GROMIS-NAMA-AGGENEIS 400KV IPP INTEGRATION: ENVIRONMENTAL SCREENING

FAUNAL IMPACT ASSESSMENT

FAUNAL IMPACT ASSESSMENT FOR THE PROPOSED
GROMIS-NAMA-AGGENEIS 400 kV IPP INTEGRATION, SPRINGBOK, NAMA KHOI MUNICIPALITY, NORTHERN CAPE

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Declaration

I, **Aliénor (Eleanor) Brassine (Pr. Sci. Nat.),** declare that -

- I act as the independent specialist in this application;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- There are no circumstances that may compromise my objectivity in performing such work;
- I have the required permit from DENC for handling fauna for this specific project.
- I hold a MSc in Zoology and I am SACNASP registered as a Professional Natural Scientist (Ecology), Registration number: 116197
- I have the required knowledge of the National Environmental Management Act (Act 107 of 1998) (NEMA), regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the NEMA Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; all the particulars furnished by me in this form are true and correct.

Signature of the specialist:

Date:

Although I, Aliénor (Eleanor) Brassine (Pr. Sci. Nat.), exercise due care and diligence in rendering services and preparing documents, the Consultants herein do not accept any liability, and the Client by receiving this document, indemnifies the Consultants against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered directly or indirectly by the Consultants and by the use of the information contained in this document.

Executive Summary

Aliénor (Eleanor) Brassine (Pr. Sci. Nat.) was appointed by EnviroWorks (Pty) Ltd to undertake a screening faunal impact assessment for the proposed Gromis-Nama-Aggeneis 400 kV IPP integration, Springbok, Nama Khoi Municipality**,** Northern Cape. The strengthening project will consist of

a) Expansion of the Gromis Substation. Install 2nd 400/220 kV 500 MVA transformers at Gromis.

b) Construct a Gromis – Nama 400 kV power line (approx. 76 km)

c) Construct Nama – Aggeneis 400 kV power line (approx. 104 km)

d) Establish Nama 400/132 kV yard at existing Nama substation with associated switchgear and transformation to accommodate renewable evacuation.

The desktop study indicated that the study area falls within the range of 76 mammals, 82 reptiles and 14 amphibian species. Faunal species likely to be impacted by the proposed substation and power line development are smaller, less mobile species (certain reptiles and amphibians).

The impacts associated with the proposed substation and power line development include:

i. Loss of faunal habitat and ecological structure;
ii. Direct impact on faunal communities;
iii. Indirect faunal impact through increased predation by Pied Crows
iv. Disturbance to faunal communities.

While route alternatives 1 and 5 are the favourable routes from a faunal perspective, I recommend route Alternative 5. Both of these routes will pose a limited threat to the fauna occurring in the vicinity of the new power line. This is largely due to the disturbance already experienced within the area coupled with the shorter length of the proposed power line.

Given the relative homogeneity of the habitat within the study area as well as existing levels of disturbance (existing power lines and substations, existing roads, urban development, renewable energy developments, and livestock farming), the proposed strengthening project is unlikely to have a significant, long-term impact on the local faunal populations. The findings of the report and severity of the associated impacts will be verified by a detailed site visit during the BA phase.

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1 INTRODUCTION

1.1 Background Details of the Project

Aliénor (Eleanor) Brassine (Pr. Sci. Nat.) was appointed by EnviroWorks (Pty) Ltd to undertake a screening faunal impact assessment for the proposed Gromis-Nama-Aggeneis 400 kV IPP integration, Springbok, Nama Khoi Municipality**,** Northern Cape.

Eskom Holdings SOC Ltd is proposing the construction of new 400 kV power line from Gromis via Nama substation towards Aggeneis substation and the establishment of a 400/123 kV yard at Nama substation in the Northern Cape Province. The strengthening project will consist of

a) Expansion of the Gromis Substation. Install 2nd 400/220 kV 500 MVA transformers at Gromis.

b) Construct a Gromis – Nama 400 kV power line (approx. 76 km)

c) Construct Nama – Aggeneis 400 kV power line (approx. 104 km)

d) Establish Nama 400/132 kV yard at existing Nama substation with associated switchgear and transformation to accommodate renewable evacuation.

The proposed development will ensure that the Namaqualand network is compliant and there is sufficient line capacity to accommodate potential Independent Power Producers (IPPs) within the Namaqualand area. The proposed development area is located within the Namakwa District Municipality, Northern Cape, South Africa (Figure 1). Namakwa District is one of the five (5) districts of the Northern Cape Province of South Africa. The capital city of Namakwa is Springbok and the region is also known as Little Namaqualand.

In 2016 a Strategic Environmental Assessment (SEA) was undertaken by CSIR. The purpose of the SEA was to identify strategic Electricity Grid Infrastructure (EGI) Corridors to support electricity transmission up to 2040. The vision for the Strategic EGI was to expand in an environmentally responsible and efficient manner that effectively meets the country's economic and social development needs.

The final EGI Power Corridors assessed as part of the 2016 EGI Strategic SEA were gazetted for implementation on 16 February 2018 in Government Gazette 41445, Government Notice R.113. One of these corridors, was the Northern Corridor. The proposed new power line will be constructed within the Northern Corridor. Route alternatives within the Northern Corridor were suggested for evaluation. The final proposed alternatives within the Northern Corridor are shown in Figure 2.

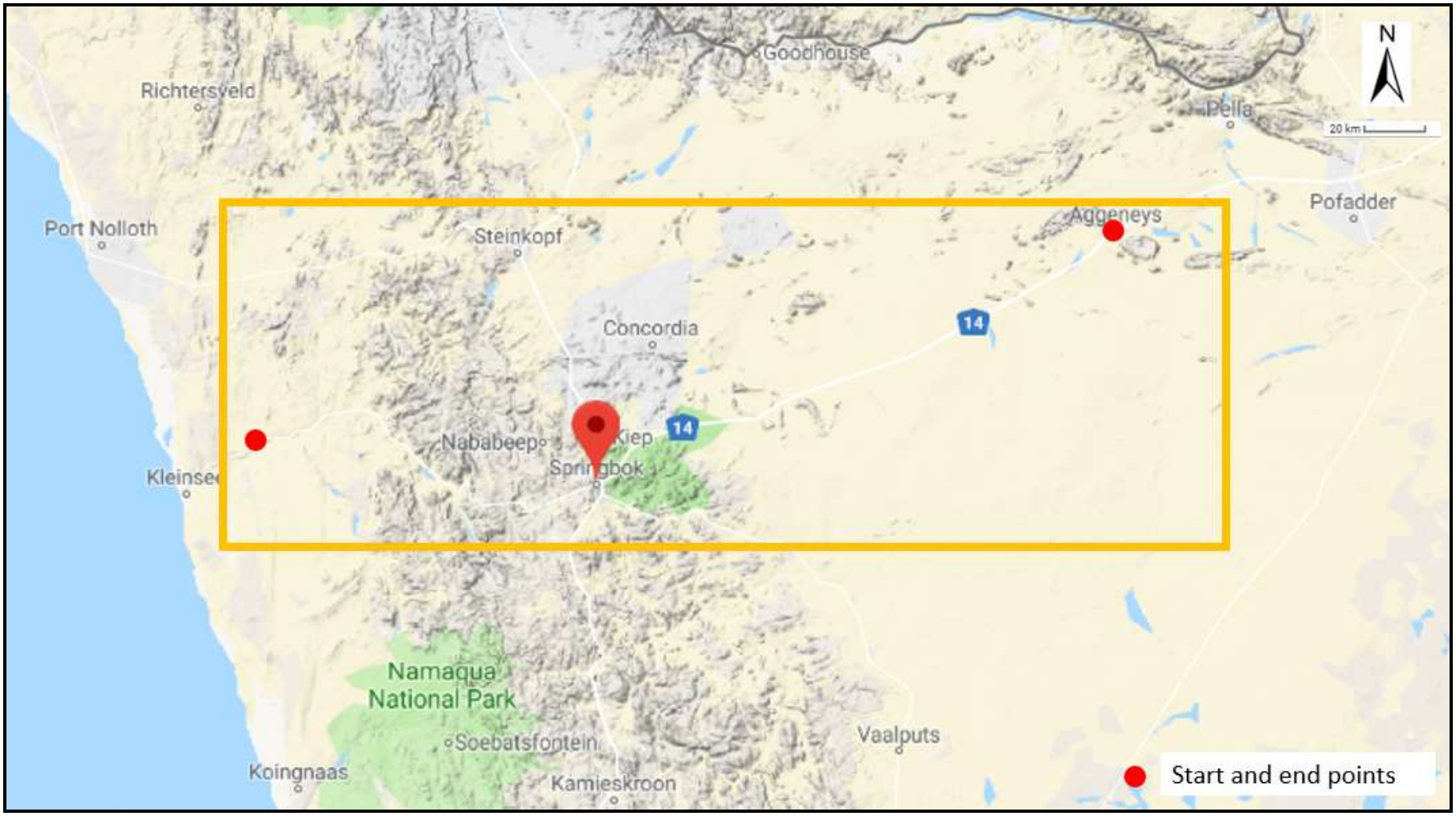

Figure 1: Locality of proposed power line infrastructure.

Figure 2. Site description map of the proposed power line route alternatives (Alternative 1: Red; Alternative 4: Purple; Alternative 5: Yellow).

1.2 Scope Of Work

In summary, the objectives of this screening faunal impact assessment report were to evaluate the study area from a faunal sensitivity perspective:

- A description of the environment that will be affected by the proposed development;
- A description of the current fauna within the study area and the identification of Red Data species potentially affected by the proposed substation and power line development;
- The use of previous ecological surveys conducted within the vicinity of the proposed development and literature investigations to supplement field data where necessary;
- Identify potential negative ecological impacts on the faunal diversity and species composition at the site of the proposed development and assess the significance of these impacts;
- To provide recommended mitigation measures to address the potential impacts to avert or lower the significance of such negative impacts on faunal species; and
- To provide recommendations regarding the alternative that will have the least impact on the faunal communities within the study area.

2 METHODOLOGY

The Screening Tool as per Regulation 16 (1)(b)(v) of the Environmental Impact Assessment Regulations, 2014, was applied and used for baseline information.

The faunal study focused on mammals, reptiles and amphibians in the proposed project area. My approach included a desktop study and site visit to understand the affected environment and to adequately investigate and evaluate significant issues. The following methodology was applied:

- The faunal species lists were compiled based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.
- Datasets discussed under “sources of information” were collected/collated and examined to determine the focus species for this study.
- Datasets were examined to determine the possible occurrence of any Red Data species and species of special concern.
- A short visit of the site with active searches in different biodiversity features. Fauna species encountered during site visit are listed in Appendix 4.
- A desktop examination of the site was done using Google Earth imagery and available spatial datasets to compare the power line route alternatives.
- The potential impacts of the proposed project on faunal species were predicted and mitigation measures were proposed.

2.1 Data sourcing and review

The study site and surrounding areas were identified and mapped at a desktop level. This was conducted using aerial photography. The desktop assessment was verified during the fieldwork. The study made use of the following data sources:

- Google Earth™ satellite imagery was used at the desktop level.
- Information on animal species distribution recorded in Quarter Degree Squares (QDS) 2917AD, BC, BD, CA, CB, DA, DB, 2918AD, AC, BA, BC, BD, CA, CB was extracted from the Animal Demography Unit (ADU) databases http://vmus.adu.org.za
- Faunal distribution data were also obtained from SANBI database and IUCN Red List database.
- Information on mammals, reptiles and amphibians which are likely to occur at the site were also derived from the literature, Marais (2012) and Bates *et al.* (2014) for reptiles, Carruthers (2001) for amphibians, Stuart and Stuart (2012) and Skinner and Chimimba (2005) for mammals.
- Faunal species lists are based on species which are known to occur in the broad geographical area, supplemented by a preliminary assessment of the availability and quality of suitable habitat at the site.
- The Conservation status of mammal species was sourced from the IUCN Red List Categories (EWT/SANBI2016) and The Red Data Book of the Mammals of South Africa, reptile species is based on the South African Reptile Conservation Assessment (Bates *et al.* 2014) and amphibian species from the Atlas and Red Data book of the frogs of South Africa, Lesotho, Swaziland (Minter *et al.* 2004). The IUCN's international Red List of Threatened Species https://www.iucnredlist.org was also consulted.
- Spatial datasets were sourced from BGIS hosted by SANBI. Spatial biodiversity information was used to determine conditions of habitats, vegetation types, special areas/features of concern, sensitive habitats and ecological corridors.
- A classification of the vegetation types in the study area was obtained from Mucina & Rutherford (2006).
- Peer reviewed references were consulted to supplement information.
- The Generic Environmental Management Programme (Empr) For The Development and Expansion of Infrastructure for The Overhead Transmission and Distribution of Electricity https://cer.org.za/wp-content/uploads/2019/03/Generic-EMPR-Substations-and-Overhead-electricty-transmission-and-distribution-infrastructure.pdf was consulted
- The Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy In South Africa. https://redzs.csir.co.za was consulted
- The Strategic Environmental Impact Assessment for Electricity Grid Infrastructure. Main Report and Appendix C: Specialist Studies. https://egi.csir.co.za/?page_id=1375 were consulted
- Northern Cape SDF http://www.spisys.co.za/northern-cape-planning-portal
- Results from DEA Screening tool

2.2 Site Visit

The site was visited 13-18 October 2019. During the site visit the different biodiversity features, habitats and landscape units present were investigated with specific attention paid to sensitive features such as drainage lines, rocky outcrops and other unique or rare habitats. The purpose of the site visit was to evaluate the condition and suitability of these different features for species of concern. Walk-through surveys and active searches were conducted for reptiles and amphibians within habitats likely to harbour or be important for species of concern within these taxa. Tracks and signs of fauna species were also noted and used to assess habitat use. Active night searches were also carried out to identify nocturnal species of the site.

