PROPOSED GSP NOMR: MOPANE PROJECT

BIODIVERSITY REPORT

Final Draft Impact Assessment Report

OCTOBER 2013

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Indemnity and conditions relating to this project

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on desktop assessment techniques, limited by time and budgetary constraints, relevant to the type and level of investigation that was undertaken. The author reserves the right to modify aspects of the report including the recommendations, if and when new information becomes available from on-going research, or further work in this field pertaining to this investigation.

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Author(s)

Mr. Percy Mhinga: is a qualified Natural Scientist and holds a honours degree (Bsc(Hons) – Environmental Science and Botany Majors) from Rhodes University. With 11 years' experience in environmental consulting in South Africa and Mozambique. He was involved in the development of a large number of Environmental Management Plans for a range of small to large projects, including large EIA's for heavy mineral mining projects as well as the development of Environmental management tools, such as strategic EMP's and State of Environment Reporting. He has gained considerable experience in project management, which is complemented by his skills in Environmental management

He has also been involved in the successful co-ordination, development of tools and course notes, quality checks of an accreditation of an introductory course in environmental impact assessment procedures with Rhodes University.

Mr Jamie Pote has a BSc honours degree in Botany and Environmental Science, specialising in Ecology, Rehabilitation and Invasive Alien Plant Management with 10 years' experience in Southern, West and Central Africa. This experience spans across a broad spectrum of habitats and operations. These operations include; mining, residential and resort developments, conservation projects, service provision and infrastructure, including power-lines, roads and pipelines, by conducting Biophysical and Ecological Assessments and compiling Environmental Management Plans.

Mr Mark Marshal of Sandula Conservation assisted with the faunal survey and assessment (Terrestrial Mammals, Reptiles and Amphibians).

Miss Jordane Visagie has a BA degree in English and Sociology and assisted with the report compilations and field work.

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Declaration of Independence

We the authors (Mr Percy Mhinga, Mr Jamie Pote and Mr Mark Marshall), declare that we are independent consultants and have no business (financial, personal or other interest) in the proposed Project application or appeal in respect of which we were appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of us performing such work.

Glossary of terms used in this report

CARA	Conservation of Agricultural Resources Act 43 of 1983
CoAL	Coal of Africa Limited
DEA	Department of Environmental Affairs
DEMC	Desired Ecological Management Class
DMR	Department of Mineral Resources
Ecological integrity	Overall functioning of the ecological system as a whole
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity Classification
EMC	Ecological Management Class
EMP	Environmental Management Plan
ESS	Ecosystem Services
GSP	Greater Soutpansberg Project
IAPs	Interested and Affected Parties
LEDET	Limpopo Department of Economic Development, Environment and Tourism
LEMA	Limpopo Environmental Management Act 7 of 2003
LM	Local Municipality
LoM	Life of Mine
MIA	Mining Infrastructure Area
MPRDA	Mineral and Petroleum Resources Development Act 28 of 2002
MRA	Mining Right Application
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act 107 of 1998
NEMBA	National Environmental Management: Biodiversity Act 10 of 2004
NFA	National Forest Act 84 of 1998
NOMR	New Order Mining Right
PEMC	Present Ecological Management Class
PES	Present Ecological State
RDL	Red Data List
RoM	Run of Mine
REC	Recommended Ecological Category
SANBI	South African Biodiversity Institute
SoER	State of the Environment Report
SSC	Species of Special Concern
TOPS	Threatened of Protected Species
VBR	Vhembe Biosphere Reserve
WBR	Waterberg Biosphere Reserve

1 Background and Introduction

1.1 Introduction

Phaki Phakanini Environmental was appointed to undertake and compile a terrestrial Ecological Assessment for a proposed Mopane coal mining project. The mine is located within the Greater Soutpansberg to the West of Mopane, in the Limpopo Province.

1.2 Terms of Reference

The terms of reference for biodiversity assessment are as follows:

1. Undertake one field assessment site visit and compile detailed species lists (fauna & flora) using appropriate sampling methodology across affected communities.
2. Identify protected and listed species.
3. Assessment of vegetation communities and conservation status (PES /EIS), ecosystem services and processes and ecological sensitivity analysis based on available relevant Regional Planning Biodiversity Frameworks.
4. Identify and map conservation areas/initiatives, including biosphere reserves, parks/game reserves, important bird areas, biodiversity programmes, etc.
5. Compile a sensitivity map of vegetation communities incorporating the above.
6. Assess potential impact and quantification thereof (as far as possible) on the above.
7. Recommend appropriate mitigation measures to reduce the identified impacts.
8. Identify any gaps in knowledge that can be translated to so called 'red-flags' or risks for the activity if necessary, and identify potential additional study requirements if necessary.
9. Compile Biodiversity monitoring plan for EMP.
10. Identify legal (permitting) requirements.

1.3 Plan of Study

The proposed Biodiversity Assessment Plan of Study is as follows:

1. Compile scoping report (desk-top inputs).
2. Undertake one spring (September/October) and possibly summer (early 2014) detailed field assessment site visit (fauna and flora specialists). This will be limited by the project schedule.
3. Undertake flora surveys using a mix of quadrat sampling and transect walk techniques.
4. Compile a Multivariate vegetation community analysis from quadrat and transect samples.
5. Undertake day and night (nocturnal) faunal survey to include the following techniques:
    a. Vehicle and foot transects, including night survey with torches and spotlight for nocturnally active faunal species.
    b. Pitfall, funnel and drift line traps at key localities to trap small faunal species.
    c. UV night trap surveys with for nocturnal insects.
    d. Scat and sign search transects for mammals and physical searching for amphibians, reptiles and small mammals (rocks and termite mounds).
    e. Interviews with Game farm managers/game guides to collect local knowledge.

6. Compile detailed species lists (fauna & flora) using appropriate sampling methodology across affected communities.
7. Identify SSC – red listed, protected and other listed species.
8. Assessment of vegetation communities and conservation status (PES /EIS), ecosystem services and processes and ecological sensitivity analysis based on available relevant Regional Planning Biodiversity Frameworks.
9. Identify and map conservation areas/initiatives, including biosphere reserves, parks/game reserves, important bird areas, biodiversity programmes, etc.
10. Compile a sensitivity map of vegetation communities as well as important faunal areas, incorporating the above.
11. Assess potential impact and quantification thereof (as far as possible) on the above.
12. Recommend appropriate mitigation measures to reduce the identified impacts.
13. Identify any gaps in knowledge that can be translated to so called 'red-flags' or risks for the activity if necessary and identify potential additional study requirements if necessary.
14. Compile Biodiversity monitoring plan for EMP.
15. Identify legal (permitting) requirements.

1.4 Vegetation and Flora Methodology

- A late winter detailed field assessment and floral survey was undertaken, which was limited by the project schedule and farm access.
- A detailed species lists has been compiled based on field observations, but largely on previous studies in the area, due to significant seasonal constraints
- Species of special concern have been identified as far as possible, but dormant and annual species could not be adequately identified as sampling was undertaken during the dry season..
- Assessment of vegetation communities and conservation status (PES /EIS), ecosystem services and processes and ecological sensitivity analysis based on available relevant Regional Planning Biodiversity Frameworks and site assessment (limited by seasonal constraints.
- Conservation areas/initiatives, including biosphere reserves, parks/game reserves, important bird areas, biodiversity programmes, have been identified and mapped
- A sensitivity map of vegetation communities as well as important faunal areas, incorporating the above has been compiled, but is limited in extent due to farm access issues..

1.5 Faunal Methodology and Field Methods

An in depth study of faunal species (both vertebrate and invertebrate) was conducted alongside the floral assessment, which studies the impacts of the proposed mine. This is to ascertain whether the mine will be destructive to the habitats of the species. The site visits were conducted (on parts of the area) to discover; species presence and activity, natural habitats, ecological functioning and the behaviour aspects of present species.

Vegetation communities that provide individual habitats for faunal species include; rocky outcrops, woodland, thicket, riparian vegetation and savanna grassland. These habitats function together as one complete unit and, as individuals, are unable to function without the other. They are formed by

the rock type, soil form and surface gradient, position to the sun, presence of water and available vegetation. This information has been gathered through a detailed investigation of the habitats.
Any form of development will have an impact on the faunal component. Mining activities will invariably alter and disturb the natural habitats, which will ultimately lead to a loss of habitat as some species are heavily dependent on their habitat (habitat specific).

Therefore this study has been conducted to identify and recognise the functioning of these habitats, as well as to determine the impacts (in terms of their significance) and mitigation measures that will be needed.

The following field methods were utilised for the identification of faunal species:

- An on foot site visit was conducted to physically inspect the study area through evidential presence; such as spoor, droppings (scat), bird nest, etc. Results were recorded.
- Drift line traps as shown on figure 1-2 below were set to verify presence of reptiles, small mammals and insects (morning and evening). Traps were checked at 10 hour intervals.
- Netted funnel traps were set in pathways between rock crevices to trap lizards (figure 1-1).
- Night road cruses and torch walks were also conducted to ascertain faunal presence.
- A desktop study was also conducted to support findings.
- A sheet with a light shone behind it, was suspended at night to attract nocturnal invertebrates (figure 1-3)

Figure 1-1: Netted funnel traps in on rocky outcrop.

Figure 1-2: Drift line trap with submerged buckets.

Figure 1-3: Sheet with light behind to attract insects at night.

After the vertebrate components of faunal species were identified, they were then divided into specific categories; invertebrates, amphibians, reptiles, mammals and birds. Each species was then studied in terms of social behaviour, breeding, feeding grounds and micro habitat. As a result of this, it was found that certain groups of species co-exist with one another, therefore occupying the same habitat. Habitats are either occupied at the same time or at different times, within yearly or twenty-four hour cycles.

The following questions were taken into account during investigation:

- Where is the animals' territory and is its habitat permanent or temporary?
- Is the animal habitat specific or generalized?
- Is the animal solitary or gregarious?
- Where does it retreat to during periods of roosting?
- What are its migratory patterns?

1.6 Limitations

In order to obtain a comprehensive understanding of the dynamics of the communities and status of the endemic (rare or threatened species in an area), ecological studies should be ideally replicated over several seasons and over a number of years. However, due to time constraints such long-term studies are not always feasible.

- The results of this assessment report are based on a single mid-winter site visit and accompanying desktop assessment including findings of an assessment report of the farm Voorburg.
- No invertebrate studies are available for the study area, but a limited study was undertaken based on observations and available literature. Light and pitfall traps were also tested but results were poor due to season (cold and very dry).
- Traps were used for small mammals and reptiles, but these were not effective due to the cold and dry conditions.
- All biodiversity surveys were only conducted in one season (dry winter season). Due to the arid climate with a very dry winter, the vegetation is deciduous, with only a few tree species retaining leaves. The herbaceous layer is absent, which limits the effectiveness of conducting vegetation surveys. An early spring (within a few weeks of the first rainfall) and mid to late summer survey is strongly recommended due to the scale of the project. This resulted in numerous constraints to sampling and the effectiveness of a applying a multivariate community analysis as per the terms of reference. Data collected is thus considered to be incomplete at this point in time. Referring to the IAIA guidelines and NEMA, this can be regarded as a fatal flaw:
    - 'Lack of information about the receiving environment to determine reliably whether impacts on biodiversity could be significant.'
    - 'A risk-averse and cautious approach should be taken where either information and/or the level of understanding is inadequate, where impacts are unprecedented or where there is inherent uncertainty as to the significance of impacts, or there is an element of substantial risk of irreversible impacts which could lead to irreplaceable loss of natural capital' - NEMA (Section 3.1)
- Limited access to farms and time available on some farms within the study area has limited the effectiveness and accuracy of vegetation mapping.

- The biodiversity specialist has not been involved in the mine layout pre planning and planning aspects of the EIA process.
- The farms Ancaster, BANFF, Cavan, Delft, Du Toit, Faure, Hermanus, Jutland, Pretorius, van de Byl, Verdun, Voorburg & Vrienden were fully surveyed as far as possible based on the access time available:
- The farms Vera small holdings, Ancaster and parts of the farm Voorburg were partly surveyed.
- The farms Cohen, Honeymoon, Krige, Bierman, Mons, Schalk, Stubbs, Ursa Minor, Scheveningen were not investigated.

1.7 Legislation Framework

The following legislative frameworks are applicable to the development of the Soutpansberg area:

- Act No. 107 of 1998: National Management Act (NEMA)
- Act No. 36 of 1998: National Water Act (NWA) – refer to Water Specialist Report
- Act No. 10 of 1983: Conservation of Agricultural Resources Act (CARA)
- Act No. 84 of 1998: National Forest Act (NFA) – Alien Invasive Species
- Act No. 7 of 2003: Limpopo Environmental Management Act (LEMA)
- Act No. 57 of 2008: National Environmental Management: Protected Areas Act
- Act No. 101 of 1998: National Veld and Forest Fire Act
- GN No. R.544, R.545 and R.546 of June 2010: NEMA: EIA Regulations
- GN No. R.152 of 2007: NEMBA: Threatened or Protected Species (TOPS) Regulations.

1.7.1 International guidelines and standards

The following international guidelines need to be taken into consideration.

Table 1.1: International Legislation Overview

1	Ramsar Convention (1972)	The Ramsar Convention on Wetlands of International Importance especially as waterfowl habitat was adopted on 02/02/1971 and ratified on 12/03/1975. This convention provides for the conservation and sustainable use of wetlands through national and international cooperation as a means of achieving sustainable development throughout the world. The enabling legislation in SA is the National Environmental Management: Biodiversity Act 10 of 2004 (Van der Linde 2006).
2	World Heritage Convention for protection of the world cultural and natural heritage (1972)	This convention aims to promote cooperation among nations in order to protect natural and cultural heritage and was ratified on 10/07/1997. The enabling legislation is the World Heritage Convention Act 49 of 1999 (Van der Linde 2006).
3	CITES (1975)	This convention aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival and was ratified on 15/07/1975. South Africa has not enacted specific legislation but relies on enforcement through the respective provincial legislation (Van der Linde 2006).

4	Convention on the Conservation of Migratory Species of Wild Animals (1979)	This convention addresses the need to cooperate in the conservation of animals that migrate across national borders and include terrestrial mammals, reptiles, marine species and birds. Special attention is given to the protection of endangered species (Van der Linde 2006). This convention was acceded on 01/12/1991 and the enabling legislation is the World Heritage Convention Act 49 of 1999.
7	Convention on Biological Diversity (1992)	This convention has three main goals: i. the conservation of biological diversity; ii. the sustainable use of its components; and iii. the fair and equitable sharing of the benefits from the use of genetic resources. This convention was ratified on 02/11/1995, acceded on 14/08/2003 and the enabling legislation is the National Environmental Management: Biodiversity Act 10 of 2004 (Van der Linde 2006).
9	The UN Framework Convention on Climate Change (1992)	The purpose is to achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with climate systems. This convention was ratified on 29/08/1997, acceded on 27/08/1997 and the enabling legislation is the National Environmental Management: Air Quality Act 39 of 2004 (Van der Linde 2006).
17	SADC Protocol on Wildlife Conservation and Law Enforcement (1999)	Article 5 of the SADC Treaty states that the sustainable use of natural resources and effective protection of the environment are key objectives of SADC. To implement article 5, the protocol ensures *inter alia*, the conservation and sustainable use of wildlife resources under the jurisdiction of each member state through cooperation at national level among governmental authorities, non-governmental organisations, and the private sector and to take appropriate measures to ensure the conservation and sustainable use of wildlife. It was ratified on 24/07/2003 but with no enabling legislation (Van der Linde 2006).
19	SADC Protocol on Forestry (2003)	The protocol applies to all activities related to development, conservation, sustainable management and utilization of all types of forests and trees, as well as the trade in forest products. It was signed on 03/10/2002 but with no enabling legislation (Van der Linde 2006).

1.7.2 Licensing Requirements

The following licensing requirements may be applicable to the proposed project.

No	ASPECT	SECTION	REQUIRED ACTION SUMMARIZED	ISSUES AND CHALLENGES
Limpopo Environmental Management Act, 2003 (LEMA)				
1	Private Nature Reserves Occurring within the proposed development area.	21(4) a & b	The MEC may withdraw the declaration on the written application by the owner of the privately owned land; or when the MEC deems it necessary.	No permit can be obtained to mine in a nature reserve – it is prohibited. The possibility do however exist to buy these areas and apply for de-proclamation. If the NR is however of high conservation value, this will probably not be considered by LEDET. A possibility exist to consider a biodiversity offset program where the biodiversity lost as a result of the mine on a specific locality are "set-off" against conservation initiatives and other areas. The implications of protected area legislation, in so far as the rights of the holder of the mining rights of land proclaimed as NR, especially when proclaimed under previous legislation where no public participation process was conducted, is uncertain. No Private Nature Reserves occur in the study area.
		28(1)	No person may conduct prospecting, mining or related operations within a Provincial Nature Reserve, a Protected Environment, a Private Nature Reserve or a Resource use area, except with the approval of the Executive Council, or on a site of ecological importance	
2.	Risk of killing/injure/ catch/pickup/ remove "listed/protected" animals on land owned by the client.	35 (3)	No person may without a permit catch specially protected wild animals, protected wild animals, game and non-indigenous wild animals.	These actions may be performed under a permit. Issuance of the permit will be considered based on carious environmental considerations. The client will have to apply for various permits if mining is to continue, for example when animals are caught and relocated as part of a rescue operation. Although there are many exceptions and special cases with regard to the type and number of permits required by the client, the most important factors that will influence the type and number of permits required are the actions to be undertaken, whether a species is listed and in which

No	ASPECT	SECTION	REQUIRED ACTION SUMMARIZED	ISSUES AND CHALLENGES
	Risk of killing/injure/ catch/pickup/ remove "listed/protected" animals on land owned by the client.	35 (5)	No person may without the written permission of the owner of the land, catch a wild or alien animal on land of which that person is not the owner.	category a species is listed in LEMA, whether or not the land on which these species occur belongs to the client, and lastly the survival potential of the animals at the new destination if they are to be relocated. Because of the complexity of the matter (different species, requiting different actions and possibly different relocation strategies), it is recommended that a specialist be appointed to manage the entire process, relocation and permit applications. A single scenario cannot be contemplated at this stage in the process.
	Actions resulting in acquiring, possessing, conveying, keeping, selling, purchasing, donating or receiving as a gift "listed/ protected" animals.	41 (1) a	No person may without a permit acquire, possess, convey, keep, sell, purchase, donate or receive as a gift, any specially protected wild animal, protected wild animal, game, non-indigenous wild animal or animals referred to in Schedules 7 or 8.	
	Convey any live wild or alien animal	41 (2)	No person may without a permit in terms of this Act or other document prescribed by other relevant legislation, convey any live wild or alien animal through the Province.	
3	Impact of mining activities on aquatic	58 a, b, c	No person may deposit into an aquatic system any solid, liquid or gaseous	No permit can be obtained, it is prohibited actions.

No	ASPECT	SECTION	REQUIRED ACTION SUMMARIZED	ISSUES AND CHALLENGES
	ecosystems and biota.		substance or thing which may, injure, damage or kill, or in any way be harmful to, aquatic biota: cause or allow such substance or thing to enter or percolate into an aquatic system; or carry on a business or occupation which may result in any such substance or thing entering or percolating into an aquatic system, without taking adequate precautions to prevent such substance or thing from entering or percolating into that aquatic system.	If the law is contravened, the polluter will be fined and may be required to pay all costs for rehabilitation and corrective action.
			In some cases, aquatic biota may be collected under a permit.	In some cases, aquatic biota may be collected under a permit
4	Impact of mining activities on invertebrates.	61, 62 and 63	No person may without a permit conduct certain activities, only for those species listed in Schedule 10.	Permits may be applied for if necessary.
5	Damaging, removal, etc of indigenous vegetation.	61 (1-5)	No person may without a permit pick, be in possession of, sell, purchase, donate, receive as a gift, import into, export or remove from the Province, or convey a specially protected plant; or pick, sell, purchase, donate, receive as a gift, import into, export or collect firewood, or remove from the Province, or convey a protected plant; or pick any indigenous plant: on a public road; on land next to a public road within a	Activities are regulated under permit, and are amongst other aspects, dependent on whether a species is listed and in which category a species is listed in LEMA, whether or not the land on which these species occur belong to the client, and lastly the survival potential of the plants at the new destination if they are to be relocated. Because of the complexity of the matter (different species, requiring different actions and possibly different relocation strategies) it is recommended that a specialist be appointed to manage the entire process, relocation and permit applications.

No	ASPECT	SECTION	REQUIRED ACTION SUMMARIZED	ISSUES AND CHALLENGES
			distance of 100 meters measured from the centre of the road; within an area bordering any natural water course, whether wet or dry, up to and within a distance of 50 meters from the high watermark on either side of the natural water course; or in a Provincial Nature Reserve, a Site of Ecological Importance, a Protected Environment or a Private Nature Reserve	
7	Littering	89	No person may discard, dump or leave litter on any land, water surface, street, road or site to which the public has access, except in a container or at a place which has been specially indicated, provided for or set aside for such purpose.	Prohibited activity.
8	Waste management	92	Aspects relating to waste management is regulated, including management, location, planning and design of the waste site, disposal of waste, etc.	Regulated under permit and waste management license.
9	Noise, vibration and shock	93	Aspects relating to noise, vibration and shock is regulated, including; management, definition, prevention, levels, measuring, etc.	Regulated under permit and the MEC may make regulations.
National Environmental Management: Biodiversity Act No. 10 of 2004 / Threatened or Protected Species Regulations, 2007 (TOPS)				
2, 4, 5	Impacts on nationally protected species of plants and	All	Where a species is protected by both national and provincial legislation, a single permit application can be submitted to the provincial office as per	Regulated under national permit. One application process, with a permit for both provincial and national legislation.

