PROPOSED ESKOM LANDFILL SITE, LEPHALALE, LIMPOPO PROVINCE

ECOLOGICAL ASSESSMENT (FINAL REPORT)

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1. INTRODUCTION

The increase in human demand for space and life-supporting resources resulted in a rapid loss of natural open space in South Africa. When open space systems are rezoned for development, indigenous fauna and flora are replaced by exotic species and converted to sterile landscapes with no dynamic propensity or ecological value (Wood *et al.,* 1994). Additionally, residential and golf course development have rarely focussed on decisive planning to conserve natural environments, while little thought was given to the consequences on the ecological processes of development in highly sensitive areas.

Transformation and fragmentation are not the only results of unplanned and intended developments, the loss of ecosystem functioning and ultimately the local extinction of species can also result. Therefore, careful planning will not only preserve rare and endemic fauna and flora, but also the ecological integrity of ecosystems on the landscape level, which is imperative for the continuation of natural resources, such as fossil fuels, water and soils with high agricultural potential.

In 1992, the Convention of Biological Diversity, a landmark convention, was signed by more than 90 % of all members of the United Nations. The enactment of the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004), together with the abovementioned treaty, focuses on the preservation of all biological diversity in its totality, including genetic variability, natural populations, communities, ecosystems up to the scale of landscapes. Hence, the local and global focus changed to the sustainable utilisation of biological diversity.

1.1 Terms of Reference

The terms of reference for this assessment are as follows:

- To provide a description of the vegetation units on the study site;
- To provide a faunal survey (with emphasis on mammals and birds) of the study site;
- To conduct a survey of threatened, “near-threatened”, endemic and conservation important species (Red Data scan) on the proposed study site;
- To conduct a faunal habitat assessment (including habitat suitable for potential threatened, “near-threatened”, endemic and conservation important species);
- To provide an indication of the relative conservation importance and ecological function of the study site (to be incorporated into a sensitivity map); and
- To provide recommendations and potential impacts based on the proposed development, if ecologically viable.

1.2 Background

Pachnoda Consulting cc was appointed by Envirolution Consulting (Pty) Ltd as an independent ecological specialist to evaluate the ecological importance and function of an area located within the limits of the Matimba power station (on the Farm Grootestryd 465 LQ) for the proposed Eskom Landfill EIA located near Lephalale, Limpopo Province (Figure 1).

The size of the property is approximately 29.62 ha in extent of which approximately 5 ha are required for the landfill site. Figure 2 shows three options (each 5 ha in extent) to be evaluated during this assessment, of which one which will be recommended (see recommendations).

2. BACKGROUND INFORMATION

2.1 Location

The study site is located within the site boundary of the existing Matimba power station (Figure 1) approximately 15 km west of the town of Lephalale, Limpopo Province.

2.2 Land Use and existing infrastructure

The site is currently vacant and situated adjacent to a dysfunctional and rehabilitated landfill site.

2.3 Biophysical Description

2.3.1 Climate

The area experiences summer rainfall with very dry winters. The summer rainfall averages between 350-500 mm/yr and the mean recorded minimum and maximum temperatures range from 2.1˚C to 38.2˚C for December and June respectively (Mucina and Rutherford, 2006).

2.3.2 Geology and Soils

The underlying geology consists primarily of sedimentary deposits such as arenite, shale, mudstone and coal of the Karoo Supergroup.

The majority of the site consists of freely drained red-yellow apedal soils with a high base status. The soil texture is uniform and fairly deep (> 300 mm).

2.3.3 Regional Vegetation Description

The study site corresponds to the Savanna Biome and more particularly to the Central Bushveld Bioregion as defined by Mucina & Rutherford (2006). The proposed development comprehends an ecological type known Limpopo Sweet Bushveld (Figure 3 & Table 1).

(a) Limpopo Sweet Bushveld: This vegetation type extends from the lower reaches of the Crocodile and Marico Rivers down to the Limpopo River valley and into Botswana on the other side of the border. It is predominantly located on extensive plains that are irregularly interspersed by tributaries of the Limpopo River. It is a short, open woodland dominated by *Acacia mellifera* and *Dichrostachys cinerea* as well as taller tree species such as *A. erioloba*, *A nigrescens* and *Terminalia sericea*.

The high palatability of the graminoid composition makes this vegetation type very suitable for game farming practices. The Limpopo Sweet Bushveld is Least Threatened and extensive in geographic coverage. It is however poorly conserved (e.g. D'Nyala Nature Reserve) even though it straddles many privately owned game farms. It is transformed by cultivation, but future threats include the mining of coal.

Table 1 summarises a list of plant species characteristic of the Limpopo Sweet Bushveld.

Table 1: A list of the characteristic plant species for each stratum (e.g. grass, forb & woody layer) representing Limpopo Sweet Bushveld (Mucina & Rutherford, 2006).

Limpopo Sweet Bushveld		
Grassy Layer	**Forb Layer**	**Woody Layer**
Digitaria eriantha subsp. *eriantha, Enneapogon cenchroides, Eragrostis lehmanniana, Panicum coloratum, Schmidtia pappophoroides, Aristida congesta, Cymbopogon nardus, Eragrostis pallens, Eragrostis rigidior, Eragrostis trichophora, Ischaemum afrum, Panicum maximum, Setaria vertcillata, Stipagrostis uniplumis, Urochloa mosambicensis.*	***Succulents**: Kleinia fulgens, Plectranthus neochilus* ***Non-succulents**: Acanthosicyos naudini* subsp. *transvaalense, Hemizygia elliottii, Hermbstaedtia odorata, Felicia muricata, Indigofera daleoides.*	***Trees**:Acacia robusta, Acacia burkei, Acacia erubescens, Acacia fleckii, Acacia nilotica, Acacia senegal var. rostrata, Albizia anthelmintica, Boscia albitrunca, Combretum apiculatum, Terminalia sericea.* ***Tall shrubs**: Catophractes alexandri, Dichrostachys cinerea, Phaeoptilum spinosum, Rhigozum obovatum, Cadaba aphylla, Combretum hereroense, Commiphora pyracanthoides, Ehretia rigida* subsp. *rigida, Euclea undulata, Grewia flava, Gymnosporia senegalensis.* ***Low shrubs**: Acacia tenuispina, Commiphora africana, Gossypium herbaceum* subsp. *africanum, Leucosphaera bainesii.*

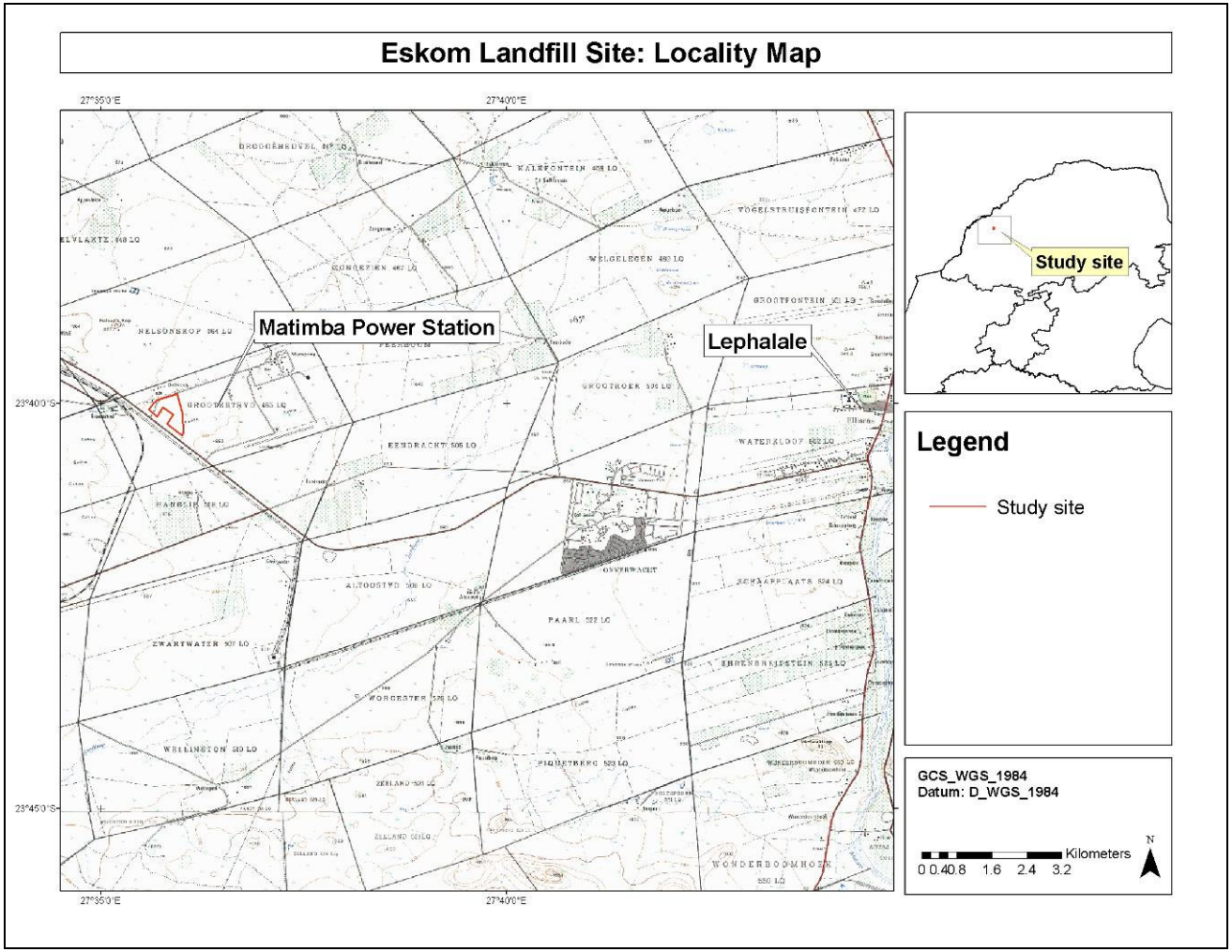

Figure 1: A locality map illustrating the geographic position of the study site.

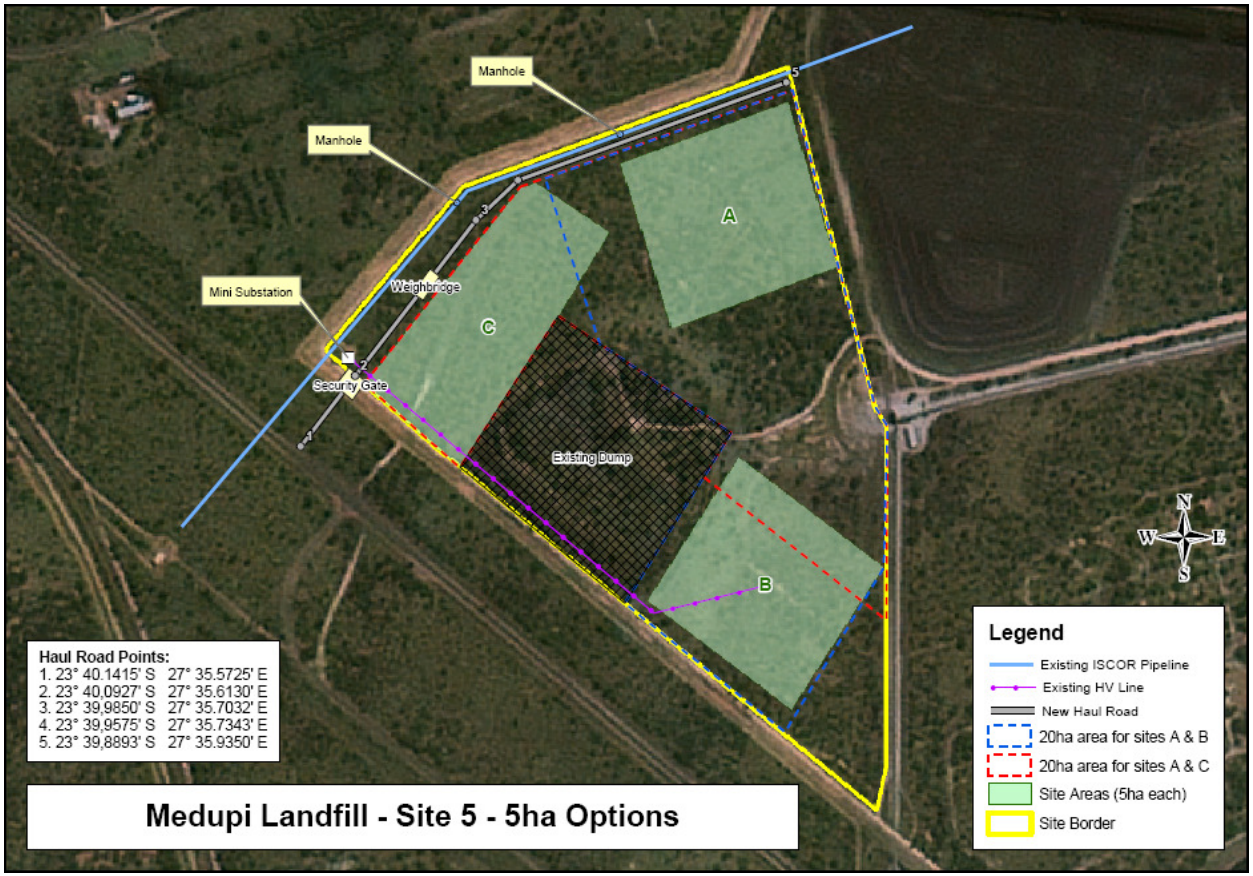

Figure 2: A map illustrating the spatial distribution of the three options (each approximately 5 ha in extent) to be evaluated during the assessment.

