced. Acceptable change within this habitat include, ONLY habitat transformation within the footprint area and associated servitude. Any change in the water fowl and wader population due to excessive power line collisions is not acceptable and should be prevented by implementing sufficient anti-collision mitigation measures as specified above and within Section 5 (Impact Assessment).

The two non-perennial watercourses with their associated tree fringes have been classified as **HIGH** sensitivity due to the fact that such watercourses and their riparian fringes are normally associated with important migration corridors for avifaunal species. Furthermore, the tree fringes are associated with a diversity of avifaunal species of which a number are dependent on these areas for nesting, feeding and potential short distance migratory routes. By implementing mitigation measures to ensure the visibility of the power line (e.g. bird flappers) this risk can be significantly reduced. Acceptable change within this habitat include, ONLY habitat transformation within the footprint area and associated servitude. Any change in the potential water fowl and wader population as well as well as within migratory faunal populations due to excessive power line collisions is not acceptable and should be prevented by implementing sufficient anti-collision mitigation measures as specified above and within Section 5 (Impact Assessment).

From the described sensitive areas and the location of the proposed development footprint area relative to these areas, it can be concluded that the majority of the proposed development will occur within a **LOW** sensitivity avifaunal area with some of the proposed footprint traversing **MEDIUM** sensitivity areas with only small portions crossing **HIGH** sensitivity areas.

Overall, it was concluded that with the necessary mitigation measures implemented this **development will have little impact on the avifaunal character of the area with minimal loss due to collision.** Both power line corridor options traverse similar habitats and subsequently will have similar impacts. In terms of the substations, the preferred option is definitely the best option as the alternative option will impact on the *Acacia karroo* thicket which has a moderately-high avifaunal diversity. Furthermore, by selecting the preferred location a portion of

the power line corridor, which may cross the flight path of water fowl and waders moving between the sewage works and gravel dam, will be significantly shortened thus furthermore lowering the risk associated with the power line.

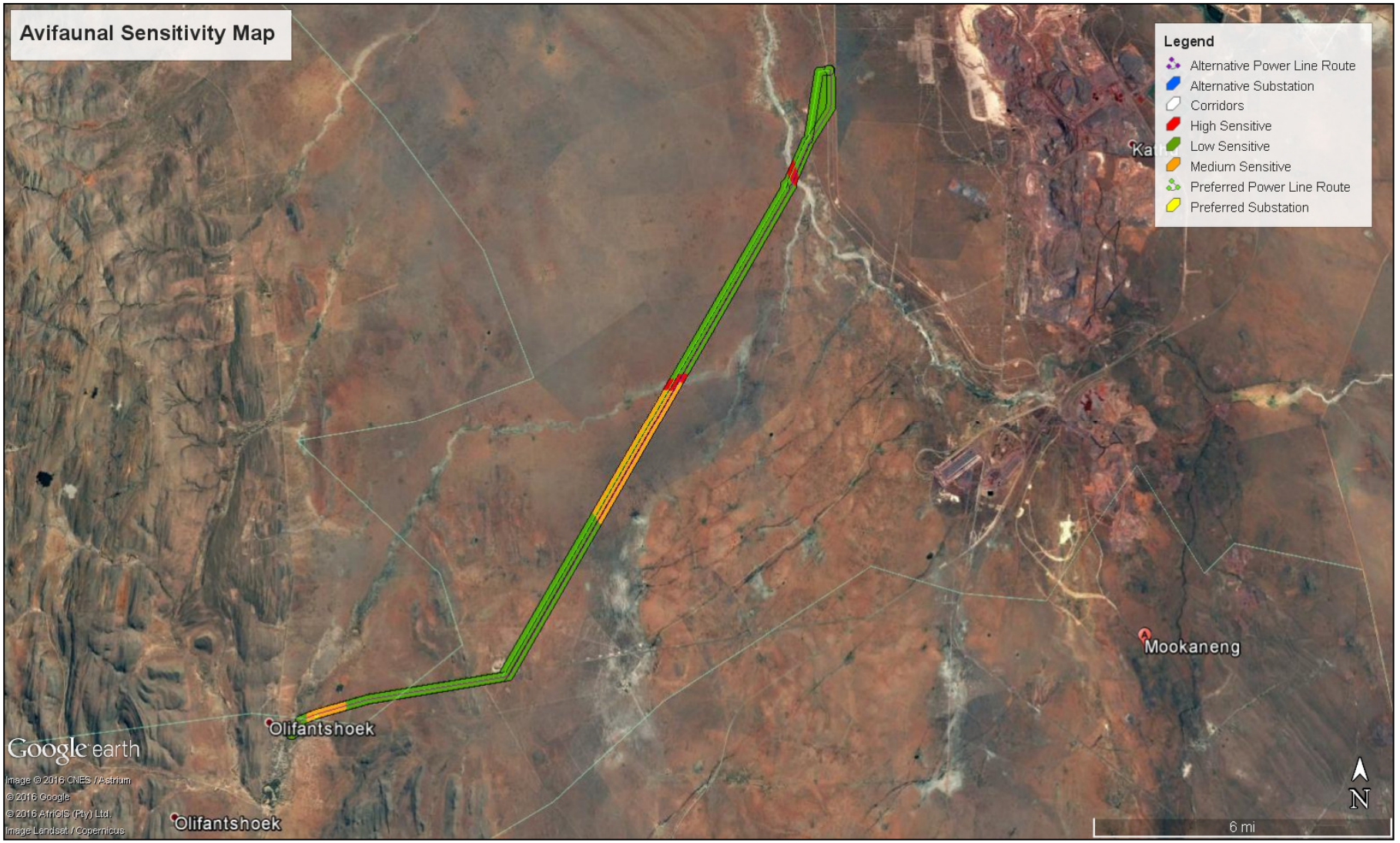

Figure 14: Avifaunal sensitivity map for the Olifantshoek 132kV power line as well as proposed substation options.

