Nzhelele Transmission Substation and 400kV powerline from Nzhelele substation to Tabor Substation.

DRAFT AVIFAUNAL IMAPACT ASSESSMENT REPORT

24TH JANUARY 2013

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EXECUTIVE SUMMARY

Eskom propose to construct the new Nzhelele Transmission Substation and a new 400kV powerline from Tabor Substation to Nzhelele substation in the Limpopo Province, South Africa. Lidwala Consulting Engineers 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.

In general terms, the impacts that could be associated with a project of this nature include: collision of birds with the overhead cables; destruction of habitat; and disturbance of birds. Electrocution is unlikely on a powerline of this size, although this is dependent on the pole structure used.

The various line options cover a large area, and the chosen route will be approximately 90- 100km long. It was found that the dominant vegetation types are all types of bushveld, and the Soutpansberg Mountain Range (which is a designated Important Bird Area), is an important feature of this study area. Numerous avifaunal microhabitats were identified and discussed. Sensitive areas were also found to be linked to mountains, ridges, streams, rivers and dams. South African Bird Atlas Data (SABAP1) recorded a total of 29 Red Data species in the study area, comprising 12 Vulnerable and 17 Near-threatened. The white Stork and Abdim's Stork, which are not listed, but are protected internationally through the Bonn Convention on Migratory species, were also recorded. SABAP 2 data for the study area was also examined, and the area was found to be very poorly counted in general. Following a site visit, and examination of all available data, the following species were identified as Focal Species for this study: Cape Vulture, Martial Eagle, Southern-Ground Hornbill, Kori Bustard, Black Stork, African Crowned Eagle, Marabou Stork, Abdim's Stork and White Stork. **Of particular concern is the Cape Vulture, as one of the proposed alternatives runs in close proximity to a large existing Cape Vulture Colony.**

Various route alternatives were discussed and it was found that the variation of Alternative 1 using both deviation options (Tab-Nzh1a & Tab-Nzh1b), as well as Alternative 2 (Tab-Nzh2), are the two preferred routings as long as mitigation as recommended by this report is implemented. Alternatives 4 and 5 are regarded as no-go options as they would result in the line passing close to the Cape Vulture Colony, as well as traversing large areas of sensitive, undisturbed habitat. The remaining alternatives are acceptable as long as mitigation as recommended by this report is implemented. Mitigation measures were proposed, the most important of which is the use of Line

Marking devises to prevent collisions. An avifaunal "walkthrough" in the EMP phase of the project was recommended to identify the exact spans requiring marking, once the final route has been decided and the tower positions have been pegged. It was concluded that, the proposed power line can be built provided that all the various mitigation measures recommended in this report are implemented.

DECLARATION OF INDEPENDANCE

Specialist Investigator

The Natural Scientific Professions Act of 2003 aims to "Provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP) and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith."

"Only a registered person may practice in a consulting capacity" – Natural Scientific Professions Act of 2003 (20(1)-pg 14)

Investigator:	Andrew Pearson (Pri.Sci.Nat)
Qualification:	BSc (hons) Conservation Ecology
Affiliation:	South African Council for Natural Scientific Professions
Registration number:	400423/11
Fields of Expertise:	Ecological Science
Registration:	Professional Member

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, 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.

Declaration of Independence

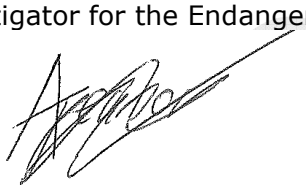
All specialist investigators specified above declare that:

- We act as independent specialists for this project.
- We consider ourselves bound by the rules and ethics of the South African Council for Natural Scientific Professions.
- 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, 2010.
- 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, 2010.
- 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.
- Information, recommendations and conclusions in this report cannot be applied to any other area without proper investigation.
- This report and all of the information contained herein remain the intellectual property of the Endangered Wildlife Trust.
- This report, in its entirety or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of the specialist investigator as specified above.
- Acceptance of this report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

Signed on the 24th January 2013 by Andrew Pearson in his capacity as specialist investigator for the Endangered Wildlife Trust's Wildlife and Energy Programme.



INTRODUCTION

Background

Eskom propose to construct the new Nzhelele Transmission Substation and a new 400kV powerline from Tabor substation to Nzhelele Substation in the Limpopo Province, South Africa. Various route alternatives have been proposed for the powerline, and all will be assessed in this study.

Lidwala Consulting Engineers has been appointed by Eskom Holdings SOC Ltd to undertake an Environmental Impact Assessment for the proposed project and the Endangered Wildlife Trust (EWT) was subsequently appointed as an avifaunal specialist. A scoping phase site visit to the study area was conducted from the 14th to the 16th of March, 2012. A follow up site visit in the EIA phase was conducted from the 12th -14th of November 2012. This second site visit included a comprehensive helicopter fly-over of all alternatives, and also assessed two additional alternative routes (alternatives 4 and 5), to the west, which was added following the scoping phase.

The avifaunal study used a set methodology (discussed elsewhere) as well as various data sets. The focal species for the study were determined, and then, by looking at the focal 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 and rated according to a set of pre-determined criteria supplied by Lidwala Consulting Engineers. In general terms, the impacts that could be associated with a project of this nature include: collision of birds with the overhead cables; destruction of habitat; and disturbance of birds. Electrocution is unlikely on a powerline of this size, although this is dependent on the pole structure used.

Figure 1: Google Earth map showing the general locality of the study area, indicated by the white polygon, in relation to major towns and roads.

Terms of reference

The following terms of reference were utilized for this study:

- Describe the current state of avifauna in the study area, outlining important characteristics which may be influenced by the proposed infrastructure or which may influence the proposed infrastructure during construction and operation.
- Identify Red Data species potentially affected by the proposed power lines and substation.
- Identify potential impacts (positive and negative, including cumulative impacts if relevant) of the proposed development on avifauna during construction and operation.
- Significance rating of potential impacts as per a pre-determined set of criteria (see Appendix B)
- Identify mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks.
- Identify information gaps, limitations and additional information required
- Ranking and identification of most and least suitable alternatives for the proposed project.
- Identify and address any other aspects related to avifauna in the study area that should be incorporated into the reports.

Methodology

In predicting the impacts of a proposed power line on birds, a combination of science, field experience and common sense is required. More specifically the methodology used to predict impacts in the current study was as follows:

- The various data sets discussed below under "sources of information" were collected and examined.
- The data was examined to determine the location and abundance of power line sensitive Red Data species as well as non-Red Data power line sensitive species in the study area.
- A desk top examination, using Google Earth imagery was done to compare alternatives.
- The area was visited, and thoroughly traversed, to obtain a first-hand perspective of the proposed routes and birdlife, and to determine which bird micro-habitats are present and relevant to the study. This involved driving the study area, taking photographs, and walking certain accessible areas, to see as much as possible of the proposed routes for the power line. An approximately 2hr long helicopter fly-over was also conducted on the 13th November 2012.
- The impacts of the proposed power line on birds were predicted on the basis of experience in gathering and analysing data on wildlife impacts with power lines throughout southern Africa since 1996 (see van Rooyen & Ledger 1999 for an overview of methodology), supplemented with first hand data. The significances of these impacts were then rated according to set criteria.
- Recommended mitigation measures for significant impacts were proposed.

Sources of information

The study made use of the following data sources:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP – Harrison, Allan, Underhill, Herremans, Tree, Parker & Brown, 1997) obtained from the Avian Demography Unit of the University of Cape Town, in order to ascertain which species occur in the study area.
- The Southern African Bird Atlas Project 2 data for certain pentads in the study area was examined.

- The conservation status of relevant all bird species was then determined with the use of The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Barnes, 2000).
- Data from the Co-ordinated Waterbird Count (CWAC) project was also consulted to determine whether any CWAC sites exist in the study area (Taylor, Navarro, Wren- Sargent, Harrison & Kieswetter, 1999).
- Data from the Co-ordinated Avifaunal Road count project (CAR – Young, Harrison, Navarro, Anderson & Colahan, 1997).
- The Important Bird Areas of southern Africa (IBA) project data (Barnes 1998) was consulted to determine its relevance to this project.
- A classification of the vegetation types in the study area was obtained from Mucina and Rutherford (2006).
- Information on the micro-habitat level was obtained through visiting the area on two separate occasions and obtaining a firsthand perspective.
- Electronic 1:50 000 maps were obtained from the Surveyor General.
- Satellite Imagery of the area was studied using Google Earth ©2012.

Limitations & assumptions

This study made the assumption that the above sources of information are reliable. The following factors may potentially detract from the accuracy of the predicted results:

- The SABAP-1 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 ASAB data, see Harrison, Allan, Underhill, Herremans, Tree, Parker & Brown, 1997).
- The two site visits were conducted in late summer and spring respectively, over which times various species may not have been present in the study area. No long term monitoring was conducted.
- During the site visit, it was not possible to access the entire length and all sections of all the proposed routes.
- Google Earth Imagery may not always reflect the true situation on the ground, as some images may be outdated.
- Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour 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 authors through the investigation of hundreds of localities in southern Africa where birds have interacted with power lines since 1996.

DESCRIPTION OF AFFECTED ENVIRONMENT

Study area vegetation and Land use

While this report is an avifaunal specialist report, vegetation and micro habitats are very important in determining avifaunal abundances and likelihood of occurrences. The large study are a van be roughly divided in to three zones, north of the Soutpansberg mountains, the Soutpansberg itself, and south of the Soutpansberg. Two maps have been produced below (Figures 2 and 3) showing the vegetation classification of the broader area (Mucina & Rutherford, 2006), divided in to north and south.

The dominant vegetation type in the south of study area is "Makhado Sweet Bushveld". A large element of "Tzaneen Sour Bushveld" lies to the east of the route alternatives. As one moves north of Makhado (Louis Trichardt), and in to the mountains, the dominant vegetation type is "Soutpansberg Mountain Bushveld". Elements of "Soutpansberg Summit Sourveld" and "Northern Mistbelt Forest" are also present in the mountains. The patches of Afromontane forest, up to 30–40 m tall, are found in valleys and moist basins, especially where south-facing. On the lower and middle slopes, sourish mixed bushveld dominates. The mountain peaks are covered with scattered clumps of *Protea* bushes. The eastern portion of the Soutpansberg has been extensively afforested with commercial timber plantations. Parts of the range are also used for subtropical fruit farming, mainly avocados, mangos, nuts and citrus. The eastern portion holds various forest reserves, including Timbadola Forest Reserve, Entabeni State Forest, Klein Australië Forest Reserve, Goedehoop Forest Reserve, Roodewal Forest Reserve and Hanglip State Forest, and the private Buzzard Mountain Retreat, 20 km west of Louis Trichardt. Most of these protected areas are partly afforested and partly covered by indigenous vegetation.

North of the Soutpansberg, as one descends towards the Limpopo River, the area is dominated by "Musina Mopane Bushveld" while patches of "Limpopo Ridge Bushveld" are also present.