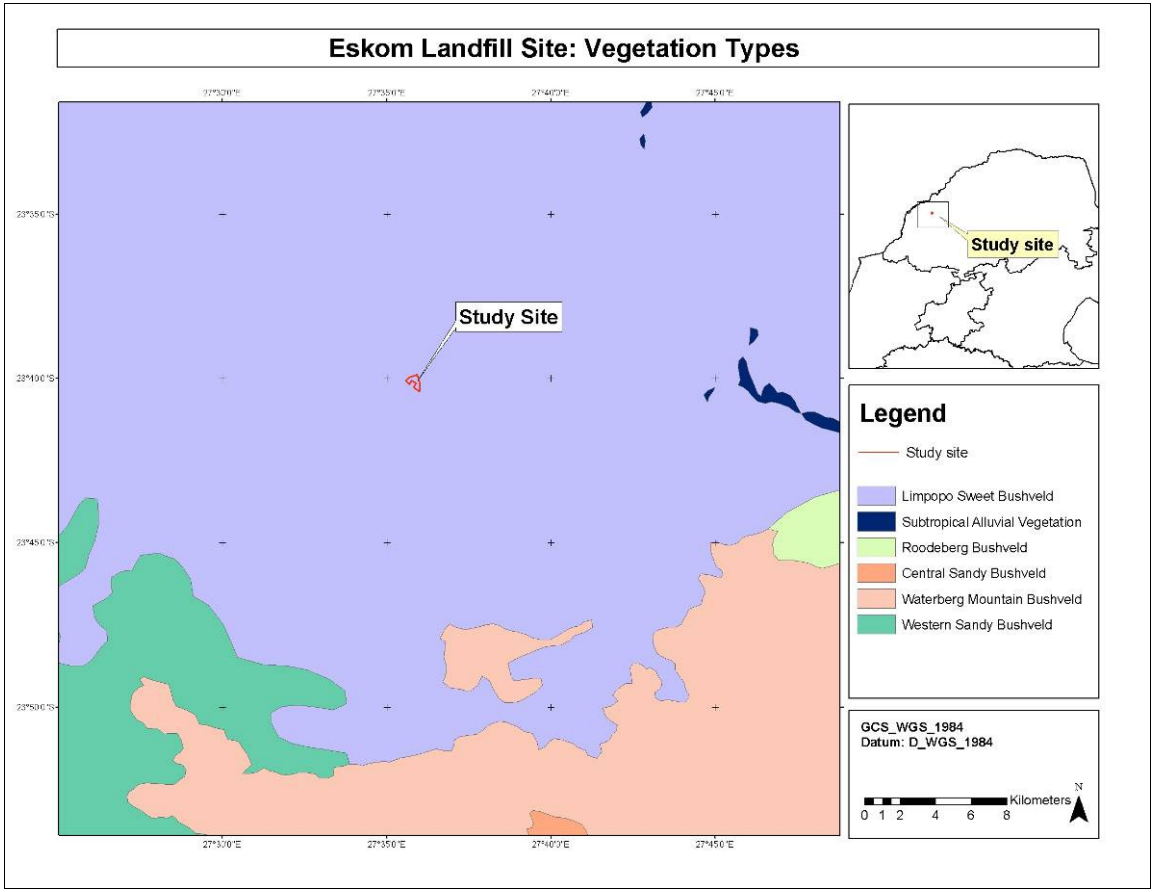

Figure 3: The spatial position of the study site and the regional vegetation types as defined by Mucina & Rutherford (2006).

3. METHODOLOGY

A baseline vegetation and faunal investigation was undertaken during the 16th of January 2009 and from the 6th to the 7th of April 2009 to evaluate the structure, composition and conservation value of the vegetation and faunal assemblages on the study site.

3.1 Vegetation Survey

3.1.1 Baseline vegetation description

- Data collection was primarily plot-based and consisted of 21 vegetation samples (Figure 4). The sampling plot size was standardised at 100 m^2. A sample entailed the compilation of a list of plant taxa, where each taxon was assigned an estimate (usually a cover-abundance estimate). Therefore, a vegetation sample can be seen as a simplified model of the vegetation stand. The species composition, as well as the mean percentage cover of each species per sampling plot was measured. Percentage cover was not measured precisely, but was placed in one of seven categories by a visual estimate as described by Braun-Blanquet (in Mueller-Dombois & Ellenberg, 1974; see Table 2). For comparison purposes, both the natural vegetation as well as rehabilitated areas was sampled; and
- Random transect walks were conducted to ensure sampling of less abundant or localised species and to assist with the compilation of a species inventory.

Table 2: Modified Braun-Blanquet cover classes (Mueller-Dombois & Ellenberg, 1974).

Class	Range of cover (%)	Mean
5	75-100	87.5
4	50-75	62.5
3	25-50	37.5
2b	12.5-25	18.75
2a	5-12.5	8.75
1	1-5	2.5
+	<1	0.1
r	<<1	0.01

In addition, the following parameters were also documented to aid the vegetation survey:

- All plant taxa were identified to species level where possible. Scientific names follow Germishuizen & Meyer (2003);

- The growth form of each plant species (a measure of structural diversity) and an indication of its perenniality;
- A survey of threatened and endemic taxa, including taxa of conservation concern;
- The identification of plant species protected by provincial and national legislation;
- A survey of plant species with medicinal or cultural value; and
- The identification of declared weeds and invader species as promulgated under the amended regulations (Regulation 15) of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983).

3.1.2 Method of analysis

- A cluster analysis (based on calculated similarity coefficients and group-average linkages; Clarke & Warwick, 1994) of measured cover estimates for the different plant species were used to classify vegetation units. A cluster analysis is used to assign associations between samples with the aim to objectively delineate groups or assemblages. Therefore, sampling entities that group together (being more similar) are believed to have similar compositions. The results of a clustering process are represented by a dendrogram and by similar non-parametric ordination techniques using non-metric multidimensional scaling (MDS). The data matrix (in this case columns being sampling plots and rows being the recorded cover estimate for each species) was subjected to square root transformation to allow for only common species to participate in the overall similarity analysis. The transformed data matrix was then converted to a similarity matrix consisting of Bray-Curtis coefficients prior to the cluster procedure. The software package PRIMER for Windows, Ver 5.2.2, was used during the analysis; and
- The percentage contribution (%) of each plant taxon as well as the consistency (calculated as the similarity coefficient/standard deviation) of its contribution within each vegetation grouping was calculated according to Clarke & Warwick (1994). Those species with high consistencies and percentage contributions were considered to be typical (or representative) for the given vegetation unit.

3.2 Faunal Survey

3.2.1 Mammals

- Mammals were identified by visual sightings through random transect walks and by means of an infrared-triggered digital camera. In addition, mammals were also identified by means of spoor, droppings, roosting sites or likely habitat types;

- The mammal survey was augmented by means of a small mammal trapping session. Five (5) trapping stations (Figure 5 & 6) were placed among natural and rehabilitated vegetation assemblages. Each trapping station consisted of 12 traps spaced 10 m apart. The traps, based on the 'Sherman Trap' design, were baited with a mixture of peanut butter, raisins and rolled oats; and
- The conservation status of mammal taxa was based on Friedmann & Daly (2004). The mammalian nomenclature was based on Skinner & Chimimba (2005).

3.2.2 Avifauna

- Birds were identified by means of random transect walks while covering as much of the study site as possible. Species, where necessary, were verified using Roberts Birds of Southern Africa, VIIth ed. (Hockey *et al*., 2005);
- Birds were also identified by means of their calls and other signs such as nests, discarded egg shells (Tarboton, 2001) and feathers;
- The bird survey was also informed through data of the South African Bird Atlas and verified by Harrison *et al*. (1997). Reporting rates were used for bird species recorded for the quarter degree grid cell (QDGC) 2327DA. Reporting rates were calculated as the total number of observer cards on which the species was recorded during the southern African bird atlas project expressed as a percentage of the total number of cards submitted for the particular QDGC. The reporting rate statistic provides a "snapshot" of the thoroughness of which the QDGC was surveyed between the periods of 1987 – 1991; and
- The conservation status of bird species was chosen according to Barnes (2000).

3.2.3 Herpetofauna

- Possible burrows, or likely reptile habitat (termitaria, stumps or rocks) were inspected for any inhabitants. Amphibians were also identified by their vocalisations (if any) and through likely habitat types (e.g. water features, drainage lines, etc.). However, the current assessment focussed largely on a desktop review.

3.2.4 Invertebrates

- The invertebrate survey was limited to the presence of conservation-dependant taxa, in particular that of scorpions and mygalomorph (e.g. baboon spider taxa) species. The presence of these was verified by intensive searching for burrows from likely habitat types or by means of rock turning.

3.3 Ecological Sensitivity

The ecological sensitivity of any piece of land is based on its inherent ecosystem service (e.g. wetlands) and overall preservation of biodiversity.

3.3.1 Ecological Function

Ecological function relates to the degree of ecological connectivity between systems within a landscape matrix. Therefore, systems with a high degree of landscape connectivity amongst one another are perceived to be more sensitive and will be those contributing to ecosystem service (e.g. wetlands) or overall preservation of biodiversity.

3.3.2 Conservation Importance

Conservation importance relates to species diversity, endemism (unique species or unique processes) and the high occurrence of threatened and protected species or ecosystems protected by legislation.

3.3.3 Sensitivity Scale

- *High* – Sensitive ecosystems with either low inherent resistance or low resilience towards disturbance factors or highly dynamic systems considered being important for the maintenance of ecosystem integrity. Most of these systems represent ecosystems with high connectivity with other important ecological systems OR with high species diversity and usually provide suitable habitat for a number of threatened or rare species. These areas should be protected;
- *Medium* – These are slightly modified systems which occur along gradients of disturbances of low-medium intensity with some degree of connectivity with other ecological systems OR ecosystems with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species; and
- *Low* – Degraded and highly disturbed/transformed systems with little ecological function and are generally very poor in species diversity (most species are usually exotic or weeds).

3.4 Limitations

In order to obtain a comprehensive understanding of the dynamics of the floral and faunal communities on the study site, as well as the status of endemic, rare or threatened species in any area, ecological assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints such long-term studies were not feasible.

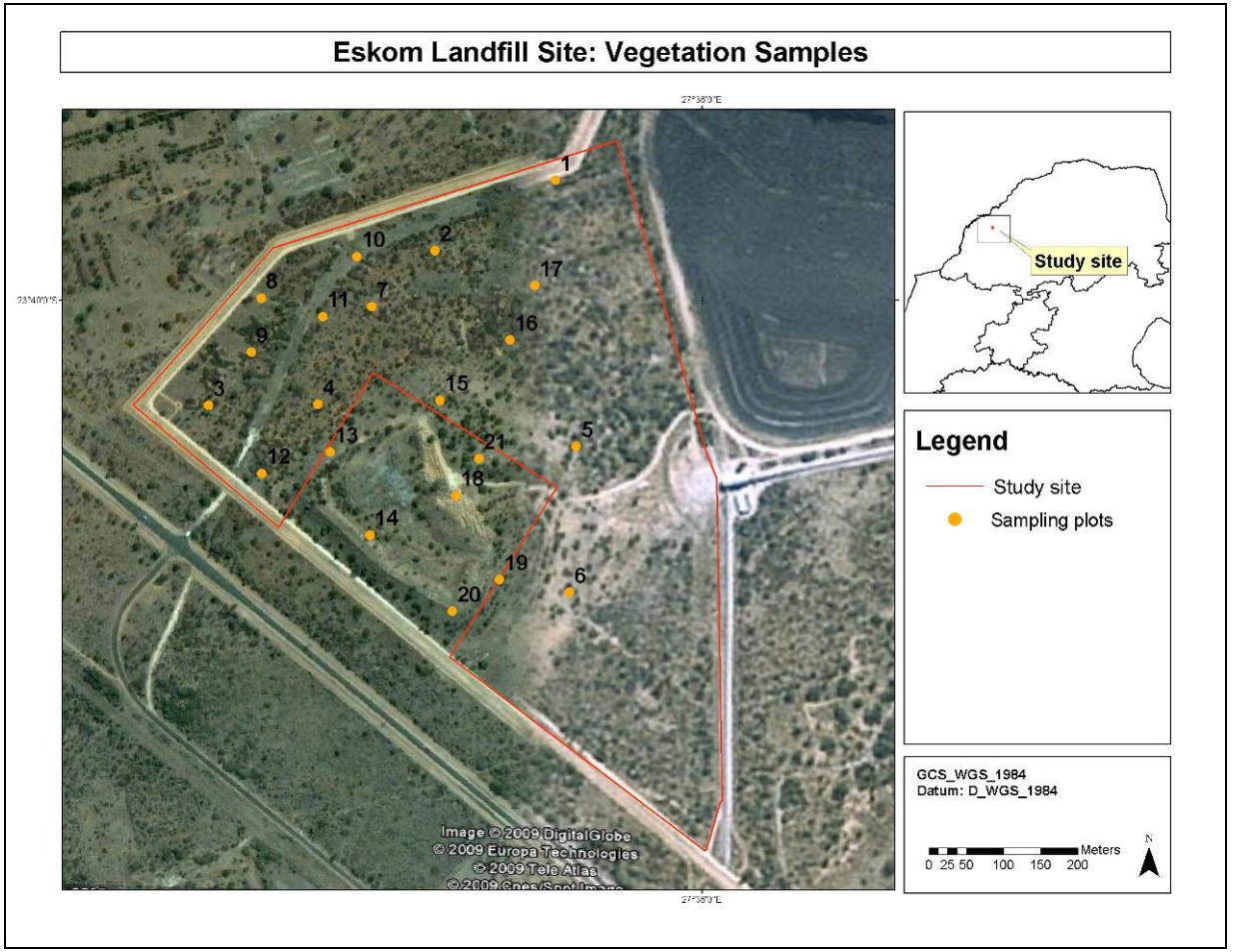

Figure 4: A map of the study site boundary illustrating the geographic placement of 21 sampling plots to assist with a baseline vegetation description (Google Earth, 2009).

