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Mookodi Integration Project

Avifaunal Impact Assessment Report

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Checked by:	Shaun Taylor
For:	Eskom Distribution

Declaration of Independence

All specialist investigators specified above declare that:

- We act as independent specialists for this project.
- We do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2006.
- We will not be affected by the outcome of the environmental process, of which this report forms part of.
- We do not have any influence over the decisions made by the governing authorities.
- We do not object to or endorse the proposed developments, but aim to present facts and our best scientific and professional opinion with regard to the impacts of the development.
- We undertake to disclose to the relevant authorities any information that has or may have the potential to influence its decision or the objectivity of any report, plan, or document required in terms of the Environmental Impact Assessment Regulations, 2006.
- Should we consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and formally register as an Interested and Affected Party.

Terms and Liabilities

- This report is based on a short term investigation using the available information and data related to the site to be affected. No long term investigation or monitoring was conducted.
- The Precautionary Principle has been applied throughout this investigation.
- The specialist investigator, and the Endangered Wildlife Trust, for whom he/she works, does not accept any responsibility for the conclusions, suggestions, limitations and recommendations made in good faith,

based on the information presented to them, obtained from these assessments or requests made to them for the purposes of this assessment.

- Additional information may become known or available during a later stage of the process for which no allowance could have been made at the time of this report.
- The specialist investigator withholds the right to amend this report, recommendations and conclusions at any stage should additional information become available.
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- Acceptance of this report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

Signed on the 25th September 2012 by Andrew Pearson in his capacity as specialist investigator for the Endangered Wildlife Trust's Wildlife and Energy Programme.

Executive Summary

Eskom Holdings Ltd is proposing to construct numerous 132kV power lines, as well as two proposed substations (Kalplats and Bophirima), as part of the Mookodi Integration project, in the North West Province. SiVEST Environmental Division has been appointed to undertake an Environmental Impact Assessment for the proposed project and the Endangered Wildlife Trust (EWT) was subsequently appointed as an avifaunal specialist.

The proposed development passes through six relevant quarter degree squares (QDGS's), across which a total of 12 Red Data species were recorded, comprising 5 Vulnerable and 7 Near-threatened. The White and Abdim's Storks, which is not listed, but are protected internationally through the Bonn Convention on Migratory species, were also recorded. This avifaunal study used a set methodology as well as various data sets. The focal species for the study were determined, and then, by looking at the relevant species which could occur in the area, as well as assessing the availability of bird micro habitats, the possible impacts of the development were then assessed. In general terms, the impacts that could be associated with a project of this nature include: collision of birds with the overhead cables; electrocution; destruction of habitat; and disturbance of birds.

For Kalplats Substation to Existing Edwards Dam Substation route options, either alternative can be built, although alternative three is slightly preferred. For the Bophirima Substation to Kalplats Substation route options, either alternative can be built, although alternative two is slightly preferred. All of the proposed substation sites are acceptable from an avifaunal perspective. Therefore, the proposed power lines and substations can be built provided that the various mitigation measures recommended in this report are implemented. Electrocution (especially of African White-backed Vultures in the north of the study area) is a major concern, however, should bird-friendly monopole structures be used (as described in this report), this impact would be mitigated to acceptable levels. Collisions then would be expected as the largest impact of this project and thorough line marking is required to mitigate for this, regardless of which line alternative is chosen. An avifaunal walk through is recommended in order to identify the spans of line for marking to mitigate for bird collisions. Provided that the high risk sections of line are mitigated in the form of marking, the impact should be contained. Provided that a bird-friendly structure is used, as discussed elsewhere in the report, the impact of electrocution should be contained.

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MOOKODI INTEGRATION PROJECT

AVIFAUNAL IMPACT ASSESSMENT REPORT

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1 INTRODUCTION

1.1 Scope of the Study

The following terms of reference were utilized for this study:

- A review of literature and experience relating to power lines and bird interactions
- Mapping of sensitive areas
- Description of the affected environment and determine status quo
- Discussion of gaps in baseline data
- Identify and discuss avifaunal impacts, and rate them according to the specified methodology.
- Identify and provide provisional mitigation measures for each impact
- Identify and address any other aspects related to avifauna in the study.

1.2 Specialist Qualifications

Andrew Pearson is employed by the Endangered Wildlife Trust's Wildlife and Energy Programme as a specialist investigator for conducting avifaunal specific specialist reports. Andrew has a Four Year BSc in Conservation Ecology from the University of Stellenbosch, certificates in Environmental Law, as well as five years experience in the environmental management field. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information.

1.3 Assumptions and Limitations

The SABAP data covers the period 1986-1997. Bird distribution patterns fluctuate continuously according to availability of food and nesting substrate. For a full discussion of potential inaccuracies in SABAP data, see Harrison *et al,* 1997. In addition the relevant quarter degree squares have not been covered in very great detail (see the numbers of cards submitted in table 1) and as such there are likely to be more species than have been recorded in this table. This is acknowledged as a limitation and as such the precautionary principle has been applied to the finding in this report.

1.4 Legislative Context

Actions that are taken with regard to nesting birds on power lines could have legal implications. The legal position with regard to the protection of birds is governed primarily through the National Environmental Management Biodiversity Act 10 of 2004, its regulations (i.e. Threatened or Protected Species Regulations), various provincial ordinances and nature conservation acts, all of which broadly concur.

2 TECHNICAL DETAILS OF THE PROJECT

The following sections were (2.1- 2.3) were supplied by SiVEST and are not the words of the EWT

2.1 Site Location and Description

This project includes the construction of two (2) substations and five (5) separate 132 KV power lines, with a total length of approximately 110km. The primary power line runs from the proposed Bophirima Substation to Kalplats Substation in the North West Province and is approximately 89 km. The Kalplats-Edwards Dam Ring Extension will consist of an additional ±35km 132kV power line, to be stepped down to 88kV at Edwards Dam existing Distribution Substation. A detailed project and route description is provided in the sections below.

2.2 Technical Project Description

2.2.1 Project Components

The proposed project consists of a number of components which are listed below:

Substations:

- the proposed Bophirima 132/88kV Distribution Substation; and
- the proposed Kalplats 132kV Distribution Substation.

132kV power lines:

- the proposed Bophirima Substation to Kalplats Substation 132kV servitude power line (~89km);
- the proposed Kalplats Substation to the existing Edwards Dam Substation 132kV servitude power line to be stepped down to 88kV at the Edwards Dam substation (~35km);
- the proposed Bophirima Substation to existing Vryburg Municipal Substation 132kV servitude power line (~7km);
- the proposed Bophirima Substation to existing Woodhouse 132kV servitude power line (~0.1km – temporary line until the decommissioning of Woodhouse Substation); and
- the proposed Bophirima Substation to Mookodi Transmission Substation 132kV servitude power line (~14km)[+].

[+] It should be noted that the Mookodi Transmission Substation does not form part of the scope of this project, as environmental authorisation for the substation has been obtained as part of a separate EIA process. However, a single alignment for the Mookodi Transmission Substation site to the proposed Bophirima Substation Alternatives is included as part of the component of this proposed project.

2.2.2 Substations

The proposed substations will occupy an approximate area of 100m X 100m (~10,000m^2 or 1ha). The substations will consist of a number of different components, including feeder bays, transformers, a central control room, lightning conductor mast (14m-high) and a bunded oil drainage area (into which transformer oil / liquids would drain in the event of a spillage). The substation would be enclosed by two levels of fencing to secure the area. The substations will also be lit at night (by a number of 400 Watt floodlights) for security and emergency operational maintenance reasons. A number of power lines will typically enter / leave the substation.