2.3 Sensitivity Mapping & Assessment

An ecological sensitivity map of the site was produced by assimilating ecological and biodiversity information from the literature and various spatial databases as well as from the findings of the site visit. Sensitive features were identified delineated and assigned sensitivity values. Features

specifically captured in the sensitivity map include drainage lines, pans, rocky outcrops and steep slopes. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Units with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. This category represents transformed or natural areas where the impact of development is likely to be local in nature and of low significance with standard mitigation measures.
- **Medium** - Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact is usually considered low. This habitat is usually extensive within the region. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.

2.4 Assumptions and Limitations

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

- The screening report is largely a desktop study and although the study site was visited briefly, a detailed site visit and faunal survey was not completed.
- Ideally a site should be visited several times with intensive searches in all sensitive habitats, however this is rarely feasible due to time and cost constrains.
- Many faunal species of conservation importance (Red Data Species) are secretive and difficult to observe even during intensive field surveys.
- Resource availability is limited, a number of species require update on their distribution and status. This is particularly true for reptile species that are data deficient.
- It is important to note that, although the predicted impacts are mostly concerned with Red Data species, non-Red Data species will also benefit from the proposed mitigation measures as they share the same habitat and face the same potential impacts.
- Conclusions of this report were based on experience of these and similar species in different parts of South Africa. Faunal behaviour cannot be entirely reduced to formulas that will hold true under all circumstances.
- Given the large size of the site, the entire area could not be investigated exhaustively, however effort was made visit as much of the alternative routes as possible.

The faunal species were evaluated in terms of their conservation priority according to the following categories as per the International Union for the Conservation of Nature (IUCN) (figure 3):

Critically endangered:	Species that are facing a very high risk of extinction in the immediate future. It is the highest risk category assigned to a species.
Endangered:	Species that are facing a high risk of extinction in the near future. If these species are not properly protected, they will become critically endangered and eventually extinct.
Vulnerable:	Species that are facing a high risk of extinction in the medium-term future.
Near threatened:	Species that are facing a risk of extinction in the medium-long term.
Least concern:	Species that are not facing an eminent threat of extinction during the next five years.
Data deficient:	Inadequate data available to make a direct or indirect assessment of a species at risk of extinction.

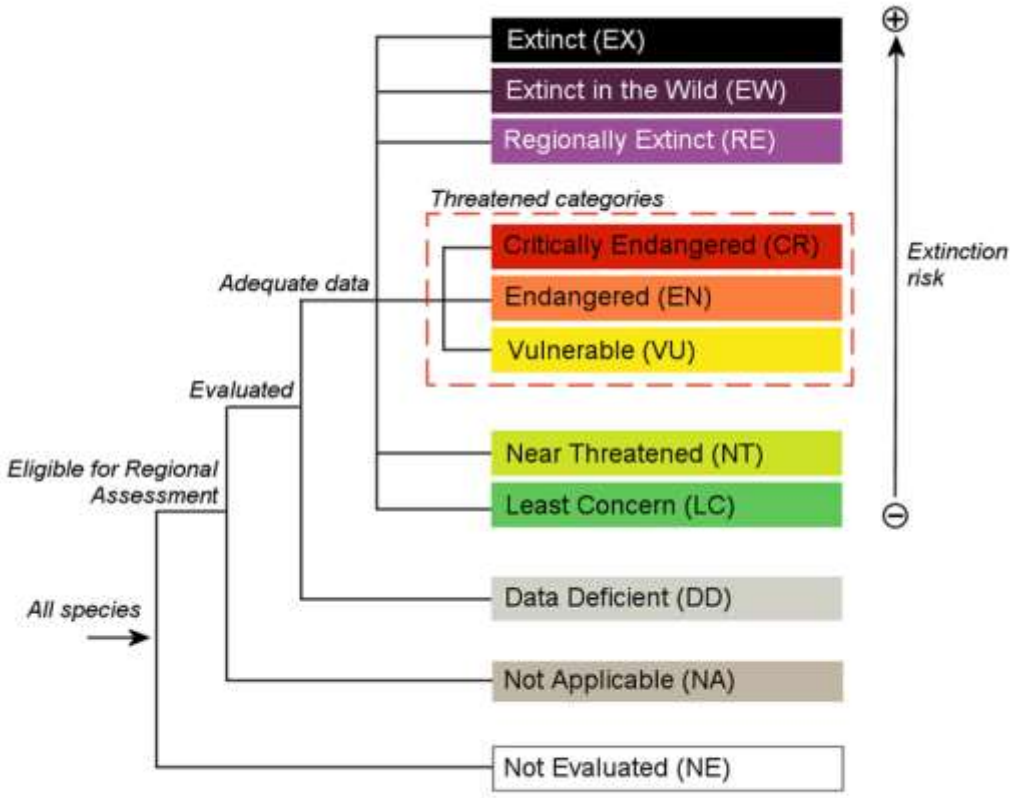

Figure 3. A hierarchical overview of the IUCN Red List extinction categories (2016 Red List of Mammals of South Africa, Lesotho and Swaziland)

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Climate and Vegetation

The development broadly falls within the Succulent Karoo and Nama Karoo Biomes. The Succulent Karoo is a semi desert region with mild climate and receives winter rainfall with the mean annual precipitation typically less than 200 mm per year (Mucina and Rutherford 2006). A coastal fog frequently occurs on the Namaqualand coast and the region has a warm temperate climate with a

Mean Annual Temperature of 16.8°C. Frost is rare but may occur along the Namaqualand escarpment (Mucina and Rutherford 2006). In the east of the site, The Nama Karoo receives most rainfall in summer, typically as localised, intense and short thunderstorms. It is an arid biome with low unreliable rainfall and experiences unpredictable droughts. Summers are hot (>43°C) and winters cold (-5°C) with frost.

According to the national vegetation map (Mucina & Rutherford 2006) six vegetation types occur within the study area. The central section of the study area consists of Namaqualand Hardeveld, while Namaqualand Sandveld occupies the western edge, and Bushmanland arid grassland and Bushmandland Inselberg shrubland are found in the eastern side of the study area. Two Inland Saline vegetation types are also found in the study area: namely Namaqualand Riviere and Bushmanland Vloere (Mucina and Rutherford, 2006).

Namaqualand Hardeveld biome consists of shrubland up to 1 m tall, scattered pachycaul Kokerboom trees, rocky habitats with abundant dwarf succulents, intermittent water courses, geophytes and ephemeral herbs, and numerous heuweltjies. The four vegetation types within this biome that make up a large section of the study area are considered Least Concern (Mucina and Rutherford, 2006).

Namaqualand Sandveld in the western section contains a range of ecologically important plants and is currently being threatened by mining; while in the eastern side there are large solitary mountains, and succulent shrubland plains, and arid grasslands (Mucina and Rutherford, 2006).

Within the site, these different vegetation types are structurally very similar and all consist of low shrub land with varying amounts of grass, succulents, forbs and geophytes depending on the aspect and landscape position (Mucina and Rutherford, 2006).

The main topographical unit within the proposed study area consists of flat plains with limited undulations and ridgelines which are characteristic of the west coast coastal plains. The Buffels Rivier and its associated tributaries is the main water course located in the study area which drains west of the proposed site alternatives. The rocky hills around Springbok have been identified as sensitive due to the occurrence of species of conservation concern. The different vegetation types have been illustrated in the map below (Figure 4).

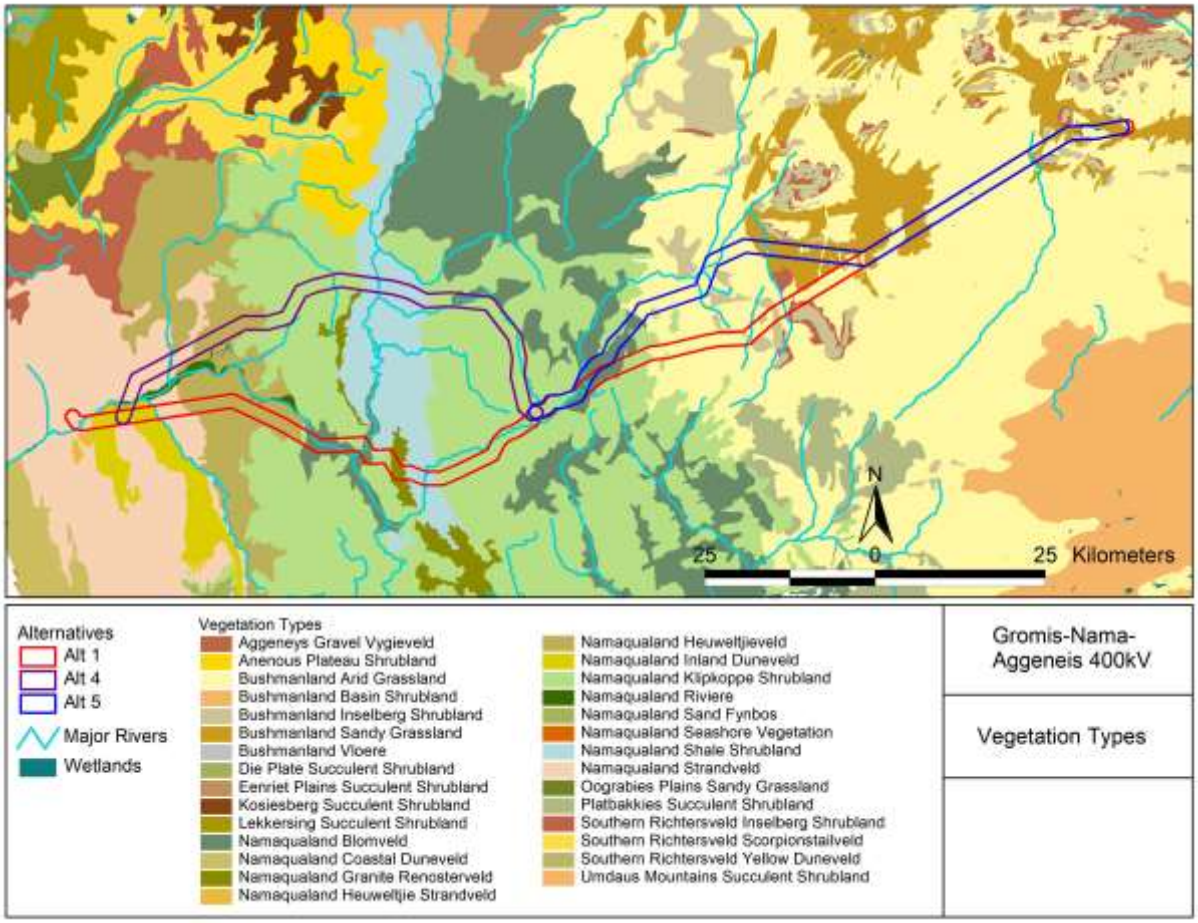

Figure 4. Vegetation map of the Gromis-Nama-Aggeneis study area

3.2 Faunal Sensitivity Features

In determining how suitable the study area is for faunal species, it is necessary to look at the habitats available to determine where the relevant species will most likely occur within the study area. These faunal microhabitats/sensitive features do not always correspond to vegetation types and are determined by a combination of vegetation type, topography, land use, food sources and other various intrinsic factors. Complex habitats and heterogenous topography have greater conservation values as they offer a greater range of shelter sites and microhabitats that can be used by biodiverse communities. Some habitats have stable substrates such as quartz patches and bedrock which are difficult or impossible to reconstruct and rehabilitate once disturbed and should therefore be avoided by the development footprint. Habitat health is also something to consider, as habitats that are relatively unchanged and have escaped degradation of mismanagement of land (such as overgrazing and invasion of invasive alien plants) have greater conservation value. Sensitive features include identified ephemeral wetlands and pans, drainage lines, rocky outcrops and steep slopes.

The different micro-habitats and features observed at the site are described below.

Drainage lines and Water bodies

Drainage lines, pans and other freshwater features are of significant importance as they provide suitable habitats for a variety of faunal species and serve as refuges during severe droughts. Various amphibians present within the study area will be localised around these micro-habitats. Permanent and periodic water bodies provide suitable habitats for roosting, foraging and breeding for fauna communities and must be avoided. Larger drainage channels are associated with riparian vegetation and are considered to be of very high sensitivity. Drainage lines also provide corridors for movement of fauna between habitats and are therefore of greater conservation value. The study site has numerous minor and a few major drainage systems including Buffel's River in the West which are considered to be very high sensitivity. No pylon should be located within drainage lines and waterbodies/pans and disturbance both within and surrounding these features should be kept to a minimum.

Figure 5. Dry riverbed and natural spring with associated riparian vegetation situated north of Alternative 4.