No	ASPECT	SECTION	REQUIRED ACTION SUMMARIZED	ISSUES AND CHALLENGES
	animals.		the national requirements.	
3 and others 27	Impacts on threatened/protected ecosystems	All	Regulations have not be promulgated yet, and until it is done, the precautionary principle will be applied for all perceived threatened ecosystems. No person may operate a captive breeding operation, commercial exhibition facility, nursery, scientific institution, sanctuary, rehabilitation facility or act as a wildlife trader involving specimens of any listed threatened or protected species, unless that breeding operation, commercial exhibition facility, nursery, scientific institution, sanctuary, rehabilitation facility or wildlife trader is registered in terms of this Chapter with the issuing authority.	The proposed development area and more especially the riparian zone, has been classified by some experts as threatened, although not listed specifically in NEMA yet and will therefore be regulated under permit of other legislation and the EIA process. Registration of a nursery is required.
National Forest Act, 1998				
11	Impacts on protected plant species as per NFA.	All	Activities similar to the LEMA listed activities are regulated under permit. A separate permit application for species listed under environmental and forestry legislation has to be submitted, each to the relevant authority.	Regulated under permit. Two different permits, one for LEMA and one for NFA.
National Environmental Management: Protected Areas Act, 2003				
1	Mining and Nationally Protected Areas	12	A protected area which was proclaimed as a protected area or nature reserve in terms of provincial legislation for any	If a nature reserve within the proposed development area have be proclaimed a long time ago under provincial legislation, it is considered a protected area under NEMPA.

No	ASPECT	SECTION	REQUIRED ACTION SUMMARIZED	ISSUES AND CHALLENGES
			purpose for which an area could in terms of this Act be declared as a nature reserve or protected environment, must be regarded to be a nature reserve or protected environment for the purpose of this Act.	No protected areas have been proclaimed in the study area.
		24	A protected area/ nature reserve may be de-proclaimed in some instances.	If an area does not have the national priority as a protected area, the landowner may apply for de-proclamation.
		48	Despite other legislation, no person may conduct commercial prospecting or mining activities in a special nature reserve or nature reserve.	New mining prohibited. Only where legal mining did take place before the proclamation of the Act, consideration will be given in consultation with the relevant Cabinet members.
Environment Conservation Act and Regulations GN154 (Act 73 of 1989)				
			Development must be environmentally, socially and economically sustainable. Sustainable development requires the consideration of and inter alia the following factors: Environmental management must place people and their needs at the forefront of its concern, therefore any environmental impacts resulting from the development activities are not distributed in such a manner as to unfairly discriminate against any persons, particularly vulnerable and disadvantaged persons. The developer is required to undertake	• that pollution and degradation of the environment is avoided, or, where they cannot be altogether avoided, are minimised and remedied; • that waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible or otherwise disposed of in a responsible manner; • that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource; • that the development use and exploitation of renewable resources and the eco-systems of which they are a part of do not exceed the level beyond which their integrity is jeopardised; and • that negative impacts on the environment and on peoples' environmental rights be anticipated and prevented, and where they

No	ASPECT	SECTION	REQUIRED ACTION SUMMARIZED	ISSUES AND CHALLENGES
			Environmental Impact Assessments for all projects listed as a Schedule 1 activity in the Environmental Impact Assessment (EIA) regulations in order to control activities which might have a detrimental effect on the environment. Such activities will only be permitted with written authorisation from a competent authority.	cannot be altogether prevented are minimised and remedied.
Conservation of Agricultural Resources Act 43 of 1983 and Conservation of Agricultural Resources Regulations.				
		6	The Minister may prescribe control measures with which all land users have to comply.	The control measure may relate to the following: • the regulating of the flow pattern of run-off water; • the control of weeds and invader plants; • the restoration or reclamation of eroded land or land which is otherwise disturbed or denuded;

2 Project Description

The mining project is located over 21 farms and split into two sections: Voorburg (905 ha) and Jutland (667 ha). The footprint covers 1572 ha for mining and a further 1964 ha of infrastructure and development. The Voorburg mining footprint is restricted by the Sand River, which runs along the northern side.

2.1.1 Mining Operations

Methodology

The project has the potential to produce a good quality, semi-soft cooking coal, as well as a dometic thermal coal product. Using open cast mining methods the mines are mineable to a depth of 200 m, with an estimate of 633.48 million tonnes produced during the life span of the mines. Strip open cast mining will prove to be the most effective method due to the flat nature of the coal, and will prove most cost effective.

The design of the mine is based on an estimated production rate of 5 million product tonnes per annum (Mtpa) RoM for the full LoM production. The average yield of the wash plant (Voorburg) is estimated at 26% for cooking product and 37% for the thermal domestic product (30% ash). The overall percentage comes to 63% for an estimated 133 million tonnes (Mt) over 33 years.

Coal will be mined using conventional truck and shovel operations and modelled to be mined by excavators with a capacity of 1400 bank cubic meters per hour (bcm/h). Recovery operations will be conducted by large hydraulic excavators in a backhoe configuration, for management of the complexity of the deposit.

Annual waste over the first 12 years is anticipated to vary between 14 and 24 million bank cubic meters (Mbcm) at an average rate of 22 Mbcm. The wasted for the remainder of the project is estimated at 11 Mbcm. 220 tonne diesel trucks have been allocated for the movement of waste.

Mining Schedule

Once the mining right has been granted (anticipated for 2015), further exploration and studies will be conducted to produce the final design. Construction will then commence at the Voorburg section in 2018, with production starting late 2019 and will run for a period of 33 years producing 2.5 Mtpa.

Due to railway constraints, additional capacity will only become available after 2030, thus allowing development at the Jutland Section to commence. Production at the Jutland section is anticipated to start in 2032 and will run for a period of 28 years producing 2.5Mtpa.

The total life span of the project is estimated at ±50 years.

2.1.2 Coal Processing

The first phase is to develop a coal beneficiation plant that will be able to process RoM at Voorburg at a rate of 4 Mtpa. After production commences the next phase would be to establish a new facility at Jutland of the same capacity, even though the yields of cooking and thermal domestic products differ.

2.1.3 Infrastructure

The mine infrastructure will provide support for the mining activities. A processing plant will be centrally located between the two sections and close to the Mopane Railway Station. The Infrastructure Hub (processing plant) will be composed of the following structures:

- Coal washing plant
- Personnel support structures
- Vehicle support structures
- Water management structures
- Management and monitoring systems.

A conveyor belt will be used for transportation between the sections. Other infrastructure includes:

- Access roads
- Mining roads
- Mine reside dumps
- Topsoil dumps and berms
- Office and resource handling facilities
- Stormwater management infrastructure
- Onsite water management

Access Roads

Access to the Infrastructure Hub is via the N 1 towards Musina and west on the D 525 7 km to the Mopane Railway Station. The D 525 Provincial road is a gravel road and requires upgrading to a surfaced road in order to carry the required traffic for mine development.

Access to the Voorburg Section is along the R 525, 7 km north of the Railway Station. The main entrance to the Jutland Section is 3 km south of the Railway Station, via the gravel road that runs adjacent to the railway line.

Mining Roads

Voorburg and Jutland sections, stockpile and infrastructure areas need to be linked from the west, central and east sides via haul roads. Haul roads are planned to be 30 m wide with gravel surfaces so as to meet the load requirements of the hauling fleet.

Service roads are to provide ease of access to remote areas for light mining vehicles. As a site safety measure, these service roads will also be made from gravel and will be separate from the haul roads.

Top Soil and Berms

Topsoil will be stripped from the pit mining areas, roads and terrace areas, as close as possible to the point of stripping. Topsoil will be used as fill material for construction of berms, to act as isolating material between discards, as well as capping material during final rehabilitation.

Storm Water Management

As water is a scarce commodity, every effort has been made to conserve and reuse as much of it as possible. Water management strategies will address the following issues:

- Water uses and users – with focus on consumption rates
- Engineering design for water reticulation and distribution systems required for infrastructure, mining and beneficiation operations
- Sewage treatment and disposal
- Dirty water collection and management, including flood protection.

Clean Water Run-Off

Clean storm water run-offs are to be diverted around infrastructure, mines and dump areas. Diversions are to be position on the southern boundaries to be collected and conveyed into the closest natural river course.

Dirty Water Run-Off

Dirty and polluted water run-offs from carbonaceous stockpiles must be retained and recycled on site.

2.1.4 Mine Residue Management

Mine residue dumps are required to accommodate overburden, partings and plant discards. They are a cost effective way of minimizing the volume and surface area required for stockpiling. In – pit backfilling as a double handling of material (the alternative to mine reside dumps) is costly and inefficient.

Mine reside is categorised as; topsoil stockpiles, non-carbonaceous stockpiles and carbonaceous stockpiles.

2.1.5 Closure Planning and Rehabilitation

A detailed Mine Rehabilitation Plan has been developed for Makhado Colliery and includes:

- A Material Placement Plan to ensure free draining of the landform
- Topsoil Management Plan
- Re-vegetation (Reclamation Plan)
- Sustainable utilisation of natural resources.

3 Regional Setting

3.1 Site Location

3.1.1 Locality

The Greater Soutpansberg Mopane Project forms part of the Great Soutpansberg Project (GSP) and is situated north of the Soutpansberg in the Limpopo Province. The area of study is located 63 km (via road) from Makhado, 73 km west of Mopane, in the Musina and Makhado Municipality areas of the Limpopo Province (Figure 3-1).

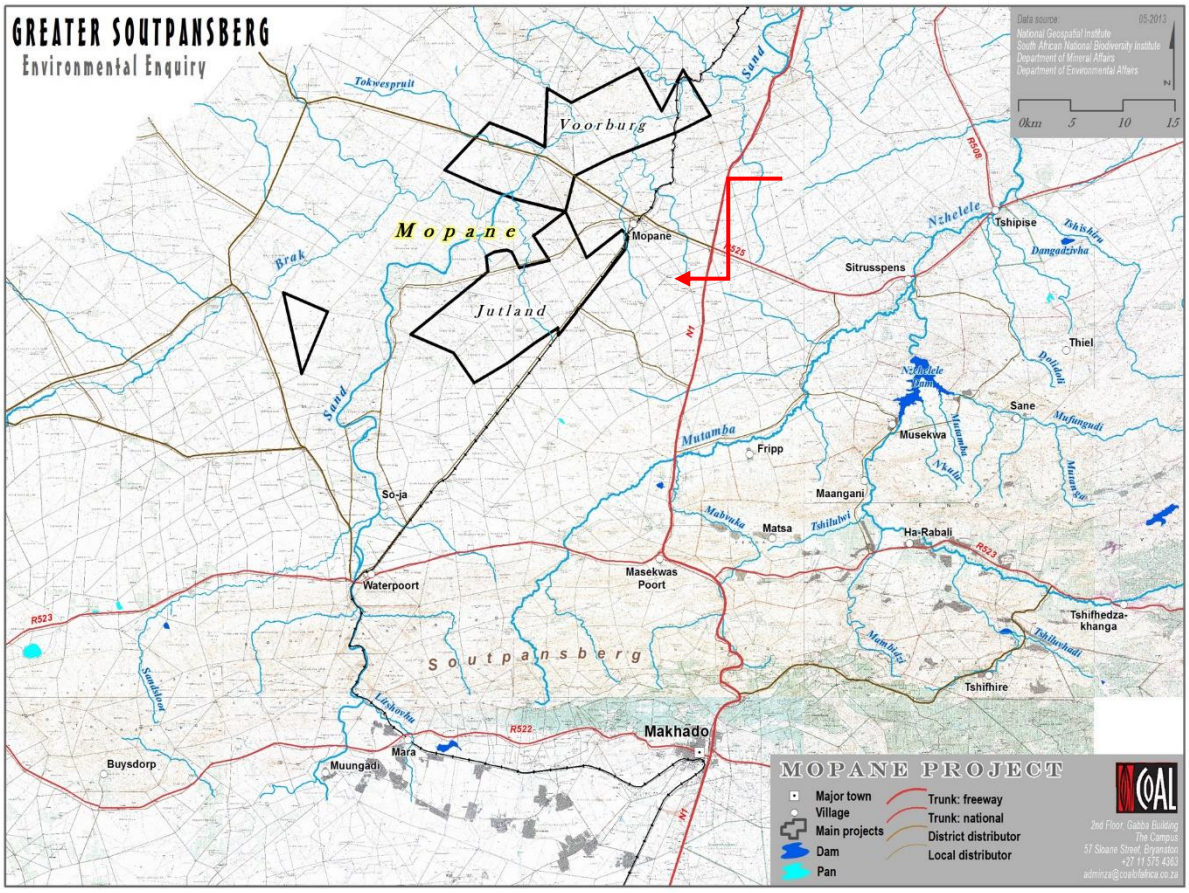

Figure 3-1: Locality Map

3.1.2 Climate

A. Regional climate

The Mopane project is situated north of the Soutpansberg in a semi-arid zone. The climate is influenced by the mountain range that is orientated east – west, and acts as a barrier between the Indian Ocean south-eastern maritime climate and the northern continental climate influences.

Rainfall during the summer months (October and March) is 300 to 400 mm with very dry winters from May to August. Temperatures range from 0.9 – 39.9 °C and the area is generally

frost free. Climate is affected by the wind patterns from mountains. Wind effects erosion, aridification and air warming.

Temperature

Information regarding the average monthly temperatures was gathered from the Tshipise Weather Station which is situated 32 km south-east of the project area. In the summer months, from November to February, the temperatures range between 33 – 20 °C, while winter (May to August) temperatures range between 28 and 7 °C.

Winds

The project area is predominated by a south-eastern wind with speeds ranging from 0.5 – 3.6 m/s and 21. – 3.6 m/s. Secondary winds have been noted coming from the east.

Effect of climate on Ecology

The arid climate, low rainfall with a high variability, high temperatures and high evaporation rates, are together with shallow rocky soils the most important environmental factors, which also determine the vegetation composition of this area. It also influences and determines, especially without active management, the success of vegetation rehabilitation programmes or veld condition improvement programmes. The variability of the amount and time of rainfall is critical for the production of grass, the availability of grazing and brows and thus the carrying capacity, stocking rates and survival of game and livestock. The available browse is also limited by severe droughts and low and erratic rainfall patterns, which can lead to a decrease in the amount of browse material available to game and livestock. Water is thus one of the most critical environmental factors playing a role in the ecology of the region and determines to a large extent the landuse potential and utilisation options of these semiarid areas.

The significant influence of climate is also noticeable in the large amount of cattle farms that have been transformed to game farms in the past 3 decades in the region. Game species that occurred historically in these areas are more adapted to the climatic conditions and habitat types of the region. Game farming and associated hunting and ecotourism activities are the most common land uses in the region.

3.1.3 Topography

The landscape is generally comprised of irregular plains north of the Soutpansberg Mountains, with some relief, with hills and ridges in areas. Non-perennial drainage lines located to the East and West. Draining occurs in a Northerly direction.

3.1.4 Land Use and Land Cover

The site is generally comprised of intact to semi-intact natural woodland and thicket areas. Some localised cultivation is present within the site (Figure 3-2).

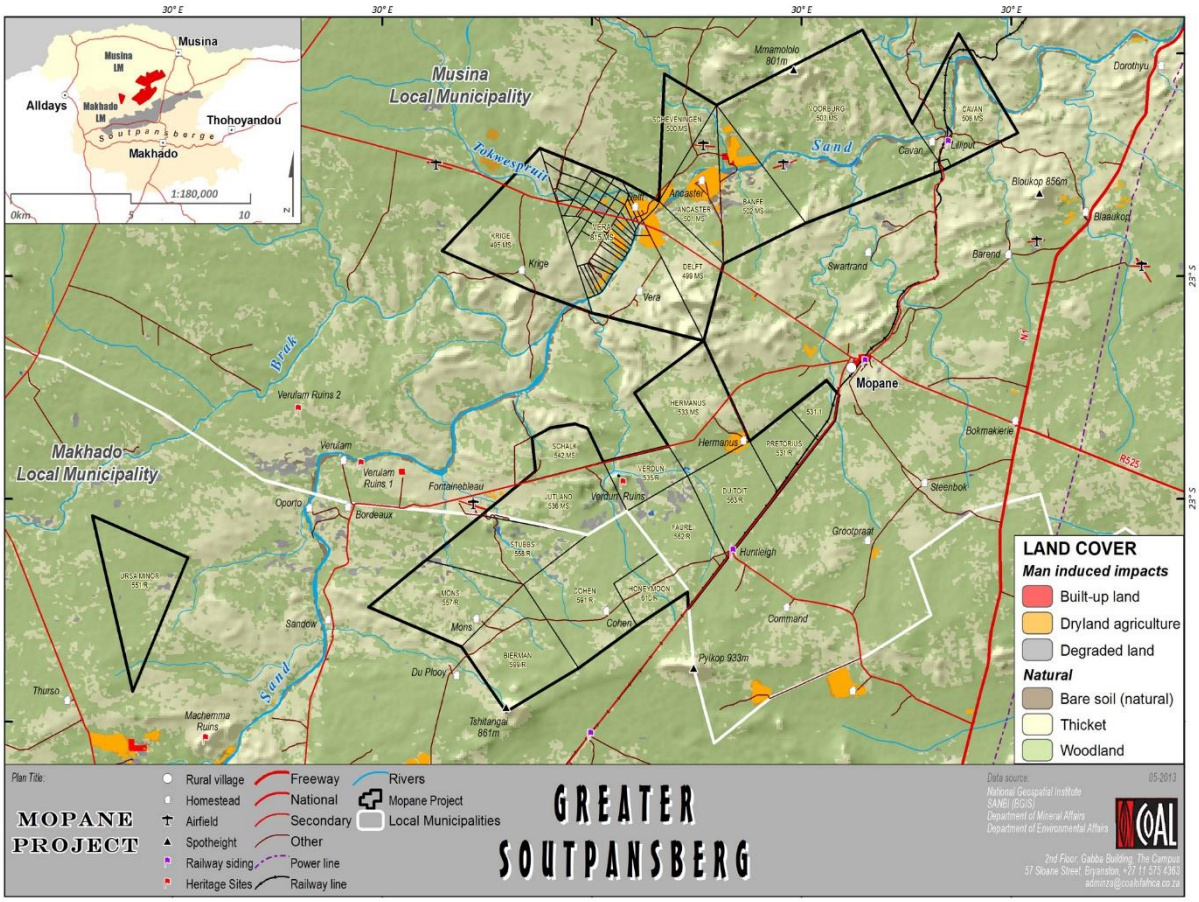

Figure 3-2: Land Cover and Use for the affected area.

Figure 3-3: Agricultural Lands for cultivation of Lucerne.

Figure 3-4: Goat farming.

Figure 3-5: Game farming.

Figure 3-6: Small scale crop farming.

3.1.5 Protected Areas and Nature reserves

No protected areas will be directly affected by the proposed development (Figure 3-7):.

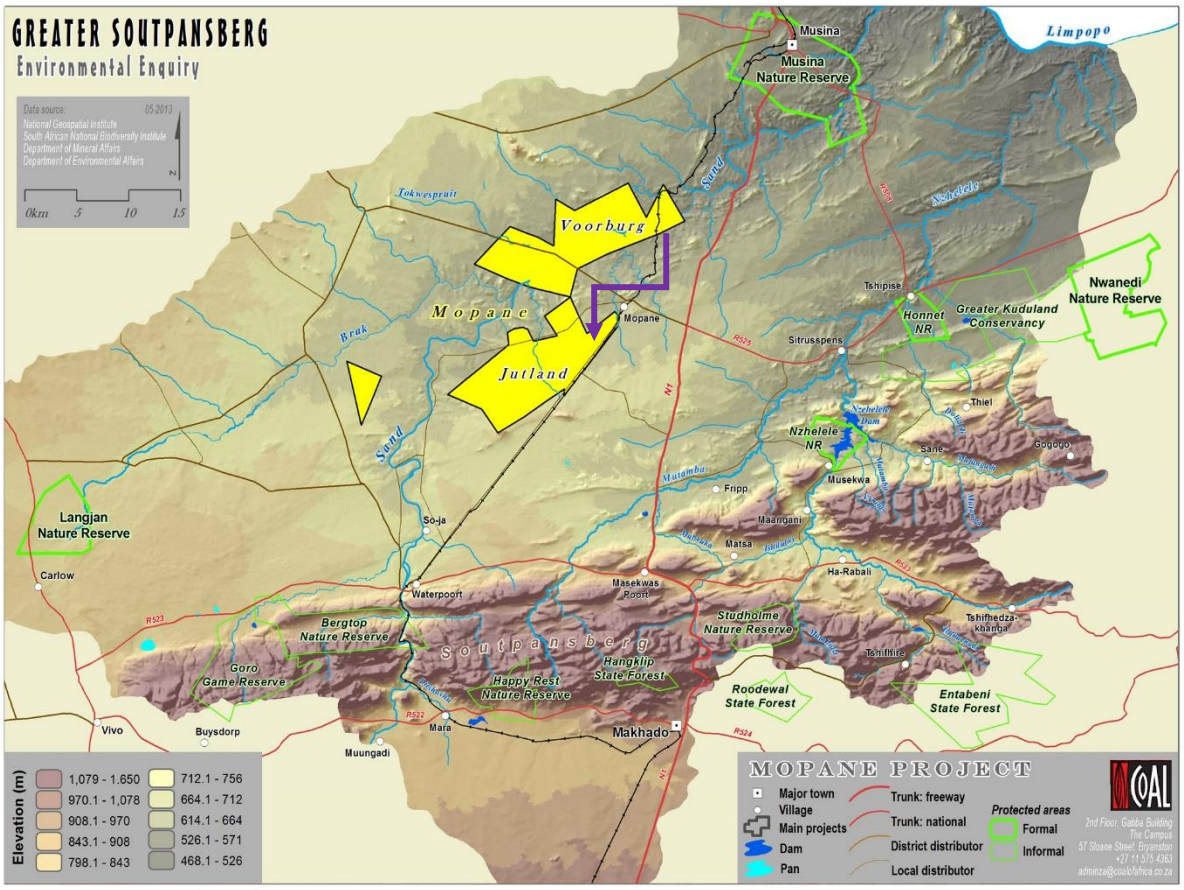

Figure 3-7: Locality of Surrounding Protected Areas State Forests and Nature Reserves.