2.2.3 Tower Types and Servitudes

It is proposed that both monopole structures (Figure 3) and lattice structures (Figure 4) will be used where appropriate. Single-tern conductor power lines are proposed. Monopole and lattice tower types that are bird-friendly will be used for the proposed power lines. The monopole tower type is approximately 25m in height. The footprint will be unique for each tower based on the ground conditions such as slope etc. A diagram of the proposed tower types are indicated below. Strain towers will also be used (A strain tower is a larger tower utilised in bends and where reinforcement is required with regards to tower stability).

In most cases the land beneath the overhead lines can be used, as normal, by the landowners. Eskom, however, require that no dwellings or vegetation/crops higher than 4m be established within the servitude.

The minimum servitude width for each line will be 31m.

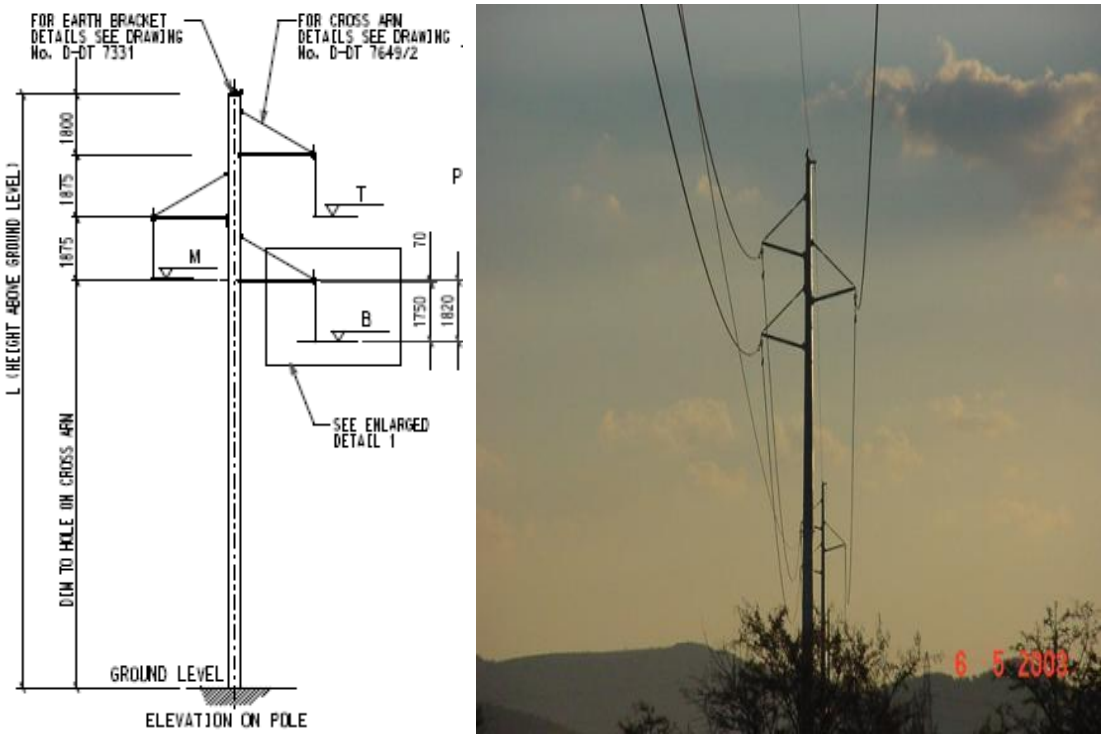

Figure 1: Proposed Monopole Structures

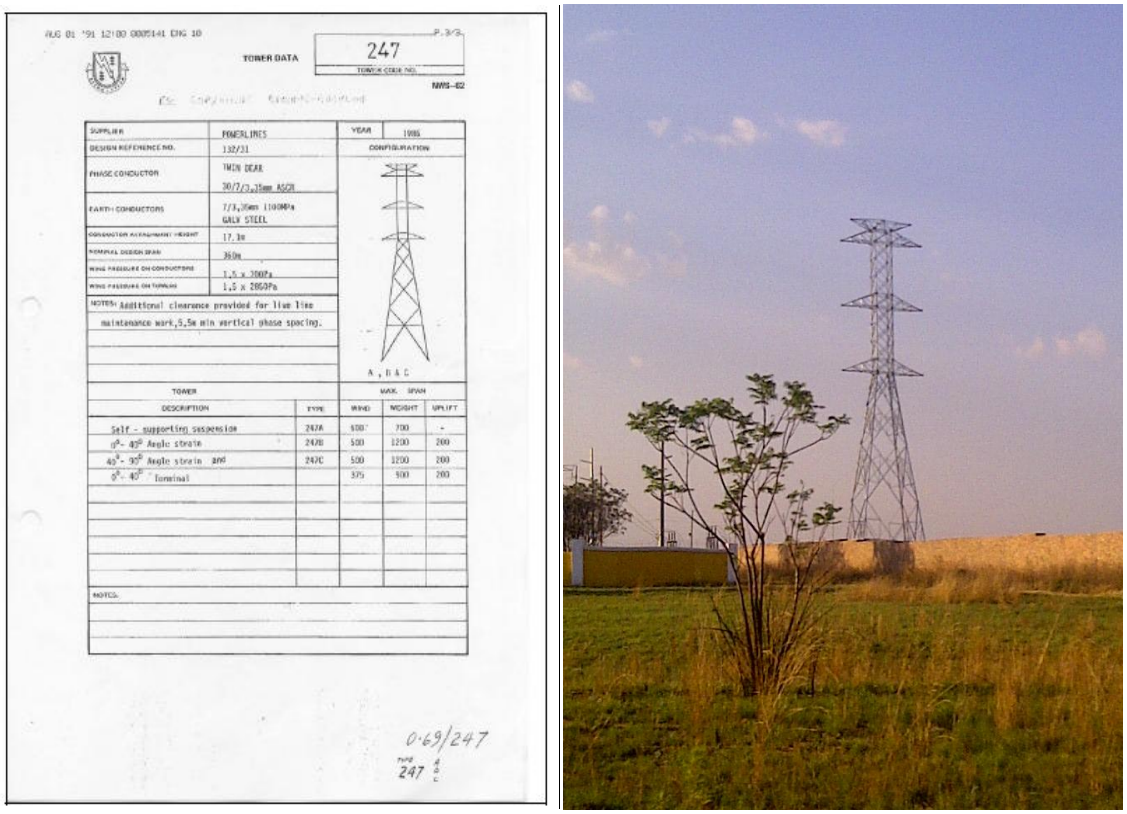

Figure 2: Proposed Lattice Structures

2.2.4 Assessment Corridor

A 300m-wide corridor is currently being investigated to allow some flexibility during construction, and to take any site-specific environmental sensitivities into account. The corridor will allow for numerous route alternatives within its width to potentially be selected, and thus forms part of the location alternative assessment. The 31m servitude will be placed within this corridor, unless the EIA studies identify the need to re-route the proposed alignment to avoid sensitive environmental or no-go areas.

2.3 Route Description

A number of proposed components have been included as part of the Mookodi Integration Project. These components are illustrated in the figures in Section 5.1 above and are described in detail below.

2.3.1 Proposed Bophirima Distribution Substation - Alternatives 1 and 2:

The general area of the proposed Bophirima Distribution Substation is located beyond the south-eastern outskirts of Vryburg close to the Bernauw smallholdings. The two substation alternative sites are located to the south of the R34 road, relatively close to the farmstead Constantia and the existing Woodhouse Substation. Alternative 1 and 2 are located in relatively close proximity to one another, with Alternative 1 being located immediately adjacent to the Woodhouse Substation and Alternative 2 being situated further to the south west from Alternative 1.

2.3.2 Proposed Kalplats Distribution Substation - Alternatives 1 and 2:

The general area of the proposed Kalplats Distribution Substation is located approximately 28.5km to the north of the town of Stella. The nearest settlement is the hamlet of Papiesvlakte located 8km to the south-east of the Alternatives locations. The two substation alternative sites are situated on agricultural land on the farm Gemsbokpan, to the west of the Môrester farmstead. Alternative 1 is located to the north of a district road, and Alternative 2 is located 500m to the south, on the southern side of the road.