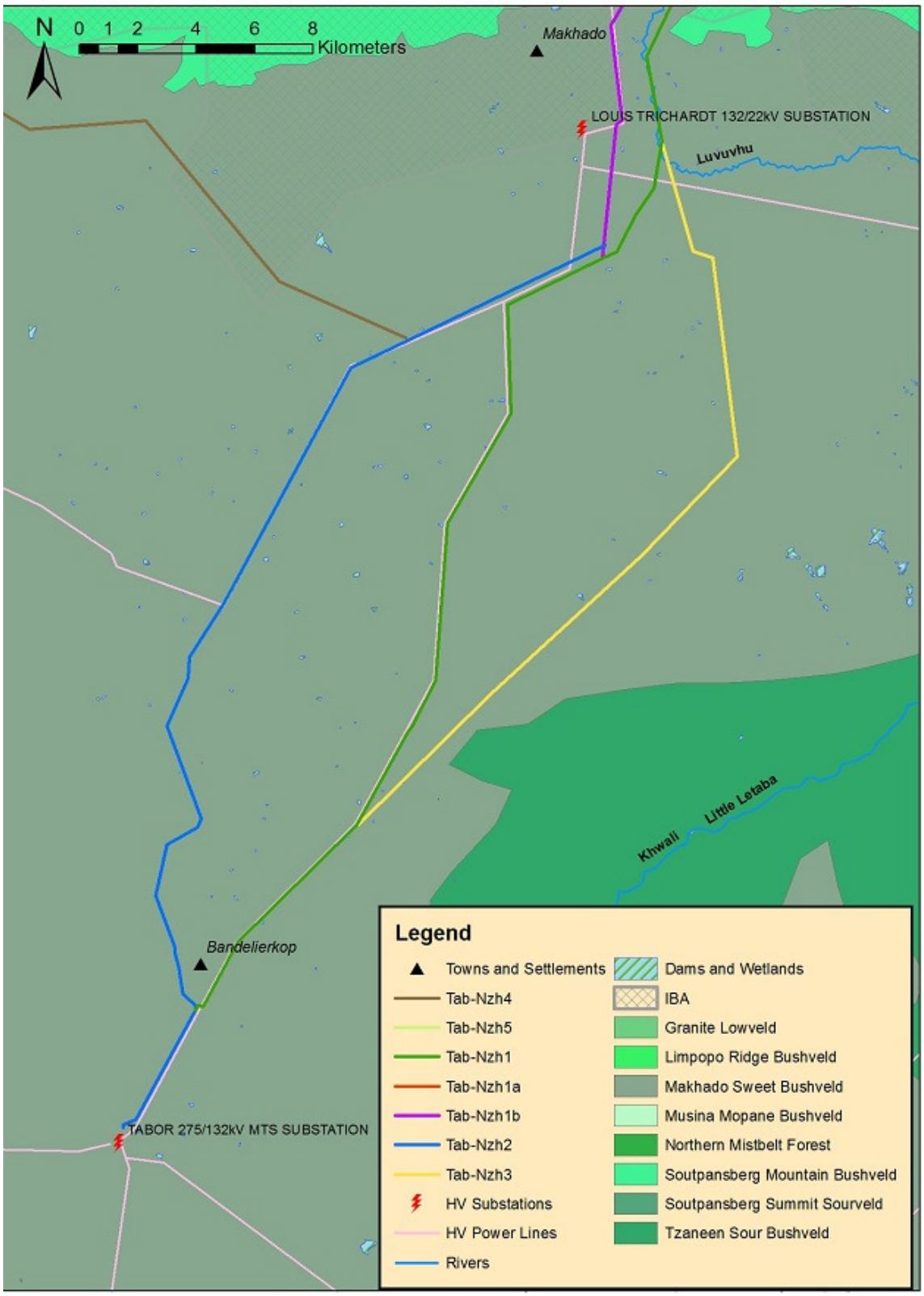


Figure 2: Map indicating the various line alternatives, as well as Towns, IBA's, Rivers and the vegetation classification for the south of the study area (Mucina & Rutherford 2006).

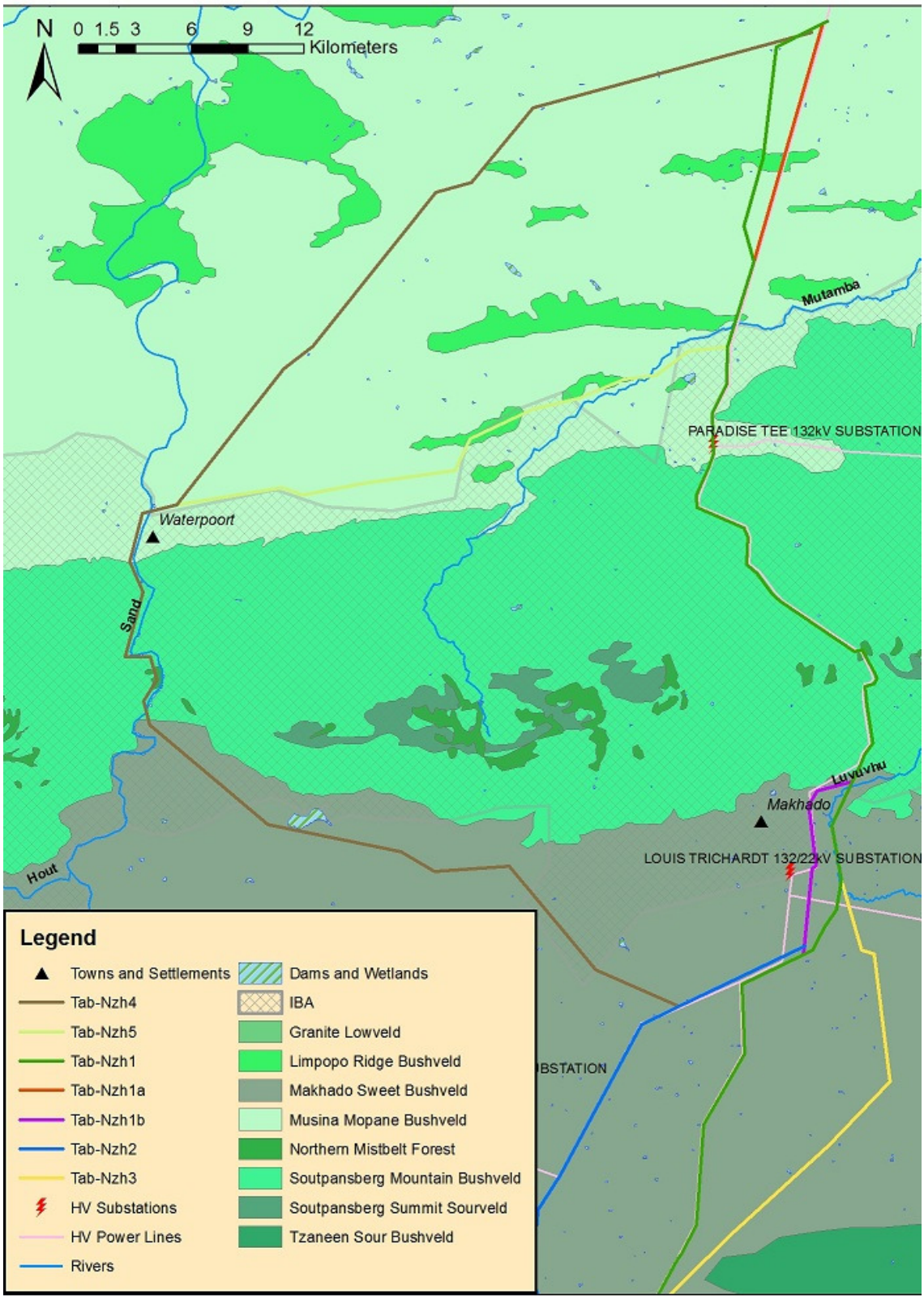


Figure 3: Map indicating the various line alternatives, as well as Towns, IBA's, Rivers and the vegetation classification for the north of the study area (Mucina & Rutherford 2006).

Bird micro habitats

In addition to the description of vegetation, it is important to understand the habitats available to birds at a smaller spatial scale, i.e. micro habitats. Micro habitats are shaped by factors other than vegetation, such as topography, land use, food sources and man-made factors. Investigation of this study area revealed the presence of the following bird micro habitats.

Undisturbed Bushveld:

As can be seen from Figures 2 and 3 above, the majority of vegetation types in the area are a type of "Bushveld". "Bushveld" is a term loosely applied to small-tree woodland found mostly below 1500m (Newman, 1996). It is mainly comprised of mixed trees and bushes 5-10m high. The plant species present are related to soil type but usually include both broad-leafed and thorn bushes, while the substrate is well grassed. Pristine Bushveld is normally rich in birdlife including both arboreal and terrestrial species. Various species may occur in this micro-habitat type including Martial Eagle, Bateleur, Cape Vulture, White-backed Vulture, Southern Ground Hornbill, Red-crested Korhaan, Kori Bustard and Secretarybird. This habitat type is also very important to physically smaller bird species, which are less likely to interact directly with the proposed power lines.

Figure 4: A large Baobab tree seen in relatively undisturbed bushveld within the broader study area.

Figure 5: Relatively undisturbed bushveld to the north of the Soutpansberg.

Disturbed Bushveld:

It is likely that the majority of Bushveld areas have been disturbed to a greater or lesser degree. Numerous private game or hunting farms are in the area, most of which are fenced creating habitat fragmentation, and many have roads, lodges or powerlines on them. Other areas of bushveld have been grazed by live-stock. These disturbed bushveld areas may contain relevant species as mentioned in the section describing undisturbed bushveld, however, they are likely to be more important to physically smaller bird species, which are less likely to interact directly with the proposed power lines.

Figure 6: Disturbed bushveld / Thornveld that has been grazed by livestock.

Mountains, Ridges and Cliffs:

Mountainous habitats are associated with the Soutpansberg in the centre of the study area. Here, many ridges, rocky cliff areas and ravines also present, especially associated with the river and various tributaries. The valleys and ravines have patches of forest (discussed below). The Mountainous areas represent a very distinct habitat type, most likely to be used by species such as the Black Stork, Peregrine Falcon, Verreaux's Eagle, African Crowned Eagle, Jackal Buzzard, Rock Kestrel, and Cape Vulture. The Soutpansberg Cape Vulture Colony is situated on a large cliff-face in the vicinity of Alternative Tab-Nzh 4. This colony was observed during the helicopter fly-over (Figure 8), as well as on foot by the author (Figures 9 & 10).

Figure 7: A rocky ridge and cliffs in the Soutpansberg, within the study area.

Figure 8: Location of the Soutpansberg Vulture colony is shown by the red circle, as observed during the fly-over.

Figure 9: View of the Soutpansberg Vulture Colony situated on a large cliff face. Note vultures soaring above.

Figure 10: Vultures perching on nest sites at the Soutpansberg colony on "Aasvoelkop".

Forest:

Patches of indigenous forest are present in the mountainous regions of the study area (see "Northern Mistbelt Forest" patches in Figure 2 above). This micro-habitat type will mostly be important to physically smaller bird species, which are less likely to interact directly with the proposed power lines, such as Doves, Cuckoos, Wagtails, Wood-peckers, Barbets, Fly-catchers, Wattle Eyes, Trogons, Turacos, Robin-chats, and Shrikes. The red-listed Orange Ground-thrush and Rosy-throated Twinspot may also be found in this micro-habitat. Of more concern to the project are larger species that may frequent indigenous forest patches, such as Bat Hawk, Martial Eagle and African Crowned Eagle. An African-Crowned Eagle nest was located during the site visit, near the Hangklip Forest Reserve, to the north of Louis Trichardt.

