FLORA AND FAUNA ASSESSMENT

FOR

MARAPONG-BOIKARABELO EFFLUENT TRANSFER PROJECT

LEDJAJA COAL (PTY) LTD

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1 INTRODUCTION

Ecology was first described by Ernst Haeckel (1866) as “the comprehensive science of the relationship of the organism to the environment”. Within ecology a broad spectrum of branches are identified. One of these branches is biodiversity. Biodiversity describes the variety of life in an area, including the number of different species, the genetic wealth within each species, the interrelationships between them, and the natural areas where they occur (E. Wilson, 1988).

In South Africa a rich species diversity is found. South Africa has a land surface area of 1,1 million km^2 that represents just 1% of the earth's total land surface. However, it still contains almost 10% of the world's total known bird, fish and plant species, and over 6% of the world's mammal and reptile species. This natural wealth is threatened by growing human populations and their demands on the environment and for this reason continual biodiversity studies are necessary (Collins, 2001).

Within a biodiversity study, a fauna study forms an integral part. A fauna study specifically refers to terrestrial animals of a project area. This study should however still be seen in context with the other studies undertaken for this project and the development of the mine.

Terrestrial animals include Mammalia (mammals), Avifauna (birds) and Herpetofauna (reptiles and amphibians). A total of 243 mammals are found in South Africa of which 17 are threatened species, including the Black Rhino, Pangolin and Giant Golden mole. The Riverine rabbit, Roan antelope and Wild dog are endangered and thus far two mammals have become extinct including the Blue antelope and the Quagga.

More than 800 bird species occur in South Africa of which 26 are threatened including the African penguin, Cape vulture, Martial eagle, Bateleur and Cape parrot. Another five species are identified to be endangered including Wattled crane, Roseate tern, Egyptian vulture, Blackrumped buttonquail and Blue swallow. The Herpetofauna comprises of 370 reptiles and amphibians of which 21 are threatened and six of these are endangered (Collins, 2001).

Although 5.4% of South Africa’s land surface area is currently formally conserved through the system of national and provincial protected areas, the protected area network is skewed towards certain biomes such as savanna, in which the area of interest is located, leaving biomes such as grasslands and succulent Karoo under conserved (DEAT, 2005). Many of these areas overlap with areas of high population density, high agricultural potential, mineral deposits and scenic beauty important for tourism. This can lead to conflict regarding decisions over land use allocations. For this reason extensive consultation regarding land use changes is required and areas considered irreplaceable for biodiversity conservation and important for ecosystem services, need to be set aside.

In many areas, especially in terrestrial ecosystems, it is not the direct use of biological resources that is threatening their sustainability, but rather indirect pressures such as changing land use and associated clearing of natural vegetation and habitat fragmentation. The Limpopo Province is rich in biodiversity, this is commonly attributed to its bio-geographical location and diverse topography. Three centres of endemism occur within the province, the Drakensberg escarpment including Wolkberg, Sekhukhuneland and Soutpansberg, and according to Acocks (1974) there are 15 different veld types within the province.

The primary objective of this investigation was to characterise the flora and fauna present and to investigate the potential impacts of the proposed project on the vegetation and animal life in the study area. The proposed project encompasses a pipeline with an approximate length of 58km long that will transfer 16M/l per day of treated chlorinated effluent from the Marapong Municipal Wastewater Treatment Works to the Boikarabelo Coal Mine. One pump

station associated with the pipeline is proposed to be constructed. The pipeline will have a servitudet of 3m on each side.

2 TERMS OF REFERENCE

Digby Wells Environmental (Digby Wells) was appointed as consultants to provide the specialist inputs on the ecology, vegetation and animal life of the pre-disturbed environment due to the proposed construction of the Marapong-Boikarabelo Effluent Transfer (MBET) pipieline in the Waterberg district in the Limpopo Province. Digby Wells was appointed according to the following terms of reference:

- Conduct a flora and fauna investigation of the proposed site;
- To identify on site and confirm by means of a desktop study (if necessary) the following:
  - Dominant indigenous species (Flora and Fauna);
  - Dominant exotic species;
  - Dominant veld type;
  - Rare and endangered species present;
  - Rare and endangered species that can possibly be present within the relevant farms, but not recorded during the survey;
  - Communicate any additional relevant issues that might be of significance to the project; and
  - Compile a report, which embraces these requirements.

3 KNOWLEDGE GAPS

Historical data on the flora and fauna obtained through official websites is assumed to be correct. No review or correction of the historical data was undertaken. No access was available on any farms during the night to conduct night surveys; therefore night surveys conducted were per road. Time constraints dictate the amount of time in the field, which translates into the amount of data that can be collected.

4 STUDY AREA

The proposed project is situated in the Waterberg Coalfield area. This region is largely undeveloped and is characterised by game farming and grazing. Figure 4-1 illustrates the regional setting of the study area. To the north of the Magaliesburg and the west of the Great Escarpment, stretches the savanna region that generally receives more rain than the Kalahari to its west and situated at higher altitudes and less tropical in character than the lowveld savanna that lies east of the Great Escarpment. This area is also referred to as the bushveld. Official records and studies have in the past been conducted predominantly in nature reserves and game farms, leaving areas outside of these with little official data. However, five official major regions are present, three of which are represented in the study area

According to White (1983), the area of concern falls within the Kalahari thornveld and the transition to Zambezian broad-leaved woodland. This vegetation type is characterized by wooded grassland. Furthermore, the area falls on the transition between the Zambezian Regional Centre of Plant Endemism (also referred to as the Zambezian Region) and the Kalahari-Highveld Regional Transitional Zone as described by White (1983).

It shows strong similarities to Sweet Bushveld, as described by Van Rooyen & Bredenkamp (Low and Rebelo, 1996), the Arid Sweet Bushveld as described by Acocks (1988) and the Limpopo sweet Bushveld according to Mucina and Rutherford (2006). The Sweet Bushveld and Arid Sweet Bushveld show similarities and correspond in vegetation composition, dominant trees, shrubs, climate and soils. The Limpopo Sweet Bushveld vegetation in Limpopo represents 94.4% of the vegetation type's occurrence, 23% of it has been modified, furthermore, nationally as well as provincially 0.59% of it is officially protected.

Sweet Bushveld occurs on fertile soils in the dry and hot valleys of the Limpopo River and the thorny, small-leaved vegetation is dominated by Acacia spp. which increases to dense, impenetrable thickets at the expense of the grass layer when over utilised. Mixed Bushveld varies from short, dense bushveld to a rather open, tree savanna. On shallow, infertile soils the broad-leaved Red Bushwillow dominates, whereas on deeper, leached soils the Silver Clusterleaf becomes dominant. The Waterberg Moist Mountain Bushveld is a typical example of moist, infertile savanna. Due to the high proportion of unpalatable grasses, the area has become known as sour bushveld.

The vegetation that characterizes this area has developed many survival strategies, including the ability to produce tannins that are triggered when the leaves are browsed, the production of toxic sap, the development of thorns or their adaptation to sourveld areas that is not generally favoured by grazers. The interaction of vegetation, fire and animals play important roles in maintaining savanna ecosystems. Over time the savanna system and the antelope that inhabit it have co-evolved. Grasses, have become well adapted to defoliation, as much a defensive response to constant pressure by grazers as to the regular veld fires that pass through the savanna in the dry seasons. The success of grasses has been a constantly renewed vast reservoir of food upon which large herds of grazers flourish. The woody component is also constantly exploited by many browsers, and with so many herbivores present, the carnivore component of the complex ecological system also flourished.

The savanna biome is populated by a greater diversity of bird species than any other biome in South Africa. The presence of both woody plants and a well-developed herbaceous layer provides diverse sources of food and shelter for specialist and generalist bird species, including seed-eaters, insectivores and diurnal and nocturnal birds of prey abound.

Much of the area is used for game farming and big game hunting, indicating that utilization and conservation of an area are not mutually exclusive. The savanna biome is the core of the wildlife, ecotourism and meat-production industries. Threats include rapidly expanding development of settlements for impoverished human populations and the associated need for firewood and building materials, diminishing water supply, agriculture and over-grazing (Knobel, 1999).

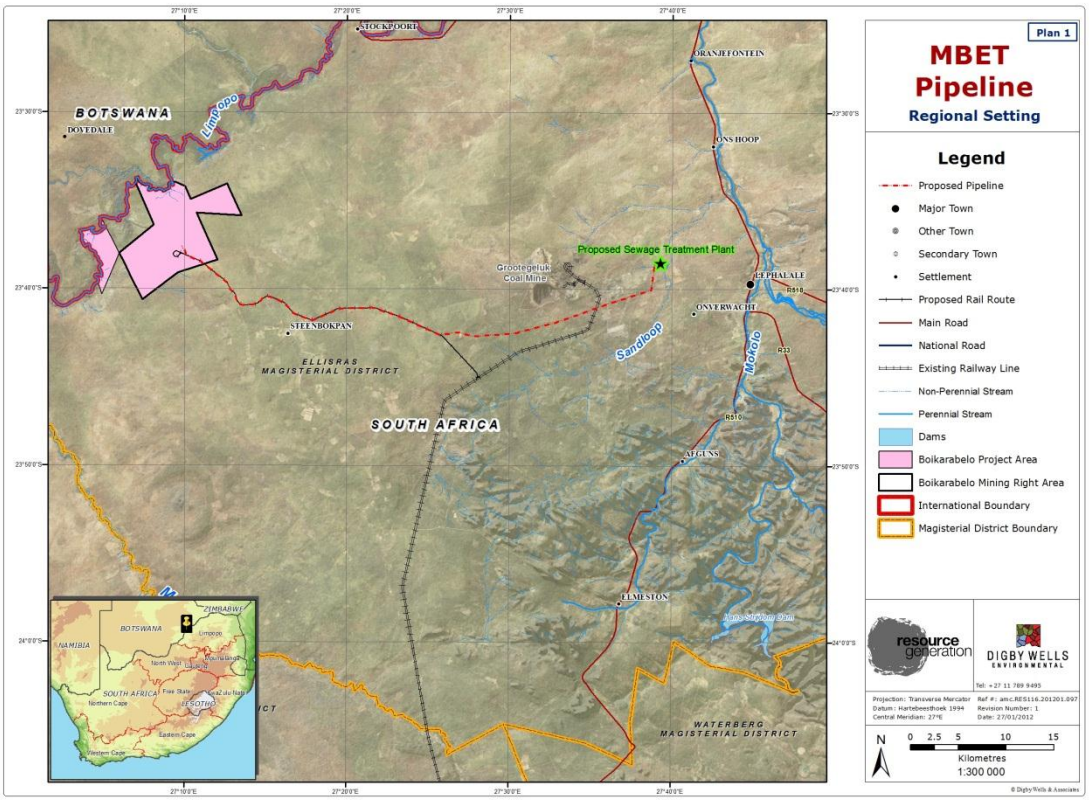

Figure 4-1: Study area

5 EXPERTISE OF THE SPECIALIST

The Biodiversity specialist (Louise Van Wyk) achieved an honours degree in Biodiversity at the University of Johannesburg; and is an environmental consultant specialising in both terrestrial ecology and environmental management. The specialist holds an M.Sc in Environmental Management from the University of Johannesburg and did a thesis on the ecology of the Kruger National Park. Experience includes predominantly ecology field work such as flora and fauna surveys, biodiversity assessments, Biodiversity Action Plans, species relocation and environmental rehabilitation. Furthermore experience has been acquired in environmental auditing, EIAs, Environmental Management Plans (EMP) and water licensing procedures. Project experience includes various countries such as Botswana, Sierra Leone, Mozambique, Ghana and throughout South Africa. A full CV is attached as Appendix D.

6 AIMS AND OBJECTIVES

The aim of this project is to determine the ecological integrity of the area to be impacted so that the loss of ecological integrity can be minimised. This is done through the following objectives:

- Determine flora and fauna species composition and habitat;
- Determine species of concern or sensitive areas;
- Establish severity of the project impacts; and
- Suggest mitigation to reduce impacts.

7 METHODOLOGY

In order to enable characterisation of the environment, as well as of floral and faunal species that may be impacted on by the proposed activities, floral and faunal groups were investigated. The groups of species investigated included:

- Vegetation;
- Mammals;
- Avifauna; and
- Herpetofauna (Reptiles and Amphibia).

All methods implemented during this study are based on accepted scientific investigative techniques/principles and were performed to acceptable standards and norms. The biodiversity survey took place during the wet season (March 2012).

7.1 Flora survey

A varied Braun-Blanquet method was used whereby vegetation is studied by means of aerial/satellite imagery based on physiognomic characteristics. Representative areas within the identified vegetation communities are then surveyed by means of line-point transects for grasses, sedges and forbs, as well as belt transects for shrubs and trees. Data obtained from these surveys are then subject to analysis to establish differences or similarities between observed communities and seasonal variation.

Vegetation communities were previously established with previous studies, as a section of the pipeline runs along a railway previously assessed and surveys. This survey confirmed previous findings, conducted a full study on the rest of the pipeline not previously covered and identified/marked all Red Data, protected and endemic species. Baseline National

Herbarium Pretoria (PRE) Computerised Information System (PRECIS) data from South African National Biodiversity Institute (SANBI) for 2327CA, 2327CB and 2327DA grid squares, were compared to the Limpopo Environmental Management Act (Act 7, 2003) protected species to compile a list of Red Data plant species that may potentially occur within the study area. A sweep (total count) of the area was conducted to mark all species of concern found within the proposed pipeline area. Floristic sensitivity analysis was determined by subjectively assessing the ecological function and conservation importance of the vegetation, as defined in Table 7-1:

Table 7-1: The Floristic sensitivity analysis through assessment of the ecological function and conservation importance.

Sensitivity	Ecological function	Conservation importance
High	Sensitive ecosystems with either low inherent resistance or resilience towards disturbance factors or highly dynamic systems considered to be stable and important for the maintenance of ecosystems integrity (e.g. pristine grasslands, pristine wetlands and pristine ridges).	Ecosystems with high species richness and usually provide suitable habitat for a number of threatened species. Usually termed 'no-go' areas and unsuitable for development, and should be protected.
Medium	Relatively important ecosystems at gradients of intermediate disturbances. An area may be considered of medium ecological function if it is directly adjacent to sensitive/pristine ecosystem.	Ecosystems with intermediate levels of species diversity without any threatened species. Low-density development may be allowed, provided the current species diversity is conserved.
Low	Degraded and highly disturbed systems with little or no ecological function.	Areas with little or no conservation potential and usually species poor (most species are usually exotic).

7.2 Animal survey

Pertinent notes were made during the survey and desktop studies were also conducted for mammals, birds, reptile and frogs. All fauna species encountered on site were identified and recorded. The following methods were used during the survey:

7.2.1 Mammals

Visual sightings and ecological indications were used to identify the mammal inhabitants of the study area; this includes scats, tracks and habitat such as burrows and dens. Scat found was collected (if required), photographed on scale along with any tracks found and identified. For identification purposes a field guide Mammals of Southern Africa (Smithers, 2000) was used.

The following was recorded:

- All mammals encountered, noted or captured during the survey;
- Animals listed in previous studies;
- A list of the most prominent mammal species; and
- A list of threatened or protected species encountered during the survey.

Small mammal trapping was also applied by using Sherman traps. Sherman traps are collapsible traps (23 cm x 9 cm x 7.5 cm) which were baited and laid along transects. Areas where clear small mammal activity could be seen such as the presence of burrows were also

used as sites for trapping. The traps were checked in the morning due to the fact that the small mammals are predominantly active at night. Captured animals were photographed and identified. Species of conservation concern and listed by the IUCN or by the Limpopo Environmental Management Act as protected and endemic within the study area, took priority and the Red Data status identified and recorded.

7.2.2 Birds

The principal ornithological field survey technique used was transect surveys. Transect surveys were planned based on site representative of different avifauna habitat, such as bushveld, open areas and road reserves by simply following the linear project that transect over these habitat types. Transect procedures involve slow attentive walks along transects during which any bird seen or heard is identified and recorded. Species observed during the vegetation transect surveys were also recorded.

The following was recorded:

- All birds encountered or noted during the survey; and
- A list of rare and endangered species encountered.

Where possible, visual identification was used to confirm bird calls. Bird species were confirmed using Sinclair *et al* (1997). Assessment of the conservation status of species recorded focused on the various categories of Globally Threatened Species (IUCN 2004) and birds listed by the Limpopo Environmental Management Act (2003). Robert's' Multimedia of Birds of Southern Africa (2006) was used to compile a list of possible species that might occur in the project area which falls within the quarter degree square 2327CA and 2327CB.

7.2.3 Reptiles and Frogs

Herpetofauna include reptile and amphibian species. Direct /opportunistic observation was done along trails or paths within the project area. Any herpetofauna species seen or heard along such paths or trails within the project area was identified and recorded. Another method used was refuge examinations using visual scanning of terrains to record smaller herpetofaunal species which often conceal themselves under rocks and in fallen logs, rotten tree stumps, under rocks, in leaf litter, rodent burrows, ponds, old termite mounds, etc. Branch (1996) and Carruthers (2001) was used to confirm identification where necessary.

7.2.4 Red Data Faunal assessment

The following parameters were used to assess the Probability of Occurrence of each Red Data species:

- Habitat requirements (HR) – Most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics in the study area was evaluated.
- Habitat status (HS) – The status or ecological condition of available habitat in the area is assessed. Often a high level of habitat degradation prevalent in a specific habitat will negate the potential presence of Red Data species (this is especially evident in wetland habitats).
- Habitat linkage (HL) – Movement between areas for breeding and feeding forms an essential part of the existence of many species. Connectivity of the study area to surrounding habitat and the adequacy of these linkages are evaluated for the ecological functioning of Red Data species habitat within the study area.

Probability of occurrence is presented in four categories, namely:

- Low (will not occur);
- Medium (could possibly occur);
- High (most likely could occur); or
- Recorded (does occur on site).

The IUCN Red Data categories are defined as in Table 7-2 and it is used for the status identification of mammals, birds, reptiles and amphibians globally.

Table 7-2: Red Data Categories and description from IUCN (IUCN, 2010).

Category	Description
CRITICALLY ENDANGERED (CR)	A taxon is Critically Endangered when it is considered to be facing an extremely high risk of extinction in the wild
ENDANGERED (EN)	A taxon is Endangered when it is considered to be facing a very high risk of extinction in the wild
VULNERABLE (VU)	A taxon is Vulnerable when the best available evidence indicates it to be facing a high risk of extinction in the wild
NEAR THREATENED (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future
DATA DEFICIENT (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status
NOT EVALUATED (NE)	A taxon is Not Evaluated when it is has not yet been evaluated against the criteria

8 RESULTS AND DISCUSSIONS

8.1 Flora

The proposed pipeline has a small area of disturbance. The first section of the pipeline will run adjacent to a proposed railway. For this reason the pipeline has the same vegetation as the railway (Flora and Fauna Assessment for Mine Railway RES 901, Digby Wells Environmental). From this report eight plant communities were identified

Community 1: This community occurs on low lying areas and is characterised by vegetation occurring on central and northern Zeekoevley which is dominated by *Acacia karroo* and *Boscia foetida* community tree species in closed woodland with little grass cover on clay rich soils. *Aristida adscensionis* and *Schmidtia pappophoroides* were the dominant grass species in this community.