Shrublands

Shrublands occupy the central boundaries of the study area. These shrubland areas support certain species such as golden moles, burrowing reptiles and several rain frogs. Although the shrublands within the area are negatively impacted due to the disturbance and encroachment from agricultural land and power line infrastructure, they provide important corridors of natural vegetation, cover and foraging opportunities for many faunal species within the largely anthropogenically disturbed landscape.

Figure 6. Relatively intact mountainous shrubland found in the central region of the site.

Rocky outcrops

Rocky outcrops and exposed bedrock have a high value for fauna and are particularly important for reptiles and small mammals which utilise rock habitats for shelter. Rocky outcrops usually have a higher diversity of vegetation which is relatively intact compared to adjacent plains that have generally been heavily impacted on by overgrazing and other human activities.

Figure 7. Small rocky outcrop in the east of the site surrounded by Bushmanland Arid grassland that is heavily impacted from livestock farming. The rocky outcrop is considered significantly more sensitive than the surrounding plains.

Steep slopes

Hills and steep slopes cannot be restored once destroyed by blasting, trenching or road building and are therefore considered sensitive features. South-facing kloofs and steep slopes are particularly sensitive as they provide refuge from the extreme heat in arid biomes.

Figure 8. Isolated mountain in the east of the site that is considered to be sensitive and of high value for fauna; these mountains have steep slopes with associated kloofs and drainage systems.

The extent of habitat features and their sensitivities within each corridor are illustrated below in Figure 9 and 10. The extent of sensitive features within each corridor varies and includes drainage features, rocky ridges, steep slopes and areas of sensitive nature such as dune fields and *V. erioloba* forest.

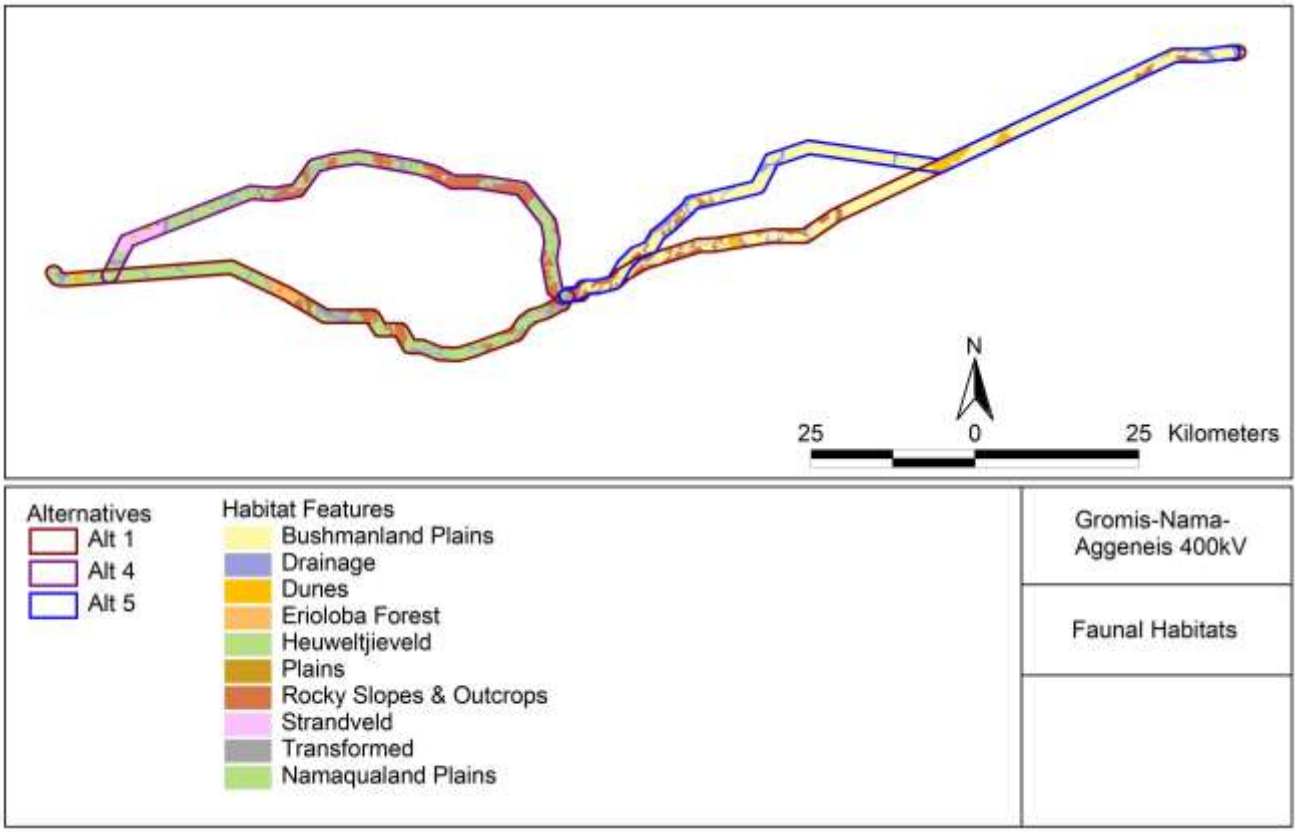

Figure 9. Sensitive faunal habitats of the Gromis-Nama-Aggeneis corridor alternatives.

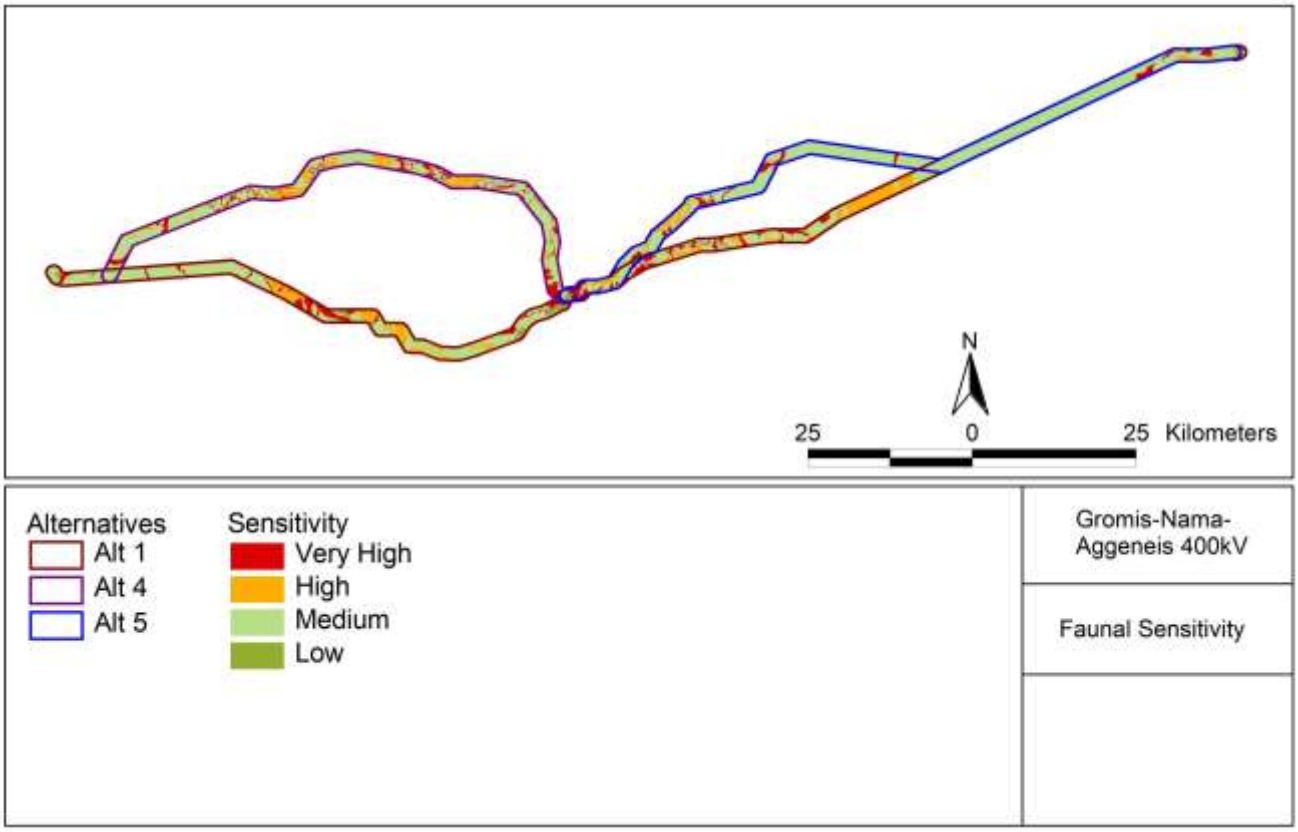

Figure 10. Ecological sensitivity map of the Gromis-Nama-Aggeneis corridor alternatives

3.3 Faunal Communities

3.3.1 Mammal Species Composition

The distribution of many medium-sized mammals is influenced by the availability of suitable habitat and food and as a result, the distribution is often patchy (Boshoff and Kerley 2001). The proposed development area is situated in a semi-arid to arid environment and fauna will favour habitats that favour shelter and foraging opportunities. Habitats such as drainage systems and rocky outcrops will have more habitat opportunities and are therefore likely to harbour a higher species diversity including species of concern. Provided that these sensitive features are avoided by the proposed development, the overall impact on listed species is likely to be low. The proposed development is likely to have more of an impact on smaller mammals that rely on the shrubland habitats for cover and are not as mobile. The power line may create disruption in landscape connectivity, however, this is likely to be insignificant for mammal species in general. Substations are likely to be fenced and have a limited footprint and in general mammals would avoid these areas.

The proposed development area falls within the distribution range of 76 mammal species (Appendix 1) of which 15 are Red listed (Table 1). This list includes species from the broader area including larger ungulates and carnivores which would likely only occur in protected areas and would likely have been eliminated from farmlands. Below is further information and a description of species of conservation concern.

De Winton's Golden Mole (*Cryptochloris wintoni*), a Critically Endangered species, could possibly occur in the far western edge of the site, in the coastal dunes and sandy areas in the Namaqualand Strandveld coastal plain (Succulent Karoo biome) (Bronner 2015). This species has only been recorded at Port Nolloth, Northern Cape Province. It is listed as Critically Endangered (Possibly extinct) due to its restricted distribution in an area of high threat from habitat transformation by alluvial diamond mining (Bronner 2015). Namaqualand Strandveld is under threat from coastal mining but some of this vegetation unit can be found in small private reserves (Mucina & Rutherford 2006). The Cape Golden Mole (*Chrysochloris asiatica*) and Grant's Golden Mole (*Eremitalpa granti*) are also expected to occur in sandy soils and both these species are near-endemics to the region. Golden moles are similar in appearance and rarely seen due to their subterranean lifestyle. Burrow traces are usually the only visible signs of their presence. The subterranean Namaqua Dune Mole Rat (*Bathyergus janetta*) is also an endemic to the region that occurs in areas of coastal sand dunes and consolidated alluvial soils (Maree 2016).

Larger mammal species such as the Hartmann's Mountain Zebra (*Equus zebra hartmannae*), Leopard (*Panthera pardus*), Brown Hyena (*Parahyaena brunnea*), Grey Rhebok (*Pelea capreolus*) and Honey Badger (*Mellivora capensis*) have broad distributions and their range extends into protected areas. The development of the new power line is unlikely to compromise the local or regional distribution of these species and the impacts would likely be very low on their population.

The Black-footed cat (*Felis nigripes*), a Vulnerable species, is endemic to the Karoo and Kalahari regions. It occurs at low densities in open arid and semi-arid habitats where it favours vegetation cover that is low and not too dense. It uses abandoned termite mounts or dens dug by other animals such as Aardvark (*Orycteropus afer*) for resting and for breeding. The species is threatened by habitat degradation and poisoning. The development is unlikely to have a significant impact on this species. Nonetheless, disturbance around any burrows/dens should be kept to a minimum as they are used by a wide variety of species (Figure 11).

Figure 11. Active burrow in Bushmanland dune field.

The Cape Horseshoe Bat (*Rhinolophus capensis*) is relatively common, it roosts in caves and forages over trees near wetlands. Any identified roost must be treated as sensitive and no-go areas. Geoffroy's Horseshoe Bat (*Rhinolophus clivosus*) will also roost in caves but also in rock crevices and abandoned mines. Both these species are wide ranging and present in a number of protected areas.

Littledale's Whistling Rat (*Parotomys littledalei*) is expected to occur in shrubland habitat whereas the Dassie Rats (*Petromus typicus*) is expected to occur in the rocky hills. Both these species have distribution that expands into protected areas and their preferred habitats are extensive in the region, impacts on their population from the development would likely be low.

Shortridge's Rat (*Thallomys shortridgei*) is listed as Data Deficient and has only been recorded from a few dispersed localities between Upington and Goodhouse in the Northern Cape (Taylor & Relton 2019). Little is known about this species but it is expected to be arboreal associated with *Acacia* (*Vachellia*) thornveld and scrub. The site is mostly devoid of trees except along larger drainage lines and in the regions surrounding Kammaggas where protected *Vachellia erioloba* trees are found scattered. The lack of suitable habitat makes the development unlikely to have a significant impact on this species. As mentioned earlier no pylon should be located within drainage lines and disturbance both within and surrounding these features should be kept to a minimum.

The Forest Shrew (*Myosorex varius*) and Lesser Dwarf Shrew (*Suncus varilla*) require further studies into their distribution, however, both species are expected to occur in a number of biomes within the country.