Figure 11: A small stream running through evergreen montane forest.

Forestry Plantations:

The eastern portion of the Soutpansberg has been extensively afforested with commercial timber plantations. Usually these consist of Gums, Pines or Wattles, closely planted allowing for little light penetration, and the ground is therefore devoid of cover. In general, plantations are unattractive to most birds although African Olive Pigeons, Doves, as well as Forest and Steppe Buzzards as well as Verreaux's Eagle may enter them. Narina Trogons may frequent the edges of pine plantations adjacent to evergreen forests. In summary then, plantations will mostly be important to physically smaller bird species, which are less likely to interact directly with the proposed power lines. They may, however, provide perching and roosting habitat for various raptor species, as well as larger birds such as francolins, Guineafowl and Hadeda Ibises.

Figure 12: Extensive forestry plantations are evident on the slopes of the Soutpansberg in the vicinity of Makhado.

Figure 13: Pine plantations in Hangklip Forest Reserve

Arable and/or cultivated lands:

Arable or cultivated lands can represent significant feeding areas for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources readily accessible to birds and other predators; the crop or pasture plants cultivated are often eaten themselves by birds, or attract insects which are in turn eaten by birds. In general, agriculture does not appear to be extensive in the study area, and this is likely to be a less significant

microhabitat. Small scale agriculture (see Figure 14 below) predominantly in the form of maize fields, is scattered throughout the area, while parts of the Soutpansberg are also used for subtropical fruit farming, mainly avocados (Figure 12), mangos, nuts and citrus. These fruit orchards are not likely to be important habitats for any of the larger focal species. Species such as Egyptian Goose, Hadeda Ibis, Black-shouldered Kite, Secretarybird, Abdim's Stork, and White Stork may be attracted to the other cultivated lands.

Figure 14: Evidence of small scale farming in the more rural settlements within the broader study area.

Figure 15: A centre pivot irrigation system being used on cultivated lands in the study area.

Figure 16: Avocado trees on a farm in the Soutpansberg.

Grassland Patches

Grasslands, in their true form, represent a significant foraging and/or hunting area for many bird species. Although the study area is not situated within the Grasslands Biome, grassland patches are present, as well as grassy savannah, were the grassy component is dominant over the woody component. Important bird species that may be found in these grassland areas of the study site are: Secretarybird, Marabou Stork, Northern Black Korhaan, Black-bellied Bustard, Southern Ground Hornbill, Kori Bustard, White Stork and Abdim's Stork. The grassland patches are also a favourite foraging area for game birds such as francolins and Helmeted Guineafowl, as well as being hunting and foraging habitat for raptors such as Cape Vulture, White-backed Vulture, Martial Eagle, Tawny Eagle, African Marsh Harrier, Lanner Falcon, Steppe Buzzard, Lesser Kestrel and Black-shouldered kite.

Figure 17: Relatively open and undisturbed grassland patch within the Ben Lavin Nature Reserve.

Wetlands and Dams:

Dams have become important attractants to various bird species in the South African landscape. Only a few small to medium sized man-made dams were observed during the site visit, however an examination of GIS maps and Google Earth imagery, showed many small to medium sized water-bodies in the area. Various waterfowl, such as Spur-winged geese, Egyptian geese, and numerous duck species, may frequent these areas and are vulnerable to collision with power lines. Various Storks may also frequent these water bodies, as well as fish eating raptors like the African Fish Eagle. In the context of this report, wetlands are defined as natural areas containing water permanently or seasonally. Wetlands may be frequented by Yellow-billed Stork, African Marsh Harrier, Coots, Grebes, Ducks, Geese, and African Spoonbills may make use of these areas.

Figure 18: One of the few large dams observed in the study area, seen from the helicopter during the fly-over.

Rivers or drainage lines:

Rivers in their true form represent important habitat for many species, including Black Stork, Yellow-billed 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. Rivers in the study area include the Sand, Mutamba, Nzehlele, and the upper reaches of the Luvuvhu (see Figures 2 and 3 above). Alternative Tab-Nzh 4 proposes to follow the Sand River "Poort" through the Soutpansberg Mountains (Figure 19). Numerous smaller drainage lines, some of which do not always carry water are also present on site. However, these drainage lines may still serve as flight paths for several bird species.

Figure 19: The Sand River, in the vicinity of the Soutpansberg, was predominantly dry at the time of the site visit.

Figure 20: The Mutamba River which was dry at the time of the site visit.

Table 1 below shows the micro habitats that each Red Data bird species (recorded in the SABAP1 data) typically frequents in the study area. It must be stressed that birds can and will, by virtue of their mobility, utilise almost any areas in a landscape from time to time. However, the analysis in Table 1 represents each species' most preferred or normal habitats. These locations are where most of the birds of that species will spend most of their time – so logically that is where impacts on those species will be most significant.

Relevant bird populations

Southern African Bird Atlas Project 1 (Harrison *et al*, 1997)

This data was collected over an 11 year period between 1986 and 1997. Although it is now quite old, it remains the best long term data set on bird distribution and abundance available to us at present. This data was collected on the basis of quarter degree squares, which is also a relatively large spatial scale. The species recorded in the relevant quarter degree squares could have been recorded anywhere within these squares and not necessarily on the exact site of the proposed developments. It does however provide a good indication of what could be found in the study area. Table 1 below Summarises data for red-listed species from these squares.

Table 1: Red Listed species recorded in the quarter degree squares covering the study area (Harrison *et al* 1997)

Species		**Report rate (%)**						**Micro habitat**
		2229DB	**2229DD**	**2329BB**	**2329BD**	2329BA	2330AA	
Total species		*233*	*231*	*337*	*245*	*322*	*334*	
Number of cards submitted		*14*	*23*	*113*	*39*	*39*	*140*	
Cape Vulture	VU	21	4	5	10	49	-	Savanna Woodland, Mountains and cliffs. Forages over grassland
White-backed Vulture	VU	21	-	4	31	3	-	Savanna woodland; Bushveld
Lappet-faced Vulture	VU	21	-	-	-	5	-	Open woodland
Martial Eagle	VU	21	-	1	3	13	4	Savanna, woodlands, semi-arid shrubland
Tawny Eagle	VU	7	-	1	-	3	-	Open Savanna woodland
Bateleur	VU	29	4	6	3	-	1	Woodlands
African Marsh Harrier	VU	-	-	1	3	-	2	Wetlands and grasslands
Lesser Kestrel	VU	-	-	-	-	-	1	Grasslands
Southern Ground Hornbill	VU	29	-	-	-	-	-	Savanna, Woodland; Grassland
Kori Bustard	VU	50	-	-	-	-	-	Savannah woodlands; Grasslands
Pink-backed Pelican	VU	-	-	-	-	3	1	Wetlands and Estuaries
African Finfoot	VU	-	-	-	-	-	4	Slow-flowing streams
Black Stork	NT	13	-	4	13	21	3	Rivers and Kloofs
Yellow-billed Stork	NT	-	-	-	-	8	1	Inland freshwater bodies; Estuaries
Lesser Flamingo	NT	-	-	-	-	-	1	Wetlands, saltpans
Black-bellied Bustard	NT	-	-	-	-	-	1	Open Grassland
African Crowned Eagle	NT	26	-	7	-	5	19	Forest, Dense Woodland
Secretarybird	NT	29	-	4	38	33	4	Grassland, arable lands
Peregrine Falcon	NT	7	9	4	3	5	-	Ridges and Cliffs; Savannah Woodland; Towns.
Lanner Falcon	NT	7	17	6	-	26	4	Woodlands; Grasslands and Exotic plantations
Pallid Harrier	NT	-	-	-	-	-	1	Woodland edges and Grasslands
Bat Hawk	NT	-	-	-	-	-	3	Dense woodland; Riparian forests; plantation edges
Red-billed Oxpecker	NT	7	-	4	21	3	-	Open woodland
Rosy-throated Twinspot	NT	-	4	-	-	-	-	Dense Scrub; Forest fringes
Orange Ground Thrush	NT	-	-	1	-	-	-	Evergreen Forests
Short-clawed Lark	NT	-	-	-	3	3	-	Dry grassland; *Acacia* savanna
Greater Painted Snipe	NT	-	-	-	-	3	-	Marshlands; wetlands
African Pygmy-Goose	NT	-	-	-	-	-	14	Permanent waters with water-lilies
Half-collared Kingfisher	NT	-	-	-	-	-	7	Coastal lagoons, Wooded streams
White Stork	Bonn	14	9	6	26	5	2	Grassland, arable lands, wetland, dams
Abdims Stork	Bonn	14	4	18	-	5	10	Grassland; Savana woodland; Cultivated fields

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

The report rates are essentially percentages of the number of times a species was recorded in the square, divided by the number of times that square was counted. It is important to note that these species were recorded in the entire quarter degree square in each case and may not actually have been recorded on the proposed site for this study.

A total of 29 Red Data species were recorded across all squares, comprising 12 Vulnerable and 17 Near-threatened. The white Stork and Abdim's Stork, which are not listed, but are protected internationally through the Bonn Convention on Migratory species, were also recorded. The most important of these species for this study are the Cape Vulture, White-backed Vulture, Martial Eagle, Bateleur, Southern-Ground Hornbill, Kori Bustard, Black Stork, African Crowned Eagle, Lanner Falcon, Abdim's Stork and White Stork. These species are historically all reasonably abundant in the area which has micro-habitat elements that may attract them, and/or are hugely vulnerable to impacts associated with overhead power lines in South Africa.

Southern African Bird Atlas Project 2

SABAP 2 data for the pentads (which are roughly 8km x 8km squares, and are smaller than the QDGS's used in SABAP1) in the study area was also examined. There area was found to be very poorly counted in general. Table 2 below shows selected pentads that had recorded relevant species, and shows the pentad number, number of counts, and number of species observed in that pentad, as well as the report rate for the relevant species.

Table 2: Relevant species recorded by SABAP2 in selected pentads, as of 24 January 2013.

Pentad	Counts	No. Species	Relevant species (% report rate)
2315_2950	2	61	Red-crested Korhaan (50%).
2305_2955	3	112	Black-chested Snake Eagle (33.3%); African Fish Eagle (33.3%).
2305_3000	17	156	Woolly-necked Stork (11.8%); Lanner Falcon (5.9%); Eurasian Hobby (5.9%)
2300_3000	16	145	African Crowned Eagle (62.5%); Buff-spotted Flufftail (12.5%); African Fish Eagle (6.3%).
2300_2955	2	99	Woolly-necked Stork (50%); African Fish Eagle (50%); African Crowned Eagle (50%).
2300_2950	7	140	Black-chested Snake-eagle (*incidental*); African Crowned Eagle (14.3%).
2255_2955	15	108	African Crowned Eagle (26.7%); Verreaux's Eagle (6.7%); Taita Falcon (*incidental*)

Interestingly, of the red listed species identified in the SABAP 1 data (i.e. Table 1), only two species (i.e. Lanner Falcon and African Crowned Eagle) were recorded in the SABAP 2 data for the pentads examined. This however, does not necessarily mean that the other species 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, or selective micro habitat counting by the SABAP2 field counters.