5 IMPACT ASSESSMENT

5.1 Methodology used to assess the potential impacts

The Environmental Impact Assessment methodology assists in the evaluation of the overall effect of a proposed activity on the environment. This includes an assessment of the significant direct, indirect, and cumulative impacts. The significance of environmental impacts is to be assessed by means of the criteria of extent (scale), duration, magnitude (severity), probability (certainty) and direction (negative, neutral or positive).

» The **nature**, which includes a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 was assigned as appropriate (with 1 being low and 5 being high).
» The **duration**, wherein it was indicated whether:
  - the lifetime of the impact will be of a very short duration (0 – 1 years) – assigned a score of 1;
  - the lifetime of the impact will be of a short duration (2 – 5 years) – assigned a score of 2;
  - medium-term (5 -15 years) – assigned a score of 3;
  - long term (> 15 years) – assigned a score of 4; or
  - permanent – assigned a score of 5;
» The **magnitude**, quantified on a scale from 0 – 10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
» The **probability** *of occurrence*, which describes the likelihood of the impact actually occurring. Probability was estimated on a scale of 1 -5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
» The **significance**, was determined through a synthesis of the characteristics described above and can be assessed as **LOW**, **MEDIUM** or **HIGH**; and
» the **status**, which was described as either positive, negative or neutral.
» the degree of which the impact can be reversed,
» the degree to which the impact may cause irreplaceable loss of resources,

» the degree to which the impact can be mitigated.

The significance was calculated by combining the criteria in the following formula:

S=(E+D+M)P where;

» S = Significance weighting
» E = Extent
» D = Duration
» M = Magnitude
» P = Probability

The significance weightings for each potential impact are as follows;

» < 30 points: **LOW** (i.e. where the impact would not have a direct influence on the decision to develop in the area),
» 30 – 60 points: **MEDIUM** (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» > 60 points: **HIGH** (i.e. where the impact must have an influence on the decision process to develop in the area).

5.2 Impact Statement

The implications of the proposed development are as follows:

» Vegetation within the 32m wide servitude, extending the length of the power line, will be altered to some extent, although still deemed largely suitable to various avian species.
» During the construction phase of the substation and power line, disturbance levels will be significantly higher in the immediate vicinity than previously. This disturbance will result from machinery and vehicle disturbance as well as other construction activities.
» During the operational phase, there will be some vehicle activity during maintenance of the substation and power line.
» The power line will potentially pose a collision risk to avifauna, particularly heavier birds with low manoeuvrability (specifically the resident Bustard species).
» The power line towers and the substation infrastructure provide perching and nesting structures for various avifauna, particularly larger raptors.
» There is a possibility that species such as crows/owls could be electrocuted on substation infrastructure.

The tables below provide an assessment of the potential impacts associated with the proposed project. As both power line options traverse, similar habitat the

potential impacts will be the same for both power line options and subsequently the impact statements provided below are applicable for bot power line options. Both substation locations will pose a similar and equal threat to avifauna in the vicinity. Furthermore, most impacts are applicable, and similar, for both the construction, operational as well as decommissioning phase and thus the statement will only be provided once (will be mentioned within statement to what phase it has relevance).

The impacts were assessed as follows:

A. PROPOSED POWER LINE OPTIONS (BOTH ALTERNATIVES)

I. Construction Phase Impacts

Impact 1: Habitat Destruction

Nature: Habitat Destruction

During the **construction** of the power line, some habitat destruction and alteration will occur, although this is will be limited. These activities may have a very slight impact on foraging, breeding and roosting ecology of avian species within the area through modification of habitat.

It is envisaged that the only Red Data specie that may be potentially displaced (temporarily) by the activities and habitat transformation that will take place as a result of construction are Kori bustard (*Ardeotis kori*). This displacement will only be from a very restricted area. The impact on smaller, non-Red Data species that are potentially breeding in the area will be local and very restricted in extent, and will not have a significant effect on regional or national populations.

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Highly Probable (4)	Probable (3)
Significance	**Low (28)**	**Low (15)**
Status	Negative	
Reversibility	High	
Irreplaceable loss of resources	Only very slight loss of resources	

Can impacts be mitigated?	Yes.
Mitigation	• The temporal and spatial footprint of the development should be kept to a minimum. • The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area. • Provide adequate briefing for site personnel on the possible important (Red Data) species occurring and/or nesting in the area and the procedures to be followed (for example notification of ECO and avoidance of area until appropriate recommendations have been provided by a specialist). • The above measures must be covered in a site specific EMPr and monitored by an ECO.