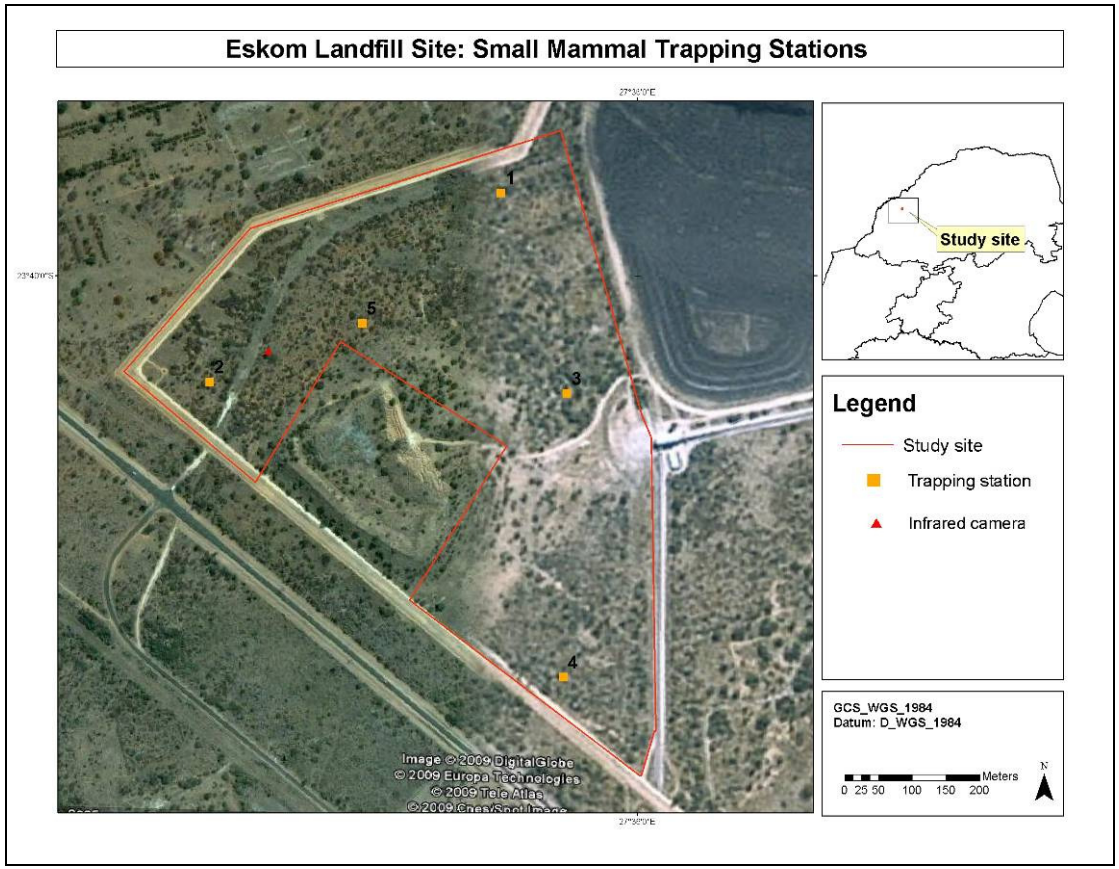

Figure 5: A map of the study site boundary illustrating the geographic placement of 5 small mammal trapping stations and an infrared digital camera (Google Earth, 2009).

Figure 6: An example of a small mammal (live) trap used during the assessment.

4. RESULTS AND DISCUSSION

4.1 Vegetation Units

The composition and distribution of the vegetation units on the study site were a consequence of a combination of factors simulated by past disturbances and rehabilitation efforts. Therefore, based on the cluster analysis, the study site is represented by two major communities (Figure 7, 8 & 9):

(1) *Rehabilitated vegetation* associated with an old landfill site and dominated by the grass *Cenchrus ciliaris*.

(2) *Mixed woodland* dominated by various microphyllous tree species (mainly *Acacia*) with a mid-successional graminoid layer.

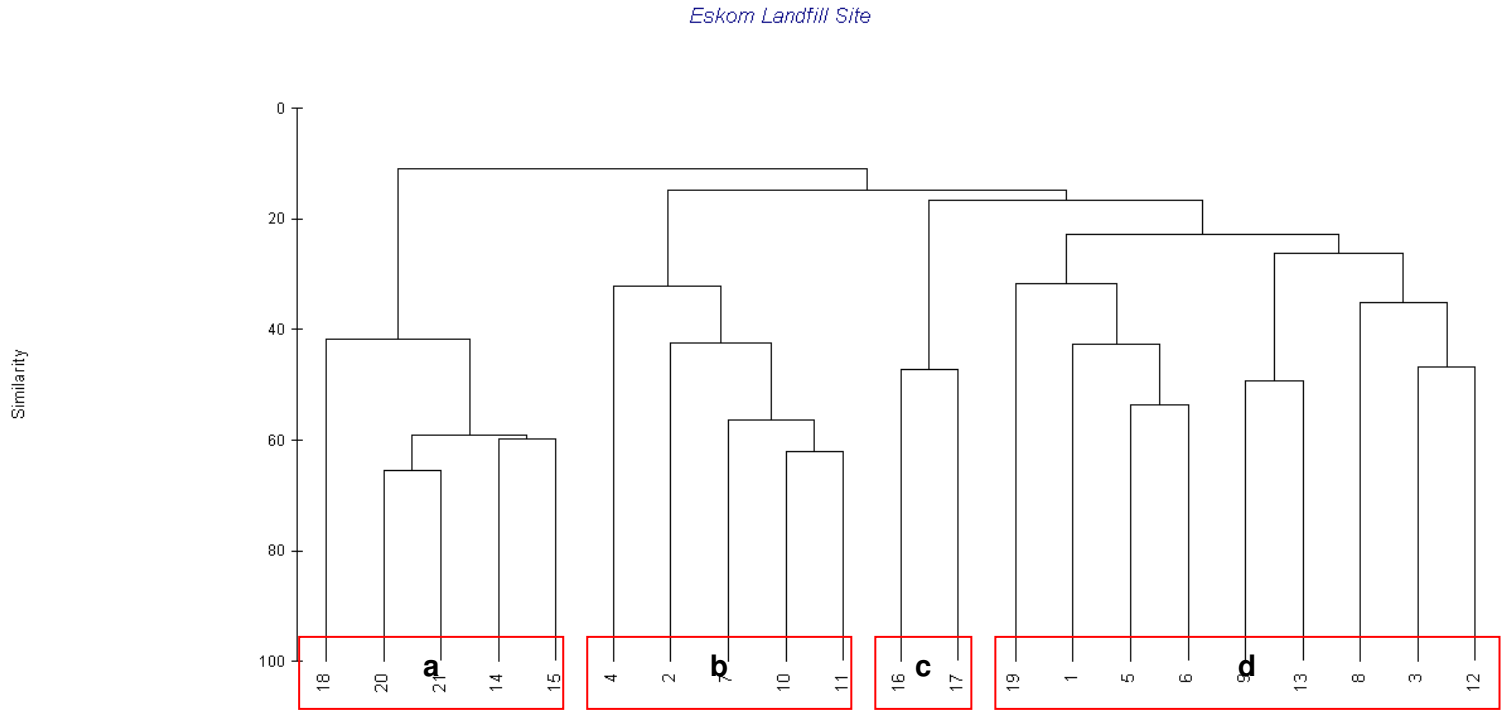

Figure 7: A dendrogram based on a cluster analysis of the sampled plots. a – *Cenchrus ciliaris* grassland, b – *Indigofera daleoides – Digitaria eriantha* shrub, c – *Acacia mellifera – Melhania acuminata* thornveld and *Acacia tortilis – Enneapogon cenhroides* woodland.

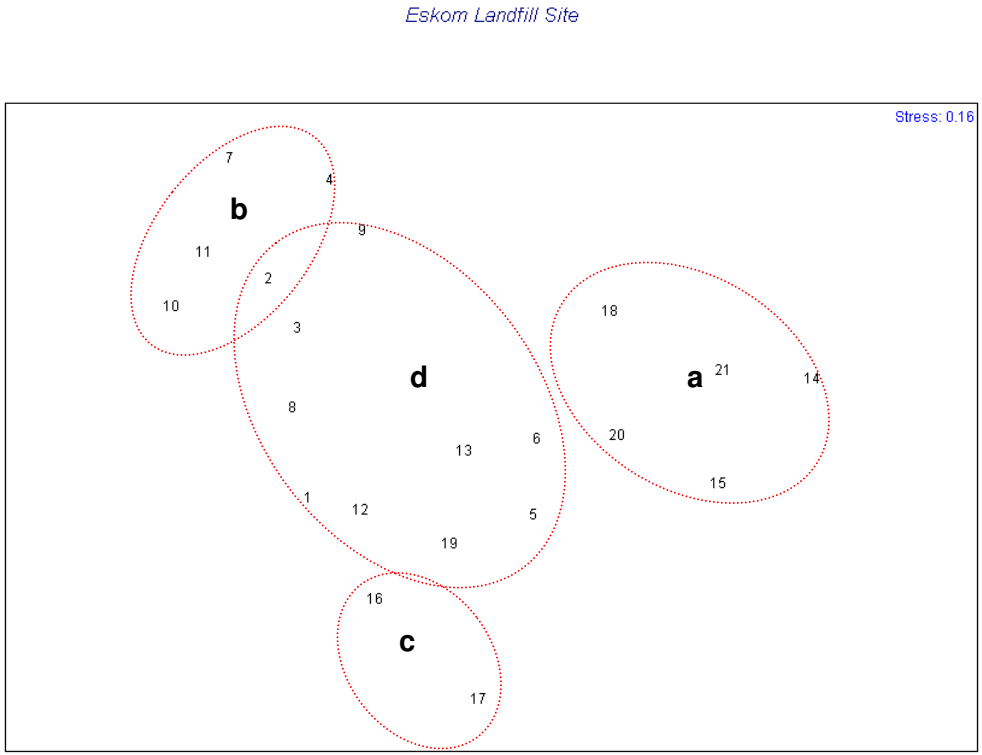

Figure 8: A non-metric Multidimensional Scaling ordination of the sampled plots illustrating: a – *Cenchrus ciliaris* grassland, b – *Indigofera daleoides – Digitaria eriantha* shrub, c – *Acacia mellifera – Melhania acuminata* thornveld and *Acacia tortilis – Enneapogon cenhroides* woodland. Please note that the samples are fairly scattered in space (hence the high stress value) due to the rather small sample size.

(a) Rehabilitated Areas

1. *Cenchrus ciliaris* grassland.

(b) Mixed Woodland

2. *Indigofera daleoides – Digitaria eriantha* shrub;
3. *Acacia mellifera – Melhania acuminata* thornveld; and
4. *Acacia tortilis – Enneapogon cenhroides* woodland

Appendix 1 provides a list of plant taxa recorded from the study site.

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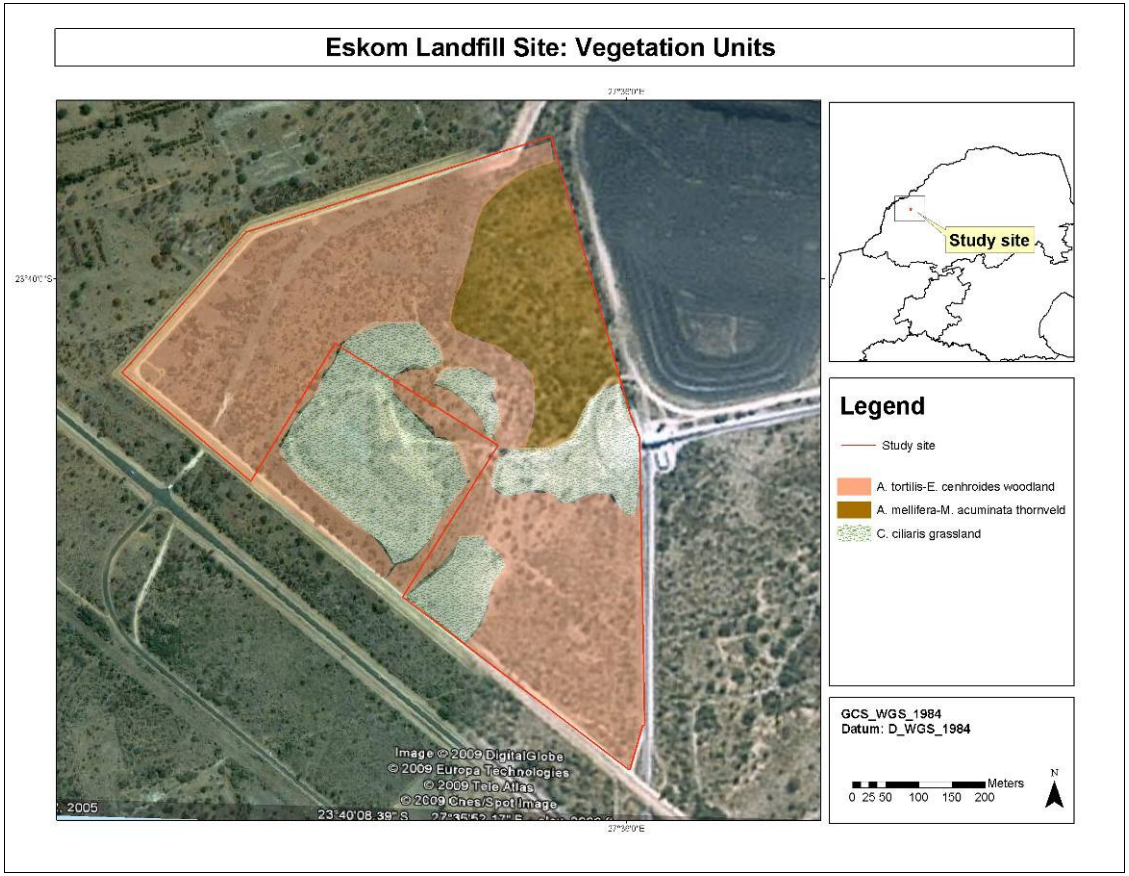


Figure 9: A map illustrating the vegetation units on the study site. Please note that the *Indigofera daleoides – Digitaria eriantha* shrub is embedded within the *Acacia tortilis – Enneapogon cenhroides* woodland unit.