Table 3. 1 Red Listed mammal species that have distribution range within the proposed substations and power line infrastructure.

COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS
De Winton's Golden Mole	*Cryptochloris wintoni*	Critically Endangered
Grant's Golden Mole	*Eremitalpa granti*	Vulnerable
Hartmann's Mountain Zebra	*Equus zebra hartmannae*	Vulnerable
Leopard	*Panthera pardus*	Vulnerable
Brown Hyena	*Parahyaena brunnea*	Vulnerable
Black-footed cat	*Felis nigripes*	Vulnerable
Grey Rhebok	*Pelea capreolus*	Near Threatened
Cape Horseshoe Bat	*Rhinolophus capensis*	Near Threatened
Geoffroy's Horseshoe Bat	*Rhinolophus clivosus*	Near Threatened
Honey Badger	*Mellivora capensis*	Near Threatened
Dassie Rat	*Petromus typicus*	Near Threatened
Littledale's Whistling Rat	*Parotomys littledalei*	Near Threatened
Shortridge's Rat	*Thallomys shortridgei*	Data Deficient
Cape Golden Mole	*Chrysochloris asiatica*	Data Deficient
Forest Shrew	*Myosorex varius*	Data Deficient
Lesser Dwarf Shrew	*Suncus varilla*	Data Deficient

3.3.2 Reptile Species Composition

The study area falls within the distribution range of 82 reptile species, however there have been limited surveys in the region and no records were found within the study area on the ADU databases. A number of species are endemic or near-endemics to the region (Appendix 2) and two species are categorized as Red Listed on the Atlas and Red List of The Reptiles of South Africa (Bates *et al.* 2014). The Large-scaled Girdled Lizard (*Cordylus macropholis*) is Near Threatened and listed in CITES Appendix II. This species is particularly abundant where *Euphorbia* plants are abundant as it uses the plants for shelter (Bates *et al.* 2014). The study area only marginally overlaps with the northern most subpopulation of *C. macropholis* and it is therefore unlikely to occur in the development area.

The Speckled Dwarf Tortoise also known as the Speckled Padloper (*Chersobius signatus*) is categorized as Vulnerable A2acde and listed in CITES Appendix II. This species is endemic to South Africa occurring mainly along the West Coast region of the Western Cape and Northern Cape. It is highly habitat-specific, preferring rocky terrain, typically granite koppies in the Namaqualand Region, sheltering in rock crevices or under medium to large boulders and rock slabs. It has very small home ranges and is slow moving hence is extremely vulnerable to habitat destruction and degradation and has shown intolerance to habitat modification. Other threats identified include habitat fragmentation, particularly inter-koppie habitat zones that may have an important role in inter-population geneflow and recolonization. Predation by Pied Crow (*Corvus albus*) have also been identified as a major threat to tortoises (Fincham *et al.* 2015).

Reptile species of conservation concern are largely restricted to rocky outcrops and mountainous habitats which provide multiple microhabitats and refuges for a variety of species. The footprint of the development should avoid these sensitive features and the development of the proposed strengthening project is unlikely to have a high direct impact on reptilian populations within the area. Furthermore, these impacts would be on a local scale.

3.3.3 Amphibian Species Composition

The development falls within the distribution range of 14 amphibian species (Appendix 3) however only species which are relatively independent of water are highly likely to be present within the study area, including the Namaqua Rain Frog (*Breviceps namaquensis*), The Deland's Sand Frog (*Tomopterna delalandii*) and the Desert Rain Frog (*Breviceps macros*).

The only Red Listed species which may occur within the study area is the Desert Rain Frog which has been listed as Near Threatened. *B. macros* occurs on the Namaqualand coast in sand dunes vegetated with low, succulent shrubs and other xerophytic vegetation, however it appears to be limited to white sand dunes. Due to the lack of suitable habitat coupled with the fact that the study area is on the edge of its recorded distribution, it is not predicted that *B. macros* will have resident populations within the study area.

The Namaqua Caco (*Cacosternum namaquense*), Namaqua Stream Frog (*Strongylopus namaquensis*), and Paradise toad (*Vanijkophrynus robinsoni*) are endemic to Namaqualand and typically found in rocky areas.

Additionally, The Namaqua Sand Frog (*Tomopterna branchi*) and Branch's Rain Frog (*Breviceps branchi*) have been listed as Data Deficient.

Potential impacts on amphibian species associated with the proposed development include habitat loss, direct mortality, and pollution and degradation of wetland habitats for species that rely on water for breeding. The proposed development does not appear to be situated on or within close proximity to any suitable breeding habitats for amphibians and is therefore not a cause of concern. However, should waterbodies be identified these should be avoided and delineated during the BA phase. During the construction and maintenance phase there will be an increase in vehicle activity and subsequently increased probability of frog mortalities on the access roads. These impacts will be amplified during the breeding season, during which frog activity and dispersal is increased.

It is unlikely that the power line development would result in long term impacts on amphibian populations as the footprint within their preferred habitats would likely be low. Despite high endemicity within this taxon, no species is confined to the study area and the development should not have an impact on regional populations.

3.4 COMPARISON OF ROUTE ALTERNATIVES

The alternative routes were overlaid with:

- Formal Protected Areas
- Critical Biodiversity Areas (CBA) that have been identified as of high biodiversity value.
- Ecological Support Areas (ESA) that support key biodiversity resources (e.g. water) or ecological processes (e.g. movement corridors) in the landscape. ESA's are functional landscapes that are moderately disturbed but maintain basic functionality and connect CBAs.
- Important Bird Areas (IBA) - areas considered of national/global importance for bird populations. Although these areas have been identified based on their bird communities, the design of this network would support the maintenance of faunal communities in the region. The study site falls over one IBA, Haramoep and Black Mountain Mine (IBA SA035) in the extreme east of the site, where Aggeneis substation is situated, thus traversing this area is unavoidable.

The study area with the different overlays is depicted below in Figure 12.

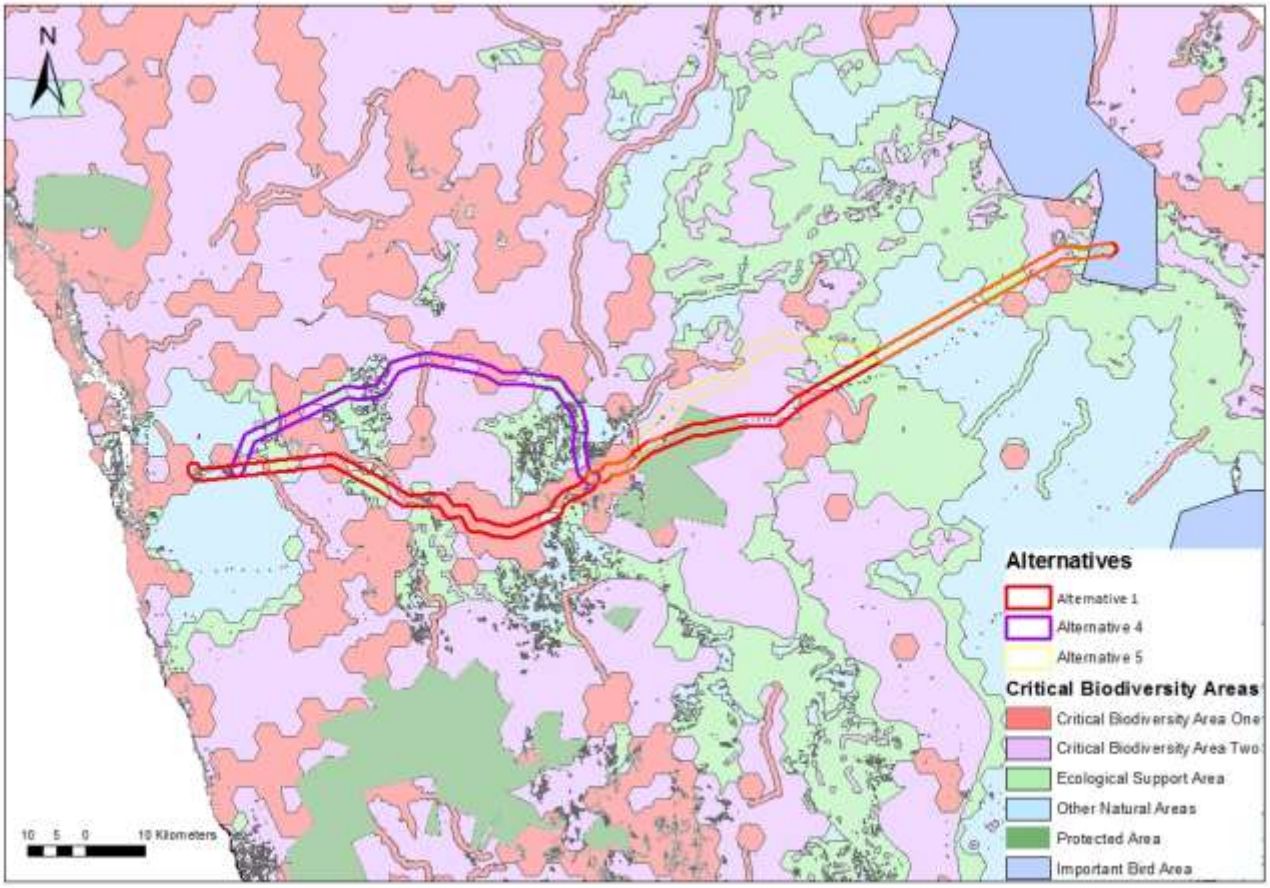

Figure 12. Critical Biodiversity Area map of the broad study area from the Northern Cape Biodiversity Spatial Plan.

Alternative 1

The corridor of Alternative 1 mostly follows the existing 220 KV power line, only deviating slightly to the north where it reaches Spektakel Pass and Buffelsrivier town. This is the most direct route, spanning approximately 174 km from Aggeneis substation via Nama substation to Gromis substation. It is located within close proximity to the National Road N14 in the east and also follows a short section of the Regional Road R355 in the west. A number of identified sensitive features fall within this alternative including two protected areas, Goegap Provincial Nature Reserve and Karas Nature Reserve (Wilderness Foundation Africa, WWF) in the middle section, with approximately 25 km of the route falling within these protected areas. The alternative also traverses an extensive area of CBA 1 and CBA 2. A large area of CBA1 is situated west of Springbok town where the corridor traverses some mountainous areas and the Buffels and Komaggas Rivers. The alternative also traverses extensive areas of CBA 2 in both the east and western sections of the route with interspersed Ecological Support Areas. Impact of the development on the sensitive features are of potential concern, especially relating to CBA1 and protected areas. However, a mitigating factor is the presence of the existing power line along this proposed alternative. The new power line would likely be adjacent to the existing power line thus reducing the extent of new servitude roads that would be required and associated habitat transformation. Habitat loss and disturbance associated with this alternative would therefore be reduced and the affected area would be relatively intact. It is the most direct of the alternatives, therefore has the smallest footprint compared to the other alternatives.

Alternative 4

Alternative 4 runs north of Alternative 1 in the western section of the site. It is a considerably longer corridor than Alternative 1, spanning approximately 90 km in length from Nama to Gromis Substations, compared to 76 km for Alternative 1 for the related section, consequently increasing the sum total of habitat loss and

degradation. Alternative 4 traverses a number of CBAs, although a considerably smaller area within Tier 1 CBAs than Alternative 1. Tier 2 CBAs are also found interspersed with Ecological Support Areas and Other Natural Areas. Despite traversing these sensitive features, the extent of the relatively homogenous mountainous area should not disturb ecological processes and disturbance on faunal communities will likely be local with low direct impact. However, this region has no existing power line and no telephone lines were seen during the site visit, thus a new development in this region would provide considerable new nesting sites in an otherwise mostly treeless environment. Indirect impact of a possible artificial increase in the Pied Crow population could be significant for tortoise populations and other sensitive fauna species that are frequently preyed upon by crows. Additionally this Alternative would require the construction of new servitude roads and a new disturbance corridor would be created. This will result in habitat degradation and loss, which is usually more extensive for mountainous regions that are difficult to access. The substantial increased length of this Alternative also makes this a less favourable route from a faunal perspective.

Alternative 5

This Alternative runs between Aggeneis and Nama substation. It is a variation of Alternative 1, following the same route as Alternative 1 in the east but deviating north in the west, avoiding mountainous areas and the two protected areas, Goegap Provincial Nature Reserve and Karas Nature Reserve (Wilderness Foundation Africa, WWF) before reaching Nama substation where it merges with Alternative 1 east of Springbok town. There are several CBA1s along this route associated with isolated mountains and drainage channels. It also traverses extensive CBA2 areas that are associated with undulating red dunes and shallow depressions that will sporadically hold water and form important breeding grounds for some amphibian species. The deviation in the west traverses some sensitive features including dry river beds and associated flood plains, however, the landscape in this region has been heavily impacted by human activities, particularly where it approaches human settlements. Existing roads are also found along the deviation thus despite not following power line infrastructures a disturbance corridor already exists to some extent. This Alternative was added as an additional alternative to avoid the protected areas, it is thus the preferred option for the new development, provided that sensitive features are avoided.

4 IMPACT ASSESSMENT

4.1 Fauna Impacts

The development of the new Gromis-Nama-Aggeneys 400 kV line and establishment of a 400/132 kV yard at Nama substation is likely to result in a variety of impacts, associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat to hard infrastructure including substations, access roads, and power line towers.