Impact 2: Disturbance

Nature: Disturbance

The disturbance of avifauna during the **construction** of the power line may occur. Species sensitive to disturbance include ground-nesting species resident within the development footprint. Disturbance can also influence the community structure of avifauna within close proximity to the development as certain species will be displaced and forced to find alternative territories.

Disturbance could have a negative impact on the breeding activities of various species, particularly if this occurs during a sensitive period in the breeding cycle.

Species of concern are Kori Bustard. Other small avian species do occur within the development footprint but these species are non-Red Data species.

The proposed site is located within an agricultural habitat close to National and Domestic roads. Therefore, species within this landscape often experience disturbance. As a result, disturbance of birds by the proposed substation is anticipated to be of low significance as birds will move away from the area temporarily. The relatively small scale of the development (in relation to the large agricultural landscape) is unlikely to have a significant impact on avifauna. However, species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during both the construction and operational (maintenance) phases.

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Low (4)

Probability	Highly Probable (4)	Probable (3)
Significance	**Low (28)**	**Low (21)**
Status	Negative	
Reversibility	High reversibility	
Irreplaceable loss of resources	Only a slight loss of resources	
Can impacts be mitigated?	Impacts can be mitigated to a large extent.	
Mitigation	• Strict control must be maintained over all activities during construction, in line with an approved construction EMPr. • During construction, if any of the Red Data species identified in this report are observed to be roosting and/or breeding in the vicinity, the ECO must be notified and were deemed necessary an appropriate buffer should be placed around the nests and/or roosting areas. If uncertain on the size of such buffer the Environmental Officer (EO) may contact an avifaunal specialist for advice. • The construction equipment camps must be as close to the site as possible. • Contractors and working staff should remain within the development footprint and movement outside these areas especially into avian micro-habitats must be restricted. • Driving must take place on existing roads and a speed limit of 30km/h must be implemented on all roads associated with the project during the construction phase.	

II. Operation Phase Impacts

Impact 1: Disturbance

Nature: Disturbance during Operation Phase due to maintenance activities See description for construction disturbance impacts mentioned above		
	Without Mitigation	**With Mitigation**
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)

Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (11)**
Status	Negative	
Reversibility	High reversibility	
Irreplaceable loss of resources	Only slight loss of resources	
Can impacts be mitigated?	Yes.	
Mitigation	• Strict control must be maintained over all activities during operation, in line with an approved operation EMPr. • Vehicle movements must be restricted to existing roads and a speed limit of 30km/h must be implemented on all roads associated with the power line during the operation phase. • Contractors and working staff should remain within the development footprint and movement outside these areas, especially into avian micro-habitats, must be restricted.	

Impact 3: Electrocution of birds due to overhead power lines

Nature: Electrocution of birds on overhead power line

Electrocution of birds on associated overhead power lines is an important cause of mortality for a variety of large bird species particularly storks, cranes and raptors in South Africa (Van Rooyen & Ledger 1999). Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004; Lehman et al. 2007).

The impact assessment found the impact of electrocution to be of moderate significance before mitigation, and low significance after the mitigation in the form of bird friendly structures.

	Without Mitigation	**With Mitigation**
Extent	Medium (2)	Medium (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)

Significance	**Moderate (36)**	**Low (20)**
Status	Negative	
Reversibility	Low (birds will be injured or killed)	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated?	Yes.	
Mitigation	• A "Bird Friendly" structure, with a bird perch (as per standard Eskom guidelines) must be used for the tower structures. • All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting 2002). • Installation of artificial bird space perches and nesting platforms should be installed, at a safe distance from energised components (Goudie 2006; Prinsen et al. 2012). • Line inspections should be ongoing for the operational life of the line.	

Impact 4: Collisions of Birds with overhead power line

Nature: Collision with the power line

Collisions are the biggest single threat posed by transmission power lines to birds in Southern Africa (van Rooyen 2004). Avian species most susceptible and impacted upon are bustards, storks and cranes. These species are heavy-bodied birds with limited manoeuvrability (as a result of high wing loading), which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (Van Rooyen 2004, Anderson 2001). Many of the collision sensitive species are considered threatened in Southern Africa.

The Red Data species that are vulnerable to power line collisions are generally long living, slow reproducing species. Furthermore, various species require specific conditions for breeding, resulting in very few successful breeding attempts and breeding might be restricted to very small areas. Consistent high adult mortality over an extensive period could have a serious long term effects on the population.

Potential collision impacts (risk) with the proposed power line by certain species such as Kori Bustard and Secretary bird are possible. This is particularly true for the Bustards which have low manoeuvrability once in flight. All three-species mentioned have been recorded within the top ten avian species in South Africa prone to collisions with overhead power lines.