Coordinated Avifaunal Road-count (CAR) data

There are no CAR routes in the vicinity of the proposed project.

Coordinated Waterbird count (CWAC) data

There are no CWAC sites in the vicinity of the proposed project.

Important Bird Areas (IBA's)

Soutpansberg (SA003 / Global: ZA002)

This is an extremely large IBA of approximately 260 000ha in size, in compassing the Soutpansberg range of mountains. The Soutpansberg, an east–west trending mountain range, stretches some 130 km from 10 km west of Thohoyandou in the east to Vivo in the

west. Louis Trichardt lies in the centre of the range, below its southern slopes. The range rises around 700 m from the surrounding plains to form various spectacular peaks. To the north, the plains drop into the lowveld of the Limpopo valley. The Soutpansberg supports a large colony of Cape Vultures, located on three separate adjacent cliffs. The colony holds approximately 116 – 171 breeding pairs. The thick forest vegetation in the valleys and basins supports a small population of Cape Parrot, as well as African Crowned Eagle, Forest Buzzard, Knysna Turaco, Chorister Robin-Chat, Narina Trogon, Olive Bush-shrike, Green Twinspot and Forest Canary, while the Protea woodland is suitable for Gurney's Sugarbird. The rivers hold small numbers of African Finfoot, White-backed Night Heron and Pel's Fishing-owl.

Personal observations

Table 3 below, shows the sightings list of birds observed on site, during the two site visits (March and November 2012). Note that the table below is merely for indicative purposes, and this list represents incidental observations (which could be positively identified). Data from this table needs to be used with caution, as observations over such a short period cannot be taken as a true indication of the presence of all bird species in the area. In particular, the target species for this study are threatened, rare species, so the likelihood of seeing one during two three day periods is limited. This study has therefore attached far more weight to the secondary data sources such as the bird atlas project (Harrison et al, 1997) which collected data over a far longer period, and more diverse conditions.

It must be noted that many "non Red Data" bird species also occur in the study area and could be impacted on by the power line. Although this impact assessment focuses on Red Data species, the impact on non Red Data species is also assessed, albeit in less detail. Furthermore, much of the mitigation recommended for Red Data species will also protect non Red Data species in the study area.

Table 3: Birds observed during the Scoping and EIA phase site visits. Common names are listed in no particular order.

No.	Common Name	No.	Common Name
1	Black-headed Heron	37	Common Fiscal
2	Cattle Egret	38	House Sparrow
3	Hamerkop	39	Cape Weaver
4	Marabou Stork	40	Yellow-billed Hornbill
5	Abdim's Stork	41	Red-billed Hornbill
6	Hadeda Ibis	42	White-browed Scrub Robin
7	Egyptian Goose	43	Speckled Mousebird
8	Yellow-billed Kite	44	Long-billed Crombec
9	Black-shouldered Kite	45	Spotted Flycatcher
10	Swainson's Spur-fowl	46	Paradise Flycatcher
11	Pied Crow	47	Whitebrowed Sparrow-weaver
12	Crested Guineafowl	48	Red-billed Buffalo Weaver
13	Helmeted Guineafowl	49	Red-billed Firefinch
14	Red-knobbed Coot	50	Blue Waxbill
15	Blacksmith Lapwing	51	Cape Vulture
16	Speckled Pigeon	52	Black-chested Snake-Eagle
17	Wahlberg's Eagle	53	Bar-throated Apalis
18	Cape Turtle Dove	54	Chinspot Batis
19	Amur Falcon	55	Paradise Flycatcher
20	Black-collared Barbet	56	Martial Eagle
21	Cardinal Woodpecker	57	Crimson-breasted Shrike
22	Long-tailed Wagtail	58	White-crested Helmet-shrike
23	Brubru	59	Red-faced Mousebird
24	Lesser-Grey Shrike	60	Black-backed Puffback
25	White-bellied Sunbird	61	Brown-hooded Kingfisher
26	Emerald Spotted Wood-Dove	62	Pygmy Kingfisher
27	Dark-Capped Bulbul	63	Forest Buzzard
28	African Stonechat	64	Jackal Buzzard
29	Grey-Go Away Bird	65	Spotted Flycatcher
30	Barn Swallow	66	Whitebrowed Scrub-robin
31	European Bee-eater	67	Red-capped Robin-chat
32	Swallow-tailed Bee-eater	68	Black-crowned Tchagra
33	Little Bee-eater	69	Cape Wagtail
34	European Roller	70	Scarlet-chested Sunbird
35	Lilac-breasted Roller	71	Black-collared Barbet
36	Fork-tailed Drongo		

Figure 21: Marabou Storks observed near to a small dam, close to the town of Louis Trichardt.

Figure 22: A group of crested Guinaefowl was observed in the Ben Lavin Nature Reserve.

Focal Species List

Determining the focal species for this study, i.e. the most important species to be considered, is a four step process. Firstly, the micro-habitats available on site were identified. An analysis of the above existing avifaunal data represents the second step, i.e. which species occur historically in the area at significant abundances. The third step is to identify those species (which may be present based on the above two steps), and are more

likely to be impacted upon by the power-line and associated development. This step called on the vast experience of the EWT in evaluated and investigating electrical infrastructure impacts on birds (these impacts are discussed in more detail below). In general, large, heavy flying birds are more vulnerable to collision with over-head powerlines, while perching Raptors are more vulnerable to electrocution. The fourth and final step was to consider the species conservation status or other reasons for protecting the species. This involved primarily consulting the Red List bird species (Barnes 2000).

The resultant list of 'focal species' for this study is as follows: Cape Vulture, Martial Eagle, Southern-Ground Hornbill, Kori Bustard, Black Stork, African Crowned Eagle, Marabou Stork, Abdim's Stork and White Stork.

In many cases, these species serve as surrogates for other similar species (as mitigation will be effective for both), examples being Cape Vulture for White-backed Vulture, all the stroke species for Woolly-necked Stork, , as well as Martial Eagle for other large raptors such as Bateleur, Verreaux's Eagle, and African Fish Eagles. Assorted more common species will also be relevant to this study, but it is believed that the above target species will to a large extent serve as surrogates for these in terms of impact assessment and management.

ASSESSMENT OF IMPACTS

General description of impacts of power lines on birds

Because of its' size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines (Ledger 1983; Verdoorn 1996; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen & Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities.

Electrocutions

Electrocution of birds on overhead lines is 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 & 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). Electrocution is highly unlikely on 400kV power lines as the clearances are usually large; this however is dependent on the exact pole structure used**. For this study, it is assumed that a bird friendly structure will be used, and the detailed impact assessment and ratings below, is based on this assumption.** Therefore, the impact of electrocution is likely to be of low significance for the proposed power line.

Collisions

Collisions are the biggest single threat posed by over-head transmission power lines to birds in southern Africa (van Rooyen 2004). In general, large transmission lines with earth wires that are not always visible to birds can have the largest impact in terms of collisions. Most heavily impacted upon are korhaans, 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 (van Rooyen 2004, Anderson 2001). **Historical data (discussed above) shows that this study area may contain numerous species sensitive to collision**. Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term. Collision of certain large flying bird species such as Bustards, Korhaans, Ibises and Storks with the proposed lines that will be constructed in this project, is a real possibility.

Habitat destruction

During the construction phase and maintenance of substations and power lines some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes, as well as clearing vegetation at the substation site. 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 of the servitude through modification of habitat. Habitat destruction is anticipated to be of moderate to high significance in this study area.

Disturbance

Similarly, the above mentioned construction and maintenance activities impact on bird through disturbance, particularly during bird breeding activities. Disturbance of birds is anticipated to be of moderate significance.

MITIGATIONS

Potential mitigations for the identified impacts are shown below. A detailed rating of all the impacts has been done according to a pre-determined set of criteria (Appendix B), and this rating is shown in the tables in Appendix C. .

Construction Phase

Impact	*Mitigation*
Habitat destruction	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. It is important to ensure that the construction Environmental Management Plan incorporates guidelines as to how best to minimize this impact.
Disturbance	Strict control should be maintained over all activities during construction. It is difficult to mitigate properly for this as some disturbance is inevitable. **During Construction, if any of the "Focal 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.

Operational Phase

Impact	*Mitigation*
Collision	Mark the relevant sections of line, within the sensitivity zones, with appropriate marking devices. These sections of line, and the exact spans, will be finalised as part of the Environmental Management Programme (EMP) phase, once power-line routes are finalised and pylon positions are pegged.
Electrocution	**Structure dependent. TBC in EIA phase.**
Nesting of birds on Tower structures and disturbance during routine maintenance.	No nests may be removed, without first consulting the EWT's Wildlife and Energy Program (WEP). During maintenance, **if any of the "Focal 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.

SENSITIVITY ANALYSIS

In general the site has areas of low, moderate and high sensitivity in terms of avifauna, based on the occurrence of a number of listed species in the study area, as well as the various micro-habitats available to avifauna. There broader area appears more sensitive, in that more red-listed species have been recorded in the larger SABAP1 QDGS's, when compared to the pentads close to the site, and the line routes themselves tend to be near to human disturbances. The sensitive zones are mapped and described below. These were determined through the examination of sensitive micro-habitats available.

The sensitivity maps below (Figures 23 -26) show only areas where the proposed power line routes pass through an area/s of medium to high sensitivity. The maps are in order from north to south, and each show two features that have been buffered. These are the Rivers which have been buffered using GIS by 200m, and Wetlands (including dams), which have been buffered by 100m. The importance of these micro-habitats to avifauna has been discussed in earlier sections of this report. All of these Rivers and Wetlands, as well as the buffered zones around them, are regarded as Medium -High Sensitivity areas, and collision mitigation (as detailed in Table 4), is recommended for any new power lines that will run through these areas. The remaining areas outside of these buffer zones are designated as Low – Medium sensitivity, and it is unlikely that any collision mitigation will be required in these areas (although this is subject to change following the avifaunal "walkthrough" in the EMP phase of the project). Following the EIA phase site visit an additional sensitivity map (Figure 27) was created for the Soutpansberg area, and to include the additional Alternative

(Tab-Nzh 4). This map includes the same sensitivities as above as well as an additional feature, the Soutpansberg Vulture Colony, which has been buffered by 3km (high sensitivity zone) and 6km (medium sensitivity zone) respectively. Furthermore, general areas of concern, that will require additional examination in the EMP/walkthrough phase to determine mitigation requirements, have been indicated by red dotted polygons.

