7. ECOLOGY

7.1. Introduction

Bathusi Environmental Consultants was appointed, by Bohlweki Environmental, to conduct an ecological impact assessment of the preferred farms identified during the scoping phase. This chapter deals with detailed descriptions of the biological environment that will be affected by the proposed development as well as providing descriptions and assessments of the potential impacts resulting from the proposed development and activities that it will entail.

7.2. Scope & Limitations

Aims of this ecological impact assessment are to present the client with descriptions of floristic and faunal attributes within the proposed areas and to highlight sensitive elements that might be affected adversely.

The Terms of Reference for the Ecological Impact Evaluation are to:

- conduct detailed and specific site investigation of floristic and faunal attributes of the selected sites and linear structures;
- describe the areas in terms of floristic and faunal species composition, assemblages, communities, red data probabilities and general environmental attributes;
- conduct a detailed Ecological Impact Assessment for the selected sites and linear structures;
- identify and describe the effect of expected impacts on ecological attributes of the selected sites and linear structures;
- compile sensitivity maps, highlighting areas of concern;
- conduct a detailed Ecological Sensitivity Analysis for the selected sites and linear structures in order to verify results obtained from the Impact Assessment;
- propose mitigation measures to minimise expected adverse impacts; and
- present all results in a suitable format.

Rare and endemic flora and fauna species do not normally occur in great densities and because of customary limitations in the search and identification of red data species, the detailed investigation of the presence of these species within the study area was not perceived as within the scope of this investigation. Estimations provided in this document only provide an indication of the Probability of the Occurrence of these species as the low levels of biological and distributional information inherently associated with Red Data species create large gaps in such estimations. These gaps are only lessened by intense sampling conducted over long periods of time. However, all areas that were sampled during the site

investigation were thoroughly investigated for the presence of these species and results obtained from these surveys were then extrapolated to present opinions for the remainder of the proposed areas.

This investigation, although based on proper scientific methods and performed to accepted standards and norms, was performed by means of stratified sampling of ecological attributes of the study areas and not on the detailed or long-term investigation of all environmental attributes and the varying degrees of biological diversity that may be present in the study area. Additional information may therefore come to light during a later stage of the process or development for which no allowance can be made at this stage of the investigation. No definite conclusions may therefore be drawn with regards to biological diversity or conservation strategies as far as the proposed areas are concerned.

7.3. Methodology

Site investigations were conducted during the 21st to 25th November 2005. Detailed site information was collected from 34 stratified random sample plots within the study area. This period of the year is considered suitable for the collection of biological data as a high percentage of the flora species that occur in the area are flowering (allowing for acuuracte identification) and faunal species are active.

All methods implemented during this investigation are based on accepted scientific investigative techniques and principles and was performed to acceptable standards and norms.

7.3.1. General Floristic Attributes

The baseline assessment of flora was achieved by means of basic investigation methods, as normally used in the delineation, survey, classification and description of vegetation communities.

Standard aerial techniques were implemented in delineation of physiognomic habitat types. Orthophotos 2327DA22, 2327DA21 and 2327DA17 (1:10 000 scale) were used in the delineation process. Other images also implemented include Google (2006) as well as a digital aerial photograph obtained from the GIS department of Matimba Power Station.

Because the study areas are remarkably homogeneous in physiognomic attributes, randomly stratified plots were sampled across the area, ensuring sure that all areas are sampled sufficiently. During the site investigation phase these plots were sampled and the following information collected:

- all plant species and growth forms;
- dominant plant species;
- cover abundance values;
- general environmental attributes, such as
  * soil colour and texture;
  * slope;
  * aspect;
  * topography;
  * rockiness; and
- samples of unidentified plant species;
- digital photographs of the site;
- GPS reference point; and
- notes and comments regarding potential impacts, red data suitability and presence and general status of the site.

Plant species that could not be identified during the site investigation were sampled and identified at a later stage from field guides or comparison to herbarium examples. During the desktop analysis phase the data was captured in a database and species lists were compiled. The preliminary vegetation units were compared in terms of species composition, dominant species and general environmental attributes and subsequently described.

7.3.2. Red Data Flora Investigation

Baseline PRECIS data presented by SANBI (Appendix N(a)) was compared to the Interim Red Data List of South African Plant Species (Threatened Species Programme, 2004) to compile a list of red data flora species that occur within the ¼ degree grid in which the study area is located (2327DA). All areas that were considered suitable for the potential presence of these species were investigated as part of the survey to verify the presence / absence of these red data flora species.

7.3.3. General Faunal Assessment

- *Terrestrial Invertebrates*
  Terrestrial Invertebrates were identified on site whenever encountered. Commonly occurring terrestrial invertebrates were sampled using a hand-net in order to attempt ecological comparisons of the various areas likely to be affected.

- *Amphibians*
  The species-specific calls of male frogs as well as visual sightings (capture and release) were used to assess the presence of amphibian species in the study area.

- *Reptiles*

  Visual sightings were used to assess the presence of reptile species in the area.

- *Birds*

  Visual sightings and species-specific calls were used to compile lists of bird species.

- *Mammals*

  The presence of small mammals (mice, rats etc.) was investigated by using small mammal live traps (baited with peanut butter, oats and raisins). Visual sightings and ecological indications were used to identify the medium- and large mammal inhabitants of the study area.

- *Aquatic Invertebrates*

  No habitat for aquatic invertebrates was present on the site and this part of the investigation was therefore excluded.

7.3.4. Red Data Fauna Assessment

In order to assess the status of red data fauna species in the study area, the following sources were used:

- South African Red Data Book – Reptiles and Amphibians (Branch, 1998);
- Red Data Book of the Mammals of South Africa (EWT, 2004);
- South African Red Data Book – Butterflies (Henning, S.F. & Henning, G.A, 1989);
- IUCN Red List Categories and Criteria (IUCN, 2001);
- IUCN Red List of Threatened Species (IUCN, 2003);
- Atlas and Red Data Book of the Frogs of South Africa (Minter, Burger, Harrison, Braack, Bishop & Loafer, 2004); and
- South African Red Data Book – Terrestrial Mammals (Smithers, 1986).

- *Probability of Occurrence*

  This assessment is used to assess the probability that a red data species might occur in an area, based on the subjective assessment of certain criteria. Three criteria were used to estimate the Probability of Occurrence for each red data spcies. namely:
  - ∗ Known distributional range;
  - ∗ Habitat presence; and
  - ∗ Presence of food.

Each of these criteria was scored between 0 and 100 (i.e. %), the average of these scores was classed as the Probability of Occurrence for each species, namely:

∗   0-24%   = LOW;
∗   25-49%   = LOW-MEDIUM;
∗   50-74%   = MEDIUM-HIGH; and
∗   75-100%   = HIGH.

It should be noted that, in the case of some of the larger mammals the Probability of Occurrence was calculated based on the availability of preferred habitat of the species rather than the probability that the species currently exists within the study area's boundaries.

- *Red Data Sensitivity Index Score (RDSIS)*
  This assessment is used to estimate the importance of the study area in terms of being suitable for the general requirements of red data fauna species that could potentially occur within the study area. Only species with a Probability of Occurrence of higher than 50% (Medium-High and High) are used in this analysis.

  Factor (F) was calculated to weight the IUCN status of relevant species. This was done to ensure that Critically Endangered species that do have a significant Probability of Occurrence for the area carry significant weight in the process of calculating the RDSIS of the area. Weighting (F) for the five relevant IUCN categories are as follows:

  ∗   Data Deficient (DD)   -   0.2
  ∗   Near Threatened (NT)   -   0.7
  ∗   Vulnerable (VU)   -   1.5
  ∗   Endangered (EN)   -   1.7; and
  ∗   Critically Endangered (CR) -   1.8.

  ∗   The Probability of Occurrence (Y) was used to calculate the Red Data Sensitivity Index Score (RDSIS) (X) for each species:
  ∗   The average Species' Score for all the species was calculated:
  ∗   The average of all the Threatened taxa's (VU, EN and CR) species scores was calculated, and the average of these two scores were calculated to add more weight to threatened taxa with a more than 50% Probability of Occurrence.
  ∗   The % of species with a Probability of Occurrence of 50% or more of the total number of Red Data species listed for the area was calculated and the average of these two scores gives the RDSIS for the area investigated.

7.3.5. Ecological Sensitivity Analysis

- *Structure*

  A flow diagram is presented to indicate the process (Figure 7.1).

  The aim of the Integrated Sensitivity Analysis is to determine the inherent ecological sensitivity of habitat units by means of the comparison of weighted floristic and faunal attributes.

  - **Sensitivity Criteria**. These criteria represent floristic and faunal attributes of the area that contribute towards the inherent sensitivity/ degradation of the different vegetation types.

  - A **Criteria Weighting** is applied to each of the Sensitivity Criterion and this is determined by means of ranking of each criterion against all other Sensitivity Criteria, placing the criteria on a scale of increasing importance from 1 to 10, where 10 represents the highest importance category and 1 the lowest.

  - Each habitat unit is subjectively rated on a scale of 1 to 10 to obtain the **Sensitivity Value** in terms of the influence that the particular Sensitivity Criterion has on the floristic status of the particular habitat.

  - Separate Values are multiplied with the respective Criteria Weighting, which emphasises the importance/ triviality that the individual Sensitivity Criteria have on the status of each habitat.

  - **Ranked Values** are then added and expressed as a percentage of the maximum possible value (**Ecological Sensitivity Value**) and placed in a particular class, namely:
    - **High**   80   –   100%
    - **Medium – high** 60   –   80%
    - **Medium**   40   –   60%
    - **Medium – low**   20   –   40%
    - **Low**   0   –   20%

  This method is considered effective in highlighting sensitive areas, based on observed floristic and faunal attributes rated across the spectrum of habitat units. Phytosociological attributes (species diversity, presence of exotic species, etc.) and physical characteristics, e.g. human impacts, size and fragmentation are important in assessing the status of the various communities.

- *Identification of Sensitivity Criteria*

  Criteria employed in assessing the ecological sensitivity of separate habitat may vary between different areas, depending on location, type of habitat, size, etc. As part of this analysis the following factors were assumed as important in determining the sensitivity of vegetation units of this particular site:

∗ Habitat suitability for the potential presence of red data flora and fauna species;
∗ Landscape or habitat sensitivity;
∗ Natural/ ecological status;
∗ Floristic and faunal species diversity; and
∗ Ecological performance/fragmentation.