Protected areas in the close vicinity of the site include:

- Musina Nature Reserve to the North-East
- Nzhelele Nature Reserve to the South-East
- Honnet Nature Reserve to the East

- Greater Kuduland Nature Reserve to the East
- Nwanedi Nature Reserve to the East
- Studholme Nature Reserve to the South
- Hangklip State Forest to the South
- Happy Rest Nature Reserve to the South
- Roodewal State Forest to the South
- Entabeni State Forest to the South
- Bergtop Nature Reserve to the South-West
- Goro Game reserve to the South-West
- Langjan Nature reserve to the West.

3.1.6 Scientific and Conservation Projects located in the Region

Institute of Conservation and Natural History of the Soutpansberg (ICONS)

This institute was established and is maintained privately by N. Hahn. A component of its activities is the Herbarium Soutpansbergensis (ZPB), founded in 1990 (Internationally Accredited). The herbarium is one of only a few functional herbaria in the Limpopo Province, is fully-computerized facility and presently full integrated with a regional GIS (Arc). The herbarium has approximately 5000 specimens and the exchange available is flora of the Soutpansberg and Trees of southern Africa. The herbarium is situated on the farm Little Leigh (22°56'34.2" south & 29°53'21.6" east) in the Soutpansberg.

The Ground Hornbill research and conservation project

At present Southern Ground Hornbills are considered 'vulnerable' and a protected species under TOPS regulations (2007) but their numbers are still declining. In South Africa, the total population is estimated at approximately 1500 birds, of which half is in the Kruger National Park. Over 70% of this species natural habitat has been lost due to farming / agriculture and cattle over the past 50 years. Indirect poisoning, indirect trapping and snaring, loss of large nesting trees, the trade in exotic birds, an increase in ancient cultural uses and electrocution on power transformer boxes are some reasons provided for the decline in numbers.

The Mabula Ground Hornbill Research and Conservation Project are addressing these issues by:

- Harvesting and hand-rearing of second hatched chicks which die of starvation in the nests.
- Re-introduction and augmentation of non-viable groups in the wild.
- Provision of artificial nests for wild groups without nests.
- Research on behaviour and other important unanswered questions.
- Awareness Campaigns to educate the general public regarding:
    - unintentional poisoning,
    - trade in ground hornbills, and
    - secondary trapping and snaring.

In conjunction with the Musina Game Study Group, artificial nest boxes are being supplied to compensate for the lack of suitable nesting trees in the Musina area. No such nesting boxes were encountered in the study area and the involvement of this project in the study area is uncertain.

Formal Conservation initiatives in the region

Vhembe Biosphere Reserve (VBR)

Biosphere reserves are protected environments which are important for conservation and sustainable utilization of natural resources. They are building blocks for bio-regional planning and economic development. Biosphere reserves are community driven initiatives assisted by government departments or agencies. Biosphere reserves are important ecosystems designated as protected areas by the United Nations Education, Science and Cultural Organization (UNESCO). The origin of Biosphere Reserves goes back to the "Biosphere Conference" organized by UNESCO in 1968, the first intergovernmental conference to seek to reconcile the conservation and use of natural resources, thereby foreshadowing the present-day notion of sustainable development. The early foundations of the Biosphere Reserve Concept derived from this conference. The aim was to establish terrestrial and coastal areas representing the main ecosystems of the planet in which genetic resources would be protected, and where research on ecosystems as well as monitoring and training work could be carried out for an intergovernmental programme called for by the Conference. This "Man and the Biosphere" (MAB) Programme was officially launched by UNESCO in 1970.

The aim is to establish areas, in which natural resources would be protected, monitored and offer training on the programme.

The importance of Biosphere Reserves are:

- To conserve the natural resources, promote sustainable utilization of natural resource and development to link conservation and development.
- To maintain healthy ecosystems.
- To learn about natural systems and how they change.
- To learn about traditional forms of land use.
- To co-operate in solving natural resources problems.
- To create partnerships between private sector, community structures and government.
- To empower local communities and authorities to be responsible for development and conservation in areas they live and work. Worldwide Biospheres all have three distinct zones (LEDET 2008):
- A legally constituted Core area or areas devoted to long-term protection, according to the conservation objectives of the Biosphere Reserve.
- A Buffer zone or zones clearly identified and surrounding or contiguous to the core areas, where only activities compatible with the conservation objectives can take place.

Limpopo Province has 3 Biosphere Reserves namely the Waterberg Biosphere Reserve (WBR), the Kruger to Canyon Biosphere (K2C) and Vhembe Biosphere Reserve (VBR).

The Vhembe Biosphere Reserve process started approximately 15 years ago (LEDET 2008). All stakeholder groups in the region have been informed of the proposed establishment of the VBR through their representatives on a steering committee and interactive consultations and work shopping process. The process has been funded, administered and guided by the Provincial Department of Economic Development, Environment and Tourism. All stakeholder groups have accepted the concept because they consider it to be the best model for the sustainable development of this unique area (LEDET 2008).

Municipal, Provincial and National Government actively support the establishment of VBR. The Department of Economic Development, Environment and Tourism has agreed to allocate funding and has the necessary staff infrastructure and expertise to assist with the future management of the proposed VBR. The concept is also enhanced by various national and international initiatives in the

region such as the Global Environment Facility Project, the Integrated Sustainable Rural Development Programme, and the Expanded Public Works Programme (LEDET 2008).

Aforementioned process resulted in a submission to UNESCO to register the Vhembe Biosphere Reserve as one of the international recognized Biosphere Reserves. The nomination was forwarded by the MEC for Economic Development, Environment and Tourism (LEDET) and approved by the National Department of Environmental Affairs and Tourism in October 2008 (LEDET 2008). The nomination was approved by UNESCO in 2009.
The Vhembe Biosphere Reserve includes the high biodiversity of the northern part of the Kruger National Park, the Mapungubwe National Park and World Heritage site, several Provincial Nature Reserves, two recognized centres of biodiversity and endemism (the Soutpansberg and Blouberg) and the Makgabeng Plateau with more than 1000 rock art sites (figure 17). It is also a favourite destination for ecotourism, cultural tourism and hunting amongst both local and international visitors (LEDET 2008).

The objectives of a Biosphere Reserve are (LEDET 2008):

- To preserve special bio-diverse environments for future generations.
- To create and encourage a balance between conservation and economic development.
- To place a priority on encouraging local communities to become involved and to become direct beneficiaries of the benefits flowing from a Biosphere.
- To establish a social contract between all stakeholders and create an integrated ownership and management structure.

The VBR is characterised by a significant variety of physical environments, which in turn give rise to a remarkable diversity of aquatic and terrestrial species and environments (LEDET 2008). The VBR includes three (3) biomes, namely savanna, grassland, and forest, four (4) bioregions and twenty-three (23) different vegetation types or biotopes. Eight (8) of these biotopes are endemic to the VBR within the South African context. The area is also a bio-geographical node, having Temperate, Kalahari, Lowveld and Tropical inputs. This creates zones of ecologically important interactions, which need to be protected to ensure conservation viability (LEDET 2008).

The unique biological and cultural features of the Soutpansberg and Limpopo River Valley, together with its largely underdeveloped rural population, lends itself to a sustainable development model which integrates conservation, development and logistical support as stipulated in the MaB programme (LEDET 2008).

The natural environment of the Soutpansberg and Limpopo River Valley is under immense pressure due to the dependence of a largely underdeveloped rural population on natural resources. The VBR, in conjunction with the Integrated Development Plan of the districts and the Environmental Management Plans of the local municipalities, should contribute significantly to creating a framework for sustainable development (LEDET 2008).

According to LEDET (2008), the VBR will in time be able to expand its functional responsibilities to South Africa's neighbouring countries, Botswana, Zimbabwe and Mozambique through the recently established Limpopo-Shashe and Great Limpopo Transfrontier Parks.

The study area falls within the boundary of the VBR but does not fall within a buffer zone or core zone of the VBR.

SA priority conservation areas

Establishment of the Vhembe Biosphere Reserve has the support of national and regional policy framework and falls within the priority areas for conservation as determined by the National Biodiversity Assessment 2004 - Priorities for Biodiversity conservation in South Africa as contemplated in the National Protected Area Expansion Strategy LEDET (2008).

The study area is also not located within the following important biodiversity areas:

- Soutpansberg centre of endemism,
- key vegetation community (Soutpansberg), and
- delineation of the Soutpansberg escarpment.

Nzhelele Nature Reserve

Nzhelele Nature Reserve is located approximately 28 kilometres to the southeast of the study area. It is just north of the Musekwa and Makushu communities and surrounds the southern part of the Nzhelele Dam on portions of the farms Gray 189 MT, Telema 190 MT, Msekwa 194 MT and The Duel 186 MT. The reserve is approximately 1400 hectares in extent and possesses game species such as bushpig, duiker, klipspringer, nyala, impala, warthog, ostrich and waterbuck. The reserve is mainly utilized for recreational and subsistence fishing. The farm Nairobi 181 MT was proclaimed as part of the Nzhelele Nature Reserve (Government Gazette No. 2473 of 8 September 1954).

Nwanedi Nature Reserve

Nwanedi Nature Reserve is approximately 46 kilometres to the east of the study area on the farms Ziskia 122 MT, Trevenna 119 MT and David 160 MT. It surrounds the Nwanedi Dam and is 8 243.4 hectares in extent.

Happy Rest Nature Reserve

Happy Rest Nature Reserve is located within the Soutpansberg Mountains approximately 47 kilometres to the south of the study area.

Messina Nature Reserve

Messina Nature Reserve is located approximately 19 kilometres to the northeast of the study area next to the town of Messina. This Nature Reserve was part of the former Baobab Forest Reserve, which was proclaimed in 1926 for the protection of the numerous baobab trees (*Adansonia digitata*) in the area. In a further attempt to protect this species from economic exploitation, baobab trees were declared a national monument. Evidence of such exploitations can be seen in the remains of a pulp factory on the banks of the Sand River. The Messina Nature Reserve was taken over by the former Transvaal Province from the Messina Town Council in 1981 with the primary mission of conservation of the high concentration of Baobab trees occurring on the reserve.

An outstanding rare feature of the reserve is the occurrence of one of the oldest rock formations in the world in the Sand River. The rock type is known as Sand River gneiss, and is estimated by geologists to be 3 800 million years old. This rock type is only found in this and adjacent areas in the Sand River.

The reserve is 4910 ha in size and consists of the following farms: Toynton 49 MT, Berkenrode 45 MT, Prinzenhage 47 MT, Stockford 46 MT and Veenen 48 MT. A small piece of the farm Veenen is located north of the Musina – Tshipise road. The farm Veenen were bought by the former Transvaal Provincial Administration and added to the reserve in 1991.

Honnet Nature Reserve

Honnet Nature Reserve is 1898 hectares in extent and is situated approximately 29 kilometres east-southeast of the study. The reserve is adjacent to the famous Tshipise hot spring and Tshipise koppie that is managed by Forever Resorts. The farm Honnet 137 MT was declared as Honnett Private Nature Reserve (Government Gazette No. 2473 of 8 September 1954).

Greater Kuduland Conservancy
Greater Kuduland conservancy is located between Honnet and Nwanedi Nature Reserves and is approximately 32 kilometres east-southeast of the study. The conservancy has not been proclaimed yet as a protected area and has no legal status in terms of the National Environmental Management: Protected Areas Act, 2003 (Act No 57 of 2003). However, a conservancy with Honnet and Nwanedi, and Greater Kuduland as the core area, were initiated with an agreement that was signed about 5 years ago (H Knott, 2011. Owner Greater Kuduland Conservancy: email correspondence).

Dongola Wildlife Sanctury (1947)
Mapungubwe was rediscovered in 1932 and in 1947 a former Prime Minister (General Jan Smuts) realized the unique conservation value of the area when the Dongola Wildlife Sanctury, consisting of 39 farms and 92 000 ha, were proclaimed. However, a year later the park was disbanded.

Mapungubwe National Park (2004) and World Heritage Site (2003)
The most eastern border of Mapungubwe National Park and World Heritage Site is approximately 42 kilometres to the northwest of the study area.

The cultural resources of the Limpopo-Shashe basin are generally associated with Iron Age settlements of around 1200 AD. The similarity of ivory objects, pottery remains and imported glass beads excavated at different sites that spread across the modern international borders of Botswana, South Africa and Zimbabwe attests to the cultural affinity of the people that lived in the Limpopo-Shashe basin during the Iron Age.

The Iron Age archaeological sites of Mapungubwe, K2, Leokwe and the Schroda site in the Mapungubwe National Park in South Africa, and the Mmamagwe site in Botswana are amongst the best-studied Iron Age sites in Southern Africa. They represent the Zhizo, K2 and Mapungubwe Iron Age cultures that existed in this region roughly between 600 AD and 1300 AD. Small Iron Age sites postdating this period have also been recorded in the area, including stonewalled sites on hilltops and Khami-type ruins.

Mapungubwe is renowned for the golden rhino and is believed to be the precursor of Great Zimbabwe, the most remarkable Iron Age site in Southern Africa. Other important archaeological sites are at Toutswe Mogala and Mmamagwe in Botswana. Several sites are also situated on Sentinel Ranch and Mapela Hill in Zimbabwe.

Additional features of cultural importance in the Limpopo valley are the numerous San rock paintings and engravings (*petroglyphs*), fossilised dinosaur footprints and skeletal remains of the dinosaur *Massospondylus carinatus* that became extinct approximately 65 million years ago.

What makes Mapungubwe a World Heritage Site and a place of pilgrimage for Africans is the amazing history of Mapungubwe Hill and its surroundings. The people that inhabited this area were cattle and crop farmers who extensively participated in the Indian Ocean trade with Egypt, India and China. Their wealth and the physical division between the sacred leader and the commoners were a first for Southern Africa. It is because of this uniqueness that the Mapungubwe landscape was proclaimed a World Heritage Site in July 2003.

Mapungubwe also speaks of earlier times of human habitation. The San and their forebears roamed the area for the last 5 000 years. They left over 150 (documented) rock art sites in the Limpopo/Shashe confluence area, a rich library of painted and engraved images that provide insight into the world and beliefs of these hunter-gatherers. Depiction of kudus is very typical for the rock art shelters in this area.
The numerous habitat types have also resulted in high species diversity in the Park. There are at least 24 *Acacia* species and 8 *Commiphora* species, amongst other. Other vegetation of the area is a typically short fairly dense growth of shrubby Mopane trees, generally associated with a number of other trees and shrubs and a somewhat sparse and tufted grassveld. From a conservation point of view, the riparian fringe of the Limpopo is of prime importance. It is in a natural state a dense vegetation community with a closed canopy, which occurs in the rich alluvial deposits along the river.

According to SANParks, Mapungubwe and its fairly recent declaration as a World Heritage Site have helped to highlight the significance of cultural heritage within SANParks. The inextricable links between people, biodiversity conservation and cultural heritage have become more evident through Mapungubwe. A number of initiatives have come up within SANParks to enable a more dedicated focus on cultural heritage and community participation.

According to SANParks, the Mapungubwe National Park also provides unparalleled opportunities for the development of cultural resources as a sustainable component in the overall park development and management. Significantly, the story of Mapungubwe and its importance in the overall history of the subcontinent has been incorporated into the national schools' curricula. This means that the site itself is increasingly becoming a focus for educational tours, with many primary and secondary schools as well as students from tertiary institutions visiting the park.

SANParks is also of the opinion that the formation of the park at a time when issues of landownership and restitution has come to the fore throughout southern Africa, also provides an opportune moment for the park authorities to implement models of outreach to local communities. The park now regularly hosts communities from Botswana and Zimbabwe who, for almost more than 100 years were cut off from ancestral land of which their ancestors once were an integral part. In this way the park is reaching out to a broader Southern-African community. Initiatives that, it is hoped, will eventually culminate in the formation of a Transfrontier Conservation Area.

The ICOMOS (International Council on Monuments and Sites) evaluation documentation named the heritage site as the "Mapungubwe Cultural Landscape" of which the core site covers nearly 30 000 ha (ICOMOS 2003). It is also mentioned under section 2: "The Property - boundaries, that that this core area is supported by a buffer zone of around 100 000 ha but that no marked maps were supplied to the evaluation authority". It further stated that the nominated site contains substantial areas of 'natural' landscape of very high quality that borders the rivers in the north and to the south the boundary cuts across geometrical citrus farms, which in time will be taken out of agriculture.

The evaluation documentation further states that the proposed boundaries correspond with those of the Vhembe-Dongola National Park (which was then in the process of being established), but that no clear buffer zone was also indicated on the maps supplied.

Specific mentioning is also made of the Trilateral Memorandum of Understanding (MoU) that has been drawn up with the objective of establishing the Limpopo-Shashe Transfrontier Conservation Area (TFCA) of 5,040 km2. On 22 June 2006, the MoU signaling the three nations' intent to establish and develop this Transfrontier conservation area was signed by Mr Kitso Mokaila, Botswana's Minister of Environment, Wildlife and Tourism, Mr Marthinus van Schalkwyk, South Africa's Minister

of Environmental Affairs and Tourism and Mr Francis Nhema, Zimbabwe's Minister of Environment and Tourism. According to ICOMOS (2003), this area "will, when established as a TFCA, constitute a very effective buffer zone". It seems thus that establishment of the TFCA has, at least as one of the objectives according to ICOSMOS, to serve as a buffer zone for the Mapungubwe Cultural Landscape. The Integrated Management Plan of the VHEMBE/DONGOLA NATIONAL PARK (2003) stated that the buffer area will be taken to be the same as the TFCA, and boundaries will change as the TFCA becomes established and grows.

During a meeting with Sanparks, Peace Parks Foundation, DEAT and SAHRA on 23 January 2008, it was established that the tri-lateral MoU for the TFCA that was signed in 2006 only refers to three of the areas, namely the Mapungubwe National Park in SA, the Northern Tuli Game Reserve (Notugre) in Botswana and the Tuli Circle Safari Area.

Limpopo-Shashe Transfrontier Conservation Area

Transfrontier Conservation Areas significantly promote regional integration, greater biodiversity, environmental tourism and economic growth.

According to information obtained from the Department of Environmental Affairs and Tourism (DEAT), the concept of establishing a transfrontier conservation area around the confluence of the Limpopo and Shashe Rivers dates back to the initiative by General J C Smuts who decreed in 1922 that some farms along the banks of the Limpopo River be set aside for the Dongola Botanical Reserve. The primary aim of this reserve was to study the vegetation and assess the agricultural and pastoral potential of the area. This idea was transformed into Dongola National park in 1940s when the results of the study showed that the area was not suitable for human habitation and that it could best be used as a "wildlife sanctuary for the recreation of the nation". It was during this time that the idea of linking the sanctuary with similar conservation areas in the then Bechuanaland Protectorate and Southern Rhodesia was first mooted.

In Botswana, land to be committed to the proposed Limpopo-Shashe TFCA would encompass the Northern Tuli Game Reserve (Notugre). This area had its origin from an association of private landowners who have agreed to remove the fences that separate their properties and jointly manage wildlife resources. Notugre presently embraces 36 farms with a combined area of 70 000 ha. It is renowned for its Tuli elephants, the largest elephant population on private land in Africa. The establishment of this TFCA will considerably expand the range of land available to this elephant population.