1. *Cenchrus ciliaris* grassland

This unit is located along the slopes of the old landfill site (Figure 10). It could be described as a monospecific grassland layer dominated by *Cenchrus ciliaris* that was artificially planted during the rehabilitation phase of the old landfill site.

Typical species	Consistency	% Contribution	Average Abundance (mean cover/plot)
Cenchrus ciliaris	4.30	92.65	77.50

Status:	Artificial – used during past rehabilitation efforts
Corresponding options:	B, albeit marginal
Ecological Importance:	Low conservation importance
Plot #:	18, 20, 21, 14, 15

Figure 10: *Cenhrus ciliaris* grassland.

2. *Indigofera daleoides – Digitaria eriantha* shrub

This unit is patchily distributed on the study site and corresponds to localised disturbances within the *Acacia tortilis – Enneapogon cenhroides* mixed woodland unit (Figure 11). It is therefore not possible to map this unit based on its scattered distribution. Structurally it conforms to an open shrub with a dense forb and grassy cover.

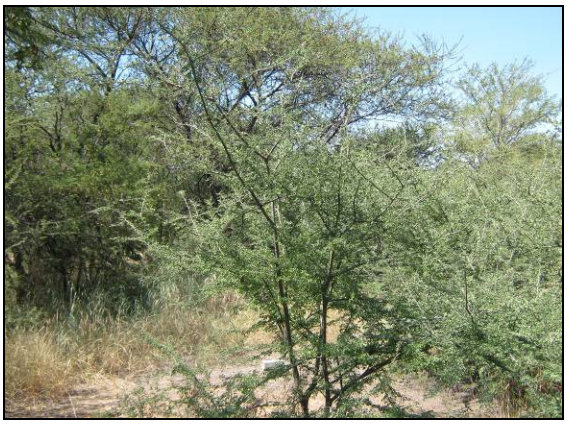
Typical species	Consistency	% Contribution	Average Abundance (mean cover/plot)
Indigofera daleoides	2.29	34.98	38
Digitaria eriantha	1.09	13.07	13.52
Grewia monticola	1.02	11.7	13.5
Stipagrostis uniplumis	0.64	9.55	16.77
Terminalia sericea	0.58	4.4	4
Aristida stipitata	0.8	4	1.52
Combretum apiculatum	0.62	3.7	1.5
Vernonia staehelinoides	1.12	3.38	1.06
Aristida congesta congesta	0.65	2.54	1.04
Dichrostachys cinerea	7.64	2.42	0.1
Hibiscus cannabinus	1.14	1.51	0.56

Status:	Disturbed mixed woodland
Corresponding options:	A, B & C
Ecological Importance:	Medium-low conservation importance
Plot #:	4, 2, 7, 10, 11

Figure 11: *Indigofera daleoides – Digitaria eriantha* shrub.

3. *Acacia mellifera – Melhania acuminata* thornveld

This unit is located on the eastern part of the study site and corresponds to areas that were previously cleared of natural vegetation (Figure 12). It therefore represents a transient composition, consisting mainly of a dense woody canopy of microphyllous taxa pertaining to the genus *Acacia*. The graminoid and forb layers are poorly defined and consequently poor in species richness.



Typical species	Consistency	% Contribution	Average Abundance (mean cover/plot)
Melhania acuminata	-	42.73	28.13
Acacia mellifera	-	29.19	8.75
Acacia tortilis	-	15.6	2.5
Grewia monticola	-	3.12	1.3

Status:	Transient microphyllous woodland
Corresponding options:	A
Ecological Importance:	Low conservation importance
Plot #:	16, 17

Figure 12: *Acacia mellifera – Melhania acuminata* thornveld.

4. *Acacia tortilis – Enneapogon cenhroides* woodland

This unit provides an example of the natural vegetation characteristics pertaining to the region. It is essentially an open *Acacia tortilis* and *Grewia monticola* woodland of which the basal layer was dominated by secondary graminoid taxa such as *Urochloa mosambicensis*, *Enneapogon cenchroides* and *Cenchrus ciliaris* (Figure 13). The latter species was established during the rehabilitation of the former landfill site. Other noteworthy woody species include *Combretum apiculatum*, *Acacia mellifera, Terminalia sericea*, *Grewia flava* and *Acacia erioloba*. Typical forb species include *Indigofera daleoides, Tephrosia purpurea, Waltherica indica* and *Melhania acuminata*.

The composition is typical of the regional vegetation type and comprises of a number of tree species protected by national legislation (e.g. *Acacia erioloba, Sclerocarya birre*a, *Combretum imberbe* and *Boscia albitrunca*). However, these occurred as individuals (as opposed to populations) within a confined (or enclosed) area. Secondly, these tree species are all regionally widespread on farms adjacent to the Matimba power station. Although it is anticipated that some individuals of these (if not all) are likely to become lost or removed during the construction phase, effort should be put in place to conserve at least the tall specimens of *Acacia erioloba* (corresponding to option C).

Typical species	Consistency	% Contribution	Average Abundance (mean cover/plot)
Enneapogon cenhroides	1.15	25.69	25.84
Acacia tortilis	0.84	13.3	7.37
Melinis repens	0.53	12.65	12.54
Aristida canescens	0.47	6.62	8.63
Eragrostis lehmanniana	0.75	5.9	2.54
Grewia monticola	0.45	5.65	9.61
Panicum maximum	0.52	4.86	3.22
Aristida adscensionis	0.5	3.93	1.82
Solanum panduriforme	0.63	2.84	1.56
Acacia mellifera	0.41	2.43	5.44
Melhania acuminata	0.58	2.03	1.29
Cenchrus ciliaris	0.24	1.71	4.19
Tephrosia purpurea	0.81	1.58	2.14
Grewia flava	0.82	1.41	0.07

Status:	Natural open woodland
Corresponding options:	A, B & C
Ecological Importance:	Medium conservation importance
Plot #:	1, 3, 5, 6, 8, 9, 12, ,13, 19

Figure 13: *Acacia tortilis – Enneapogon cenhroides* woodland.

4.2 Red Data Plant Assessment

South Africa has been recognised globally as having a remarkable plant diversity with high levels of endemism. Almost ten percent of the earth's plants are found within South Africa approximating 23 420 species (Golding, 2002). Of the 948 taxa assessed, 414 species that are 'threatened with extinction, while 270 of these have populations with extremely localised geographic distributions (Golding, 2002).

In terms of conserving biodiversity, there has been a shift towards focussing on ecosystems and landscapes (habitats[1]) rather than efforts in conserving specific

[1] Habitats normally comprise several biotopes or areas of uniformity (Davies & Day, 1998).

species. This is the case due to the variety of living organisms, which make up ecosystems relying on suitable habitats to which they have become adapted over long periods of time. Habitat degradation is one of the main reasons for species becoming extinct in a particular area. However, it can be viewed that threatened species are seen as indicators of the overall health of an ecosystem and serve, with varying degrees of success, as 'umbrellas' for the protection of other organisms as well as ecosystems (Hilton-Taylor, 1996; 2000). According to Hilton-Taylor (1996) threatened species can be seen as biodiversity attention grabbers. The Threatened Plant Species Programme (TSP) is currently revising all threatened plant species assessments made by Craig Hilton-Taylor (1996) using IUCN Red Listing Criteria modified from Davis *et al.* (1986).

However, no threatened, "near-threatened" or any "rare and declining" species as listed by the TSP are expected to occur on the study site. The PRECIS database (SANBI) supported the absence of Red Data species based on the quarter-degree grid squares corresponding to the study site.

4.3 Protected Plant Species

One species was observed and listed as protected (see Table 3) under Schedule 12 of the Limpopo Environmental Management Act (No 7 of 2003).

Table 3: Protected plant species recorded from the vegetation units.

Species	Status on study site	Vegetation Unit
Spirostachys africana (Euphorbiaceae) – tree	Localised	Mainly recorded from the old landfill site (probably implants used during rehabilitation)

A permit is required to remove or disturb a protected plant. It is recommended that protected plants in danger of becoming destroyed during the construction phase be removed prior to the commencement of construction activities and translocated to suitable habitat, or used during the rehabilitation phase.

Four tree species (Table 4) appear on the national list of declared protected tree species as promulgated by the National Forests Act, 1998 (No 84 of 1998). The main reasons for this list are to provide strict protection to certain species while others require control over harvesting and utilisation.

These species occur widely throughout the study site and is by no means restricted in range. In addition, these species are not threatened (not Red Data listed), but should be considered during the development phase of the project based on their legal status.

In terms of the National Forests Act of 1998, a licence should be granted by the Department of Water Affairs and Forestry (or a delegated authority) prior to the removal, damage or destruction of any individual. Therefore, such activities (as mentioned above) should be directed to the responsible Forestry official in each province or area (please contact Mr D. Mavhungu at Private Bag X2413, Louis Trichardt, 0920 or (015) 516 0201 or e-mail him at mavhunguD@dwaf.gov.za).

Table 4: Protected tree species recorded from the vegetation units identified from the study site.

Species	Status on study site	Vegetation Unit
Acacia erioloba (Mimosaceae) – Camel Thorn	Widespread	*A. tortilils – E. cenchroides* mixed woodland
Boscia albitrunca (Capparaceae) – Shepard's Tree	Widespread	*A. tortilils – E. cenchroides* mixed woodland
Combretum imberbe (Combretaceae) - Leadwood	Localised	*A. tortilils – E. cenchroides* mixed woodland
Sclerocarya birrea subsp. *caffra* (Anacardiaceae) - Marula	Localised	*A. tortilils – E. cenchroides* mixed woodland *C. ciliaris* grassland (implanted)

4.4 Medicinal Plant Species

It is estimated that the Southern African subcontinent holds approximately 24 300 plant taxa (Arnold & De Wet, 1993), an estimated 10 % of the world's flora. In addition, South Africa is home to a diversity of cultural groups all of which utilises plant species for some purpose.

A number of these species are highly prized for their traditional healing properties, especially for "muthi" (they have ethnomedicinal value). It is estimated that more than 28 million people in South Africa consume about 19 500 tonnes of plant material per annum (Mander, 1998). For example, certain popularly traded species have become over-exploited and are now rare or extinct in the wild. This has resulted in the forced use of alternative species and a geographical shift in the harvesting pressure of previously unexploited areas. Although most of these plant species are regionally widespread and abundant, some of the more sought-after plant resources are currently declining and should be envisaged as priority conservation entities. Table 5 lists those species considered to be of economical or cultural value (according to Van Wyk *et al.,* 1997).

Table 5: A list of medicinal species observed on the study site (according to Van Wyk *et al.*, 1997). Important (heavily utilised) species are highlighted in grey.

Species	Parts used	Treatment
Elephantorrhiza elephantina	Rhizomes	Treatment of a wide range of ailments including diarrhoea and dysentery.
Euclea undulata	Roots	Used as a remedy for headaches and toothaches.
Sclerocarya birrea subsp. *caffra*	Bark and fruit	Treatment of various ailments, including malaria. Fruit rich in Vitamin C.
Terminalia sericea	Roots	An infusion is made to treat pneumonia and wounds.
Ziziphus mucronata	Roots, leaves and bark	Treatment of respiratory ailments.

4.5 Declared Weeds and Invader Plants

Invaders and weed species are plants that invade natural or semi-natural habitats; especially areas disturbed by humans and are commonly known as environmental weeds. Weeds that invade severely disturbed areas are known as ruderal and agrestal weeds. Most of these weeds are annuals colonising waste sites and cultivated fields. These weeds only persist on recently disturbed areas and seldom invade established areas (Henderson, 2001).

Declared weeds and invaders have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems.

The amended Regulations (Regulation 15) of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) identify three categories of problem plants:

- Category 1 plants may not occur on any land other than a biological control reserve and must be controlled or eradicated. Therefore, no person shall establish, plant, maintain, propagate or sell/import any category 1 plant species.
- Category 2 plants are plants with commercial application and may only be cultivated in demarcated areas (such as biological control reserves) otherwise they must be controlled.
- Category 3 plants are ornamentally used plants and may no longer be planted, except those species already in existence at the time of the commencement of the regulations (30 March 2001), unless they occur within 30 m of a 1:50 year floodline and must be prevented from spreading.

The study site was relatively free of declared invader and weed species except for the occasional occurrence of annual and ruderal species such as *Bidens bipinnata* and *Tagetes minuta*. *Achyranthes aspera* was the only declared weed observed from

the mixed woodland units while the invader *Nicotiana galuca* was observed from the old landfill site.

4.6 Biogeographically important taxa and Endemic (including Near-endemic) Taxa

According to Mucina & Rutherford (2006), an important central bushveld endemic found within this region is *Piaranthus atrosanguineus*, a succulent stapeliad. It is scantily distributed along the Limpopo River valley from Gaborone in Botswana eastwards to Zeerust and northwards to Lephalale and into areas north of the Soutpansberg (Bruyns, 2005).

It has been located in *Acacia-Grewia* bushveld, growing specifically under heavily grazed *Acacia tortillis* individuals. It was not recorded on the study site.

4.7 Mammals

4.7.1 Observed and Expected Richness

37 mammalian species could occur on the study site (Appendix 2) of which 10 were confirmed during the site visit (Table 6 & Figure 14).

It appears that the most dominant mammalian taxa pertain to the Order Rodentia and include *Tatera leucogaster* (Bushveld Gerbil), *Cryptomys hottentotus* (Common Mole-rat), *Hystrix africaeaustralis* (Cape Porcupine) and *Pedetes capensis* (Springhare).