- *Weighting of Sensitivity Criteria*
  ∗ Presence of red data species/habitat suitability   **10.00**
  ∗ Landscape sensitivity   **7.00**
  ∗ Natural / ecological status   **6.00**
  ∗ Species diversity (flora & fauna)   **5.00**
  ∗ Ecological functionality fragmentation   **1.00**

Please note: This section is only included in order to verify results obtained from the Impact Evaluation and is presented in Appendix N(b).
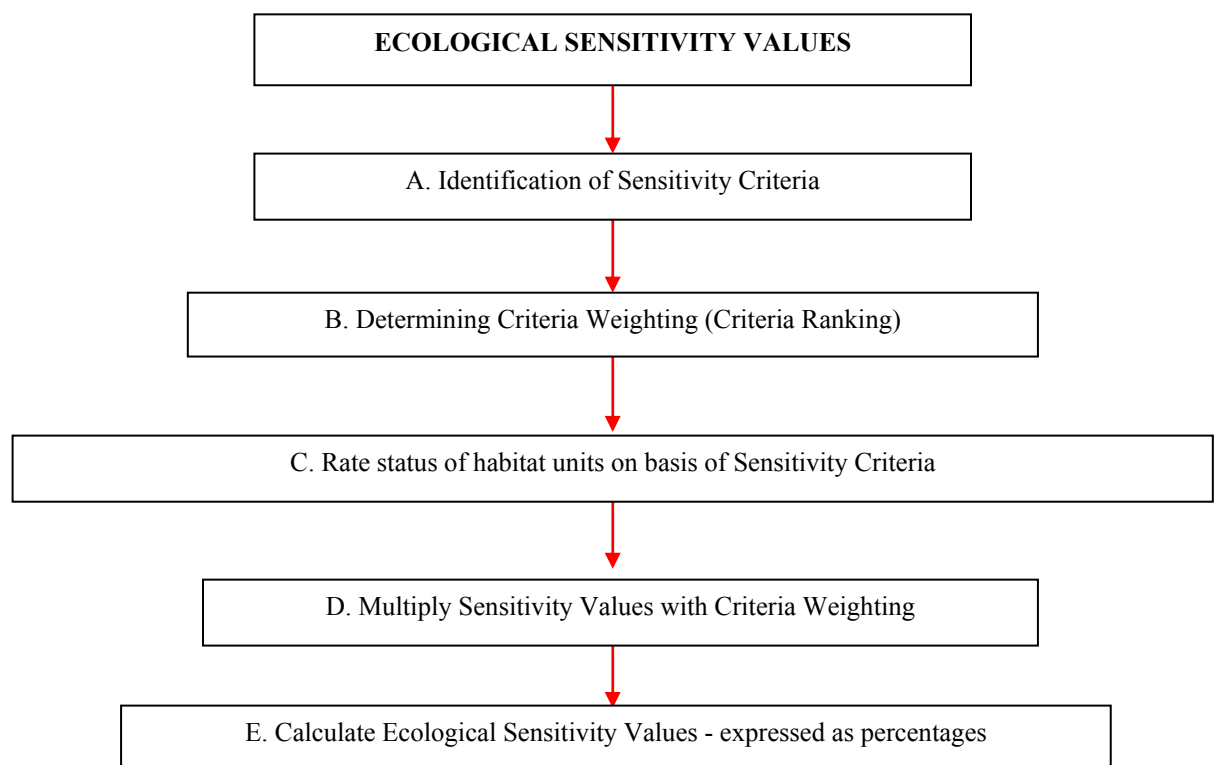
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│      ECOLOGICAL SENSITIVITY VALUES       │
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│   A. Identification of Sensitivity Criteria │
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│ B. Determining Criteria Weighting (Criteria Ranking) │
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│ C. Rate status of habitat units on basis of Sensitivity Criteria │
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│ D. Multiply Sensitivity Values with Criteria Weighting │
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│ E. Calculate Ecological Sensitivity Values - expressed as percentages │
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Figure 7.1:   Calculating the Ecological Sensitivity Values

7.3.6. Ecological Impact Evaluation

The structure of this evaluation is standard to the format applied by Bohlweki Environmental. The reader is referred to the relevant section for an explanation of the evaluation.

7.4. Regional Overview

7.4.1. Regional Overview of the Flora

Vegetation types, according to descriptions presented by Van Rooyen and Bredenkamp in 'The Vegetation of South Africa, Lesotho and Swaziland' (Low and Rebelo, 1998) that comprises the eight farms include mostly Mixed Bushveld (18) with a small portion of Waterberg Moist Mountain Bushveld (12), forming part of the Savanna Biome (Figure 9.2).

The Savanna Biome is the largest biome in Southern Africa, occupying over one-third of the area of South Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants. The environmental factors delimiting the biome are complex; altitude ranges from sea level to 2 000 m; rainfall varies from 235 mm to 1 000 mm per year; frost may occur and almost every major geological and soil type occurs within the biome. A major factor delimiting the biome is the lack of sufficient rainfall which prevents the upper layer from dominating, coupled with fires and grazing, which keep the grass layer dominant. The shrub layer may vary from 1 to 20 m in height, but in Bushveld typically varies from 3 to 7m. The shrub-tree element may come to dominate the vegetation in areas which are being overgrazed.

Waterberg Moist Mountain Bushveld occurs on sandstone and quartzite of the Waterberg Mountains, comprising an extremely small south eastern portion of the farm Naauwontkomen. The tree layer is dominant, consisting of a composition of *Faurea saligna, Acacia caffra, Burkea africana, Terminalia sericea* and *Peltophorum africanum* on deep, sandy areas, with *Kirkia acuminata, Englerophytum magalismontanum, Protea caffra, Croton gratissimus, Combretum apiculatum, Alibizia tanganyikensis* and *Combretum molle* characteristic of the rocky slopes. The shrub- and grass layer is moderately to well-developed, depending on the intensity of the grazing component, which, together with fire, is an important driving force behind vegetation development. Aspect and slope also play important roles in the distribution of plant species. Only a small portion of the study area constitutes this particular vegetation type.

Mixed Bushveld, as is deduced from the name, represents a great variety of plant communities, with many variations and transitions. The vegetation varies from a dense, short bushveld to a rather open tree savanna. On shallow soils *Combretum apiculatum* dominates, occurring together with *Acacia caffra, Dichrostachys cinerea, Lannea discolour, Sclerocarya birrea* and various *Grewia* species. The grazing is sweet and the herbaceous layer is dominated by the grasses *Digitaria eriantha, Schmidtia pappophoroides, Anthephora pubescens, Stipagrostis uniplumis* and various *Aristida* and *Eragrotis* species. On deeper and

sandier soils *Terminalia sericea* becomes dominant, with *Ochna pulchra, Grewia flava, Peltophorum africanum* and *Burkea africana* often prominent species. The grass sward is scanty with *Eragrostis pallens* and *Perotis patens* characteristic. The structure of this vegetation type is determined by fire and grazing. The majority of the study area constitutes this vegetation type.

The vegetation that characterises 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 are not generally favoured by grazers. The interaction of vegetation, fire and animals play important roles in maintaining savanna ecosystems (Knobel, 1999).

PRECIS data from SANBI indicate a total of 305 plant species within the ¼ degree grid (Appendix N(a)). The fact that only 47 (39.2%) of the species that were identified in the study area are listed on the PRECIS list clearly illustrate the low state of knowledge of the botanical diversity of this area in general, particularly when taking the relative small size of the study area in relation to the ¼ degree grid into consideration.

The Interim Red Data List of South African Plant Species (Threatened Species Programme, 2004) indicates a total of 319 potential red data species for the Limpopo Province. Comparison of this list of red data species with the PRECIS list revealed the presence of 4 Red Data flora species within the relevant ¼ degree grid (Refer to Figure 9.3).

A list of trees was produced by the South African National Botanical Institute that contain certain tree species that does not have any Red Data status, but are considered important in a South African perspective as a result of scarcity, high utilisation, common value, etc. (South African National Botanical Institute, 2004.
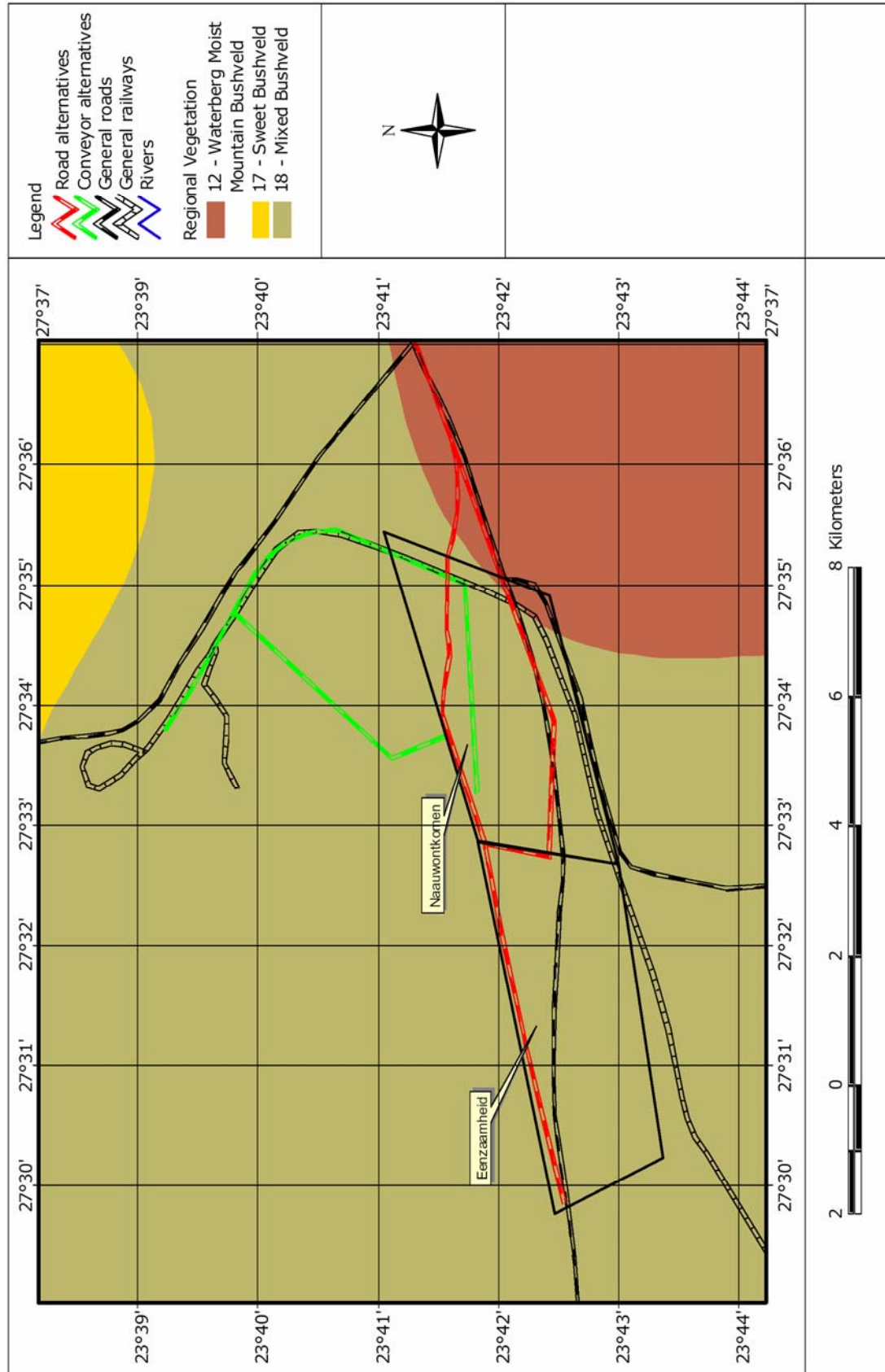
Figure 9.2: Low and Rebel vegetation types of the study area

7.4.2. Regional Overview of the Fauna

Over thousands of years the savanna system and the antelope that inhabit them have developed side by side. Grasses, for example, have become well adapted to defoliation, as much a defensive response to constant pressure by grazers as to the regular veld fires that rage 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 has 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, illustrating that utilisation 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.

The savanna of South Africa includes numerous animal species; approximately 167 mammals (15% endemism), 532 birds (15% endemism), 161 reptiles (40% endemism), 57 amphibians (18% endemism) and an unknown number of invertebrates. Flagship species include the Starburst Horned Baboon Spider, ground Hornbill, Cape Griffon, Wild dog, Short-Eared Trident Bat and the White Rhinoceros (Knobel, 1999).

Photos 7 – 12 included in Appendix O show some of the fauna species noted on site. Table 9.1 shows the red data fauna species are listed for the region.