The likely impacts on the terrestrial fauna of the site are identified and discussed for the construction and operational phases of the development, with reference to the characteristics and features of the site. The major impacts and contributing activities that are likely associated with the development are identified and briefly outlined and summarised below before the impacts are assessed. Although the study focuses on listed terrestrial fauna species (mammals, reptiles and amphibians), the mitigation measures proposed for Red Data species will also serve to protect the more common species.

4.1.1 Loss of faunal habitat and ecological structure

The construction of the proposed power line and substation development will result in the loss of faunal habitats and a loss of ecological connectivity within the area. This impact relates to the complete removal or partial destruction/disturbance of existing vegetation by machinery and construction personnel, impacting directly on the ecological condition of natural vegetation and habitat availability to the resident fauna. These activities will have an impact on the foraging and breeding ecology of faunal species. Habitat loss to

vegetation clearing is expected to be minimal given that much of the vegetation is naturally sparse and low. The impact on smaller, non-Red Data species that are potentially breeding in the area will be local in extent, in that it will not have a significant effect on regional or national populations.

The impact can be positive where clearance is of invasive alien plant species and where *Prosopis* species are present the total clearing of invasive woody vegetation would be beneficial. However, removal of indigenous vegetation and soil disturbance promotes an increase in cover and density of alien plants particularly where they already occur. Increases in invasive alien plant species can change habitat structure and food resource availability for fauna.

4.1.2 Direct Impact on faunal communities

Activities involving the clearing of servitudes (Earthworks/excavating, movement of vehicles/heavy machinery) and ongoing maintenance activities will result in smaller and less mobile species being killed or injured. Illegal hunting and the trapping and collecting of various faunal species is likely to take place during the construction phase due to the increased human activity within the area during the construction phase of the project. Vehicle traffic at the site increases the risk of collision with fauna. Slower species such as tortoises, snakes and amphibians would be most susceptible, and the impact would be largely concentrated to the construction phase when vehicle activity is high. Access roads are expected to be infrequently used during the operational phase and thus impact is expected to be low.

4.1.3 Predation from likely influx of Pied Crow

Power line infrastructure are often used for nesting sites and may lead to the proliferation of crows in the region (Cunningham *et al.* 2015). In the past three decades Pied Crow numbers have increased significantly in South Africa with their spread facilitated by electrical infrastructure (Cunningham *et al.* 2015; Fincham *et al.* 2015). A strong relationship has been found between the rate of population increase and density of power line infrastructure in shrubland biomes (Cunningham *et al.* 2015). This is particularly due to the expansion of power lines in treeless environments. Pied Crows are generalist predators, preying on a wide range of species, with evidence of heavy predation pressures on threatened or restricted-range species such as tortoises. The development may thus create increased predation pressures on *C. signatus* and a number of other susceptible vulnerable faunal species of the region. The indirect increase in Pied Crow abundance may have substantial long term negative impacts on prey and competitor species.

It is understood that two tower designs will be used for the new 400 kV power line development. Cross Rope Suspension Towers (probably 528A) will be used where the gradient is below 15% and Self-Supporting Towers (probably 518H) will be used where the gradient is steeper than 15% Steel lattice towers. The Cross Rope Suspension Towers are likely to be less desirable and provide fewer opportunities for nesting sites. However, the Self Supporting towers will have a lattice structure with horizontal sections providing numerous nesting sites on various levels. Additionally, anti-climb fences currently found on the existing power line (Eskom HV 220kV Line) are also providing nesting sites for Pied Crows (Figure 13). It is likely that crows (and other birds) will also nest on insulator carriers which can cause electrical problems if conducive materials such as wire are used or if a nest becomes wet during rain.

Figure 13. Pied Crow nest on existing power line between Aggeneis and Nama Substations

The possible artificial increase in Pied Crow abundance may have long term impacts on fauna populations as nest building will occur throughout the operational phase. This impact is assessed as negative, of local extent, of long duration (throughout the life of the infrastructure) and low reversibility (tortoise populations have very slow growth). The unmitigated impact is of medium significance. Mitigation involves fitting of nest deterrents/discouragers on all horizontal lattices but particularly at cross beam sections which are favoured by crows. This is particularly of importance in shrubland biomes where pylons provide nesting sites in an otherwise treeless environment.

4.1.4 Disturbance

Disturbance created by increased levels of noise-pollution associated with human presence and construction activities (including machinery and artificial lighting) will likely be detrimental to local fauna using habitats within the study area. Sensitive faunal species are likely to disperse away from the area during the construction phase however, this impact is likely to be short-lived. Disturbance during operational phase is expected to be infrequent and restricted to access roads used by maintenance vehicles.

4.2 Significance of Identified Impacts

Significance scoring assesses and predicts the significance of environmental impacts through evaluation of the following factors; the **probability** of the impact; **duration** of the impact; **extent** of the impact; **irreplaceable** loss of resources, **reversibility** of the potential impacts and **magnitude** of negative or positive impacts. The significance of environmental impacts is then assessed taking into account any proposed mitigations. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required. Impact scores given "with mitigation "are based on the assumption that the mitigation measures recommended in this assessment are implemented correctly and rehabilitation of the site is undertaken. Failure to implement mitigation measures during and after construction will keep the impact at an unacceptably high level.

The evaluation components and ranking scales used to assess each potential impact are shown in Table 4.1 and Table 4.2 below:

Table 4. 1 Evaluation components, ranking scales and descriptions.

Evaluation component	Ranking scale and description (criteria)
DURATION	**5 - Permanent** **4 - Long term**: Impact ceases after operational phase/life of the activity (> 20 years). **3 - Medium term**: Impact might occur during the operational phase/life of the activity (5 to 20 years). **2 - Short term**: Impact might occur during the construction phase (< 5 years). **1 - Immediate**
EXTENT (or spatial scale/influence of impact)	**5 - International**: Beyond National boundaries. **4 - National**: Beyond Provincial boundaries and within National boundaries. **3 - Regional**: Beyond 5 km of the proposed development and within Provincial boundaries. **2 - Local**: Within 5 km of the proposed development. **1 - Site-specific**: On site or within 100 m of the site boundary. **0 -** None
IRREPLACEABLE loss of resources	**5 – Definite** loss of irreplaceable resources. **4 – High** potential for loss of irreplaceable resources. **3 – Moderate** potential for loss of irreplaceable resources. **2 – Low** potential for loss of irreplaceable resources. **1 – Very low** potential for loss of irreplaceable resources. **0 - None**
REVERSIBILITY of impact	**5 –** Impact **cannot** be reversed. **4 – Low** potential that impact might be reversed. **3 – Moderate** potential that impact might be reversed. **2 – High** potential that impact might be reversed. **1 –** Impact **will be** reversible. **0 –** No impact.
MAGNITUDE of <u>NEGATIVE</u> IMPACT (at the indicated spatial scale)	**10 - Very high**: Bio-physical and/or social functions and/or processes might be *severely* altered. **8 - High**: Bio-physical and/or social functions and/or processes might be *considerably* altered. **6 - Medium**: Bio-physical and/or social functions and/or processes might be *notably* altered. **4 - Low** : Bio-physical and/or social functions and/or processes might be *slightly* altered. **2 - Very Low**: Bio-physical and/or social functions and/or processes might be *negligibly* altered. **0 - Zero**: Bio-physical and/or social functions and/or processes will remain *unaltered.*
MAGNITUDE of <u>POSITIVE</u> IMPACT (at the indicated spatial scale)	**10 - Very high (positive)**: Bio-physical and/or social functions and/or processes might be *substantially* enhanced. **8 - High (positive)**: Bio-physical and/or social functions and/or processes might be *considerably* enhanced. **6 - Medium (positive)**: Bio-physical and/or social functions and/or processes might be *notably* enhanced. **4 - Low (positive)**: Bio-physical and/or social functions and/or processes might be *slightly* enhanced. **2 - Very Low (positive)**: Bio-physical and/or social functions and/or processes might be *negligibly* enhanced. **0 - Zero (positive)**: Bio-physical and/or social functions and/or processes will remain *unaltered.*
PROBABILITY (of occurrence)	**5 - Definite**: >95% chance of the potential impact occurring. **4 - High probability**: 75% - 95% chance of the potential impact occurring. **3 - Medium probability**: 25% - 75% chance of the potential impact occurring **2 - Low probability**: 5% - 25% chance of the potential impact occurring. **1 - Improbable**: <5% chance of the potential impact occurring.

Evaluation component	Ranking scale and description (criteria)
DURATION	**5 - Permanent** **4 - Long term**: Impact ceases after operational phase/life of the activity (> 20 years). **3 - Medium term**: Impact might occur during the operational phase/life of the activity (5 to 20 years). **2 - Short term**: Impact might occur during the construction phase (< 5 years). **1 - Immediate**
EXTENT (or spatial scale/influence of impact)	**5 - International**: Beyond National boundaries. **4 - National**: Beyond Provincial boundaries and within National boundaries. **3 - Regional**: Beyond 5 km of the proposed development and within Provincial boundaries. **2 - Local**: Within 5 km of the proposed development. **1 - Site-specific**: On site or within 100 m of the site boundary. **0 -** None
IRREPLACEABLE loss of resources	**5 – Definite** loss of irreplaceable resources. **4 – High** potential for loss of irreplaceable resources. **3 – Moderate** potential for loss of irreplaceable resources. **2 – Low** potential for loss of irreplaceable resources. **1 – Very low** potential for loss of irreplaceable resources. **0 - None**
REVERSIBILITY of impact	**5 –** Impact **cannot** be reversed. **4 – Low** potential that impact might be reversed. **3 – Moderate** potential that impact might be reversed. **2 – High** potential that impact might be reversed. **1 –** Impact **will be** reversible. **0 –** No impact.
MAGNITUDE of <u>NEGATIVE</u> IMPACT (at the indicated spatial scale)	**10 - Very high**: Bio-physical and/or social functions and/or processes might be *severely* altered. **8 - High**: Bio-physical and/or social functions and/or processes might be *considerably* altered. **6 - Medium**: Bio-physical and/or social functions and/or processes might be *notably* altered. **4 - Low** : Bio-physical and/or social functions and/or processes might be *slightly* altered. **2 - Very Low**: Bio-physical and/or social functions and/or processes might be *negligibly* altered. **0 - Zero**: Bio-physical and/or social functions and/or processes will remain *unaltered.*
MAGNITUDE of <u>POSITIVE</u> IMPACT (at the indicated spatial scale)	**10 - Very high (positive)**: Bio-physical and/or social functions and/or processes might be *substantially* enhanced. **8 - High (positive)**: Bio-physical and/or social functions and/or processes might be *considerably* enhanced. **6 - Medium (positive)**: Bio-physical and/or social functions and/or processes might be *notably* enhanced. **4 - Low (positive)**: Bio-physical and/or social functions and/or processes might be *slightly* enhanced. **2 - Very Low (positive)**: Bio-physical and/or social functions and/or processes might be *negligibly* enhanced. **0 - Zero (positive)**: Bio-physical and/or social functions and/or processes will remain *unaltered.*
PROBABILITY (of occurrence)	**5 - Definite**: >95% chance of the potential impact occurring. **4 - High probability**: 75% - 95% chance of the potential impact occurring. **3 - Medium probability**: 25% - 75% chance of the potential impact occurring **2 - Low probability**: 5% - 25% chance of the potential impact occurring. **1 - Improbable**: <5% chance of the potential impact occurring.
CUMULATIVE impacts	**High**: The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern. **Medium**: The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern. **Low**: The activity is localised and might have a negligible cumulative impact. **None**: No cumulative impact on the environment.

The significance of each potential impact is assessed (or calculated) using the following formula:

SP (significance points) = (duration + extent + irreplaceable + reversibility + magnitude) x probability

The maximum value is 150 SP (significance points). The unmitigated and mitigated scenarios for each potential environmental impact are rated as per Table 4.2 below.

Table 4. 2 Definition of significance ratings (positive and negative).

Significance Points	Environmental Significance	Description
100 – 150	**High (H)**	An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options.
40 – 99	**Moderate (M)**	If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project.
<40	**Low (L)**	An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation.
+	**Positive impact (+)**	A positive impact is likely to result in a positive consequence/effect, and is likely to contribute to positive decisions about whether or not to proceed with the project.

Unknown parameters are given the highest score (5 or 10) as significance scoring follows the Precautionary Principle. The Precautionary Principle is based on the following statement: When the information available to an evaluator is uncertain as to whether or not the impact of a proposed development on the environment will be adverse, the evaluator must accept as a matter of precaution, that the impact will be detrimental. It is a test to determine the acceptability of a proposed development. It enables the evaluator to determine whether enough information is available to ensure that a reliable decision can be made.

The findings of this report and identification of potential impacts are based on preliminary desktop work and a brief site visit. The specification of the duration, probability and reversibility of the impacts will be subject to change prior to a detailed site inspection. The significance of impacts stated below were calculated using prior knowledge of similar developments coupled with the desktop work detailed in this report, as well as a 5 day site visit. Furthermore, the precautionary principle will be applied with respect to impacts where there is uncertainty.