2.3.3 Mookodi Transmission Substation to Bophirima Substation 132kV Power Line Route

The Mookodi Transmission Substation site is located approximately 6km to the south of the town of Vryburg, to the west of the N18 road on the farm Rosendal 673-IN. A single alignment for the 132kV lines that will link the Mookodi Transmission Substation and the proposed Bophirima Distribution Substation have been provided for assessment. The alignment runs from the Mookodi Transmission Substation site in a north easterly direction. It crosses the N18 road and a railway line, running in a north-easterly direction across open natural veld, passing north of the Georgia farmstead. The alignment then follows parallel to two existing distribution power lines in this area, as well as parallel to the initial section of the proposed Bophirima Substation to Vryburg Municipal Substation 132kV route alignment.

2.3.4 Bophirima Distribution Substation to Vryburg Municipal Substation 132kV power line route

From the proposed Bophirima Substation alternative sites the route of the proposed alignment runs to the south-west across open vacant land, running parallel to two existing distribution power lines and parallel to the alignment for the proposed Mookodi to Bophirima 132kV power line route. The route turns north west before an unsurfaced district road. The route runs parallel with the unsurfaced district road until it meets with the N14. The route then crosses the N14 and runs in a north westerly direction for approximately 400m before turning north east for a short distance of approximately 100m, and then turns to the north-west behind a BP filling station / truck stop-over complex. The alignment heads back towards the N14 and crosses the Leeuspruit wetland. The alignment then runs towards the Vryburg town centre running through a light industrial area. The proposed power

line will then run parallel to the N14 in the road reserve to where the existing Vryburg Municipal Substation is located.

2.3.5 Bophirima Distribution Substation to Kalplats Distribution Substation 132kV Power Line Route

Alternative alignments have been provided for comparative assessment along a part of the alignment to the north of the town of Stella. Both alternatives follow the same alignment between Vryburg (Bophirima) and Stella.

The route is proposed to exit the proposed Bophirima Substation, running north-east from the substation site and crossing the R34 road into the Bernauw smallholdings. The alignment crosses mostly open vacant grazing land in this area and is proposed to run parallel to a set of existing distribution power lines. To the south of the farmstead Helena, the alignment turns and runs in a north-westerly direction along a cadastral boundary between the farms Bernauw and Welgelegen. The alignment runs across open natural veld used for livestock grazing to where it crosses the N14 road near the farmstead Oppie Koppie. The route continues in a north-westerly alignment, crossing a railway, across open grazing land. The route intersects the Paradise unsurfaced local access road, running parallel to it before intersecting the N18 road.

To the north of this point the alignment turns to run parallel to the N18 in a north-easterly direction towards Stella. The alignment passes the Boereplaas Resort and the turn-off to Devondale, traversing the farms Elma, Thabanchu, Mabula, Weltevreden, Pan Plaats and Spitz Kop. The route traverses open veld and pastures which are used mainly for grazing through this area. Approximately 3km to the south of Stella the route turns away to the north-west from the N18, following a farm access road to the Chwaing farmstead. The alignment then moves away from the farm access road to follow a cadastral boundary, thus running to the east of the Chwaing farmstead. The route continues to run across open grazing pastures along the cadastral boundary of Zoutpansfontein to where it intersects with a local district road. The route turns to the north-east to run parallel to the road, then running across more pastures to the south of the Stroebelsrus farmstead. The route traverses the R377 (unsurfaced) road to the point where Alternative 1 and 2 split.

The proposed Bophirima Substation to Kalplats Substation Alternative 1 runs to the north east for a short distance along the boundary of the Farm Wilgemoed 344 consisting mainly of dry land maize cultivation before turning predominantly northwards. The proposed power line route runs through the farms Wilgemoed 344 (close to the Gelboer farmstead), Wonderklip 339 (close to the Waterval farmstead), and Koodos Rand near the Paardepan farmstead. The alignment traverses a mix of natural bushveld vegetation and cleared pastures and cultivated fields as it passes the farms Wonderklip and Koodoos Rand. From this point, the proposed route turns to the northwest, traversing a district road and the farm boundary of the Koodoos Rand and Gemsbok Pan for a relatively short distance. The proposed route then turns to the west where it eventually meets with the two proposed Kalplats Substation Sites.

Bophirima Substation to Kalplats Substation Alternative 2 leaves Alternative 1 to the north of Stella, running across maize fields before intersecting, and then running parallel to the R377 in a north-westerly direction. It crosses a mix of farming land (maize fields) and natural thornveld, traversing the farms Welgemoed, Koodoos

Dam, Blink Klip and Koodoos Rand. At the intersection of the R377 and a district road, the route turns away from the R377 in a northerly direction for a short distance before following the cadastral boundary of the farm Koodoos Rand to the north east. The route intersects the district road still running in a north easterly direction until meeting up with the Bophirima Substation to Kalplats Substation Alternative 1 where the proposed alignment follows the same route to the Kalplats Substation Sites.

2.3.6 Proposed Kalplats Substation Alternatives 1 and 3 to existing Edwards Dam Substation 132kV power line route

Alternative 1 exits the proposed Kalplats substation and heads west over agricultural/ cultivated land for approximately 3.7kms until it meets with a district road. The route then turns north, following the district road alignment across the farm Groot Gewaagd to Klip Pan, and then heads north-west towards Heeferslust. Just south of Heeferslust, the route turns west and then south-west following an existing power line servitude all the way to Edwards Dam situated adjacent to the Provincial Road R377. This last sector of the route travels across cultivated lands comprising the farms Heefers Lust, Kinderdam, Houmoed and Helpmekaar.

Alternative 3 exits the proposed Kalplats substation and heads west across the District Road following the alignment of a local road for approximately 2kms through agricultural land. The route then runs along the northern boundary of the farm Gemsbok Pan heading in a westerly direction where it then follows the Groot Verdriet 310 farm boundary until it meets up with the R377. The proposed route then follows the alignment of the Provincial Road R377 to Edwards Dam crossing the farms Bont Bok 259 and Helpmekaar.

3 ASSESSMENT METHODOLOGY

3.1 Methodology for Impact Assessment

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

3.1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 2. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

3.1.2 Impact Rating System

Impact assessment must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

- Rating System Used To Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 1: Description of criteria used in the rating of impacts.

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with

		intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).

4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY / MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.

4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to

		achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Table 2: Rating of impacts

IMPACT TABLE FORMAT	
Environmental Parameter	*A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water*
Issue/Impact/Environmental Effect/Nature	*A brief description of the nature of the impact that is likely to affect the environmental aspect as a result of the proposed activity e.g. alteration of aquatic biota The environmental impact that is likely to positively or negatively affect the environment as a result of the proposed activity e.g. oil spill in surface water*
Extent	*A brief description of the area over which the impact will be expressed*
Probability	*A brief description indicating the chances of the impact occurring*
Reversibility	*A brief description of the ability of the environmental components recovery after a disturbance as a result of the proposed activity*
Irreplaceable loss of resources	*A brief description of the degree in which irreplaceable resources are likely to be lost*
Duration	*A brief description of the amount of time the proposed activity is likely to take to its completion*
Cumulative effect	*A brief description of whether the impact will be exacerbated as a result of the proposed activity*
Intensity/magnitude	*A brief description of whether the impact has the ability to alter the functionality or quality of a system*

IMPACT TABLE FORMAT		
	permanently or temporarily	
Significance Rating	*A brief description of the importance of an impact which in turn dictates the level of mitigation required*	
	Pre-mitigation impact rating	
Extent	4	Extent
Probability	4	Probability
Reversibility	4	Reversibility
Irreplaceable loss	4	Irreplaceable loss
Duration	4	Duration
Cumulative effect	4	Cumulative effect
Intensity/magnitude	4	Intensity/magnitude
Significance rating	-96 (high negative)	Significance rating
Mitigation measures	*Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. Describe how the mitigation measures have reduced/enhanced the impact with relevance to the impact criteria used in analyzing the significance. These measures will be detailed in the EMP.*	

4 CURRENT STATUS QUO

An initial scoping study was carried out by Luke Strugnell of the EWT. Various sections of this study have been used below to describe the current status of avifaunal abundance as well as available microhabitats in the study area. An additional site visit was conducted in August 2011, and information gathered during this visit by the author, is also used below.