Table 9.1: Red data fauna species listed for the region

Biological Name	English Name	Red Data Status
Frogs		
Pyxicephalus adspersus	Giant Bullfrog	Near Threatened
Snakes		
Xenocalamus transvaalensis	Transvaal Quillsnout Snake	Data Deficient
Birds		
Alcedo semitorquata	Half-collared Kingfisher	Near Threatened
Aquila rapax	Tawny Eagle	Vulnerable
Ardeotis kori	Kori Bustard	Vulnerable
Bucorvus leadbeateri	Southern Ground-Hornbill	Vulnerable

Buphagus erythrorhynchus	Red-billed Oxpecker	Near Threatened
Ciconia nigra	Black Stork	Near Threatened
Circus macrourus	Pallid Harrier	Near Threatened
Ephippiorhynchus senegalensis	Saddle-billed Stork	Endangered
Falco biarmicus	Lanner Falcon	Near Threatened
Falco naumanni	Lesser Kestrel	Vulnerable
Falco peregrinus	Peregrine Falcon	Near Threatened
Glareola nordmanni	Black-winged Pratincole	Near Threatened
Gorsachius leuconotus	White-backed Night-Heron	Vulnerable
Gyps africanus	White-backed Vulture	Vulnerable
Gyps coprotheres	Cape Vulture	Vulnerable
Hieraaetus ayresii	Ayres's Hawk-Eagle	Near Threatened
Leptoptilos crumeniferus	Marabou Stork	Near Threatened
Mycteria ibis	Yellow-billed Stork	Near Threatened
Pelecanus rufescens	Pink-backed Pelican	Vulnerable
Phoenicopterus minor	Lesser Flamingo	Near Threatened
Phoenicopterus ruber	Greater Flamingo	Near Threatened
Podica senegalensis	African Finfoot	Vulnerable
Polemaetus bellicosus	Martial Eagle	Vulnerable
Rostratula benghalensis	Greater Painted-snipe	Near Threatened
Sagittarius serpentarius	Secretarybird	Near Threatened
Terathopius ecaudatus	Bateleur	Vulnerable
Torgos tracheliotus	Lappet-faced Vulture	Vulnerable
Trigonoceps occipitalis	White-headed Vulture	Vulnerable
Vanellus albiceps	White-crowned Lapwing	Near Threatened
Mammals		
Acinonyx jubatus	Cheetah	Vulnerable
Atelerix frontalis	South African Hedgehog	Near Threatened
Cloeotis percivali	Short-eared Trident Bat	Critically Endangered
Crocidura cyanea	Reddish-grey Musk Shrew	Data Deficient
Crocidura hirta	Lesser Red Musk Shrew	Data Deficient
Crocuta crocuta	Spotted Hyaena	Near Threatened
Damaliscus lunatus lunatus	Tsessebe	Endangered
Dasymys incomtus	Water Rat	Near Threatened
Diceros bicornis minor	Black Rhinoceros	Vulnerable
Elephantulus brachyrhynchus	Short-snouted Elephant-shrew	Data Deficient
Elephantulus intufi	Bushveld Elephant-shrew	Data Deficient
Graphiurus platyops	Rock Dormouse	Data Deficient
Hippotragus equinus	Roan Antelope	Vulnerable
Hippotragus niger niger	Sable Antelope	Vulnerable
Hyaena brunnea	Brown Hyaena	Near Threatened
Lemniscomys rosalia	Single-striped Mouse	Data Deficient
Leptailurus serval	Serval	Near Threatened
Lycaon pictus	African Wild Dog	Endangered
Manis temminckii	Pangolin	Vulnerable
Mellivora capensis	Honey Badger	Near Threatened
Miniopterus schreibersii	Schreiber's Long-fingered Bat	Near Threatened
Myotis tricolor	Temminck's Hairy Bat	Near Threatened

Panthera leo	Lion	Vulnerable
Pipistrellus rusticus	Rusty Bat	Near Threatened
Poecilogale albinucha	African Weasel	Data Deficient
Rhinolophus blasii	Peak-saddle Horseshoe Bat	Vulnerable
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	Near Threatened
Rhinolophus darlingi	Darling's Horseshoe Bat	Near Threatened
Rhinolophus hildebrantii	Hildebrant's Horseshoe Bat	Near Threatened
Tatera leucogaster	Bushveld Gerbil	Data Deficient

7.5.   Flora Of The Study Area

7.5.1. Floristic Species Diversity

The floristic species diversity of the study area is considered relative poor. A total of 120 species were identified during the site investigation (Table 9.2).   This relative low diversity reflects the general absence of topographical and environmental diversity that cause changes to the land surface resulting in the formation of varying communities and hence diverse species composition.   In addition to the plant species that are known to occur in the area (PRECIS Data), an additional 73 plant species were recorded.

The physiognomy of the area is displayed in the dominance of the tree component (37.6%) while the grass sward is considered poorly represented (16.7%) due to two main factors (Figure 9.3).   While a pristine species composition would dictate a more diverse grass sward, this particular case is affected not only by the late season (the grass sward are not considered fully developed since the start of the raining season), but also as a result of the degraded status of the herbaceous layer.   Over utilisation and vegetation manipulation has resulted in an increase in woody species in most areas, causing the woody structures to dominate the grass layer, resulting in the presence of only a few grass species that dominate herbaceous layer.

Forbs and other herbs are well represented (40.83%), but the dominance of certain species also indicates the degraded status of the vegetation.

It should be noted that over utilisation by means of grazing does not have a direct influence on the woody component, but depletion of the grass sward eventually causes a dominance of the woody layer due to higher germination success of seeds. This, in effect, lowers the competitive ability of the grass sward as the increased shade effect of the woody layer results in a lower germination success of grass seeds. This effect is particularly pronounced in areas where periodic burning is not utilised as part of a management plan.

A total of 47 plant families were identified during the site investigation. Mimosaceae (9.2%) (Acacias) and Poaceae (15.8%) (grasses) dominate the composition.

Table 9.2: Plant species recorded in the study area

Species Name	Growth Form	Family
Abutilon austro-africanum Hochr.	Forb	Malvaceae
Acacia erioloba	Tree	Mimosaceae
Acacia erubescens Welw. ex Oliv.	Tree	Mimosaceae
Acacia grandicornuta Gerstner	Tree	Mimosaceae
Acacia karroo Hayne	Tree	Mimosaceae
Acacia mellifera	Tree	Mimosaceae
Acacia nigrescens Oliv.	Tree	Mimosaceae
Acacia robusta	Tree	Mimosaceae
Acacia senegal	Tree	Mimosaceae
Acacia tortilis	Tree	Mimosaceae
Adansoinia digitata	Tree	Bombacaceae
Agathisanthemum bojeri	Forb	Rubiaceae
Albizia harveyi E.Fourn.	Tree	Mimosaceae
Ammocharis coranica (Ker Gawl.) Herb.	Geophyte	Amaryllidaceae
Aptosimum albomarginatum	Forb	Scrophulariaceae
Aristida congesta Roem. & Schult. ssp. barbicollis	Grass	Poaceae
Aristida species	Grass	Poaceae
Aristida stipitata	Grass	Poaceae
Asparagus laricinus Burch.	Shrub	Liliaceae
Asparagus virgatus Baker	Shrub	Liliaceae
Bauhinia galpinii N.E.Br.	Shrub	Ceasalpiniaceae
Blepharis subvolubilis	Forb	Acanthaceae
Boscia albitrunca	Tree	Capparaceae
Boscia foetida	Tree	Capparaceae
Cenchrus ciliaris L.	Grass	Poaceae
Chaetacanthus costatus Nees	Forb	Acanthaceae
Chaetacanthus species	Forb	Acanthaceae
Combretum apiculatum	Tree	Combretaceae
Combretum hereroense Schinz	Tree	Combretaceae
Combretum imberbe Wawra	Tree	Combretaceae
Combretum zeyheri Sond.	Tree	Combretaceae
Commelina africana	Forb	Commelinaceae
Commelina species	Forb	Commelinaceae
Commiphora africana (A.Rich.) Engl.	Tree	Burseraceae
Commiphora mollis (Oliv.) Engl.	Tree	Burseraceae
Commiphora pyracanthoides Engl.	Tree	Burseraceae
Crotalaria spartioides	Forb	Fabaceae
Croton gratissimus	Tree	Euphorbiaceae
Cucumis hirsutus Sond.	Forb	Cucurbitaceae

Species Name	Growth Form	Family
Cucumis zeyheri Sond.	Forb	Cucurbitaceae
Cyperus obtusiflorus	Sedge	Cyperaceae
Cyphostemma species	Succulent	Vitaceae
Dichrostachys cinerea	Tree	Mimosaceae
Digitaria eriantha Steud.	Grass	Poaceae
Dipcadi species	Geophyte	Liliaceae
Dipcadi viride	Geophyte	Liliacea
Ehretia rigida (Thunb.) Druce	Tree	Ehretiaceae
Enneapogon cenchroides (Roem. & Schult.) C.E.Hubb.	Grass	Poaceae
Enneapogon scoparius Stapf	Grass	Poaceae
Enteropogon macrostachyus (A.Rich.) Benth.	Grass	Poaceae
Eragrostis lehmanniana	Grass	Poaceae
Eragrostis pallens Hack.	Grass	Poaceae
Eragrostis rigidior Pilg.	Grass	Poaceae
Eragrostis superba Peyr.	Grass	Poaceae
Euclea natalensis	Tree	Ebenaceae
Euclea undulata	Tree	Ebenaceae
Gardenia volkensii	Tree	Rubiaceae
Grewia flava DC.	Tree	Tiliaceae
Grewia flavescens	Tree	Tiliaceae
Grewia monticola Sond.	Tree	Tiliaceae
Grewia retinervis Burret	Tree	Tiliaceae
Harpagophytum zeyheri	Forb	Pedaliaceae
Helichrysum species	Forb	Asteraceae
Heliotropium ciliatum Kaplan	Forb	Boraginaceae
Heliotropium steudneri Vatke	Forb	Boraginaceae
Hermbstaedtia odorata	Forb	Amaranthaceae
Heteropogon contortus (L.) Roem. & Schult.	Grass	Poaceae
Hibiscus micranthus L.f.	Forb	Malvaceae
Hibiscus species	Forb	Malvaceae
Indigofera species	Forb	Fabaceae
Kalanchoe rotundifolia (Haw.) Haw.	Succulent	Crassulaceae
Kyllinga alba Nees	Sedge	Cyperaceae
Kyphocarpa angustifolia (Moq.) Lopr.	Forb	Amaranthaceae
Lantana rugosa Thunb.	Forb	Verbenaceae
Ledebouria revoluta (L.f.) Jessop	Geophyte	Liliaceae
Lycium cinereum	Tree	Solanaceae
Malva species	Forb	Malvaceae
Maytenus tenuispina (Sond.) Marais	Tree	Celastraceae
Melhania forbesii Planch. ex Mast.	Forb	Malvaceae
Melhania species	Forb	Malvaceae
Merremia palmata Hallier f.	Forb	Convolvulaceae
Ochna natalitia	Tree	Ochnaceae
Ornithogalum seineri (Engl. & K.Krause) Oberm.	Geophyte	Hyacinthaceae
Ozoroa sphaerocarpa R.& A.Fern.	Tree	Anacardiaceae