Overall, the impact assessment found this risk impacts to be of moderate to low significance. This rating is related to the number and frequency of large avifaunal species such as bustard and korhaan inhabiting or visiting the traversed habitat.		
	Without Mitigation	**With Mitigation**
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Moderate (44)**	**Low (27)**
Status	Negative	
Reversibility	Low (birds will be injured or killed)	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated?	Yes.	
Mitigation	• Mark sections of line in high sensitivity areas with anti-collision marking devices (diurnal and nocturnal diverters) to increase the visibility of the power line and reduce likelihood of collisions. Marking devices should be spaced 10 m apart, and must be installed as soon as the conductors are strung • These line marking devices include spiral vibration dampers, strips, Bird Flight Diverters, bird flappers, aerial marker spheres, ribbons, tapes, flags and aviation balls (Prinsen et al. 2012). • Construction of the power line in close proximity to the existing power line will reduce the cumulative impacts and collision risk. All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting 2002). • Line inspections should be ongoing for the operational life of the line.	

III. Decommissioning Phase Impacts

Impact 1: Disturbance

Disturbance during Decommissioning Phase due to maintenance activities
See description for potential disturbance during operational phase above.

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Low (28)**	**Low (21)**
Status	Negative	
Reversibility	High reversibility	
Irreplaceable loss of resources	Only a slight loss of resources	
Can impacts be mitigated?	Impacts can be mitigated to a large extent.	
Mitigation	• Strict control must be maintained over all activities during decommissioning, in line with an approved construction EMPr. • During decommissioning, if any of the Red Data species identified in this report are observed to be roosting and/or breeding in the vicinity, the ECO must be notified and were deemed necessary an appropriate buffer should be placed around the nests and/or roosting areas. If uncertain on the size of such buffer the Environmental Officer (EO) may contact an avifaunal specialist for advice. • The decommissioning equipment camps must be as close to the site as possible. • Contractors and working staff should remain within the development footprint and movement outside these areas especially into avian micro-habitats must be restricted. • Driving must take place on existing roads and a speed limit of 30km/h must be implemented on all roads associated with the project during the construction phase.	

B. PROPOSED SUBSTATION OPTIONS

I. Construction Phase Impacts

Impact 1: Habitat Destruction

Nature: Habitat Destruction

During the **construction** of the substation, some habitat destruction and alteration will occur, although this is will be limited. These activities may have a very slight impact on foraging, breeding and roosting ecology of avian species within the area through modification of habitat.

It is envisaged that the only Red Data specie that may be potentially displaced (temporarily) by the activities and habitat transformation that will take place as a result of construction are Kori bustard (*Ardeotis kori*). This displacement will only be from a very restricted area. The impact on smaller, non-Red Data species that are potentially breeding in the area will be local and very restricted in extent, and will not have a significant effect on regional or national populations.

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Highly Probable (4)	Probable (3)
Significance	**Low (28)**	**Low (15)**
Status	Negative	
Reversibility	High	
Irreplaceable loss of resources	Only very slight loss of resources	
Can impacts be mitigated?	Yes.	
Mitigation	• The temporal and spatial footprint of the development should be kept to a minimum. • The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area. • Provide adequate briefing for site personnel on the possible important (Red Data) species occurring and/or nesting in the area and the procedures to be followed (for example notification of ECO and avoidance of area until appropriate recommendations have been provided by a specialist). • The above measures must be covered in a site specific EMPr and monitored by an ECO.	

Impact 2: Disturbance

Nature: Disturbance

The disturbance of avifauna during the **construction** of the substation may occur. Species sensitive to disturbance include ground-nesting species resident within the development footprint. Disturbance can also influence the community structure of avifauna within close proximity to the development as certain species will be displaced and forced to find alternative territories.

Disturbance could have a negative impact on the breeding activities of various species, particularly if this occurs during a sensitive period in the breeding cycle.

Species of concern are Kori Bustard. Other small avian species do occur within the development footprint but these species are non-Red Data species.

The proposed site is located within an agricultural habitat close to National and Domestic roads. Therefore, species within this landscape often experience disturbance. As a result, disturbance of birds by the proposed substation is anticipated to be of low significance as birds will move away from the area temporarily. The relatively small scale of the development (in relation to the large agricultural landscape) is unlikely to have a significant impact on avifauna. However, species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during both the construction and operational (maintenance) phases.

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Low (28)**	**Low (21)**
Status	Negative	
Reversibility	High reversibility	
Irreplaceable loss of resources	Only a slight loss of resources	
Can impacts be mitigated?	Impacts can be mitigated to a large extent.	

Mitigation	• Strict control must be maintained over all activities during construction, in line with an approved construction EMPr. • During construction, if any of the Red Data species identified in this report are observed to be roosting and/or breeding in the vicinity, the ECO must be notified and were deemed necessary an appropriate buffer should be placed around the nests and/or roosting areas. If uncertain on the size of such buffer the Environmental Officer (EO) may contact an avifaunal specialist for advice. • The construction equipment camps must be as close to the site as possible. • Contractors and working staff should remain within the development footprint and movement outside these areas especially into avian micro-habitats must be restricted. • Driving must take place on existing roads and a speed limit of 30km/h must be implemented on all roads associated with the project during the construction phase.