Community 2: Occurring on the outer edges of community 1 this community is more grass rich with fewer trees, mostly *Boscia foetida.* In this area open grassland community with a few small tree species were dominant. *Acacia senegal, Grewia flava, Grewia flavescens* and *Boscia albitrunca* were dominant tree species, with *Brachiaria deflexa* and *Schmidtia pappophoroides* dominating the grass sword.

Community 3: This community occurs to the northwest where a rocky sandstone ridge dominates the landscape. It is this characteristic which gave rise to *Euclea undulata,*

Gardenia volkensii community woodland, interspersed with *Combretum apiculatum* and *Acacia fleckii*. The grass sword comprised of dominant species such as *Pogonarthria squarrosa* and *Eragrostis biflora.*

Community 4: This community occurs on the northern border of the project site adjacent to the Limpopo River. It is a low lying community prone to flooding during the wet season. It is dominated by a low growing open Acacia woodland with a strong grass sword.

Community 5: This community borders community 4 to the south, here *Terminalia sericea* and *Acacia melifera* formed dense woodland with a grass sword comprising of *Schmidtia pappophoroides, Digitaria eriantha* and *Aristida congesta s. barbicollis* dominates the landscape.

Community 6: This community follows the lower lying banks of the Limpopo River, this community sonsists of predominantly riparian vegetation with large *Faidherbia albida* tree occurring throughout.

Community 7: This community is dominated by a *Grewia flava/ Ximenia americana* community woodland, covering most of the central, eastern and northern flat sandy areas. Here *Terminalia sericea* and *Acacia melifera* formed dense woodland with a grass sword comprising of *Schmidtia pappophoroides, Digitaria eriantha* and *Aristida congesta s. barbicollis.*

Community 8: This community was found on the farm Diepspruit, with dominant tree species being *Acacia tortillis* (Umbrella thorn), *Acacia karoo* (Sweet thorn), *Peltophorum africanum* (Weeping wattle), *Combretum apiculatum* (Red Bushwillow) and *Terminalia sericea* (Silver cluster leaf). The shrub component was dominated by *Euclea undulata* (Common guarrie), *Rhigozum brevispinosum* (Simple leaf Rhigozum), *Grewia flava* (Velvet Raisin) and *Dichrostachys cinerea* (Sickle bush) and the grass sword was dominated by *Schmidtia pappophoroides* (Sand Quick), *Perotis patens* (Cat's Tail), *Eragrosis pallens* (Broom love grass) and *Eragrostis nindensis* (Whether love grass).

The second part of the pipeline will remain within a road reserve. From the pipeline survey the same species combination of trees were found throughout the project area; however the dominant species will vary depending on environmental attributes and the existing level of disturbance on the area. In some sections the grassy layer dominated with only a few scattered trees (Figure 8-1) and in other areas the direct opposite was found (Figure 8-2). Commonly occurring tree species of which the dominance changed included *Terminalia sericea*, *Combretum apiculatum*, *Sclerocarya birrea*, *Boscia albitrunca*, *Boscia foetida*, *Acacia karroo*, *Acacia tortilis*, *Acacia nigrescens*, *Dichrostachys cinerea* and shrubs *Grewia flava* or *Grewia flavescens*. Commonly occurring grasses included *Aristida congesta s. barbicolli*, *Aristida congesta s. congesta*, *Stipagrostis uniplumis* and *Eragrostis* species.

Once the road reserve is reached vegetation was depleted to grass cover and exotic/invasive species (Figure 8-3). Some scattered trees were found along the road reserve that was dominantly *Sclerocarya birrea* (Marula). Permits form these have been applied for under the railway line project. Due to the fact that the pipeline will be situated in already disturbed areas the impacts will be greatly reduced. All species found during the field survey can be seen in Appendix A.

Figure 8-1: A section where the grassland dominates bushveld cover.

Figure 8-2: Most of the bushveld had a dominating tree and shrub level.

Figure 8-3: Road reserve vegetation that consists of grass species and exotic/invasive species

8.1.1 Red Data plant species

The Red Data species retrieved from SANBI PRECIS data for the grid squares 2327CA, 2327CB and 2327DA can be seen in Table 8-1. These species along with species protected by the Limpopo Environmental Management Act (Act No 7 of 2003) and the National Forest Act (1998) were considered when assessing Red Data and protected species occurrence.

Table 8-1: Red Data species listed to possibly occur in the project grid squares.

Family	Species Name	Status
EUPHORBIACEAE	*Acalypha caperonioides var. caperonioides*	DDT
EUPHORBIACEAE	*Euphorbia waterbergensis*	Rare
MALVACEAE	*Corchorus psammophilus*	Threatened
POACEAE	*Eulalia aurea*	NT

No Red Data species were found to occur on the project area, however protected species were found. Protected species can be seen in Table 8-2 and include *Acacia erioloba* (Camel thorn), *Boscia albitrunca* (Sheperds tree) *Combretum imberbe* (Leadwood) and *Sclerocarya birrea* (Marula). A large portion of the project area was covered in protected species. Figure 8-4 indicates all the protected species marked for the pipeline.

Table 8-2: Protected species found within the project area.

Species name	Protected status	Description	Image
Acacia erioloba	National Forest Act protected	A large shrub or rounded tree to 15m. The bark is grey and furrowed and the young branches reddish – brown. The thorns are in straight pairs, fused at the base and swollen into an ant-gall	
Boscia albitrunca	National Forest Act protected	A small to medium sized tree to 7m with a rounded crown. The main stem is white or whitish-grey. The branches are stout and crooked. The leaves are clustered with a rounded apex, leathery and greyish-green.	
Combretum imberbe	National Forest Act protected	A medium to large deciduous tree, 7 to 20m, with a wide spreding canopy. The main stem is large, upright and branching occurs high up. The bark is grey and rough, cracking into deep vertical and horizontal fissures. The fruit is 4-winged and pale yellowish green.	

Species name	Protected status	Description	Image
Sclerocarya birrea	National Forest Act protected	A medium to large deciduous tree to 18m. The main stem is upright, branching high up with a spreading and rounded crown. The bark is pale grey-brown and the leaflets have long petiolules. The fruit is fleshy plum like – the Marula.	

8.1.2 Exotic and invasive plant species

Invasives and exotics encountered on the project area can be seen in Table 8-3. These species were not encountered in large numbers in the bushveld and only sparsely distributed singular plants were found. In the vicinity of homesteads the occurrence and density of weed species were considerably higher than away from them as well as on the road reserve section of the pipeline. This could be indicative of the tendency of these species to colonise previously disturbed areas.

Table 8-3: Invasives and exotics found within the project area.

Family	Species Name	Common Name
AMARANTHACEAE	*Geigeria burkei*	Vermeersiektebossie
AMARANTHACEAE	*Gomphrena celosioides*	Batchelor's Button
ASCLEPIADACEAE	*Gomphocarpus fruticosus*	Milkweed
ASTERACEAE	*Flaveria bidentis*	Smelter's bush
ASTERACEAE	*Pseudognaphalium luteo-album*	Jersey Cudweed
ASTERACEAE	*Tagetes minuta*	Tall Khaki Weed
BRASSICACEAE	*Capsella bursa-pastoris*	-
BRASSICACEAE	*Lepidium africanum*	Pepperweed
CACTACEAE	*Opuntia ficus-indica*	Sweet Prickly Pear
CYPERACEAE	*Cyperus esculentus*	Yellow Nut Sedge
MALVACEAE	*Sida cordifolia*	Flannel Weed
POACEA	*Paspalum dilatatum*	Dallis Grass
SOLANACEAE	*Solanum incanum*	Grey Bitter-apple
SOLANACEAE	*Solanum panduriforme*	Yellow Bitter-apple
SOLANACEAE	*Solanum sp.*	
ZYGOPHYLLACEAE	*Tribulus terrestris*	Devil thorns

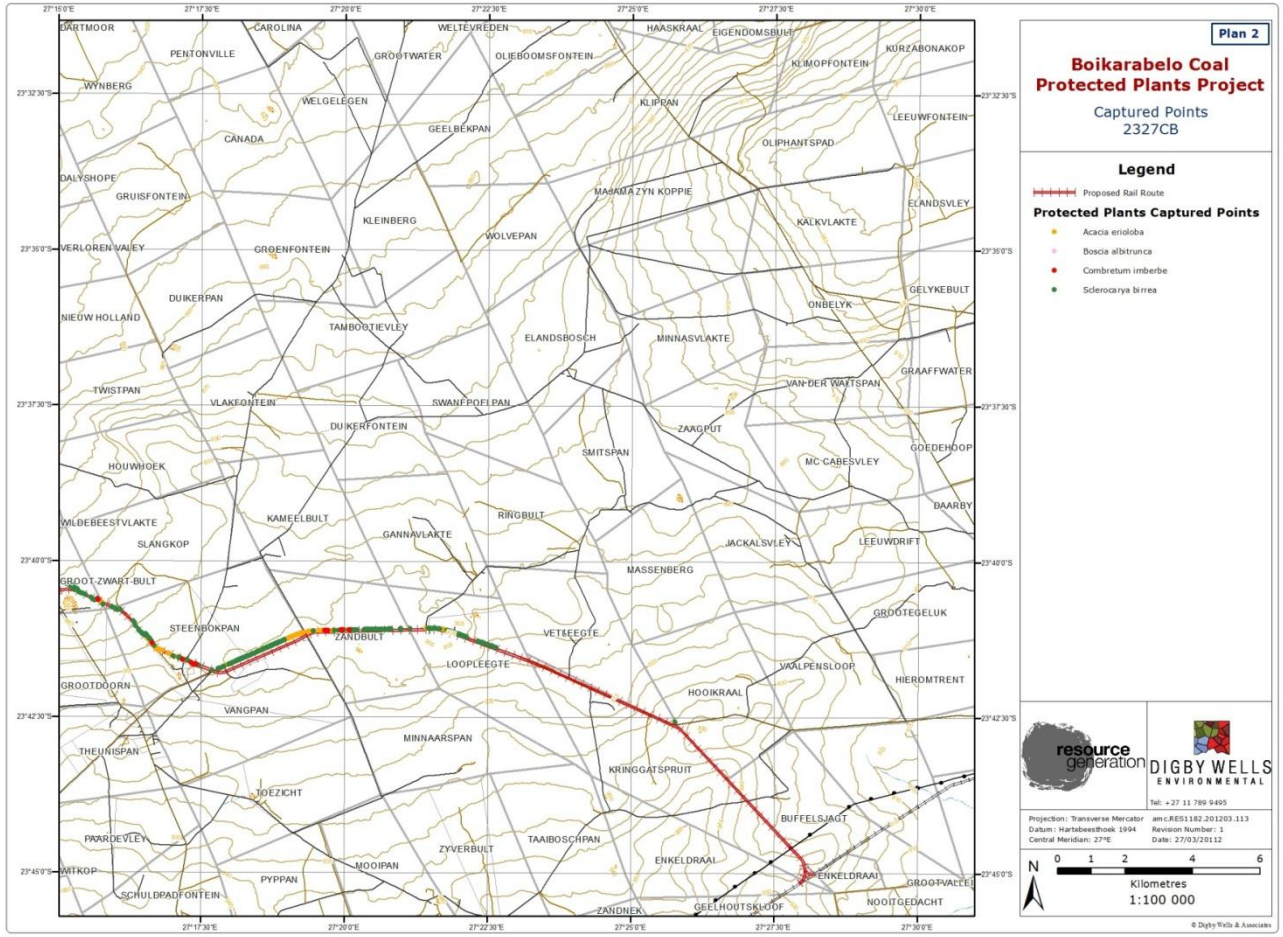

Figure 8-4: Protected species marked on the pipeline servitude.

8.1.3 Medicinal plant species

From the list of plant species identified during the field survey, there are 35 species recognised as having medicinal or cultural value (Table 8-4). Medicinal plants have been used traditionally for centuries to cure many ailments. Plants have also been used traditionally for other cultural uses, such as building material, and for spiritual uses such as charms.

Table 8-4: Plant identified during the survey to have medicinal/cultural uses.

Family	Species Name	Comon Name
ANACARDIACEAE	*Searsia pyroides*	Common wild current
ANACARDIACEAE	*Sclerocarya birrea*	Marula
ASPARAGACEAE	*Asparagus laricinus*	Cluster leaved asparagus
ASTERACEAE	*Pseudognaphalium luteo-album*	Jersey Cudweed
BURSERACEAE	*Commiphora pyracanthoides*	Common corkwood
CAPPARACEAE	*Boscia albitrunca*	Shepherds tree
CELASTRACEAE	*Gymnosporia senegalensis*	Red Spike Thorn
COMBRETACEAE	*Combretum imberbe*	Leadwood
COMBRETACEAE	*Combretum molle*	Velvet bushwillow
COMBRETACEAE	*Terminalia sericea*	Silver cluster leaf
COMMELINACEAE	*Commelina africana*	Yellow Commelina
COMMELINACEAE	*Cyanotis speciosa*	Doll's powderpuff
CUCURBITACEAE	*Cucumis myriocarpus*	Wild cucumber
CYPERACEAE	*Cyperus esculentus*	Yellow Nut Sedge
EBENACEAE	*Euclea undulata*	Common guarrie
FABACEAE	*Acacia burkei*	Black monkey thorn
FABACEAE	*Acacia erioloba*	Camel thorn
FABACEAE	*Acacia karroo*	Sweet thorn
FABACEAE	*Acacia tortilis*	Umbrella thorn
FABACEAE	*Dichrostachys cinerea*	Sickle bush
FABACEAE	*Elephantorrhiza elephantina*	Elephant's Root
FABACEAE	*Peltophorum africanum*	Weeping wattle
FABACEAE	*Tephrosia purpurea*	Silver Tephrosia
HYACINTHACEAE	*Ledebouria ovatifolia*	-
MALVACEAE	*Hibiscus trionum*	Bladder Hibiscus
OLACACEAE	*Ximenia caffra*	Sourplum
RHAMNACEAE	*Ziziphus mucronata*	Buffalo thorn
RUBIACEAE	*Vangueria infausta*	Velvet wild medlar
SALICACEAE	*Dovyalis caffra*	Kei apple
SOLANACEAE	*Solanum incanum*	Grey Bitter-apple
SOLANACEAE	*Solanum panduriforme*	Yellow Bitter-apple

Family	Species Name	Comon Name
STRYCHNACEAE	*Strychnos spinosa*	Green monkey orange
TILIACEAE	*Grewia bicolor*	Whit leaved raisin
TILIACEAE	*Grewia flava*	Velvet Raisin
TILIACEAE	*Grewia occidentalis*	Cross berry

8.2 Fauna

Desktop studies included identifying animals potentially occurring in the area of interest and identifying their Red Data status. Of all the species of different taxa observed during the survey, eight were found to either have Red Data statuses or are protected.

8.2.1 Mammals

8.2.1.1 Mammals found to be present on the site area according to a desktop study

For a desktop review of mammals that could possibly occur within the project area, SIBIS was used. SIBIS is part of South African National Biodiversity Institute (SANBI's) Integrated Biodiversity Information System. Animal species that were previously recorded within the Limpopo Province and the project area can be seen in Appendix B. The list also indicated the global and national IUCN status, as well as the NEMBA status. By making a comparison between the previously recorded species list and the currently occurring species found during the field survey, the magnitude of impacts resulting in species reduction or loss can be estimated.

8.2.1.2 Mammals found during the field survey

Burrows and holes of small mammals, which can possibly belong to mice, rats, suricates, etc. were found during the field survey. Sherman traps were previously set up to capture small mammals that are nocturnal. Species captured included *Gerbilliscus leucogaster* (Figure 8-5).

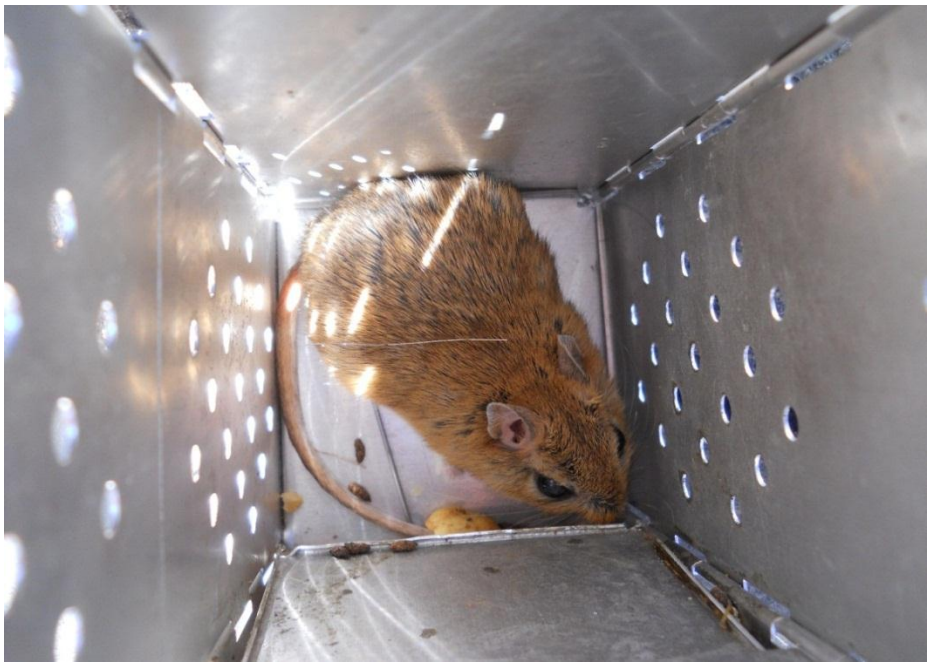

Figure 8-5: *Gerbilliscus leucogaster* previously captured on site in a Sherman trap.

All the mammals recorded during the animal survey can be seen in Table 8-5.

Table 8-5: Mammal species identified to occur in the project area.