On the South African side, the land to be committed to the TFCA would comprise a complex mosaic of private land, state-owned land and national parks (figure 18). South African National Parks (SANParks) with the assistance of the World Wide Fund for Nature (South Africa), De Beers Consolidated Mines Ltd, the National Parks Trust and Peace Parks Foundation, has since 1998 been involved in land purchases to create Mapungubwe National Park. This park forms the core area of South Africa's contribution to the Limpopo- Shashe TFCA and will include 18 properties of 25 800 ha in total. A major advance in the consolidation of the core area was made in 2002 when De Beers and SANParks signed an agreement whereby properties owned by De Beers would be integrated into the core area. To date, roughly 75% of the park's core area has been consolidated by means of purchase or contract, and the Mapungubwe National parks (replacing the working name Vhembe-Dongola) was officially opened on 24 September 2004.

Establishment of the TFCA has been stipulated in the vision, mission and objectives of the Integrated Management Plan of the VHEMBE/DONGOLA NATIONAL PARK in 2003. This plan further emphasises that the ecological and cultural boundaries of the Mapungubwe Cultural Landscape extend beyond

the Park boundaries and that the Trans-Frontier Conservation Area will enlarge the managed landscape to a more representative level in terms of ecological, economic and cultural viability.
The total area that could potentially be included in the proposed TFCA could be approximately 500 000 ha, with South Africa contributing 200,000 ha, Botswana 150,000 ha and Zimbabwe 150,000 ha (figure 19). The potential area that Zimbabwe can commit to the proposed TFCA is the Tuli Circle Safari Area covering an area of 41 100 ha (figure 19). This area is contiguous with the northern end of Notugre and has no physical barriers to impede the movement of wildlife. The potential also exists to incorporate portions of the Maramani Communal Land into the area of the proposed Limpopo-Shashe TFCA.

The landscape south of the Limpopo River is a flat Mopane veld with sandstone and conglomerate ridges and koppies. Nearer the Limpopo, the flat landscape changes into rigged, hilly terrain. The altitude varies from 300 to 780 m above sea level. In the Tuli Circle Safari area, the relatively flat basalt landscape gives way to the Shashe River basin running north-south to join the Limpopo River. Other major rivers that cross the proposed TFCA are the Tune and Motloutse rivers in Botswana, and Mogalakwena River in South Africa.

Three main vegetation communities are recognized in the region: riparian fringe along the Limpopo and the Shashe rivers and tributaries; the *Acacia-Salvadora* community of the Limpopo flats (including flood plains) and vlei areas, and unique baobab and Ilala palm stands and mixed western Mopane veld on ridges and flats south of the riparian fringe and floodplains. Both the riparian forest and the *Acacia-Salvadora* communities are regarded as being among the most endangered vegetation communities in South African environment.
Twenty-six Red Data plant species occur within the Mapungubwe National Park.

Within the Tuli Circle Safari Area, there are three botanical reserves: Tolo River (0,44 km²), Pioneer (0,38 km²) and South Camp (0,26 km²). The region has excellent potential for a “big five” conservation area. Viable populations of lion, leopard, cheetah and spotted hyena still occur, apart from the well-known Tuli elephant. In addition, there are significant populations of ungulates within the area of a proposed TFCA, such as eland, gemsbok, duiker, impala, zebra, Sharpe's grysbok, steenbok and blue wildebeest. The habitat is also suitable for both white and black rhinoceros, which led to the release of four white rhinoceros into Mapungubwe
National Park in 2004. The permanent pools in the Limpopo River offer refuge to crocodiles and hippopotamus as well as a variety indigenous fish species. De Beers recently reintroduced wild dogs, roan, tsessebe and elephant into Venetia Limpopo Nature Reserve.

This area also has great diversity of birdlife and over 350 species have been recorded to date. At least eight black eagle breeding pairs have been recorded in sandstone hills.
A large number of privately owned farms to the south and east of Mapungubwe National Park have also been earmarked to be included in the proposed Limpopo Valley Game Reserve Conservancy that will be included in the TFCA.
The study area falls outside the current planned areas for the TFCA.

5.3.12 Protection status of the farm Voorburg
Besides from being part of Sheldrake Game Ranch, the legal protection status of the farm Voorburg is not known at this stage.

3.1.7 Tourism and Hunting

Many of the farms adjacent to and in the region of the study area are managed as game farms and hunting, and tourism are the main sources of income. Even farms along the Sand River where intensive agricultural land uses are implemented, also utilise the remaining areas on the farms as

hunting and tourism areas. Many of the farms also have cattle, but to a lesser extent. Game farming (intensive or extensive), trophy hunting, recreational ("biltong") hunting and other tourism / ecotourism activities (game drives, hiking trails etc.) are the main activities that are presented on these farms.

The hunting and tourism industry, and potential for these land use options, largely rely on an unspoiled environment, the scenic beauty of the area ("sense of place") and the "wilderness character" of the area. Although not always acknowledged, these land use options also depend on intactness and proper functioning of the ecosystems.

4 Vegetation

The vegetation units within the Soutpansberg, as described by Rutherford and Rutherford (2006) include; Musina Mopane Bushveld (plains) and Limpopo Ridge Bushveld (ridges). Both of these vegetation types have a Least Threatened conservation status and are poorly protected. Variations in vegetation are a function of climate, topography and soil.

Several studies in the Soutpansberg mountain area indicated its importance with regard to biodiversity, endemic plant species and also some red data species (Hahn 1994, 2002, 2003, 2006; Mostert 2006; Mostert et al. 2008). Vegetation surveys in the area indicated that the area has an outstanding diversity of plant species, with 2 500-3 000 plant species recorded from the area. This resulted in the recognition of the Soutpansberg Centre of Endemism (Van Wyk & Smith 2001). The conservation value of the Centre lies in its unique ability to house a wide variety of floristic elements from the surrounding floristic regions (Hahn 2002). Not only is the diversity of plant species in this area high, but the diversity in ecosystems is equally high, as indicated by Mostert (2006). The Kruger National Park which covers 2 million hectares contains about 380 tree species. The Soutpansberg which covers about 2 000 hectares has 321 tree species (Hahn 2002).

4.1 Low and Rebelo (1996)

The vegetation of the study area belongs to the broad vegetation group the Savannah Biome (Low and Rebelo, 1996). The Savannah Biome is the largest Biome in Southern Africa, occupying 46% of its area, and over one-third of the area occurs in South Africa. It is well developed over the Lowveld and Kalahari region of South Africa and is also the dominant vegetation in Botswana, Namibia and Zimbabwe. A grassy ground layer and a distinct upper layer of woody plants (trees and shrubs) are characteristic of the Savannah Biome. Where this upper layer is near the ground (low growing) the vegetation may be referred to as Shrubveld, where it is tall and dense, as Woodland, and the intermediate stages are locally known as Bushveld.

The environmental factors delimiting the biome are complex and include (Low and Rebelo, 1996):

- Altitude ranges from sea level to 2 000 m.
- Rainfall varies from 235 to 1 000 mm per year.
- Frost may occur from 0 to 120 days per year.
- 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 (tree and shrub) layer from dominating, coupled with fires and grazing, which keep the grass layer dominant. Summer rainfall is essential for the grass dominance, which, with its fine material, fuels near-annual fires. In fact, almost all species are adapted to survive fires, with less than 10% of plants (both in the grass and tree layer) killed by fire. Even with severe burning, most species can re-sprout from the stem bases (Low and Rebelo, 1996).

The shrub-tree layer may vary from 1 to 20 m in height, however within Bushveld areas they typically vary from 3 to 7 m. Soil depth is one of the critical factors that determine tree height in the biome. The shrub-tree element may come to dominate the vegetation through bush encroachment in areas that are being overgrazed (Low and Rebelo, 1996).

Most of the savannah vegetation types are used for grazing, mainly by cattle or game. Goats are the major stock in the southernmost savannah types.

Representation of the savannah biome in conservation areas in South Africa is good, mainly due to the presence of the Kruger- and Kalahari Gemsbok National Parks within the biome.
However, the large areas conserved in South Africa belies the fact that half of savannah vegetation types are inadequately conserved, in having less than 5% of their area in reserves. However, much of the area is used for game farming and can thus be considered effectively preserved, provided that sustainable stocking rates and sound environmental practices are maintained. Tourism and hunting has become important utilisation options in the savannah biome.

4.2 Vegetation of Southern Africa (Mucina and Rutherford, 2006)

According to Mucina & Rutherford (2006), the study area is situated within three vegetation types (Figure 4-1):

- Musina Mopane Bushveld on the plains (Least Threatened)
- Limpopo Ridge Bushveld on scattered hills (Least Threatened)
- Soutpansberg Mountain Bushveld on the Soutpansberg mountain ridges to the south (Vulnerable)

Vulnerable vegetation types have lost more than 20% of their original extent, which could result in some ecosystem functions being altered.
Least Threatened applies to vegetation and is used when no significant disruption of ecosystem functioning is assumed and the vegetation types still have more than 80% of their original extent untransformed.

4.2.1 Musina Mopane Bushveld

The Musina Mopane Bushveld is characterized by undulating to very irregular plains with some hills at an altitude of around 600m. On areas with deep sandy soils, the *Kirkia acuminata* (White Seringa) is one of the dominant tree species along with *C. mopane* (Mopane), *C. apiculatum* (Red Bushwillow) and *Grewia spp*. (Raisin bushes). The herbaceous layer is poorly developed, especially where mopane occurs in dense stands. This vegetation type is classified as poorly protected and “Least

threatened" with 2% statutorily conserved in the Mapungubwe National Park, as well as the Nzhelele, Nwanedi, Musina and Honnet Nature Reserves. About 3% is transformed, mainly by cultivation, and soil erosion is moderate to high. The conservation target is 19%.

The geology consists mainly of gneisses and meta-sediments of the Beit Bridge Complex, with variable soils from deep red/brown clays to deep, freely drained sandy soils, to shallower types including skeletal Glenrosa and Mispah soil forms. The mean annual precipitation varies between 300 – 400 mm and the area is generally frost-free.

Important taxa include trees such as *Colospermum mopane* (Mopane), *Adensonia digitata* (Baobab), *A. nigrescens* (Knobthorn), *Commiphora apiculatum* (Red Bushwillow), *Acacia senegal var. leiorhachis* (Slender Three-hook Thorn) and *Commiphora mollis* (Velvet Corkwood). Conspicuous small trees and shrubs include *Grewia bicolor* (White Raisin), *Grewia flava* (Velvet Raisin), *Boschia foetida subsp. rehmanniana* (Stink Shepherd's tree) and *T. prunioides* (Lowveld Cluster-leaf). The grass layer is characterized by *Aristida spp.* (Three-awn grasses), *S. uniplumis* (Silky Bushman grass), *S. pappophoroides* (Sand Quick), B. deflexa (False Signal grass), *E. cenchroides* (Nine-awned grass) and *U. mosambicensis* (Bushveld Signal grass).

The vegetation units within the site include *Musina Mopane Bushveld* on the plains and *Limpopo Ridge Bushveld* on the ridges as described by Mucina and Rutherford (Figure 4-1; 2006) both having a *Least Threatened* Conservation status and being poorly protected.

4.2.2 Limpopo Ridge Bushveld

This vegetation type covers the irregular hills and ridges of much of the area in the vicinity of the Limpopo River. The altitude varies from 300 m to 700 m in the east, with some hills reaching 1 000 m in the west. The vegetation structure is moderately open savannah with a poorly developed ground layer. *K. acuminata* (White Seringa) is prominent on many of the ridges along with *A. digitata* (Baobab). On shallow calcareous gravel and calc-silicate soils, the shrub *Catophractes alexandri* is dominant. Areas of sandstone of the Clarens Formation are prominent in places such as Mapungubwe National Park. Although not as prominent as at Mapungubwe National Park, sandstone ridges also occur in the study area.

The mean annual precipitation varies from 300-400 mm and the area is generally frost-free.

Important plant species include the *A. digitata* (Baobab), *S. birrea* (Marula), *C. mopane* (Mopane), *C. glandulosa* (Tall Common Corkwood), *T. prunioides* (Lowveld Cluster-leaf), *B. albitrunca* (Shepherd's tree) and various figs, e.g. *F. tettensis*.

This vegetation type is classified as moderately protected and "Least Threatened", with some 18% statutorily conserved in the Kruger and Mapungubwe National Parks. Only about 1% is transformed, mainly by cultivation and mining. The conservation target is 19%.

4.2.3 Soutpansberg Mountain Bushveld

Although not directly affected within the mining right application (MRA) area, some floristic elements of this unit may be present on higher lying ridges and hills within the site. Hence it is included in the report.

This vegetation unit is characterised by a dense tree layer and poorly developed grassy layer covering the mountain ridges of the Soutpansberg. The topography of the east-west orientated ridges of the mountain changes drastically over short distances, resulting in orographic rain on the southern ridges and a rainshadow effect on the northern ridges. Because of this topographic diversity, the Soutpansberg Mountain Bushveld comprises a complex mosaic of sharply contrasting kinds of vegetation within limited areas. The main vegetation variations are subtropical moist thickets (mainly along the lower-lying southern slopes, on clayey soils of volcanic origin), mistbelt bushclumps (within the mistbelt of the southern and central ridges; on rugged quartzitic outcrops with shallow sandy soils), relatively open savanna sandveld (on both deep and shallow quartzitic sands along the relatively dry middle and northern slopes of the mountain), and an arid mountain bushveld (along the very arid northern ridges of the mountain).

The geology consists mainly of reddish or brown sandstone and quartzite, conglomerate, basalt, tuff, shale and siltstone of the Soutpansberg group. The unit experiences summer rainfall with dry winters. Mean annual precipitation id between 450 and 900 mm.

Important plant species include *Burkea africana, Ochna pulchra, Enneapogon cenchroides, Catha edulis, Flueggea virosa, Mimusops zeyheri, Syzygium legatii* and *Parinari capensis.* This vegetation type is classified as moderately protected and “Vulnerable”, with some 2 % statutorily conserved in the Blouberg, Happy Rest and Nwanedi Nature Reserves. About 21% is transformed, mainly by cultivation and plantations. The conservation target is 24 %.

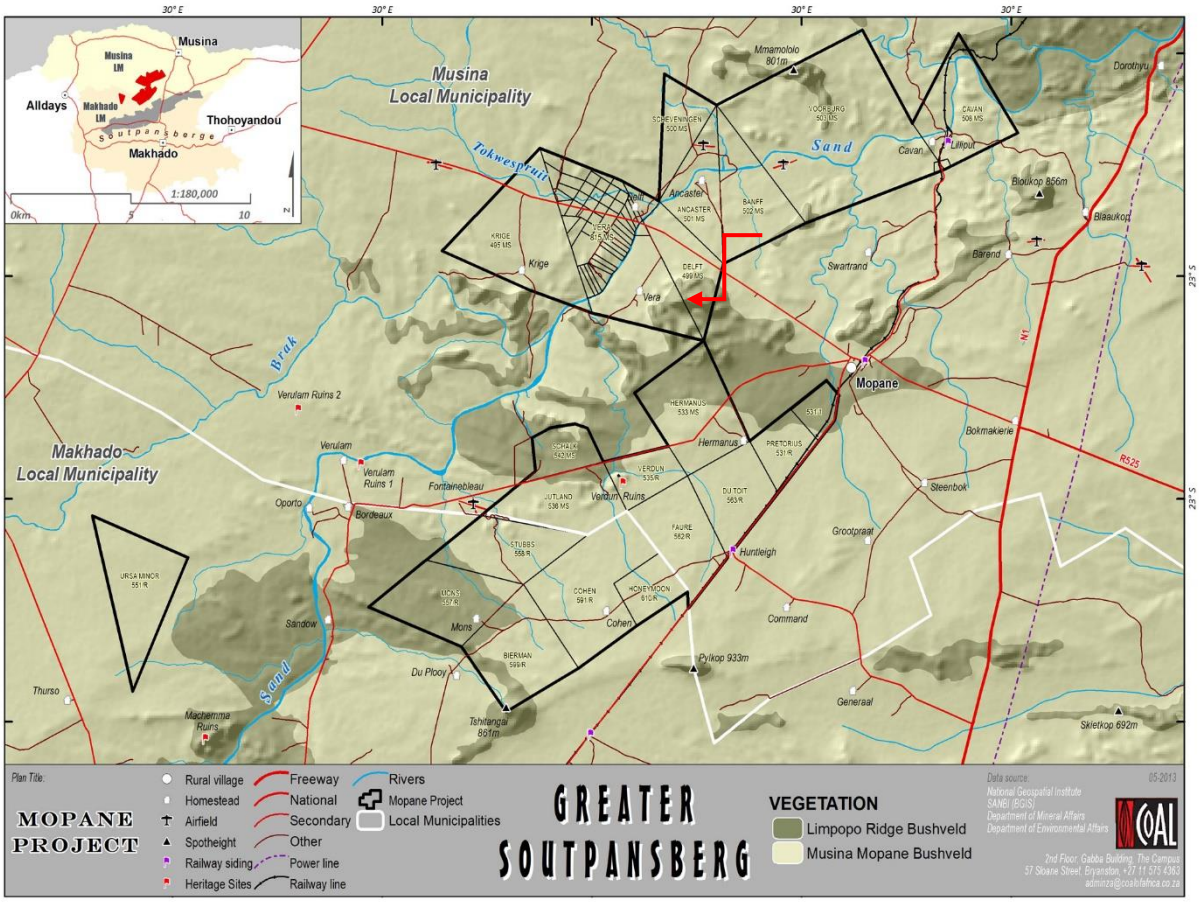

Figure 4-1: Vegetation of the site and surrounding area (Mucina and Rutherford, 2006).

5 Vegetation Communities and Sensitivity Mapping

The study area is dominated by tree and shrub forms of *Colophospermum mopane*, *Terminalia prunoides, Commiphora spp., Grewia spp. and Boscia albitrunca.* The herbaceous layer is not well developed, probably due to low rainfall and overgrazing and consists mostly of grasses such as *Aristida congesta subsp. congesta, Aristida adscensionis, Tragus berteronianus, Bothriochloa insculpta and Microchloa caffra.*

The plant species diversity is regarded as fairly low and has been supplemented with data collected from previous surveys in the area, due to the seasonal sampling limitations. A plant species list is provided in Appendix 1, and can be summarised as follows:

- Trees: 40
- Shrubs: 28
- Grasses: 24
- Liana: 1
- Dwarf shrubs: 1
- Climbers: 1
- Forbs: 5
- Succulents: 5
- Sedges: 1

Different plant communities develop as a result of differences in climate, geology, topography, rockiness, drainage, soil texture, soil depth, slope, and historic management. Each plant community usually represents a different habitat, has its own inherent grazing and browsing capacity and represents a specific habitat for certain types of fauna species.

The vegetation survey was conducted during the middle of the dry season and the possibility of encountering herbaceous annuals and flowering plants was very low. The herbaceous layer, especially the grass layer, is heavily utilised and this can also influence the herbaceous species diversity. Herbaceous plants are an important food source for game, especially in the dry season and in drought periods when the grass layer is depleted. Many of these plants are annuals and also do not appear every season, and Geophytic species are dormant during dry periods. The importance of long-term monitoring actions / surveys is imperative to assess the true diversity of a specific area, especially arid areas.

The entire study area has not been mapped fully, as not all farms within the mining right application (MRA) area were visited due to farm access issues. Furthermore, inconsistencies in time spent on farms may have resulted from access limitations. For example is some instances, sampling time was limited on larger farms, but more time was available on smaller farms. The following distinct vegetation communities were however identified:

1. The River Ecosystems
2. The Ridges Ecosystem
3. The Plateaus Ecosystem
4. Bushveld
   - 4.1. *Terminalia prunoides* Bushveld
   - 4.2. *Combretum apiculatum-Commiphora* Arid Bushveld
   - 4.3. *Terminalia sericea* Bushveld
   - 4.4. Mopane Bushveld
   - 4.5. *Acacia tortilis-Cataphractus* Veld on limestone
   - 4.6. *Kirkia-Acacia senegal* Bushveld
5. Old Fields, Current Agriculture and Secondary regrowth

5.1 The River Ecosystems

Within the study area there is basically a single river system, the permanent Sandrivier, with a number of tributaries (including the Tokwespruit and Brak rivers).

Figure 5-1: Typical River System vegetation (Voorburg).

Figure 5-2: Riparian Zone during dry season.

Figure 5-3: Typical River System vegetation (Voorburg).

Figure 5-4: Trees along seasonal river banks.

Figure 5-5: Typical River System vegetation (Voorburg).

Figure 5-6: Typical River System vegetation (Voorburg).

Figure 5-7: Large pools present during the dry season with a band of riparian trees along banks.

Figure 5-8: Band of large trees along Sand River banks (Voorburg).

Figure 5-9: Large Riparian trees along the southern side of the Sand River on the farm Delft.

Figure 5-10: Large Riparian trees along the southern side of the Sand River on the farm Ancaster.

Figure 5-11: Riparian vegetation along the Sand River on the farm Cavan upstream of railway bridge.

Figure 5-12: Riparian vegetation along the Sand River on the farm Cavan upstream of railway bridge.

The riparian tree zone occurs on the river banks on both sides of the two river systems. This zone is approximately 10 - 20 m, or sometimes even up to 50 m wide, and indigenous trees and shrubs make up the canopy cover in this zone. In the case of the Sand River, a number of areas along its banks have been affected by agriculture. Stands of *Phragmites australis* (Common reed) occur along the river edges and drier river beds.

As the rivers in the area are considered as an ecological unit, the river banks, terraces and river bed are not separated for the description of the vegetation, but treated as a unit.