II. Operation Phase Impacts

Impact 1: Disturbance

Nature: Disturbance during Operation Phase due to maintenance activities See description for construction disturbance impacts mentioned above		
	Without Mitigation	**With Mitigation**
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (11)**
Status	Negative	
Reversibility	High reversibility	
Irreplaceable loss of resources	Only slight loss of resources	

Can impacts be mitigated?	Yes.
Mitigation	• Strict control must be maintained over all activities during operation, in line with an approved operation EMPr. • Vehicle movements must be restricted to existing roads and a speed limit of 30km/h must be implemented on all roads associated with the power line during the operation phase. • Contractors and working staff should remain within the development footprint and movement outside these areas, especially into avian micro-habitats, must be restricted.

Impact 2: Electrocution of Birds due to substation infrastructure

Nature: Electrocution of birds on substations infrastructure

Since there is live hardware in the substation yard, the potential exists for birds to bridge the gap between a phase and earth resulting in electrocution. However, very few electrocutions have been recorded on substations. Species likely to be affected are crows, ravens and other species that are tolerant of disturbance. Small raptors such as Lanner Falcons are sometimes attracted into substation yards in pursuit of species nesting there such as sparrows and canaries and may be susceptible to electrocutions.

The impact assessment found the impact of electrocution from substation infrastructure to be much lower of significance once mitigation in the form of bird friendly structures and bird deterrent measures have been put in place. Species likely to be affected are crows and other non-threatened species with the majority of threatened species avoiding the substation yard as they are sensitive to disturbances.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (30)**	**Low (14)**
Status	Negative	
Reversibility	Low (birds will be injured or killed)	
Irreplaceable loss of resources	Yes	

Can impacts be mitigated?	Yes
Mitigation	• All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting, 2002). • Installation of artificial bird space perches and nesting platforms, at a safe distance from energised components (Goudie, 2006; Prinsen et al., 2012).

III. Decommissioning Phase Impacts (of the existing substation as well as the proposed new substation)

Impact 1: Disturbance

Disturbance during Decommissioning Phase due to maintenance activities See description for potential disturbance during operational phase above.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Low (28)**	**Low (21)**
Status	Negative	
Reversibility	High reversibility	
Irreplaceable loss of resources	Only a slight loss of resources	
Can impacts be mitigated?	Impacts can be mitigated to a large extent.	
Mitigation	• Strict control must be maintained over all activities during decommissioning, in line with an approved construction EMPr. • During decommissioning, if any of the Red Data species identified in this report are observed to be roosting and/or breeding in the vicinity, the ECO must be notified and were deemed necessary an appropriate buffer should be placed around the nests and/or roosting areas. If uncertain on the size of such buffer the Environmental Officer (EO) may contact an avifaunal specialist for advice.	

	• The decommissioning equipment camps must be as close to the site as possible. • Contractors and working staff should remain within the development footprint and movement outside these areas especially into avian micro-habitats must be restricted. • Driving must take place on existing roads and a speed limit of 30km/h must be implemented on all roads associated with the project during the construction phase.

C. CUMULATIVE IMPACTS

Impact 1: Habitat Destruction

The proposed development will be largely situated within the existing servitude of the 275kV & 400kV lines and subsequently the cumulative impact of the development will be low.

Minimal additional destruction and alteration of habitats will occur, cumulative and thus, will also have limited impact on foraging, breeding and roosting ecology of avian species.

	Cumulative Contribution of Proposed Project	**Cumulative Impact without Proposed Project**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (14)**	**Low (10)**
Status	Neutral to Slightly Negative	Neutral to Slightly Negative
Reversibility	High	
Irreplaceable loss of resources	Very limited loss of resources	
Can impacts be mitigated?	Yes.	
Mitigation	• The temporal and spatial footprint of the development should be kept to a minimum. • The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area.	

	• Provide adequate briefing for site personnel on the possible important (Red Data) species occurring and/or nesting in the area and the procedures to be followed (for example notification of ECO and avoidance of area until appropriate recommendations have been provided by ECO). The above measures must be covered in a site specific EMPr and monitored by an ECO.
Residual Impacts	Low

Impact 2: Disturbance

The proposed development will be largely situated within the existing servitude of the 275kV & 400kV lines and subsequently the cumulative impact of the development will be low.

Minimal additional disturbance of avifaunal species will occur and will have very little impact on sensitive ground-nesting species, cumulative, as well as on the community structure of avifauna of the region.

	Cumulative Contribution of Proposed Project	**Cumulative Impact without Proposed Project**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (3)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (24)**	**Low (14)**
Status	Neutral to Slightly Negative	
Reversibility	High	
Irreplaceable loss of resources	Very limited loss of resources	
Can impacts be mitigated?	Yes.	
Mitigation	• Strict control must be maintained over all activities associated with the development, in line with an approved EMPr. • During all phases associated with the development, if any of the Red Data species identified in this report are observed to be roosting and/or breeding in the vicinity, the	

	ECO must be notified and were deemed necessary an appropriate buffer should be placed around the nests and/or roosting areas. If uncertain on the size of such buffer the Environmental Officer (EO) may contact an avifaunal specialist for advice. • The equipment camps must be as close to the site as possible. • Contractors and working staff should remain within the development footprint and movement outside these areas especially into avian micro-habitats must be restricted. • Driving must take place on existing roads and a speed limit of 30km/h must be implemented on all roads associated with the project during the construction phase.
Residual Impacts	Low