Family	Scientific Name	Common Name
BOVIDAE	*Aepyceros melampus*	Impala
BOVIDAE	*Alcelaphus buselaphus*	Red Hartebeest
BOVIDAE	*Connochaetes taurinus taurinus*	Blue Wildebeest
BOVIDAE	*Damaliscus dorcas*	Blesbuck
BOVIDAE	*Oryx gazella*	Gemsbok
BOVIDAE	*Raphicerus campestris*	Steenbok
BOVIDAE	*Sylvicapra grimmia*	Grey /Common Duiker
BOVIDAE	*Syncerus caffer*	Cape Buffalo
BOVIDAE	*Taurotragus oryx*	Eland
BOVIDAE	*Tragelaphus strepsiceros*	Kudu
BOVIDAE	*Tragelaphus scriptus*	Bushbuck
CANIDAE	*Canis mesomelas*	Black-backed Jackal
CANIDAE	*Otocyon megalotis*	Bat-eared Fox
CERCOPITHECIDAE	*Cercopithecus aethiops pygerythrus*	Vervet Monkey
CERCOPITHECIDAE	*Papio ursinus*	Chacma Baboon
FELIDAE	*Acinonyx jubatus*	Cheetah
FELIDAE	*Caracal caracal*	Caracal
FELIDAE	*Hippotragus niger niger*	Sable Antelope
FELIDAE	*Hystrix africeaustralis*	Porcupine
FELIDAE	*Lepus saxatilis*	Scrub/Savannah Hare
FELIDAE	*Panthera pardus*	Leopard
HERPESTIDAE	*Galerella sanguinea*	Slender Mongoose
HYAENIDAE	*Proteles cristata*	Aardwolf
MURIDAE	*Gerbilliscus leucogaster*	Bushveld Gerbil
ORYCTEROPODIDA	*Orycteropus afer*	Aardvark
PEDETIDAE	*Pedetes capensis*	Springhare
SCIURIDAE	*Paraxerus cepapi*	Tree Squirrel
SCIURIDAE	*Xerus inauris*	Cape Ground Squirrel
SUIDAE	*Phacochoerus africanus*	Warthog
VIVERRIDAE	*Civettictis civetta*	African Civet
VIVERRIDAE	*Genetta genetta*	Common Genet

Note: Red areas denotes species protected by the Limpopo Environmental Management Act (2003) Schedule 3

Red Data or protected species were identified to be introduced, reintroduced or naturally occurring. Sable is the only protected species that is reintroduced and the Cape Buffalo is introduced. All the other species are naturally occurring as they can move between boundaries and are not stocked by farmers. For this reason it is concluded that the site

represents suitable habitat for many Red Data and protected mammal species. The Cheetah has an IUCN status and is protected by the Limpopo Province. The Aardwolf is an indication of a unique ecological system. Aardwolf feed on termite mounds and other insects, but they do not have the claws to open the termite mounds. In the dry season they are very dependent on the Aardvark to excavate termite mounds so that they can feed. Where aardwolves are found, Aardvark is usually present and for this reason Aardvark is considered as a keystone species.

The burrows of Springhare (also found during the field survey) are used by Aardwolf for their dens. In turn, excavated termite mounds present habitat for snakes and birds and other small mammal species or reptiles. This ecological system will be impacted if any of the Aardwolf, Aardvark or Springhare species are impacted/removed by the development. A mated pair of the Bat-eared fox was seen at the start of the pipeline/railway. This indicates that there is a den within the vicinity of the project area that needs to be located and not disturbed. If disturbed species will need to be relocated or other conservation measures set in place such as an offset area. Illustrations of the protected and endangered species can be seen in Figure 5 – 8.

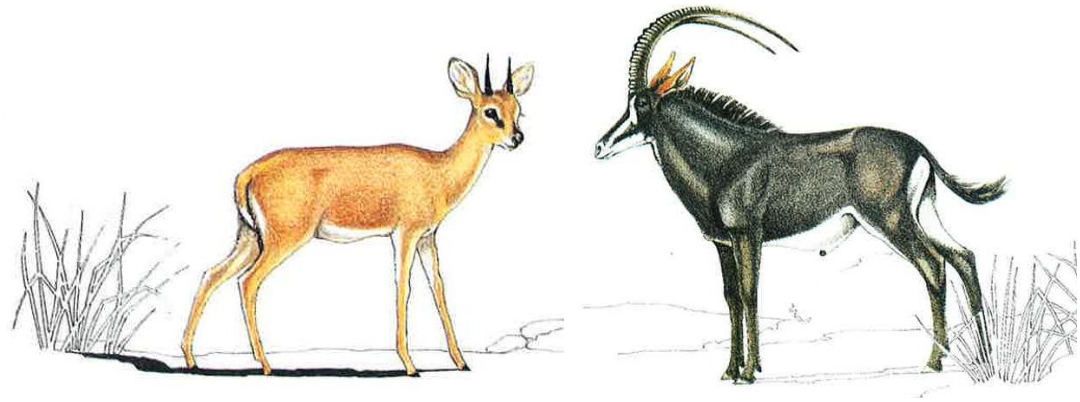

Figure 8-6: Protected species *Raphicerus campestris* (Steenbok) left and *Hippotragus niger niger* (Sable) right (Smithers, 2000).

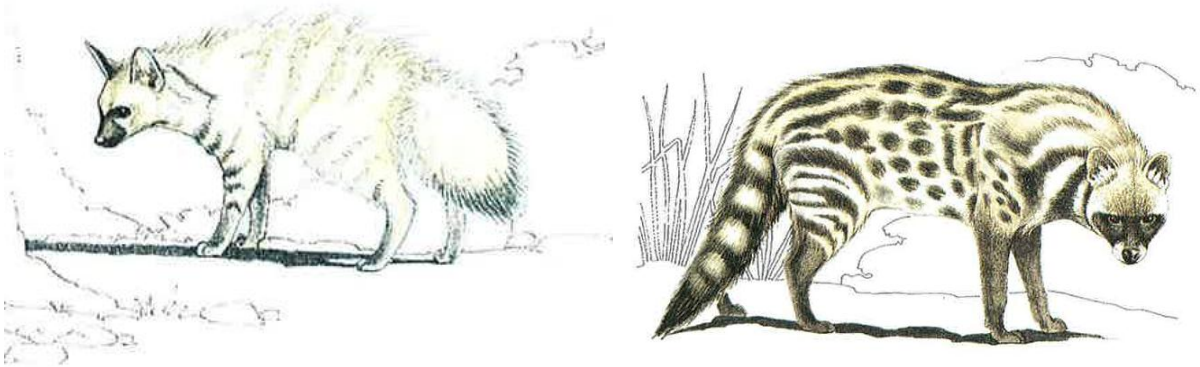

Figure 8-7: Protected species *Proteles cristata* (Aardwolf) left and *Civettictis civetta* (Civet) right (Smithers, 2000).

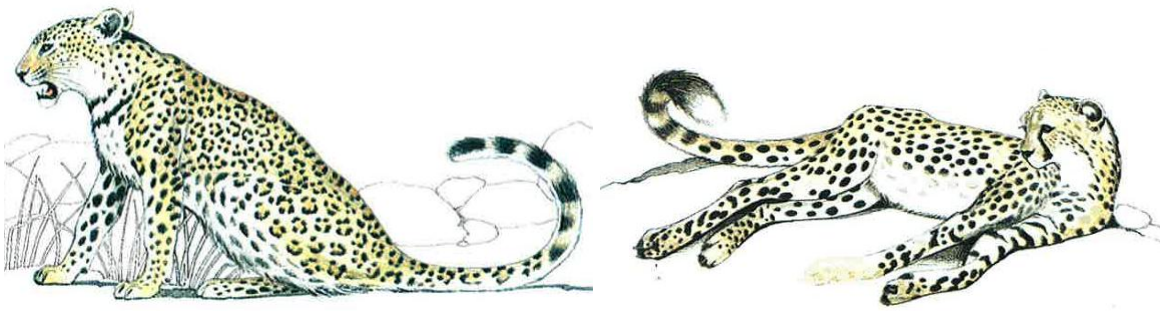

Figure 8-8: Protected species *Panthera pardus* (Leopard) left and *Acinonyx jubatus* (Cheetah) right (Smithers, 2000).

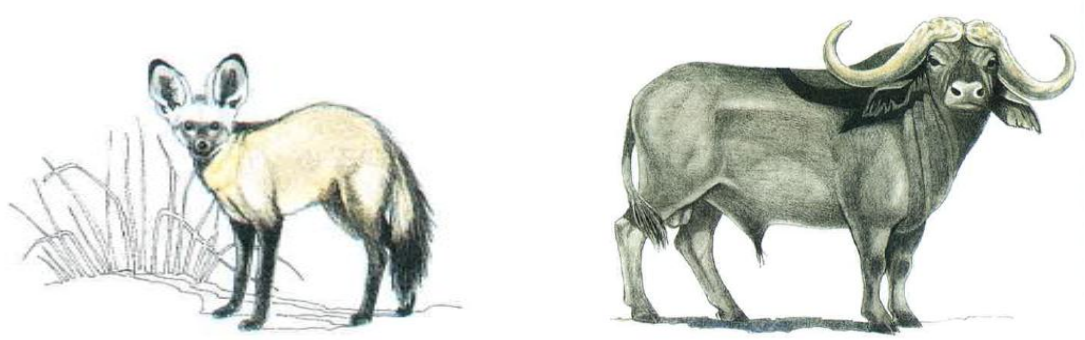

Figure 8-9: Protected species *Otocyon megalotis* (Bat-eared fox) left and *Syncerus caffra* (Cape Buffalo) right (Smithers, 2000).

8.2.1.3 Red Data and protected mammals

The Red Data species considered for this survey can be seen in Table 8-6, protected mammals have been discussed above. The probability of occurrence was estimated based on habitat requirement and distribution. The only naturally occurring Red Data species found was the Cheetah. The Cheetah is categorised as a Red Data species because of the threats that are exerted on it and limited genetic variation. One of the most common threats is habitat loss. This development will add to habitat loss, but might also provide protection or protected areas for the Cheetah to continue within this region. The current game and cattle farming does not provide this protection to the Cheetah, in fact they are regarded as pests that feed on live stock.

Table 8-6: Red Data species of the Limpopo Province.

Category	Scientific Name	Common Name	Probability
Critically Endangered	*Diceros bicornis*	Black Rhinoceros	Low
	Amblysomus julianae	Juliana's golden mole	Medium
Endangered	*Loxodonta africana*	African elephant	Low
	Lycaon pictus	African wild dog	Medium
Vulnerable	*Amblysomus gunningi*	Gunning's golden mole	Low
	Lutra maculicollis	Spotted-necked otter	Low
	Acinonyx jubatis	Cheetah	**Recorded**
	Felis lybica	African wild cat	Medium

Category	Scientific Name	Common Name	Probability
	Panthera leo	Lion	Low
Near Threatened	*Ceratotherium simum*	White rhinoceros	Low

8.2.2 Birds.

8.2.2.1 Birds species found to be present in the site area based on a desktop study

Roberts (2003) listed a complete bird species list of over 300 species that can possibly be present in the proposed area of development, situated in Grid 2327CA, 2327CB and 2327DA. The list of these species can be found in Appendix C. From this a comparison can be drawn on the species that can possibly occur and the species that were recorded on site.

8.2.2.2 Bird species found during the field survey

118 bird species were identified to occur within the project area. Table 8-7 summarizes all species of birds recorded. This list cannot be considered as a complete list as many other birds can be present within any given season or day of the year. Of the birds recorded, four were found to have a Red Data status. It is recommended that any development should take place during the dry season so that the fledgling numbers are reduced.

Table 8-7: Bird species found during the field survey.

Scientific Name	Common Name	Scientific Name	Common Name
Aquila rapax	Tawny Eagle	*Lanius collurio*	Redbacked Shrike
Ardeotis kori	Kori Bustard	*Lybius torquatus*	Blackcollared Barbet
Batis molitor	Chinspot Batis	*Megaceryle maxima*	Giant Kingfisher
Bostrychia hagedash	Hadeda Ibis	*Melaenornis pammelaina*	Black Flycatcher
Bradornis mariquensis	Marico Flycatcher	*Melierax canorus*	Pale Chanting Goshawk
Bubalornis niger	Redbilled Buffalo Weaver	*Melierax gabar*	Gabar Goshawk
Bubo africanus	Spotted Eagle Owl	*Merops apiaster*	Eurasian Bee-eater
Bubulcus ibis	Cattle Egret	*Merops hirundineus*	Swallowtailed Bee-eater
Burhinus capensis	Spotted Dikkop	*Merops persicus*	Bluecheeked Bee-eater
Buteo vulpinus	Steppe Buzzard	*Merops pusillus*	Little Bee-eater
Calendulauda sabota	Sabota Lark	*Milvus migrans*	Black Kite
Caprimulgus pectoralis	Fierynecked Nightjar	*Motacilla aguimp*	African Pied Wagtail
Cercotrichas paena	Kalahari Robin	*Muscicapa striata*	Spotted Flycatcher
Chalcomitra amethystina	Black Sunbird	*Myrmecocichla formicivora*	Anteating Chat
Charadrius tricollaris	Threebanded Plover	*Numida meleagris*	Helmeted Guineafowl
Chrysococcyx caprius	Diederik Cuckoo	*Oena capensis*	Namaqua Dove
Circaetus cinereus	Brown Snake Eagle	*Parus niger*	Southern Black Tit

Scientific Name	Common Name	Scientific Name	Common Name
Circaetus pectoralis	Blackbreasted Snake Eagle	*Passer diffusus*	Southern Greyheaded Sparrow
Clamator glandarius	Great Spotted Cuckoo	*Passer domesticus*	House Sparrow
Colius striatus	Speckled Mousebird	*Petronia superciliaris*	Yellowthroated Sparrow
Columba guinea	Rock Pigeon	*Plegadis falcinellus*	Glossy Ibis
Coracias caudata	Lilacbreasted Roller	*Plocepasser mahali*	Whitebrowed Sparrowweaver
Coracias garrulus	Eurasian Roller	*Ploceus velatus*	Masked Weaver
Coracias naevia	Purple Roller	*Polyboroides typus*	Gymnogene
Corvinella melanoleuca	Longtailed Shrike	*Psophocichla litsipsirupa*	Groundscraper Thrush
Corythaixoides concolor	Grey Lourie	*Pternistis natalensis*	Natal Francolin
Creatophora cinerea	Wattled Starling	*Pternistis swainsonii*	Swainson's Francolin
Cuculus clamosus	Black Cuckoo	*Pterocles burchelli*	Burchell's Sandgrouse
Cuculus solitarius	Redchested Cuckoo	*Pycnonotus tricolor*	Blackeyed Bulbul
Dendroperdix sephaena	Crested Francolin	*Quelea quelea*	Redbilled Quelea
Dendropicos fuscescens	Cardinal Woodpecker	*Rhinopomastus cyanomelas*	Scimitarbilled Woodhoopoe
Dendropicos namaquus	Bearded Woodpecker	*Serinus flaviventris*	Yellow Canary
Dicrurus adsimilis	Forktailed Drongo	*Serinus gularis*	Streakyheaded canary
Dryoscopus cubla	Puffback	*Sigelus silens*	Fiscal Flycatcher
Egretta intermedia	Yellowbilled Egret	*Sporopipes squamifrons*	Scalyfeathered Finch
Elanus caeruleus	Blackshouldered Kite	*Streptopelia capicola*	Cape Turtle Dove
Emberiza tahapisi	Cinnamonbreasted Rock Bunting	*Streptopelia semitorquata*	Redeyed Dove
Erythropygia leucophrys	Whitebrowed robin	*Streptopelia senegalensis*	Laughing Dove
Estrilda astrild	Common Waxbill	*Struthio camelus*	Ostrich
Euplectes orix	Red Bishop	*Tockus erythrorhynchus*	Redbilled Hornbill
Eupodotis ruficrista	Redcrested Korhaan	*Tockus leucomelas*	Southern Yellowbilled Hornbill
Eurocephalus anguitimens	Whitecrowned Shrike	*Tockus nasutus*	Grey Hornbill
Francolinus coqui	Coqui francolin	*Trachyphonus vaillantii*	Crested Barbet
Francolinus sephaena	Crested francolin	*Tricholaema leucomelas*	Pied Barbet

Scientific Name	Common Name	Scientific Name	Common Name
Francolinus swainsonii	Swainson's francolin	*Turdoides bicolor*	Pied Babbler
Fulica cristata	Redknobbed Coot	*Turdoides jardineii*	Arrowmarked Babbler
Granatina granatina	Violeteared Waxbill	*Tockus leucomelas*	Southern yellowbilled hornbill
Gyps africanus	Whitebacked Vulture	*Turdus libonyanus*	Kurrichane Thrush
Gyps coprotheres	Cape Vulture	*Turtur chalcospilos*	Greenspotted Dove
Haliaeetus vocifer	African Fish Eagle	*Upupa africana*	African Hoopoe
Hieraaetus pennatus	Booted Eagle	*Uraeginthus angolensis*	Blue Waxbill
Hirundo cucullata	Greater Striped Swallow	*Uraeginthus granatinus*	Violeteared Waxbill
Hirundo rustica	Eurasian Swallow	*Urocolius indicus*	Redfaced Mousebird
Indicator indicator	Greater Honeyguide	*Vanellus armatus*	Blacksmith Plover
Lamprotornis mevesii	Longtailed Starling	*Vanellus coronatus*	Crowned Plover
Lamprotornis nitens	Glossy Starling	*Vidua macroura*	Pintailed Whydah
Laniarius atrococcineus	Crimsonbreasted Shrike	*Vidua purpurascens*	Purple Widowfinch
Lanius collaris	Fiscal Shrike	*Vidua reia*	Shaft tailed Whydah

8.2.2.3 Red data and protected bird species

The following Red Data bird species were considered during the field survey (Table 8-8). The possibility of occurrence was based on the distribution and habitat requirements of these Red Data species. Four Red Data species were found during the field survey, images of these species can be seen in Figure 8-10 and Figure 8-11. Three of the species only used the project area for food resources/feeding grounds. The Kori bustard was found with young and it is speculated the site area or immediate surroundings are utilised by the Kori bustard as a breeding site. The optimum preference is avoidance, however if avoidance is not possible, the development must take place outside of the breeding season (dry season). Before the development can take place, a sweep of the study area must be done to ensure that there are no breeding sites with young. An area must be conserved within the project surroundings to ensure sufficient breeding habitat and food resources are available for the species to continue.

Table 8-8: Red Data species considered during the field survey.