Impact 1: Loss of faunal habitat and ecological structure

The construction phase and operational phase of the proposed substation and power line development will result in the loss of faunal habitats within the area. This impact relates to the complete removal or partial destruction/disturbance of existing vegetation by machinery and personnel, impacting directly on the ecological condition of natural vegetation and habitat availability. These activities will have an impact on foraging and breeding ecology of faunal species. Loss of vegetation generally affects nutrient cycles, removes the organic litter layer and results in habitat fragmentation and destruction of wildlife corridors. The habitat is however already largely transformed and fragmented due to the adjacent mining activities and the site is not a unique habitat within the landscape. It is not envisaged that any Red Data species will be displaced by the habitat transformation that will take place as a result of the construction and operation of the proposed development. The impact on smaller, non-Red Data species that are potentially breeding in the area will be local in extent, i.e. it will not have a significant effect on regional or national populations. Alternative 1, 4 and 5 all intersect habitats regarded as sensitive, additionally Alternative 1 intersects Provincial and other Nature Reserves, which should be avoided if possible. With mitigation and careful placement of towers the proposed development will have a limited impact on the loss of faunal habitat.

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE								
		BEFORE MITIGATION								
		Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE
Potential Impacts on faunal communities										
Project activity:	**Planning and design**									
Alternative 1	**Loss of faunal habitat and ecological structure**	8	3	2	2	3	5	90	M	M
Alternative 4	**Loss of faunal habitat and ecological structure**	6	3	2	2	3	5	80	M	M
Alternative 5	**Loss of faunal habitat and ecological structure**	6	3	2	2	3	5	80	M	M

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE								
		AFTER MITIGATION								
		Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE
Potential Impacts on faunal communities										
Project activity:	**Planning and design**									
Alternative 1	**Loss of faunal habitat and ecological structure**	6	2	1	1	2	5	60	M	M
Alternative 4	**Loss of faunal habitat and ecological structure**	4	2	1	1	2	5	50	M	M
Alternative 5	**Loss of faunal habitat and ecological structure**	4	2	1	1	2	5	50	M	M

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE																	
		BEFORE MITIGATION									AFTER MITIGATION								
		Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE	Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE
No Go Alternative	**The no-go option would prevent Loss of faunal habitat and ecological structure**	0	-	0	0	0	0	0	L	None	0	-	0	0	0	5	0	L	None

Recommended Mitigation

- All construction and maintenance activities must be carried out according to the generally accepted environmental best practice and the temporal and spatial footprint of the development must be kept to a minimum.
- The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area.
- Edge effects of all construction and operational activities, such as erosion and alien plant species proliferation, which will affect faunal habitats adjacent to the development area, need to be strictly managed.
- Any natural areas beyond the development footprint, which have been affected by the construction activities, must be rehabilitated using indigenous plant species. Rehabilitation of disturbed areas must be carried out immediately after construction has been completed and rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas to approximates the original condition or at least 85% thereof.
- Erosion control measures must be implemented in areas sensitive to erosion such as exposed soil, edges of slopes (including trenches cut for construction) etc. These measures include but are not limited to - the use of sand bags, hessian sheets, silt fences and retention or replacement of vegetation;
- Education and awareness campaigns on faunal species and their habitat must form part of staff induction procedures to help increase awareness, respect and responsibility towards the environment for all staff and contractors.

Impact 2: Direct Impact on Faunal Communities

Activities involving the clearing of natural vegetation with the use of heavy machinery will result in the loss of faunal species. The extent of this impact is likely to be local in nature and restricted to the site. Faunal diversity within the study area have been negatively impacted as a result of historic and on-going disturbances associated with mining activities. Fauna impacts will be mostly restricted during construction phase, however, a further loss of fauna may occur during the operational phase due to the increased access leading to potential poaching. The impact is similar for all Alternatives but with more significance for the section of Alternative 1 that traverses Natural Protected Areas (approx. 25 km) as well as sections passing through sensitive features.

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE																	
		BEFORE MITIGATION									AFTER MITIGATION								
		Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE	Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE
Potential Impacts on faunal communities																			
Project activity:	**Planning and design**																		
Alternative 1	**Direct faunal impacts**	8	2	1	3	4	5	90	M	M	6	2	1	1	3	3	39	L	L
Alternative 4	**Direct faunal impacts**	6	2	1	3	4	5	80	M	M	4	2	1	1	3	3	33	L	L
Alternative 5	**Direct faunal impacts**	6	2	1	3	4	5	80	M	M	4	2	1	1	3	3	33	L	L
No Go Alternative	**The no-go option would prevent impact on faunal species and habitat**	0	-	0	0	0	0	0	L	None	0	-	0	0	0	0	0	L	None

Recommended Mitigation

- Preconstruction walk-trough of the power line and substation sites need to be conducted by a fauna specialist to identify sensitive fauna habitats
- No collection, trapping or hunting of fauna is to take place. Access control must be implemented to ensure that no illegal trapping or poaching takes place.
- During construction any fauna directly threatened by the activities should be removed to a safe location by the ECO or other suitably qualified person.
- No deliberate or intentional killing of fauna is allowed;
- No fires should be allowed within the site as there is a risk of runaway veld fires.
- Harvesting of firewood or any plant material is prohibited.
- No unauthorized persons must be allowed onto the site and site access should be strictly controlled
- During the construction phase, workers must be limited to areas under construction and access to the undeveloped areas must be strictly controlled;
- All construction vehicles should adhere to a low speed limit (40km/h for cars and 30km/h for trucks) to avoid collisions with susceptible species such as geckos, snakes, tortoises, rabbits and hares.
- All personnel must undergo environmental induction with regards to fauna and including awareness about not harming or collecting fauna.
- All hazardous materials must be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.

Impact 3: Predation from likely influx in Pied Crow

Power line infrastructure are often used for nesting sites and may lead to the proliferation of crows in the region (Cunningham *et al.* 2015). In the past three decades Pied Crow (*Corvus albus*) numbers have increased significantly in South Africa with their spread facilitated by electrical infrastructures (Cunningham *et al.* 2015; Fincham *et al.* 2015). A strong relationship has been found between the rate of population increase and density of power line infrastructure where they occur in arid treeless environments (Cunningham *et al.* 2015). This is particularly true for the expansion of power lines in shrubland biomes where power line infrastructures provide nesting sites (Cunningham *et al.* 2015). Pied Crows are generalist predators, preying on a wide range of species, with evidence of heavy predation pressures on threatened or restricted-range species such as tortoises (Fincham and Lambrecht 2014; Fincham *et al.* 2015). The development may thus create increase predation pressures on *C. signatus* and a number of other susceptible vulnerable faunal species of the region. The indirect artificial increase in Pied Crow abundance (also termed native invaders) may have substantial long term negative impact on relative abundances of prey and competitor species. Furthermore, we currently have very little understanding of the ecological consequences and

ecosystem-level implications of these native invaders in shrubland biomes. It is anticipated that this impact will be most severe in shrubland regions were no other power line infrastructures exists (Alternative 4), providing nesting sites in an otherwise treeless environment. This impact will only be of concern during the operational phase of the project.

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE																	
		BEFORE MITIGATION									AFTER MITIGATION								
		Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE	Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE
Potential Impacts on faunal communities																			
Project activity:	**Planning and design**																		
Alternative 1	**Indirect faunal impacts from influx of in Pied Crows**	6	5	2	4	4	3	63	M	M	4	5	2	4	3	3	54	M	M
Alternative 4	**Indirect faunal impacts from influx of in Pied Crows**	8	5	2	4	4	4	92	M	M	6	5	2	4	3	3	60	M	M
Alternative 5	**Indirect faunal impacts from influx of in Pied Crows**	8	5	2	4	4	4	92	M	M	6	5	2	4	3	3	60	M	M
No Go Alternative	**The No Go option would prevent a potential influx of Pied Crows in the region and not have a negative impact on sensitive fauna communities**	0	-	0	0	0	0	0	L	None	0	-	0	0	0	0	0	L	None

Recommended Mitigation where expansion of new power lines is in shrubland regions

- Pied Crow nesting deterrents must be installed on horizontal and cross beam sections on any self supporting towers where they occur in shrubland biomes (including treeless habitats) and do not follow existing power line infrastructures. Preconstruction walk-through of the power line sites must be conducted by a faunal specialist to identify towers that would require nesting deterrents based on surrounding habitat and other available nesting sites.
- Nesting deterrent measures include but are not limited to the use of nest excluders on horizontal and particularly cross arm sections which are typically preferred by crows.
- The design of the anti-climb fence must not offer any suitable sites for nest of crows. This can be done by modifying structures so that they are angled downwards to avoid having horizontal platforms. Anti-climb fences must also be set as low as possible on the towers to discourage nesting by Pied Crows.
- Ecological research into the conservation impacts of pied crow is strongly encouraged to better understand the ecosystem-level implications of increased numbers of pied crows in shrubland biomes. Research should also focus on evaluating cost effective mitigation measures for new power line developments.

Impact 4: Disturbance

Disturbance created by noise-pollution associated with workers and construction activities can affect local wildlife utilising adjacent habitats, particularly mammalian species. This is likely to be short-lived during the construction phase but will continue to have a limited impact during the operational life span of the development. The proposed development area is located within close proximity to urban and mining developments, therefore, species within this landscape often experience disturbance. As a result, disturbance of fauna by the proposed project during the construction phase is anticipated to be of moderate significance particularly where development follows existing roads and other development in the region.

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE																	
		BEFORE MITIGATION									AFTER MITIGATION								
		Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE	Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE
Potential Impacts on faunal communities																			

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE																	
		BEFORE MITIGATION									AFTER MITIGATION								
		Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE	Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE
Project activity:	**Planning and design**																		
Alternative 1	**Disturbance**	6	2	1	2	2	5	65	M	L	4	2	1	2	1	4	40	M	L
Alternative 4	**Disturbance**	8	2	1	2	2	5	75	M	L	4	2	1	2	1	4	40	M	L
Alternative 5	**Disturbance**	6	2	1	2	2	5	65	M	L	4	2	1	2	1	4	40	M	L
No Go Alternative	**The no-go option would prevent disturbance of fauna due to dust, noise and light pollution.**	0	-	0	0	0	0	0	L	None	0	-	0	0	0	0	0	L	None

Recommended Mitigation for the construction phase

- In line with an approved Construction EMPr, strict control must be maintained over all activities during construction.
- The ECO must be notified of any Red Data species identified in this report observed to be roosting and/or breeding in the vicinity.
- All animal burrows/dens in close proximity to the works areas must be marked as Access restricted areas.

Cumulative impact on fauna

Impact on fauna and fauna habitat due to the cumulative loss and fragmentation of habitat as well as long term ecosystem-level implications of increased powerline infrastructure in shrubland biomes.

PROJECT	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE																	
		BEFORE MITIGATION									AFTER MITIGATION								
		Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE	Magnitude	Duration	Extent	Irreplaceable	Reversibility	Probability	TOTAL (SP)	Significance	CUMULATIVE
Potential Impacts on faunal communities																			
Project activity:																			
Project considered in Isolation	Cumulative	5	3	2	4	4	5	90	M	L	4	3	2	3	3	3	45	M	L
Project and other projects in the area	Cumulative	6	3	3	3	3	5	90	M	M	4	3	2	3	3	3	45	M	M

All above mentioned recommended mitigation for faunal impacts 1-4 should be followed to reduce the overall long term impact of this new development. Development must avoid High Sensitivity features of the site.

5 CONCLUSION

5.1 Recommendations and further studies to be conducted during BA process

Potential impacts identified during the screening phase should be revised, updated and investigated further during the BA phase. The proposed development is not predicted to have a detrimental impact on regional populations or Red Data listed species if all recommended mitigation measures listed are adhered to.

Proposed scope of work for the BA phase for the preferred Alternative:

- Finer scale investigation of identification of key faunal species residing within the study area;
- Further inspection, delineation and mapping of faunal microhabitats and their ability to support Red Data listed or endemic species;
- Design infrastructure (substation expansion, tower placement and route alignments) should avoid highly sensitivity areas, including areas of high to very high impact or within no-go areas.
- Ground assessments and pre-construction walk-through by faunal specialist should be done to further refine the layout and further reduce impacts on sensitive habitats and protected species through micro-siting of the development footprint;
- Placement of infrastructure should be done in such a way that no threatened or rare, or species of conservation concern are affected;
- Design to use as much common/shared infrastructure as possible with development in nodes, rather than spread out;
- Use should be made of the most recent and up to date environmental sensitivity maps and least cost path when planning the final placement of the power line route and tower placements.

5.2 Recommended 'no-go areas'

- Drainage lines
- Ephemeral wetlands or pans. These sensitive features depend exclusively on rainfall and flooding events and can sometimes be dry for years but are important biodiversity features and development may change drainage patterns and affect fauna communities (including birds, amphibians and fish) that use the pans.
- Rocky hills and steep slopes which cannot be restored once destroyed by blasting, trenching or road building.
- If any bat roosts are identified during future field visits

5.3 How does your recommendations tie into existing and future (at least next 5 years) spatial/spatial-planning frameworks?