Table 6: An inventory of mammalian taxa observed from the study site.

Scientific Name	Vernacular Name	Observation Indicators	Observed Habitat
Aethomys ineptus	Tete Veld Rat	Trapped (Trapping station 1)	Fairly common from the study site.
Crocidura sp. nr. *C. hirta*	Musk Shrew	Trapped (Trapping Station 1)	Fairly common from most habitat types on the study site.
Cryptomys hottentotus	Common Molerat	Soil heaps	Dominant and widespread.
Hystrix africaeaustralis	Cape Porcupine	Excavations & quills	Widespread.
Mungos mungo	Banded Mongoose	Visual sightings	Mainly present from the *A. tortilis-E. cenchroides* woodland.
Pedetes capensis	Sprinhare	Droppings & burrows	Widespread on sandy soils.
Potamochoerus larvatus	Bushpig	Visual sightings	Mainly present from the *A. tortilis-E. cenchroides* woodland.
Saccostomus campestris	Pouched Mouse	Dead individual	Mainly present from the *A. tortilis-E. cenchroides* woodland.

Scientific Name	Vernacular Name	Observation Indicators	Observed Habitat
Sylvicapra grimmia	Common Duiker	Camera, spoor and droppings	Mainly present from the *A. tortilis-E. cenchroides* woodland.
Tatera leucogaster	Bushveld Gerbil	Burrows & trapped (Trapping station 2, 3 & 4)	Widespread on sandy soils.

Figure 14: A series of photographs illustrating some of the mammalian taxa observed on the study site: (a) a *Sylvicapra grimmia* (Common Duiker) captured by means of an infrared camera, (b) *Sylvicapra grimmia* (Common Duiker) droppings and (c) a *Crocidura* sp. nr. *C. hirta* (Musk Shrew) individual captured from trapping station 1.

4.7.2 Red listed, "near-threatened" and "data deficient" species

The study site provides potential habitat for one (1) "Near-threatened" species and five (5) "Data Deficient" species. Red list categories were chosen according to Friedmann & Daly (2004).

1. South African Hedgehog (Atelerix frontalis) - "Near-threatened"

This species occurs in a wide variety of habitat types, which makes prediction regarding its habitat requirements very difficult. It adapts readily to urban

environments and is frequently encountered in urban gardens (Skinner & Smithers, 1990; Skinner & Chimimba, 2005), although illegal hunting, habitat transformation to make way for agricultural land, and hard-surfaced infrastructure have contributed towards population declines across its distribution range.

The South African Hedgehog is highly likely to occur on the study site based on its preference for dry open habitat types. Hedgehogs will readily adapt to most types of development, if emphases is placed on preserving the natural function and connectivity of their preferred habitat type.

2. Data Deficient taxa

The shrew taxa (genus *Crocidura*), *Tatera leucogaster* (Bushveld Gerbil), *Lemniscomys rosalia* (Single-striped Grass Mouse) and *Elephantulus brachyrhynchus* (Short-snouted Elephant-shrew) and all classified as "Data Deficient" and most of these could occur on the study area. For example, the genus *Tatera* often colonises disturbed areas and was abundant on the study site. However, these species are perceived to be relatively widespread and abundant, but current modifications of suitable habitats and the paucity of scientific information on meta-population demographics place them in the "Data Deficient" category.

4.8 Herpetofauna

Although a number of reptile and amphibian species are expected to occur on the study site, the current survey did not pretentiously focus on this rather cryptic group. Few species were observed during the survey and include widespread taxa such as *Schismaderma carens* (Red Toad), *Naja mossambica* (Mozambique Spitting Cobra), *Agama aculeata distanti* (Ground Agama), *Panaspis wahlbergii* (Wahlberg's Snake-eyed Skink), *Lygodactylus capensis* (Cape Dwarf Gecko) and *Heliobolus lugubris* (Bushveld Lizard).

Currently, none of the frog species likely to occur are Red listed (Minter *et al.*, 2004), although the *Python natalensis* (Southern African Python) could occur. The latter species is currently classified as "Vulnerable" (Branch, 1988) and has a distribution range sympatric to that of the study site.

4.9 Avifauna

4.9.1 Observed and Expected Richness

A total of 216 bird species could occur on the study (Appendix 3) of which 100 were recorded during the two site visits. According to the South African Bird Atlas Project (SABAP1) (Harrison *et al.*, 1997), a total of 289 bird species have been recorded from the quarter degree grid cell (QDGC) 2327DA corresponding to that of the study site.

4.9.2 Red listed species

According to the South African Bird Atlas Project, a total of 13 Red listed species have been recorded from the QDGC 2327DA. Table 7 provides an indication of their occurrence to utilise the study site based on their breeding, roosting and foraging requirements. However, the Atlas data should be used with caution since the observations were made by the lay person. This means that some areas were less sampled than other areas, with the possibility that unknown Red listed populations could have been overlooked in the past for reasons such as popularity (areas frequently visited due to the bird compositions they hold) or due to restricted access. Many of the species as listed under Table 7 are in fact vagrants or irregular visitors (e.g. *Terathopius ecaudatus* Bateleur, *Aquila rapax* Tawny Eagle and *Polemaetus bellicosus* Martial Eagle) to the study site.

Table 7: Red Data Bird species assessment (according to Harrison *et al.,* 1997; Barnes, 2000) and an indication of their likelihood of occurrence.

Scientific Name	Common Name	Conservation Status	Probability of Occurrence	Habitat
Aquila rapax	Tawny Eagle	Vulnerable	Vagrant to study site	Lowveld and Kalahari savanna, especially game farming areas and reserves.
Ardeotis kori	Kori Bustard	Vulnerable	Unlikely to occur	Arid open lowland savanna and karroid shrub.
Buphagus erythrorhynchus	Red-billed Oxpecker	Near-threatened	Co-occur with larger bovine game and cattle; absent from study site	Bushveld areas with game and livestock.
Ciconia nigra	Black Stork	Near-threatened	Vagrant to study site	Wetlands, pans in lowland regions.
Glareola nordmanni	Black-winged Pratincole	Near-threatened	Vagrant to study site	Open grassland and arable land near wetlands
Gyps africanus	White-backed Vulture	Vulnerable	Irregular visitor – unlikely to breed on study site	Breed on tall, flat-topped trees.
Gyps coprotheres	Cape Vulture	Vulnerable	Irregular visitor – unlikely to breed on study site	Breeds on steep south- and east-facing cliffs; foraging habitat varies.
Leptoptilus crumeniferus	Marabou Stork	Near-threatened	Irregular visitor to study site	Varied, from savanna to wetlands, pans and

Scientific Name	Common Name	Conservation Status	Probability of Occurrence	Habitat
				floodplains – dependant of game farming areas.
Mycteria ibis	Yellow-billed Stork	Near-threatened	Unlikely to occur	Wetlands, pans and flooded grassland.
Polemaetus bellicosus	Martial Eagle	Vulnerable	Irregular visitor to study site	Varied, from open karroid shrub to lowland savanna.
Saggitarius serpentarius	Secretarybird	Near-threatened	Probably absent from study site	Open woodland and savannoid grassland.
Terathopius ecaudatus	Bateleur	Vulnerable	Irregular visitor to study site	Lowveld and Kalahari savanna; mainly on game farms and reserves.
Torgos tracheliotos	Lappet-faced Vulture	Vulnerable	Irregular visitor – likely to be vagrant to the study site	Lowveld and Kalahari savanna; mainly on game farms and reserves.

4.10 Invertebrates

4.10.1 Species of conservation concern

A number of invertebrate taxa are currently protected by Schedule B1 of the list of threatened and protected species issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 and likely to occur on the study site.

Table 8 provides a list of species of conservation concern and their respective probabilities of occurrence.

Table 8: A list of invertebrate taxa of conservation concern likely to occur on the study site. All species are protected by Schedule B1 of the list of threatened and protected invertebrate species issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004.

Scientific Name	Common Name	Conservation Status	Probability of Occurrence	Habitat
Mantichora sp.	Monster Tiger Beetle	Protected	Confirmed.	Aggressive predator on sandy plains.
Opistacanthus asper		Protected	Likely to occur.	Arboreal, partial towards *Acacia nigrescens*.
Opistophthalmus "wahlbergii"	Burrowing Scorpion	Protected	Confirmed.	Sandy plains.

Scientific Name	Common Name	Conservation Status	Probability of Occurrence	Habitat
Opistophthalmus glabrifrons	Burrowing Scorpion	Protected	High – could occur.	Sandy to loamy soils.
Opistophthalmus carinatus	Burrowing Scorpion	Protected	High – could occur.	Sandy soils along rocks or on plains.
Ceratogyrus darlingi	Horned Baboon Spider	Protected	High – could occur.	Sandy soils.

There are currently no Red List butterfly species likely to occur on the study site.

4.11 Ecological Sensitivity (Figure 15)

The study site shows an absence of highly sensitive areas since it is already fragmented by numerous linear features (e.g. roads, fences and conveyors), all disrupting the natural migration of larger faunal species. In addition, neighbouring activities associated with the power station have all contributed towards disrupting the ecological connectivity of the woodland units with that of adjacent woodland types.

4.11.1 Areas of Medium Ecological Sensitivity

The following vegetation units were considered to be of medium ecological importance:

- *Acacia tortilis – Enneapogon cenhroides* woodland; and
- *Indigofera daleoides – Digitaria eriantha* shrub

The composition of these units was floristically more diverse when compared to the other units. They were particularly rich in woody taxa and two of the few units hosting more than one protected tree species. In addition, although not of primary condition, the former unit shared many floristic similarities with that of the regional type, namely the Limpopo Sweet Bushveld. It therefore represents a “snapshot” of the regional vegetation type.

In addition, both units host a higher richness of faunal taxa in comparison to the other units due to an improved structural and vertical heterogeneity.

4.11.2 Areas of Medium-Low Ecological Sensitivity

The following vegetation unit was considered to be of medium-low ecological importance:

- *Acacia mellifera – Melhania acuminata* thornveld.

This unit was not considered to be pristine, and occurred on areas where previous disturbances took place in the past (such bush clearing). It provided potential ephemeral foraging habitat for a number of faunal species.

4.11.3 Areas of Low Ecological Sensitivity

The following vegetation unit was considered to be of low ecological importance:

- *Cenchrus ciliaris* grassland.

This unit was disturbed or transformed, and was composed of typical pioneer/mid-successional species or taxa, many with annual life histories. These species were considered transient and ecologically redundant.

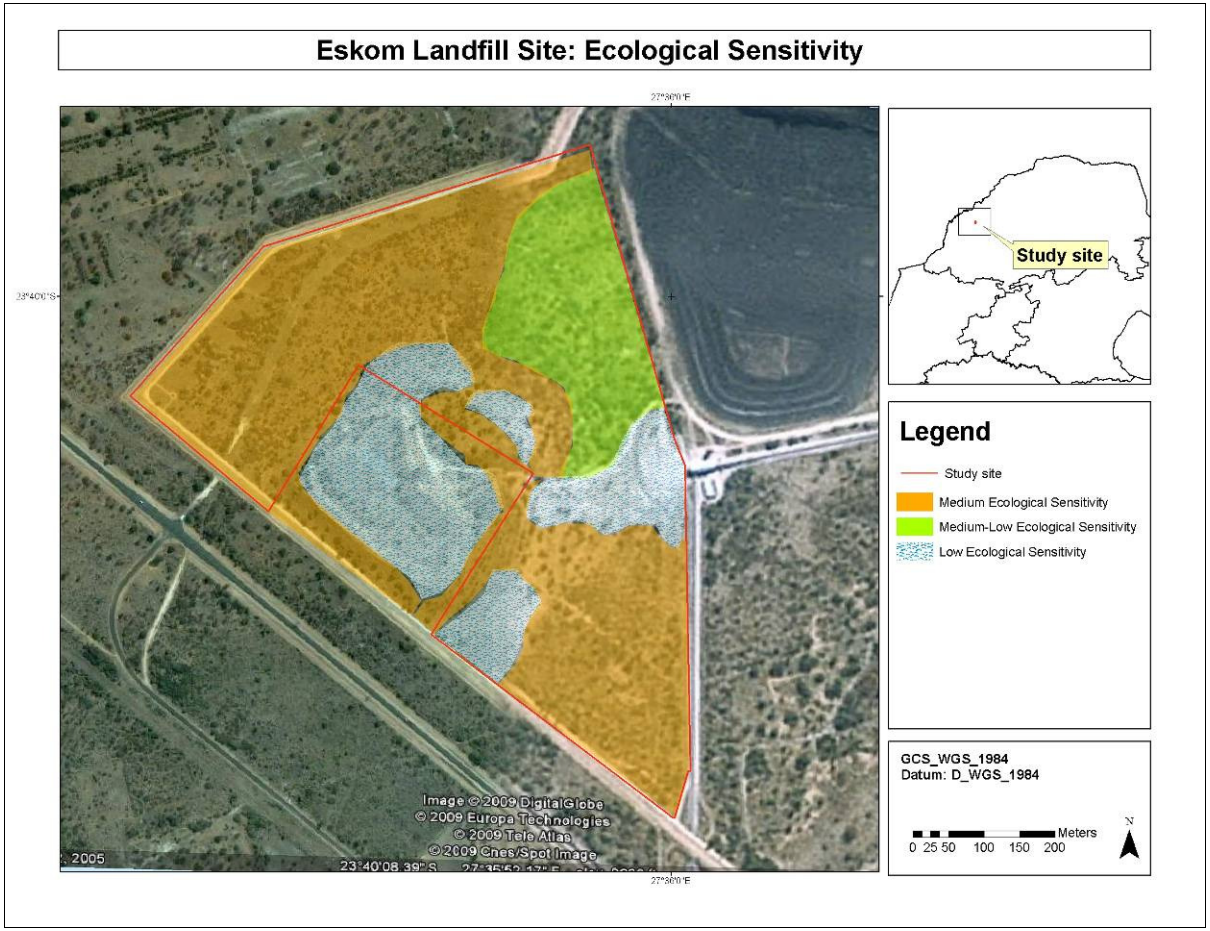


Figure 15: A sensitivity map of the study site based on the vegetation aspects.