Status	Scientific name	Common name	Probability
Vulnerable	*Aquila rapax*	Tawny eagle	**Recorded**
Vulnerable	*Ardeotis kori*	Kori bustard	**Recorded**
Near threatened	*Buphagus erythrorhynchus*	Red billed oxpecker	High
Near threatened	*Ciconia nigra*	Black stork	Low
Near threatened	*Glareola nordmanni*	Black winged pranticole	Medium
Vulnerable	*Gyps africanus*	White backed vulture	**Recorded**

Status	Scientific name	Common name	Probability
Vulnerable	*Gyps coprotheres*	Cape vulture	**Recorded**
Near threatened	*Leptopethilus crumeniferus*	Marabou stork	Low
Near threatened	*Mycteria ibis*	Yellow billed stork	Low
Vulnerable	*Polemaetus bellicosus*	Martial eagle	Medium
Near threatened	*Saggitarius serpentarius*	Secretary bird	High
Vulnerable	*Terathopius ecaudatus*	Bateleur	High
Vulnerable	*Torgos tracheliotos*	Lappet faced vulture	High

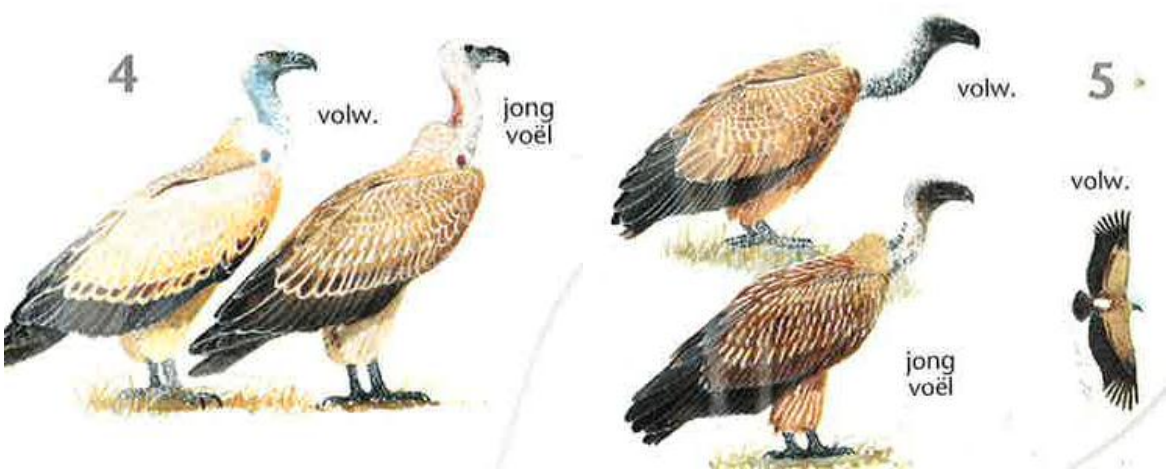

Figure 8-10: Red Data species Gyps coprotheres (Cape vulture) left and Gyps africanus (White-backed vulture) right (Sinclair, 1997).

Figure 8-11: Red Data species Aquila rapax (Tawny eagle) left and Ardeotis kori (Kori bustard) right (Sinclair, 1997).

8.2.3 Herpetofauna

8.2.3.1 Reptiles and amphibians observed and recorded in the area

During the field survey the reptiles in Table 8-9 were found. Two species, the Waterberg dwarf gecko and Waterberg flat lizard are endemic to the Waterberg region. Although the development will not eliminate the species or a large part of the species habitat, cumulatively continual development within this region could, due to the fact that this is the only region were these species occur. No amphibians were found during the field survey, this is due to the fact that the pipeline development is restricted to disturbed servitudes.

Table 8-9: Reptiles found during the field survey

Order	Family	Species Name	Common Name
Squamata	Lacertidae	*Heliobolus lugubris*	Bushveld Lizard
Squamata	Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-Throated Plated Lizard
Squamata	Elapidae	*Dendroaspis polylepis*	Black mamba
Squamata	Chamaeleonidae	*Chamaeleo dilepis*	Flap neck chameleon
Squamata	Gekkonidae	*Lygodactylus waterbergensis*	Waterberg dwarf gecko
Squamata	Cordylidae	*Platysaurus minor*	Waterberg flat lizard
Squamata	Varanidae	*Varanus albigularis*	Rock Monitor
Testudines	Testudinidae	*Geochelone pardalis*	Leopard tortoise

8.2.3.2 Red Data herpetofauna

No Red Data status reptiles were found during the surveys. The probability of occurrence was determined based on the distribution and habitat requirements. The Red Data species assessed can be seen in Table 8-10.

Table 8-10: Red Data reptiles for the Limpopo Province.

Status	Scientific Name	Common Name	Probability
Extinct	*Tetradactylus eastwoodi*	Eastwood's Longtailed seps	Low
Rare	*Lamprophis swazicus*	Swazi Rock snake	Low
	Homoroselaps dorsalis	Striped Harlequin snake	Low
	Xenocalamus transvaalensis	Transvaal Quill-snout snake	High
Vulnerable	*Python sebae natalensis*	Python	High
	Lygodactylus methueni	Methuen's Dwarf Gecko	Low
	Crocodylus niloticus	Nile Crocodile	Medium
	Breviceps sylvestris	Transvaal forest rainfrog	Low
Near Threatened	*Pyxicephalus adspersus*	Gaint Bulfrog	Medium
Peripheral	*Lycophidion variegatum*	Variegated Wolf snake	Medium
	Psammophis jallae	Jalla's Sand snake	Medium
Restricted	*Platysaurus relictus*	Relic Flat Lizard	Low
	Lacerta rupicola	Soutpandberg Rock lizard	Low
	Afroedura pondolia langi	Woodbush/Pondo Flat gecko	Low

Status	Scientific Name	Common Name	Probability
	Homopholis mulleri	Muller's Velvet gecko	Low
	Chirindia langi occidentalis	Lang's Pink Roundheaded Worm lizard	Low
	A. microphthalma nigra	Black Whitelipped snake	Medium
	Acontophiops lineatus	Woodbush Legless skink	Medium
	Scelotes limpopoensis	Whitebellied Limpopo	Medium
	Typhlosaurus lineatus subtaeniatus	Stripe-bellied Blind Legless skink	Medium
	Typhlosaurus lineatus richardi	Richard's Blind Legless skink	Medium

9 IMPACT ASSESSMENT

9.1 Construction phase

Activity 1: Transportation and delivery of pipes.

Impacted environment: The activity will affect the amount of traffic of heavy vehicles in an undeveloped area where heavy vehicle traffic has been limited. This will result in disturbance of fauna cycles/species specifically.

Description: Naturally occurring species within this region include Red Data predators, warthog, small antelope and reptiles. The mortality rate of these species will increase due to the traffic increase. Furthermore the current speed limit is 120km/h which adds to the likelihood.

Parameter	Description	Rating
Duration	Permanent	7
Extent	Regional	5
Severity	Significant	6
Likelihood	Likely	5
Significance	**Medium-high**	**90**

Activity 2: Removal of vegetation and topsoil

Impacted environment: The activity will immediately affect the flora assemblages on site therefore the surrounding ecology will also be impacted on indirectly.

Description: The existing vegetation within the proposed area of development will be impacted on as the existing vegetation will be removed to facilitate the construction. This in turn will affect the habitat availability of fauna species or cause mortality of burrowing animals. Furthermore it will allow for secondary growth including the growth of more robust species such as exotics and invasives.

Impact assessment:

Parameter	Description	Rating
Duration	Project Life	5
Extent	Local	3
Severity	Serious	5

Parameter	Description	Rating
Likelihood	Almost certain	6
Significance	**Medium-high**	**78**

Activity 3 and 6: Stockpiling of topsoil, digging of trenches and tunnels and backfilling of trenches

Impacted environment: Flora and fauna on site.

Description: Stockpiling will smother plants and should be therefore limited to an area already disturbed. Furthermore it must be ensured that the topsoil is not mixed with other soils or waste, so that plant growth can persist after disturbance. The digging of trenches can harm small burrowing animals, therefore before digging commences a sweep must take place to determine small mammal colonies.

Impact assessment:

Parameter	Description	Rating
Duration	Short term	2
Extent	Local	3
Severity	Serious	5
Likelihood	Likely	5
Significance	**Medium-low**	**50**

Activity 4 and 5: Hydrocarbon spillages / leakages from machinery and waste generation

Impacted environment: Waste not properly disposed of or managed correctly can affect the site and the immediate surroundings of the site

Description: Pollution of the project area due to a lack in waste management will result in ecological degradation and a loss in the ecological integrity

Impact Assessment:

Parameter	Description	Rating
Duration	Permanent	6
Extent	Local	3
Severity	Moderate	3
Likelihood	Probable	4
Significance	**Medium-low**	**48**

Activity 7: Re-vegetation of disturbed areas.

Impacted environment: Flora on site.

Description: This may be considered to be a neutral impact if implemented properly. The replacement of topsoil and re-vegetation thereof may result in the reduction of available space for alien invasive species, soil erosion and soil compaction, associated with top soil

storage areas. This activity will create favourable habitat for indigenous plant species, and promote rehabilitation efforts.

Impact assessment:

Parameter	Description	Rating
Duration	Permanent	6
Extent	Site specific	2
Severity	Moderate	3
Likelihood	Almost certain	6
Significance	**Medium-low**	**66**

9.2 Operational phase

Activity 8: Vehicle movement during maintenance and repair of the pipeline.

Impacted environment: The activity will affect the site and the immediate surrounding ecology.

Description: Continual human disturbance will disturb ecological processes. Furthermore if vehicles should access areas that have been rehabilitated/re-vegetated, this can allow for destruction of vegetation species and the possible encroachment of exotic/invasives. Vehicles will need to remain on roads.

Impact assessment:

Parameter	Description	Rating
Duration	Permanent mitigated	6
Extent	Site specific	2
Severity	Serious	4
Likelihood	Probable	4
Significance	**Medium-low**	**48**

10 CUMULATIVE IMPLACTS

The pipeline on its own will have a limited effect on the project site and surrounding area if it should remain in already disturbed areas such as the railway and road reserve. Leachate that might escape from the pipeline undetected can lead to a serious cumulative effect through pollution of environmental resources.

The cumulative effects of the planned mining infrastructure, in addition to the effect of the current land use practices, will greatly reduce the available graze and browse that wild herbivores need for survival. This coupled with other planned infrastructure in the areawill have a negative effect on the ecosystem services available to natural occurring animals. The ecosystem functioning and services that is currently produced in the area will be removed completely or reduced to a very small area; these include food and shelter for the animals including naturally occurring species. The remaining natural habitat on neighbouring farms can be assumed to be under the same type of management strategy as the farms assessed, purely because of the same farming method employed on all of them. Animals that were reliant on this region will further increase the pressure on these remaining areas including natural occurring predatory species.

The effect on a local scale where neighbouring farms are being negatively influenced will only be visible after a few seasons when available habitat is reduced to such an extent that local fauna populations decrease including Red Data species numbers. Also a single change in land use will automatically reduce the surrounding ecological integrity and this can lead to more development to be authorised. There are other mining projects known that applied for a mining licence in the same region. This in turn will lead to complete destruction of ecological systems, loss of habitat and loss of Red Data species. A large area will have to be conserved to ensure future habitat availability for species. Trans-boundary impact will also occur due to species that will search for habitat and other resources into Botswana.

11 MITIGRATION MEASURES AND MANAGEMENT PLAN

Activity	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after Mitigation
CONSTRUCTION PHASE								
Traffic on site	Limit the footprint of the disturbed areas	Make use of existing roads and/or areas and roads designated for the mining operation	Weekly	National Environmental Biodiversity Act 10 2004 (NEMBA)	Rehabilitation	Construction and operational	Environmental Co-ordinator	Minor
	Avoid impacts to vegetation and soil through spillages and leaks	Proper maintenance of operating vehicles and regular vehicle inspections.	Weekly	National Environmental Biodiversity Act 10 2004 (NEMBA)	Vehicle inspections	Construction and operational	Environmental Co-ordinator	Minor
	Limit the negative effects of excessive dust	Remove lose earth from the road sides. Periodic spraying of roads with water or dust inhibitor.	Daily	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Rehabilitation	Construction and operational	Environmental Co-ordinator	Minor
	Reduce mortality of fauna	Reduce speed of heavy vehicles to 40km/h and standard vehicles to 60km/h. Enforcement and fining should be implemented. Warning signage of animals crossing should be erected and staff should be educated and health and safety as well as environmental effect of breaking road regulations. Ecological crossings must be erected so that animals can cross the road.	Daily	National Environmental Biodiversity Act 10 2004 (NEMBA)	Road rule enforcement/fines and ecological crossings.	Throughout life of mine	Environmental Co-ordinator	Moderate

Activity	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after Mitigation
Spillages and waste generation	Avoid impacts vegetation and soil by means of pollution, leaks and spillages.	The storage of materials and substances will be housed in suitable facilities. Management of these facilities will be on-going and this will include regular inspections to detect faults/issues. A waste management plan and pipeline audit will need to be implemented.	Weekly	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Possible removal and replacement of facilities, or repair of existing facilities.	Construction, operational and Decommissioning phases.	Environmental Co-ordinator	Minor
Site clearing and topsoil removal	Limit degradation and destruction of natural environment to designated project areas	Keep the footprint of the disturbed area to the minimum and designated areas only. Vegetate and wet stockpiles to limit erosion.	Daily	National Environmental Biodiversity Act 10 2004 (NEMBA)	Planting of indigenous plants will aid rehabilitation of exposed areas	Construction and operational phases	Environmental Co-ordinator	Moderate-low
	Restrict alien invasive plant recruitment	Removal of vegetation during stripping and dump operation will be minimised to reduce the risk of open areas occurring.	Daily	Conservation of Agricultural resources Act (CARA), 1983 (Act no. 43 0f 1983)	Rehabilitation	Construction and operational phases	Environmental Co-ordinator	Moderate-low
	Retain biological properties of soil	Stockpile soil in the correct layers, avoid excessive height, and slope	Weekly	Conservation of Agricultural resources Act (CARA), 1983 (Act no. 43 0f 1983)	Adhere to best practice guidelines	Construction and operational phases	Environmental Co-ordinator	Moderate-low
	Avoid destruction of Red Data plant species that were identified on site.	Consult with relevant authorities, and apply for the correct permit as per Authorities recommendations.	Daily	National Environmental Biodiversity Act 10 2004 (NEMBA)	Removal of protected plant species, for re-planting in offset	Construction and operational phases	Environmental Co-ordinator	Moderate

Activity	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after Mitigation
					area.			
Topsoil stockpiling and digging of trenches	Limit destruction of exposed areas and stockpiles to designated areas.	Keep the footprint of the disturbed area to the minimum and designated areas only.	Daily	National Environmental Biodiversity Act 10 2004 (NEMBA)	Planting of indigenous plants will aid rehabilitation of exposed areas	Construction and Operational phases	Environmental Co-ordinator	Moderate-low
	Retain biological properties of soil	Stockpile soil in the correct layers, avoid excessive height, and slope	Weekly	Conservation of Agricultural resources Act (CARA), 1983 (Act no. 43 0f 1983)	Adhere to best practice guidelines	Construction and Operational phases	Environmental Co-ordinator	Moderate-low
	Prevent loss of burrowing fauna species	Ecological audit prior to the digging of trenches to determine how species can be avoided/if necessary relocated and to ensure no species get trapped in the trenches.	Daily	National Environmental Biodiversity Act 10 2004 (NEMBA)	Ecological audits	Construction phase	Environmental Co-ordinator and auditor	Moderate
Replacement of topsoil and revegetation	Reduce areas available for alien infestation	The footprint of the area disturbed by the mining operation will have natural indigenous vegetation restored.	Daily	Conservation of Agricultural resources Act (CARA), 1983 (Act no. 43 0f 1983)	Soils to be stockpiled and managed properly for rehabilitation	Operational phase	Environmental Co-ordinator	Moderate (Positive)
	Limit the erosion potential of exposed areas.	Exposed areas will be re-vegetated	Weekly	National Environmental Biodiversity Act 10 2004 (NEMBA)	Planting of indigenous plants will aid rehabilitation of exposed areas.	Operational phase	Environmental Co-ordinator	Moderate (Positive)
	Restore water	Re-vegetated areas will form	Weekly	National	Planting of	Operational phase	Environmental	Moderate

Activity	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after Mitigation
	infiltration, and reduce surface water runoff	seepage areas which will help aid infiltration.		Environmental Biodiversity Act 10 2004 (NEMBA)	indigenous plants will aid rehabilitation of exposed areas.		Co-ordinator	(Positive)

12 MONITORING PROGRAMME

The continued survival of plant and animal species present depends on management actions that are implemented and not delivering the desired results being changed to suit the desired outcome.

The monitoring of the flora environment is completed by investigating its constituent components specifically the herb, grass shrub and tree layers. These components have differentiation within them and these are Red Data/protected, medicinal, endemic, alien invasive and weedy species. Fauna component include habitat condition, habitat availability, ecosystem function and the species within these ecosystems. A monitoring program needs to evaluate the management actions and their effects on each of these components and the focus needs to be on Red Data/protected species. The method of monitoring is the Braun Blanquet method for vegetation and line transects, point count transects and trapping and transects for fauna surveys.

- Monitoring must take place annually;
- Monitoring must be completed by qualified specialists;
- Adaptive management must be applied;
- Monitoring during the wet season is essential; and
- Findings must be compared to previous years to establish ecosystem change.

Monitoring will also confirm the impact of the development on Red Data species and further mitigation can be suggested. The alien vegetation monitoring will be of importance due to the threat posed by surrounding land use, which is farming and other developments that could provide open areas where alien invasive species could establish. Therefore the open areas created during the construction phase could persist during the operational phase, and thereby create areas where alien invasive species could establish.

13 RECOMMENDATIONS

13.1 Flora

It is recommended that a specific rehabilitation/management plan be implemented which will firstly monitor flora present in the area, and secondly devise management measures to enhance the status of the habitat present.

Further destruction of the natural areas such as the savanna areas should be avoided, this includes possible expansion plans that could threaten the remaining natural areas. Monitoring of existing flora will indicate the effectiveness of any management measures employed. To summarise:

- Management/Rehabilitation plan; and
- Flora monitoring plan;

The opportunity to maintain or increase the ecological functioning of this area exists, thereby indirectly supporting the population of animal species possibly reliant on this area for services. By increasing the savanna habitat type and removing the threats, the ecological functioning of the areas will be positively affected thereby increasing the suite of ecological services offered to animals, making the area an attractive option for animals to re-colonize.

13.2 Fauna

It is recommended that an ecological audit take place before and during construction to ensure that fauna (including flora) species including Red Data species that might be harmed be relocated. Furthermore due to the fact the traffic will mostly affect the natural occurring and Red Data species, measures mentioned in the mitigation plan must be strictly implemented. This includes an awareness program on the impacts of speeding and traffic on the fauna of the Limpopo province. Impact on natural occurring species due to traffic is inevitable and the more traffic increases, the higher the risk of species loss. Therefore road traffic rules will have to be implemented. Heavy vehicle speed should be reduced to 40km/h and standard vehicles to 60km/h. Regular inspection of the pipeline (at least every three months) is suggested to ensure there are polluting substances escaping into the environment.

It is recommended that a conservation area should be established to ensure sufficient habitat and food resources for natural occurring and Red Data species for their continued existence within this region. This conservation area will have to be managed correctly and must be appropriate in size. It is suggested that the size of the conserved area be equivalent in size to the natural habitat lost. Conserved areas can also be part of a Joint Venture between mining companies within this region. This will also prevent developmental expansion and continued deterioration of the natural environment. Tourism will then also be less affected.