| Species Name	Growth Form	Family
Panicum maximum Jacq.	Grass	Poaceae
Paspalum dilatatum Poir.	Grass	Poaceae
Peltophorum africanum Sond.	Tree	Ceasalpiniaceae
Phyllanthus angolensis Müll.Arg.	Forb	Euphorbiaceae
Phyllanthus reticulatus Poir.	Tree	Euphorbiaceae
Pogonarthria squarrosa (Roem. & Schult.) Pilg.	Grass	Poaceae
Pollichia campestris Aiton	Forb	Illebracaceae
Portulaca kermesina N.E.Br.	Succulent	Portulacaceae
Raphionachme species	Forb	Peripoplacaceae
Rhigozum brevispinosum	Tree	Bignoniaceae
Rhus dentata Thunb.	Tree	Anacardiaceae
Rhynchosia minima	Forb	Fabaceae
Rhynchosia species	Forb	Fabaceae
Sansevieria hyacinthoides (L.) Druce	Forb	Liliaceae
Sarcostemma viminale (L.) R.Br.	Climber	Asclepidaceae
Schmidtia pappophoroides Steud.	Grass	Poaceae
Sclerocarya birrea	Tree	Anacardiaceae
Sida dregei Burtt Davy	Forb	Malvaceae
Solanum incanum L.	Forb	Solanaceae
Solanum panduriforme E.Mey.	Forb	Solanaceae
Solanum species	Forb	Solanaceae
Spirostachys africana Sond.	Tree	Euphorbiaceae
Sporobolus species	Grass	Poaceae
Sterculia rogersii N.E.Br.	Tree	Sterculiaceae
Stipagrostis uniplumis	Grass	Poacaea
Strychnos madagascariensis Poir.	Tree	Loganiaceae
Talinum caffrum (Thunb.) Eckl. & Zeyh.	Forb	Portulacaceae
Terminalia sericea Burch. ex DC.	Tree	Combretaceae
Trachyandra asperata	Geophyte	Liliaceae
Tribulus terrestris L.	Forb	Zygophyllaceae
Trochomeria macrocarpha	Geophyte	Cucurbitaceae
Urochloa mosambicensis (Hack.) Dandy	Grass	Poaceae
Waltheria indica L.	Forb	Sterculiaceae
Ximenia caffra	Tree	Olacaceae
Ziziphus mucronata	Tree	Rhamnaceae
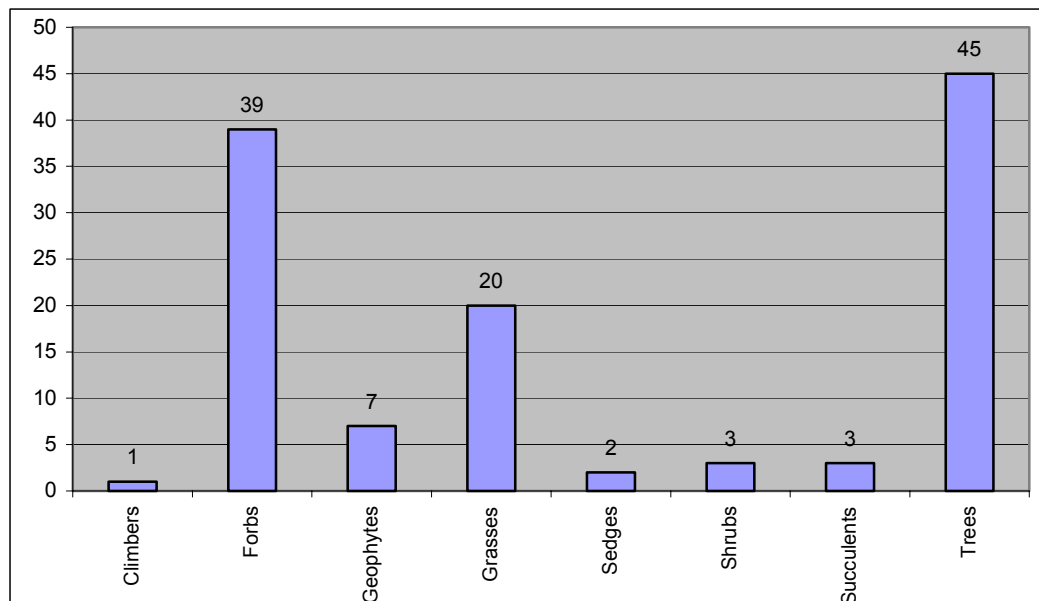
Figure 9.3: Growth forms of the study area.

7.5.2. Vegetation Communities

The uniformity of the vegetation is a characteristic feature and the only significant variation that is noted from aerial photographs is human influences. The uniformity in terms of topography, soils and regional vegetation is displayed in the similarity of natural woodlands. Variation in the geology is not transferred to the vegetation as human influences played a more dominant role as a driving force behind recent vegetation development.

Smaller variations do exist within the vegetation, but occur as mosaical patterns within the natural woodland, a characteristic of the regional vegetation (Mixed Bushveld). Although recognisable by means of species composition (woody component), these units are not recognisable from aerial photography and it is therefore not possible to map these variations. It is therefore described as a single vegetation community with smaller variations.

Vegetation units that were identified during the investigation include the following (see photos 1 – 6 in Appendix O):

- Primary woodland;
- Secondary woodland; and
- Non-perennial stream.

(PLEASE NOTE: Descriptions of the vegetation that will be affected by - (1) the alignments of the conveyor alternatives (east and west); (2) the alignment of the Steenbokpan road (north and south); and (3) the location of the construction

camp on the farm Eenzaamheid - are included in the following descriptions. Any variations of note that do exist within these alignments or locations will be indicated and discussed separately.)

- *Primary woodland*

  This vegetation unit constitutes natural woodland that is representative of the regional vegetation. A dominant woody layer is characteristic, consisting of two variations, namely a broadleaf variation and an *Acacia* savanna. These variations form mosaical patterns across the area that is not discernable from aerial photographs.

  The broadleaf variation prevails on deeper, sandy soils that are poor in nutrients as a result of leaching; resulting in sour veld conditions that are characterized by the profusion of tree species such as *Combretum zeyheri, C. hereroense, Commiphora africana, C mollis, Terminalia sericea* and *Boscia albitrunca*.

  On shallower soils with slightly higher clay content, *Acacia* species predominate, including *A. tortillus, A. erubescens, A. mellifera,* together with *Dichrostachys cinerea* and several *Grewia* species. As a result of the slightly higher clay content, leaching of soil nutrients is not as severe as in sandy areas and the resulting vegetation is sweeter. Typically this vegetation is preferred by cattle and game, accounting for the effects of intensive grazing noted in some areas.

  Woody species that are typically prominent throughout the entire area include *Acacia nigrescens, Combretum apiculatum, Commiphora pyracanthoides, Grewia* species and *Sclerocarya birrea* and *Combretum imberbe* to a lesser degree.

  The herbaceous layer is relative poor in species, providing evidence of the over grazed state of the vegetation. Forb species that may dominate in some areas include *Gossyphium herbaceum, Heliotropium steudnerii, Chaetacanthus costatus, Crotalaria spartioides, Cucumis zeyheri, Hibiscus micranthus, Merremia palmata, Ornithogalum seineri, Indigofera* species, *Rhynchosia* species, *Sida dregei* and *Talinum cafrum.*

  The grass sward is dominated by a few species, including *Urochloa mosambicensis* (particularly dominant), *Cenchrus ciliaris, Digitaria eriantha, Enneapogon scoparius, Eragrostis lehmanniana, Panicum maximum, Pogonarthria squarossa, Schmidtia pappophoroides* and *Stipagrostis uniplumis.*

The over utilised status of the herbaceous layer is indicated by the uniformity of the lower stratum (in terms of species composition) across the two major variations, which would normally vary significantly in terms of the species composition and dominance. The dominance of the geophyte *Ornithogalum seineri* (a geophyte that characterises the overgrazed areas in the Limpopo Province) (Fabian) and the grass *Urochloa mossambicensis*, which is classified as an Increaser IIc (a species that increase under heavy utilisation) (Van Oudtshoorn, 1991) provide ample evidence of the degraded status of the herbaveous layer.

A slight difference is noted between the Naauwontkomen and Eenzaamheid farms. Woodlands on Naauwontkomen are denser as a result of the absence of fire, while density of the woody layer on Eenzaamheid was controlled to a degree by high grazing pressure. Also, due to lower grazing intensities on the Naauwontkomen farm, the herbaceous layer may be moribund in some places.

The floristic status of this vegetation is considered medium as a result of the over utilised state of the herbaceous layer and encroached state of the woody layer in some places.

Please note that, although not indicated on the vegetation map as such, the western conveyor alternative that will occupy natural woodland to the north of the farm Naauwontkomen, constitute woodland that conforms to this vegetation community in species composition and status.

- *Secondary woodland*

This community represent woodland that has been subjected to severe disturbances in the recent past, resulting in a vegetation type that is dissimilar to the natural woodland of the general region. Changes to the species composition and physiognomy are particularly evident in the woody structure. The species diversity of these areas is particularly low. Two separate units are recognised.

Unit 1 – Located in the northwestern section of the farm Naauwontkomen, this unit is characterised by woodland that has been subjected to severe manipulation, to the extent that the entire woody layer has been altered in physiognomy and species composition. On the 1981 aerial image this area is entirely without trees and it is assumed that the area was cleared for agricultural purposes. Subsequent to the clearing, pioneer species has populated the area, including *Dichrostachys cinerea* (Sickle bush) and *Acacia* species. *Dichrostahys* has since become dominant in this area, but has recently been cleared selectively. An open savanna is the result of these

efforts, characterised by a fairly equal dominance of *Acacia* and *Dichrostachys*.

The herbaceous layer has, similar to the woody layer, gone through successional stages to represent a semi-climax state. Grasses dominate the physiognomy, but many forb species are present. Grass species that are dominant include *Schmidtia pappophoroides, Urochloa mossambicense, Eragrostis lehmanniana* and *Enneapogon scoparius*. Forb species that are prominent include *Sida dregei, Solanum panduriforme, Tribulus terrestris, Kyphocarpha angustifolia, Indigofera* species and *Pollichia campestris.*

The dissimilarity of the forb composition, particularly the absence of many geophyte species provides evidence of the historic surface disturbances.

Unit 2 – Located in the central southern part of the farm Naauwontkomen, this unit represent an old borrow pit area. It is clearly visible on the 1981 aerial photos and it is assumed that the gravely soil that occur in the area was utilised for road construction purposes. In some instances it is evident that large trees were avoided during the excavation process, but shrubs and the lower stratums were completely decimated. The seral stage of the vegetation that characterises the area is thus representative of the regional vegetation in terms of the woody layer. The shrub and herbaceous layer in these areas are low in density and poor in species diversity, characteristic of areas where topsoil has been removed. Vegetation in other areas was completely destroyed, similar to areas where agricultural practices took place. The woody layer in these particular areas has recovered to a fairly natural state, but the herbaceous layer is indicative of the degraded status with bare areas.

The floristic status of this community is considered low as a result of the secondary vegetation that characterises this community. It should be noted that protected tree species do occur in this community. In particular a Baobab tree (*Adansonia digitata*) is present south of the Steebokpan road. Mitigation measures for this individual will be presented.

Due to the secondary nature of the vegetation, the floristic status of this community is considered low.

- *Non-perennial stream*
  This community is not particularly well defined and is barely noticeable on available aerial photographs. However, physiognomic differences as well as slight variations in the species composition can be noted in the area. Large trees, particularly *Spirostachys africana*, are well represented in this community. The remainder of the species composition is remarkably similar to surrounding woodland, providing an indication of the fact that this non-

perennial stream contains a higher incidence of water only in events of exceptionally high rainfall.

Environmental attributes do not indicate any variation in driving forces behind vegetation development, but the presence of a high incidence of *Spirostachys africana* is considered a characteristic feature of this community. Similar species composition, particularly the presence of *Spirostachys africana* has been noted in other areas where seasonal pans and depressions are featured. The association of this species with moist soil conditions is marginal, indicated by the similarity of the species composition of surrounding woodland to these areas.