Impact 3: Electrocution of Birds due to substation infrastructure

Potential cumulative impacts are regarded as low and no additional potential deaths of avifaunal species (including Red Data) species will occur as this substation will not increase the threat, but will replace the existing substation and subsequently will only replace the threat. As such the substation, will not contribute to cumulative impacts.		
	Cumulative Contribution of Proposed Project	**Cumulative Impact without Proposed Project**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Slightly Probable (2)	Improbable (2)
Significance	**Low (16)**	**Low (10)**
Status	Neutral	
Reversibility	High	
Irreplaceable loss of resources	No additional loss of resources expected	
Can impacts be mitigated?	Yes.	
Mitigation	• All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting, 2002). • Installation of artificial bird space perches and nesting platforms, at a safe distance from energised components (Goudie, 2006; Prinsen et al., 2012).	

Residual Impacts	None

Impact 4: Electrocution of birds due to overhead power lines

The proposed power line is to be routed adjacent to the existing 275kV power line's servitude (as well as 400kV power line). As such, the additional line will not likely exponentially increase the risk of avian electrocutions as this risk already occurs.

	Cumulative Contribution of Proposed Project	**Cumulative Impact without Proposed Project**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (3)	Small (0)
Probability	Probable (3)	Improbable (2)
Significance	**Low (27)**	**Low (10)**
Status	Neutral	
Reversibility	High	
Irreplaceable loss of resources	No additional loss of resources expected	
Can impacts be mitigated?	Yes.	
Mitigation	• A "Bird Friendly" structure, with a bird perch (as per standard Eskom guidelines) must be used for the tower structures. • All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting 2002). • Installation of artificial bird space perches and nesting platforms should be installed, at a safe distance from energised components (Goudie 2006; Prinsen et al. 2012). • Line inspections should be ongoing for the operational life of the line.	
Residual Impacts	None	

Impact 5: Collisions of Birds with overhead powerline

Potentially Low. The risk of birds colliding with the overhead power line is not expected to exponentially increase as a result of this development as the proposed power line runs parallel to and in close proximity to the existing 275kV

line as well as the new 400kV line and therefore will not pose an altogether new risk to avifauna in the area.		
	Cumulative Contribution of Proposed Project	**Cumulative Impact without Proposed Project**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (24)**	**Low (14)**
Status	Negative	Neutral to Slightly Negative
Reversibility	High	
Irreplaceable loss of resources	No additional loss of resources expected	
Can impacts be mitigated?	Yes.	
Mitigation	• Mark sections of line in high sensitivity areas with anti-collision marking devices (diurnal and nocturnal diverters) to increase the visibility of the power line and reduce likelihood of collisions. Marking devices should be spaced 10 m apart, and must be installed as soon as the conductors are strung • These line marking devices include spiral vibration dampers, strips, Bird Flight Diverters, bird flappers, aerial marker spheres, ribbons, tapes, flags and aviation balls (Prinsen et al. 2012). • Construction of the power line in close proximity to the existing power line will reduce the cumulative impacts and collision risk. All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting 2002). • Line inspections should be ongoing for the operational life of the line.	
Residual Impacts	None	

5.3 Preferred VS alternative power line and substation options

Power Line Options

From an avifaunal perspective both power line options will have similar potential impact on the avifaunal character of the study area as these power lines traverse

very similar habitat types. The impacts for both options are mostly regarded as low and the collective impact of both power line options on the avifaunal character can be regarded as low. As such both options can be considered in the final layout.

Substation Options

Regarding the substation options the situation is slightly different than for the power line options, with the preferred option being the favourable of the two options. The preferred option will be constructed within a habitat type largely consistent with that which will be traversed by the proposed power line options and as such impacts will be contained in fewer habitat types, impacting on a potential lower number of avifaunal species.

On the other hand, the alternative substation will result in a longer power line and will be situated within an additional habitat type (A. karroo riparian thicket which is regarded as more sensitive in terms of avifauna habitat. Not only will the location pose a higher potential threat to an additional habitat but the alternative substation and additional power line may pose a potential threat to avifaunal species from adjacent habitat types (e.g. upper portion of the Olifantsloop watercourse, the sewage plant and dam located to the south of the town of Olifantsloop). The additional power line which will be the result of this substation will cross a potential important route used by water fowl and waders moving between the sewage plant and the dam to the south, subsequently posing a collision threat to these species.

Thus, from an avifaunal perspective the alternative option should not be considered. The preferred option is therefore considered to be the only viable option.

6 DISCUSSION AND CONCLUSION

The proposed Olifantshoek 132kV Power Line and Substation will have a minimal impact on avifauna due to the extensive spatial requirements of the development, the study area being mostly uniform in vegetation composition as well as avifaunal composition with small variation occurring between the different micro-habitats. Therefore, the proposed development is unlikely to have any long-term significant impacts on avifaunal species within the study area.

During the site survey a total of 92 bird species were recorded within the study area.