14 CONCULSION

In conclusion the impacts of the pipeline development are moderate. However the overall mining operation that the pipeline project forms part of will have a severe impact on the flora and fauna and needs to be managed collectively. This is due to the fact that Red Data species were found to occur in the project area and many indigenous species exist in this region. Red Data/protected fauna species that will be impacted include Cheetah, Leopard, Civet, Aardwolf, Steenbok, Bat-eared Foxes, Kori Bustard, Tawny Eagle, White-backed Vulture and the Cape Vulture. Vegetation findings included four protected species *Acacia erioloba*, *Sclerocarya birrea*, *Combretum imberbe* and *Boscia albitrunca*. .

An ecological audit should be implemented prior to the digging of trenches and species found should be relocated or avoided. It is suggested that construction take place during the dry seasonStrict traffic management measures will have to be implemented during construction.

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Appendix A: Plant species list found on site.

Family	Species Name	Common Name
ACANTHACEAE	*Blepharis subvolubilis*	-
AMARANTHACEAE	*Geigeria burkei*	Vermeersiektebossie
AMARANTHACEAE	*Gomphrena celosioides*	Batchelor's Button
AMARANTHACEAE	*Indigofera species*	-
AMARANTHACEAE	*Kyphocarpa angustifolia*	-
ANACARDIACEAE	*Ozoroa paniculosa*	Bushveld resin tree
ANACARDIACEAE	*Searsia pyroides*	Common wild current
ANACARDIACEAE	*Sclerocarya birrea*	Marula
ASCLEPIADACEAE	*Gomphocarpus fruticosus*	Milkweed
ASPARAGACEAE	*Asparagus laricinus*	Cluster leaved asparagus
ASPARAGACEAE	*Sansevieria hyacinthoides*	-
ASPHODELACEAE	*Aloe littoralis*	Mopane Aloe
ASTERACEAE	*Flaveria bidentis*	Smelter's bush
ASTERACEAE	*Helichrysum sp.*	
ASTERACEAE	*Pseudognaphalium luteo-album*	Jersey Cudweed
ASTERACEAE	*Tagetes minuta*	Tall Khaki Weed
BIGNONIACEAE	*Rhigozum brevispinosum*	Simple leaf Rhigozum
BORAGINACEAE	*Heliotropium steudneri*	-
BRASSICACEAE	*Capsella bursa-pastoris*	-
BRASSICACEAE	*Lepidium africanum*	Pepperweed
BURSERACEAE	*Commiphora pyracanthoides*	Common corkwood
CACTACEAE	*Opuntia ficus-indica*	Sweet Prickly Pear
CAPPARACEAE	*Boscia albitrunca*	Shepherds tree
CAPPARACEAE	*Boscia foetida*	Stink bush
CAPPARACEAE	*Cleome angustifolia*	Yellow Cleome
CELASTRACEAE	*Gymnosporia senegalensis*	Red Spike Thorn
CELASTRACEAE	*Gymnosporia buxifolia*	Common spike thorn
COMBRETACEAE	*Combretum apiculatum*	Red Bushwillow
COMBRETACEAE	*Combretum imberbe*	Leadwood
COMBRETACEAE	*Combretum molle*	Velvet bushwillow
COMBRETACEAE	*Terminalia sericea*	Silver cluster leaf
COMMELINACEAE	*Commelina africana*	Yellow Commelina
COMMELINACEAE	*Cyanotis speciosa*	Doll's powderpuff
CONVOLVULACEAE	*Ipomoea magnusiana*	Small pink Ipomoea
CUCURBITACEAE	*Cucumis myriocarpus*	Wild cucumber

CYPERACEAE	*Cyperus esculentus*	Yellow Nut Sedge
CYPERACEAE	*Mariscus congestus*	Cultural
EBENACEAE	*Euclea sp.*	-
EBENACEAE	*Euclea undulata*	Common guarrie
FABACEAE	*Acacia burkei*	Black monkey thorn
FABACEAE	*Acacia erioloba*	Camel thorn
FABACEAE	*Acacia erubescens*	Blue thorn
FABACEAE	*Acacia karroo*	Sweet thorn
FABACEAE	*Acacia mellifera*	Black thorn
FABACEAE	*Acacia nigrescens*	Knob thorn
FABACEAE	*Acacia tortilis*	Umbrella thorn
FABACEAE	*Albizia harveyi*	Common False-thorn
FABACEAE	*Chamaecrista comosa*	Trailing dwarf cassia
FABACEAE	*Dichrostachys cinerea*	Sickle bush
FABACEAE	*Elephantorrhiza elephantina*	Elephant's Root
FABACEAE	*Indigofera hilaris*	Red indigo bush
FABACEAE	*Peltophorum africanum*	Weeping wattle
FABACEAE	*Tephrosia macropoda*	Creepin tephrosia
FABACEAE	*Tephrosia purpurea*	Silver Tephrosia
HYACINTHACEAE	*Ledebouria ovatifolia*	-
MALVACEAE	*Hibiscus trionum*	Bladder Hibiscus
MALVACEAE	*Sida cordifolia*	Flannel Weed
OLACACEAE	*Ximenia caffra*	Sourplum
POACEA	*Alloteropsis semialata*	Black-seed grass
POACEA	*Aristida adscensionis*	Annual three awn
POACEA	*Aristida congesta s. barbicollis*	Spreading three awn
POACEA	*Aristida congesta s. congesta*	Tassel Tree-awn
POACEA	*Aristida diffusa*	Iron Grass
POACEA	*Aristida junciformis*	Ngongoni Three-awn
POACEA	*Aristida stipatata*	Long awned grass
POACEA	*Bothriochloa radicans*	Stinking grass
POACEA	*Brachiaria deflexa*	False signal grass
POACEA	*Brachiaria serrata*	Velvet Signal Grass
POACEA	*Cenchrus ciliaris*	Foxtail Buffalo grass
POACEA	*Chloris virgata*	Feather top chloris
POACEA	*Cynodon dactylon*	Couch Grass
POACEA	*Dactyloctenium giganteum*	Gaint Crowfoot
POACEA	*Digitaria eriantha*	Common Finger Grass
POACEA	*Digitaria tricholaenoides*	Purple Finger Grass

POACEA	*Digitaria velutina*	Long plumed finger grass
POACEA	*Dinebra retroflexa*	Catstail vlei grass
POACEA	*Enneapogon cenchroides*	Nine awned grass
POACEA	*Enneapogon scoparius*	Bottlebrush grass
POACEA	*Eragrosis pallens*	Broom love grass
POACEA	*Eragrostis biflora*	Shade eragrostis
POACEA	*Eragrostis chloromelas*	(Narrow) Curly Leaf
POACEA	*Eragrostis cilianensis*	Stink love grass
POACEA	*Eragrostis gummiflua*	Gum Grass
POACEA	*Eragrostis nindensis*	Whether love grass
POACEA	*Eragrostis racemosa*	Narrow Heart Love Grass
POACEA	*Eragrostis trichophora*	Hairy Love Grass
POACEA	*Heteropogon contortus*	Spear Grass
POACEA	*Hyparrhenia hirta*	Common Thatching Grass
POACEA	*Melinis repens*	Natal Red Top
POACEA	*Panicum maximum*	Guinea grass
POACEA	*Paspalum dilatatum*	Dallis Grass
POACEA	*Perotis patens*	Cat's Tail
POACEA	*Phragmites australis*	Common Reed
POACEA	*Pogonarthria squarrosa*	Herringbone Grass
POACEA	*Rendlia altera*	Mahem's Crest
POACEA	*Schmidtia pappophoroides*	Sand Quick
POACEA	*Setaria sphacelata*	Bristle Grass
POACEA	*Sporobolus africanus*	Ratstail dropseed
POACEA	*Sporobolus fimbriatus*	Dropseed grass
POACEA	*Sporobolus ioclados*	Pan Dropseed
POACEA	*Stipagrostis uniplumis*	Silky Bushmans grass
POACEA	*Tragus berteronianus*	Carrot-seed Grass
POACEA	*Trichoneura grandiglumis*	Small Rolling Grass
POACEA	*Urochloa mosambicensis*	Bushveld Signal Grass
POLYGONACEAE	*Persicaria sp.*	
RHAMNACEAE	*Ziziphus mucronata*	Buffalo thorn
RUBIACEAE	*Gardenia volkensii*	Bushveld Gardenia
RUBIACEAE	*Vangueria infausta*	Velvet wild medlar
SALICACEAE	*Dovyalis caffra*	Kei apple
SOLANACEAE	*Solanum incanum*	Grey Bitter-apple
SOLANACEAE	*Solanum panduriforme*	Yellow Bitter-apple
SOLANACEAE	*Solanum sp.*	
STERCULIACEAE	*Waltheria indica*	-

STRYCHNACEAE	*Strychnos spinosa*	Green monkey orange
TILIACEAE	*Grewia bicolor*	Whit leaved raisin
TILIACEAE	*Grewia flava*	Velvet Raisin
TILIACEAE	*Grewia flavescens*	Sandpaper Raisin
TILIACEAE	*Grewia occidentalis*	Cross berry
ZYGOPHYLLACEAE	*Tribulus terrestris*	Devil thorns

Appendix B: SIBIS Mammal species to possibly occur within project area and Province.

Common Name	Scientific Name	IUCN Status (Global)	IUCN Status (National)	NEMBA Status
Cheetah	*Acinonyx jubatus*	Vulnerable	Vulnerable	Vulnerable
Spiny Mouse	*Acomys spinosissimus*	Least Concern	Least Concern	Not listed
Impala	*Aepyceros melampus*	Least Concern	Least Concern	Not listed
Red Veld Rat	*Aethomys chrysophilus*	Least Concern	Least Concern	Not listed
Tete Veld Rat	*Aethomys ineptus*	Least Concern	Least Concern	Not listed
Namaqua Rock Mouse	*Aethomys namaquensis*	Endangered	Least Concern	Not listed
Red Hartebeest	*Alcelaphus buselaphus*	Least Concern	Least Concern	Not listed
Hottentot's Golden Mole	*Amblysomus hottentotus*	Not evaluated	Data Deficient	Not listed
Springbuck	*Antidorcas marsupialis*	Least Concern	Least Concern	Not listed
African Clawless Otter	*Aonyx capensis*	Least Concern	Least Concern	Protected
South African Hedgehog	*Atelerix frontalis*	Least Concern	Near Threatened	Protected
Water Mongoose	*Atilax paludinosus*	Least Concern	Least Concern	Not listed
Yellow Golden Mole	*Calcochloris obtusirostris*	Least Concern	Vulnerable	Not listed
Side-striped Jackal	*Canis adustus*	Least Concern	Near Threatened	Not listed
Black-backed Jackal	*Canis mesomelas*	Least Concern	Least Concern	Not listed
Caracal	*Caracal caracal*	Least Concern	Least Concern	Not listed
Red Duiker	*Cephalophus natalensis*	Least Concern	Least Concern	Not listed
White Rhinoceros	*Ceratotherium simum*	Near Threatened	Least Concern	Protected
Vervet Monkey	*Cercopithecus aethiops pygerythrus*	Least Concern	Least Concern	Not listed
Stairs's or Mozambique Monkey	*Cercopithecus mitis erythrarchus*	Least Concern	Least Concern	Not listed
Samango Monkey	*Cercopithecus mitis labiatus*	Least Concern	Endangered	Not listed
Ansorge's Free-tailed Bat	*Chaerephon ansorgei*	Least Concern	Least Concern	Not listed
Little Free-tailed Bat	*Chaerephon pumila*	Least Concern	Least Concern	Not listed
African Civet	*Civettictis civetta*	Least Concern	Least Concern	Not listed
Percival's Trident Bat	*Cloeotis percivali*	Near Threatened	Critically Endangered	Not listed
Black Wildebeest	*Connochaetes gnou*	Least Concern	Least Concern	Protected
Blue Wildebeest	*Connochaetes taurinus taurinus*	Least Concern	Least Concern	Not listed

Giant Rat	*Cricetomys gambianus*	Least Concern	Vulnerable	Vulnerable
Reddish-grey Musk Shrew	*Crocidura cyanea*	Least Concern	Data Deficient	Not listed
Tiny Musk Shrew	*Crocidura fuscomurina*	Least Concern	Data Deficient	Not listed
Lesser Red Musk Shrew	*Crocidura hirta*	Least Concern	Data Deficient	Not listed
Maquassie Musk Shrew	*Crocidura maquassiensis*	Least Concern	Vulnerable	Not listed
Swamp Musk Shrew	*Crocidura mariquensis*	Least Concern	Data Deficient	Not listed
Lesser Grey-brown Musk Shrew	*Crocidura silacea*	Least Concern	Data Deficient	Not listed
Spotted Hyaena	*Crocuta crocuta*	Least Concern	Near Threatened	Protected
Common Molerat	*Cryptomys hottentotus*	Least Concern	Least Concern	Not listed
Yellow Mongoose	*Cynictis penicillata*	Least Concern	Least Concern	Not listed
Tsessebe	*Damaliscus lunatus lunatus*	Least Concern	Endangered	Endangered
Blesbuck	*Damaliscus pygargus phillipsi*	Least Concern	Least Concern	Not listed
Water Rat	*Dasymys incomtus*	Least Concern	Near Threatened	Not listed
Grey Climbing Mouse	*Dendromus melanotis*	Least Concern	Least Concern	Not listed
Brants' Climbing Mouse	*Dendromus mesomelas*	Least Concern	Least Concern	Not listed
Chestnut Climbing Mouse	*Dendromus mystacalis*	Least Concern	Least Concern	Not listed
Nyika Climbing Mouse	*Dendromus nyikae*	Least Concern	Near Threatened	Not listed
Short-tailed Gerbil	*Desmodillus auricularis*	Least Concern	Least Concern	Not listed
Black Rhino	*Diceros bicornis minor*	Critically Endangered	Vulnerable	Not listed
Short-snouted Elephant-shrew	*Elephantulus brachyrhynchus*	Least Concern	Data Deficient	Not listed
Bushveld Elephant-shrew	*Elephantulus intufi*	Least Concern	Data Deficient	Not listed
Rock Elephant-shrew	*Elephantulus myurus*	Least Concern	Least Concern	Not listed
Gambian Epauletted Fruit Bat	*Epomophorus gambianus crypturus*	Least Concern	Data Deficient	Not listed
Wahlberg's Epauletted Fruit Bat	*Epomophorus wahlbergi*	Least Concern	Least Concern	Not listed
Long-tailed Serotine Bat	*Eptesicus hottentotus*	Least Concern	Least Concern	Not listed
Burchell's Zebra	*Equus burchellii*	Least Concern	Least Concern	Not listed
African Wild Cat	*Felis silvestris*	Least Concern	Least Concern	Not listed
Lesser Bushbaby	*Galago moholi*	Least Concern	Least Concern	Not listed
Slender Mongoose	*Galerella sanguinea*	Least Concern	Least Concern	Not listed

Small-spotted Genet	*Genetta genetta*	Least Concern	Least Concern	Not listed
Large-spotted Genet	*Genetta tigrina*	Least Concern	Least Concern	Not listed
Hairy-footed Gerbil	*Gerbillurus paeba*	Least Concern	Least Concern	Not listed
Giraffe	*Giraffa camelopardalis*	Least Concern	Least Concern	Not listed
Butterfly Bat	*Glauconycteris variegatus*	Least Concern	Near Threatened	Not listed
Mozambique Woodland Mouse	*Grammomys cometes*	Least Concern	Data Deficient	Not listed
Woodland Mouse	*Grammomys dolichurus*	Least Concern	Data Deficient	Not listed
Woodland Dormouse	*Graphiurus murinus*	Least Concern	Least Concern	Not listed
Rock Dormouse	*Graphiurus platyops*	Least Concern	Data Deficient	Not listed
Dwarf Mongoose	*Helogale parvula*	Least Concern	Least Concern	Not listed
Large Grey Mongoose	*Herpestes ichneumon*	Least Concern	Least Concern	Not listed
Yellow-spotted Hyrax	*Heterohyrax brucei*	Least Concern	Least Concern	Not listed
Hippopotamus	*Hippopotamus amphibius*	Least Concern	Least Concern	Not listed
Sundevall's Leaf-nosed Bat	*Hipposideros caffer*	Least Concern	Data Deficient	Not listed
Roan Antelope	*Hippotragus equinus*	Least Concern	Vulnerable	Vulnerable
Sable Antelope	*Hippotragus niger niger*	Least Concern	Vulnerable	Not listed
Brown Hyaena	*Hyaena brunnea*	Near Threatened	Near Threatened	Protected
Cape Porcupine	*Hystrix africaeaustralis*	Least Concern	Least Concern	Not listed
White-tailed Mongoose	*Ichneumia albicauda*	Least Concern	Least Concern	Not listed
Striped Polecat	*Ictonyx striatus*	Least Concern	Least Concern	Not listed
Damara Woolly Bat	*Kerivoula argentata*	Least Concern	Endangered	Not listed
Lesser Woolly Bat	*Kerivoula lanosa*	Least Concern	Near Threatened	Not listed
Waterbuck	*Kobus ellipsiprymnus ellipsiprymnus*	Least Concern	Least Concern	Not listed
Botswana Long-eared Bat	*Laephotis botswanae*	Near Threatened	Vulnerable	Not listed
Single-striped Mouse	*Lemniscomys rosalia*	Least Concern	Data Deficient	Not listed
Cape Hare	*Lepus capensis*	Least Concern	Least Concern	Not listed
Scrub Hare	*Lepus saxatilis*	Least Concern	Least Concern	Not listed
African Elephant	*Loxodonta africana*	Endangered	Least Concern	Protected
Spotted-necked Otter	*Lutra maculicollis*	Vulnerable	Near Threatened	Protected
African Wild Dog	*Lycaon pictus*	Vulnerable	Endangered	Endangered
Pangolin	*Manis temminckii*	Near	Vulnerable	Vulnerable