The Steenbokpan road crosses this community and as a result of the raised construction, has created a local topography that causes water to accumulate during the raining season. This semi-permanent stand of water results in a unique composition of faunal species that occupies this area. The surrounding vegetation creates atypical habitat that is considered suitable for a diverse faunal species composition.
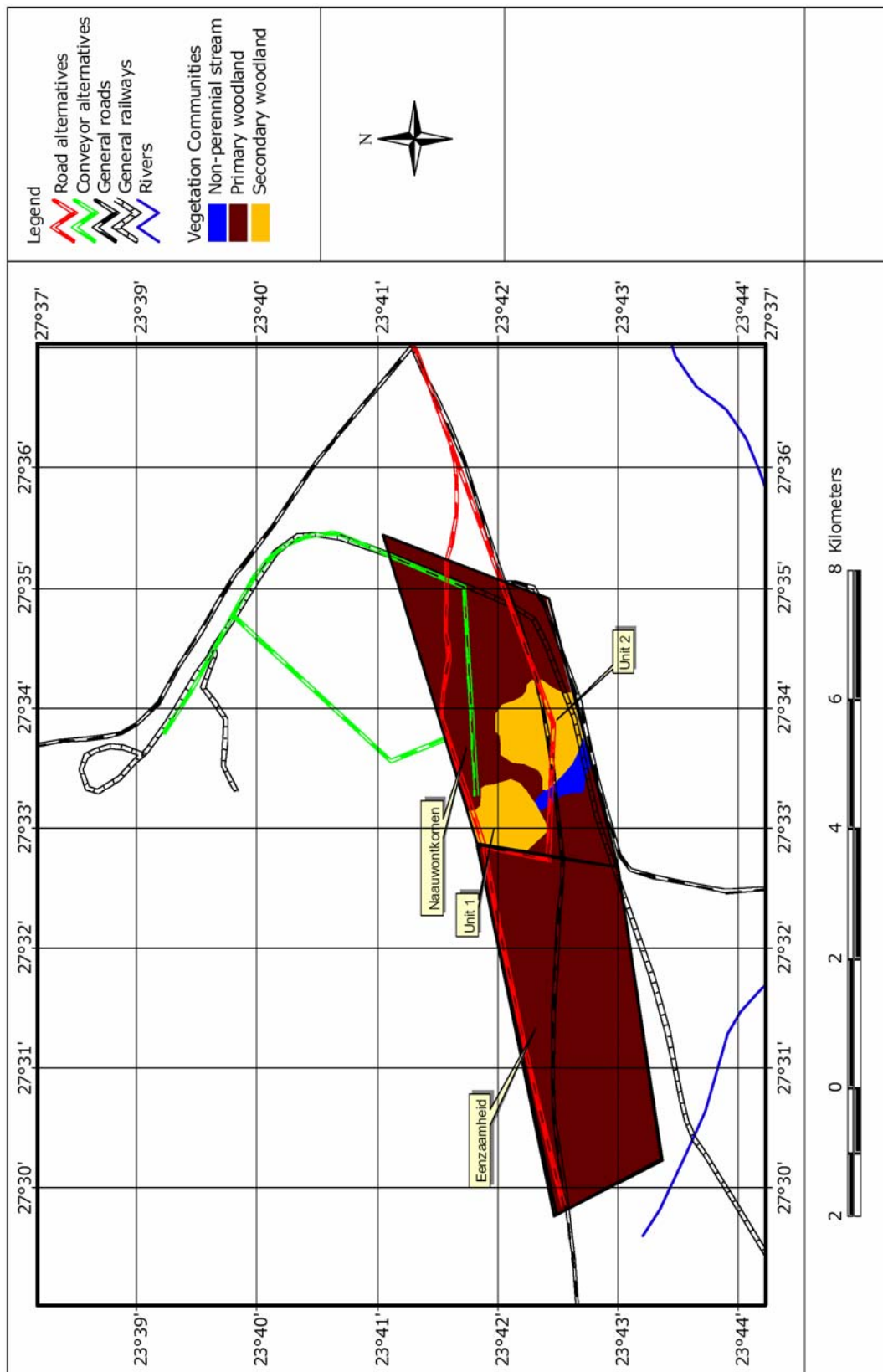
Figure 9.4: Vegetation communities of the study area

7.5.3. Red Data Flora Species

Four red data flora species were listed within the relevant quarter degree square. None of these species were observed in the study area during the site investigation. The level of confidence attributed to results of this part of the investigation is considered medium-high. Furthermore, habitat conditions are such that the likelihood of encountering red data flora species in the study area is considered medium-low.

7.5.4. Protected Tree Species

Comparing results of the preliminary investigation and general information with the List of Protected Trees, the presence of the four (4) protected tree species within the proposed farms was confirmed (see Table 9.3).

Table 9.3: Protected tree species confirmed within the study area

Botanical Name	Family	English Name	Afrikaans name
Acacia erioloba	Mimosaceae	Camel thorn	Kameeldoring
Adansonia digitata	Bombacaceae	Baobab	Kremetart
Boscia albitrunca	Capparaceae	Shepherd's tree	Witgat
Combretum imberbe	Combretaceae	Leadwood	Hardekool

These species, although not protected should not have a bearing on the outcome of the application, but should receive consideration during the process. In particular, *Adansonia digitata* (Photo 5 in Appendix O) was observed in the study area only once and is estimated to occur in the general region at extremely low percentages. The removal and relocation of this individual, which is of a size that would allow successful translocation, is recommended Several individuals were successfully translocated to the entrance of Matimba Power Station, providing evidence of the success rate of such an operation.

Other protected tree species occur widespread at relative high densities throughout the study area as well as surrounding areas. The proposed development is not expected to affect the status of these species in the regional setting while the relocation of the proposed development is not perceived as a viable alternative.

7.6.   Fauna Of The Study Area

7.6.1. Faunal Diversity

- *Naauwontkomen*

    A total of seventy-one animals were observed within the boundaries of Naauwontkomen (Table 9.4), including:
    * 12 invertebrates;
    * 5 reptiles
    * 7 frogs
    * 40 birds; and
    * 7 mammals.

- *Eenzaamheid*

    A total of sixty-four animals were observed within the boundaries of Eenzaamheid (Table 9.5), including:
    * 9 invertebrates;
    * 3 reptiles;
    * 4 frogs
    * 42 birds; and
    * 6 mammals.

- *Conveyor belt section*

    Forty-four animals were observed within the areas proposed for the conveyer belt (Table 9.6), including:
    * 5 invertebrates;
    * 29 birds; and
    * 10 mammals.

- *Road re-alignment*

    Since both the options for the road re-alignment traverses the farms, no specific surveys were conducted in these options and the results obtained from the investigations on the respective farms is considered adequate detail to consider the proposed alternatives.

- *Construction camp*

    The species composition of the farm Eenzaamheid, on which this feature could potentially be located, is considered representative.

Table 9.4: Fauna species observed on the farm Naauwontkomen

Phylum	Class	Order	Family	Genus – species	Common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae	*Pedinorrhina plana*	Yellow-belted Fruit Chafer
				Plaesiorrhinella trivittata	Fruit Chafer
				Phoxomeloides laticincta	Fruit Chafer
				Rhabdotis albinigra	Scarce Limpopo Fruit Chafer
				Dischista cincta	Common Savanna Fruit Chafer
				Leucocelis vitticollis	Fruit Chafer
				Leucocelis amethystina	Amethyst Fruit Chafer
			Buprestidae	*Agelia peteli*	Meloid-mimicking Jewel Beetle
			Meloidae	*Decapotoma transvaalica*	Transvaal Blister Beetle
			Curculionidae	*Polyclaeis equestris*	Pink-banded Weevil
		Lepidoptera	Nymphalidae	*Danaus chrysippus*	African Monarch
		Hymenoptera	Formicidae	*Megaponera foetens*	Matabele Ant
Vertebrata	Reptilia	Testudines	Testudinidae	*Geochelone pardalis*	Leopard Tortoise
			Pelomedusidae	*Pelomedusa subrufa*	Marsh Terrapin
		Squamata	Elapidae	*Naja mossambica*	M'fezi
			Psammophidae	*Psammophis subtaeniatus*	Stripe-bellied Sand Snake
			Lacertidae	*Nucras intertexta*	Spotted Sandveld Lizard
	Amphibia	Anura	Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina
			Michrohylidae	*Phrynomantis bifasciatus*	Banded Rubber Frog
			Petropedetidae	*Cacosternum boettgeri*	Boettger's Caco
			Pipidae	*Xenopus laevis*	Common Platanna
			Ranidae	*Ptychadena mossambica*	Broad-banded Grass Frog
				Ptychadena porosissima	Striped Grass Frog
			Rhacophoridae	*Chiromantis xerampelina*	Southern Foam Nest Frog
	Aves	Galliformes	Phasianidae	*Pternistis natalensis*	Natal Francolin
			Numididae	*Numida meleagris*	Helmeted Guineafowl
		Anseriformes	Anatidae	*Alopochen aegyptiacus*	Egyptian Goose
		Piciformes	Picidae	*Dendropicos namaquus*	Bearded Woodpecker
		Bucerotiformes	Bucerotidae	*Tockus nasutus*	African Grey Hornbill
				Tockus leucomelas	Southern Yellow-billed Hornbill
		Coraciiformes	Meropidae	*Merops pusillus*	Little Bee-eater
		Coliiformes	Coliidae	*Urocolius indicus*	Red-faced Mousebird
		Cuculiformes	Cuculidae	*Cuculus clamosus*	Black Cuckoo
				Clamator jacobinus	Jacobin Cuckoo
				Chrysococcyx klaas	Klaas's Cuckoo

		Apodiformes	Apodidae	*Apus affinis*	Little Swift
		Musophagiformes	Musophagidae	*Corythaixoides concolor*	Grey Go-away-bird
		Columbiformes	Columbidae	*Streptopelia capicola*	Cape Turtle-Dove
				Streptopelia senegalensis	Laughing Dove
				Streptopelia semitorquata	Red-eyed Dove
				Oena capensis	Namaqua Dove
		Gruiformes	Otididae	*Eupodotis ruficrista*	Red-crested Korhaan
		Charadriiformes	Scolocapidae	*Actitis hypoleucos*	Common Sandpiper
			Charadriidae	*Vanellus coronatus*	Crowned Lapwing
				Vanellus armatus	Blacksmith Lapwing
		Passeriformes	Oriolidae	*Oriolus larvatus*	Black-headed Oriole
			Monarchidae	*Terpsiphone viridis*	African Paradise-Flycatcher
			Malaconotidae	*Batis molitor*	Chinspot Batis
			Laniidae	*Lanius collurio*	Red-backed Shrike
				Nilaus afer	Brubru
				Dryoscopus cubla	Black-backed Puffback
			Hirundinidae	*Hirundo rustica*	Barn Swallow
				Hirundo semirufa	Red-breasted Swallow
				Hirundo cucullata	Greater Striped Swallow
				Hirundo abyssinica	Lesser Striped Swallow
			Sylviidae	*Sylvietta rufescens*	Long-billed Crombec
				Phylloscopus trochilus	Willow Warbler
			Cisticolidae	*Cisticola chinianus*	Rattling Cisticola
				Calamonastes fasciolatus	Barred Wren-Warbler
				Camaroptera brevicaudata	Grey-backed Camaroptera
			Ploceidae	*Bubalornis niger*	Red-billed Buffalo-Weaver
				Ploceus cucullatus	Village Weaver
				Ploceus velatus	Southern Masked-Weaver
			Estrildidae	*Uraeginthus angolensis*	Blue Waxbill
	Mammalia	Primates	Cercopithecidae	*Papio ursinus*	Chacma Baboon
		Rodentia	**Muridae**	***Tatera leucogaster***	**Bushveld Gerbil**
		Carnivora	Canidae	*Canis mesomelas*	Black-backed Jackal
		Tubulidentata	Orycteropidae	*Orycteropus afer*	Aardvark
		Artiodactyla	Bovidae	*Tragelaphus strepsiceros*	Kudu
				Damaliscus dorcas phillipsi	Blesbok
				Aepyceros melampus	Impala

Table 9.5: Fauna species observed on the farm Eenzaamheid

Phylum	Class	Order	Family	Genus - species	Common name
Arthropoda	Insecta	Coleoptera	Carabidae	*Graphipterus limbatus*	Velvet Ground Beetle
			Scarabaeidae	*Dischista cincta*	Common Savanna Fruit Chafer
				Mausoleopis amabilis	White-spotted Fruit Chafer
				Leucocelis vitticollis	Fruit Chafer
				Leucocelis amethystina	Amethyst Fruit Chafer
			Meloidae	*Mylabris oculata*	CMR Beetle
		Lepidoptera	Nymphalidae	*Danaus chrysippus*	African Monarch
			Pieridae	*Belenois aurota*	Brown-veined White
		Hymenoptera	Formicidae	*Megaponera foetens*	Matabele Ant
Vertebrata	Reptilia	Squamata	Varanidae	*Varanus albigularis*	Rock Monitor
			Agamidae	*Acanthocercus atricollis*	Southern Tree Agama
			Lacertidae	*Nucras intertexta*	Spotted Sandveld Lizard
	Amphibia	Anura	Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina
			Michrohylidae	*Phrynomantis bifasciatus*	Banded Rubber Frog
			Ranidae	*Tomopterna krugerensis*	Knocking Sand Frog
			Rhacophoridae	*Chiromantis xerampelina*	Southern Foam Nest Frog
	Aves	Galliformes	Phasianidae	*Dendroperdix sephaena*	Crested Francolin
				Pternistis natalensis	Natal Francolin
			Numididae	*Numida meleagris*	Helmeted Guineafowl
		Anseriformes	Anatidae	*Sarkidiornis melanotos*	Comb Duck
		Piciformes	Picidae	*Campethera abingoni*	Golden-tailed Woodpecker
			Lybiidae	*Trachyphonus vaillantii*	Crested Barbet
		Bucerotiformes	Bucerotidae	*Tockus nasutus*	African Grey Hornbill
				Tockus erythrorhynchus	Red-billed Hornbill
		Upupiformes	Upupidae	*Upupa africana*	African Hoopoe
			Phoeniculidae	*Phoeniculus purpureus*	Green Wood-Hoopoe
			Rhinopomastidae	*Rhinopomastus cyanomelas*	Common Scimitarbill
		Coraciiformes	Coraciidae	*Coracias naevia*	Purple Roller
			Dacelonidae	*Halcyon albiventris*	Brown-hooded Kingfisher