Power line infrastructures and their associated development corridors have ecological footprints on natural resources and sensitive ecological systems, however the imposed load of this footprint is relatively small provided that activity is restricted to demarcated zones. The National Screening Tool of the Department of Environmental Affairs was used to assess and visualize the distribution of environmental sensitivities for terrestrial biodiversity. Impact of the development on these sensitive features are of potential concern,

especially relating to CBA1 and Protected Areas. The tool integrates multiple input features and maximum score approach is used for any combination of features such that only the highest sensitivity of all input features is reflected in the output summary. The tool found multiple high sensitive features on the overall site and traversing sensitive features is unavoidable. This is particularly true for Alternative 1. But by selecting the shortest route yet avoiding the highest sensitive features (ie Protected Areas) the overall route impacts are minimised. This is the globally accepted best approach to minimize overall impacts of powerline infrastructures. Additionally, the sensitivity map is at a relatively coarse scale and sensitive features are likely avoidable by the development footprint with ground truthing.

5.4 Summary of Recommended Mitigation Measures

- No interference with livestock must occur without the landowner's written consent and with the landowner or a person representing the landowner being present;
- No poaching must be tolerated under any circumstances. All animal burrows/dens in close proximity to the works areas must be marked as Access restricted areas;
- No deliberate or intentional killing of fauna is allowed;
- In areas where snakes are abundant, snake deterrents to be deployed on the pylons to prevent snakes climbing up, being electrocuted and causing power outages; and
- No Threatened or Protected species (ToPs) and/or protected fauna as listed according NEMBA (Act No. 10 of 2004) and relevant provincial ordinances may be removed and/or relocated without appropriate authorisations/permits.
- Preconstruction walk-through of the substation and power line sites by a faunal specialist to identify areas of faunal sensitivity.
- During construction and decommissioning phases any fauna directly threatened by the activities should be removed to a safe location by the ECO or other suitably qualified person.
- The construction sites must be confined to disturbed areas or areas identified with low conservation importance. All construction sites must be demarcated, and no construction personnel or vehicles may leave the demarcated area except those authorised to do so.
- No excavated holes or trenches should be left open for extended periods as fauna may fall in and become trapped. Any open trenches should be checked regularly for trapped fauna.
- No fires should be allowed within the site as there is a risk of runaway veld fires.
- Harvesting of firewood or any plant material is prohibited.
- The construction of new servitude roads should be limited. All servitude roads should be monitored for erosion after construction and appropriate action taken to avoid and reduce erosion including the use of runoff management and control features.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- No unauthorized persons should be allowed onto the site and site access should be strictly controlled
- All construction vehicles should adhere to a low speed limit (40 km/h for cars and 30 km/h for trucks) to avoid collisions with susceptible species such as snakes, tortoises, rabbits and hares.

- All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes; tortoises and snakes are often persecuted out of fear or superstition.
- Pied Crow nesting deterrents must be installed on horizontal and cross beam sections on any self supporting towers where they occur in shrubland biomes (including treeless habitats) and do not follow existing power line infrastructures. Preconstruction walk-through of the power line sites must be conducted by a faunal specialist to identify towers that would require nesting deterrents based on surrounding habitat and other available nesting sites.
- Nesting deterrent measures include but are not limited to the use of nest excluders on horizontal and particularly cross arm sections which are typically preferred by crows.
- The design of the anti-climb fence should not offer any suitable sites for nest of crows. This can be done by modifying structures so that they are angled downwards to avoid having horizontal platforms. Anti-climb fences should also be set as low as possible on the towers to discourage nesting by Pied Crows.
- Ecological research into the conservation impacts of Pied Crow is strongly encouraged to better understand the ecosystem-level implications of increased numbers of Pied Crows in shrubland biomes. Research should also focus on evaluating cost effective mitigation measures for new power line developments.
- Mountainous areas, where erosion and degradation are likely to occur, should have careful route planning to avoid sensitive features (such as isolated rocky outcrops) and rugged terrain where possible.
- No pylons should be located on or near Wetlands (500m buffer) and Major Rivers (32m buffer).

5.5 Recommended monitoring requirements

- An alien plant monitoring and eradication program should be in place to prevent alien plant proliferation and invasion. The program should continue until disturbed areas have recovered and properly stabilized.
- All servitude roads should be monitored for erosion after construction and appropriate action taken to avoid and reduce erosion including the use of runoff management and control features.

5.6 Final specialist recommendations & Conclusion

The fauna communities of the site are poorly documented and this assessment report is largely based on desktop study, previous field visits conducted in the area and supplemented by a short field visit of the corridor and proposed Alternatives. The new power line development is likely to have negative impact on fauna communities due to reduced habitat availability, displacement of fauna, increase mortality and injury of small, less mobile fauna species, and increased predation pressures on priority species from likely influx in crow abundance. The negative effects of the power line can partially be mitigated by the management of personnel and environmental induction during construction, minimisation of footprint and servitude roads, habitat restoration and erosion control and the fitting of nest deterrents on self-supporting towers. An environmental control officer should be appointed by Eskom to monitor impacts, and mitigation management activities, report on non-compliance to relevant contractors, and to oversee implementation of

recommended actions. Mitigation measures are also related to the design of the towers used and avoiding the placement of towers on sensitive features.

A series of faunal microhabitats have been identified within the study site. Ephemeral pans, drainage lines, rocky outcrops are of highest conservation concern as they are high in biodiversity and support species of conservation concern. Apart from avoiding these sensitive features, the footprint of the power line should be kept to a minimum and vegetation clearing should only be carried out if completely necessary.

All of the route corridor alternatives pass through a variety of sensitive areas including Nature Reserves in the central part of the study area, mountainous schrublands and large drainage channels in the eastern section (Buffels Rivier). *V. erioloba* forests west of Kommagas is also considered to be sensitive. Although the Alternatives pass through numerous habitats that are sensitive for fauna, the sensitive features such as rocky outcrops and drainage channels can generally be avoided and mitigated through design considerations and tower placement. It is recommended that Alternative 5 is used for the section between Aggeneis and Nama substations and Alternative 1 is used between Nama and Gromis substations. This route follows existing infrastructure for most of its length and avoids Protected Areas. These are the preferred alternatives from a faunal perspective, excluding avifauna.

Potential impacts identified during the screening phase will be revised, updated and investigated further during the BA phase. The proposed development is not predicted to have a detrimental impact on regional populations or Red Data listed species if all recommended mitigation measures listed are adhered to.

6 REFERENCES

Bates, M. F., Branch, W. R., Bauer, A. M., Burger, M., Marais, J., Alexander, G. J. & de Villiers, M. S. 2014. Suricata 1: Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland.

Boshoff, A.F. & Kerley, G.I.H. 2001. Potential distributions of the medium to large-sized mammals in the Cape Floristic Region, based on historical accounts and habitat requirements. *African Zoology* **36:** 245-273.

Branch, W. R. 2001. The Field Guide to the Snakes and other Reptiles of Southern Africa. Ralph Curtis Books.

Bronner, G. 2015. *Cryptochloris wintoni*. The IUCN Red List of Threatened Species 2015: e.T5748A21287143. http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T5748A21287143.en. Downloaded on 03 October 2019.

Carruthers, V. 2001 Frogs and Frogging in Southern Africa. Struik Publishers. Cape Town.

Child, M.F., Roxburgh, L., Do Linh San, E., Raimondo, D. & Davies-Mostert, H.T. 2016. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Cunningham, S., Madden, C., Barnard, P. & Amar, A. 2015. Electric crows: Power lines, climate change and the emergence of a native invader. *Diversity and Distributions* **22:** 17-29.

Du Preez, L. & Carruthers, V. 2009. A Complete Guide to the Frogs of Southern Africa. Struik Publishers, Cape Town.

Ezemvelo KZN Wildlife. 2013, Guideline on Biodiversity Impact Assessment in KwaZulu-Natal. Scientific Services.

Fincham, J.E., Visagie, R., Underhill, L.G., Brooks, M. & Markus, M.B. 2015. The impacts of the Pied Crow *Corvus albus* on other species need to be determined. *Ornithological Observations* **6:** 232-239.

Friedman, Y. & Daly, B. 2004. Red Data Book of the Mammals of South Africa: A Conservation Assessment: CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust. South Africa.

GENERIC ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr) FOR THE DEVELOPMENT AND EXPANSION OF INFRASTRUCTURE FOR THE OVERHEAD TRANSMISSION AND DISTRIBUTION OF ELECTRICITY https://cer.org.za/wp-content/uploads/2019/03/Generic-EMPR-Substations-and-Overhead-electricty-transmission-and-distribution-infrastructure.pdf

Marais, J.A. 2012. Complete Guide to the Snakes of Southern Africa. Struik Publishers.

Maree, S. 2016. *Bathyergus janetta*. The IUCN Red List of Threatened Species 2016: e.T2619A22185370. http://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T2619A22185370.en. Downloaded on 30 September 2019.

Minter, L. R., Burger, M., Harrison, J. A., Braack, H. H. Bishop, P. J. & Kloepfer, D. 2004. Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SANBI. 2012. *National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report*. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.

Skinner, J. D. & Chimimba, T. C. 2005. The Mammals of the Southern African Subregion. 3rd edition. Cambridge University Press.

STRATEGIC ENVIRONMENTAL IMPACT ASSESSMENT FOR ELECTRICITY GRID INFRASTRUCTURE. Main Report and Appendix C: Specialist Studies. https://egi.csir.co.za/?page_id=1375;

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA. https://redzs.csir.co.za/.

Stuart, C. & Stuart, M. 2012. Stuarts' African Mammals app. Penguin Random House South Africa. A Penguin Random House Company.

Taylor, P. & Relton, C. 2019. *Thallomys shortridgei*. The IUCN Red List of Threatened Species 2019: e.T21693A22436032. http://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T21693A22436032.en. Downloaded on 02 October 2019.

7 APPENDICES

7.1 Appendix 1: List of Mammals

Appendix 1. List of mammal species which are likely to occur in the broad vicinity of the power line alternatives. Conservation status is from the IUCN Red List 2016.

Common name	Scientific name	Conservation Status
Southern African Mole-rat	*Cryptomys hottentotus*	Least Concern
Namaqua Dune Mole Rat	*Bathyergus janetta*	Least Concern
Springbok	*Antidorcas marsupialis*	Least Concern
Gemsbok	*Oryx gazella*	Least Concern
Klipspringer	*Oreotragus oreotragus*	Least Concern
Grey Rhebok	*Pelea capreolus*	Near Threatened
Steenbok	*Raphicerus campestris*	Least Concern
Common Duiker	*Sylvicapra grimmia*	Least Concern
Bat-eared Fox	*Otocyon megalotis*	Least Concern
Cape Fox	*Vulpes chama*	Least Concern
Black-backed Jackal	*Canis mesomelas*	Least Concern
Chacma Baboon	*Papio ursinus*	Least Concern
Vervet Monkey	*Chlorocebus pygerythrus*	Least Concern
Cape Golden Mole	*Chrysochloris asiatica*	Data Deficient
Grant's Golden Mole	*Eremitalpa granti*	Vulnerable
De Winton's Golden Mole	*Cryptochloris wintoni*	Critically Endangered
Hartmann's Mountain Zebra	*Equus zebra hartmannae*	Vulnerable
Cape Mountain Zebra	*Equus zebra zebra*	Least Concern
Brown Hyena	*Parahyaena brunnea*	Vulnerable
Leopard	*Panthera pardus*	Vulnerable
Black-footed cat	*Felis nigripes*	Vulnerable
African Wildcat	*Felis silvestris*	Least Concern
Caracal	*Caracal caracal*	Least Concern
Stone Dormouse	*Graphiurus rupicola*	Least Concern
Spectacled Dormouse	*Graphiurus ocularis*	Least Concern
Yellow Mongoose	*Cynictis penicillata*	Least Concern
Cape Grey Mongoose	*Herpestes pulverulentus*	Least Concern
Meerkat	*Suricata suricatta*	Least Concern
Aardwolf	*Proteles cristata*	Least Concern
Cape Porcupine	*Hystrix africaeaustralis*	Least Concern
Cape Hare	*Lepus capensis*	Least Concern
Cape Scrub Hare	*Lepus saxatilis*	Least Concern
Smith's Red Rock Hare	*Pronolagus rupestris*	Least Concern
Cape Elephant Shrew	*Elephantulus edwardii*	Least Concern
Western Rock Elephant Shrew	*Elephantulus rupestris*	Least Concern
Short-eared Elephant Shrew	*Macroscelides proboscideus*	Least Concern
Natal Long-fingered Bat	*Miniopterus natalensis*	Least Concern
Roberts's Flat-headed Bat	*Sauromys petrophilus*	Least Concern
Egyptian Free-tailed Bat	*Tadarida aegyptiaca*	Least Concern
Namaqua Rock Mouse	*Micaelamys namaquensis*	Least Concern
Cape Short-tailed Gerbil	*Desmodillus auricularis*	Least Concern
Paeba Hairy-footed Gerbil	*Gerbilliscus paeba*	Least Concern