Discussion

River systems are always considered to be ecologically sensitive, and are thus given a very high (No-Go) sensitivity. This is due to the unique habitats they provide and support for several flora and fauna species. The river systems provide migration corridors for many species. River systems are particularly important due to the water transport and associated biological, economic, health and cultural values. The provision of clean and healthy water to people, agriculture and natural biological systems is of utmost importance in this arid region.

The following is suggested:

- No mining development can be supported within the 1:100 year flood line on both sides of the rivers. A further buffer zone will be needed to protect the rivers from effects of mining, especially from pollution and erosion. A 100 m buffer from the outside of the riparian edge is recommended by DWAF
- Care should be taken that no erosion takes place along the river banks.
- The rivers and river bank areas should be included in an open space plan, where the indigenous vegetation is protected and no development allowed.
- All alien woody species on the river banks should be removed and controlled.

5.2 The Ridges Ecosystem

These hills and ridges form part of the Soutpansberg foothills, but as they are somewhat separated from the main mountain, not so high and not so diverse in plant species composition, although there are a number of species of special concern present. They also tend to form 'islands' within the typical Mopaneveld matrix and are thus considered to have a High sensitivity. The vegetation is typical mountain bushveld, with many woody species present.

Figure 5-13: Typical Ridge located on the farm Voorburg.

Figure 5-14: View of Hill surrounded by Mopane Bushveld.

Figure 5-15: Ridges vegetation.

Discussion

The ridges north of the Soutpansberg are generally considered to be rich in plant species and ecologically medium sensitive. This is an excellent area for conservation and ecotourism, and most of this ecosystem is situated on a privately owned up-market game farm and conservation area.

It seems that the coal reserve may be present under the ridge, and that the ridge ecosystem will be destroyed should mining be authorised.

5.3 The Plateaus Ecosystem

The ridges discussed above form a flat to slightly undulating plateau on the crest of the ridge. The plateaus often have deeper soils and tend to be vegetated with grassland or sparse woodland. The area forms part of the Ridges Ecosystem and therefore also has a High sensitivity.

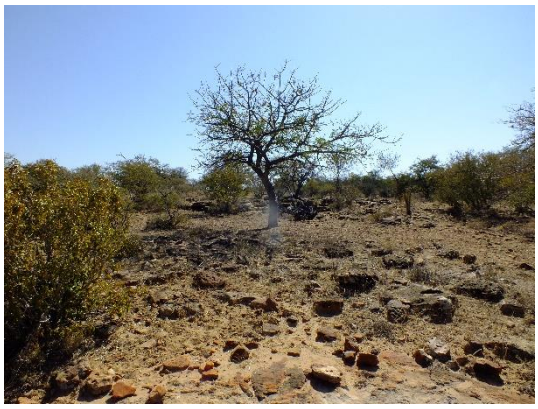

Figure 5-16: Typical Ridges vegetation – Rocky areas.

Figure 5-17: Typical Ridges vegetation

Figure 5-18: Typical Ridges vegetation.

Figure 5-19: Typical Ridges vegetation – grassed areas.

Discussion

The ridges north of the Soutpansberg are generally considered to be rich in plant species and ecologically have at least a medium sensitivity. The plateaus are part of the ridges. Most of this ecosystem is situated on a privately owned up-market game farm and conservation area. It seems that the coal reserve may be present under the ridge, and that the ridge ecosystem, with the plateaus will be destroyed should mining be authorised.

5.4 Mopane Bushveld

A number of bushveld communities occurring on the level plains with distinct species assemblages can be differentiated within the study area. These communities are often highly fragmented and are often associated with slight variations in the underlying soils. Whilst it is possible to differentiate the communities using ordination techniques, they are difficult to distinctly map as the boundaries are not usually distinct and vary along a continuum. Sampling time limitations further exacerbated this. They are thus grouped together for the purposes of this report and generally have a Medium sensitivity.

Figure 5-20: View over typical Mopane Bushveld from Ridge.

Figure 5-21: Typical Mopane Bushveld. Note fence cutline.

Figure 5-22: Typical Mopane Bushveld.

Figure 5-23: Typical Mopane Bushveld with Mopane Trees. Note fence cutline.

Figure 5-24: Typical Mopane Bushveld. Note Commiphora trees in foreground.

Figure 5-25: Terminalia Bushveld

Figure 5-26: Small Baobab tree in Mopane Bushveld.

Figure 5-27: Open Mopane Bushveld.

Figure 5-28: Mopane Bushveld on Rocky outcrops.

Figure 5-29: Open Mopane Bushveld on gravel soils.

Figure 5-30: Open Mopane Bushveld on gravel soils.

Figure 5-31: Commiphora Bushveld

Figure 5-32: Hill slopes with Commiphora spp.

Figure 5-33: Mopane Bushveld on rocky areas.

Figure 5-34: Scattered Baobabs in Mopane Bushveld.

Figure 5-35: Mopane Bushveld on rocky areas.

Figure 5-36: Mopane Bushveld on limestone.

5.4.1 Combretum apiculatum-Commiphora Arid Bushveld

The vegetation is a dense bushveld, dominated by *Combretum apiculatum, Sclerocarya birrea, Strychnos madagascariensis* and several *Commiphora* species. The herbaceous layer is generally poorly developed, with many open, bare patches. The grass layer is well utilised by livestock and game.

Discussion

In general this vegetation is not rare and not threatened, except that it is often prone to droughts and then often overgrazed. There is concern on the presence of large number of the protected tree

species, *Sclerocarya birrea* (Marula) and large numbers of various species of *Commiphora.* Most of the area is probably too far north of the coal seam to be endangered.

5.4.2 Terminalia prunoides Bushveld

The vegetation is a dense bushveld, dominated by *Terminalia prunoides.* The trees clumped into scattered bush clumps with open grassy patches in between. The soils are shallow, sometimes with a calcareous base. The herbaceous layer is generally poorly developed, with many open, bare patches. The grass layer is well utilised by livestock and game.

Discussion

In general this vegetation is not rare and not threatened, except that it is often prone to droughts and then often overgrazed. There is concern on the presence of large number of the protected tree *Adansonia digitata*. This is the ideal area to place the mining infrastructurea.

5.4.3 Terminalia sericea Bushveld

The vegetation is dense bushveld, dominated by *Terminalia sericea.* The soils are deep sand. The herbaceous layer is generally poorly developed, with many open, bare patches. The grass layer is well utilised by livestock and game.

Discussion

In general this vegetation is not rare and not threatened, except that it is often prone to droughts and then often overgrazed. This is the ideal area to place the mining infrastructure, but it is far from the coal seam.

5.4.4 Mopane Bushveld

The vegetation is an open to dense Mopane veld, dominated by *Colophospermum mopane.* The herbaceous layer is generally poorly developed, with many open, bare patches. The grass layer is utilised by livestock and game.

Discussion

In general this vegetation is not rare and not threatened, except that it is often prone to droughts and then often overgrazed. There is concern on the presence of large *Adansonia digitata* and *Sclerocarya birrea* which are protected trees.

5.4.5 Acacia tortilis - Cataphractus Veld on limestone

This vegetation is found on shallow loamy sand on a limestone base, and is mostly degraded short open shrubveld with signs of bush encroachment. *Acacia tortilis* is dominant but *Terminalia prunoides* is locally prominent. The herbaceous layer is generally poorly developed, with many open, bare patches. The area is mostly heavily grazed.

Discussion

In general this vegetation type is not widespread and has a limited distribution within the study area. Due to the sweet veld and generally arid conditions on limestone the vegetation is overgrazed and degraded.

5.4.6 Kirkia-Acacia senegal Bushveld

The vegetation is dense tall bushveld, dominated by *Acacia senegal,* with *Kirkia acuminata* also prominent. The soils are deep sand. The herbaceous layer is generally poorly developed, especially under the dense tree cover. The grass layer is well utilised by game.

Discussion

In general this vegetation is considered as fairly rare and vulnerable. It is situated on the up-market game farm and contains beautiful large trees including tree protected species. It is probably in the way of the mining operation.

5.5 Old Fields, Current Agriculture and Secondary Regrowth

Various old fields occur within the study area, some irrigated with water from the Sand River. Smaller patches of old fields, some lying fallow for many years, occur on numerous farms as well. The vegetation of the old fields (not currently cultivated) is either open secondary grassland, or an open thornveld, dominated by *Acacia tortilis* and *Dichrostachys cinerea.*

Figure 5-37: Cultivated lands with small baobab retained.

Figure 5-38: Cultivated lands.

Figure 5-39: Old fields with secondary regrowth.

Figure 5-40: Old fields with secondary regrowth.

Figure 5-41: Small stock farming resulting in land degradation.

Figure 5-42: Game breeding is an effective way to use old lands minimising further degradation.

Figure 5-43: Stock camps (livestock and game) lead to concentrated degradation in confined areas.

Figure 5-44: Excessive loss of vegetation cover can lead to sheet erosion and topsoil loss.

Figure 5-45: Stock camps (livestock and game) lead to concentrated degradation in confined areas.

Figure 5-46: Farm buildings and infrastructure construction leads to clearing of vegetation and hardening of ground surfaces.

Discussion

The agricultural fields and old fields have low conservation value and low sensitivity, and are, from an ecological point of view, ideal for the development of mining infrastructure.

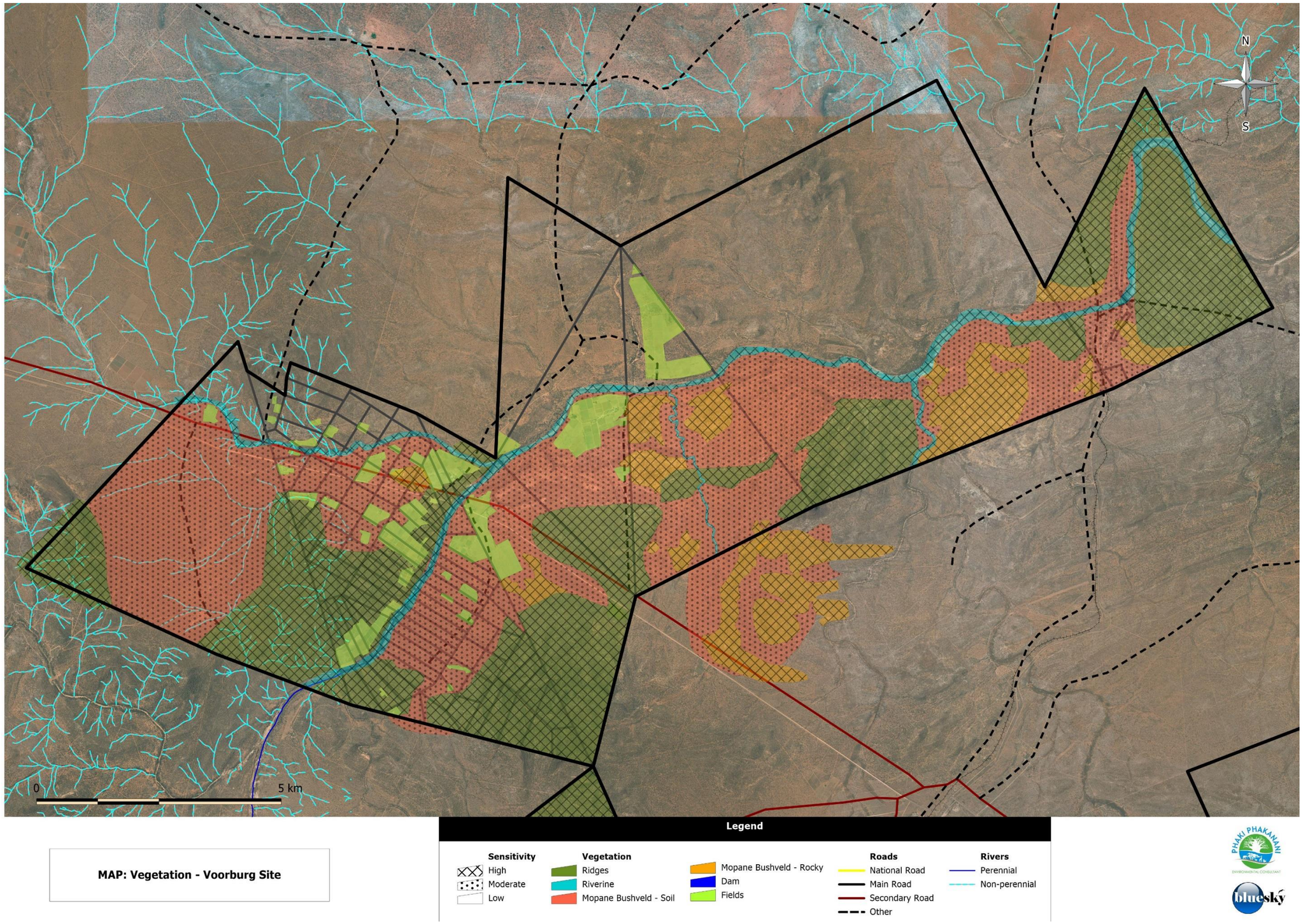

Figure 5-47: Mapped vegetation communities of the mining right application (MRA) area (Voorburg).

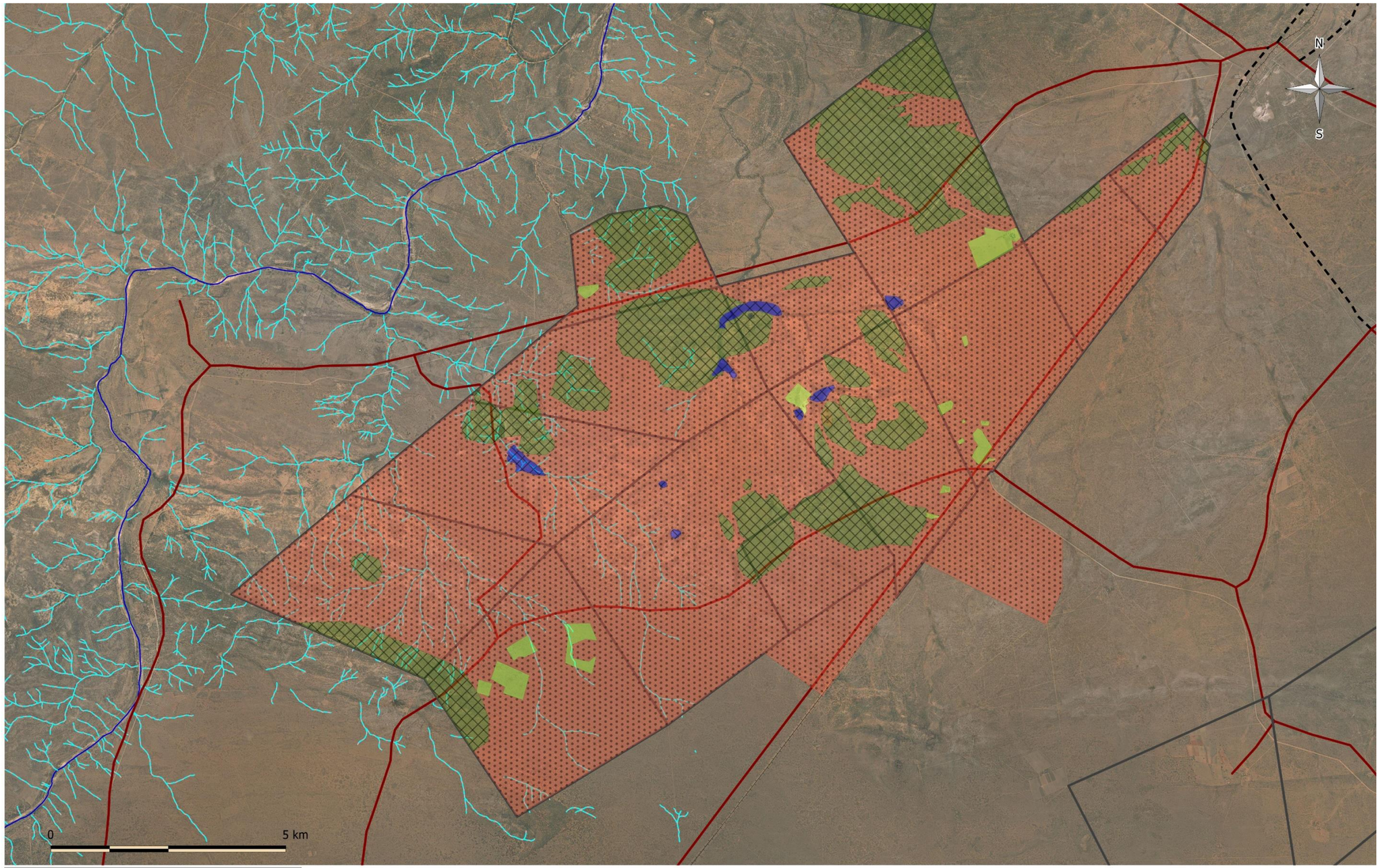

Figure 5-48: Mapped vegetation communities of the mining right application (MRA) area (Jutland).

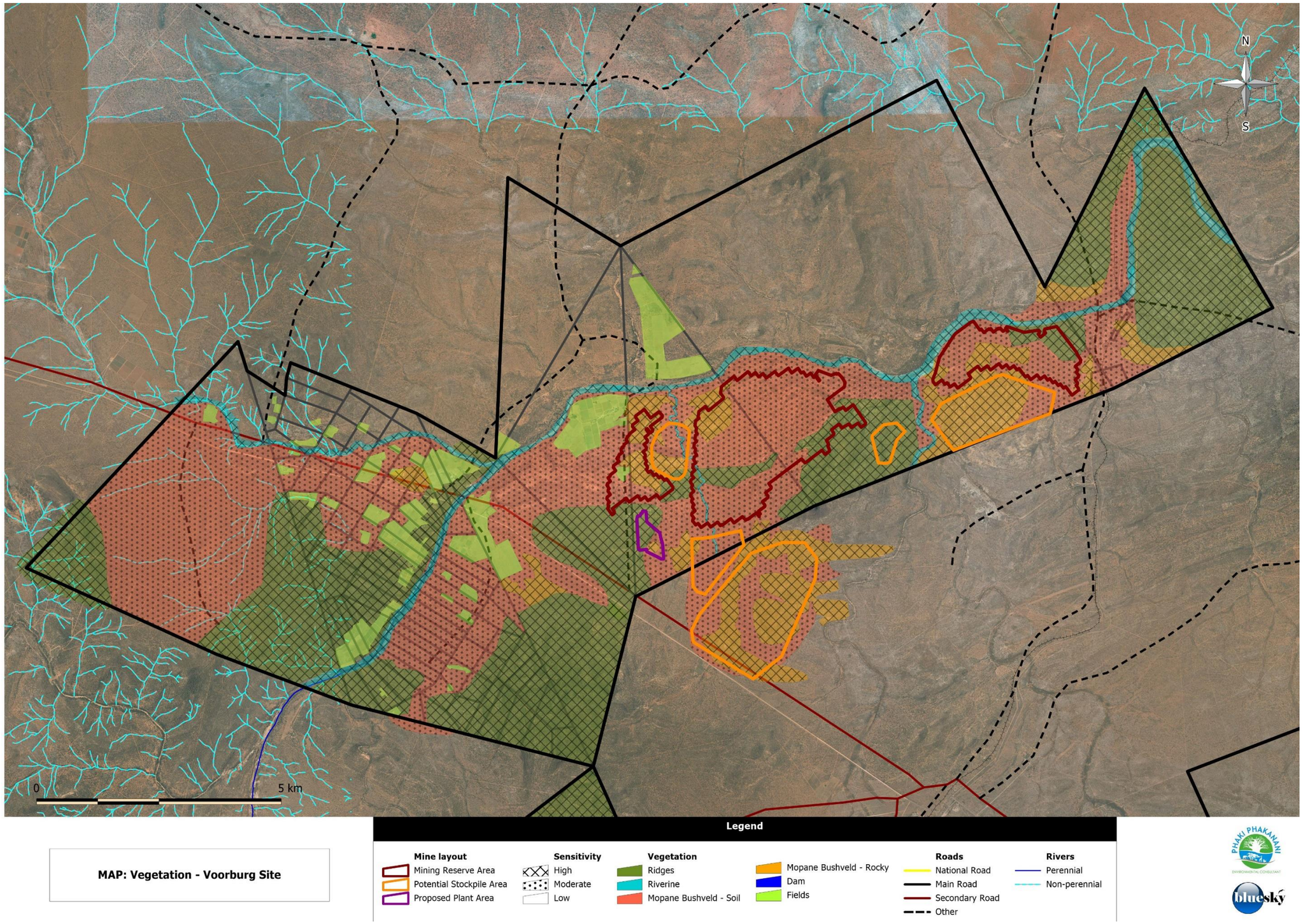

Figure 5-49: Mine layout overlaying vegetation sensitivity map (Voorburg).