4.1 Vegetation and land use

The vegetation and land use maps presented below are not particularly helpful for a study of this magnitude. They have, however, been presented and used to assess the likelihood of a certain species occurring in the area.

This process follows the following steps:

1. Bird data is obtained from the South African Bird Atlas Project (SABAP) for the relevant quarter degree squares in which this study falls, as well as the SABAP2 Projects for the relevant Pentads.
2. The habitat data is then obtained from Roberts 7 for each species.
3. The below vegetation and land use maps are then consulted along with these habitat requirements and a "Likelihood of Occurrence" is given using our specialist knowledge and experience.

All of this data is presented in Table 3 under relevant bird populations below.

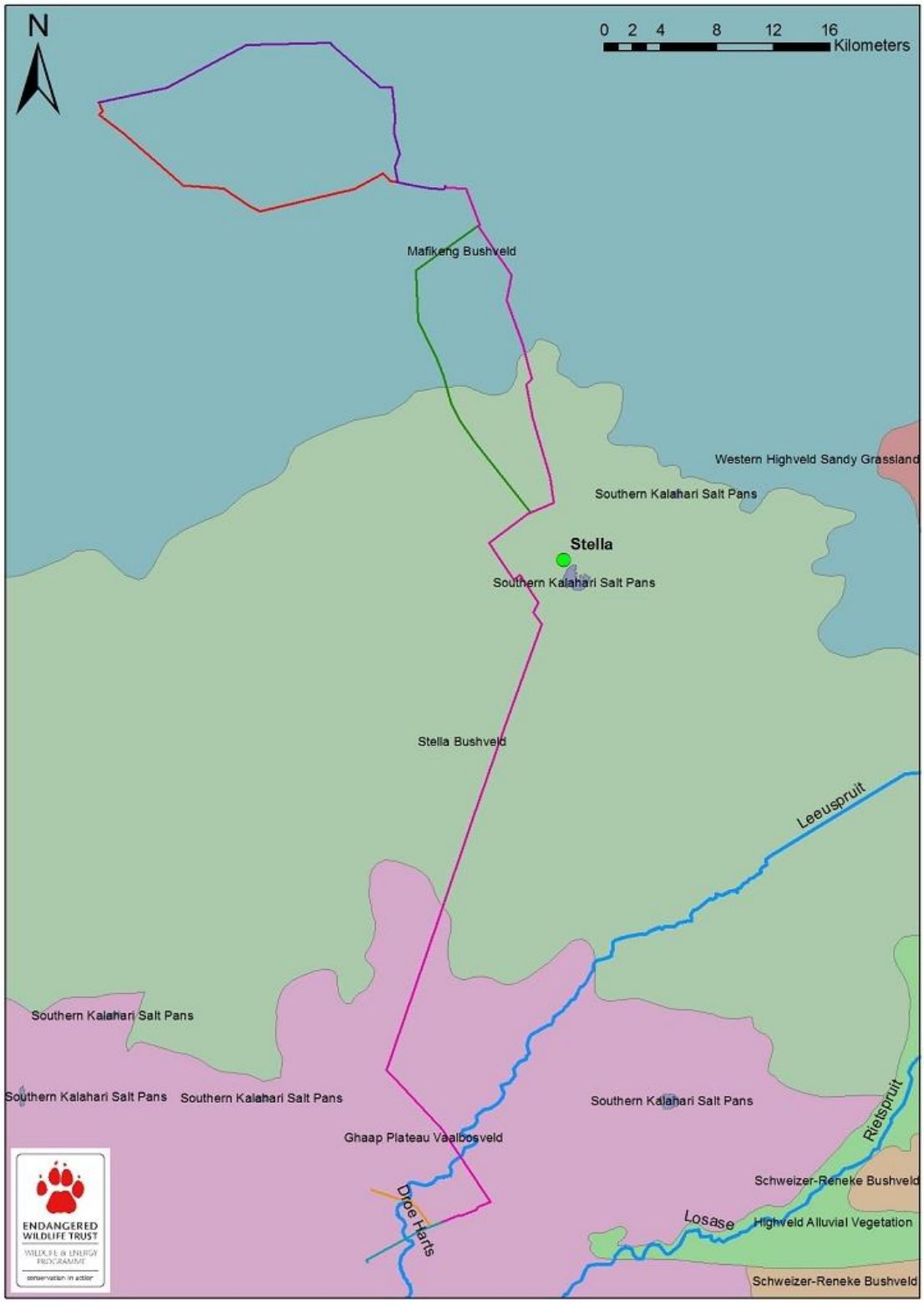

Figure 3: Vegetation classification (Mucina and Rutherford, 2006)