		Threatened		
Multimammate Mouse	*Mastomys coucha*	Least Concern	Least Concern	Not listed
Natal Multimammate Mouse	*Mastomys natalensis*	Least Concern	Least Concern	Not listed
Honey Badger	*Mellivora capensis*	Least Concern	Near Threatened	Not listed
Lesser Long-fingered Bat	*Miniopterus fraterculus*	Near Threatened	Near Threatened	Not listed
Schreibers' Long-fingered Bat	*Miniopterus schreibersii*	Near Threatened	Near Threatened	Not listed
Angolan Free-tailed Bat	*Mops condylurus*	Least Concern	Least Concern	Not listed
Midas Free-tailed Bat	*Mops midas*	Least Concern	Least Concern	Not listed
Banded Mongoose	*Mungos mungo*	Least Concern	Least Concern	Not listed
Desert Pygmy Mouse	*Mus indutus*	Least Concern	Least Concern	Not listed
Pygmy Mouse	*Mus minutoides*	Least Concern	Least Concern	Not listed
Thomas' Pygmy Mouse	*Mus neavei*	Least Concern	Data Deficient	Not listed
Dark-footed Forest Shrew	*Myosorex cafer*	Least Concern	Data Deficient	Not listed
Forest Shrew	*Myosorex varius*	Least Concern	Data Deficient	Not listed
Rufous Hairy Bat	*Myotis bocagei*	Least Concern	Data Deficient	Not listed
Temminck's Hairy Bat	*Myotis tricolor*	Not Evaluated	Near Threatened	Not listed
Welwitsch's Hairy Bat	*Myotis welwitschii*	Least Concern	Near Threatened	Not listed
Gunning's Golden Mole	*Neamblysomus gunningi*	Vulnerable	Endangered	Endangered
Juliana's Golden Mole	*Neamblysomus julianae*	Critically Endangered	Vulnerable	Vulnerable
Cape Serotine Bat	*Neoromicia capensis*	Least Concern	Least Concern	Not listed
Banana Bat	*Neoromicia nanus*	Least Concern	Least Concern	Not listed
Aloe Bat	*Neoromicia zuluensis*	Near Threatened	Least Concern	Not listed
Livingstone's Antelope	*Neotragus moschatus zuluensis*	Least Concern	Vulnerable	Vulnerable
Common Slit-faced Bat	*Nycteris thebaica*	Least Concern	Least Concern	Not listed
Wood's Slit-faced Bat	*Nycteris woodi*	Near Threatened	Near Threatened	Not listed
Schlieffen's Bat	*Nycticeinops schlieffeni*	Near Threatened	Least Concern	Not listed
Klipspringer	*Oreotragus oreotragus*	Least Concern	Least Concern	Not listed
Antbear	*Orycteropus afer*	Least Concern	Least Concern	Not listed
Gemsbuck	*Oryx gazella*	Least Concern	Least Concern	Not listed

Bat-eared Fox	*Otocyon megalotis*	Least Concern	Least Concern	Not listed
Thick-tailed Bushbaby	*Otolemur crassicaudatus*	Least Concern	Least Concern	Not listed
Angoni Vlei Rat	*Otomys angoniensis*	Least Concern	Least Concern	Not listed
Vlei Rat	*Otomys irroratus*	Least Concern	Least Concern	Not listed
Laminate Vlei Rat	*Otomys laminatus*	Least Concern	Least Concern	Not listed
Lion	*Panthera leo*	Vulnerable	Vulnerable	Vulnerable
Leopard	*Panthera pardus*	Least Concern	Least Concern	Vulnerable
Chacma Baboon	*Papio ursinus*	Least Concern	Least Concern	Not listed
Selous' Mongoose	*Paracynictis selousi*	Least Concern	Data Deficient	Not listed
Tree Squirrel	*Paraxerus cepapi*	Least Concern	Least Concern	Not listed
Springhare	*Pedetes capensis*	Vulnerable	Least Concern	Not listed
Grey Rhebok	*Pelea capreolus*	Least Concern	Least Concern	Not listed
Four-toed Elephant-shrew	*Petrodromus tetradactylus*	Least Concern	Endangered	Endangered
Warthog	*Phacochoerus africanus*	Least Concern	Least Concern	Not listed
Anchieta's Pipistrelle	*Pipistrellus anchietae*	Vulnerable	Near Threatened	Not listed
Kuhl's Pipistrelle	*Pipistrellus hesperidus*	Least Concern	Least Concern	Not listed
Rusty Bat	*Pipistrellus rusticus*	Least Concern	Near Threatened	Not listed
African Weasel	*Poecilogale albinucha*	Least Concern	Data Deficient	Not listed
Bushpig	*Potamochoerus porcus koiropotamus*	Least Concern	Least Concern	Not listed
Rock Dassie	*Procavia capensis*	Least Concern	Least Concern	Not listed
Jameson's Red Rock Rabbit	*Pronolagus randensis*	Least Concern	Least Concern	Not listed
Hewitt's Red Rock Rabbit	*Pronolagus saundersiae*	Least Concern	Least Concern	Not listed
Aardwolf	*Proteles cristatus*	Least Concern	Least Concern	Not listed
Steenbuck	*Raphicerus campestris*	Least Concern	Least Concern	Not listed
Sharp's Grysbuck	*Raphicerus sharpei*	Least Concern	Near Threatened	Protected
Common Reedbuck	*Redunca arundinum*	Least Concern	Least Concern	Protected
Mountain Reedbuck	*Redunca fulvorufula*	Least Concern	Least Concern	Not listed
Striped Mouse	*Rhabdomys pumilio*	Least Concern	Least Concern	Not listed
Peak-saddle Horseshoe Bat	*Rhinolophus blasii*	Least Concern	Vulnerable	Not listed
Geoffroy's Horseshoe Bat	*Rhinolophus clivosus*	Least Concern	Near Threatened	Not listed
Darling's Horseshoe Bat	*Rhinolophus darlingi*	Least Concern	Near Threatened	Not listed
Rüppell's Horseshoe Bat	*Rhinolophus fumigatus*	Least Concern	Near Threatened	Not listed
Hildebrandt's	*Rhinolophus*	Least Concern	Near	Not listed

Horseshoe Bat	*hildebrandtii*		Threatened	
Lander's Horseshoe Bat	*Rhinolophus landeri*	Least Concern	Near Threatened	Not listed
Bushveld Horseshoe Bat	*Rhinolophus simulator*	Least Concern	Least Concern	Not listed
Swinny's Horseshoe Bat	*Rhinolophus swinnyi*	Least Concern	Endangered	Not listed
Meller's Mongoose	*Rhynchogale melleri*	Least Concern	Data Deficient	Not listed
Egyptian Fruit Bat	*Rousettus aegyptiacus*	Least Concern	Least Concern	Not listed
Pouched Mouse	*Saccostomus campestris*	Least Concern	Least Concern	Not listed
Flat-headed Free-tailed Bat	*Sauromys petrophilus*	Least Concern	Least Concern	Not listed
Yellow House Bat	*Scotophilus dinganii*	Least Concern	Least Concern	Not listed
Lesser Yellow House Bat	*Scotophilus viridis*	Least Concern	Least Concern	Not listed
Krebs's Fat Mouse	*Steatomys krebsii*	Least Concern	Least Concern	Not listed
Fat Mouse	*Steatomys pratensis*	Near Threatened	Least Concern	Not listed
Least Dwarf Shrew	*Suncus infinitesimus*	Least Concern	Data Deficient	Not listed
Greater Dwarf Shrew	*Suncus lixus*	Least Concern	Data Deficient	Not listed
Lesser Dwarf Shrew	*Suncus varilla*	Least Concern	Data Deficient	Not listed
Common Duiker	*Sylvicapra grimmia*	Least Concern	Least Concern	Not listed
Buffalo	*Syncerus caffer*	Least Concern	Least Concern	Not listed
Egyptian Free-tailed Bat	*Tadarida aegyptiaca*	Least Concern	Least Concern	Not listed
Mauritian Tomb Bat	*Taphozous mauritianus*	Least Concern	Least Concern	Not listed
Highveld Gerbil	*Tatera brantsii*	Least Concern	Least Concern	Not listed
Bushveld Gerbil	*Tatera leucogaster*	Least Concern	Data Deficient	Not listed
Common Eland	*Taurotragus oryx*	Least Concern	Least Concern	Not listed
Tree Rat	*Thallomys paedulcus*	Least Concern	Least Concern	Not listed
Greater Cane Rat	*Thryonomys swinderianus*	Least Concern	Least Concern	Not listed
Nyala	*Tragelaphus angasii*	Least Concern	Least Concern	Not listed
Bushbuck	*Tragelaphus scriptus*	Least Concern	Least Concern	Not listed
Kudu	*Tragelaphus strepsiceros*	Least Concern	Least Concern	Not listed
Cape Fox	*Vulpes chama*	Least Concern	Least Concern	Protected

Appendix C: Possible bird species that occur within the project grid squares.

English Name	Scientific	English Name	Scientific
Ostrich	*Struthio camelus*	Ostrich	*Struthio camelus*
Dabchick	*Tachybaptus ruficollis*	Dabchick	*Tachybaptus ruficollis*
Pinkbacked Pelican	*Pelecanus rufescens*	Pinkbacked Pelican	*Pelecanus rufescens*
Whitebreasted Cormorant	*Phalacrocorax lucidus*	Whitebreasted Cormorant	*Phalacrocorax lucidus*
Reed Cormorant	*Phalacrocorax africanus*	Reed Cormorant	*Phalacrocorax africanus*
Darter	*Anhinga rufa*	Darter	*Anhinga rufa*
Grey Heron	*Ardea cinerea*	Grey Heron	*Ardea cinerea*
Blackheaded Heron	*Ardea melanocephala*	Blackheaded Heron	*Ardea melanocephala*
Goliath Heron	*Ardea goliath*	Goliath Heron	*Ardea goliath*
Purple Heron	*Ardea purpurea*	Purple Heron	*Ardea purpurea*
Great White Egret	*Egretta alba*	Great White Egret	*Egretta alba*
Little Egret	*Egretta garzetta*	Little Egret	*Egretta garzetta*
Yellowbilled Egret	*Egretta intermedia*	Yellowbilled Egret	*Egretta intermedia*
Black Egret	*Egretta ardesiaca*	Black Egret	*Egretta ardesiaca*
Cattle Egret	*Bubulcus ibis*	Cattle Egret	*Bubulcus ibis*
Squacco Heron	*Ardeola ralloides*	Squacco Heron	*Ardeola ralloides*
Greenbacked Heron	*Butorides striatus*	Greenbacked Heron	*Butorides striatus*
Blackcrowned Night Heron	*Nycticorax nycticorax*	Blackcrowned Night Heron	*Nycticorax nycticorax*
Whitebacked Night Heron	*Gorsachius leuconotus*	Whitebacked Night Heron	*Gorsachius leuconotus*
Little Bittern	*Ixobrychus minutus*	Little Bittern	*Ixobrychus minutus*
Dwarf Bittern	*Ixobrychus sturmii*	Dwarf Bittern	*Ixobrychus sturmii*
Hamerkop	*Scopus umbretta*	Hamerkop	*Scopus umbretta*
White Stork	*Ciconia ciconia*	White Stork	*Ciconia ciconia*
Black Stork	*Ciconia nigra*	Black Stork	*Ciconia nigra*
Abdim's Stork	*Ciconia abdimii*	Abdim's Stork	*Ciconia abdimii*
Saddlebilled Stork	*Ephippiorhynchus senegalensis*	Saddlebilled Stork	*Ephippiorhynchus senegalensis*
Marabou Stork	*Leptoptilos crumeniferus*	Marabou Stork	*Leptoptilos crumeniferus*
Yellowbilled Stork	*Mycteria ibis*	Yellowbilled Stork	*Mycteria ibis*
Sacred Ibis	*Threskiornis aethiopicus*	Sacred Ibis	*Threskiornis aethiopicus*
Glossy Ibis	*Plegadis falcinellus*	Glossy Ibis	*Plegadis falcinellus*
Hadeda Ibis	*Bostrychia hagedash*	Hadeda Ibis	*Bostrychia hagedash*
African Spoonbill	*Platalea alba*	African Spoonbill	*Platalea alba*
Greater Flamingo	*Phoenicopterus ruber*	Greater Flamingo	*Phoenicopterus ruber*
Lesser Flamingo	*Phoenicopterus minor*	Lesser Flamingo	*Phoenicopterus minor*
Whitefaced Duck	*Dendrocygna viduata*	Whitefaced Duck	*Dendrocygna viduata*
Fulvous Duck	*Dendrocygna bicolor*	Fulvous Duck	*Dendrocygna bicolor*
Whitebacked Duck	*Thalassornis*	Whitebacked Duck	*Thalassornis leuconotus*

	leuconotus		
Egyptian Goose	*Alopochen aegyptiacus*	Egyptian Goose	*Alopochen aegyptiacus*
Yellowbilled Duck	*Anas undulata*	Yellowbilled Duck	*Anas undulata*
African Black Duck	*Anas sparsa*	African Black Duck	*Anas sparsa*
Cape Teal	*Anas capensis*	Cape Teal	*Anas capensis*
Hottentot Teal	*Anas hottentota*	Hottentot Teal	*Anas hottentota*
Redbilled Teal	*Anas erythrorhyncha*	Redbilled Teal	*Anas erythrorhyncha*
Cape Shoveller	*Anas smithii*	Cape Shoveller	*Anas smithii*
Southern Pochard	*Netta erythrophthalma*	Southern Pochard	*Netta erythrophthalma*
Knobbilled Duck	*Sarkidiornis melanotos*	Knobbilled Duck	*Sarkidiornis melanotos*
Spurwinged Goose	*Plectropterus gambensis*	Spurwinged Goose	*Plectropterus gambensis*
Maccoa Duck	*Oxyura maccoa*	Maccoa Duck	*Oxyura maccoa*
Secretarybird	*Sagittarius serpentarius*	Secretarybird	*Sagittarius serpentarius*
Cape Vulture	*Gyps coprotheres*	Egyptian Vulture	*Neophron percnopterus*
Whitebacked Vulture	*Gyps africanus*	Cape Vulture	*Gyps coprotheres*
Lappetfaced Vulture	*Torgos tracheliotus*	Whitebacked Vulture	*Gyps africanus*
Whiteheaded Vulture	*Trigonoceps occipitalis*	Lappetfaced Vulture	*Torgos tracheliotus*
Black Kite	*Milvus migrans*	Whiteheaded Vulture	*Trigonoceps occipitalis*
Yellowbilled Kite	*Milvus aegyptius*	Black Kite	*Milvus migrans*
Blackshouldered Kite	*Elanus caeruleus*	Yellowbilled Kite	*Milvus aegyptius*
Honey Buzzard	*Pernis apivorus*	Blackshouldered Kite	*Elanus caeruleus*
Black Eagle	*Aquila verreauxii*	Honey Buzzard	*Pernis apivorus*
Tawny Eagle	*Aquila rapax*	Black Eagle	*Aquila verreauxii*
Steppe Eagle	*Aquila nipalensis*	Tawny Eagle	*Aquila rapax*
Lesser Spotted Eagle	*Aquila pomarina*	Steppe Eagle	*Aquila nipalensis*
Wahlberg's Eagle	*Aquila wahlbergi*	Lesser Spotted Eagle	*Aquila pomarina*
Booted Eagle	*Hieraaetus pennatus*	Wahlberg's Eagle	*Aquila wahlbergi*
African Hawk Eagle	*Hieraaetus spilogaster*	Booted Eagle	*Hieraaetus pennatus*
Ayres' Eagle	*Hieraaetus ayresii*	African Hawk Eagle	*Hieraaetus spilogaster*
Martial Eagle	*Polemaetus bellicosus*	Ayres' Eagle	*Hieraaetus ayresii*
Brown Snake Eagle	*Circaetus cinereus*	Martial Eagle	*Polemaetus bellicosus*
Blackbreasted Snake Eagle	*Circaetus pectoralis*	Brown Snake Eagle	*Circaetus cinereus*
Bateleur	*Terathopius ecaudatus*	Blackbreasted Snake Eagle	*Circaetus pectoralis*
African Fish Eagle	*Haliaeetus vocifer*	Bateleur	*Terathopius ecaudatus*
Steppe Buzzard	*Buteo vulpinus*	African Fish Eagle	*Haliaeetus vocifer*
Longlegged Buzzard	*Buteo rufinus*	Steppe Buzzard	*Buteo vulpinus*
Lizard Buzzard	*Kaupifalco monogrammicus*	Lizard Buzzard	*Kaupifalco monogrammicus*
Ovambo Sparrowhawk	*Accipiter ovampensis*	Ovambo Sparrowhawk	*Accipiter ovampensis*
Little Sparrowhawk	*Accipiter minullus*	Little Sparrowhawk	*Accipiter minullus*
Black Sparrowhawk	*Accipiter melanoleucus*	Black Sparrowhawk	*Accipiter melanoleucus*
Little Banded Goshawk	*Accipiter badius*	Little Banded Goshawk	*Accipiter badius*
Gabar Goshawk	*Melierax gabar*	Gabar Goshawk	*Melierax gabar*

Pale Chanting Goshawk	*Melierax canorus*	Pale Chanting Goshawk	*Melierax canorus*
Eurasian Marsh Harrier	*Circus aeruginosus*	Eurasian Marsh Harrier	*Circus aeruginosus*
Montagu's Harrier	*Circus pygargus*	Montagu's Harrier	*Circus pygargus*
Pallid Harrier	*Circus macrourus*	Pallid Harrier	*Circus macrourus*
Gymnogene	*Polyboroides typus*	Gymnogene	*Polyboroides typus*
Osprey	*Pandion haliaetus*	Osprey	*Pandion haliaetus*
Peregrine Falcon	*Falco peregrinus*	Peregrine Falcon	*Falco peregrinus*
Lanner Falcon	*Falco biarmicus*	Lanner Falcon	*Falco biarmicus*
Northern Hobby Falcon	*Falco subbuteo*	Northern Hobby Falcon	*Falco subbuteo*
Western Redfooted Kestrel	*Falco vespertinus*	Western Redfooted Kestrel	*Falco vespertinus*
Eastern Redfooted Kestrel	*Falco amurensis*	Eastern Redfooted Kestrel	*Falco amurensis*
Rock Kestrel	*Falco rupicolis*	Rock Kestrel	*Falco rupicolis*
Greater Kestrel	*Falco rupicoloides*	Greater Kestrel	*Falco rupicoloides*
Lesser Kestrel	*Falco naumanni*	Lesser Kestrel	*Falco naumanni*
Coqui Francolin	*Peliperdix coqui*	Coqui Francolin	*Peliperdix coqui*
Crested Francolin	*Dendroperdix sephaena*	Crested Francolin	*Dendroperdix sephaena*
Natal Francolin	*Pternistis natalensis*	Natal Francolin	*Pternistis natalensis*
Swainson's Francolin	*Pternistis swainsonii*	Swainson's Francolin	*Pternistis swainsonii*
Common Quail	*Coturnix coturnix*	Common Quail	*Coturnix coturnix*
Harlequin Quail	*Coturnix delegorguei*	Harlequin Quail	*Coturnix delegorguei*
Helmeted Guineafowl	*Numida meleagris*	Helmeted Guineafowl	*Numida meleagris*
Kurrichane Buttonquail	*Turnix sylvatica*	Kurrichane Buttonquail	*Turnix sylvatica*
African Crake	*Crecopsis egregia*	African Crake	*Crecopsis egregia*
Black Crake	*Amaurornis flavirostris*	Black Crake	*Amaurornis flavirostris*
Spotted Crake	*Porzana porzana*	Spotted Crake	*Porzana porzana*
Common Moorhen	*Gallinula chloropus*	Common Moorhen	*Gallinula chloropus*
Lesser Moorhen	*Gallinula angulata*	Lesser Moorhen	*Gallinula angulata*
Redknobbed Coot	*Fulica cristata*	Redknobbed Coot	*Fulica cristata*
Kori Bustard	*Ardeotis kori*	African Finfoot	*Podica senegalensis*
Redcrested Korhaan	*Eupodotis ruficrista*	Kori Bustard	*Ardeotis kori*
Whitewinged Korhaan	*Eupodotis afraoides*	Redcrested Korhaan	*Eupodotis ruficrista*
African Jacana	*Actophilornis africanus*	Whitewinged Korhaan	*Eupodotis afraoides*
Old World Painted Snipe	*Rostratula benghalensis*	African Jacana	*Actophilornis africanus*
Ringed Plover	*Charadrius hiaticula*	Old World Painted Snipe	*Rostratula benghalensis*
Kittlitz's Plover	*Charadrius pecuarius*	Ringed Plover	*Charadrius hiaticula*
Threebanded Plover	*Charadrius tricollaris*	Kittlitz's Plover	*Charadrius pecuarius*
Caspian Plover	*Charadrius asiaticus*	Threebanded Plover	*Charadrius tricollaris*
Crowned Plover	*Vanellus coronatus*	Caspian Plover	*Charadrius asiaticus*
Blacksmith Plover	*Vanellus armatus*	Crowned Plover	*Vanellus coronatus*
Wattled Plover	*Vanellus senegallus*	Blacksmith Plover	*Vanellus armatus*
Ruddy Turnstone	*Arenaria interpres*	Whitecrowned Plover	*Vanellus albiceps*