Endemic species recorded during the site survey included South African Shelduck (*Tadorna cana*), White-backed Mousebird (*Colius colius*), Ant-eating Chat (*Myrmecocichla formicivora*), Rufous-eared Warbler (*Malcorus pectoralis*), Southern Pied Barbet (*Turdoides bicolor*), Karoo Scrub Robin (*Cercotrichas caryphoeus*), Sickle-winged Chat (*Emarginata sinuata*), Marico Flycatcher (*Melaenornis mariquensis*), Bokmakierie (*Telophorus zeylonys*) and Sociable weaver (*Philetairus socius*).

Red listed species recorded within and around the development footprint area included White-backed Vulture - *Gyps africanus* (Endangered), Martial Eagle – *Polemaetus bellicosus* (Endangered), Red-footed Falcon – *Falco vespertinus* (Global: Near Threatened). Listed avifaunal species not recorded within the study area although highly likely to occur within the area include Kori Bustard - *Ardeotis kori* (Near Threatened), Secretary Bird - *Sagittarius serpentarius* (Vulnerable), Lanner Falcon – *Falco biarmicus* (Vulnerable) and Peregrine Falcon - *Falco peregrinus* (Near Threatened).

Investigation of the study area revealed the following important avian micro-habitats.

- *Acacia erioloba Woodland*
- *Tarchonanthus camphoratus – Acacia mellifera Woodland*
- *Acacia tortilis – Acacia mellifera Ridge*
- *Non-perennial watercourses*
- *Small depression wetlands*
- *Acacia karroo Thicket*
- *Artificial landscapes including:*
  a) Cleared servitude underneath the 275kV & 400kV power lines
  b) The 275kV power line & 400kV power line (currently under construction)
  c) Olifantshoek sewage works

The largest portion of the footprint area is covered by *A. erioloba* woodland. This is a highly varying habitat varying in terms of tree height, density and abundance. The most significant *A. erioloba* woodland is the dense patch of tall *A. erioloba* species found just south of the Olifantsloop River. This unit was relatively high in species diversity as well as abundance, comprising off more the 55 species of which 14 was near-endemic and 7 endemics. Potential red-data species associated with this habitat include Kori Bustard and Secretarybirds. Other noteworthy species include sociable weavers as well as their nests although only a few nests were noted within the natural veld with most nest located within the 275kV towers.

A relatively large portion of the footprint area is furthermore covered by *Tarchonanthus camphoratus – Acacia mellifera* habitat. This habitat is characterised by a shorter more open tree cover although *A. mellifera* may form small patches of relatively dense stands where overgrazing within this habitat has persisted over a long period of time. Although not as significant as the most of the *Acacia erioloba* woodland this habitat also houses a number of avifaunal species (more than 27 species). Especially the larger denser *A. mellifera* shrubs are utilised as nesting site by smaller passerines such as Pririt Batis, Cape Penduline Tit, Chestnut-vented Warbler and Scaly-feathered Weaver. Of the approximate 27 bird species noted, 11 were near-endemics and 5 endemics.

The *Acacia tortilis – Acacia mellifera* woodland is associated with shallower soils of the low ridges located south of the N14. This habitat was relatively species poor with only 11 species noted. Of these 11 species 5 species were near-endemics and 2 were endemics.

Two non-perennial watercourses will be traversed by the power line, namely the Olifantsloop River and the Ga-magara River. Whilst the broader Ga-magara River bed is characterised by an open, grassy vegetation cover, the smaller and more inconspicuous Olifantsloop River contains a few shrubs and tree species within the bed. Although, in terms of local species abundance these areas are relatively low (5 species), their wooded fringes comprise of a relatively high diversity of species (approximately 32 species). These watercourses furthermore fulfil an important role as migration corridors for some avifaunal species.

Small wetland depressions located with the larger environment are temporarily inundated following sufficient rainfall events and may provide important resources for some avifaunal species. The fringes of these depressions are normally characterised by thorny trees and shrubs providing potential nesting sites for smaller avifaunal species.

The *Acacia karroo* thicket will only be affected if substation option 2 (alternative option) is selected, although this is not preferred. This habitat is characterised by

a dense stand of relatively tall *A. karroo* trees fringing the upper parts of the Olifantsloop River. This unit provides valuable habitat for numerous species (more than 20 species), of which 4 species are near-endemics.

The towers of the 275kV power line are currently used by various raptors as perching sites three red data species; White-backed Vulture (Vulnerable), Martial Eagle (Vulnerable) and Red-footed Falcon (near-threatened). White-backed Vultures as well as the Martial Eagles use these towers as furthermore as roosting sites. Towers located along the southern portion of this power line (south of the Olifantsloop River and north of the N14) are also used by Sociable Weavers to construct their nests in.

Even though the Olifantshoek sewage plant is located outside of the investigated corridors, it is still worth taking into account especially the position of this permanent waterbody relative to the gravel dam located at the southern point of the town. These waterbodies provide habitat for water fowl and waders which may move between these waterbodies. If the alternative site substation is selected, the power line will extend across the potential flight path of these species and may result in some collisions. Subsequently, the preferred substation and power line options should be selected as this will mostly avoid this potential impact.

Most of the power line corridor alternatives traverse low sensitivity areas.