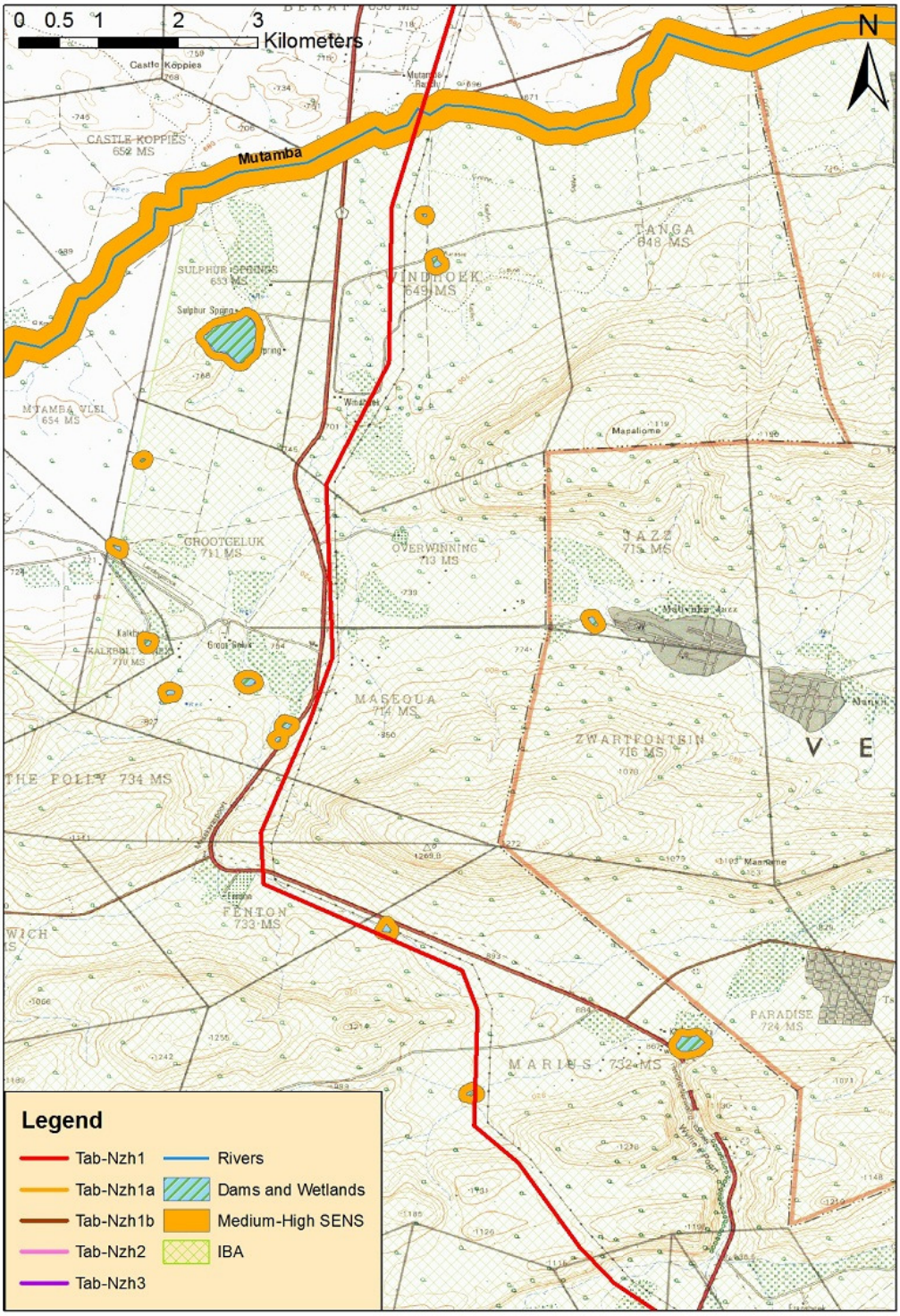


Figure 23: Sensitivity Map 1, showing areas of medium to high avifaunal sensitivity. The Mutamba River crossing is the main area of concern here.

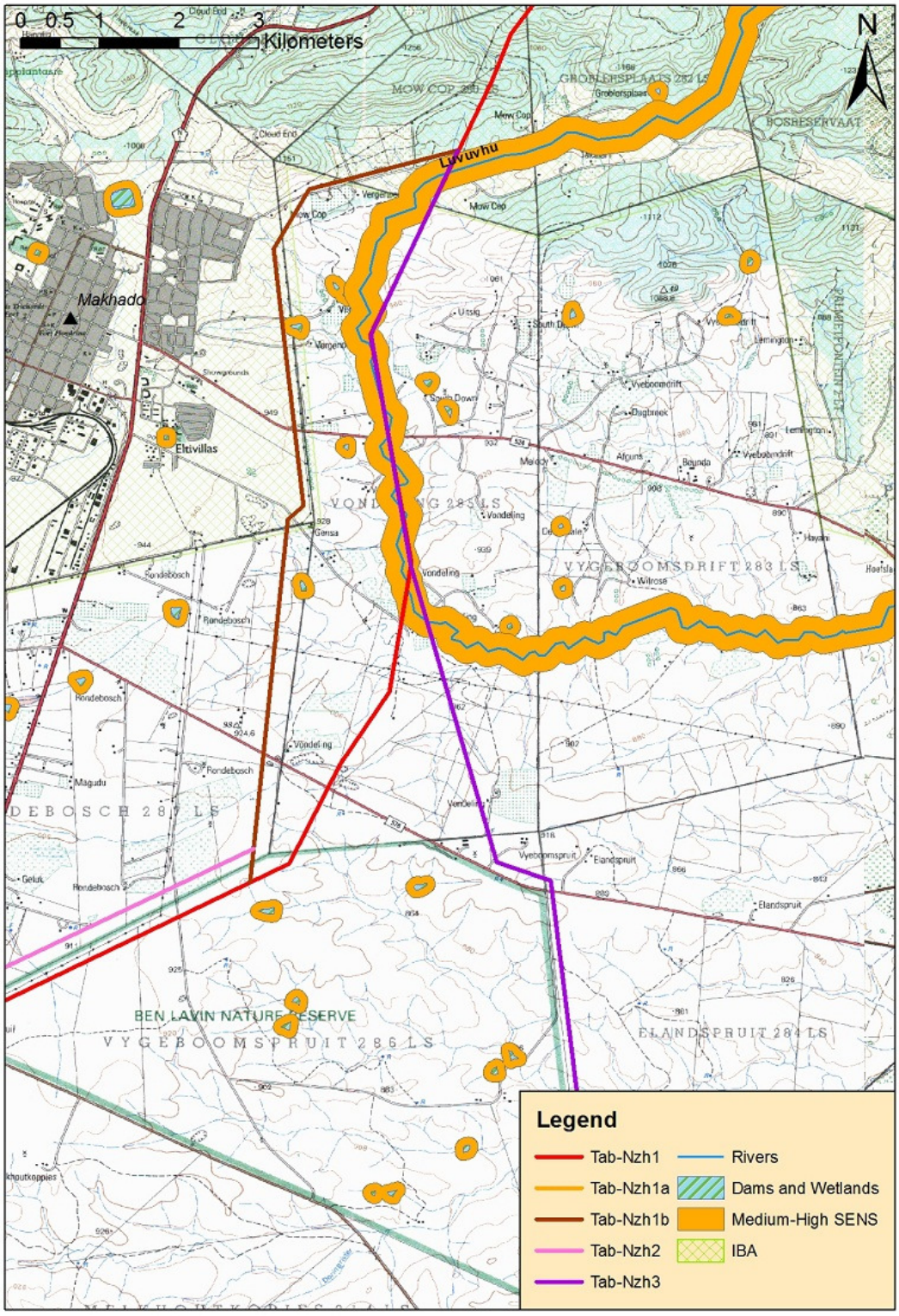


Figure 24: Sensitivity Map 2, showing areas of medium to high avifaunal sensitivity. The Luvuvhu River is the main area of concern here.

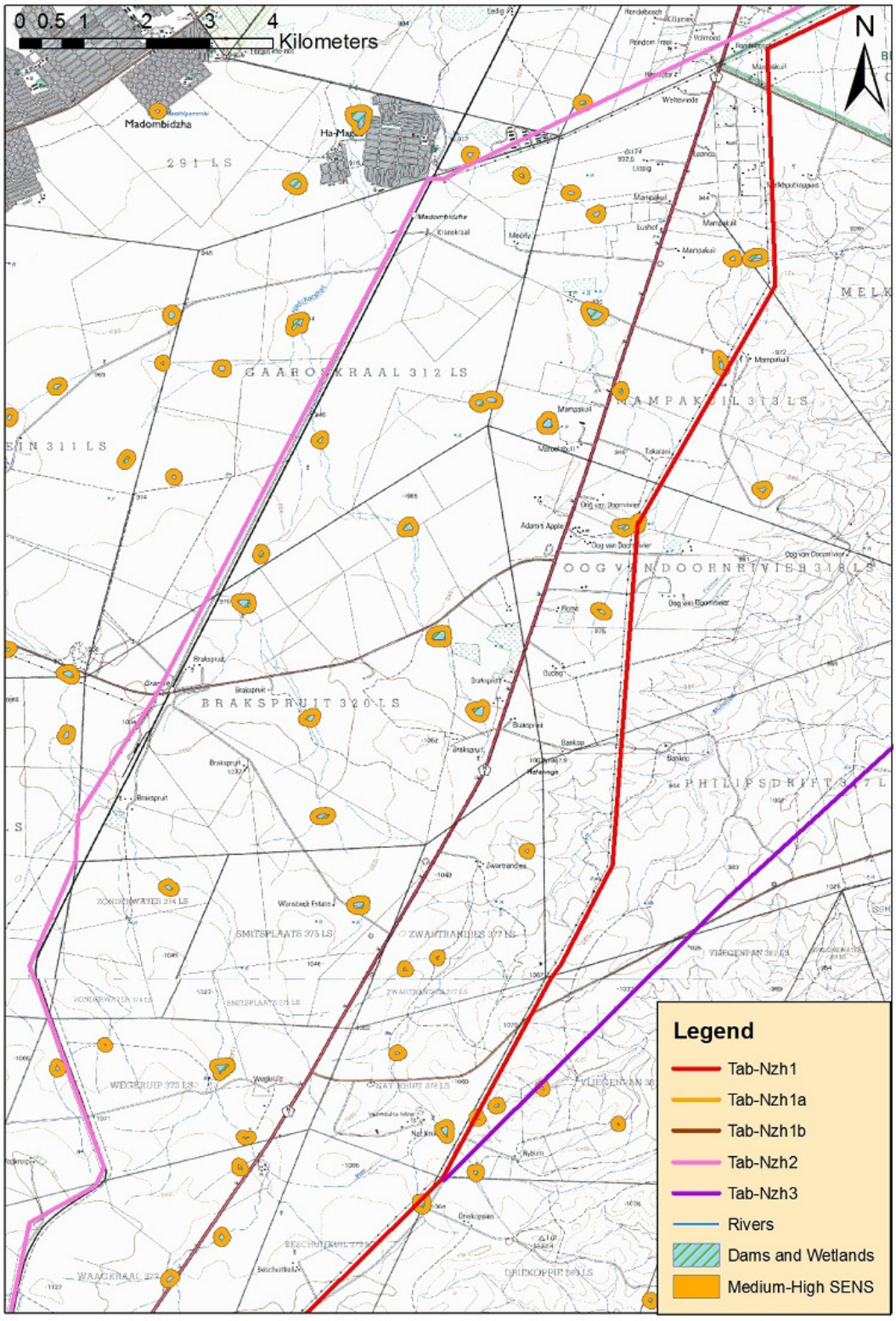


Figure 25: Sensitivity Map 3, showing areas of medium to high avifaunal sensitivity.