Common Sandpiper	*Actitis hypoleucos*	Wattled Plover	*Vanellus senegallus*
Green Sandpiper	*Tringa ochropus*	Ruddy Turnstone	*Arenaria interpres*
Wood Sandpiper	*Tringa glareola*	Common Sandpiper	*Actitis hypoleucos*
Marsh Sandpiper	*Tringa stagnatilis*	Green Sandpiper	*Tringa ochropus*
Greenshank	*Tringa nebularia*	Wood Sandpiper	*Tringa glareola*
Curlew Sandpiper	*Calidris ferruginea*	Marsh Sandpiper	*Tringa stagnatilis*
Little Stint	*Calidris minuta*	Greenshank	*Tringa nebularia*
Sanderling	*Calidris alba*	Curlew Sandpiper	*Calidris ferruginea*
Ruff	*Philomachus pugnax*	Little Stint	*Calidris minuta*
Ethiopian Snipe	*Gallinago nigripennis*	Sanderling	*Calidris alba*
Whimbrel	*Numenius phaeopus*	Ruff	*Philomachus pugnax*
Pied Avocet	*Recurvirostra avosetta*	Ethiopian Snipe	*Gallinago nigripennis*
Blackwinged Stilt	*Himantopus himantopus*	Whimbrel	*Numenius phaeopus*
Spotted Dikkop	*Burhinus capensis*	Pied Avocet	*Recurvirostra avosetta*
Water Dikkop	*Burhinus vermiculatus*	Blackwinged Stilt	*Himantopus himantopus*
Temminck's Courser	*Cursorius temminckii*	Spotted Dikkop	*Burhinus capensis*
Doublebanded Courser	*Rhinoptilus africanus*	Water Dikkop	*Burhinus vermiculatus*
Threebanded Courser	*Rhinoptilus cinctus*	Temminck's Courser	*Cursorius temminckii*
Bronzewinged Courser	*Rhinoptilus chalcopterus*	Threebanded Courser	*Rhinoptilus cinctus*
Blackwinged Pratincole	*Glareola nordmanni*	Bronzewinged Courser	*Rhinoptilus chalcopterus*
Greyheaded Gull	*Larus cirrocephalus*	Blackwinged Pratincole	*Glareola nordmanni*
Whiskered Tern	*Chlidonias hybridus*	Greyheaded Gull	*Larus cirrocephalus*
Whitewinged Tern	*Chlidonias leucopterus*	Whiskered Tern	*Chlidonias hybridus*
Burchell's Sandgrouse	*Pterocles burchelli*	Whitewinged Tern	*Chlidonias leucopterus*
Doublebanded Sandgrouse	*Pterocles bicinctus*	Burchell's Sandgrouse	*Pterocles burchelli*
Feral Pigeon	*Columba livia*	Doublebanded Sandgrouse	*Pterocles bicinctus*
Rock Pigeon	*Columba guinea*	Feral Pigeon	*Columba livia*
Redeyed Dove	*Streptopelia semitorquata*	Rock Pigeon	*Columba guinea*
Cape Turtle Dove	*Streptopelia capicola*	Redeyed Dove	*Streptopelia semitorquata*
Laughing Dove	*Streptopelia senegalensis*	Cape Turtle Dove	*Streptopelia capicola*
Namaqua Dove	*Oena capensis*	Laughing Dove	*Streptopelia senegalensis*
Greenspotted Dove	*Turtur chalcospilos*	Namaqua Dove	*Oena capensis*
African Green Pigeon	*Treron calva*	Greenspotted Dove	*Turtur chalcospilos*
Meyer's Parrot	*Poicephalus meyeri*	African Green Pigeon	*Treron calva*
Grey Lourie	*Corythaixoides concolor*	Meyer's Parrot	*Poicephalus meyeri*
Eurasian Cuckoo	*Cuculus canorus*	Grey Lourie	*Corythaixoides concolor*
African Cuckoo	*Cuculus gularis*	Eurasian Cuckoo	*Cuculus canorus*
Redchested Cuckoo	*Cuculus solitarius*	African Cuckoo	*Cuculus gularis*

Black Cuckoo	*Cuculus clamosus*	Redchested Cuckoo	*Cuculus solitarius*
Great Spotted Cuckoo	*Clamator glandarius*	Black Cuckoo	*Cuculus clamosus*
Striped Cuckoo	*Clamator levaillantii*	Great Spotted Cuckoo	*Clamator glandarius*
Jacobin Cuckoo	*Clamator jacobinus*	Striped Cuckoo	*Clamator levaillantii*
Klaas's Cuckoo	*Chrysococcyx klaas*	Jacobin Cuckoo	*Clamator jacobinus*
Diederik Cuckoo	*Chrysococcyx caprius*	Klaas's Cuckoo	*Chrysococcyx klaas*
Burchell's Coucal	*Centropus burchellii*	Diederik Cuckoo	*Chrysococcyx caprius*
Barn Owl	*Tyto alba*	Burchell's Coucal	*Centropus burchellii*
Marsh Owl	*Asio capensis*	Barn Owl	*Tyto alba*
African Scops Owl	*Otus senegalensis*	Marsh Owl	*Asio capensis*
Whitefaced Owl	*Ptilopsus granti*	African Scops Owl	*Otus senegalensis*
Pearlspotted Owl	*Glaucidium perlatum*	Whitefaced Owl	*Ptilopsus granti*
Spotted Eagle Owl	*Bubo africanus*	Pearlspotted Owl	*Glaucidium perlatum*
Giant Eagle Owl	*Bubo lacteus*	Spotted Eagle Owl	*Bubo africanus*
Eurasian Nightjar	*Caprimulgus europaeus*	Giant Eagle Owl	*Bubo lacteus*
Fierynecked Nightjar	*Caprimulgus pectoralis*	Eurasian Nightjar	*Caprimulgus europaeus*
Rufouscheeked Nightjar	*Caprimulgus rufigena*	Fierynecked Nightjar	*Caprimulgus pectoralis*
Freckled Nightjar	*Caprimulgus tristigma*	Rufouscheeked Nightjar	*Caprimulgus rufigena*
Eurasian Swift	*Apus apus*	Freckled Nightjar	*Caprimulgus tristigma*
Black Swift	*Apus barbatus*	Eurasian Swift	*Apus apus*
Whiterumped Swift	*Apus caffer*	Black Swift	*Apus barbatus*
Horus Swift	*Apus horus*	Whiterumped Swift	*Apus caffer*
Little Swift	*Apus affinis*	Horus Swift	*Apus horus*
Alpine Swift	*Tachymarptis melba*	Little Swift	*Apus affinis*
Palm Swift	*Cypsiurus parvus*	Alpine Swift	*Tachymarptis melba*
Speckled Mousebird	*Colius striatus*	Palm Swift	*Cypsiurus parvus*
Whitebacked Mousebird	*Colius colius*	Speckled Mousebird	*Colius striatus*
Redfaced Mousebird	*Urocolius indicus*	Whitebacked Mousebird	*Colius colius*
Pied Kingfisher	*Ceryle rudis*	Redfaced Mousebird	*Urocolius indicus*
Giant Kingfisher	*Megaceryle maxima*	Pied Kingfisher	*Ceryle rudis*
Malachite Kingfisher	*Alcedo cristata*	Giant Kingfisher	*Megaceryle maxima*
Pygmy Kingfisher	*Ispidina picta*	Halfcollared Kingfisher	*Alcedo semitorquata*
Woodland Kingfisher	*Halcyon senegalensis*	Malachite Kingfisher	*Alcedo cristata*
Brownhooded Kingfisher	*Halcyon albiventris*	Pygmy Kingfisher	*Ispidina picta*
Greyhooded Kingfisher	*Halcyon leucocephala*	Woodland Kingfisher	*Halcyon senegalensis*
Striped Kingfisher	*Halcyon chelicuti*	Brownhooded Kingfisher	*Halcyon albiventris*
Eurasian Bee-eater	*Merops apiaster*	Greyhooded Kingfisher	*Halcyon leucocephala*
Bluecheeked Bee-eater	*Merops persicus*	Striped Kingfisher	*Halcyon chelicuti*
Carmine Bee-eater	*Merops nubicoides*	Eurasian Bee-eater	*Merops apiaster*
Whitefronted Bee-eater	*Merops bullockoides*	Bluecheeked Bee-eater	*Merops persicus*

Little Bee-eater	*Merops pusillus*	Carmine Bee-eater	*Merops nubicoides*
Swallowtailed Bee-eater	*Merops hirundineus*	Whitefronted Bee-eater	*Merops bullockoides*
Eurasian Roller	*Coracias garrulus*	Little Bee-eater	*Merops pusillus*
Lilacbreasted Roller	*Coracias caudata*	Swallowtailed Bee-eater	*Merops hirundineus*
Purple Roller	*Coracias naevia*	Eurasian Roller	*Coracias garrulus*
Broadbilled Roller	*Eurystomus glaucurus*	Lilacbreasted Roller	*Coracias caudata*
African Hoopoe	*Upupa africana*	Purple Roller	*Coracias naevia*
Redbilled Woodhoopoe	*Phoeniculus purpureus*	Broadbilled Roller	*Eurystomus glaucurus*
Scimitarbilled Woodhoopoe	*Rhinopomastus cyanomelas*	African Hoopoe	*Upupa africana*
Grey Hornbill	*Tockus nasutus*	Redbilled Woodhoopoe	*Phoeniculus purpureus*
Redbilled Hornbill	*Tockus erythrorhynchus*	Scimitarbilled Woodhoopoe	*Rhinopomastus cyanomelas*
Southern Yellowbilled Hornbill	*Tockus leucomelas*	Grey Hornbill	*Tockus nasutus*
Southern Ground Hornbill	*Bucorvus leadbeateri*	Redbilled Hornbill	*Tockus erythrorhynchus*
Blackcollared Barbet	*Lybius torquatus*	Southern Yellowbilled Hornbill	*Tockus leucomelas*
Pied Barbet	*Tricholaema leucomelas*	Southern Ground Hornbill	*Bucorvus leadbeateri*
Yellowfronted Tinker Barbet	*Pogoniulus chrysoconus*	Blackcollared Barbet	*Lybius torquatus*
Crested Barbet	*Trachyphonus vaillantii*	Pied Barbet	*Tricholaema leucomelas*
Greater Honeyguide	*Indicator indicator*	Yellowfronted Tinker Barbet	*Pogoniulus chrysoconus*
Lesser Honeyguide	*Indicator minor*	Crested Barbet	*Trachyphonus vaillantii*
Sharpbilled Honeyguide	*Prodotiscus regulus*	Greater Honeyguide	*Indicator indicator*
Bennett's Woodpecker	*Campethera bennettii*	Lesser Honeyguide	*Indicator minor*
Goldentailed Woodpecker	*Campethera abingoni*	Sharpbilled Honeyguide	*Prodotiscus regulus*
Cardinal Woodpecker	*Dendropicos fuscescens*	Bennett's Woodpecker	*Campethera bennettii*
Bearded Woodpecker	*Dendropicos namaquus*	Goldentailed Woodpecker	*Campethera abingoni*
Monotonous Lark	*Mirafra passerina*	Cardinal Woodpecker	*Dendropicos fuscescens*
Rufousnaped Lark	*Mirafra africana*	Bearded Woodpecker	*Dendropicos namaquus*
Fawncoloured Lark	*Calendulauda africanoides*	Monotonous Lark	*Mirafra passerina*
Sabota Lark	*Calendulauda sabota*	Rufousnaped Lark	*Mirafra africana*
Shortclawed Lark	*Certhilauda chuana*	Fawncoloured Lark	*Calendulauda africanoides*
Dusky Lark	*Pinarocorys nigricans*	Sabota Lark	*Calendulauda sabota*
Redcapped Lark	*Calandrella cinerea*	Shortclawed Lark	*Certhilauda chuana*
Pinkbilled Lark	*Spizocorys conirostris*	Dusky Lark	*Pinarocorys nigricans*

Chestnutbacked Finchlark	*Eremopterix leucotis*	Redcapped Lark	*Calandrella cinerea*
Greybacked Finchlark	*Eremopterix verticalis*	Pinkbilled Lark	*Spizocorys conirostris*
Eurasian Swallow	*Hirundo rustica*	Chestnutbacked Finchlark	*Eremopterix leucotis*
Whitethroated Swallow	*Hirundo albigularis*	Greybacked Finchlark	*Eremopterix verticalis*
Pearlbreasted Swallow	*Hirundo dimidiata*	Eurasian Swallow	*Hirundo rustica*
Redbreasted Swallow	*Hirundo semirufa*	Whitethroated Swallow	*Hirundo albigularis*
Greater Striped Swallow	*Hirundo cucullata*	Pearlbreasted Swallow	*Hirundo dimidiata*
Lesser Striped Swallow	*Hirundo abyssinica*	Redbreasted Swallow	*Hirundo semirufa*
South African Cliff Swallow	*Hirundo spilodera*	Greater Striped Swallow	*Hirundo cucullata*
Rock Martin	*Hirundo fuligula*	Lesser Striped Swallow	*Hirundo abyssinica*
House Martin	*Delichon urbica*	South African Cliff Swallow	*Hirundo spilodera*
Sand Martin	*Riparia riparia*	Rock Martin	*Hirundo fuligula*
Brownthroated Martin	*Riparia paludicola*	House Martin	*Delichon urbica*
Banded Martin	*Riparia cincta*	Sand Martin	*Riparia riparia*
Black Cuckooshrike	*Campephaga flava*	Brownthroated Martin	*Riparia paludicola*
Forktailed Drongo	*Dicrurus adsimilis*	Banded Martin	*Riparia cincta*
Eurasian Golden Oriole	*Oriolus oriolus*	Black Cuckooshrike	*Campephaga flava*
Blackheaded Oriole	*Oriolus larvatus*	Forktailed Drongo	*Dicrurus adsimilis*
Black Crow	*Corvus capensis*	Eurasian Golden Oriole	*Oriolus oriolus*
Pied Crow	*Corvus albus*	Blackheaded Oriole	*Oriolus larvatus*
Ashy Tit	*Parus cinerascens*	Black Crow	*Corvus capensis*
Southern Black Tit	*Parus niger*	Pied Crow	*Corvus albus*
Cape Penduline Tit	*Anthoscopus minutus*	Ashy Tit	*Parus cinerascens*
Grey Penduline Tit	*Anthoscopus caroli*	Southern Black Tit	*Parus niger*
Arrowmarked Babbler	*Turdoides jardineii*	Cape Penduline Tit	*Anthoscopus minutus*
Pied Babbler	*Turdoides bicolor*	Grey Penduline Tit	*Anthoscopus caroli*
Redeyed Bulbul	*Pycnonotus nigricans*	Arrowmarked Babbler	*Turdoides jardineii*
Blackeyed Bulbul	*Pycnonotus tricolor*	Pied Babbler	*Turdoides bicolor*
Terrestrial Bulbul	*Phyllastrephus terrestris*	Redeyed Bulbul	*Pycnonotus nigricans*
Kurrichane Thrush	*Turdus libonyanus*	Blackeyed Bulbul	*Pycnonotus tricolor*
Groundscraper Thrush	*Psophocichla litsipsirupa*	Terrestrial Bulbul	*Phyllastrephus terrestris*
Shorttoed Rockthrush	*Monticola brevipes*	Kurrichane Thrush	*Turdus libonyanus*
Capped Wheatear	*Oenanthe pileata*	Groundscraper Thrush	*Psophocichla litsipsirupa*
Familiar Chat	*Cercomela familiaris*	Mountain Chat	*Oenanthe monticola*
Anteating Chat	*Myrmecocichla formicivora*	Capped Wheatear	*Oenanthe pileata*
Stonechat	*Saxicola torquata*	Familiar Chat	*Cercomela familiaris*
Whitethroated Robin	*Cossypha humeralis*	Mocking Chat	*Thamnolaea cinnamomeiventris*

Whitebrowed Robin	*Cercotrichas leucophrys*	Anteating Chat	*Myrmecocichla formicivora*
Kalahari Robin	*Cercotrichas paena*	Stonechat	*Saxicola torquata*
Garden Warbler	*Sylvia borin*	Cape Robin	*Cossypha caffra*
Whitethroat	*Sylvia communis*	Whitethroated Robin	*Cossypha humeralis*
Titbabbler	*Parisoma subcaeruleum*	Whitebrowed Robin	*Cercotrichas leucophrys*
Icterine Warbler	*Hippolais icterina*	Kalahari Robin	*Cercotrichas paena*
Olivetree Warbler	*Hippolais olivetorum*	Garden Warbler	*Sylvia borin*
Great Reed Warbler	*Acrocephalus arundinaceus*	Whitethroat	*Sylvia communis*
African Marsh Warbler	*Acrocephalus baeticatus*	Titbabbler	*Parisoma subcaeruleum*
Eurasian Marsh Warbler	*Acrocephalus palustris*	Icterine Warbler	*Hippolais icterina*
Eurasian Sedge Warbler	*Acrocephalus schoenobaenus*	Olivetree Warbler	*Hippolais olivetorum*
Cape Reed Warbler	*Acrocephalus gracilirostris*	Great Reed Warbler	*Acrocephalus arundinaceus*
Willow Warbler	*Phylloscopus trochilus*	African Marsh Warbler	*Acrocephalus baeticatus*
Barthroated Apalis	*Apalis thoracica*	Eurasian Marsh Warbler	*Acrocephalus palustris*
Longbilled Crombec	*Sylvietta rufescens*	Eurasian Sedge Warbler	*Acrocephalus schoenobaenus*
Yellowbellied Eremomela	*Eremomela icteropygialis*	Cape Reed Warbler	*Acrocephalus gracilirostris*
Burntnecked Eremomela	*Eremomela usticollis*	African Sedge Warbler	*Bradypterus baboecala*
Greybacked BleatingWarbler	*Camaroptera brevicaudata*	Willow Warbler	*Phylloscopus trochilus*
Desert Barred Warbler	*Calamonastes fasciolatus*	Barthroated Apalis	*Apalis thoracica*
Fantailed Cisticola	*Cisticola juncidis*	Longbilled Crombec	*Sylvietta rufescens*
Desert Cisticola	*Cisticola aridulus*	Yellowbellied Eremomela	*Eremomela icteropygialis*
Tinkling Cisticola	*Cisticola rufilatus*	Burntnecked Eremomela	*Eremomela usticollis*
Rattling Cisticola	*Cisticola chinianus*	Greybacked BleatingWarbler	*Camaroptera brevicaudata*
Neddicky	*Cisticola fulvicapillus*	Desert Barred Warbler	*Calamonastes fasciolatus*
Tawnyflanked Prinia	*Prinia subflava*	Fantailed Cisticola	*Cisticola juncidis*
Blackchested Prinia	*Prinia flavicans*	Desert Cisticola	*Cisticola aridulus*
Spotted Flycatcher	*Muscicapa striata*	Tinkling Cisticola	*Cisticola rufilatus*
Bluegrey Flycatcher	*Muscicapa caerulescens*	Rattling Cisticola	*Cisticola chinianus*
Fantailed Flycatcher	*Myioparus plumbeus*	Redfaced Cisticola	*Cisticola erythrops*
Black Flycatcher	*Melaenornis pammelaina*	Lazy Cisticola	*Cisticola aberrans*
Marico Flycatcher	*Bradornis mariquensis*	Neddicky	*Cisticola fulvicapillus*