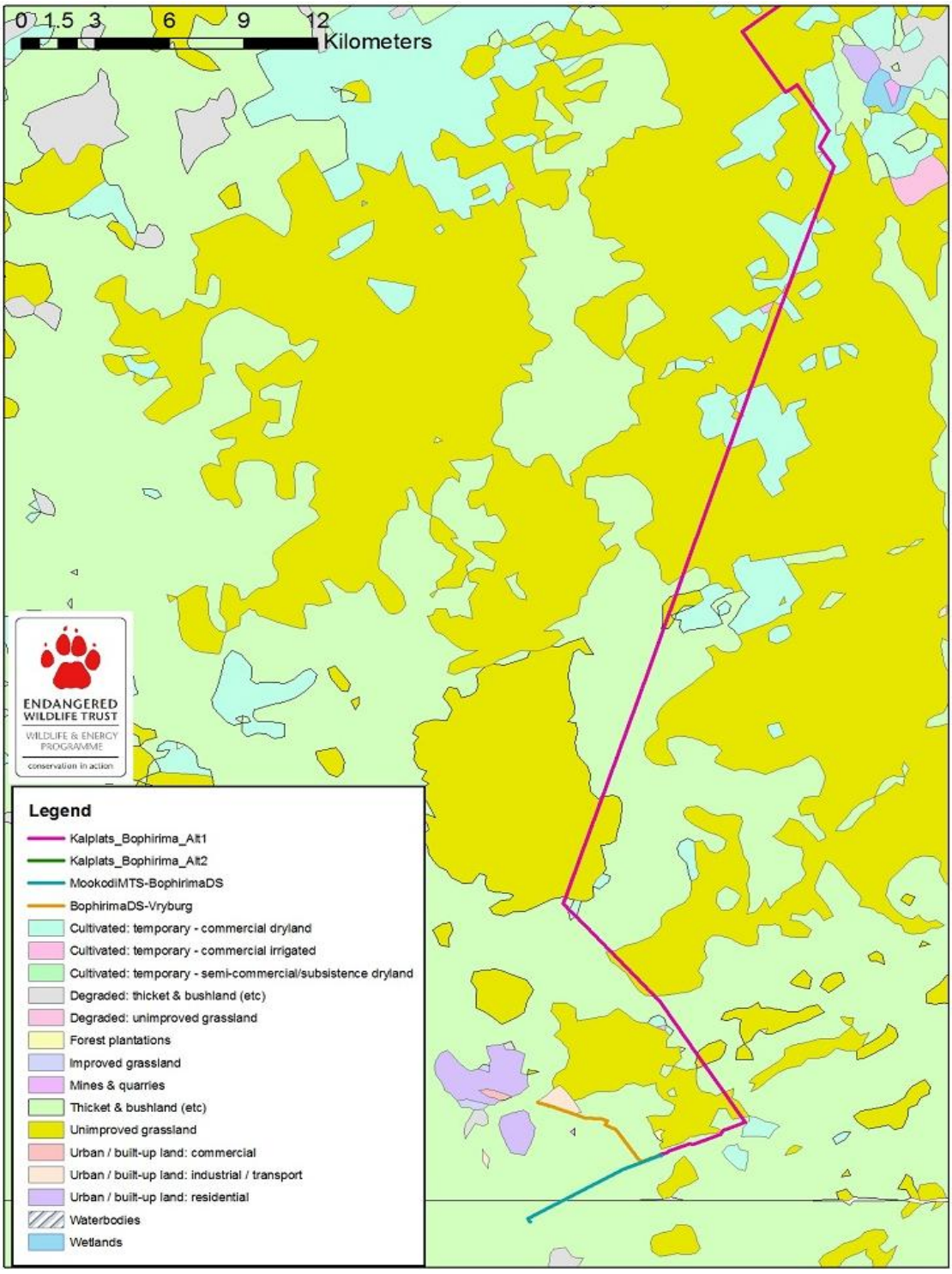

Figure 4**:** Land use in the south and central of the study area, and the proposed line routes (CSIR)

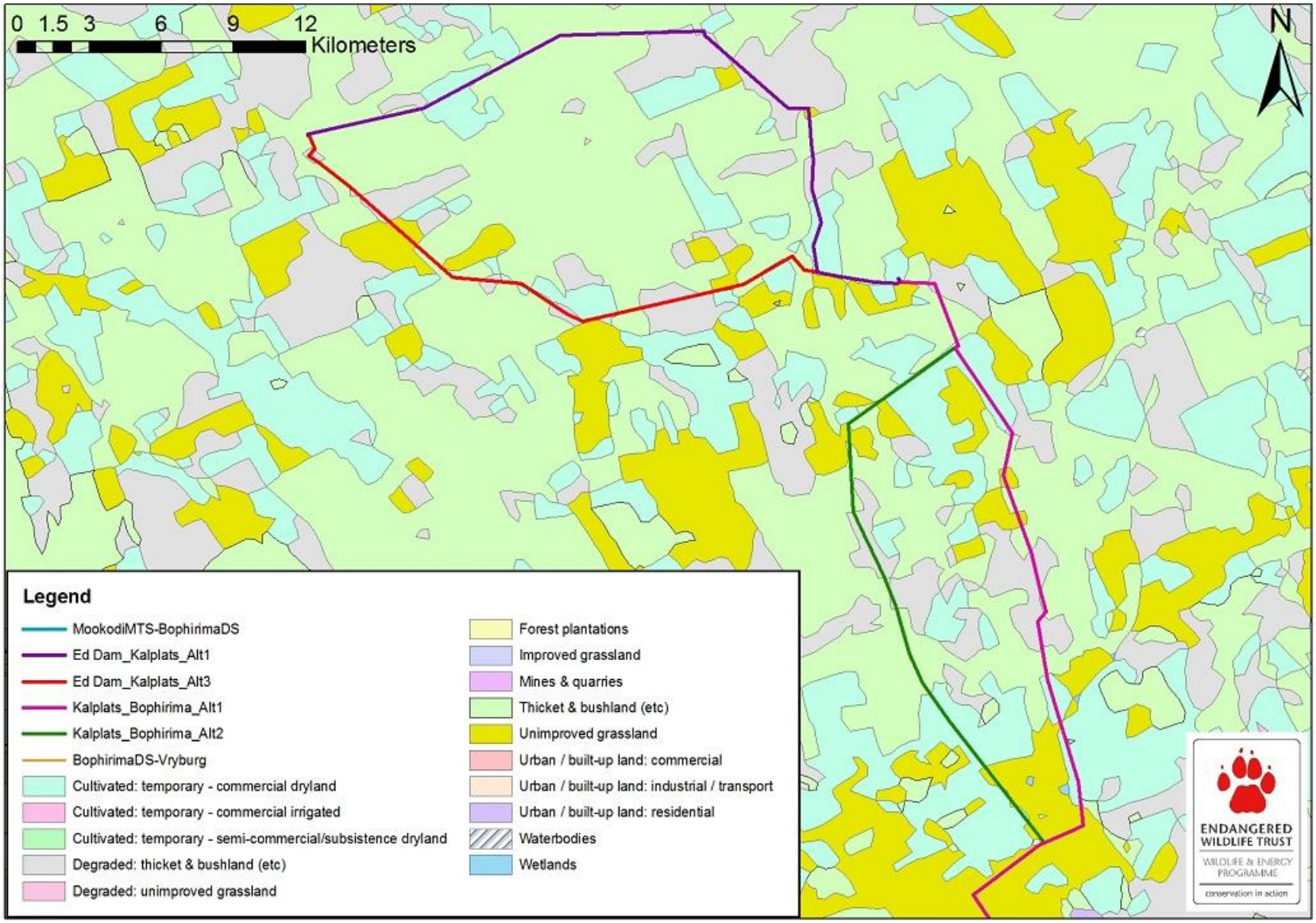

Figure 5: Land use in the Kalplats, Edwards Dam and Stella regions of study area (CSIR).

4.2 Micro-habitats

Perhaps more important than the vegetation and land use in the area is the micro-habitats that are available to birds. The following micro-habitats have been identified in this study area:

4.2.1 Grassland

As can be seen in the land use maps above, most of the area has been classified as unimproved grassland. Grassland is normally a very attractive micro-habitat attracting certain sensitive species in this area, for example Secretarybird, Blue crane, White stork and Abdims stork. Other birds that prefer this micro-habitat include korhaans, kestrels and bustards. The grassland micro-habitat is seen as one of the most sensitive for this project despite it being disturbed and degraded to some extent. Grassland appeared less disturbed in the north of the study area.

Figure 6: Grassland observed in the study area.

4.2.2 Woodland and Savanna

Figure 7: An example of a savanna habitat in the north of the study area, including both “grassy” and “woody” components.

Figure 8: Woodland Savanna

Figure 9: Two relatively common Woodland and Savanna species observed in the north of the study area, the Southern Yellow-billed Hornbill (left) and the Lilac-breasted Roller (right).

4.2.3 Wetlands

Wetlands are normally a very attractive micro-habitat for avifauna and in the area, are present in the form of salt pans and dams. These areas will definitely attract certain bird species and must be avoided where possible.

Figure 10: Large shallow wetlands and salt pans, such as that pictured above, are found in relatively close proximity to the site and may support a multitude of bird species. Note the group of Greater Flamingos circled in red.

4.2.4 Agricultural fields

There are a fair number of agricultural fields in the area, some of these are irrigated and some are dry land. The majority seem to be under maize cultivation. In terms of birds, agricultural fields can be very attractive at certain times. This is also dependant on what crops are planted. For example Lucerne will attract a number of species, including White storks, Secretarybird, Abdims stork etc. Maize is usually not as attractive as Lucerne but should still be considered when assessing the various alignments. Species such as Blue Cranes and Kori Bustards have also been known to frequent agricultural fields.

Figure 11: Agricultural lands observed in the study area.

4.2.5 Rivers and drainage lines

Rivers in their true form represent important habitat for many species, including Black Stork and a variety of other water birds, while the wooded riparian habitat along the river may provide habitat for various species such as the Hamerkop, African Darter, various cormorants, kingfishers, bee-eaters, robin-chats and numerous smaller species. Rivers also represent feeding areas for fish eating raptors such as the African Fish Eagle. Rivers and drainage lines also represent important flight paths for many species. In this study area there are no significant, large rivers, however some smaller drainage lines are present on site. Although not always carrying water, these drainage lines may still serve as flight paths for several bird species.