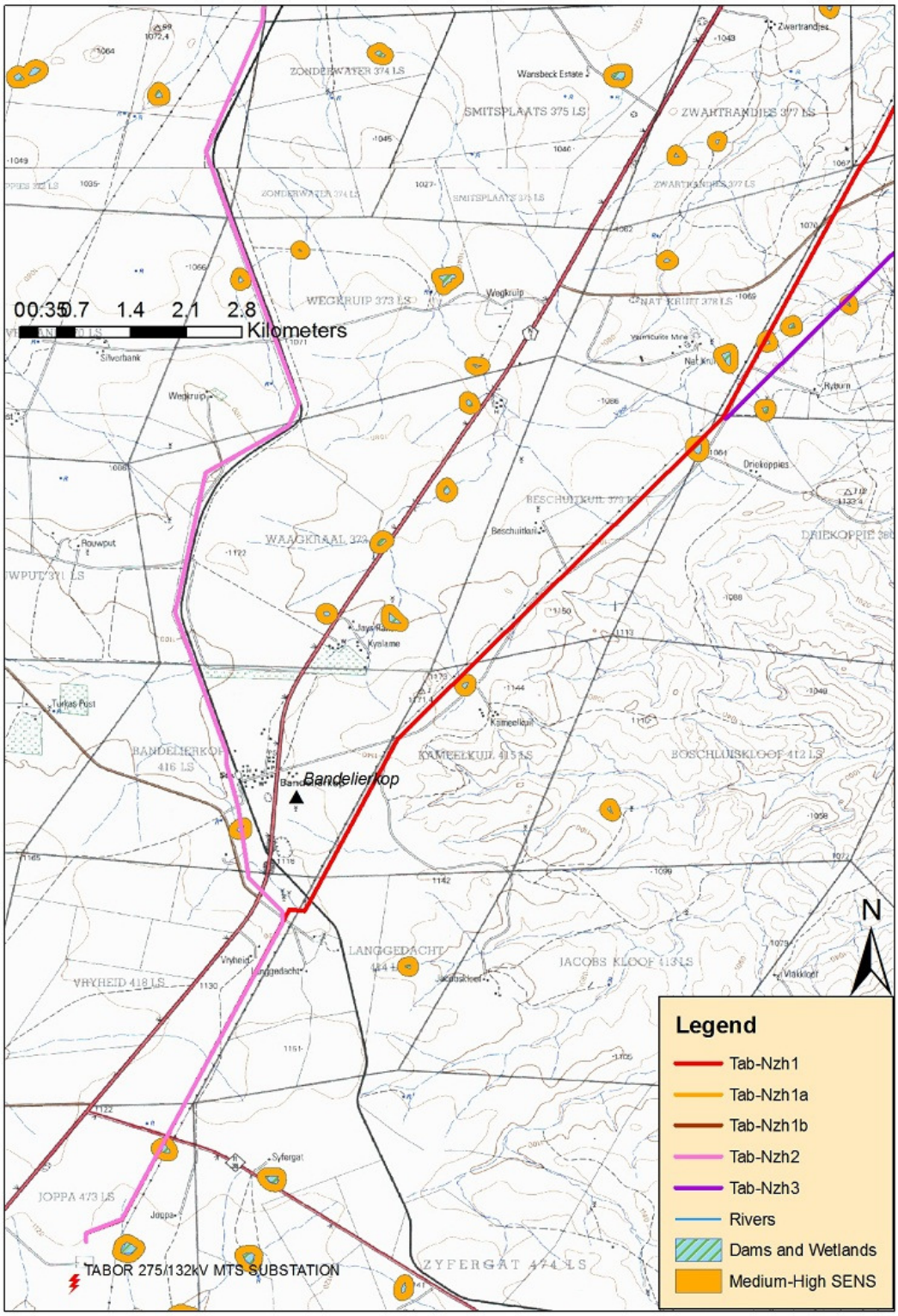


Figure 26: Sensitivity Map 4, showing areas of medium to high avifaunal sensitivity.

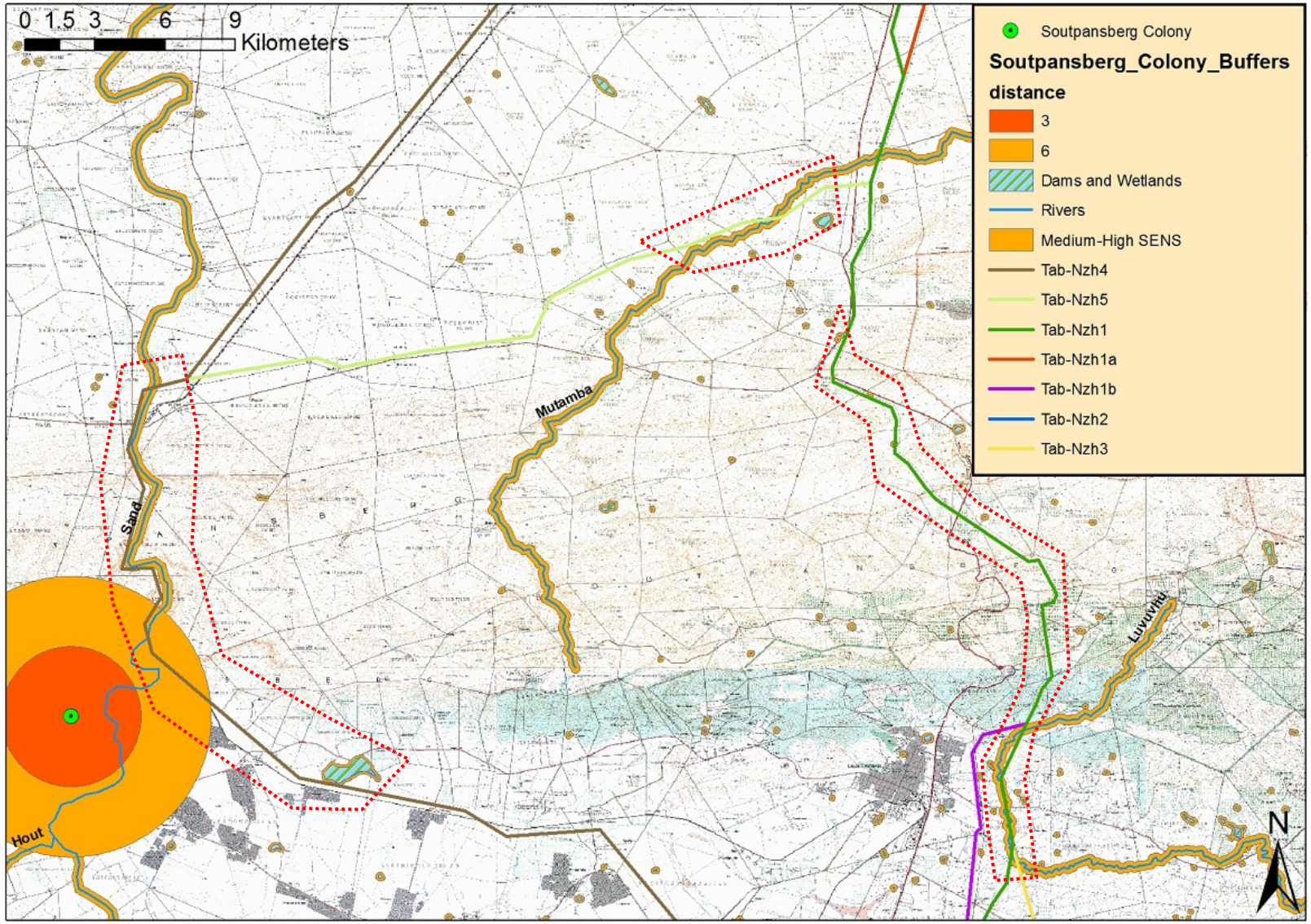


Figure 26: Sensitivity map for the Soutpansberg region, showing the Vulture Colony, buffered wetlands and rivers, as well as areas of general concern (red polygons).

COMPARISON OF ALTERNATIVES

There were no alternatives considered for the position of the new Nzehlele Substation.
The following alternatives represent various corridor options for the new Tabor Nzhelele 400kv Power Line, and are all presented graphically in Figure 27 below.

Alternative 1 (Tab-Nzh1)

- Represented by the dark green line in the map below.
- Approximately 93 kilometres in length.
- Follows existing high voltage power lines for the majority of its length.
- For approximately 14km section in the north, it leaves existing powerline corridor, and runs instead along the main tar road.
- Cuts the South western corner of Ben Lavin Nature Reserve, and runs for approximately 4 km, just inside the reserve.
- In the vicinity of Louis Trichardt, this option also leaves existing lines and runs on its own for approximately 12km, 6km of which are very near to the Luvuvhu River.
- This alternative has two additional small detour options, Tab-Nzh1a and Tab-Nzh1b, discussed below.
    - Tab-Nzh1a is the eastern alignment (see red line in figure 27 below), running the last 13km to Nzehlele Substation in the North. This option continues to run along the existing power line, instead of deviating west to run along the road.
    - Tab-Nzh1b is an approximately 10 km deviation in the central area of the study site, near to Louis Trichardt. This deviation takes Alternative 1 more to the West, closer to the town, and further away from the Luvuvhu River.

Alternative 2 (Tab-Nzh2):

- Represented by the blue line.
- This is an alternative routing for the south of the project. From Louis Trichardt north, this option is identical to Alternative 1.
- Approximately 96km in length.
- Follows existing HV power lines for the majority of its route.
- Follows the same deviation as Tab-Nzh1b (purple line) in the vicinity of Lois Trichardt i.e. it runs more to the west of the Luvuvhu River
- More westerly route, which also follows the railway line.
- Runs along the North western boundary of Ben Lavin Nature Reserve, outside of the reserve.

Alternative 3 (Tab-Nzh3):

- Represented by the yellow line.

- This is an alternative routing for the south of the project. From Louis Trichardt north, this option is identical to Alternative 1.
- Approximately 95km in length.
- Does not follow existing HV power lines for the majority of its route in the south.
- More easterly route, running along the eastern boundary of the Ben Lavin Nature Reserve.

Alternative 4 (Tab-Nzh4):

- This represents an alternative route for the crossing of the Soutpansberg Mountains.
- South of Louis Trichardt it heads north west and west, where it joins up with a rail-line, and follows this rail line north through a "poort" and through the mountains.
- Represented by the brown line in the map below, and is approximately 119km in length.
- Passes within 5km of a large Cape Vulture Colony.

Alternative 5 (Tab-Nzh5):

- This forma an alternative link, north of the Soutpansberg, to connect the westerns passage through the Soutpansberg, back east to the N1 and the other route options.
- Represented by the light green line in table 27 below, and will result in a total line length of approximately 126km if chosen.

In order to identify which of the alternative routes is deemed preferred the alternative routes were ranked in the tables below, according to a route ranking methodology, as supplied by Lidwala Consulting Engineers (Appendix A).

Table 4: Criteria for Route Preference Ratings.