5. IMPACT ASSESSMENT & RECOMMENDATIONS

5.1 Impact Assessment

5.1.1 Construction Impacts: Vegetation

Impact 1 – *Clearing of vegetation*. The development will result in the clearing of a large proportion of vegetation to accommodate the proposed landfill site and associated infrastructure.

In addition, decommissioning (and rehabilitation efforts) of the landfill site will result in the establishment of vegetation that is atypical of the region. This is clearly illustrated by the floristic composition on the current (and derelict) landfill area which was basically merely "stabilised" through the planting of a single graminoid species. Included were a number of tree species which were uncommon or rare from the adjacent vegetation communities (e.g. *Spirostachys africana*, *Acacia burkei* and *Dodonaea angustifolia*). It is also anticipated that the low representation in plant species diversity as evidenced by prior rehabilitation techniques, the occurrence of non-native plant species and the change in structural diversity will result in a corresponding change in the faunal diversity.

Impact 2 – *Loss of conservation important plant taxa*. It is possible that sensitive species (e.g. medicinal species and those protected by provincial legislation) may become lost during the construction phase. In addition, the anticipated increase in anthropogenic activities could lead to the uncontrolled and unsustainable harvesting of sensitive/medicinal plant species (by both the labour force and residents).

Impact 3 – *Establishment of alien and invader taxa*. The clearing of vegetation will leave bare patches of soil, thereby enhancing the colonisation by ruderal weeds (mostly annual weeds) or declared alien species that will prohibit the natural succession during rehabilitation activities. Such soil disturbances (as well as the inappropriate handling of topsoil) could enhance the establishment or spread of *Melia azedarach* and *Nicotiana glauca* to natural systems adjacent of the development.

Issue	Nature	Extent	Duration	Intensity	Probability	Potential Significance		'No go' areas
						WOM	WM	
Impact 1	*C. ciliaris* grassland	Local	Permanent	Low	Probable	Low	N/a	-
	A. mellifera-M. acuminata thornveld	Local	Permanent	Medium	Highly probable	Medium	Low	-
	I. daleoides-D. eriantha shrub	Local	Permanent	Medium	Highly probable	Medium	Low	-

	A. tortilis-E. cenchroides woodland	Local	Permanent	High	Highly probable	Medium	Low	-
Impact 2	Loss conservation important taxa	Local	Permanent	Medium	Definite	High	Medium	-
Impact 3	Establishment of alien & invader taxa	Regional	Long-term	Medium	Highly probable	Medium	Low	-

Table 9: An impact assessment table summarising the potential construction impacts on the vegetation units. WOM – Without mitigation; WM – With mitigation.

5.1.2 Construction Impacts: Fauna

Birds in general, are highly mobile and therefore able to vacate areas should adverse environmental conditions prevail. Therefore, direct impacts on adult mortality are less likely to occur, although indirect impacts will have severe consequences on the "fitness" (e.g. the ability of a species to reproduce) of these species. Likely examples include habitat loss and disturbances preventing individuals from breeding successfully. Persistent disturbances across extended temporal scales will eventually affect any population's ability to sustain itself, and will more than likely result in total abandoning of a particular area.

Species most likely to be affected are either K-selected species or habitat specialists. K-selected species are mostly long-lived species with slow reproductive rates while habitat specialists are those restricted to a particular type of microhabitat or niche, being it structurally, altitudinal or floristic. Most of these species are threatened, "near-threatened" or Red Listed, and therefore of conservation importance.

As with the birds, most mammal species are likely to vacate areas when environmental conditions become unfavourable. However, those species most likely to be affected will include subterranean species, species requiring large home ranges or habitat specialists (such as *Opistophthalmus* scorpions). Once again, continual disturbances across both temporal and spatial scales will discourage the colonisation of most species.

Impact 1 - *Loss of habitat*. A number of habitat types will be completely removed and transformed to new habitat types consisting of monospecific grasslands (e.g. *Cenchrus ciliaris* grassland). Species most likely to be affected will include habitat specialists or stenotopic taxa (e.g. *Ceratogyrus* spiders, *Opistophthalmus* scorpions and *Mantichora* beetles).

Species that will benefit from the development, more so from the creation of artificial grasslands and bare patches of soil, will include common species such as the Common

Mole-rat (*Cryptomys hottentotus*), Bushveld Gerbil (*Tatera leucogaster*) and Cape porcupine (*Hystrix africaeaustralis*).

Impact 2 - *Disturbance caused during construction activities*. Although almost all faunal species are to be affected by disturbances, it will be the larger mammal species (e.g. ungulates) and those requiring larger home ranges that will be affected.

Other possible disturbances include killing and snaring of mammal and reptile species by labour and residents.

Impact 3 – *Loss of taxa of conservation concern*. It is anticipated that many stenotopic and fossorial taxa of conservation concern will become lost during earth-moving activities associated with the construction of the landfill site.

Issue	Nature	Extent	Duration	Intensity	Probability	Potential Significance		'No go' areas
						WOM	WM	
Impact 1	Loss of habitat	Local	Permanent	High	Definite	High	Medium	-
Impact 2	Disturbances	Regional	Long-term	High	Definite	Medium	Low	-
Impact 3	Loss of taxa of conservation concern	Local	Permanent	High	Definite	High	Medium	-

Table 10: An impact assessment table summarising the potential construction impacts on the faunal assemblages. WOM – Without mitigation; WM – With mitigation.

5.1.3 Operational Impacts: Vegetation

Impact 1 - *Loss of conservation important plant taxa*. It is possible that sensitive species (e.g. medicinal species and those protected by provincial legislation) may become lost during the operation phase due to an anticipated increase of anthropogenic activities that could lead to the uncontrolled and unsustainable harvesting of sensitive/medicinal plant species (by both the labour force and residents).

Impact 2 - *Establishment of alien and invader taxa*. The continual clearing of vegetation and disturbances to the soil surface will facilitate the colonisation by ruderal weeds (mostly annual weeds) or declared alien species that will prohibit the natural succession during rehabilitation activities.

Issue	Nature	Extent	Duration	Intensity	Probability	Potential Significance		'No go' areas
						WOM	WM	
Impact	Loss of	Local	Long-term	Medium	Probable	Medium	Low	-

1	conservation important plant taxa							
Impact 2	Establishment of alien & invader taxa	Regional	Long-term	High	Definite	Medium	Low	-

Table 11: An impact assessment table summarising the potential operational impacts on the vegetation units. WOM – Without mitigation; WM – With mitigation.

5.1.4 Operational Impacts: Fauna

Impact 1 – *Disturbances*. Similar to Section 5.1.2: Impact 2.

Impact 2 – *Changes in community structure*. It is believed that the densities of certain opportunistic species (mainly bird species) could increase tenfold due to the establishment of a landfill site. These taxa could easily out-compete other less resilient taxa in the area. For example, it is believed that the densities of Pied Crows (*Corvus albus*) are likely to increase in the region. These species are aggressive competitors, which will eventually compete with other raptors in the area, leading to an imbalance in the natural food chain.

Impact 3 – *Potential introduction of alien species*. Typical landfill environments provide the ideal breeding and roosting habitat for alien or introduced mammalian taxa. It is possible that the landfill site could provide the ideal nucleus for the proliferation of invader species such as *Mus musculus* (House Mouse), *Rattus rattus* (Brown Rat), domestic dogs and cats. In addition, many of these species could be host to a number of parasite species or vectors of foreign diseases that could spread to the local indigenous mammal populations – sometimes with disastrous consequences. These species could competitively exclude the indigenous fauna or they could prey on the indigenous taxa, thereby inducing imbalances in the natural food chain. Although many of these species are only able to survive in close association with humans, some are known to take up residence in the field.

Issue	**Nature**	**Extent**	**Duration**	**Intensity**	**Probability**	**Potential Significance**		**'No go' areas**
						WOM	**WM**	
Impact 1	Disturbances	Regional	Long-term	Medium	Highly probable	Medium	Low	-
Impact 2	Changes in community structure	Regional	Long-term	High	Highly probable	High	Medium	-
Impact 3	Potential introduction of alien species	Local	Long-term	High	Highly probable	High	Medium	-

Table 12: An impact assessment table summarising the potential operational impacts on the faunal community. WOM – Without mitigation; WM – With mitigation.

5.2 Recommendations and suggested mitigation measures

- *Option A* is preferred since it corresponded to vegetation units (e.g. the *Acacia mellifera – Melhania acuminata* thornveld) of secondary successional stage that is reminiscent of past perturbations. Therefore, where possible, development should be restricted to disturbed areas;
- The development should strive to promote connectivity between the *Acacia tortilis – Enneapogon cenhroides* woodland habitat types. Therefore, natural corridors must be retained where possible to promote the movement of fauna, especially during the construction and operational phase when a high rate of natural disruption is expected;
- The extent of the construction site should be demarcated on site layout plans (preferably on disturbed areas such as the *Cenchrus ciliaris* grassland unit), and no construction personnel or vehicles may leave the demarcated area except those authorised to do so. Those areas surrounding the construction site that are not part of the demarcated development area should be considered as "no-go" areas for employees, machinery or even visitors;
- The impact on natural habitat types can never be completely ameliorated if development proceeds, but can be minimized. Where natural habitat types are to be transformed, especially the *Acacia tortilis – Enneapogon cenhroides* woodland areas, consideration should be given to the quality of the habitat based on the presence of micro-habitats and areas of high quality must be conserved;
- Intentional killing of invertebrates and herpetofauna should be avoided by means of awareness programmes presented to the labour force. The labour force should be made aware of the conservation issues pertaining to the taxa occurring on the study site;
- Any taxa, especially those of conservation concern (as indicated in this document) exposed during the construction activities should be captured for later release or translocation to adjacent suitable habitat;
- A monitoring and eradication programme should be put in place whereby the distribution and abundance of alien and invader fauna are monitored through fixed trapping points. The monitoring programme should be part of the operational EMP;
- All construction activities must be limited to daylight hours;
- All geophytes (if any) and medicinal species (from affected vegetation units) must be removed with the necessary permits and established in a nursery. After construction, the species must be re-planted during the rehabilitation phase. A *management plan* (to be compiled by the ECO) should be implemented to ensure

proper establishment of *ex situ* individuals, and should include a monitoring programme for at least two years after re-establishment (to ensure successful translocation);

- Rehabilitation should consist of indigenous species only, and preferably of species native to the study site and immediate surroundings. The species selected should strive to represent habitat types typical of the ecological landscape prior to construction. Rehabilitation should strive to increase spatial habitat heterogeneity. A monitoring programme should be implemented to evaluate the success of rehabilitation and to take necessary action if required;
- *Post-decommissioning rehabilitation and landscaping* along the edges of the landfill site should provide for high structural diversity (mosaic of plant species and grasses). Edges should be curvilinear, complex and soft, but should refrain from straight, simple or hard edges. This will ensure increased movement of fauna across edges and not along edges. Landscaping guidelines should strive to follow ecological principles as set out by Dramstad *et al*., 1996); and
- It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive plant species.

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7. APPENDICES

Appendix 1: A list of plant species observed on the study site. *- Exotic species.

Scientific Name	Vernacular Name	Family	Growth Form
Abutilon austro-africanum		Malvaceae	Perennial Herb
Acacia burkei	Black Monkey Thorn	Mimosaceae	Tree
Acacia caffra	Common Hook-thorn	Mimosaceae	Tree
Acacia erioloba	Camel Thorn	Mimosaceae	Tree
Acacia erubescens	Blue Thorn	Mimosaceae	Tree
Acacia grandicornuta	Horned Thorn	Mimosaceae	Tree
Acacia hebeclada		Mimosaceae	Tree
Acacia mellifera subsp. *detinens*	Black Thorn	Mimosaceae	Tree
Acacia nigrescens	Knobthorn	Mimosaceae	Tree
Acacia nilotica subsp. *kraussiana*	Scented-pod Thorn	Mimosaceae	Tree
Acacia tortilis subsp. *heteracantha*	Umbrella Thorn	Mimosaceae	Tree
Acalypha glabrata		Euphorbiaceae	Shrub
Acanthosicyos naudinianus	Gemsbok Cucumber	Cucurbitaceae	Perennial Trailing Herb
*Achyranthes aspera**	Burrweed	Amaranthaceae	Perennial Herb
Acrotome hispida		Lamiaceae	Perennial Herb
Agathisanthemum bojeri		Rubiaceae	Perennial Herb
Aristida adscensionis	Annual Three-awn	Poaceae	Annual Tufted Grass
Aristida canescens	Pale Three-awn	Poaceae	Perennial Tufted Grass
Aristida congesta subsp. *barbicollis*	Spreading Three-awn	Poaceae	Perennial Tufted Grass
Aristida congesta subsp. *congesta*	Tassel Three Awn	Poaceae	Perennial Tufted Grass
Aristida stipitata subsp. *graciliflora*	Long-awned Grass	Poaceae	Perennial Tufted Grass
Asparagus buchananii		Asparagaceae	Perennial Herb
Barleria galpinii		Acanthaceae	Perennial Herb
Bauhinia petersiana	Cofee Neat's Foot	Fabaceae	Shrub
Becium filamentosum		Lamiaceae	Perennial Herb
*Bidens bipinnata**	Spanish Blackjack	Asteraceae	Annual Herb