Figure 12: The bridge over the “Leeuspruit” is close to the town of Vryburg and supports a large colony of South African Cliff Swallows (see flying birds circled in red).

Figure 13: The majority of the areas surrounding the town of Vryburg consists of disturbed grasslands, were the invasion of “thickets” is visible. This photograph was taken in the vicinity of the existing Woodhouse substation.

4.3 Relevant bird populations

The relevant bird populations that have been reported by the South African Bird Atlas Project can be found below in Table 1. In addition, the preferred habitat as well as likelihood of occurrence can be seen in the last two columns of the table. Report rates are essentially an expression of the number of times a species was recorded in a square, as a percentage of the number of times that square was counted. A report rate of 0 means that the species was recorded in the square, but at a very low frequency. It is important to note that these species could have been recorded anywhere in the square, and not necessarily in the exact study area

Table 3: Red Data species report rates for the quarter degree squares which cover the study area (Harrison et al, 97)

Total Cards		11	13	6	14	11	48		
Total Species		106	132	90	100	106	204		
Name	**Conservation status**	**2624BD**	**2624DB**	**2724BB**	**2624DD**	**2624BD**	**2624BC**	**Habitat**	**Likelihood of occurrence**
White-backed Vulture	VU	9	8			9	83	Savanna and bushveld	Likely
Lesser Kestrel	VU		23		7		31	Open grassveld, , usually near towns or farms	Possible
Kori Bustard	VU			17			29	Open plains of karoo, highveld grassland, Kalahari sandveld, arid scrub	Possible
Lappet-faced Vulture	VU						27	Savanna to desert	Possible
Martial Eagle	VU						10	Woodland, savanna	Possible
Yellow-billed Stork	NT		8		7			Mainly inland waters; rivers, dams, pans, floodplains	Possible
Lesser Flamingo	NT		15					Large bodies of shallow water, both inland and coastal; saline and brackish waters preferred	Unlikely
Secretarybird	NT		8	17			67	Semidesert, grassland, savanna, open woodland, farmland, mountain slopes	Likely
Black Stork	NT			17			2	Feeds in or around marshes, dams, rivers and estuaries; breeds in mountainous regions	Unlikely
Greater Flamingo	NT				21			Large bodies of shallow water, both inland and coastal; saline and brackish waters preferred	Possible
Lanner Falcon	NT						4	Mountains or open country from semidesert to woodland and agricultural land; also cities	Possible
Short-clawed Lark	NT						4	Open ground in semi-arid scrub	Possible
White Stork	Bonn		8			9	13	Highveld grasslands, mountain meadows, cultivated lands, marshes, karoo	Possible
Abdim's Stork	Bonn		8				21	Mainly highveld grassland; also semi-arid Kalahari (especially after rain), cultivated lands, inland waters	Possible

EN = Endangered; V = Vulnerable; NT = Near-threatened; Bonn = Protected Internationally under the Bonn Convention on Migratory Species.

4.3.1 Southern African Bird Atlas Project 2 (SABAP2)

SABAP 2 data for the pentads in the study area was examined, and it was found that the area is relatively poorly counted by this project at present (i.e. low numbers of cards have been submitted per pentad). Table 3 shows the report rates for species deemed relevant to the study, for selected pentads in the study area.

Table 4: Report rates from Southern African Bird Atlas Project 2, for relevant species

	Pentad Report Rate							
	2655_2440	**2645_2445**	**2630_2450**	**2620_2450**	**2620_2440**	**2615_2435**	**2615_2445**	**2610_2440**
No Cards	8	14	9	3	3	3	3	3
Total Species	132	128	123	104	55	76	99	86
White-backed Vulture						33.3%	33.3%	
Lesser Kestrel	12.5%	42.9%	11.1%					
Kori Bustard				33.3%				
Lappet-faced Vulture								
Martial Eagle								
Yellow-billed Stork								
Lesser Flamingo								
Greater Flamingo			77.8%					
Secretary Bird								*Incident-al*
Lanner Falcon								
Black Stork	12.5%							
White-Stork		7.1%						
Abdims Stork			11.1%					
Northern Black Korhaan	75%	78.6%	77.8%	100%	100%	66.7%	66.7%	100%
Red-crested Korhaan				66.7%			66.7%	33.3%
Brown Snake-eagle							33.3%	
African Fish Eagle							33.3%	

Interestingly, 5 of the red-listed species identified in the SABAP 1 data, have not been recorded in the SABAP 2 data for the pentads examined. They are: Lappet-faced Vulture, Martial Eagle, Yellow-billed Stork, Lesser Flamingo and Lanner Falcon. This however, does not necessarily mean that these species do not occur here, or that they have moved from the area, post SABAP1, but may merely be due to the low counting effort of the pentads. Although, it is still surprising as these are relatively conspicuous species. Species shown in bold are listed species, while the remainder are species of interest deemed relevant to the study.

4.3.2 Co-ordibated water bird Counts (CWAC), Co-ordinated Avifaunal Road counts (CAR) and Important Bird Areas (IBA's).

The site is not situated within or close to any CWAC sites or IBA's. Furthermore, there are no CAR routes that pass within close proximity to the site.

5 IMPACT ASSESSMENT

5.1 Background on Bird impacts with Electrical Infrastructure

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are the electrocution of birds (and other animals) and birds colliding with power lines. Other problems include: electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure; and disturbance and habitat destruction during the construction and maintenance activities associated with electrical infrastructure.

5.1.1 Electrocution

Electrocution of birds on overhead lines is an emotional issue as well as an important cause of unnatural mortality of raptors and storks. It has attracted plenty of attention in Europe, USA and South Africa (APLIC 1994; van Rooyen and 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).

5.1.2 Collision

Collision is the biggest single threat posed by power lines to birds in southern Africa (van Rooyen 2004). Collision refers to the scenario where a bird collides with the conductors or earth wires of overhead power lines. This occurs because the birds cannot see the cables whilst in flight. Most heavily impacted species are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines. Unfortunately, many of the collision-sensitive species are considered threatened (Red Data status) in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. These species have not evolved to cope with high adult mortality, with the result that consistently high adult mortalities over an extensive period could have a serious negative effect on a population's ability to sustain itself in the long or even medium term. It is therefore imperative to reduce any form of unnatural mortality in these species, regardless of how insignificant it might seem at the present moment in time.

5.1.3 Habitat destruction

During the construction phase and maintenance of power lines and substations, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the levelling of substation yards. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, through the modification of habitat.

5.1.4 Disturbance

During the construction and maintenance of electrical infrastructure, a certain amount of disturbance results. For shy, sensitive species this can impact on their usual daily activities, particularly whilst breeding.

5.1.5 Impact of the birds on the proposed power line

There are a number of mechanisms through which birds are able to cause electrical faults on power lines. In the case of a bird streamer induced fault, the fault is caused by the bird releasing a “streamer” of faeces which can constitute an air gap intrusion between the conductor and the earthed structure. Bird pollution is a form of pre-deposit pollution. A flashover occurs when an insulator string gets coated with pollutant, which compromises the insulation properties of the string. Bird nests may also cause faults through nest material protruding and constituting an air gap intrusion. Crows in particular often incorporate wire and other conductive material into their nests. When nests cause flashovers, the nesting material may catch fire. This in turn can lead to equipment damage or a general veld fire. Apart from the cost of replacing damaged equipment, the resultant veld fire can lead to claims for damages from landowners.

5.2 Potential Impacts during Construction

The potential impacts on avifauna during the construction phase include destruction of habitat, as well as disturbance, and have been discussed above, and are rated in the tables below.