		Cuculiformes	Cuculidae	*Cuculus clamosus*	Black Cuckoo
				Chrysococcyx caprius	Diderick Cuckoo
		Apodiformes	Apodidae	*Apus apus*	Common Swift
				Apus affinis	Little Swift
		Musophagiformes	Musophagidae	*Corythaixoides concolor*	Grey Go-away-bird
		Strigiformes	Strigidae	*Glaucidium perlatum*	Pearl-spotted Owlet
		Columbiformes	Columbidae	*Streptopelia capicola*	Cape Turtle-Dove
				Streptopelia senegalensis	Laughing Dove
				Oena capensis	Namaqua Dove
				Turtur chalcospilos	Emerald-spotted Wood-Dove
		Gruiformes	Otididae	*Eupodotis ruficrista*	Red-crested Korhaan
		Passeriformes	Dicruridae	*Dicrurus adsimilis*	Fork-tailed Drongo
			Malaconotidae	*Malaconotus blanchoti*	Grey-headed Bush-Shrike
				Batis molitor	Chinspot Batis
			Laniidae	*Lanius collurio*	Red-backed Shrike
				Corvinella melanoleuca	Magpie Shrike
				Laniarius atrococcineus	Crimson-breasted Shrike
			Paridae	*Parus niger*	Southern Black Tit
			Sylviidae	*Sylvietta rufescens*	Long-billed Crombec
				Turdoides bicolor	Southern Pied Babbler
			Cisticolidae	*Cisticola chinianus*	Rattling Cisticola
				Calamonastes fasciolatus	Barred Wren-Warbler
			Sturnidae	*Lamprotornis australis*	Burchell's Starling
			Nectariniidae	*Cinnyris talatala*	White-bellied Sunbird
			Ploceidae	*Bubalornis niger*	Red-billed Buffalo-Weaver
				Ploceus cucullatus	Village Weaver
			Estrildidae	*Uraeginthus angolensis*	Blue Waxbill
			Viduidae	*Vidua regia*	Shaft-tailed Whydah
			Passeridae	*Passer melanurus*	Cape Sparrow
	Mammalia	Primates	Cercopithecidae	*Cercopithecus aethiops*	Vervet Monkey
		Rodentia	Sciuridae	*Paraxerus cepapi*	Tree Squirrel

		Artiodactyla	Hystricidae	*Hystrix africaeaustralis*	Porcupine
			Suidae	*Phacochoerus africanus*	Warthog
			Bovidae	*Aepyceros melampus*	Impala
				Raphicerus campestris	Steenbok

Table 9.6: Fauna species observed on the conveyor belt section

Phylum	Class	Order	Family	Genus - species	Common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae	*Polystalactica furfurosa*	Fruit Chafer
				Leucocelis vitticollis	Fruit Chafer
				Leucocelis amethystina	Amethyst Fruit Chafer
		Lepidoptera	Nymphalidae	*Danaus chrysippus*	African Monarch
				Vanessa cardui	Painted Lady
Vertebrata	Aves	Galliformes	Phasianidae	*Dendroperdix sephaena*	Crested Francolin
				Pternistis natalensis	Natal Francolin
				Pternistis swainsonii	Swainson's Spurfowl
			Numididae	*Numida meleagris*	Helmeted Guineafowl
		Bucerotiformes	Bucerotidae	*Tockus nasutus*	African Grey Hornbill
				Tockus leucomelas	Southern Yellow-billed Hornbill
		Coraciiformes	Meropidae	*Merops persicus*	Blue-cheeked Bee-eater
		Cuculiformes	Cuculidae	*Chrysococcyx caprius*	Diderick Cuckoo
		Apodiformes	Apodidae	*Apus apus*	Common Swift
				Apus affinis	Little Swift
		Musophagiformes	Musophagidae	*Corythaixoides concolor*	Grey Go-away-bird
		Columbiformes	Columbidae	*Streptopelia semitorquata*	Red-eyed Dove
				Oena capensis	Namaqua Dove
		Gruiformes	Otididae	*Eupodotis ruficrista*	Red-crested Korhaan
		Charadriiformes	Charadriidae	*Vanellus coronatus*	Crowned Lapwing
				Vanellus armatus	Blacksmith Lapwing
		Falconiformes	Accipitripidae	*Buteo rufofuscus*	Jackal Buzzard
		Ciconiiformes	Ardeidae	*Nycticorax nycticorax*	Black-crowned Night-Heron
		Passeriformes	Dicruridae	*Dicrurus adsimilis*	Fork-tailed Drongo

			Malaconotidae	*Tchagra senegala*	Black-crowned Tchagra
			Laniidae	*Nilaus afer*	Brubru
				Dryoscopus cubla	Black-backed Puffback
			Paridae	*Parus niger*	Southern Black Tit
			Hirundinidae	*Hirundo rustica*	Barn Swallow
				Hirundo cucullata	Greater Striped Swallow
			Sylviidae	*Sylvietta rufescens*	Long-billed Crombec
			Cisticolidae	*Cisticola chinianus*	Rattling Cisticola
				Camaroptera brevicaudata	Grey-backed Camaroptera
			Estrildidae	*Uraeginthus angolensis*	Blue Waxbill
	Mammalia	Rodentia	Hystricidae	*Hystrix africaeaustralis*	Porcupine
		Perrissodactyla	Rhinocerotidae	*Ceratotherium simum*	White Rhinoceros
		Artiodactyla	Suidae	*Phacochoerus africanus*	Warthog
			Bovidae	*Taurotragus oryx*	Eland
				Tragelaphus strepsiceros	Kudu
				Tragelaphus scriptus	Bushbuck
				Hippotragus niger	**Sable Antelope**
				Alcelaphus buselaphus	Red Hartebeest
				Damaliscus lunatus	**Tsessebe**
				Aepyceros melampus	Impala

7.6.2. Faunal Status

- *Naauwontkomen*
  The faunal diversity of this farm is considered representative of the region. The natural woodland habitat is uniform and adequately represented in the region. Dominant woody layers and degraded lower stratums provide extremely low diversity in habitat. Although the degraded habitat might provide some variation in terms of available habitat, the species composition that characterises these areas is considered less diverse as a result of the manipulated nature. Natural woodland and the seasonal moist conditions that are created in the central part of the farm is considered the only slight variation that would be occupied by a faunal species composition that is different to the rest of the farm. The species composition of this habitat type is likely to be similar to that of other, similar habitat in the general surrounds.

  The migration to other regions that might satisfy the immediate or long-term habitat-, breeding- or territorial requirements is a direct result of the mobility of fauna. This, inevitably, results in a variation in the species that occupy an area at any given period and might vary on a daily, seasonal or longer period.

- *Eenzaamheid*
  The uniformity of the habitat on this property, as well as the similarity to available habitat in the region, will result in a species composition that is similar to surrounding areas and, on a smaller scale, across the entire property. Extremely little variation is noted and long-term monitoring results are expected to reveal a species compostion across the farm that does not vary significantly. Significant movement of fauna species between this and adjacent properties is expected with varying conditions (seasonal). Likely, impacts resulting from the proposed mining activity are expected to result in animal species migrating from this property to nearby areas that is suited to their breeding-, general habitat- or territorial requirements.

- *Conveyor belt section*
  Natural habitat that will be affected by the proposed alternative to the north of the farm Naauwonkomen is considered similar in faunal attributes to the relevant farm.

- *Road re-alignment*
  Results obtained from the relevant farms are considered adequate in highlighting the faunal status of the areas that this structure will cross.

- *Construction camp*
  Results obtained from assessment are considered adequate in highlighting the faunal status of the area on Eenzaamheid that this structure will occupy.

7.6.3. Red Data Fauna Species

- *General*
  - ∗ no Red Data invertebrates are listed for the study area;
  - ∗ the Giant Bullfrog is the only Red Data amphibian listed for the study area;
  - ∗ no Red Data reptiles are listed for the study area;
  - ∗ twenty-nine Red Data birds are listed as potential inhabitants of the study area; and
  - ∗ thirty Red Data mammal species are listed for the study area.

- *Survey Results*

  The Bushveld Gerbil, *Tatera leucogaster*, was trapped on Naauwontkomen and is listed as Data Deficient. The general habitat description for this species is sandy soils in a variety of habitat types.

  No red data fauna species were observed on Eenzaamheid.

  Two Red Data mammals were observed in the area proposed for the conveyer belt. The Sable Antelope (*Hippotragus niger*) and the Tsessebe (*Damaliscus lunatus*) were observed. However, these species are introduced and managed in a breeding programme and are therefore not considered free-roaming species within the study area.

Red Data Probabilities & RDSIS - Naauwontkomen

Table 9.7: RD Probabilities for Naauwontkomen

Biological Name	English Name	RD	DISTR	HAB	FOOD	TOT	PROB
Mycteria ibis	Yellow-billed Stork	NT	40	1	1	14.00	L
Vanellus albiceps	White-crowned Lapwing	NT	40	1	5	15.33	L
Bucorvus leadbeateri	Southern Ground-Hornbill	VU	40	5	5	16.67	L
Falco naumanni	Lesser Kestrel	VU	45	1	5	17.00	L
Circus macrourus	Pallid Harrier	NT	45	5	5	18.33	L
Falco peregrinus	Peregrine Falcon	NT	45	5	5	18.33	L
Dasymys incomtus	Water Rat	NT	40	5	10	18.33	L
Glareola nordmanni	Black-winged Pratincole	NT	50	1	5	18.67	L
Ephippiorhynchus senegalensis	Saddle-billed Stork	EN	55	1	1	19.00	L
Phoenicopterus ruber	Greater Flamingo	NT	55	1	1	19.00	L
Damaliscus lunatus lunatus	Tsessebe	EN	50	5	5	20.00	L
Alcedo semitorquata	Half-collared Kingfisher	NT	55	1	5	20.33	L
Ardeotis kori	Kori Bustard	VU	55	1	5	20.33	L
Podica senegalensis	African Finfoot	VU	55	1	5	20.33	L
Gorsachius leuconotus	White-backed Night-Heron	VU	60	1	1	20.67	L
Phoenicopterus minor	Lesser Flamingo	NT	60	1	1	20.67	L
Hippotragus equinus	Roan Antelope	VU	55	5	5	21.67	L
Hippotragus niger niger	Sable Antelope	VU	55	5	5	21.67	L
Pelecanus rufescens	Pink-backed Pelican	VU	65	1	1	22.33	L
Leptoptilos crumeniferus	Marabou Stork	NT	60	5	5	23.33	L
Trigonoceps occipitalis	White-headed Vulture	VU	35	15	20	23.33	L
Rostratula benghalensis	Greater Painted-snipe	NT	65	1	5	23.67	L
Ciconia nigra	Black Stork	NT	70	1	1	24.00	L
Aquila rapax	Tawny Eagle	VU	45	20	15	26.67	LM
Cloeotis percivali	Short-eared Trident Bat	CR	40	5	35	26.67	LM
Rhinolophus blasii	Peak-saddle Horseshoe Bat	VU	40	5	35	26.67	LM
Falco biarmicus	Lanner Falcon	NT	65	15	5	28.33	LM
Gyps africanus	White-backed Vulture	VU	65	5	15	28.33	LM
Gyps coprotheres	Cape Vulture	VU	70	5	10	28.33	LM
Acinonyx jubatus	Cheetah	VU	65	5	15	28.33	LM
Myotis tricolor	Temminck's Hairy Bat	NT	45	5	35	28.33	LM
Rhinolophus hildebrantii	Hildebrant's Horseshoe Bat	NT	45	5	35	28.33	LM
Hieraaetus ayresii	Ayres's Hawk-Eagle	NT	40	35	15	30.00	LM
Torgos tracheliotus	Lappet-faced Vulture	VU	75	5	10	30.00	LM
Crocuta crocuta	Spotted Hyaena	NT	60	15	15	30.00	LM
Lemniscomys rosalia	Single-striped Mouse	DD	70	5	15	30.00	LM
Leptailurus serval	Serval	NT	70	5	15	30.00	LM
Lycaon pictus	African Wild Dog	EN	60	15	15	30.00	LM
Panthera leo	Lion	VU	60	15	15	30.00	LM
Terathopius ecaudatus	Bateleur	VU	50	30	15	31.67	LM
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	NT	55	5	35	31.67	LM
Rhinolophus darlingi	Darling's Horseshoe Bat	NT	55	5	35	31.67	LM
Miniopterus schreibersii	Schreiber's Long-fingered Bat	NT	60	5	35	33.33	LM