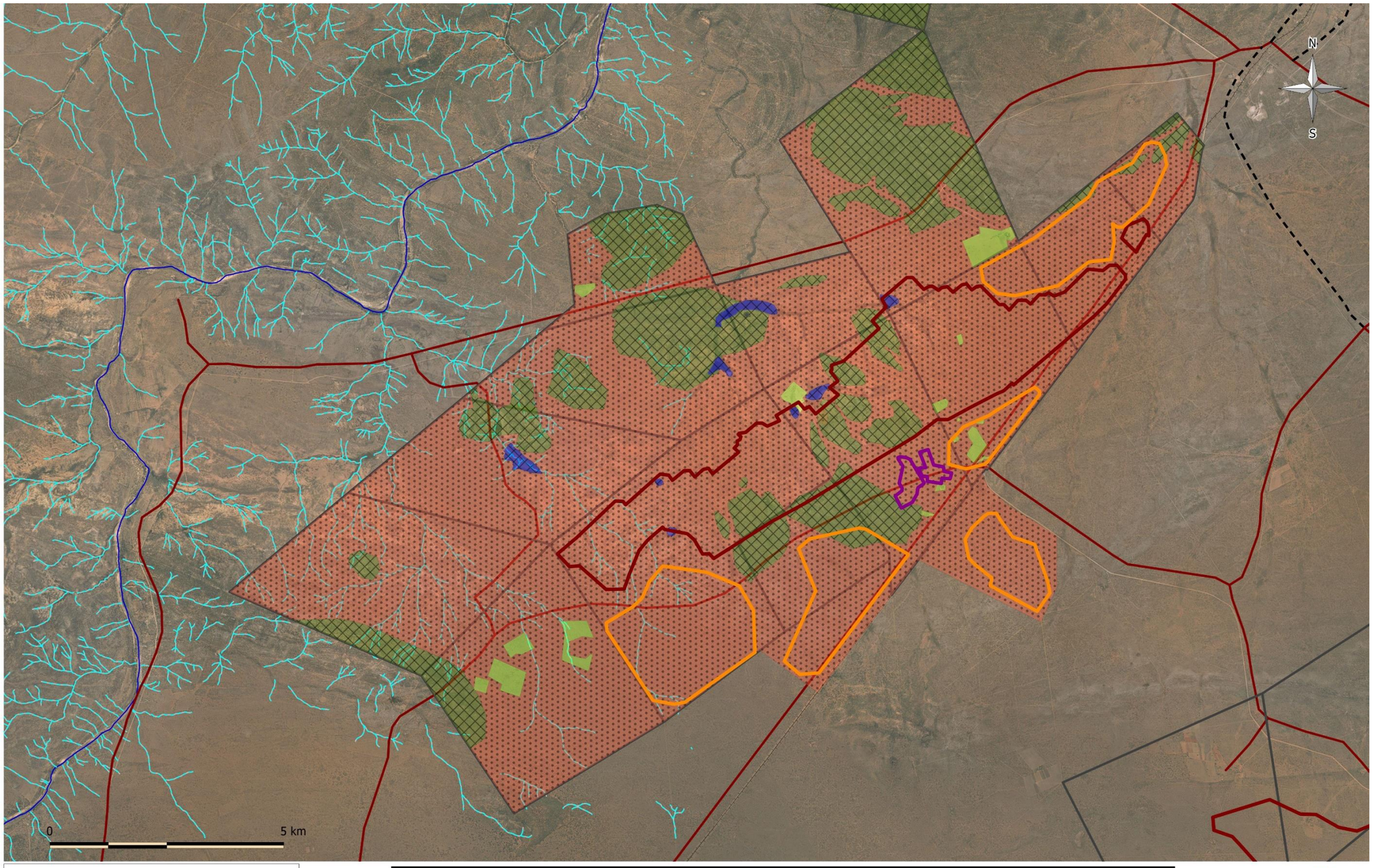

Figure 5-50: Mine layout overlaying vegetation sensitivity map (Jutland).

6 Flora

6.1 Protected and Endemic Flora

Table 6.2 lists the protected flora that could potentially occur within the site, having distributions within Limpopo and the Soutpansberg, although many may not be present at lower altitudes such as is the case regarding the Mopane site. These were investigated during the site visit, as far as possible, based on site visit and seasonal limitations.

Due to seasonal (winter) constraints during the site visit, the presence/absence of these species could not be confirmed.

Table 6.1: List of applicable conservation status (status indicated in table below.)

**Status	Conservation Status
LEMA12	Limpopo Environmental Management Act, No. 7 of 2003. Schedule 12: Protected plants
NFA	National Forest Act, No. 84 of 1998.
RED-E	J. Golding (ed), 2002. *Southern African Plant Red Data lists* (Southern African Botanical Diversity Network Report 1). Pretoria, South Africa: National Botanical Institute – Endemic species
HAHN	Hahn, 2003. Soutpansberg Endemic Flora
RED-RDL	J. Golding (ed), 2002. *Southern African Plant Red Data lists* (Southern African Botanical Diversity Network Report 1). Pretoria, South Africa: National Botanical Institute – Red data listed
TOPS-E	Threatened or Protected Species Regulations, Govt Notice No. R152 of 23 February 2007 – Endangered species
TOPS-P	Threatened or Protected Species Regulations, Govt Notice No. R152 of 23 February 2007 – Protected species
TOPS-V	Threatened or Protected Species Regulations, Govt Notice No. R152 of 23 February 2007 – Vulnerable specie

Table 6.2: List of potential plant species with respective conservation statuses indicated.

Botanical Name	Afrikaans Name	English Name	**Status	Presence*
Acacia erioloba		Camel Thorn	RED-RDL (DE)	C
Adansonia digitata	Kremetartboom	Baobab	NFA, LEMA12	C
Adenia gummifera var. *gummifera*		Monkey Rope	RED-RDL (DE)	N
Adenium multiflorum	Impalalelie	Impala lily	LEMA12	C
Adromischus umbraticola subsp. *ramosus*			RED-RDL (DD)	N
Alepidea peduncularis			RED-RDL (DD)	N
Aloe angelica		Williespoort Aloe	HAHN	N
Aloe littoralis	Mopanie-aalwyn/Bergaalwyn	Mopane Aloe littoralis	LEMA12	N
Aloe swynnertonii		Vumba Aloe	RED-RDL (DD)	N
Aloe vossii			RED-RDL (DD)	U
Aristida scabrivalvis subsp. *contracta*	Pers-steekgras	Purple three-awn grass	RED-E	N
Balanites maughamii	Fakkelhout	Torchwood	NFA	C

Botanical Name	Afrikaans Name	English Name	**Status	Presence*
Barleria holubii	Kleinblaar-barleria	Small-leaved Barleria	RED-RDL	N
Blepharis spinipes			HAHN	N
Boscia albitrunca	Witgat	Shepherd's tree	NFA	C
Bowiea volubilis subsp. *volubilis*		Climbing Onion	RED-RDL (VU)	N
Ceratotheca saxicola			HAHN	N
Ceropegia cimiciodora			RED-RDL (VU)	N
Cineraria alchemilloides subsp. *alchemilloides*			RED-RDL (Rare)	N
Combretum imberbe	Hardekool	Leadwood	NFA	C
Combretum vendae		Venda Bushwillow	HAHN	C
Cryptocarya transvaalensis			RED-RDL (DE)	N
Curtisia dentata		Assegai	RED-RDL (NT)	N
Cyamopsis dentata			RED-E	N
Delosperma zoutpansbergense		Ice Plant	HAHN	N
Dicoma montana			HAHN RED-RDL (Rare)	N
Duvalia procumbens			HAHN	N
Elaeodendron transvaalense		Bushveld Saffron	RED-RDL (NT)	N
Encephalartos hirsutus		Venda Cycad	HAHN	N
Euphorbia aeruginosa			HAHN	N
Gunnera perpensa		River Pumpkin	RED-RDL (DE)	N
Harpagophytum procumbens	Duiwelsklou	Devil's Claw /Grapple plant	TOPS-P	N
Hibiscus waterbergensis			RED-RDL	N
Hoodia corrorii subsp. lugardii	Ghaap	Ghaap	LEMA12,TOPS-P	N
Huernia spp *Huernia nouhuysii*		Huernia (all species) – Zebraflower, Toad plant, Owl-eye, etc.	LEMA12 RED-RDL (VU)	N
Ilex mitis var. *mitis*		African Holly	RED-RDL (DE)	N
Ipomoea bisavium			HAHN RED-RDL (Rare)	N
Justicia montis-salinarum			RED-RDL (Rare)	N
Kalanchoe crundallii			HAHN	N
Khadia borealis			RED-RDL (Rare)	N
Myrothamnus flabellifolius			RED-RDL (DD)	N
Mystacidium brayboniae			HAHN RED-RDL (NT)	N
Ochna glauca	Bloublaarrooihout	Bird's eye/blue-leaved ochna	RED-RDL	N
Ocotea kenyensis		Transvaal stinkwood	RED-RDL (VU)	U
Orbea hardyi			RED-RDL (Rare)	N
Orbea maculata subsp.			RED-RDL	N

Botanical Name	Afrikaans Name	English Name	**Status	Presence*
maculate				
Orbea spp		Orbea (all species)	LEMA12	N
Otholobium polyphyllum			RED-RDL	N
Panicum dewinteri			HAHN RED-RDL (NT)	N
Pavetta tshikondeni			HAHN	N
Peristrophe cliffordii		Peristrophe	LEMA12, RED-RDL, RED-E	N
Peristrophe gillilandiorum		Peristrophe	LEMA12, RED-RDL, RED-E	N
Philenoptera violacea	Appelblaar	Apple-leaf /Raintree	NFA	C
Plinthus rehmannii			RED-RDL	N
Prunus africana		Red Stinkwood	RED-RDL (VU)	U
Psoralea repens			RED-RDL	N
Rapanea melanophloeos			RED-RDL (DE)	N
Rhus magalismontana subsp. coddii	Bergtaaibos		HAHN	N
Rhynchosia vendae			HAHN	N
Sartidia jucunda			RED-RDL (VU)	N
Sclerocarya birrea subsp. *caffra*	Maroela	Marula	NFA	C
Sesbania leptocarpa/mossambicensis			RED-E	N
Stapelia spp	Aasblom	Carrion Flower/Stapelia (all spp)	LEMA12	N
Streptocarpus caeruleus			HAHN	N
Tavaresia/Decabelone spp		Ghaap (all species)	LEMA12	N
Tylophora coddii			RED-RDL (Rare)	N
Warburgia salutaris	Peperbasboom	Pepper-bark tree	RED-RDL (EN)	N
Zoutpansbergia caerulea			HAHN	N

*** Presence: C-Confirmed; N-Not confirmed, but possibly present; U-Unlikely.**

The core of the Soutpansberg Centre of Endemism is associated with the rocky areas within the Soutpansberg Mountains, with approximately 3 000 vascular plant species and one endemic genus. Approximately 1.5% of the species recorded within the Soutpansberg Centre of Endemism are considered endemic/near-endemic species/infraspecific taxa. Of the 45 endemic or near endemic species, almost 47% of the species are succulents.

Many species are dormant or a positive identification is not possible during the winter months, and their presence/absence could not be confirmed.

6.2 Introduced and Exotic/Alien Plants

Due to the low rainfall, the project area is generally free of unwanted species and is likely to remain so. Introduced and exotic plants are limited to developed, disturbed and riparian areas.

Table 6.3: Exotic and weed plant species found within the site.

Botanical Name	Common Name	CARA Status*	Presence/Comment
Argemone subfusiformis	Mexican poppy	1	Scattered, often in disturbed areas, can become problematic if left uncontrolled
Caesalpinia gilliesii	Bird of paradise	1	
Melia azedarach	Syringa	3	Scattered, uncommon outside of riparian area and along watercourses
Ricinus communis	Castor Oil Bush	2	Scattered, often in disturbed areas, can become problematic if left uncontrolled
Sesbania punicea	Dorset pea	1	Scattered, often in disturbed areas, can become problematic if left uncontrolled

***CARA Status: Refer to relevant legislation section for clearing requirements.**

The Mexican Poppy, Castor Oil Bush and Dorset Pea can become invasive as weedy pioneers in disturbed areas and would require control during post mining rehabilitation.

7 Fauna

7.1 Key Findings

7.1.1 Mammals

The Soutpansberg has a remarkable diversity of mammals that make up 60% of the total number of species that occur in South Africa. More mammal species have been recorded in the Soutpansberg than in the Cape Floristic Kingdom, which was previously recorded at 127. The Kruger National Park only contains two more species of mammals than the Soutpansberg, which is particularly rich in bats, carnivores and larger hoofed animals.

Of the 104 mammal species (listed in Appendix 2) known to occur within the Mopane bushveld area, there are 2 species which are critically endangered:

- Black Rhinoceros (*Diceros bicornis michaeli*)
- Short eared Trident Bat (;*Cloeotis percivali*)

There are 2 endangered species:

- Tsessebe (*Damaliscus lunatus lunatus*)
- African wild dog (*Lycaon pictus*)

10 Near threatened species:

- South African Hedge-hog(*Atelerix frontalis*)
- Serval (*Leptailurus serval*)
- Spotted Hyaena (*Crocuta crocuta*)
- Brown Hyaena (*Hyaena brunnea*)
- Honey Badger (*Mellivora capensis*)
- Leopard (*Panthera pardus*)
- Goeffroy's Horseshoe Bat (*Rhinolophus clivosus*)
- Darling's Horseshoe Bat (*Rhinolophus darlingi*)
- Hildebrandt's Horseshoe Bat *(Rhinolophus Hildebrandtii*)
- Schreiber's Long-fingered Bat(*Mimiopterus schriebersii)*

And 6 vulnerable species include:

- Roan antelope (*Hippotragus equinus*)
- Sable antelope (*Hippotragus niger niger*)
- Cheetah (*Acinonyx jubatus*)
- Lion (*Panthera leo*)
- Ground pangolin(*Manis temminckii*)
- Giant rat (*Cricetomys gambianus*)

Figure 7-1: Bat droppings from bats roosting under roof of building.

Mammals form a significant part of the fauna in the Mopane bushveld, and can be subdivided into the following categories: small mammals, large mammals and extralimital mammals.

A. Large and extralimital mammals:

Large mammals are important as they control the populations of small mammals, such as rodents. A large portion of the Mopane bushveld in the Limpopo Province has been subdivided into game farms by and many species are prevented from vagility (free movement) due to large scale of fencing. Medium mammals (baboons and bat eared foxes) can still move between habitats through holes under fences and by climbing fence poles, however larger mammals are restricted by the fencing.

Game farm management is a major practise in the Limpopo province. This is practised mainly to generate financial income for the people who reside in the area.

Game ranch management (farming) is practised for the following reasons:

- Tourism – with game farming, people are able to experience wild African game, with activities such as; safaris, game hunting, camping and resorts. Game are attracted to water holes (for tourists to see) by means of supplement feeding, water and salt licks.
- Breeding – game farmers breed their animals for sales purposes. Many farmers breed certain large mammals for sale or auction, mammals such as sable or disease free buffalo can fetch a high price on auction.
- Another form of game breeding is for the purpose of colour mutation. For example; the black impala and black giraffe. This was observed on the Farm Ancaster.

Figure 7-2: Salt lick provided to attract game to a determined area.

Figure 7-3: Sign advertising a game farm.

Figure 7-4: Look out where clients can view game by a water hole.

Figure 7-5: Game ranch where selective game breeding is practised.

Figure 7-6: Amenities offered to clients visiting a game farm.

Small mammals

Little taxonomy exists regarding small mammals due to their; size, habitat and habits (nocturnal species)). As site visits were conducted in the dry season (winter), the presence of small animals was limited due to the lack of grasses. Therefore, insubstantial evidence was obtained in ascertaining their presence.

Small mammals make up the majority of all mammals (in number of species and abundance) and are represented in the following taxa: *Insectivora*; *Primates*; Lagomorpha; *Rodentia*; *Carnivora*; and *Hyracoidea*.

Small mammals play an important ecological role (Smit *et al*, 2001), as they act as pollinators of certain plants. For example, the Namaqua rock mouse (*Aethomys namaquensis*) pollinates flowers of the *Hyacinthaceae* family (Fleming and Nicolson, 2001). Other small mammals are seed and seedling predators and serve as important regulators of plant composition in savannah ecosystems (Petersen, 2006). Whereas other small mammals make nests underground which increases soil fertility through decomposition of plant matter and aeration (Keller & Schradin, 2008 .Mugatha, 2002).

Semi-fossorial small mammals make burrows into the ground which provide other mammals refuge from harsh environmental conditions and predators, and others provide insect control of small pest insects.

Small mammals are also an important food source for other faunal species such as; reptiles, raptors, herons, cranes, storks, and larger mammals such as servals. Small mammals occupy almost every niche within the Mopane bushveld.

Extralimital game

In the past certain mammal species naturally occurred in the Mopane district but have been removed from the area due to over hunting, fragmentation of their habitats, etc. Through the realization of financial benefits to man and through intense reserve management, these animals have been brought back into the area by game farmers. The Big 5 (Elephant, Rhino, Leopard, Lion and Buffalo) are a major attraction for the tourist market (game viewing and hunting), and therefore these animals have been reintroduced to the area, although they are within game fence boundaries and not free roaming. The leopard is one of the big 5 species, however it is a naturally occurring species and used to be hunted by small stock farmers. Due to its big 5 status, it enjoys a degree of protection nowadays. This mammal still free roams and has the ability to pass through game fences, except leopard proof fences. The average game fence is designed to keep in large game species, but

due to selective breeding of certain antelopes (prey of the leopard), these animals are protected by leopard proof fencing. In other words due to the animals value, these breeding programs cannot afford to be damaged by predators such as leopard, Owner of Ancaster, *pers coms*.

The Black Rhino, which was previously extinguished from the Soutpansberg has been re-introduced by Game Farms in the area. Elephant, which remain in the eastern part of the Kruger National Park, are also present and occasionally move to the northern foothills of the Limpopo region. Cheetah is found on the plains north of the mountain and Springhare is still relatively common in areas with a suitable habitat.

Figure 7-7: Sable antelope; common game species used in selective breeding.

Figure 7-8: Leopard proof game fence, notice the anti-climbing shock lines.

Figure 7-9: Giraffe, extralimital game to attract clients.

Figure 7-10: Escaped crocodile spotted in a pool on the farm Cavan.

Interrelationships within the Mopane bushveld

There are recognisable interrelationships within the Mopane bushveld and the mammals that reside within it, even though a large portion of the Mopane veld is occupied by large mammal species (present or extralimital). As the Mopane tree is the dominant species in the veld, it offers various advantages to the mammals. For example; during times of limited water and lack of grasses, many buck species (such as the impala) will convert from grazing to browsing, and feed on the small branch tips and fresh leaves of the Mopane tree. The tree also offers nesting and safe haven for tree

squirrels (as was noticed on the farm Du Toit) as several tree squirrel families were noticed using the empty cavities of the Mopane tree for housing.

There is a relationship which exists between the Baobab tree (present in the Mopane bushveld) and the Wahlberg's Epauletted fruit Bat (also present in the Mopane bushveld. Thus the survival of the Baobab is dependent on the 4 species of Epauletted fruit Bat that exist within the Mopane bushveld (Jayway, KZN Wildlife). The Mopane bushveld offers many different food sources for a variety of mammals and thus aids in seed dispersal.

Figure 7-11: *Grewia* sp. producing seed.

Figure 7-12: Seed dispersal by baboons.

Figure 7-13: Tree squirrel climbing a Mopane tree.

Conservation of mammals

Due to the financial benefits realized by game farmeing, many large mammal species are now indirectly protected. Rhino poaching is the main conservation issue and is an ongoing practice. Rhinos are poached, killed or sedated and their horns are removed for sale to a middle-east market (Black Market). This is done due to the belief that the horn has aphrodisiac properties. For example, an alive Rhinoceros is worth R 750 000, but a rhinoceros horn sold on the black market can fetch R 6 000 000. Up to date an average of 1 Rhinoceros is poached every day throughout South Africa.

Other forms of mammal farming:

Other forms of animal farming occur within the Mopane bushveld, such as cattle stock farming. Cattle farming is geared towards beef production and stud breeding (such as on the farm Du Toit). These animals are protected from predators by fencing. Certain farmers allow cattle onto their game

farms as a form of pest tick control. They treat the cattle with poisons, the ticks attach to the cattle, are poisoned and die. The presence of cattle reduces the number of ticks that would have attached to the game. Goat farming is also practised.

Figure 7-14: Goat farming.

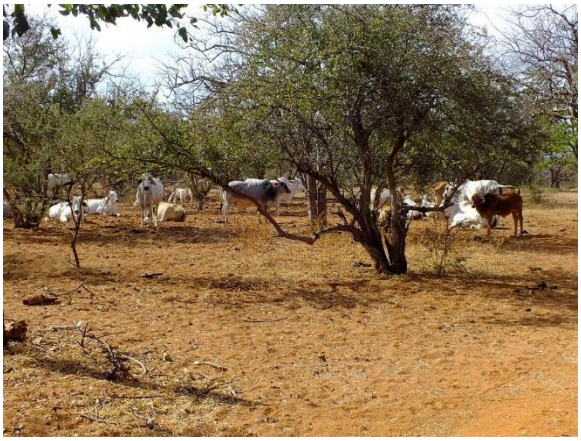

Figure 7-15: Cattle farming.