Bushy-tailed Hairy-footed Gerbil	*Gerbillurus vallinus*	Least Concern
Highveld Gerbil	*Gerbilliscus brantsii*	Least Concern
Southern African Pygmy Mouse	*Mus minutoides*	Least Concern
House Mouse	*Mus musculus musculus*	Least Concern
Karoo Bush Rat	*Otomys unisulcatus*	Least Concern
Brants's Whistling Rat	*Parotomys brantsii*	Least Concern
Littledale's Whistling Rat	*Parotomys littledalei*	Near Threatened
Four-striped Grass Mouse	*Rhabdomys pumilio*	Least Concern
West-Central South African Four-striped Grass Rat	*Rhabdomys bechuanae*	Least Concern
Shortridge's Rat	*Thallomys shortridgei*	Data Deficient
Striped Polecat	*Ictonyx striatus*	Least Concern
Honey Badger	*Mellivora capensis*	Near Threatened
Brukkaros Pygmy Rock Mouse	*Petromyscus monticularis*	Least Concern
Barbour's Rock Mouse	*Petromyscus barbouri*	Least Concern
Gerbil Mouse	*Malacothrix typica*	Least Concern
Pygmy Rock Mouse	*Petromyscus collinus*	Least Concern
Cape Long-eared Bat	*Nycteris thebaica*	Least Concern
Aardvark	*Orycteropus afer*	Least Concern
Spring Hare	*Pedetes capensis*	Least Concern
Dassie Rat	*Petromus typicus*	Near Threatened
Cape Rock Hyrax	*Procavia capensis*	Least Concern
African Straw-coloured Fruit-bat	*Eidolon helvum*	Least Concern
Cape Horseshoe Bat	*Rhinolophus capensis*	Near Threatened
Geoffroy's Horseshoe Bat	*Rhinolophus clivosus*	Near Threatened
Darling's Horseshoe Bat	*Rhinolophus darlingi*	Least Concern
Damara horseshoe bat	*Rhinolophus damarensis*	Least Concern
South African Ground Squirrel	*Xerus inauris*	Least Concern
Reddish-gray Musk Shrew	*Crocidura cyanea*	Least Concern
Lesser Dwarf Shrew	*Suncus varilla*	Data Deficient
Greater Red Musk Shrew	*Crocidura flavescens*	Least Concern
Forest Shrew	*Myosorex varius*	Data Deficient
Cape Serotine	*Neoromicia capensis*	Least Concern
Hottentot Serotine Bat	*Eptesicus hottentotus*	Least Concern
Common Genet	*Genetta genetta*	Least Concern

7.2 Appendix 2: List of Reptiles

Appendix 2. List of reptile species which are likely to occur in the broad vicinity of the power line alternatives. Conservation status is from the Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates *et al.* 2014).

Type	Common name	Scientific name	Conservation status
Snakes	Puff Adder	*Bitis arietans*	Least Concern
Snakes	Many horned Adder	*Bitis cornuta*	Least Concern
Snakes	Desert Mountain Adder	*Bitis xeropaga*	Least Concern
Snakes	Horned Adder	*Bitis caudalis*	Least Concern
Snakes	Namaqua Dwarf Adder	*Bitis schneideri*	Least Concern
Snakes	Cape Cobra	*Naja nivea*	Least Concern
Snakes	Coral Snake	*Aspidelaps lubricus*	Least Concern

Snakes	Dwarf Beaked Snake	*Dipsina multimaculata*	Least Concern
Snakes	Karoo Whip/Sand Snake	*Psammophis notostictus*	Least Concern
Snakes	Kalahari Sand Snake	*Psammophis trinasalis*	Least Concern
Snakes	Namib Sand Snake	*Psammophis namibensis*	Least Concern
Snakes	Crossed Whip Snake	*Psammophis crucifer*	Least Concern
Snakes	Spotted Skaapsteker	*Psammophylax rhombeatus*	Least Concern
Snakes	Beetz's/Namib tiger Snake	*Telescopus beetzii*	Least Concern
Snakes	Brown House Snake	*Boaedon capensis*	Least Concern
Snakes	Spotted House Snake	*Lamprophis guttatus*	Least Concern
Snakes	Fisk's House Snake	*Lamprophis fiskii*	Least Concern
Snakes	Mole Snake	*Pseudaspis cana*	Least Concern
Snakes	Spotted Harlequin Snake	*Homoroselaps lacteus*	Least Concern
Snakes	Twin-striped Shovel-snout	*Prosymna bivittata*	Least Concern
Snakes	South-western Shovel-snout	*Prosymna frontalis*	Least Concern
Snakes	Sundevall's Shovel-snout	*Prosymna sundevallii*	Least Concern
Snakes	Spotted/Variegated Bush Snake	*Philothamnus semivariegatus*	Least Concern
Snakes	Rhombic Egg-eater	*Dasypeltis scabra*	Least Concern
Snakes	Delalande's Beaked Blind Snake	*Rhinotyphlops lalandei*	Least Concern
Snakes	Schinz's Beaked Blind Snake	*Rhinotyphlops schinzi*	Least Concern
Chameleons	Namaqua Chameleon	*Chamaeleo namaquensis*	Least Concern
Chameleons	Namaqua Dwarf Chameleon	*Bradypodion occidentale*	Least Concern
Geckos	Common Giant Ground Gecko	*Chondrodactylus angulifer*	Least Concern
Geckos	Bibron's Thick-toed Gecko	*Chondrodactylus bibronii*	Least Concern
Geckos	Turner’s Thick-toed Gecko	*Chondrodactylus turneri*	Least Concern
Geckos	Namaqua Day Gecko	*Phelsuma ocellata*	Least Concern
Geckos	Striped Pygmy Gecko	*Goggia lineata*	Least Concern
Geckos	Namaqua Pygmy Gecko	*Goggia rupicola*	Least Concern
Geckos	Western Cape Gecko	*Pachydactylus labialis*	Least Concern
Geckos	Namaqua Flat Gecko	*Afroedura a. namaquensis*	Least Concern
Geckos	Austen's Gecko	*Pachydactylus austeni*	Least Concern
Geckos	Barnard's Rough Gecko	*Pachydactylus barnardi*	Least Concern
Geckos	Namaqua Gecko	*Pachydactylus namaquensis*	Least Concern
Geckos	Weber's Gecko	*Pachydactylus weberi*	Least Concern
Geckos	Namaqua Banded Gecko	*Pachydactylus amoenus*	Least Concern
Geckos	Large-scaled Banded Gecko	*Pachydactylus macrolepis*	Least Concern
Geckos	Augrabies Gecko	*Pachydactylus atorquatus*	Least Concern
Geckos	Quartz Gecko	*Pachydactylus latirostris*	Least Concern
Geckos	Purcell’s Gecko	*Pachydactylus purcelli*	Least Concern
Geckos	Rough Thick-toed Gecko	*Pachydactylus rugosus*	Least Concern
Geckos	Common Barking Gecko	*Ptenopus garrulus maculatus*	Least Concern
Lizards	Ground Agama	*Agama aculeata*	Least Concern
Lizards	Western Rock Agama	*Agama anchietae*	Least Concern
Lizards	Spiny Ground Agama	*Agama hispida*	Least Concern
Lizards	Southern Rock Agama	*Agama atra*	Least Concern
Lizards	Armadillo Girdeled Lizard	*Ouroborus cataphractus*	Least Concern
Lizards	Large-scaled girdled Lizard	*Cordylus macropholis*	Near-threatened
Lizards	Karoo Girdled Lizard	*Karusasaurus polyzonus*	Least Concern
Lizards	Peer's Girdled Lizard	*Namazonurus peersi*	Least Concern
Lizards	Namaqua Flat Lizard	*Platysaurus capensis*	Least Concern
Lizards	Dwarf Plated Lizard	*Cordylosaurus subtessellatus*	Least Concern

Lizards	Karoo/Namaqua Plated Lizard	*Gerrhosaurus typicus*	Least Concern
Lizards	Karoo Sand Lizard	*Pedioplanis laticeps*	Least Concern
Lizards	Plain Sand Lizard	*Pedioplanis inornata*	Least Concern
Lizards	Spotted Sand Lizard	*Pedioplanis lineoocellata*	Least Concern
Lizards	Namaqua Sand Lizard	*Pedioplanis namaquensis*	Least Concern
Lizards	Smith's Desert Lizard	*Meroles ctenodactylus*	Least Concern
Lizards	Knox's Desert Lizard	*Meroles knoxii*	Least Concern
Lizards	Spotted Sand Lizard	*Meroles suborbitalis*	Least Concern
Lizards	Striped or Banded Sand Lizard	*Nucras tessellata*	Least Concern
Lizards	Namaqua Dwarf Legless Skink	*Acontias tristis*	Least Concern
Lizards	Namaqualand Legless Skink	*Acontias namaquensis*	Least Concern
Lizards	Coastal Legless Skink	*Acontias litoralis*	Least Concern
Lizards	Striped Dwarf Legless Skink	*Acontias lineatus*	Least Concern
Lizards	Pink Blind Legless Skink	*Typhlosaurus vermis*	Least Concern
Lizards	Striped Dwarf Burrowing Skink	*Scelotes sexlineatus*	Least Concern
Lizards	Cape Dwarf Burrowing Skink	*Scelotes caffer*	Least Concern
Lizards	Cape Skink	*Trachylepis capensis*	Least Concern
Lizards	Western three-striped skink	*Trachylepis occidentalis*	Least Concern
Lizards	Western Rock Skink	*Trachylepis sulcata*	Least Concern
Lizards	Variegated Skink	*Trachylepis variegata*	Least Concern
Lizards	Red-sided Skink	*Trachylepis homalocephala*	Least Concern
Terrapin	South African Helmeted Terrapin	*Pelomedusa subrufa*	Least Concern
Tortoises	Speckled Dwarf Tortoise/Padloper	*Homopus signatus*	Vulnerable A2acde
Tortoises	Angulate Tortoise	*Chersina angulata*	Least Concern
Tortoises	Tent Tortoise	*Psammobates tentorius*	Least Concern
Tortoises	Leopard Tortoise	*Stigmochelys pardalis*	Least Concern

7.3 Appendix 3: List of Amphibians

Appendix 3. List of amphibian species which are likely to occur in the broad vicinity of the power line alternatives. Conservation status is from the IUCN Red List 2016..

Common name	Scientific name	Conservation Status
Namaqua Rain Frog	*Breviceps namaquensis*	Least Concern
Desert Rain Frog	*Breviceps macros*	Near Threatened
Karoo Toad	*Vandijkophrynus gariepensis*	Least Concern
Paradise toad	*Vandijkophrynus robinsoni*	Least Concern
Namaqua Stream Frog	*Strongylopus springbokensis*	Least Concern
Namaqua Caco	*Cacosternum namaquense*	Least Concern
Namaqua Sand Frog	*Tomopterna branchi*	Data Deficient
Branch's Rain Frog	*Breviceps branchi*	Data Deficient
Marbled Rubber Frog	*Phrynomantis annectens*	Least Concern
Catequero Bullfrog	*Tomopterna cryptotis*	Least Concern
Delalande's Sand Frog	*Tomopterna delalandii*	Least Concern
African Clawed Frog	*Xenopus laevis*	Not Applicable
Poynton's River Frog	*Amietia poyntoni*	Least Concern
Delalande's River Frog	*Amietia delalandii*	Least Concern

7.4 Appendix 4: List of observed species during site visit

Common name	Scientific name	Notes
MAMMALS		
Aardvark	*Orycteropus afer*	Tracks only
Bat-eared Fox	*Otocyon megalotis*	Dead only
Springbok	*Antidorcas marsupialis*	Passive survey
Gemsbok	*Oryx gazella*	Passive survey
Klipspringer	*Oreotragus oreotragus*	Passive survey
Smith's Red Rock Hare	*Pronolagus rupestris*	Night Drive
Chacma Baboon	*Papio ursinus*	Passive survey
REPTILES		
Cape Coral Snake	*Aspidelaps lubricus lubricus*	Night Drive
Spotted House Snake	*Lamprophis guttatus*	Active Night Search
Bibron's Tuberculated Gecko	*Chondrodactylus bibronii*	Night Drive, Active Day Search
Striped pygmy Gecko	*Goggia lineata*	Active Day Search
Barnard's Gecko	*Pachydactylus barnardi*	Night Drive
Namaqua Gecko	*Pachydactylus namaquensis*	Active Day Search, Active Night search
Weber's Gecko	*Pachydactylus weberi*	Night Drive
Large Scaled Banded Gecko	*Pachydactylus macrolepis*	Night Drive
Spotted Barking Gecko	*Ptenopus garrulus maculatus*	Passive survey
Anchietae's agama	*Agama anchietae*	Active Day Search
Southern Rock Agama	*Agama atra*	Passive Survey
Karoo Girdled Lizard	*Karusasaurus polyzonus*	Active Day Search
Plain Sand Lizard	*Pedioplanis inornata*	Active Day Search
Namaqua Sand Lizard	*Pedioplanis namaquensis*	Active Day Search
Knox's Desert Lizard	*Meroles knoxii*	Active Day Search
Coastal Legless Skink	*Acontias litoralis*	Active Day Search
Western Rock Skink	*Trachylepis sulcata*	Active Day Search, Active Night Search
Variegated Skink	*Trachylepis variegata*	Active Day Search
Angulate Tortoise	*Chersina angulata*	Active Day Search

Content Requirements of Specialist Reports, as prescribed by Appendix 6 of GN 326

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	End of report
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	*Page ii*
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.2
(c) an indication of the quality and age of base data used for the specialist report;	Section 2.1
(c) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 3
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2.2
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 3.2, Figure 9 & 10
(g) an identification of any areas to be avoided, including buffers;	Section 5.2
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 9 & 10
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.3
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	Section 4
(k) any mitigation measures for inclusion in the EMPr;	Section 5.4
(l) any conditions for inclusion in the environmental authorisation;	
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 5.5
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; i. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	Section 5.6
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	
(p) any other information requested by the competent authority	
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	