Scientific Name	Vernacular Name	Family	Growth Form
Blepharis saxatilis		Acanthaceae	Perennial Herb
Boscia albitrunca	Sheperd-tree	Capparaceae	Tree
Boscia foetida subsp. *rehmanniana*	Bushveld Shepard-tree	Capparaceae	Tree
Catophractes alexandri	Tumpeter-thorn	Bignoniaceae	Shrub
Cenchrus ciliaris	Foxtail Buffalo Grass	Poaceae	Perennial Tufted Grass
Chloris pycnothrix		Poaceae	Perennial Tufted Grass
Cleome angustifolia		Capparaceae	Annual Herb
Coccinia sessilifolia		Cucurbitaceae	Perennial Twining Herb
Combretum apiculatum subsp. *apiculatum*	Red Bushwillow	Combretaceae	Tree
Combretum hereroense	Russet Bushwillow	Combretaceae	Tree
Combretum imberbe	Leadwood	Combretaceae	Tree
Commelina africana	Yellow Commelina	Commelinaceae	Perennial Spreading Herb
Commelina benghalensis	Benghal Commelina	Commelinaceae	Perennial Herb
Commelina cf. rogersii (?)		Commelinaceae	Perennial Herb
Commiphora pyracanthoides	Firethorn Corkwood	Burseraceae	Shrub
Cucumis metuliferus		Cucurbitaceae	Perennial Twining Herb
Cucumis zeyheri		Cucurbitaceae	Perennial Twining Herb
Cyperus sp.		Cyperacae	Perennial Graminoid
Cyphostemma simulans		Vitaceae	Perennial Twining Herb
Dicoma anomala		Asteraceae	Perennial Herb
Dichrostachys cinerea subsp. *cinerea*	Small-leaved Sickle-bush	Mimosaceae	Tree
Digitaria eriantha	Common Finger Grass	Poaceae	Perennial Graminoid
Dodonaea angustifolia	Narrow-leaved Sand-olive	Sapindaceae	Shrub
Eheretia rigida	Puzzle Bush	Boraginaceae	Tree
Elephantorrhiza elephantina	Elandsbean	Fabaceae	Perennial Suffrutex
Enneapogon cenchroides	Nine-awned Grass	Poaceae	Annual Tufted Grass
Eragrostis lehmanniana	Lehmann's Love Grass	Poaceae	Perennial Tufted Grass
Eragrostis pallens	Broom Love Grass	Poaceae	Perennial Tufted Grass
Euclea crispa		Ebenaceae	Tree
Euclea undulata		Ebenaceae	Tree
Euphorbia inaequilatera var. *inaequilatera*		Euphorbiaceae	Annual Herb
Eustachys paspaloides	Brown Rhodes Grass	Poaceae	Perennial Tufted Grass

Scientific Name	Vernacular Name	Family	Growth Form
Evolvulus alsinoides		Convolvulaceae	Perennial Herb
Felicia mossamedensis	Yellow Felicia	Asteraceae	Perennial Herb
*Flaveria bidentis**		Asteraceae	Annual Herb
Gardenia volkensii		Rubiaceae	Shrub
Gossypium herbaceum subsp. *africanum*	Wild Cotton	Malvaceae	Perennial Herb
Grewia bicolor	White-leaved Raisin	Tiliaceae	Shrub
Grewia flava	Velvet Raisin	Tiliaceae	Shrub
Grewia flavescens var. *flavescens*	Sandpaper Raisin	Tiliaceae	Shrub
Grewia monticola	Grey Raisin	Tiliaceae	Shrub
Grewia retinervis	Kalahari Raisin	Tiliaceae	Shrub
Heliotropium ciliatum		Boraginaceae	Perennial Herb
Hemizygia cf. elliottii		Lamiaceae	Perennial Herb
Hermannia glandulifera		Sterculiaceae	Perennial Herb
Heteropogon contortus	Spear Grass	Poaceae	Perennial Tufted Grass
Hibiscus calyphyllus	Wild Stockrose	Malvaceae	Perennial Herb
Hibiscus cannabinus		Malvaceae	Annual Herb
Hibiscus meeusei		Malvaceae	Perennial Herb
Hibiscus trionum		Malvaceae	Annual Herb
Hirpicium bechuanense		Asteraceae	Perennial Herb
Indigofera daleoides		Fabaceae	Perennial Herb
Indigofera newbrowniana		Fabaceae	Perennial Herb
Ipomoea bathycolpos		Convolvulaceae	Perennial Herb
Ipomoea magnusiana	Small Pink Ipomoea	Convolvulaceae	Perennial Herb
Justicia flava		Acanthaceae	Perennial Herb
Kyphocarpa angustifolia	Sliky Burweed	Amaranthaceae	Perennial Herb
Lagerra decurrens	Wolbos	Asteraceae	Shrub
Maytenus undata	Koko Tree	Celastraceae	Tree
Melhania acuminata		Sterculiaceae	Perennial Herb
Melhania rehmannii		Sterculiaceae	Perennial Herb
Melinis repens	Natal Red Top	Poaceae	Annual Tufted Grass
Merremia palmata		Convolvulaceae	Perennial Herb
Neorautanenia amboensis		Fabaceae	Perennial Herb

Scientific Name	Vernacular Name	Family	Growth Form
*Nicotiana glauca**	Wild Tobacco	Solanaceae	Shrub
Nidorella resedifolia		Asteraceae	Annual Herb
Ochna pulchra	Peeling Plane	Ochnaceae	Tree
Ocimum gratissimum		Lamiaceae	Perennial Herb
Panicum maximum	Guinea Grass	Poaceae	Perennial Tufted Grass
Pavonia burchellii		Malvaceae	Perennial Herb
Pavonia transvaalensis		Malvaceae	Annual Herb
Peltophorum africanum	African-wattle	Caesalpiniaceae	Tree
Pentarrhinum insipidum	Donkieperske	Apocynaceae	Perennial Twining Herb
Pergularia daemia		Apocynaceae	Perennial Twining Herb
Perotis patens	Cat's Tail	Poaceae	Annual Tufted Grass
Pupalia lappacea	Forest Burr	Amaranthaceae	Annual Herb
Rhigozum obovatum	Pomegranate	Bignoniaceae	Shrub
Rhynchosia caribaea		Fabaceae	Perennial Twining Herb
Rhynchosia minima		Fabaceae	Perennial Twining Herb
Rhynchosia totta		Fabaceae	Perennial Twining Herb
Ruellia cf. *patula*		Acanthaceae	Perennial Herb
Sansevieria aethiopicus		Dracaenaceae	Perennial Herb
Schmidtia pappophoroides	Sand Quick	Poaceae	Perennial Tufted Grass
Sclerocarya birrea subsp. *caffra*	Marula	Anacardiaceae	Tree
Senna italica subsp. *arachoides*		Caesalpiniaceae	Perennial Herb
Sesamum triphyllum var. *triphyllum*	Wild Sesame	Pedaliaceae	Annual Herb
Sida cordifolia	Flannel Weed	Malvaceae	Perennial Herb
Solanum cf. *tomentosum*		Solanaceae	Perennial Herb
Solanum lichtensteinii	Grey Bitter-apple	Solanaceae	Shrub
Solanum panduriforme		Solanaceae	Perennial Herb
Spirostachys africana	Tamboti	Euphorbiaceae	Tree
Stipagrostis uniplumis	Silky Bushman Grass	Poaceae	Perennial Tufted Grass
*Tagetes minuta**	Khaki Weed	Asteraceae	Annual Herb
Tarchonanthus camphoratus	Camphor Tree	Asteraceae	Shrub
Tephrosia elongata		Fabaceae	Perennial Herb
Tephrosia purpurea		Fabaceae	Perennial Herb

Scientific Name	Vernacular Name	Family	Growth Form
Terminalia sericea	Silver Cluster-leaf	Combretaceae	Tree
Tricholaena monachne	Blue-seed Grass	Poaceae	Perennial Tufted Grass
Tricliceras longipedunculatum		Turneraceae	Perennial Herb
Tylosema cf. *esculentum*	Gemsbok Bean	Fabaceae	Perennial Prostrate Herb
Urochloa mosambicensis	Bushveld Signal Grass	Poaceae	Perennial Tufted Grass
Vernonia staehelinoides	Blouteebossie	Asteraceae	Annual Herb
Vigna unguiculata		Fabaceae	Perennial Twining Herb
Waltheria indica	Meidebossie	Sterculiaceae	Perennial Herb
Zehneria scabra		Cucurbitaceae	Perennial Twining Herb
Ziziphus mucronata subsp. *mucronata*	Buffalo-thorn	Rhamnaceae	Tree

Appendix 2: A list of mammal species with distribution ranges that correspond to that of the study site. The table excludes any introduced game species. SA – South Africa. Conservation status chosen according to Friedmann & Daly (2004) and nomenclature according to Skinner & Chimimba (2005).

Scientific Name	Vernacular Name	Probability of Occurrence	Habitat	Conservation Status
Aethomys ineptus	Tete Veld Rat	High, a widespread species likely to occur.	Rocky crevices and piles of boulders, in varied vegetation types.	Least Concern
Canis mesomelas	Black-Backed Jackal	Low, could occur.	Wide habitat tolerance; arid, savanna and well watered regions. Absent from forests.	Least Concern
Cercopithecus pygerythrus	Vervet Monkey	Medium-High, could occur.	Savanna and forested areas.	Least Concern
Crocidura cyanea	Reddish-Grey Musk Shrew	High, a widespread species that could occur.	Dry terrain among rocks in dense scrub and grass, in moist places and in hedges. Wet vleis with good grass cover.	Data Deficient
Crocidura fuscomurina	Tiny Musk Shrew	Medium, could occur.	Varied, a wide habitat tolerance.	Data Deficient
Crocidura hirta	Lesser Red Musk Shrew	High, likely to occur.	Moist savanna, especially near drainage lines.	Data Deficient
Cryptomys hottentotus	Common Molerat	High, a very widespread species.	Wide diversity of substrates, from sandy soil to heavier compacted types.	Least Concern
Dendromus melanotis	Grey Climbing Mouse	High, likely to occur.	Stands of tall grasses (e.g. *Hyparrhenia* spp.) with bushes and other thick vegetation.	Least Concern
Elephantulus brachyrhynchus	Short-snouted Elephant-shrew	Medium, could occur.	Mainly woodland areas with sandy soils.	Data Deficient
Galago moholi	Southern Lesser Galago	High, likely to occur.	Savanna woodland.	Least Concern

Scientific Name	Vernacular Name	Probability of Occurrence	Habitat	Conservation Status
Galerella sanguinea	Slender Mongoose	High, a widespread species.	Catholic habitat requirements, arid to more mesic regions. Cover in the form of holes in the ground, hollow logs or rocks are essential.	Least Concern
Genetta genetta	Small-Spotted Genet	High, a widespread species likely to occur.	Savanna, adapts well to rural gardens and urban areas.	Least Concern
Genetta maculata	Common Large-Spotted Genet	High, a widespread species likely to occur.	Varied; adapts well to rural gardens and urban areas.	Least Concern
Graphiurus murinus	Woodland Dormouse	High, likely to occur.	Woodland areas.	Least Concern
Hystrix africaeaustralis	Cape Porcupine	High, a widespread species.	Catholic, but prefers broken country with hills and rocks.	Least Concern
Ictonyx striatus	Striped Polecat	High, likely to occur.	Varied, from forest to grassland.	Least Concern
Lemniscomys rosalia	Single-striped Mouse	High, likely to occur.	Tall grasslands.	Data Deficient
Lepus saxatilis	Shrub Hare	High, a widespread species.	Savanna woodland and scrub with grass cover.	Least Concern
Mastomys choucha	Southern Multimammate Mouse	High, a widespread species likely to occur on the study site.	Wide habitat tolerance.	Least Concern
Mungos mungo	Banded Mongoose	High, likely to occur on the study site.	Savannas.	Least Concern
Mus minutoides	Pygmy Mouse	High, likely to occur.	Savanna with good ground cover.	Least Concern
Neoromicia capensis	Cape Serotine Bat	High, a widespread species likely to occur	Variable but prefers savanna. Commonly enters houses and readily visits lights.	Least Concern
Nycteris thebaica	Egyptian Slit-faced Bat	High, a widespread species.	Varied. Will utilise nearby rock crevices and manmade structures for day and night roosts.	Least Concern
Paraxerus cepapi	Tree Squirrel	High, likely to occur.	Savanna woodland.	Least Concern

Scientific Name	Vernacular Name	Probability of Occurrence	Habitat	Conservation Status
Pedetes capensis	Springhare	High, widespread and likely to occur.	Arid bushveld on sandy soils.	Least Concern
Phacochoerus africanus	Common Warthog	Medium, a widespread species recorded from all woodland habitat types.	Savanna areas with short grass cover and surface water.	Least Concern
Pipistrellus hesperidus	African Pipistrelle	High, likely to occur.	Savannas and urban areas with a preference for riparian vegetation.	Least Concern
Potamochoerus larvatus	Bushpig	High, a widespread species recorded from thicket habitat types.	Mainly in forested and thicket areas.	Least Concern
Rhabdomys pumilio	Striped Mouse	High, a widespread species likely to occur	Grassland with good grass cover.	Least Concern
Saccostomus campestris	Pouched Mouse	High, likely to occur.	Catholic habitat requirements. Common in sandy substrate with scrub bush or cover in open woodland.	Least Concern
Scotophilus dinganii	Yellow House Bat	High, a widespread species.	Woodland and savannah. Associated with built-up areas.	Least Concern
Steatomys pratensis	Fat Mouse	High, likely to occur.	A grassland and savanna species with a preference for riparian vegetation.	Least Concern
Sylvicapra grimmia	Common Duiker	High, a widespread species.	All biomes	Least Concern
Tadarida aegyptiaca	Egyptian Free-Tailed Bat	High, a widespread species likely to occur	Cosmopolitan, occurring in all vegetation types.	Least Concern
Taphozous mauritianus	Mauritian Tomb Bat	High, likely to occur.	Savanna and urban areas.	Least Concern
Tatera leucogaster	Bushveld Gerbil	High, likely to occupy disturbed areas on sandy soils.	Savanna on sandy soils.	Data Deficient

Scientific Name	Vernacular Name	Probability of Occurrence	Habitat	Conservation Status
Thallomys paedulcus	Acacia Rat	High, likely to occur.	Widespread in savannas.	Least Concern

Appendix 3: A list of bird species likely to occur on the study site. Species highlighted in grey were confirmed. # refers to the new SA numbers. Nomenclature, scientific and colloquial names were used according to Hockey *et al*. (2005).