7.1.2 Avifauna

According to the Soutpansberg Birding Route Organization, the Soutpansberg Mountains and Limpopo River Valley hosts over 540 bird species. This is 56% of the South African avifauna and 76% of the South African terrestrial and fresh water avifauna, excluding vagrants and oceanic avifauna. The Soutpansberg Mountain Range itself hosts between 380 and 400 species. The western Soutpansberg covers an area of 900 km^2 and has 298 species of avifauna (Stuart, Stuart, Gaigher & Gaigher, 2001).The quarter degree Grid Square 2230AA (an area of about 700 km^2) has 338 native species and the quarter degree Grid square which includes The Greater Kuduland Conservancy 2130DA (700km^2 with 412 species) and the Greater Kuduland Conservancy itself (150 km^2 with 304 species). A complete list of potential bird species is provided in Appendix 2.

There are 38 birds of prey species which includes SSC of the Soutpansberg:

- Cape vulture(*Gyps coprotheres*)
- Crowned eagle (*Stephanoaetus coronatus*)
- Forest Buzzard (*Buteo trizonatus*)
- Bat Hawk (*Macheiramphus alcinus*)
- Crested Guineafowl (*Guttera pucherani*)
- Blue spotted wood dove (*Turtur afer*)
- Knysna Turaco (Tauraco corythais)
- Pel's fishing Owl (*Scotopelia peli*)
- Mottled spinetail *(Telecanthura ussheri*)
- Narina Trogon (*Apaloderma narina*)
- African Broadbill (*Smithornis capensis*)
- Grey Cuckoo-shrike (*Coracina caesia*)
- African golden Oriole (*Oriolus auratus*)
- Eastern bearded Robin (*Erythropygia quadrivirgata*)
- Gorgeous Bush Shrike (*Telephorus quadricolo*r)
- Black Fronted bush-shrike (*T. Nigrifrons*)
- Golden Backed Pytilia (*Pytilia afra*)

- Green Twinspot (*Mandingoa nitidula*)
- Pink Throated-Twinspot (*Hypargos margaritatus*)

The Blouberg Nature Reserve is situated approximately 60 kilometres from the study area. The mountain in this reserve houses the largest breeding colony of Cape Vulture (endangered) in the world. These birds have extensive home ranges and the study area falls well within the birds feeding ground.

At least 6 Red Data species that are listed as vulnerable occur in the area:

- White-Backed Night heron(*Gorsachius leuconotus*)
- Cape Vulture, Martial Eagle (*Polemaetus bellicosus*)
- African fin-foot (*Podica senegalensis*)
- Grass Owl (*Tyto capensis*)
- Pel's Fishing Owl

11 near threatened species:

- The Black Stork (*Ciconia nigra*),
- Bat Hawk (*Macheiramphus alcinus*)
- Ayres' Eagle (*Hieraetus ayresii*)
- Crowned Eagle
- Peregrine Falcon (*Falco peregrines minor*)
- Lanner Falcon (*Falco biarmicus*)
- Half collared King-fisher (*Alcedo semitorquata*)
- African Broadbill
- Orabge Thrush (*Zoothera gurneyi*)
- .Wattled-eyed Flycatcher (*Platysteira peltata)*
- Pink -Throated Twinspot

Birds are attracted to the Mopane veld for food and nesting grounds. . Weavers make use of many trees for nest building and breeding, with some species making use of only one species of tree, and others a variety tree species. Weavers are attracted to Mopane veld as many tree species therein have thin branch tips to bind nests to and thorns, to provide protection against predatory nest raiders. . The buffalo weaver (*Dinemellia dinemelli)* limits its breeding to the Baobab (*Adansonia digitata*).

Bee- eaters (*Merops* spp) use steep river banks to dig tunnel nests which offers an advantage. Rollers, such as the Lilac breasted Roller (*Coracias caudatus),* make use of cavities in trees for nesting, many Mopane trees naturally develop cavities in their trunks when they become old.

Birds of Prey (Raptors) are site specific in terms of breeding. The Mopane veld offers a wide variety of habitats that is utilized as nesting habitats for Raptors. For example, African Fish Eagles (*Haliaeetus vocifer*) build large nests in forked branches of a large trees near water courses, while Crowned Eagles make use of similar trees situated in heavily forested areas. Martial Eagles and Black Eagles (*Ictinaetus malayensis*) nest on large cliff faces, while Spotted Eagle Owls (*Bubo africana*) use small cliff edges or edges on river banks to breed. Raptors are attracted to the Mopane veld due to habitat and an abundance of prey, which includes; rodents and birds for the small Raptors and small mammals for larger Raptors. The number of large Raptors that were surveyed for the purpose

of the proposed mine was limited, due to the fact that they have large home ranges. For example the Martial Eagle has a home range of up to 100 km², and therefore the resident pair of Martial Eagles will keep out any of its own species within the radius of 100 km.

Figure 7-16: Buffalo weaver nests in a Baobab tree.

Figure 7-17: Sociable weaver sp. nests in *Acacia* sp. tree.

Figure 7-18: Weaver sp. nests in *Acacia* sp. tree.

Figure 7-19: Sociable weaver sp. Nests

Figure 7-20: Little Bee-eater (*Merops pusillus*).

Figure 7-21: Lilac-breasted Roller (*Coracias caudatus)*.

Figure 7-22: Grey Go-away-bird (*Corythaixoides concolor*).

Figure 7-23: Magpie Shrike (*Corvinella melanoleuca*).

Figure 7-24: Southern Yellow-billed Hornbill (*Tochus leucomelas*).

Figure 7-25: African fish eagle (*Haliaeetus vocifer*).

Figure 7-26: Pale chanting goshawk (*Melierax canorus*).

Figure 7-27: Potential swallow nest under a bridge.

Avifaunal Conservation in the area

There are various Bird conservation groups within the Mopane veld area which have endorsed bird conservation initiatives.

BirdLife South Africa (www.birdlife.org.za) is an Organization that manages the Important Bird Areas (IBA) Programme in South Africa. This programme is designed to identify and protect a network of sites, at a bio-geographical scale, that are critical for the long term viability of naturally-occurring bird populations. This Organization promotes this by being a recognized as an Interested and Affected Parties to mining and large scale development projects Environmental Impact Assessments throughout South Africa. It is advisable to communicate with this organization during the E.I.A. process. They can be contacted by email on: info@birdlife.org.za

The Mabula Ground-Hornbill Project (www.mabulagroundhornbillconservationproject) has a Mandate to reverse the decline of the Southern Ground- Hornbill (Bucorvus leadbeateri) population by 2020. They can be contacted on +27832898610.

7.1.3 Reptiles

There are over 400 reptile species in southern Africa, with a possible occurrence of 120 species in the Mopane bushveld. Reptiles are important as they aid in the control of rodents and provide food for many animals (secretary birds, raptors and carnivorous mammals). They occupy every habitat within the Mopane veld, and certain species occupy restricted habitats (niches). Any form of destruction/development will have extremely negative effects on these reptiles. A complete list of reptiles is provided in Appendix 2.

There are 4 species that could occur in the Mopane bushveld with a near threatened status:

- Distant's ground agama(*Agama aculeate distant)*
- Southern African Python(*Python natalensis*) Soutpansberg
- Flat Lizard(*Platysaurus relictus*)
- Soutpansberg Rock Lizard(*Australolacerta rupicola*)

There are 4 species that hold a vulnerable status and could occur within the Mopane bushveld:

- South African Python (*Python natalensis*)
- Muller's velvet gecko (*Homopholis mulleri*)
- Cryptic Dwarf Gecko (*Lygodactylus nigropunctatus incognitus)*
- Soutpansberg Dwarf Gecko (*Lygodactylus ocellatus soutpansbergensis*)

There is one exotic species, the Tropical house gecko (*Hemidactylus mabouia),* along with the presence of the Nile crocodile which was recorded in the Sand River. The presence of the crocodile is a result of recent flooding of the Limpopo River where the crocodiles escaped from a crocodile farm.

Table 7.1: Reptile Species of Special Concern (SSC) that have been identified.

SCIENTIFIC NAME	COMMON NAME	HABITAT	POTENTIAL IMPACT
Homopholos mulleri	Muller's Velvet Gecko	Likely to occur within the mature trees of the Mopane Bushveld.	Destruction of trees during bush clearing will result in a loss of habitat
Lygodactylus nigropunctatus incognitus	Cryptic dwarf gecko	Restricted to outcrops of the Soutpansberg, with isolated populations within the Musina plain.	Direct destruction of outcrops during mining operations.
Lygodactylus Occendentalis soutpansbergensis	Soutpansberg Dwarf Gecko,	Restricted to the mountain outcrops of the Soutpansberg, with isolated outcrops within the Musina Plain.	Destruction of outcrops during mining operations.
Typhlosaurus lineatus subtaeneatus	Striped-bellied Blind legless skink	Restricted to sandy soils within the Musina Plain.	Habitat destruction during mining operations.
Australolacerta rupicola	Soutpansberg rock lizard	Restricted to the Soutpansberg mountain tops. One record, however, confirmed that it can occur within outcrops north of the Soutpansberg.	Destruction of outcrops leading to the destruction of habitat.
Python natalensis	Southern Rock Python	Found throughout the habitat.	Destruction of habitat resulting in conflict with humans.
Amblyodipsas microphthalma nigra	Soutpansberg Purple glossed snake	Restricted to Aeolian soils within the Musina Plain.	Destruction of habitat during mining operations
Xenocalamus tranvaalensis	Speckled Quill-snouted snake	Restricted to Aeolian soils of the Musina Plain.	Destruction of the habitat during mining operations.
Platysaurus relictus	Soutpansberg Flat Lizard	Restricted to the Soutpansberg	Destruction of outcrops leading to habitat destruction.

Figure 7-28: Rainbow skink (*Trachylepis margaritifer*).

Figure 7-29: Striped skink (*Trachylepis striata*).

Figure 7-30: Nile monitor (*Varanus niloticus*) found dead in dam.

Figure 7-31: Turner's Gecko (*Chondrodactylus turneri*).

Figure 7-32: Nile crocodile (*Crocodylus niloticus*).

Figure 7-33: *Afroablepharus maculicolis.*

Figure 7-34: Mountain tortoise (*Stigmochelys pardalis*) shell.

Figure 7-35: Peter's Ground Agama (*Agama armata).*

Figure 7-36: Horned adder (*Bitis caudalis).*

Figure 7-37: Long-tailed Worm Snake (*Leptotyphlops longicaudus*).

Figure 7-38: Common Flat Lizard (*Platysaurus intermedius rhodesianus*).

Figure 7-39: Juvenile bushveld lizard (*Heliobolus lugbris*).

Figure 7-40: Ornate Sandveld Lizard (*Nucras ornate*).

Figure 7-41: Puff adder (*Bitis arientans*).

Figure 7-42: Western Yellow-bellied Sand Snake (*Psammophis subtaeniatus*).

Figure 7-43: Tropical House Gecko (*Hemidactylus mabouia*).

Figure 7-44: Rhombic egg-eater (*Dasypeltis scabra*).

Figure 7-45: Mozambique spitting cobra (*Naja mossambica*).

7.1.4 Amphibians

Amphibians are difficult to survey as many of them are nocturnal and many are restricted to permanent water bodies. The correct time to survey frogs is during times of high rainfall or whilst it is raining. One can identify frogs by the calls (vocalization) of the males during breeding season.

As the surveys were conducted in July (which is out of frog season), there is a lack of species recorded. There is a possibility of 26 amphibian species that could occur within the Mopane veld, of which 1 species is considered endangered, the Northern Forest Rain Frog (*Breviceps silvestris*). There are 2 species which are protected under the National Environmental Management: Biodiversity Act 2007, under the Threatened and Protected Species Rating; the Giant African Bull Frog (*Pyxicephalus adspersus*) and the African Bull Frog (*Pyxicephalus edulis*). A complete species list is provided in Appendix 2.

Rain frogs spend much of their lives underground and only rise after heavy rainfall. During dry spells, they will lay dormant for many months waiting for rains. During times of rainfall, they emerge all at once and begin courtship and mating, they are called explosive breeders. During these times they are often killed (by the hundreds) at night on busy roads. These frogs are not water specific and do not need to reside near permanent water for survival or breeding.

A. Bush veld Rain frog (*Breviceps adspersus)*

Bull frogs are not usually attracted to flowing water bodies, but occur in pans. The bull frog is dependent on pans as it has adapted its life cycle to the exclusive functioning of a pan; in other words, bull frogs rely on the cycle (drying up and water saturation) of pans to survive. They need to aestivate in order to survive. If the correct functioning of a pan changes, for example the water level stays permanent, then the life cycle of the frog will be detrimentally disturbed. Bull frogs will use temporary puddles and flowing waters(during times of high rainfall) to traverse between pans. During times of limited rainfall, bull frogs will dig underground (up to several meters) and aestivate, they can stay in this state for several years at a time.

Figure 7-46: Bush veld Rain frog(*Breviceps adspersus*).

Figure 7-47: Grey foam nest tree frog (*Chiromantis xerampelina*).

Figure 7-48: Raucous Toad (*Amietophrynus rangeri*).

Figure 7-49: Giant African Bull Frog (*Pyxicephalus adspersus*).

7.1.5 Invertebrates

An elimination process was undertaken when investigating invertebrate (insects). Firstly, insects were categorized and analysed according to the insects' occurrence within the Limpopo Province and its distribution in terms of the study area (the northern area of the Limpopo Province). They were then cross referenced for specific occurrence in the Mopane bushveld through important factors, such as; dietary requirements, flora and micro habitat. Other important factors include; cultural, pest, ecological factors and conservation status.

For example, the *Pontia helice* (Meadow White Butterfly) occurs within the Limpopo Province as well as throughout South Africa. It was therefore excluded from this report as it will not be affected by the mining activities. However, the *Sagra bicolor* (Swollen-legged Leaf beetle) only occurs in the Limpopo Province, the northern parts of the North West Province and Mpumalanga, it has limited distributed throughout South Africa and has therefore been included.

Invertebrate communities consist of decomposers, herbivores, parasites and predators (carnivores), and all occur within the Mopane veld. However, even though a particular species is dependent on the Mopane veld, they have been documented to survive on other vegetation habitats.

A. Termites

There are seven species of termites that occur in the northern region of the Limpopo Province (Picker, Griffiths & Weaving, 2004), with three important species occurring within the study area: *Amitermes hastats* (Black Mound Termite), *Odontotermes badius* (Common Fungus-growing Termite) and *Macrotermes natalensis* (Large Fungus-growing Termite).

Termites play a major role in the Mopane veld ecology.

- They aid in moribund tree decomposition (collapsed old dead trees) thus bringing them to the soil surface to decay.
- They provide a means of burying plant matter underground, which in turn increasing the nutrient value of the soil.
- An abandoned moribund termite mounds serve as a refuge for reptiles, such as snakes and geckos.
- They also act as a food source for animals such as birds, small mammals and larger mammals, such as the aardvark.

Thus said, Termites are a major contributor to the ecological functioning of the Mopane veld. The ecological balance between termites and the woodland will be disrupted as a result of unsound human development practices. For example, termites might consume too many trees and affect development by devouring fence poles, wooden structures and buildings. Termites have more mobility as they spread to new areas via flying ants. Therefore, Termites are highly important as they build their nests around and against trees, and then convert the tree into soil (when the tree dies) to provide nutrients for new plants and trees to grow.

Figure 7-50: Black mound termites (*Amitermes hastats*).

Figure 7-51: Common Fungus-growing Termite (*Odontotermes badius*).

Figure 7-52: Nest of Common Fungus-growing Termite (*Odontotermes badius)*.

Figure 7-53: Nest of Common Fungus-growing Termite (*Odontotermes badius*).

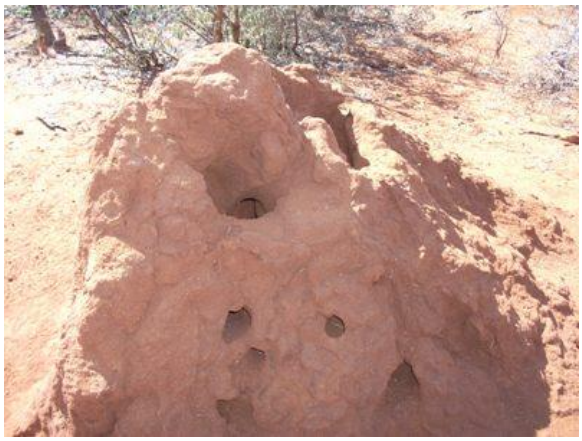

Figure 7-54: Nest of Large Fungus-growing Termite (*Macrotermes natalensis*).

Figure 7-55: Air vent in nest of Large Fungus-growing Termite (*Macrotermes natalensis*).

Butterflies and moths

Many butterfly species are habitat specific and can be regarded as bio-indicator of rare ecosystems (Terblanche, 2012). According to Woodhall (2005) it is preferable to survey butterflies at specific times of the year, mainly springtime and early summer, or late summer to autumn. Since the rainy season had no yet commenced during the site-visit, many plant species were still dormant and thus, a full butterfly survey was unable to be completed.

There are 9 Red Data Butterfly species which could occur within the study area. According to Henning, Terblanche & Ball (2009) threatened butterfly species of the Limpopo Province are:

- *Alaena margaritace* (Wolkberg Zulu): critically endangered
- *Aloeides stevensoni* (Steven's POrt): Vulnerable
- *Anthene crawshayi juanitae* (Juanita's Ciliated Blue/Hairtail): Vulnerable
- *Dingana jerinae* (Jerine's Widow): vulnerable
- *Erikssonia edgei* (Edge's Acraea Copper) :critically endangered
- *Lepidochry sops lotana* (Lotana Blue critically): endangered
- *Pseudonympha swanepoeli* (Swanepoel's Brown): critically endangered
- *Telchinia induna salmontana* (Soutpansberg Acraea): vulnerable.
- *Anthene liodes* (Liodes Ciliated Blue/Hairtail) is not threatened but is of special conservation concern due to its very restricted range in South Africa.

The greater Soutpansberg area can support over 250 butterfly species (Woodhall, 2005). The *Acraea machequena* and *Acraea lygus* are both rare species with limited distributions in South Africa and could occur within the Mopane veld.

Over 50 species of butterflies occur within the Mopane bushveld. Out of the habitats investigated, it was found that the butterfly species were most abundant within the riparian zones. The most important species identified are as follows and are listed in terms of their distribution and association to the Mopane Veld:

- White-cloaked Skipper (*Leucochitonea levubu*)
- Friar (*Amauris niavius*)
- African Monarch (*Danaus chrysippus*)
- Guinea Fowl (*Hamanumida daedalus*)
- Green-veined Charaxes (*Charaxes candiope*)
- Foxy Charaxes (*Charaxes jasius*)
- Club-tailed Charaxes (*Charaxes zoolina*)
- Straight-line Sapphire (*Lolaussilas*)
- Swanepoel's Copper (*Aloeides swanepoeli*)

Figure 7-56: Foxy Charaxes (*Charaxes jasius*).

Figure 7-57: Blue Pansy (*Junonia oenone*) common in Mopane Veld.

Figure 7-58: Scarlet Tip (*Colotis danae*) common in Mopane Veld.

Ant lions

There are 14 species of Ant lion that occur within the Mopane bushveld area (Picker, Griffiths & Weaving, 2004). Ant lions control the ant population in South Africa, and they are all predators.
The larval stage of the Ant lions life-span is terrestrial, later they become flying insects that resemble dragonflies. Ant lions burrow funnel traps into loose sand whilst submerging themselves in the centre of the burrow to wait for prey to fall into the trap. They are not sand specific and can be found in many different types of soil; the main factor for their occurrence is loose dry soils.
Although certain species occur throughout South Africa, some species are limited to the Mopane veld. The most important species are:

- Gregarious antlion (*Hagenomyia tristis)* whose larvae lives off soft vegetation under trees
- Large grassland antlion (*Creoleon Diana*) which lives in the Acacia grassland
- Grassland Ant lions (*Distoleon pulverulentus*) whose larvae live in shallow loose sand.
- *Neuroleon* whose larvae lives in fine sand under over hanging rock
- Dotted veld ant lion (*Palpares sobrinus*), the larvae travels freely in loose sand and lie just below the surface to ambush and drag prey under
- Mottled veld ant lion (*Palpares caffer*) whose larvae travels freely in loose soil just beneath the surface to ambush prey and drag them under the sand
- Hook tailed ant lion (*Palparidius concinnus*), the larvae live and feed in deep sand

- Blotched long-horned antlion (*Tmesibasis lacerate*), with this species, the larvae live under stones.

Figure 7-59: Actual size of an antlion larvae.

Figure 7-60: Blotched long-horned antlion (*Tmesibasis lacerate*) larvae.

Figure 7-61: Different soils used by ant lions.

Figure 7-62: Different soils used by ant lions.

Figure 7-63: Different soils used by ant lions.

Figure 7-64: Different soils used by ant lions.