The dense *Acacia karroo* riparian thicket, 275kV power line traversing the dense *Acacia erioloba* woodland (just south of the point of crossing of the Olifantsloop River) as well as the portion of proposed power line that will be located close to the sewage works are all classified as medium sensitivity areas. The dense *A. erioloba* woodland have been classified as medium sensitive due to the diversity of avifaunal species as well as the potential for red data species such as Kori Bustards and Secretarybirds. The towers of the mentioned section of 275kV line traversing the dense A. woodland is utilised as perching and roosting sites by red data species such as White-backed Vultures, Marshal Eagles and Red-footed Falcons. The proposed power line corridor opposite the sewage works potentially crosses the flight path of water fowl and waders posing a potential collision risk.

The only High sensitivity areas identified are associated with the non-perennial watercourses and associated wooded fringes. This is due to the fact that such watercourses and their riparian fringes are normally associated with important migration corridors for avifaunal species.

The impacts associated with the development include displacement due to habitat loss and disturbance, electrocution of birds on overhead power line and substation, as well as potential collision with the power line. All of these impacts can be

successfully mitigated and subsequently the development is regarded as a low threat impact and will not significantly affect the avifaunal character of the area or pose a threat to red data species.

Both the power line corridor options traverse the same habitat types and subsequently will likely have the same impacts on the avifaunal character of the area (low impact). Thus, the power line option preferred from a technical perspective can by selected as the final preferred alternative.

The preferred substation site is also deemed, from an avifaunal perspective as the preferred option as this will exclude any impacts within the *Acacia karroo* thicket as well as shorten the proposed power line, reducing the risk to movements of water fowl and waders between the Sewage works and the gravel dam.

7 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. Draft report to Eskom Resources and Strategy Division. Johannesburg. South Africa.

Allan, D.G.1996b. Population structure and breeding habits of the Blue Crane *Anthropoides paradiseus* in the Western Cape Province and Karoo, South Africa. In Beilfuss R et al. (eds), *The African Crane and Wetland Training Workshop,* Maun, Botswana, 1993. International Crane Foundation pp. 355-376.

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

Goudie, R.I., 2006. Effects of power lines on birds. Harlequin Enterprises. St. John's, Newfoundland.

Harrison, J.A., Allan. D.G., Underhill, L.G., Herremans, M., Tee, A.J., Parker, V., Brown, C.J (eds). 1997. The atlas of southern African Birds. Vol. 1 & 2. BirdLife South Africa: Johannesburg.

Herholdt, J.J., Anderson, M.D. 2006. Observations on the population and breeding status of the African Whitebacked Vulture, the Black-chested Snake Eagle, and the Secretarybird in the Kgalagadi Transfontier Park. Ostrich 77, 127-135.

Hunting, K., 2002. A roadmap for PIER research on avian power line electrocution in California. California Energy Commission, California.

Jenkins, A.R., Smallie, J.J. & Diamond, M. 2010. Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. Bird Conservation International 20: 263-278.

Jenkins, A., Smallie, J. 2009. Terminal Velocity. End of the line for Ludwig's Bustard? Africa – Birds and Birding. 35 – 39.

Kagan, R.A., T.C. Viner, P.W. Trail, and E.O. Espinoza. 2014. Avian Mortality at Solar Energy Facilities in Southern California: A Preliminary Analysis. National Fish and Wildlife Forensics Laboratory.

King, D.I. & Byers, B.E. 2002. An evaluation of power line rights-of-way as habitat for early-successional shrubland birds. Wildlife Society Bulletin 30: 868-874.

Lehman, R.N., Kennedy, P.L. & Savidge, J.A. 2007. The state of the art in raptor electrocution research: a global review. Biological Conservation 136: 159-174.
Alexander, G. & Marais, J. 2007. *A Guide to the Reptiles of Southern Africa*. Struik Nature, Cape Town.

Maclean, G.L. 1999. Southern African endemic birds: Their distribution and conservation. Ostrich 69: Iss. 1-2.

Marnewick MD, Retief EF, Theron NT, Wright DR, Anderson TA. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.
Martin, G.R., Shaw, J.M. 2010. Bird collisions with power lines: Failing to see the way ahead? Biological Conservation. 2695-2702.

Mucina, L., Rutherford, M.C. & Powrie, L.W. (eds) 2006. Vegetation Map of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Prinsen, H.A.M., Smallie, J.J., Boere, G.C., Pires, N. 2012. Guidelines on how to avoid or mitigate impact of electricity power grids on migratory birds in the African-Eurasian region. Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) Conservation Guidelines No. 14.

Scott-Shaw, C.R and Escott, B.J. (Eds) (2011) KwaZulu-Natal Provincial Pre-Transformation Vegetation Type Map – 2011. Biodiversity Conservation Planning Division, Ezemvelo KZN Wildlife, P. O. Box 13053, Cascades, Pietermaritzburg, 3202.

Shaw, J.M., Jenkins, A.R., Smallie, J.J. & Ryan, P.G., 2010. Modelling power-line collision risk for the Blue Crane *Anthropoides paradiseus* in South Africa. Ibis 152: 590-599

Smit, H.A. 2012. Guidelines to minimize the impact on birds of solar facilities and associated infrastructure in South Africa. BirdLife South Africa, Johannesburg.

Van Rooyen, C.S. 2004a. 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.