#	Scientific Name	Colloquial Name
4	*Dendroperdix sephaena*	Crested Francolin
12	*Pternistis natalensis*	Natal Spurfowl
14	*Pternistis swainsonii*	Swainson's Spurfowl
16	*Coturnix delegorguei*	Harlequin Quail
20	*Numida meleagris*	Helmeted Guineafowl
41	*Turnix sylvaticus*	Kurrichane Buttonquail
45	*Indicator indicator*	Greater Honeyguide
46	*Indicator minor*	Lesser Honeyguide
49	*Prodotiscus regulus*	Brown-backed Honeybird
53	*Campethera abingoni*	Golden-tailed Woodpecker
57	*Dendropicos fuscescens*	Cardinal Woodpecker
58	*Dendropicos namaquus*	Bearded Woodpecker
65	*Pogoniulus chrysoconus*	Yellow-fronted Tinkerbird
67	*Tricholaema leucomelas*	Acacia Pied Barbet
68	*Lybius torquatus*	Black-collared Barbet
69	*Trachyphonus vaillantii*	Crested Barbet
71	*Tockus erythrorhynchus*	Red-billed Hornbill
73	*Tockus leucomelas*	Southern Yellow-billed Hornbill
76	*Tockus nasutus*	African Grey Hornbill
80	*Upupa africana*	African Hoopoe
81	*Phoeniculus purpureus*	Green Wood-Hoopoe
83	*Rhinopomastus cyanomelas*	Common Scimitarbill
85	*Coracias garrulus*	European Roller
86	*Coracias caudatus*	Lilac-breasted Roller
88	*Coracias naevius*	Purple Roller
94	*Halcyon senegalensis*	Woodland Kingfisher
96	*Halcyon albiventris*	Brown-hooded Kingfisher
97	*Halcyon chelicuti*	Striped Kingfisher

#	Scientific Name	Colloquial Name
100	*Merops bullockoides*	White-fronted Bee-eater
101	*Merops pusillus*	Little Bee-eater
102	*Merops hirundineus*	Swallow-tailed Bee-eater
107	*Merops apiaster*	European Bee-eater
108	*Merops nubicoides*	Southern Carmine Bee-eater
110	*Colius striatus*	Speckled Mousebird
111	*Urocolius indicus*	Red-faced Mousebird
112	*Clamator jacobinus*	Jacobin Cuckoo
113	*Clamator levaillantii*	Levaillant's Cuckoo
114	*Clamator glandarius*	Great Spotted Cuckoo
116	*Cuculus solitarius*	Red-chested Cuckoo
117	*Cuculus clamosus*	Black Cuckoo
119	*Cuculus gularis*	African Cuckoo
123	*Chrysococcyx klaas*	Klaas's Cuckoo
125	*Chrysococcyx caprius*	Diderick Cuckoo
131	*Centropus burchellii*	Burchell's Coucal
144	*Cypsiurus parvus*	African Palm-Swift
147	*Apus apus*	Common Swift
151	*Apus affinis*	Little Swift
152	*Apus horus*	Horus Swift
153	*Apus caffer*	White-rumped Swift
159	*Corythaixoides concolor*	Grey Go-away-bird
160	*Tyto alba*	Barn Owl
162	*Otus senegalensis*	African Scops-Owl
163	*Ptilopsus granti*	Southern White-faced Scops-Owl
165	*Bubo africanus*	Spotted Eagle-Owl
169	*Glaucidium perlatum*	Pearl-spotted Owlet
171	*Asio capensis*	Marsh Owl
172	*Caprimulgus pectoralis*	Fiery-necked Nightjar
176	*Caprimulgus rufigena*	Rufous-cheeked Nightjar
177	*Caprimulgus europaeus*	European Nightjar
179	*Columba livia*	Rock Dove

#	Scientific Name	Colloquial Name
180	*Columba guinea*	Speckled Pigeon
185	*Streptopelia senegalensis*	Laughing Dove
187	*Streptopelia capicola*	Cape Turtle-Dove
188	*Streptopelia semitorquata*	Red-eyed Dove
189	*Turtur chalcospilos*	Emerald-spotted Wood-Dove
192	*Oena capensis*	Namaqua Dove
193	*Treron calvus*	African Green-Pigeon
197	*Lophotis ruficrista*	Red-crested Korhaan
229	*Pterocles bicinctus*	Double-banded Sandgrouse
230	*Pterocles burchelli*	Burchell's Sandgrouse
272	*Burhinus capensis*	Spotted Thick-knee
291	*Vanellus armatus*	Blacksmith Lapwing
294	*Vanellus senegallus*	African Wattled Lapwing
297	*Vanellus coronatus*	Crowned Lapwing
300	*Rhinoptilus chalcopterus*	Bronze-winged Courser
303	*Cursorius temminckii*	Temminck's Courser
345	*Aviceda cuculoides*	African Cuckoo Hawk
346	*Pernis apivorus*	European Honey-Buzzard
348	*Elanus caeruleus*	Black-shouldered Kite
350	*Milvus [migrans] parasitus*	Yellow-billed Kite
361	*Circaetus pectoralis*	Black-chested Snake-Eagle
362	*Circaetus cinereus*	Brown Snake-Eagle
371	*Polyboroides typus*	African Harrier-Hawk
374	*Melierax canorus*	Southern Pale Chanting Goshawk
375	*Melierax gabar*	Gabar Goshawk
377	*Accipiter badius*	Shikra
378	*Accipiter minullus*	Little Sparrowhawk
382	*Buteo vulpinus*	Steppe Buzzard
391	*Aquila spilogaster*	African Hawk-Eagle
394	*Aquila wahlbergi*	Wahlberg's Eagle
407	*Falco amurensis*	Amur Falcon
440	*Ardea melanocephala*	Black-headed Heron

#	Scientific Name	Colloquial Name
443	*Bubulcus ibis*	Cattle Egret
457	*Bostrychia hagedash*	Hadeda Ibis
459	*Threskiornis aethiopicus*	African Sacred Ibis
534	*Oriolus oriolus*	Eurasian Golden Oriole
537	*Oriolus larvatus*	Black-headed Oriole
539	*Dicrurus adsimilis*	Fork-tailed Drongo
541	*Terpsiphone viridis*	African Paradise-Flycatcher
543	*Nilaus afer*	Brubru
544	*Dryoscopus cubla*	Black-backed Puffback
546	*Tchagra senegalus*	Black-crowned Tchagra
547	*Tchagra australis*	Brown-crowned Tchagra
551	*Laniarius ferrugineus*	Southern Boubou
552	*Laniarius atrococcineus*	Crimson-breasted Shrike
554	*Telophorus sulfureopectus*	Orange-breasted Bush-Shrike
558	*Malaconotus blanchoti*	Grey-headed Bush-Shrike
559	*Prionops plumatus*	White-crested Helmet-Shrike
565	*Batis molitor*	Chinspot Batis
571	*Corvus albus*	Pied Crow
573	*Lanius collurio*	Red-backed Shrike
575	*Lanius minor*	Lesser Grey Shrike
576	*Lanius collaris*	Common Fiscal
578	*Eurocephalus anguitimens*	Southern White-crowned Shrike
581	*Campephaga flava*	Black Cuckooshrike
586	*Parus niger*	Southern Black Tit
591	*Parus cinerascens*	Ashy Tit
598	*Hirundo rustica*	Barn Swallow
603	*Hirundo dimidiata*	Pearl-breasted Swallow
604	*Hirundo cucullata*	Greater Striped Swallow
605	*Hirundo abyssinica*	Lesser Striped Swallow
606	*Hirundo semirufa*	Red-breasted Swallow
610	*Hirundo fuligula*	Rock Martin
611	*Delichon urbicum*	Common House-Martin

#	Scientific Name	Colloquial Name
615	*Pycnonotus tricolor*	Dark-capped Bulbul
616	*Pycnonotus nigricans*	African Red-eyed Bulbul
639	*Acrocephalus palustris*	Marsh Warbler
644	*Hippolais olivetorum*	Olive-tree Warbler
645	*Hippolais icterina*	Icterine Warbler
647	*Eremomela icteropygialis*	Yellow-bellied Eremomela
650	*Eremomela usticollis*	Burnt-necked Eremomela
653	*Sylvietta rufescens*	Long-billed Crombec
655	*Phylloscopus trochilus*	Willow Warbler
661	*Turdoides bicolor*	Southern Pied Babbler
662	*Turdoides jardineii*	Arrow-marked Babbler
666	*Parisoma subcaeruleum*	Chestnut-vented Tit-Babbler
668	*Sylvia borin*	Garden Warbler
669	*Sylvia communis*	Common Whitethroat
671	*Zosterops capensis*	Cape White-eye
676	*Cisticola chiniana*	Rattling Cisticola
683	*Cisticola tinniens*	Levaillant's Cisticola
685	*Cisticola fulvicapilla*	Neddicky
687	*Cisticola juncidis*	Zitting Cisticola
688	*Cisticola aridulus*	Desert Cisticola
692	*Prinia subflava*	Tawny-flanked Prinia
693	*Prinia flavicans*	Black-chested Prinia
706	*Camaroptera brevicaudata*	Grey-backed Camaroptera
707	*Calamonastes fasciolatus*	Barred Wren-Warbler
710	*Mirafra passerina*	Monotonous Lark
712	*Mirafra africana*	Rufous-naped Lark
717	*Calendulauda sabota*	Sabota Lark
718	*Calendulauda africanoides*	Fawn-coloured Lark
733	*Eremopterix leucotis*	Chestnut-backed Sparrowlark
735	*Calandrella cinerea*	Red-capped Lark
749	*Turdus libonyanus*	Kurrichane Thrush
755	*Bradornis mariquensis*	Marico Flycatcher

#	Scientific Name	Colloquial Name
756	*Melaenornis pammelaina*	Southern Black Flycatcher
757	*Sigelus silens*	Fiscal Flycatcher
758	*Muscicapa striata*	Spotted Flycatcher
761	*Myioparus plumbeus*	Grey Tit-Flycatcher
767	*Cossypha caffra*	Cape Robin-Chat
768	*Cossypha humeralis*	White-throated Robin-Chat
776	*Cercotrichas leucophrys*	White-browed Scrub-Robin
777	*Cercotrichas paena*	Kalahari Scrub-Robin
782	*Saxicola torquatus*	African Stonechat
787	*Oenanthe pileata*	Capped Wheatear
792	*Cercomela familiaris*	Familiar Chat
800	*Lamprotornis nitens*	Cape Glossy Starling
804	*Lamprotornis australis*	Burchell's Starling
806	*Cinnyricinclus leucogaster*	Violet-backed Starling
808	*Creatophora cinerea*	Wattled Starling
810	*Acridotheres tristis*	Common Myna
818	*Chalcomitra amethystina*	Amethyst Sunbird
828	*Cinnyris talatala*	White-bellied Sunbird
832	*Cinnyris mariquensis*	Marico Sunbird
836	*Bubalornis niger*	Red-billed Buffalo-Weaver
837	*Sporopipes squamifrons*	Scaly-feathered Finch
838	*Plocepasser mahali*	White-browed Sparrow-Weaver
840	*Ploceus intermedius*	Lesser Masked-Weaver
846	*Ploceus velatus*	Southern Masked-Weaver
847	*Ploceus cucullatus*	Village Weaver
851	*Anaplectes rubriceps*	Red-headed Weaver
854	*Quelea quelea*	Red-billed Quelea
857	*Euplectes orix*	Southern Red Bishop
861	*Euplectes albonotatus*	White-winged Widowbird
867	*Amandava subflava*	Orange-breasted Waxbill
868	*Ortygospiza atricollis*	African Quailfinch
869	*Amadina erythrocephala*	Red-headed Finch

#	Scientific Name	Colloquial Name
870	*Amadina fasciata*	Cut-throat Finch
875	*Estrilda erythronotos*	Black-faced Waxbill
878	*Estrilda astrild*	Common Waxbill
880	*Granatina granatina*	Violet-eared Waxbill
881	*Uraeginthus angolensis*	Blue Waxbill
884	*Pytilia melba*	Green-winged Pytilia
886	*Lagonosticta senegala*	Red-billed Firefinch
889	*Lagonosticta rhodopareia*	Jameson's Firefinch
890	*Spermestes cucullatus*	Bronze Mannikin
893	*Vidua chalybeata*	Village Indigobird
897	*Vidua regia*	Shaft-tailed Whydah
898	*Vidua macroura*	Pin-tailed Whydah
899	*Vidua paradisaea*	Long-tailed Paradise-Whydah
901	*Passer domesticus*	House Sparrow
903	*Passer melanurus*	Cape Sparrow
904	*Passer diffusus*	Southern Grey-headed Sparrow
906	*Petronia superciliaris*	Yellow-throated Petronia
908	*Motacilla capensis*	Cape Wagtail
915	*Macronyx capensis*	Cape Longclaw
920	*Anthus cinnamomeus*	African Pipit
925	*Anthus similis*	Long-billed Pipit
929	*Anthus caffer*	Bushveld Pipit
935	*Serinus atrogularis*	Black-throated Canary
937	*Serinus mozambicus*	Yellow-fronted Canary
947	*Emberiza impetuani*	Lark-like Bunting
948	*Emberiza tahapisi*	Cinnamon-breasted Bunting
950	*Emberiza flaviventris*	Golden-breasted Bunting