Table 5: Rating Matrix for the destruction of habitat during the Construction phase

IMPACT TABLE FORMAT	
Environmental Parameter	**Various bird species.**
Issue/Impact/Environmental Effect/Nature	**Destruction of habitat used by relevant bird species.**
Extent	*Site*
Probability	*Definite*
Reversibility	*Partly reversible*
Irreplaceable loss of resources	*Marginal Loss of resources*
Duration	*Long term*
Cumulative effect	*Negligible*
Intensity/magnitude	*Medium*

IMPACT TABLE FORMAT		
Significance Rating	*Negative Low Impact*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	2	2
Significance rating	**-26 (low negative)**	**-26 (low negative)**
Mitigation measures	Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff. It is difficult to mitigate properly for this as some habitat destruction is inevitable.	

Table 6: Rating Matrix for the disturbance of birds during the Construction phase

IMPACT TABLE FORMAT	
Environmental Parameter	**Various bird species.**
Issue/Impact/Environmental Effect/Nature	**Disturbance relevant bird species.**
Extent	*Site*
Probability	*Possible*
Reversibility	*Partly reversible*
Irreplaceable loss of resources	*No loss*
Duration	*Short Term*
Cumulative effect	*Negligible*
Intensity/magnitude	*Medium*
Significance Rating	*Negative Low Impact*

IMPACT TABLE FORMAT			
		Pre-mitigation impact rating	Post mitigation impact rating
Extent		1	1
Probability		3	2
Reversibility		2	1
Irreplaceable loss		2	2
Duration		2	1
Cumulative effect		1	1
Intensity/magnitude		2	2
Significance rating		**-22 (low negative)**	**-16 (low negative)**
Mitigation measures	Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff. It is difficult to mitigate properly for this as some disturbance is inevitable. **During Construction, if any of the Red-listed species identified in this report are observed to be roosting and/or breeding in the vicinity, the EWT is to be contacted for further instruction.**		

5.3 Potential Impacts during Operation

The potential impacts on avifauna during the operational phase include Electrocution, as well as Collision, and have been discussed above, and are rated in the tables below

Table 7: Rating Matrix for Electrocution during the Operation phase

IMPACT TABLE FORMAT	
Environmental Parameter	**Large raptors and vultures (e.g. African White-backed Vulture and Martial Eagle).**
Issue/Impact/Environmental Effect/Nature	**Electrocution of birds on the power lines and in the substations.**
Extent	*Site*
Probability	*Unlikely*
Reversibility	Completely reversible
Irreplaceable loss of resources	Marginal loss of resource

IMPACT TABLE FORMAT		
Duration	Long term	
Cumulative effect	Low Cumulative Impact	
Intensity/magnitude	High	
Significance Rating	*Negative Low Impact*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	4	2
Duration	3	3
Cumulative effect	2	1
Intensity/magnitude	3	3
Significance rating	-39 (Medium negative)	-27 (Low negative)
Mitigation measures	It is highly recommended that the steel monopole design be used and that this incorporates the standard bird perch. If this is the case then most raptors and birds of high electrocution risk will perch well above the conductors and out of harm's way. **In addition it is critical that all clearances between live and earth components are greater than 1.8 meters, as this is the dimension of the largest birds wing span. If this is the case then the impact of bird electrocution will be very minimal. The illustrations in Figures 1 and 2, do not clearly show whether or not this is the case.** Electrocutions in the proposed substation yard should not affect the sensitive bird species as they are unlikely to use the substation yards for perching or roosting. Should this become an issue the impact can be mitigated reactively using a range of insulation devices that exist and are approved by ESKOM.	

Table 8: Rating Matrix for Collision during the Operation phase

IMPACT TABLE FORMAT		
Environmental Parameter	**Large, heavy flying birds (e.g. Cranes, Storks, Flamingoes and Bustards)**	
Issue/Impact/Environmental Effect/Nature	**Collisions of birds with the earth wires**	
Extent	*Site*	
Probability	*Possible*	
Reversibility	*Partly*	
Irreplaceable loss of resources	*Marginal*	
Duration	*Long Term*	
Cumulative effect	Low	
Intensity/magnitude	High	
Significance Rating	*Negative Medium Impact*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	1
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	3	3
Significance rating	-39 (Medium negative)	-33 (Medium negative)

IMPACT TABLE FORMAT	
Mitigation measures	Line routing is critical to mitigate for this and as such the power line route should avoid crossing any highly sensitive microhabitats, for example wetland, dams, rivers, etc. Fortunately on this project there are very few areas of large concern and there are also existing power lines that the proposed new line will follow. It is best practice to follow any existing lines as electrical infrastructure grouped together generally mitigates for the impact of collision by making the lines more visible. Mark the identified sections of line with anti collision marking devices on the earth wire to increase the visibility of the line and reduce likelihood of collisions. Marking devices should be spaced 10m apart. **The sections of line that pose a concern and require marking should be finalised in a site "walkthrough" by EWT once final route is decided and towers/pylons pegged.**

5.4 Confidence in Impact Assessment

The Impact assessment contained in this report, has been conducted with a moderate level of confidence. Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behavior can not be reduced to formulas that will hold true under all circumstances. However, power line impacts can be predicted with a fair amount of certainty, based on experience gained by the EWT through the investigation of hundreds of localities in southern Africa where birds have interacted with power lines since 1996.

6 MITIGATION MEASURES

The mitigation measures, for both construction and operational phase impacts, have been discussed in the Impact tables elsewhere in this report. A summary of the proposed measures is given below.

6.1 Construction

Habitat Destruction

- Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff.
- Only the required servitude areas should be cleared.
- Choosing the shortest route option will also help to minimize this impact.

Disturbance

- Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff.
- During Construction, if any of the Red-listed species identified in this report are observed to be roosting and/or breeding in the vicinity, the EWT is to be contacted for further instruction.

6.2 Operation

Electrocution

- It is highly recommended that the steel monopole design be used and that this incorporate the standard bird perch.
- In addition it is critical that all clearances between live and earth components are greater than 1.8 meters, as this is the dimension of the largest birds wing span
- Electrocutions in the proposed substation yard should not affect the sensitive bird species as they are unlikely to use the substation yards for perching or roosting. Should this become an issue the impact can be mitigated reactively using a range of insulation devices that exist and are approved by ESKOM.

Collision

- Follow any existing lines as electrical infrastructure grouped together generally mitigates for the impact of collision by making the lines more visible.
- Mark the identified sections of line with anti collision marking devices on the earth wire to increase the visibility of the line and reduce likelihood of collisions.
- Marking devices should be spaced 10m apart.
- The sections of line that pose a concern and require marking should be finalised in a site “walkthrough” by EWT once final route is decided and towers/pylons pegged.

6.3 Achievability of Mitigation Measures

All of the proposed mitigation measures are relatively simple to achieve. Provided adequate funding is put towards mitigation, and that the avifaunal specialist is consulted where required, the proposed mitigations should reduce the likely impacts to acceptable levels.

7 ALTERNATIVES

All of the project alternatives have been described in detail in section 2 above, and are shown in the map in figure 14 below. The discussion that follows below, looks briefly at the alternatives again from an avifaunal perspective, and also presents notes taken by the specialist whilst on site.