Buphagus erythrorhynchus	Red-billed Oxpecker	NT	60	15	30	35.00	LM
Diceros bicornis minor	Black Rhinoceros	VU	55	15	35	35.00	LM
Xenocalamus transvaalensis	Transvaal Quillsnout Snake	DD	35	40	40	38.33	LM
Sagittarius serpentarius	Secretarybird	NT	80	10	25	38.33	LM
Graphiurus platyops	Rock Dormouse	DD	50	15	50	38.33	LM
Mellivora capensis	Honey Badger	NT	75	20	20	38.33	LM
Manis temminckii	Pangolin	VU	60	30	30	40.00	LM
Poecilogale albinucha	African Weasel	DD	75	20	25	40.00	LM
Polemaetus bellicosus	Martial Eagle	VU	75	35	15	41.67	LM
Elephantulus brachyrhynchus	Short-snouted Elephant-shrew	DD	70	35	20	41.67	LM
Hyaena brunnea	Brown Hyaena	NT	75	35	25	45.00	LM
Elephantulus intufi	Bushveld Elephant-shrew	DD	70	45	25	46.67	LM
Pyxicephalus adspersus	Giant Bullfrog	NT	45	50	50	48.33	LM
Pipistrellus rusticus	Rusty Bat	NT	65	50	35	50.00	MH
Tatera leucogaster	Bushveld Gerbil	DD	75	35	45	51.67	MH
Atelerix frontalis	South African Hedgehog	NT	70	55	50	58.33	MH
Crocidura cyanea	Reddish-grey Musk Shrew	DD	75	55	50	60.00	MH
Crocidura hirta	Lesser Red Musk Shrew	DD	75	60	50	61.67	MH

Table 9.8: RDSIS for Naauwontkomen

Biological Name	English Name	STATUS	TOT	F	SP SCORE
Tatera leucogaster	Bushveld Gerbil	DD	51.67	0.2	10.3
Crocidura cyanea	Reddish-grey Musk Shrew	DD	60.00	0.2	12.0
Crocidura hirta	Lesser Red Musk Shrew	DD	61.67	0.2	12.3
Pipistrellus rusticusb	Rusty Bat	NT	50.00	0.7	35.0
Atelerix frontalis	South African Hedgehog	NT	58.33	0.7	40.8
Species Score - Total					110.5
Species Score - Average					22.1
Threatened Taxa - Average					0.0
Average					11.1
% SPP >50%					8.2
RDSIS					**9.6%**

Red Data Probabilities & RDSIS - Eenzaamheid

Table 9.9: RD Probabilities for Eenzaamheid							
Biological Name	**English Name**	**RD**	**DISTR**	**HAB**	**FOOD**	**TOT**	**PROB**
Mycteria ibis	Yellow-billed Stork	NT	40	5	5	16.67	L
Vanellus albiceps	White-crowned Lapwing	NT	40	10	5	18.33	L
Phoenicopterus ruber	Greater Flamingo	NT	55	1	1	19.00	L
Circus macrourus	Pallid Harrier	NT	45	10	5	20.00	L
Falco naumanni	Lesser Kestrel	VU	45	10	5	20.00	L
Falco peregrinus	Peregrine Falcon	NT	45	10	5	20.00	L
Phoenicopterus minor	Lesser Flamingo	NT	60	1	1	20.67	L
Alcedo semitorquata	Half-collared Kingfisher	NT	55	5	5	21.67	L
Ephippiorhynchus senegalensis	Saddle-billed Stork	EN	55	5	5	21.67	L
Glareola nordmanni	Black-winged Pratincole	NT	50	10	5	21.67	L
Podica senegalensis	African Finfoot	VU	55	5	5	21.67	L
Pelecanus rufescens	Pink-backed Pelican	VU	65	1	1	22.33	L
Gorsachius leuconotus	White-backed Night-Heron	VU	60	5	5	23.33	L
Dasymys incomtus	Water Rat	NT	40	15	15	23.33	L
Ciconia nigra	Black Stork	NT	70	5	5	26.67	LM
Rostratula benghalensis	Greater Painted-snipe	NT	65	15	10	30.00	LM
Falco biarmicus	Lanner Falcon	NT	65	10	20	31.67	LM
Gyps coprotheres	Cape Vulture	VU	70	10	15	31.67	LM
Cloeotis percivali	Short-eared Trident Bat	CR	40	15	50	35.00	LM
Rhinolophus blasii	Peak-saddle Horseshoe Bat	VU	40	15	50	35.00	LM
Leptailurus serval	Serval	NT	70	20	20	36.67	LM
Myotis tricolor	Temminck's Hairy Bat	NT	45	15	50	36.67	LM
Rhinolophus hildebrantii	Hildebrant's Horseshoe Bat	NT	45	15	50	36.67	LM
Xenocalamus transvaalensis	Transvaal Quillsnout Snake	DD	35	35	50	40.00	LM
Ardeotis kori	Kori Bustard	VU	55	30	35	40.00	LM
Gyps africanus	White-backed Vulture	VU	65	25	30	40.00	LM
Hieraaetus ayresii	Ayres's Hawk-Eagle	NT	40	40	40	40.00	LM
Leptoptilos crumeniferus	Marabou Stork	NT	60	30	30	40.00	LM
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	NT	55	15	50	40.00	LM
Rhinolophus darlingi	Darling's Horseshoe Bat	NT	55	15	50	40.00	LM
Trigonoceps occipitalis	White-headed Vulture	VU	35	40	50	41.67	LM
Miniopterus schreibersii	Schreiber's Long-fingered Bat	NT	60	15	50	41.67	LM
Bucorvus leadbeateri	Southern Ground-Hornbill	VU	40	40	50	43.33	LM
Terathopius ecaudatus	Bateleur	VU	50	40	40	43.33	LM
Pyxicephalus adspersus	Giant Bullfrog	NT	45	45	45	45.00	LM
Aquila rapax	Tawny Eagle	VU	45	40	50	45.00	LM
Acinonyx jubatus	Cheetah	VU	65	35	40	46.67	LM
Damaliscus lunatus lunatus	Tsessebe	EN	50	45	50	48.33	LM
Hippotragus equinus	Roan Antelope	VU	55	45	45	48.33	LM
Hippotragus niger niger	Sable Antelope	VU	55	45	45	48.33	LM
Buphagus erythrorhynchus	Red-billed Oxpecker	NT	60	40	50	50.00	MH
Graphiurus platyops	Rock Dormouse	DD	50	50	50	50.00	MH
Torgos tracheliotus	Lappet-faced Vulture	VU	75	40	40	51.67	MH
Diceros bicornis minor	Black Rhinoceros	VU	55	50	50	51.67	MH

Lycaon pictus	African Wild Dog	EN	60	45	50	51.67	MH
Panthera leo	Lion	VU	60	45	50	51.67	MH
Crocuta crocuta	Spotted Hyaena	NT	60	50	50	53.33	MH
Manis temminckii	Pangolin	VU	60	50	50	53.33	MH
Polemaetus bellicosus	Martial Eagle	VU	75	45	45	55.00	MH
Sagittarius serpentarius	Secretarybird	NT	80	40	45	55.00	MH
Pipistrellus rusticus	Rusty Bat	NT	65	50	50	55.00	MH
Atelerix frontalis	South African Hedgehog	NT	70	50	50	56.67	MH
Elephantulus intufi	Bushveld Elephant-shrew	DD	70	50	50	56.67	MH
Lemniscomys rosalia	Single-striped Mouse	DD	70	50	50	56.67	MH
Poecilogale albinucha	African Weasel	DD	75	50	50	58.33	MH
Tatera leucogaster	Bushveld Gerbil	DD	75	50	50	58.33	MH
Hyaena brunnea	Brown Hyaena	NT	75	55	50	60.00	MH
Mellivora capensis	Honey Badger	NT	75	55	55	61.67	MH
Crocidura cyanea	Reddish-grey Musk Shrew	DD	75	50	65	63.33	MH
Elephantulus brachyrhynchus	Short-snouted Elephant-shrew	DD	70	55	65	63.33	MH
Crocidura hirta	Lesser Red Musk Shrew	DD	75	70	65	70.00	MH

Table 9.10: RDSIS for Eenzaamheid					
Biological Name	**English Name**	**STATUS**	**TOT**	**F**	**SP SCORE**
Graphiurus platyops	Rock Dormouse	DD	50.00	0.2	10.0
Elephantulus intufi	Bushveld Elephant-shrew	DD	56.67	0.2	11.3
Lemniscomys rosalia	Single-striped Mouse	DD	56.67	0.2	11.3
Poecilogale albinucha	African Weasel	DD	58.33	0.2	11.7
Tatera leucogaster	Bushveld Gerbil	DD	58.33	0.2	11.7
Crocidura cyanea	Reddish-grey Musk Shrew	DD	63.33	0.2	12.7
Elephantulus brachyrhynchus	Short-snouted Elephant-shrew	DD	63.33	0.2	12.7
Crocidura hirta	Lesser Red Musk Shrew	DD	70.00	0.2	14.0
Buphagus erythrorhynchus	Red-billed Oxpecker	NT	50.00	0.7	35.0
Crocuta crocuta	Spotted Hyaena	NT	53.33	0.7	37.3
Sagittarius serpentarius	Secretarybird	NT	55.00	0.7	38.5
Pipistrellus rusticus	Rusty Bat	NT	55.00	0.7	38.5
Atelerix frontalis	South African Hedgehog	NT	56.67	0.7	39.7
Hyaena brunnea	Brown Hyaena	NT	60.00	0.7	42.0
Mellivora capensis	Honey Badger	NT	61.67	0.7	43.2
Torgos tracheliotus	Lappet-faced Vulture	VU	51.67	1.5	77.5
Diceros bicornis minor	Black Rhinoceros	VU	51.67	1.5	77.5
Panthera leo	Lion	VU	51.67	1.5	77.5
Manis temminckii	Pangolin	VU	53.33	1.5	80.0
Polemaetus bellicosus	Martial Eagle	VU	55.00	1.5	82.5
Lycaon pictus	African Wild Dog	EN	51.67	1.7	87.8
Species Score - Average					852.3
Threatened Taxa - Average					40.6
Average					80.5
% SPP >50%					60.5
RDSIS					34.4
Species Score - Average					**47.5%**

- *Discussion*

Aspects that will affect the ecological sensitivity status of the habitat units in a positive manner include the confirmed presence of protected tree species of the medium floristic and faunal status of the study area and adequate connectivity to areas of adjacent natural habitat (low fragmentation factor).