Site preference Rating	Criteria
Avifauna	
Preferred (4)	Shortest Length, least sensitive habitats passed, follows existing infrastructure for the majority, highly unlikely to impact on red-listed species, high levels of anthropogenic disturbance.
Acceptable (3)	Short Length, few sensitive habitats passed, follows some infrastructure, unlikely to impact on red listed species, medium levels of anthropogenic disturbance.
Not Preferred (2)	Long Length, Some sensitive habitats, follows some infrastructure, Likely to impact on red-listed species, low levels of anthropogenic disturbance.
No-Go (1)	Longest Length, Extensive sensitive habitats, Follows little or no linear infrastructure, Highly Likely to impact on red-listed species, very low levels of anthropogenic disturbance.

Table 5: Final Site Ranking Matrix

Study	Alt 1	Alt 1a	Alt 1b	Alt 2	Alt3	Alt 4	Alt 5	***Alt 1a & 1b***
Avifauna	3	3	3	4	2	1	1	4

As can be seen from the discussions and tables above, the variation of Alternative 1 using both deviation options (Tab-Nzh1a & Tab-Nzh1b), as well as Alternative 2 (Tab-Nzh2), are the two preferred routings as long as mitigation as recommended by this report is implemented. Alternatives 4 and 5 are regarded as no-go options as they would result in the line passing close to a Cape Vulture Colony, as well as traversing large areas of sensitive, undisturbed habitat. The remaining alternatives are acceptable as long as mitigation as recommended by this report is implemented.

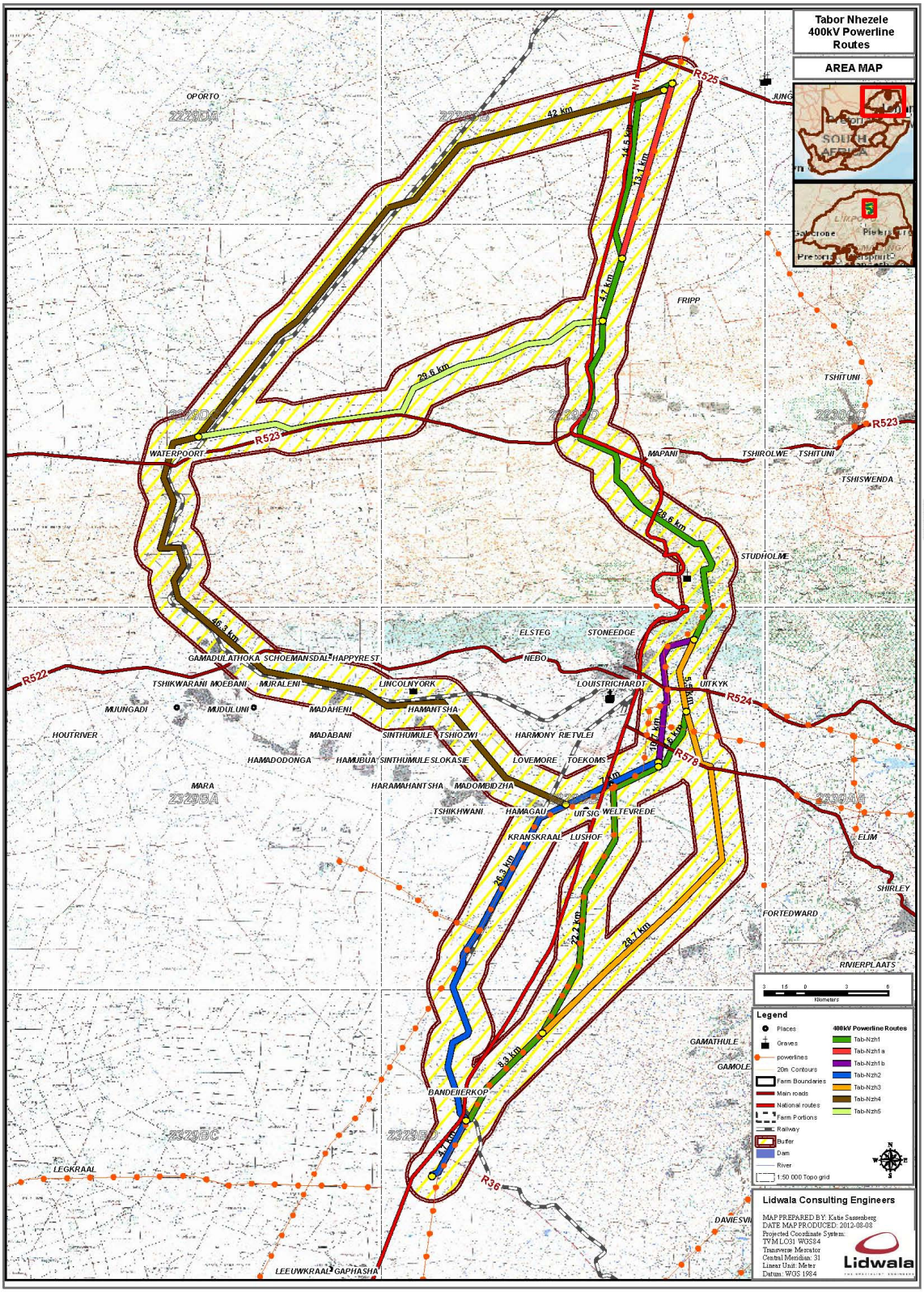


Figure 27: Route Alternatives Map, as supplied by Lidwala Consulting Engineers.

CONCLUSION

In conclusion, the proposed power line can be built provided that the various mitigation measures recommended in this report are implemented.

Various route alternatives were discussed and it was found that the variation of Alternative 1 using both deviation options (Tab-Nzh1a & Tab-Nzh1b), as well as Alternative 2 (Tab-Nzh2), are the two preferred routings. Alternatives 4 and 5 are regarded as no-go options as they would result in the line passing close to the Cape Vulture Colony, as well as traversing large areas of sensitive, undisturbed habitat. The remaining alternatives are acceptable as long as mitigation as recommended by this report is implemented.

From an avifaunal perspective, the sensitivity of the site varies considerably. The site is very large with many areas that are disturbed and other areas that are quite pristine. In general, the site has moderate to high sensitivity. **Of particular concern is the Cape Vulture, as one of the proposed alternatives runs in close proximity to a large existing Cape Vulture Colony.** Mitigation will be required, regardless of which alternative is used. Collisions are expected to be the largest impact of this project (assuming that "bird-friendly" pylon structures are used which prevent the impact of electrocution) and some line marking is required to mitigate for this. Sensitive areas have been mapped, within which the abovementioned collision mitigation must be implemented. Once final pylon positions are pegged, an avifaunal "walk through" is recommended in order to, "fine tune" these sensitive zones, and to identify the exact 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. Although electrocution is unlikely on a large transmission line, it is still unclear at this stage as to what type of structure will be used, or whether sections of the new line will be hung on existing structures. The EWT is to be continuously consulted in this regard to ensure that electrocution will not be an issue. This is important due to the due to the presence of Vultures and a number of Storks and large Raptors in the area, which are highly vulnerable to electrocution if an unsafe structure is used. Detail of the exact pole structure to be used was not available, and the predictions made in this report are based on the assumption that a bird-friendly, safe structure will be used. Once decided upon, the structures to be used must be presented to the EWT for acceptance, prior to construction thereof.

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Appendix A: ROUTE PREFERENCE RATING SYSTEM

In order to identify which of the alternative routes is deemed preferred the specialists were requested to rank the alternatives routes according to a route ranking methodology.

The evaluation and nomination of a preferred route involves a highly interdisciplinary approach. The approach undertaken has involved a number of specialist studies which examine a number of different issues. In order to evaluate routes and determine a preferred route, the studies need to be comparative and therefore a route rating matrix was developed. The site preference rating system is applied to each discipline, and the rating of each site was conducted according to the following system:

1 = Not suitable for development / No-Go (impact of very high significance - negative)
2 = not preferred (impact of high significance - negative)
3 = acceptable (impact of moderate significance - negative)
4 = Preferred (impact of low or negligible significance - negative)

While each specialist study was required to have the Route Preference as an outcome, how they evaluated each route varied from discipline to discipline and the description of their specific approaches are outlined in each specialist report.

The route preference results for each route from each specialist study were entered into a matrix and added together. The route with the highest value is then considered the most preferable.

Table 8.1 outlines each specialist studies criteria for each of the route preference ratings.

Table 8.1: Specialist Criteria for Route Preference Ratings

Site preference Rating	**Criteria**
Flora	
Preferred (4)	
Acceptable (3)	
Not Preferred (2)	
No-Go (1)	
Fauna	
Preferred (4)	
Acceptable (3)	
Not Preferred (2)	
No-Go (1)	
Soil and Agricultural Potential	
Preferred (4)	
Acceptable (3)	
Not Preferred (2)	
No-Go (1)	
Avifauna	
Preferred (4)	
Acceptable (3)	
Not Preferred (2)	
No-Go (1)	
Social	
Preferred (4)	
Acceptable (3)	
Not Preferred (2)	
No-Go (1)	
Visual	
Preferred (4)	
Acceptable (3)	

Not Preferred (2)	
No-Go (1)	

Table 8.2: Final Site Ranking Matrix

Study	Alt 1	Alt 1a	Alt 1b	Alt 2	Alt3	Alt 4	Alt 5
Fauna							
Avifauna							
Flora							
Soils and Agricultural Potential							
Social							
Visual							
Heritage							
Design and Technical							
Total							

Appendix B: Significance Rating Scales

The Significance Rating Scales – for an EIA
Example 3

Issues are assessed in terms of the following criteria:

- The **nature**, a description of what causes the effect, what will be affected and how it will be affected;
- The physical **extent**, wherein it is indicated whether:
  - 1 - the impact will be limited to the site;
  - 2 - the impact will be limited to the local area;
  - 3 - the impact will be limited to the region;
  - 4 - the impact will be national; or
  - 5 - the impact will be international;
- The **duration**, wherein it is indicated whether the lifetime of the impact will be:
  - 1 - of a very short duration (0–1 years);
  - 2 - of a short duration (2-5 years);
  - 3 - medium-term (5–15 years);
  - 4 - long term (> 15 years); or
  - 5 - permanent;
- The **magnitude of impact on ecological processes**, quantified on a scale from 0-10, where a score is assigned:
  - 0 - small and will have no effect on the environment;
  - 2 - minor and will not result in an impact on processes;

- 4 - low and will cause a slight impact on processes;
- 6 - moderate and will result in processes continuing but in a modified way;
- 8 - high (processes are altered to the extent that they temporarily cease); or
- 10 - 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 is estimated on a scale where:
  - 1 - very improbable (probably will not happen;
  - 2 - improbable (some possibility, but low likelihood);
  - 3 - probable (distinct possibility);
  - 4 - highly probable (most likely); or
  - 5 - definite (impact will occur regardless of any prevention measures);
- the **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high;
- the **status**, which is described as either positive, negative or neutral;
- the degree to which the impact can be reversed;
- the degree to which the impact may cause irreplaceable loss of resources; and
- the *degree* to which the impact can be mitigated.

The **significance** is determined 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 this impact would not have a direct influence on the decision to develop in the area),
- **31-60 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).