Pallid Flycatcher	*Bradornis pallidus*	Tawnyflanked Prinia	*Prinia subflava*
Fiscal Flycatcher	*Sigelus silens*	Blackchested Prinia	*Prinia flavicans*
Chinspot Batis	*Batis molitor*	Spotted Flycatcher	*Muscicapa striata*
Fairy Flycatcher	*Stenostira scita*	Bluegrey Flycatcher	*Muscicapa caerulescens*
Paradise Flycatcher	*Terpsiphone viridis*	Fantailed Flycatcher	*Myioparus plumbeus*
African Pied Wagtail	*Motacilla aguimp*	Black Flycatcher	*Melaenornis pammelaina*
Cape Wagtail	*Motacilla capensis*	Marico Flycatcher	*Bradornis mariquensis*
Yellow Wagtail	*Motacilla flava*	Pallid Flycatcher	*Bradornis pallidus*
Grassveld Pipit	*Anthus cinnamomeus*	Fiscal Flycatcher	*Sigelus silens*
Plainbacked Pipit	*Anthus leucophrys*	Chinspot Batis	*Batis molitor*
Buffy Pipit	*Anthus vaalensis*	Fairy Flycatcher	*Stenostira scita*
Bushveld Pipit	*Anthus caffer*	Paradise Flycatcher	*Terpsiphone viridis*
Lesser Grey Shrike	*Lanius minor*	African Pied Wagtail	*Motacilla aguimp*
Fiscal Shrike	*Lanius collaris*	Cape Wagtail	*Motacilla capensis*
Redbacked Shrike	*Lanius collurio*	Yellow Wagtail	*Motacilla flava*
Longtailed Shrike	*Corvinella melanoleuca*	Grassveld Pipit	*Anthus cinnamomeus*
Tropical Boubou	*Laniarius aethiopicus*	Longbilled Pipit	*Anthus similis*
Crimsonbreasted Shrike	*Laniarius atrococcineus*	Plainbacked Pipit	*Anthus leucophrys*
Puffback	*Dryoscopus cubla*	Buffy Pipit	*Anthus vaalensis*
Brubru	*Nilaus afer*	Striped Pipit	*Anthus lineiventris*
Threestreaked Tchagra	*Tchagra australis*	Bushveld Pipit	*Anthus caffer*
Blackcrowned Tchagra	*Tchagra senegala*	Lesser Grey Shrike	*Lanius minor*
Orangebreasted Bush Shrike	*Telophorus sulfureopectus*	Fiscal Shrike	*Lanius collaris*
Greyheaded Bush Shrike	*Malaconotus blanchoti*	Redbacked Shrike	*Lanius collurio*
White Helmetshrike	*Prionops plumatus*	Longtailed Shrike	*Corvinella melanoleuca*
Whitecrowned Shrike	*Eurocephalus anguitimens*	Southern Boubou	*Laniarius ferrugineus*
Wattled Starling	*Creatophora cinerea*	Tropical Boubou	*Laniarius aethiopicus*
Plumcoloured Starling	*Cinnyricinclus leucogaster*	Crimsonbreasted Shrike	*Laniarius atrococcineus*
Burchell's Starling	*Lamprotornis australis*	Puffback	*Dryoscopus cubla*
Longtailed Starling	*Lamprotornis mevesii*	Brubru	*Nilaus afer*
Glossy Starling	*Lamprotornis nitens*	Threestreaked Tchagra	*Tchagra australis*
Greater Blue-eared Starling	*Lamprotornis chalybaeus*	Blackcrowned Tchagra	*Tchagra senegala*
Redwinged Starling	*Onychognathus morio*	Orangebreasted Bush Shrike	*Telophorus sulfureopectus*
Redbilled Oxpecker	*Buphagus erythrorhynchus*	Greyheaded Bush Shrike	*Malaconotus blanchoti*
Marico Sunbird	*Cinnyris mariquensis*	White Helmetshrike	*Prionops plumatus*
Whitebellied Sunbird	*Cinnyris talatala*	Whitecrowned Shrike	*Eurocephalus anguitimens*
Black Sunbird	*Chalcomitra*	Wattled Starling	*Creatophora cinerea*

	amethystina		
Cape White-eye	*Zosterops virens*	Plumcoloured Starling	*Cinnyricinclus leucogaster*
Redbilled Buffalo Weaver	*Bubalornis niger*	Burchell's Starling	*Lamprotornis australis*
Whitebrowed Sparrowweaver	*Plocepasser mahali*	Longtailed Starling	*Lamprotornis mevesii*
House Sparrow	*Passer domesticus*	Glossy Starling	*Lamprotornis nitens*
Great Sparrow	*Passer motitensis*	Greater Blue-eared Starling	*Lamprotornis chalybaeus*
Cape Sparrow	*Passer melanurus*	Redwinged Starling	*Onychognathus morio*
Southern Greyheaded Sparrow	*Passer diffusus*	Redbilled Oxpecker	*Buphagus erythrorhynchus*
Yellowthroated Sparrow	*Petronia superciliaris*	Marico Sunbird	*Cinnyris mariquensis*
Scalyfeathered Finch	*Sporopipes squamifrons*	Whitebellied Sunbird	*Cinnyris talatala*
Spottedbacked Weaver	*Ploceus cucullatus*	Black Sunbird	*Chalcomitra amethystina*
Masked Weaver	*Ploceus velatus*	Cape White-eye	*Zosterops virens*
Lesser Masked Weaver	*Ploceus intermedius*	Redbilled Buffalo Weaver	*Bubalornis niger*
Redheaded Weaver	*Anaplectes rubriceps*	Whitebrowed Sparrowweaver	*Plocepasser mahali*
Redbilled Quelea	*Quelea quelea*	House Sparrow	*Passer domesticus*
Red Bishop	*Euplectes orix*	Great Sparrow	*Passer motitensis*
Golden Bishop	*Euplectes afer*	Cape Sparrow	*Passer melanurus*
Whitewinged Widow	*Euplectes albonotatus*	Southern Greyheaded Sparrow	*Passer diffusus*
Melba Finch	*Pytilia melba*	Yellowthroated Sparrow	*Petronia superciliaris*
Jameson's Firefinch	*Lagonosticta rhodopareia*	Scalyfeathered Finch	*Sporopipes squamifrons*
Redbilled Firefinch	*Lagonosticta senegala*	Spectacled Weaver	*Ploceus ocularis*
Blue Waxbill	*Uraeginthus angolensis*	Spottedbacked Weaver	*Ploceus cucullatus*
Violeteared Waxbill	*Granatina granatina*	Cape Weaver	*Ploceus capensis*
Common Waxbill	*Estrilda astrild*	Masked Weaver	*Ploceus velatus*
Blackcheeked Waxbill	*Estrilda erythronotos*	Lesser Masked Weaver	*Ploceus intermedius*
Quail Finch	*Ortygospiza atricollis*	Redheaded Weaver	*Anaplectes rubriceps*
Orangebreasted Waxbill	*Amandava subflava*	Cuckoofinch	*Anomalospiza imberbis*
Cutthroat Finch	*Amadina fasciata*	Redbilled Quelea	*Quelea quelea*
Redheaded Finch	*Amadina erythrocephala*	Red Bishop	*Euplectes orix*
Bronze Mannikin	*Lonchura cucullata*	Golden Bishop	*Euplectes afer*
Pintailed Whydah	*Vidua macroura*	Whitewinged Widow	*Euplectes albonotatus*
Shafttailed Whydah	*Vidua regia*	Redcollared Widow	*Euplectes ardens*
Paradise Whydah	*Vidua paradisaea*	Melba Finch	*Pytilia melba*
Purple Widowfinch	*Vidua purpurascens*	Jameson's Firefinch	*Lagonosticta*

			rhodopareia
Steelblue Widowfinch	*Vidua chalybeata*	Redbilled Firefinch	*Lagonosticta senegala*
Yelloweyed Canary	*Serinus mozambicus*	Blue Waxbill	*Uraeginthus angolensis*
Blackthroated Canary	*Serinus atrogularis*	Violeteared Waxbill	*Granatina granatina*
Yellow Canary	*Serinus flaviventris*	Common Waxbill	*Estrilda astrild*
Goldenbreasted Bunting	*Emberiza flaviventris*	Blackcheeked Waxbill	*Estrilda erythronotos*
Rock Bunting	*Emberiza tahapisi*	Quail Finch	*Ortygospiza atricollis*
Larklike Bunting	*Emberiza impetuani*	Orangebreasted Waxbill	*Amandava subflava*
		Cutthroat Finch	*Amadina fasciata*
		Redheaded Finch	*Amadina erythrocephala*
		Bronze Mannikin	*Lonchura cucullata*
		Pintailed Whydah	*Vidua macroura*
		Shafttailed Whydah	*Vidua regia*
		Paradise Whydah	*Vidua paradisaea*
		Purple Widowfinch	*Vidua purpurascens*
		Steelblue Widowfinch	*Vidua chalybeata*
		Yelloweyed Canary	*Serinus mozambicus*
		Blackthroated Canary	*Serinus atrogularis*
		Yellow Canary	*Serinus flaviventris*
		Streakyheaded Canary	*Serinus gularis*
		Goldenbreasted Bunting	*Emberiza flaviventris*
		Rock Bunting	*Emberiza tahapisi*
		Larklike Bunting	*Emberiza impetuani*

Appendix D: CV of Specialist

LOUISE VAN WYK

Louise van Wyk
Environmental Scientist/Ecologist

EDUCATION

2008	M.Sc. Environmental Management (UJ)
2006	B.Sc. Honours Biodiversity and Conservation (UJ)
2003-2005	B.Sc. Zoology and Botany (Rand Afrikaans Universiteit)

EMPLOYMENT

January 2011 - present	Terrestrial Ecologist/Environmental Consultant Digby Wells Environmental
June 2008 - December 2010	Terrestrial Ecologist Golder Associates (Pty) Ltd
January 2008 - June 2008	Environmental Scientist Paulette Jacobs Consulting (Hydroscience)
February 2007 – October 2007	Research Assistant Wildlife Biological Resource Centre

WORK EXPERIENCE

- Environmental pre-feasibility studies for gold tailings reclamation and iron ore mining projects.
- Public Participation Processes and Public Consultation.
- Biodiversity Assessments including Flora, Mammalia, Avifauna, Herpetofauna and Arthropoda in terms of The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) and Provincial legislation.
- Research in conservation methods and environmental health.
- Impact assessments based on the terrestrial environment.
- Biodiversity Action Plans (BAP), rehabilitation and monitoring methods
- Ecological auditing, permit application and species relocation
- Project management of ecological specialist studies.
- Environmental Impact Assessments (EIAs), Basic Assessments and Environmental Management Plans (EMPs) for environmental authorisations in terms of the South African National Environmental Management Act (NEMA), 1998 (Act 107 of 1998).
- Assistance with Integrated Water Use License Applications (IWULAs) in terms of the South African National Water Act (NWA), 1998 (Act 36 of 1998).

PROJECT INVOLVEMENT

- Vaal Life X, Free State: Terrestrial survey and reporting on the Mammalia, Avifauna, Herpetofauna, Arthropoda and Flora of the proposed project area for a coal mine development. Also an assessment associated with the impacts on the terrestrial environment.
- SANRAL Swartkopfontein, Botswana: Project manager and terrestrial specialist. Survey and reporting on the Mammalia, Avifauna, Herpetofauna, Arthropoda and Flora of the proposed road

upgrade and bridge development at the Swartkopfontein border post. Also an assessment associated with the impacts on the terrestrial environment.

- Rustenburg Landfill Site, North West: Ecological survey and reporting on the Mammalia, Avifauna, Herpetofauna, Arthropoda and Flora of the proposed project area. Also an assessment associated with the impacts on the terrestrial environment.
- Rand Uranium, Gauteng: Ecological survey and reporting on the Mammalia, Avifauna, Herpetofauna, Arthropoda and Flora of the proposed project area for the development of a TSF and other mining infrastructure. Also an assessment associated with the impacts on the terrestrial environment and suggestions on mitigation.
- Belfast NBC, Mpumalanga: Ecological background study, which includes legislation, biodiversity requirements, expected species lists, Red Data and threatened species list and project/location information.
- Mogale Alloys, Gauteng: Terrestrial survey and reporting on the Mammalia, Avifauna, Herpetofauna, Arthropoda and Flora of the proposed project area for the development of mining infrastructure in Krugersdorp, Gauteng.
- Swartkoppies, Gauteng: Terrestrial survey and reporting on the Flora of the proposed project area for housing development
- Zuurfontein Fauna and Flora, Gauteng: Ecological Reporting on the Mammalia, Avifauna, Herpetofauna, Arthropoda and Flora of the proposed project area.
- Foskor PEP 3, Limpopo: Terrestrial survey and reporting on the Mammalia, Avifauna, Herpetofauna, Arthropoda and Flora of the proposed project area for the development of mining infrastructure. Also an assessment associated with the impacts on the terrestrial environment and suggestions on mitigation.
- PMC Biomonitoring, Limpopo: Riparian survey and reporting as part of the biomonitoring project regarding the Selati and Olifants River. The riparian reporting includes the application of VEGRAI 3.
- Vanchem relocation project, Mpumalanga: Ecological study on the relocation of *Protea gaguedi*, including methods on relocation of Protea species, probability of survival, procedures to follow, permit application and possible locations for Protea relocation.
- Eastplats species of concern Assessment, Limpopo: An ecological audit to determine areas of concern and mitigation including species relocation that could be applied.
- Moatize Avian and Mammal study, Mozambique: Ecological desktop study which includes legislation, biodiversity requirements, expected species lists, Red Data and threatened species list and project/location information.
- Crown Pipeline ecological audits, Gauteng: Weekly inspection of the pipeline site to determine management measures and improvement that can be applied.
- WUC Pipeline, Gauteng: Terrestrial survey and reporting on the Mammalia, Avifauna, Herpetofauna, Arthropoda and Flora for a pipeline stretching over the Gauteng Province from the west as far as Randfontein to Springs in the East. Also an assessment associated with the impacts on the terrestrial environment and suggestions on mitigation.
- SASOL Synfuels Secunda, Mpumalanga: Terrestrial survey and reporting on the Mammalia, Avifauna, Herpetofauna, Arthropoda and Flora of the proposed project area. Also an assessment associated with the impacts on the terrestrial environment and suggestions on mitigation measures. Furthermore and ecological audit and GRASS OWL RELOCATION PROCEDURE, due to Red Data species recorded on site.

- ASA Metals, Mpumalanga: Basic Assessment including meetings with authorities and the client. Initial screening level site assessment and research on background information for the development of mining infrastructure.
- Waterval 42 Rustenburg, North West: EIA and Public Participation including meetings with authorities and the client. Meeting with stakeholders and I and AP's. Initial screening level site assessment. Assistance on terrestrial and hydrological specialist studies. Research on background information.
- Waterval 25 Rustenburg, North West: Basic Assessment and Public Participation including meetings with authorities and the client. Meeting with stakeholders and I and AP's. Initial screening level site assessment and research on background information for the development
- Pilansberg Filling Station, North West: EIA and Public Participation including meetings with authorities and the client. Meeting with stakeholders and I and AP's. Initial screening level site assessment. Research on background information.
- ARNOT Mooifontein, Mpumalanga: All Water Use Licensing procedures and applications for the re-routing of a watercourse and the involvement in documenting the Scoping Report
- Koidu Holdings, Sierra Leone: Fauna survey studies and impact assessment for the expansion of kimberlite mine.
- Anglo Gold Ashanti, Ghana: Fauna assessment to determine the ecology integrity for the purpose of rehabilitation monitoring.
- Temo Coal, Waterberg Limpopo: Fauna Assessment and an impact assessment based on the development of an opencast coal mine.
- Mareesburg RoD EBA, Sekhukhuneland Limpopo: To determine the sensitivity of a project area that a RoD was already achieved on. During the field survey findings included seven Red Data species, eight protected species and thirteen endemic species. Furthermore Red Data Leopard and Brown Hyena and the endemic and previously declared extinct *Pycna sylvia* (cicada) was found to occur on site. From this a nursery plan was developed and further monitoring as mitigation on the loss of *Pycna sylvia*.

COURSES ATTENDED

- Technical Writing, Golder Associates, 14 August 2009
- Project Management 24, Golder Associates, 11 September 2008
- Wild Flower Identification course, Africa Land Use Training, 7 November 2009
- First Aid Training Level 1: Golder Associates, December 2009
- Snake ID and Snakebite treatment course, African Reptiles and Venom, June 2011
- Venomous Snake handling Course, African Reptiles and Venom, June 2011

CONFERENCES AND SEMINARS ATTENDED

- Wetland Indaba, Kruger National Park, South Africa 2008.
- Wetland Indaba, Langebaan, South Africa 2009.
- Land Rehabilitation Workshop, Phil Tanner, 2012.

- Risk Assessment and Facilitation Course, Phil Tanner, 2012.

PRESENTATIONS

- The comparison of four semen extenders in the preservation of epididymal sperm of Zebra (*Equus burchellii*) and Black Wildebeest (*Connochaetes gnou*) presented July 2006
- Implications of Fallout Dust on the Ambient Environment. A Case Study of the Rand Leases Mine Dump presented October 2007
- Kruger National Park - The Relationship between Tourism and Artificial Waterholes and its Ecological Implications presented November 2009