The suitability of Eenzaamheid, in terms of general red data fauna requirements, is considered MEDIUM-LOW due to available habitat being considered moderately suited to the general habitat requirements of red data fauna species that could potentially occupy the area.

It should be noted that this assessment is only an assessment of the suitability of the habitat in terms of the general requirements of red data fauna species. The confirmed presence of a red data fauna species on the Naauwontkomen farm provides evidence that these species might be more adaptable, and even more widespread, than anticipated. The variability in distribution and difficulty in observing / locating these species within a relative short period is also evident from the results obtained from Eenzaamheid, which is considered more suitable (medium-low) for the presence of red data fauna species, although no red data species were observed on this property.

7.7. Sensitive Habitat Types

Unless a vegetation type is considered under severe threat from impacts on a regional or national scale, such as the Rocky Highveld Grassland or Egoli Granite Grassland in the Grassland Biome are threatened by development and large-scale agriculture, the regional vegetation is generally not considered as particularly sensitive. However, even within areas that are not considered particularly sensitive, atypical and localised variations exist that are considered sensitive as the species composition within these areas is atypical to the surrounding vegetation. In addition, the association of these areas with Red Data flora species has been indicated in various scientific reports. Such habitat types include rocky outcrops, riparian areas and any habitat type that is topographically or environmentally distinctly dissimilar to the general surrounds.

The rationale behind sensitivity associated with these areas and the contributing environmental features is a result of micro-habitats that are created, which are not abundantly represented in the general area. Changes in vegetation characteristics over short distances (ecotonal areas), will cause variation in the species composition and vegetation structure, resulting in an increase in the diversity of species (faunal and floral) that occupies an area. These areas thus represent areas of high biodiversity and because of the restricted distribution, any adverse impact on these areas is considered significant.

The topographical similarity of the two farms is noticeable characteristic. No distinct riparian areas are present and the general vegetation conforms largely to the regional vegetation types, albeit relatively degraded. Small, localised pans were observed on the Eenzaamheid property and represent areas of surface water. These pans, presumably, were created by large game during periods when they still roamed the area freely. Associated vegetation indicates the well-established status of these features. The floristic status of these features however conforms to the surrounding vegetation, mostly as a result of the extremely small size and does not represent areas of particular sensitivity.

Sensitive habitats are considered as important topographical and ecological features on the basis of the following criteria:

(A) association with riverine or wetland regimes

(B) prime examples of natural vegetation types, particularly those that are under pressure from urbanization, agriculture or development

(C) habitat associated with red data plant or animal species

(D) topographical features and habitat that occur naturally, but infrequently, in a given area

(E) habitat or areas that are considered biodiversity or conservation 'hotspots'

(F) areas classified as hills or ridges

Table 9.11: Landscape sensitivity aspects	
Ecological Unit	Attribute
Primary woodland	**None**
Secondary woodland	**None**
Non-perennial stream	**None**

7.8. Ecological Impact Assessment

To ensure a direct comparison between various specialist studies, six standard rating scales were identified and used to assess and quantify the identified impacts. The rating scale used for assessing impacts is based on three criteria, namely:

- the relationship of the impact / issue to temporal scales;
- the relationship of the impact / issue to spatial scales; and
- the severity of the impact.

These three criteria are combined to describe the overall importance rating, namely the significance. In addition, the following parameters are used to describe the impact / issues:

- the risk or likelihood of the impact occurring; and
- the degree of confidence placed in the assessment of the impact/ issue.

Impacts on the following areas will be discussed separately:

- available natural habitat of the farm Naauwontkomen;
- available natural habitat of the farm Eenzaamheid;
- the two alternatives of the proposed conveyor belt section; and
- the two alternatives of the Steenbokpan road re-alignment.

7.8.1. Identification of Potential Impacts

The following impacts / issues were identified that could potentially have an adverse effect on the biological environment:

- destruction of natural habitat, including vegetation communities that represent regional vegetation types and faunal assemblages that contain common fauna species;
- destruction of Red Data flora and fauna species and habitat suitable for these flora and fauna species;
- destruction of protected tree species and associated habitat;
- destruction of sensitive ecological habitat types (outcrops, riparian fringes, non-perennial streams, etc.); and
- impacts on surrounding habitat and species resulting during the construction or operational phase.

In order to assume the worst case scenario, the following assumptions are made:

- The proposed project implies 100% removal of natural vegetation and destruction of ecosystem attributes.
- The proposed areas will be affected similarly and entirely;
- The duration of the impact will be permanent; and
- No impacts are anticipated to have a neutral or positive influence on the ecological habitats.

The Precautionary Principal has been applied throughout this assessment.

7.8.2. Results

- *Preferred Sites*

IMPACT - Naauwontkomen	Duration	Extent	Severity	Significance	Probability	Confidence	Mitigation Potential
Destruction of natural habitat	Permanent	Localised	Very severe	Moderate	Definite	Definite	Low
Destruction of areas that is high in biodiversity	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Destruction of red data flora or fauna species & habitat	Permanent	Localised	Very severe	Very high	Unlikely	Probable	Low
Destruction of protected tree species and habitat	Permanent	Localised	Very severe	High	Definite	Definite	Low
Destruction of ecologically sensitive habitat types	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Impacts on surrounding habitat and species	Permanent	Localised	Moderately severe	Low	May occur	Unsure	Medium
IMPACT - Eenzaamheid	Duration	Extent	Severity	Significance	Probability	Confidence	Mitigation Potential
Destruction of natural habitat	Permanent	Localised	Very severe	Moderate	Definite	Definite	Low
Destruction of areas that is high in biodiversity	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Destruction of red data flora or fauna species & habitat	Permanent	Localised	Very severe	Very high	Unlikely	Probable	Low
Destruction of protected tree species and habitat	Permanent	Localised	Very severe	High	Definite	Definite	Low
Destruction of ecologically sensitive habitat types	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Impacts on surrounding habitat and species	Permanent	Localised	Moderately severe	Low	May occur	Unsure	Medium

- *Steenbokpan road alignment alternatives*

IMPACT - Road alternative (northern alternative)	Duration	Extent	Severity	Significance	Probability	Confidence	Mitigation Potential
Destruction of natural habitat	Permanent	Localised	Very severe	Moderate	Definite	Definite	Low
Destruction of areas that is high in biodiversity	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Destruction of red data flora or fauna species & habitat	Permanent	Localised	Very severe	Very high	Unlikely	Probable	Low
Destruction of protected tree species and habitat	Permanent	Localised	Very severe	High	May occur	Definite	Low
Destruction of ecologically sensitive habitat types	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Impacts on surrounding habitat and species	Permanent	Localised	Slight	Low	May occur	Unsure	Medium
IMPACT - Road alternative (southern alternative)	Duration	Extent	Severity	Significance	Probability	Confidence	Mitigation Potential
Destruction of natural habitat	Permanent	Localised	Very severe	Moderate	Definite	Definite	Low
Destruction of areas that is high in biodiversity	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Destruction of red data flora or fauna species & habitat	Permanent	Localised	Very severe	Very high	Unlikely	Probable	Low
Destruction of protected tree species and habitat	Permanent	Localised	Very severe	High	May occur	Definite	Low
Destruction of ecologically sensitive habitat types	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Impacts on surrounding habitat and species	Permanent	Localised	Slight	Low	May occur	Unsure	Medium

- *Conveyor belt alternatives*

IMPACT - Conveyor section (eastern alternative)	Duration	Extent	Severity	Significance	Probability	Confidence	Mitigation Potential
Destruction of natural habitat	Permanent	Localised	Very severe	Low	Unlikely	Definite	Low
Destruction of areas that is high in biodiversity	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Destruction of red data flora or fauna species & habitat	Permanent	Localised	Very severe	Very high	Very unlikely	Probable	Low
Destruction of protected tree species and habitat	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Destruction of ecologically sensitive habitat types	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Impacts on surrounding habitat and species	Permanent	Localised	No effect	Low	May occur	Unsure	Medium
IMPACT - Conveyor section (western alternative)	Duration	Extent	Severity	Significance	Probability	Confidence	Mitigation Potential
Destruction of natural habitat	Permanent	Localised	Very severe	Moderate	Definite	Definite	Low
Destruction of areas that is high in biodiversity	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Destruction of red data flora or fauna species & habitat	Permanent	Localised	Very severe	Very high	Unlikely	Probable	Low
Destruction of protected tree species and habitat	Permanent	Localised	Very severe	High	May occur	Definite	Low
Destruction of ecologically sensitive habitat types	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Impacts on surrounding habitat and species	Permanent	Localised	Slight	Low	May occur	Unsure	Medium

- *Construction camp*

IMPACT – Construction camp	Duration	Extent	Severity	Significance	Probability	Confidence	Mitigation Potential
Destruction of natural habitat	Permanent	Localised	Very severe	Moderate	Definite	Definite	Low
Destruction of areas that is high in biodiversity	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Destruction of red data flora or fauna species & habitat	Permanent	Localised	Very severe	Very high	Unlikely	Probable	Low
Destruction of protected tree species and habitat	Permanent	Localised	Very severe	High	May occur	Unsure	Medium
Destruction of ecologically sensitive habitat types	Permanent	Localised	Very severe	High	Very unlikely	Definite	Low
Impacts on surrounding habitat and species	Long term	Localised	Moderately severe	High	May occur	Possible3	Medium

7.8.3. Discussion

- *Naauwontkomen*

  Impacts of some significance that should be taken into consideration include:
  - ∗ destruction of natural habitat; and
  - ∗ destruction of protected tree species and associated habitat.

  Natural habitat are considered to be of medium sensitivity and adequately represented in the surrounding environment. This impact should therefore not have a bearing on the proposed development.

  Protected tree species are abundantly represented in the surrounding areas and the impact will not have a direct influence on surrounding areas. Limited mitigation measures will suffice in limiting the effect of this impact.

- *Eenzaamheid*

  Impacts of some significance that should be taken into consideration include:

  - ∗ destruction of natural habitat; and
  - ∗ destruction of protected tree species and associated habitat.

  Natural habitat are considered to be of medium sensitivity and adequately represented in the surrounding environment. This impact should therefore not have a bearing on the proposed development.

  Protected tree species are abundantly represented in the surrounding areas and the impact will not have a direct influence on surrounding areas. Limited mitigation measures will suffice in limiting the effect of this impact.

- *Steenbokpan road alignment alternatives*

  No significant impacts were identified that should be taken into consideration. The northern alternative is recommended as it is considered to have less influence on surrounding biological attributes.

- *Conveyor belt alternatives*

  No significant impacts were identified that should be taken into consideration. The eastern alternative is recommended as it is will be constructed along an existing line of degradation and will therefore have less influence on surrounding biological attributes.

- *Construction camp*

  Impacts of some significance that should be taken into consideration include:
  - ∗ impacts on surrounding habitat and species.

The presence of a huge number of humans in a natural setting is always detrimental to the environment. Activities that will lead to degradation of surrounding areas include:

* collection of firewood;
* trapping and snaring of animals;
* collection of plants of medicinal value; and
* hygienic aspects.

These effects can however be mitigated and the potential impacts should not have a bearing on the proposed development.

7.9. Conclusions And Recommendations

Since the entire area will be destroyed there is extremely few mitigation measures that could be recommended that will ameliorate potential impacts. Fauna species generally move away from areas of high activity by themselves and repopulate surrounding areas of suitable habitat.

General recommendations include:

* remove and relocate the single *Adansonia digitata* individual present on Naawontkomen (S23.70484° and E27.56224°) (could be utilised in landscaping);
* remove, relocate, protect and utilize as many of the other protected tree species as possible, preserving existing integrity of natural vegetation;
* contain all construction and operational activities within the boundaries of the specified areas;
* utilise trees that normally grow to extensive heights for screening effects;
* implement a collection and re-establishment programme of bulbs and geophytes for rehabilitation purposes;
* allow for free movement of small and medium size mammals through fences;
* relocate large mammals that are unable to utilise available movement corridors; and
* contain human movement and activities within the construction camp in order to prevent peripheral impacts on surrounding natural habitat.