Appendix C: Impact Ratings

Alternative 1

Construction Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Habitat destruction	**Nature of impact:**	Permanent removal of habitat that is used, or may be used, by avifauna.							
	with	1	2	4	3	**21**	**Low**		medium
	without	1	2	4	5	**35**	**Medium**		medium
	degree to which impact can be reversed:	Partially reversable							
	degree of impact on irreplaceable resources:	Low							
Disturbance	**Nature of impact:**	Noise and movement, from staff and machinery, may disturb avifauna, and nests may be disturbed.							
	with	1	1	4	3	**18**	**Low**		medium
	without	2	1	6	5	**45**	**Medium**		medium
	degree to which impact can be reversed:	Irreversible							
	degree of impact on irreplaceable resources:	medium							

Operational Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Collision	**Nature of impact:**	Collision or red data species with the overhead line (usually the earth wire).							
	with	1	4	4	4	**36**	**Medium**		medium
	without	1	4	4	5	**45**	**Medium**		medium

	degree to which impact can be reversed:	low							
	degree of impact on irreplaceable resources:	medium							
Electrocution	**Nature of impact:**	Bird perches on pylon and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components, resulting in death or severe injury.							
	with	1	4	2	3	**21**	**Low**		medium
	without	1	4	6	5	**55**	**Medium**		medium
	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	medium							
Nesting of birds on Tower structures and disturbance during routine maintenance	**Nature of impact:**	Routine maintenance of pylons and power lines could result in disturbance of certain bird species							
	with	1	2	4	3	**21**	**Low**		medium
	without	2	2	4	4	**32**	**Medium**		medium
	degree to which impact can be reversed:	high							
	degree of impact on irreplaceable resources:	medium							

Alternative 1a

Construction Phase								
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**	**Status (+ve or -ve)**	**Confidence**
Habitat destruction	**Nature of impact:**	Permanent removal of habitat that is used, or may be used, by avifauna.						

	with	1	2	4	3	**21**	**Low**		medium
	without	1	2	4	5	**35**	**Medium**		medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Disturbance	**Nature of impact:**	Noise and movement, from staff and machinery, may disturb avifauna, and nests may be disturbed.							
	with	1	1	4	3	**18**	**Low**		medium
	without	2	1	4	4	**28**	**Low**		medium
	degree to which impact can be reversed:	Irreversible							
	degree of impact on irreplaceable resources:	medium							
Operational Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Collision	**Nature of impact:**	Collision or red data species with the overhead line (usually the earth wire).							
	with	1	4	2	3	**21**	**Low**		medium
	without	1	4	4	4	**36**	**Medium**		medium
	degree to which impact can be reversed:	low							
	degree of impact on irreplaceable resources:	medium							
Electrocution	**Nature of impact:**	Bird perches on pylon and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components, resulting in death or severe injury.							

	with	1	4	2	3	**21**	**Low**		medium
	without	1	4	4	4	**36**	**Medium**		medium
	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	medium							
Nesting of birds on Tower structures and disturbance during routine maintenance	**Nature of impact:**	Routine maintenance of pylons and power lines could result in disturbance of certain bird species							
	with	1	2	4	2	**14**	**Low**		medium
	without	2	2	4	3	**24**	**Low**		medium
	degree to which impact can be reversed:	high							
	degree of impact on irreplaceable resources:	medium							

Alternative 1b

Construction Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Habitat destruction	**Nature of impact:**	Permanent removal of habitat that is used, or may be used, by avifauna.							
	with	1	2	4	3	**21**	**Low**		medium
	without	1	2	4	5	**35**	**Medium**		medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							

Disturbance	**Nature of impact:**	Noise and movement, from staff and machinery, may disturb avifauna, and nests may be disturbed.							
	with	1	1	4	3	**18**	**Low**		medium
	without	2	1	4	4	**28**	**Low**		medium
	degree to which impact can be reversed:	Irreversible							
	degree of impact on irreplaceable resources:	medium							
Operational Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Collision	**Nature of impact:**	Collision or red data species with the overhead line (usually the earth wire).							
	with	1	4	2	3	**21**	**Low**		medium
	without	1	4	4	4	**36**	**Medium**		medium
	degree to which impact can be reversed:	low							
	degree of impact on irreplaceable resources:	medium							
Electrocution	**Nature of impact:**	Bird perches on pylon and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components, resulting in death or severe injury.							
	with	1	4	2	3	**21**	**Low**		medium
	without	1	4	4	4	**36**	**Medium**		medium
	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	medium							

Nesting of birds on Tower structures and disturbance during routine maintenance	**Nature of impact:**	Routine maintenance of pylons and power lines could result in disturbance of certain bird species							
	with	1	2	4	2	**14**	**Low**		medium
	without	2	2	4	3	**24**	**Low**		medium
	degree to which impact can be reversed:	high							
	degree of impact on irreplaceable resources:	medium							

Alternative 2

Construction Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Habitat destruction	**Nature of impact:**	Permanent removal of habitat that is used, or may be used, by avifauna.							
	with	1	2	4	3	**21**	**Low**		medium
	without	1	2	4	5	**35**	**Medium**		medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Disturbance	**Nature of impact:**	Noise and movement, from staff and machinery, may disturb avifauna, and nests may be disturbed.							
	with	1	1	4	3	**18**	**Low**		medium
	without	2	1	4	4	**28**	**Low**		medium
	degree to which impact can be reversed:	Irreversible							

	degree of impact on irreplaceable resources:	medium							
Operational Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Collision	**Nature of impact:**	Collision or red data species with the overhead line (usually the earth wire).							
	with	1	4	2	3	**21**	**Low**		medium
	without	1	4	4	4	**36**	**Medium**		medium
	degree to which impact can be reversed:	low							
	degree of impact on irreplaceable resources:	medium							
Electrocution	**Nature of impact:**	Bird perches on pylon and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components, resulting in death or severe injury.							
	with	1	4	2	3	**21**	**Low**		medium
	without	1	4	4	4	**36**	**Medium**		medium
	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	medium							
Nesting of birds on Tower structures and disturbance during routine maintenance	**Nature of impact:**	Routine maintenance of pylons and power lines could result in disturbance of certain bird species							
	with	1	2	4	2	**14**	**Low**		medium
	without	2	2	4	3	**24**	**Low**		medium
	degree to which impact can be reversed:	high							

	degree of impact on irreplaceable resources:	medium	

Alternative 3

Construction Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Habitat destruction	**Nature of impact:**	Permanent removal of habitat that is used, or may be used, by avifauna.							
	with	1	2	4	3	**21**	**Low**		medium
	without	1	2	4	5	**35**	**Medium**		medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Disturbance	**Nature of impact:**	Noise and movement, from staff and machinery, may disturb avifauna, and nests may be disturbed.							
	with	1	1	4	3	**18**	**Low**		medium
	without	2	1	4	4	**28**	**Low**		medium
	degree to which impact can be reversed:	Irreversible							
	degree of impact on irreplaceable resources:	medium							

Operational Phase								
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**	**Status (+ve or -ve)**	**Confidence**
Collision	**Nature of impact:**	Collision or red data species with the overhead line (usually the earth wire).						

	with	1	4	2	3	**21**	**Low**		medium
	without	1	4	4	4	**36**	**Medium**		medium
	degree to which impact can be reversed:	low							
	degree of impact on irreplaceable resources:	medium							
Electrocution	**Nature of impact:**	Bird perches on pylon and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components, resulting in death or severe injury.							
	with	1	4	2	3	**21**	**Low**		medium
	without	1	4	4	4	**36**	**Medium**		medium
	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	medium							
Nesting of birds on Tower structures and disturbance during routine maintenance	**Nature of impact:**	Routine maintenance of pylons and power lines could result in disturbance of certain bird species							
	with	1	2	4	2	**14**	**Low**		medium
	without	2	2	4	3	**24**	**Low**		medium
	degree to which impact can be reversed:	high							
	degree of impact on irreplaceable resources:	medium							

Alternative 4

Construction Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Habitat destruction	**Nature of impact:**	Permanent removal of habitat that is used, or may be used, by avifauna.							
	with	1	2	4	3	**21**	**Low**		medium
	without	1	2	4	5	**35**	**Medium**		medium
	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Disturbance	**Nature of impact:**	Noise and movement, from staff and machinery, may disturb avifauna, and nests may be disturbed.							
	with	1	1	4	3	**18**	**Low**		medium
	without	2	1	6	5	**45**	**Medium**		medium
	degree to which impact can be reversed:	Irreversible							
	degree of impact on irreplaceable resources:	medium							

Operational Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Collision	**Nature of impact:**	Collision or red data species with the overhead line (usually the earth wire).							
	with	1	4	4	4	**36**	**Medium**		medium
	without	1	4	4	5	**45**	**Medium**		medium
	degree to which impact can be reversed:	low							

	degree of impact on irreplaceable resources:	medium							
Electrocution	**Nature of impact:**	Bird perches on pylon and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components, resulting in death or severe injury.							
	with	1	4	2	3	**21**	**Low**		medium
	without	1	4	6	5	**55**	**Medium**		medium
	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	medium							
Nesting of birds on Tower structures and disturbance during routine maintenance	**Nature of impact:**	Routine maintenance of pylons and power lines could result in disturbance of certain bird species							
	with	1	2	4	3	**21**	**Low**		medium
	without	2	2	4	4	**32**	**Medium**		medium
	degree to which impact can be reversed:	high							
	degree of impact on irreplaceable resources:	medium							

Alternative 5

Construction Phase								
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**	**Status (+ve or -ve)**	**Confidence**
Habitat destruction	**Nature of impact:**	Permanent removal of habitat that is used, or may be used, by avifauna.						
	with	1	2	4	3	**21**	**Low**		medium
	without	1	2	4	5	**35**	**Medium**		medium

	degree to which impact can be reversed:	Partially reversible							
	degree of impact on irreplaceable resources:	Low							
Disturbance	**Nature of impact:**	Noise and movement, from staff and machinery, may disturb avifauna, and nests may be disturbed.							
	with	1	1	4	3	**18**	**Low**		medium
	without	2	1	6	5	**45**	**Medium**		medium
	degree to which impact can be reversed:	Irreversible							
	degree of impact on irreplaceable resources:	medium							
Operational Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Collision	**Nature of impact:**	Collision or red data species with the overhead line (usually the earth wire).							
	with	1	4	4	4	**36**	**Medium**		medium
	without	1	4	4	5	**45**	**Medium**		medium
	degree to which impact can be reversed:	low							
	degree of impact on irreplaceable resources:	medium							
Electrocution	**Nature of impact:**	Bird perches on pylon and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components, resulting in death or severe injury.							
	with	1	4	2	3	**21**	**Low**		medium
	without	1	4	6	5	**55**	**Medium**		medium

	degree to which impact can be reversed:	Low							
	degree of impact on irreplaceable resources:	medium							
Nesting of birds on Tower structures and disturbance during routine maintenance	**Nature of impact:**	Routine maintenance of pylons and power lines could result in disturbance of certain bird species							
	with	1	2	4	3	**21**	**Low**		medium
	without	2	2	4	4	**32**	**Medium**		medium
	degree to which impact can be reversed:	high							
	degree of impact on irreplaceable resources:	medium							