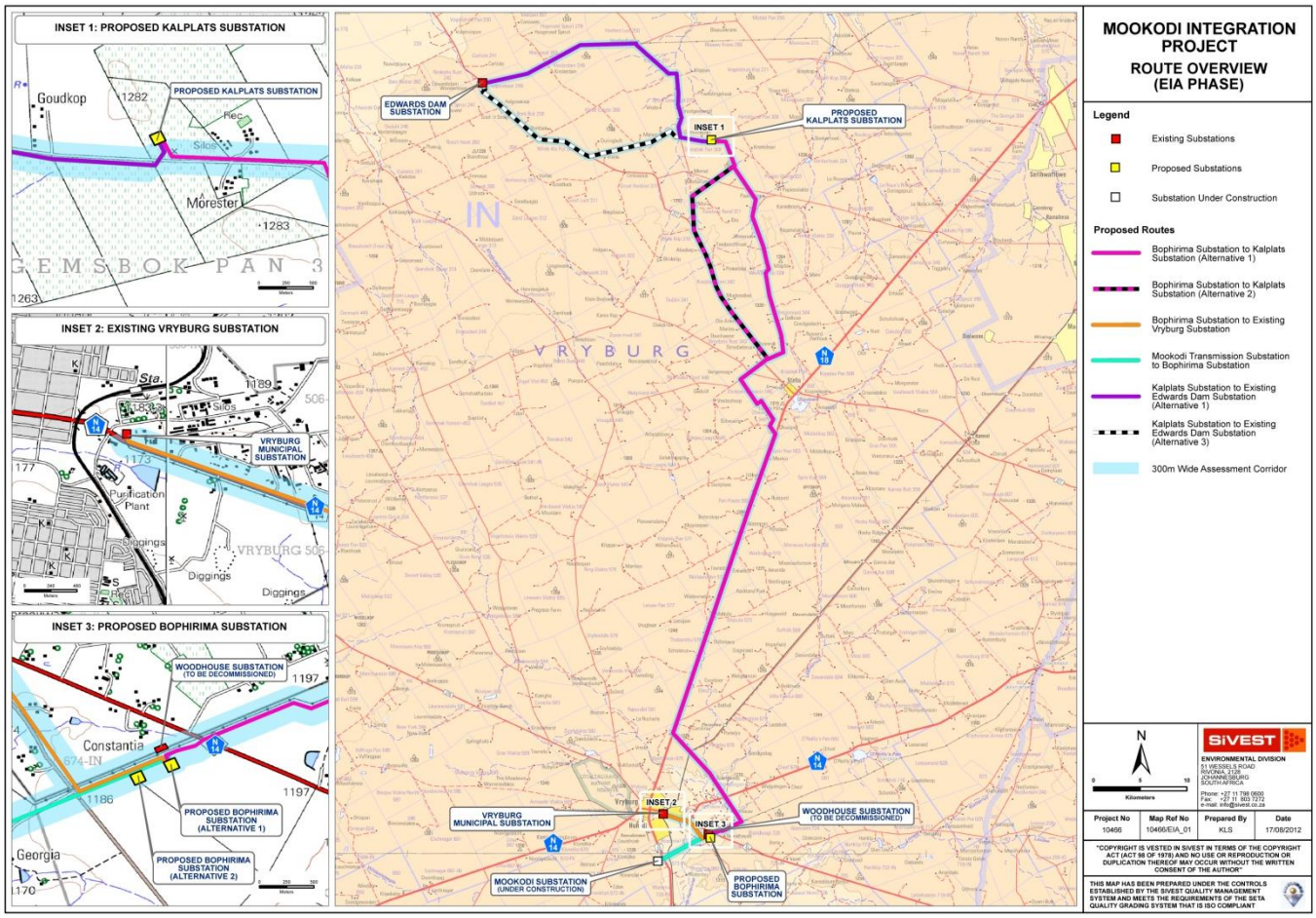

Figure 14: An overview map showing the various project alternatives (source: SiVEST)

Kalplats Substation to Existing Edwards Dam Substation

- Alternative 1
  - This is the more northerly route option
  - Follows existing roads for much of its length.
  - Area appears less disturbed, and better habitats available to birds (based on specialist opinion following the site visit).
  - Follows an existing HV power line for approximately 15km.
- Alternative 3
  - More southerly route option
  - Follows existing roads for much of its length
  - Follows existing MV power lines, as well as Telkom lines for much of its length
  - **Alternative 3 is slightly preferred to alternative 1.**

Bophirima Substation to Kalplats Substation

- Alternative 1
  - Shares the same routing as Alternative 2 for the majority of its length.
  - North of Stella, this option runs more to the east.
- Alternative 2
  - Shares the same routing as Alternative 1 for the majority of its length.
  - North of Stella, this option runs more to the west.
  - North of Stella, it is associated with existing telephone lines and roads for much of its length.
  - **Alternative 2 is slightly preferred.**

Bophirima 132/88kV Distribution Substation

- Alternative 1
  - GIS examination of Land Cover (CSIR) shows this site to fall within "Thicket & Bushland (etc)". On the outskirts of Vryburg, close to R34 tar road. Is located immediately adjacent to the Woodhouse Substation.
- Alternative 2
  - GIS examination of Land Cover (CSIR) shows this site to fall within "Thicket & Bushland (etc)". On the outskirts of Vryburg, close to R34 tar road, slightly further south west of Alternative 1.
- **Either Alternative is acceptable from an avifaunal perspective**

Kalplats 132kV Distribution Substation

- Alternative 1
  - GIS examination of Land Cover (CSIR) shows this site to fall within "Cultivated:temporary-commercial dryland". It is situated in agricultural land on the farm Gemsbokpan, to the west of the Môrester farmstead, on the northern side of a district road.

- Alternative 2
  - 500m south of district Road, also just west of Môrester farmstead. Although GIS mapping shows the Land Cover (CSIR) of this site to be "Unimproved grassland", the site visit and Google earth examination found it to be extremely similar to Alternative 1.
- **Either Alternative is acceptable from an avifaunal perspective.**

Table 9: Alternatives assessment table.

Alternative	Preferred/Not preferred/ No Preference	Specialist Concerns	Fatal Flaws (Yes/No)
Bophirima Substation to Kalplats Substation Corridor Alternative 1	Not preferred	All potential impacts as discussed in sections 5.2 and 5.3. Vulture electrocution is of particular concern.	No
Bophirima Substation to Kalplats Substation Corridor Alternative 2	Preferred	All potential impacts as discussed in sections 5.2 and 5.3. Vulture electrocution is of particular concern.	No
Kalplats Substation to Existing Edwards Dam Substation Corridor Alternative 1	Not preferred	All potential impacts as discussed in sections 5.2 and 5.3. Vulture electrocution is of particular concern.	No
Kalplats Substation to Existing Edwards Dam Substation Corridor Alternative 3	Preferred	All potential impacts as discussed in sections 5.2 and 5.3. Vulture electrocution is of particular concern.	No
Bophirima Substation Alternative 1	No Preference	Electrocution in substation yard.	No
Bophirima Substation Alternative 2	No Preference	Electrocution in substation yard.	No
Kalplats Substation Alternative 1	No Preference	Electrocution in substation yard.	No
Kalplats Substation Alternative 2	No Preference	Electrocution in substation yard.	No

8 CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the large study area was found to be moderately sensitive for avifauna. For Kalplats Substation to Existing Edwards Dam Substation route options, either alternative can be built, although alternative three is slightly preferred. For the Bophirima Substation to Kalplats Substation route options, either alternative can be built, although alternative two is slightly preferred. All of the proposed substation sites are acceptable from an avifaunal perspective. Therefore, the proposed power lines and substations can be built provided that the various mitigation measures recommended in this report are implemented. Electrocution of birds such as African White-backed Vulture is of particular concern in the north, while collision of heavy flying birds such as Flamingos is possible throughout the site. Collisions are expected to be the largest impact of this project and thorough line marking is required to mitigate for this, regardless of which line alternative is chosen. An avifaunal walk through is recommended in order to identify the spans of line for marking to mitigate for bird collisions. Provided that the high risk sections of line are mitigated in the form of marking, the impact should be contained. The EWT, through its partnership with Eskom and ongoing international networking, is well aware of the room for improvement on the effectiveness of line marking devices. However, it is our view that currently available devices, although not 100 % effective, would provide an acceptable level of mitigation for this project. Provided that a bird-friendly steel lattice structure is used, as discussed elsewhere in the report, the impact of electrocution should be contained.

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