Lady Birds (Family: Coccinellidae)

Lady birds are important invertebrates as they are a form of biological pest control for citrus farming. The larvae are commonly black with conspicuous yellow or white markings. Adults and larvae are usually carnivorous (feeding on various homopteran bugs, small insects and mites), except

for the subfamily *Epilachninae* which are herbivorous. 5 carnivorous species occur within the Mopane veld, (Picker, Griffiths & Weaving, 2004) namely:

- Black Two-spot Ladybird (*Chilocorus distigma*) which feeds on Aloe white scale
- Humbug Ladybird (*Micraspis striata*),which feeds on small insects (such as thrips)
- Spotted Amber Ladybird (*Hippodamia variegate*), a specialized feeder of aphids
- Lunate Ladybird (*Cheilomenes lunata*), specialist feeder of aphids (including wheat aphids)
- Black Mealy Bug Predator (*Exochomus flavipes*), which feeds on aphids, mealy bugs, soft scales and cochineal insects.

There are two species of lady birds which are herbivorous and are known pests, namely:

- Nightshade Ladybug (*Epilachna paykulli*) which is a pest for feeding on the leaves of potato leaves, solenaceous plants, and tomatoes.
- Potato Ladybird (*Epilachna dregei*); which feeds on leaves of potatoes and tomatoes.

Mygalomorph spiders (with reference to baboon spiders)

Mygalomorph spiders are a primitive group of spiders and mainly consist of tarantulas, baboon spiders and trap door spiders. It is important to note that all baboon spiders are protected by the National Environmental Management: Biodiversity Act (NEMA) 2007, Threatened or Protected Species (TOPS). Baboon spiders (*Arachnida Theraphosidae*) with a high conservation status in the Limpopo Province are:

- *Ceratogyrys bechuanicus,* they are not threatened but all *Ceratogyrus* species are protected by TOPS.
- *Ceratogyrys brachycephalus*, all *Ceratogyrus* species are protected by TOPS
- *Pterinochilus*, all *Pterinochilus* species are protected by TOPS.

Baboon spiders belonging to the *Ceratogyrus* family (Horned baboon spiders) are mainly found in the Limpopo Province. It is of importance to the pet trade and is on the TOPS list with other baboon spider genera *Harpactira* and *Pterinochilus*.
Ceratogyrus bechuanicus and *Ceratogyrus brachycephalus* are usually only found in small colonies, whereas Baboon spiders, such as *Pterinochilus* are usually in much larger colonies. The distribution of *Ceratogyrus bechuanicus* ranges from Botswana, Central Namibia, Zimbabwe and Mozambique to the northern parts of South Africa (Dippenaar-Schoeman, 2002). *Ceratogyrus bechuanicus* has also been recorded in the western Soutpansberg (Foord, Dippenaar-Schoeman & Van der Merwer, 2002).

In contrast to *Ceratogyrus bechuanicus*, *Ceratogyrus brachycephalus* has a more restricted distribution. They are confined to localities in central Botswana, southern Zimbabwe and the extreme north of Limpopo (De wet & Dippenaar-Schoeman, 1991: Dippenaar-Schoeman, 2002). *Ceratogyrus* bechuanicus is well represented in the Kruger National Park (De wet & Schoonbee, 1991). *Ceratogyrus brachycephalus* has only been found in the Messina Provincial Nature Reserve, while its historical distribution includes the Langjan Nature Reserve (De wet & Schoonbee 1991). *Ceratogyrus brachycephalus* with a much smaller distribution has a higher conservation priority than *Ceratogyrus bechuanicus*.

There appears to be no threatened baboon spider species on the site, although care must be taken to provide for natural no-go areas to provide habitat if there should be on the site. The diversity of micro habitats supports the statement that baboon spiders are present on the site.
There is an abundance of orb web spiders within the Mopane Veld which encourages the female wasp of *Batozonellus fuliginosus* into the bushveld as it specializes in preying on orb web spiders.

Figure 7-65: Orb web spider, preyed upon by *Batozonellus fuliginosus.*

Figure 7-66:

Scorpions

Hadogenes troglodytes, a non-threatened rock scorpion, is habitat sensitive and therefore protected by TOPS. *Hadogenes troglodytes* is sensitive to habitat destruction owing to its small brood size and slow rate of reproduction (Leeming, 2003). *Hadogenes troglodytes* is restricted to rocky outcrops and mountain ranges in the northern parts of South Africa (Leeming, 2003) and is the longest scorpion in the world. *Opistophthalmus wahlbergi* is known from the area and is protected by TOPS.

Figure 7-67: *Hadogenes troglodytes.*

Figure 7-68: *Parabuthus transvaalicus.*

Figure 7-69: *Parabuthus granulatus*

Wasps

Wasps are known as insect predators. Wasps either occur throughout the entire South Africa or have widespread distributions within South Africa; none of which are exclusively dependant on or are have exclusive distribution within the Mopane veld .The cricket hunter wasp (*Chlorion maxillosum*) preys on the giant burrowing cricket (*Brachytrupes membranaceus*), which is restricted to the Mopane veld.

Dung beetles

Dung beetles perform an important ecological function in the bushveld. Dung beetles convert animal dung into humus and deliver manure under the ground, thus aiding in nutrient delivery to plant roots.There are over 700 dung beetle species throughout South Africa. The conservation important dung beetles within the area are:

- *Scarabaeus schulzeae*
- *Metacatharsius sp*
- *Proagoderus lanista*
- *Onitis obenbergeri*

Other important dung beetles which do not have a listed conservation status are:

- Green dung beetle (*Garreta nitens*)
- Grooved dung beetle (*Heteronitis castelnaui*)
- Trident dung beetle(*Heliocopris neptunus)*
- Plum dung beetle (*Anachalcos convexus)*
- Bi-coloured dung beetle (*Proagoderus tersidorsis*)
- Large Copper dung beetle (*Kheper nigroaeneus)*
- Fork nosed dung beetle (*Coptorhina klugi*)

These dung beetle species were identified as important due to their exclusive distribution within the Mopane veld and limited distribution throughout South Africa etc.

Figure 7-70: Armoured darkling beetle found in bucket from previous night trapping.

Mopane Moth (*Imbrasia belina*)

The larvae of the Mopane Moth feed on a large variety of plants including; Mopane (*Colophospermum Mopane*), *Ficus, Terminalia, Trema* and *Rhus*. They form an important constituent (after evisceration and drying) of the local diet. Outbreaks of this species defoliate shrubs which deprives game of available food. After the moths appear, the Mopane trees recover. This species is in competition with the Speckled Emperor moth (*Gynanisa maja*) and can compete for Mopane trees during the larvae stage, especially when outbreaks occur by both species simultaneously. The Mopane moth is opportunistic and their larvae may feed on citrus trees therefore they may become a pest for the citrus farmers in the surrounding areas.

Other invertebrates of importance are listed in Table 7.2 below

Table 7.2: Table of Invertebrate Species having Ecological Importance.

INSECT SPECIES	ECOLOGICAL IMPORTANCE/COMMENT
Dung beetles	Converts dung into humus which provides nutrients to the soil. 17 difference species occur within the Mopane bushveld.
Armoured darkling beetle	The beetle larvae lives in the soil and feeds on roots and plant detritus, converting the matter into soil nutrients. Its presence was confirmed in the Sand River, 4 were found in the pit traps on one occasion.
Corn cricket	This insect feeds on acacia leaves and forms a major food source for bat eared foxes, birds and jackals. There are citrus farms in proximity to the proposed mining area, where the insect has been known to become pests.
Giant burrowing cricket (*Brachytrupes membranaceus*)	Occur mainly within Mopane Veld, and is hunted by the cricket hunter wasp (*Chlorion maxillosum*). The Giant burrowing cricket is the largest and loudest cricket in the world.
Bush hoppers (family *Euschmidtiidae*)	Mainly occurs within the Limpopo Province.
Brachytypus rotundifrons (no	Distribution is restricted to the Limpopo Province.

INSECT SPECIES	ECOLOGICAL IMPORTANCE/COMMENT
common name)	
Pantoleistes princeps	Occurs within the Mopane Veld and is associated with termite mounds.
Homoeocerus auriculatus	Occurs within Mopane veld, and feeds on both indigenous and alien acacia species (*Acacia mearnsii*).
Leptoglossus membranaceus	This insect is a pest to citrus farmers, as the fruit which they feed on will drop from the tree. There are many Citrus farms in the area.
Dieuches	A ground dwelling insect that feeds on dassie (*Hyrax*) dung.
Edible stinkbug (*Encosternum delegorguei*)	A diurnal insect that feeds on Acacia and other shrubs and trees. The bug (harugwa), a local delicacy, is killed in hot water and squeezed to remove the almost nauseating secretion then roasted or dried. Also eaten in South Africa raw or cooked.
Red Scale (*Aonidiella aurantii*)	This is a pest of citrus trees as its toxic saliva cause yellow spots. Most citrus trees in the area are infested with thus bug.
Aloe white scale (*Duplachionaspis exalbida*)	This is a pest to aloes and sever infestations can cause leaf tips to wither. Populations are generally kept under control by wasps and ladybird beetles.
Marsh ground beetle (*Bradybaenus opulentus*)	Predator of small insects and occurs mainly within Mopane veld
Butterflies	50 species occur within the Mopane bushveld. The most important species are: White-cloaked Skipper (*Leucochitonea levubu*), Friar (*Amauris niavius*), African Monarch (*Danaus chrysippus*), Guinea Fowl (*Hamanumida daedalus*), Green-veined Charaxes (*Charaxes candiope*), Foxy Charaxes (*Charaxes jasius*), Club-tailed Charaxes (*Charaxes zoolina*), Straight-line Sapphire (*Lolaus silas*) and Swanepoel's Copper (*Aloeides swanepoeli*).
Bees	Bees form a major role in pollination of the plants and trees in Mopane Veld. There are several species of bees throughout the Limpopo Province, the most important being the Honey bee (*Apis mellifera*). The Cape Honey bee invades and supplants colonies of the less aggressive African Honey bee. Although they are very important as crop pollinators, honey bees may deprive more specialized and efficient indigenous bees of pollen and nectar, effectively reducing pollination of wild flowers. Honey bees are also important for honey production for humans. Bee populations are on the decline due to a disease called American Foul Disease (AFD).) This disease

INSECT SPECIES	ECOLOGICAL IMPORTANCE/COMMENT
	affects the immune system of the bee, thus allowing pathogens to enter and destroy the bee, and subsequently the entire colony.
Mopane bee (*Meliponula* sp.)	This small bee is stingless and is known for trying to collect moisture from eyes and mouths of humans, although not dangerous, it is an irritant in the Mopane bushveld.

8 Fauna Sensitivity Areas

Areas sensitive from a faunal perspective are related to the habitat present. Sensitive areas include the river systems and drainage lines as well as areas having exposed rocky outcrops usually having notable populations of reptiles.

9 Biodiversity and Ecosystem Processes

9.1 National Biodiversity Assessment (NBA, 2011)

No NBA 2011 Endangered or Critically Endangered Ecosystems are affected by the proposed development.

9.2 Biodiversity Proxy

The Biodiversity Proxy was created by combining a layer created through the interpolation of species grid information compiled by the Vhembe Biosphere Reserve (VBR) scientific group with the Conservation Status of the SANBI vegetation. Values were then subtracted using the land cover to reflect transformation and impacts.

In general the Biodiversity for the affected area is low with some areas being moderate (Figure 9-1).

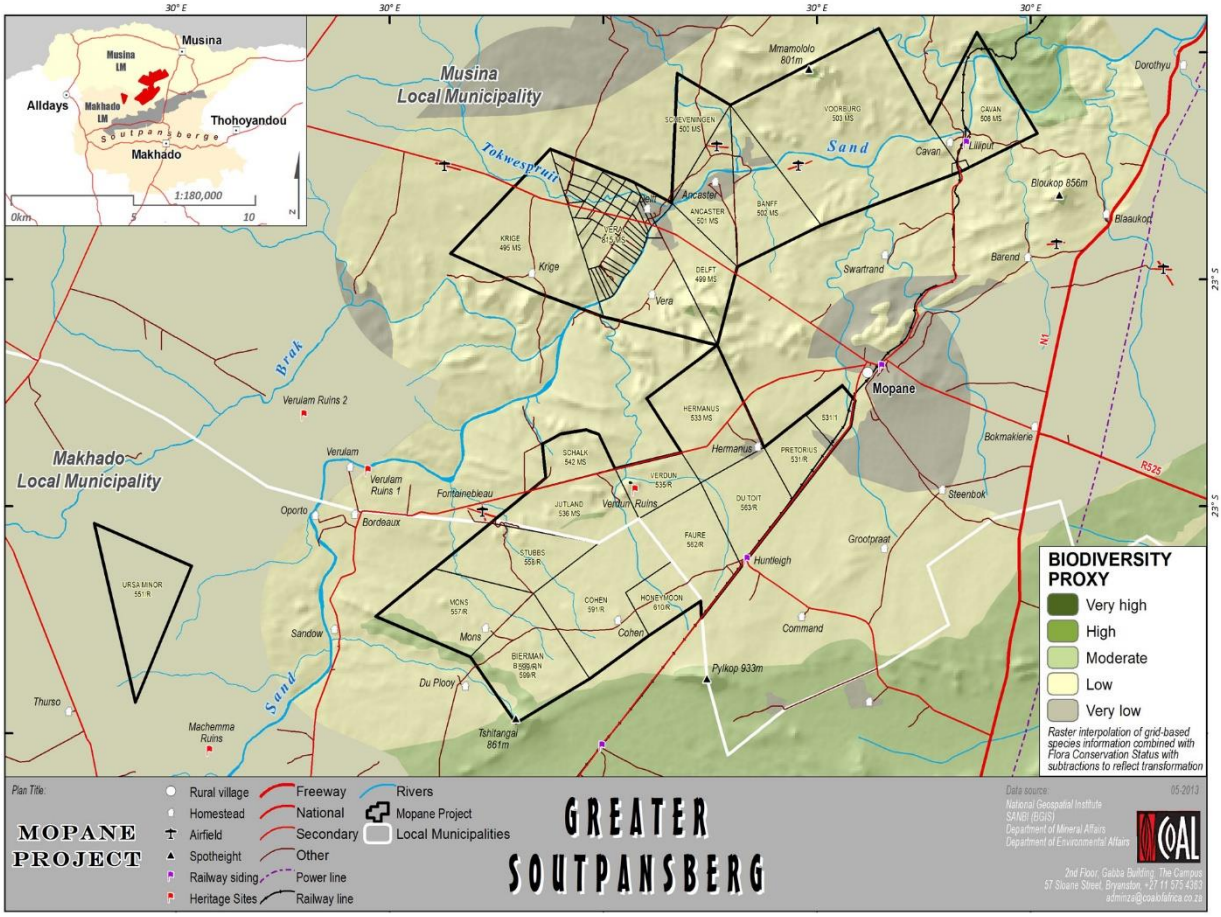

Figure 9-1: Biodiversity Proxy of the affected area.

9.3 Ecosystem Services

The Ecosystem Services (ESS) Index for the Mopane Project and surrounding areas was compiled using the ESS Classification developed for the Department of Environmental Affairs (DEA) by Transboundary Consulting Africa (2012). It has be compiled by combining the values of the Provisioning (Food, Fresh Water and Mineral Value), Regulating (Carbon Sequestration, Groundwater Regulation and Water Purification), Supporting (Biomass Production, Threatened Ecosystems and Conservation Status) and Cultural (Scenic Value, Preservation Value, Heritage Value and Human Impacts) Service.

Ecosystem Services are low for most of the affected area, becoming moderate around the Sand River, associated drainage lines and areas having ridges.

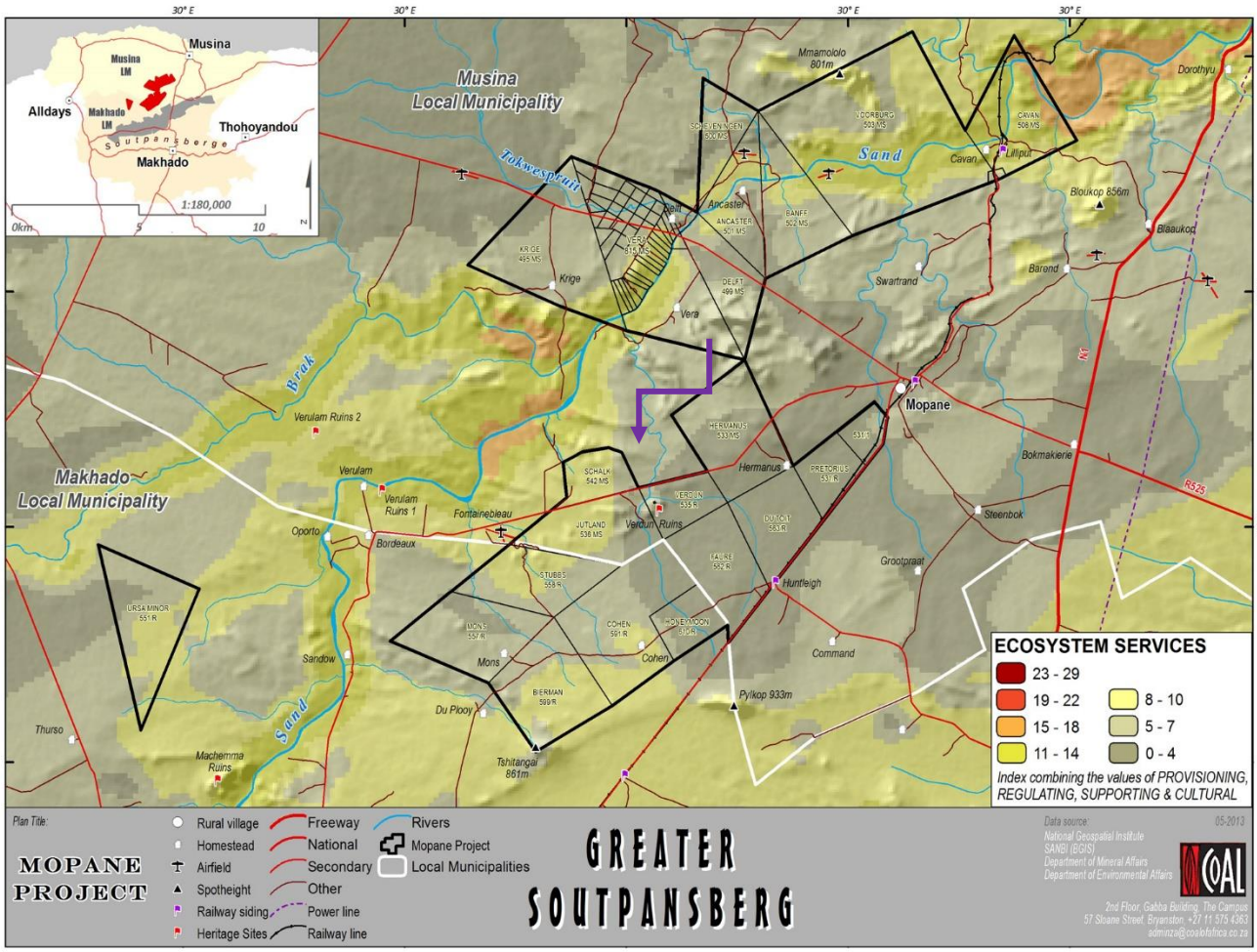

Figure 9-2: Ecosystem services for the affected area.

Broad ecosystem delineation is limited to the terrestrial mopane and mixed veld areas, sandstone ridges and plateaus, rocky ridges and outcrops and the Sand River with associated riverine forest, floodplains and large drainage lines.

The Sand River riverine forest and floodplains are important dry season refuge areas for many fauna species in their natural state. It is also a centre of floral diversity. Some of these areas are however degraded and overgrazed. The Sand River does provide a source of water, while the deeper alluvial soils may provide better forage than areas inland of the riparian zone. Any impacts on the sensitive aquatic ecosystems, regardless of the source, need to be avoided. Impacts on this system include erosion, deforestation through flooding, habitat loss and degradation and the associated impacts on faunal and floral diversity, dewatering, water abstraction as well as increased sedimentation. Continued impacts on the riverine ecosystems may also ultimately reduce the capacity of this system to absorb dramatic flooding events.

9.3.1 Biodiversity maintenance

De Beer (2006) conducted studies on various trees in the riverine forest of the Limpopo River that were either subjected to elephant damage or to water abstraction as a result of agricultural practises. Areas containing *Croton megalobothrys* are strongly correlated with areas that are not subjected to increased water use (De Beer, 2006). Tree density decreased as trees are subjected to increased agricultural activities where large quantities of water are abstracted. Areas directly adjacent to increased agricultural development also showed a decline of *Croton megalobothrys*. This

correlation of a decrease in density has been found to be even stronger for *Ficus sycomorus* and *Faidherbia albida.*

A significant decline of 40% in the number of riparian trees occurred from 1999 to 2004 in the Limpopo River (De Beer, 2006). This was not only attributed to elephants because damage to areas where no elephants are present also occurred. This damage was attributed to water abstraction, creepers and flood damage.

Not all the species that was included in the study of De Beer (2006) occur in the study area and elephants are for decades not part of this ecosystem anymore. Current water abstraction is also not nearly as severe in the study area as along the Limpopo River. However, as illustrated above, developments and impacts to natural components and processes of ecosystems can influence the biodiversity of such systems. Many riparian forests are closed canopy areas and fairly opened underneath. If riparian forests are opened up, through whichever source, competition for especially sunlight decreases and creepers and other undergrowth tend to flourish, even to such an extent that large trees are completely overgrown by creepers. To maintain the biodiversity of an area, a fine balance is needed between all components of such ecosystems and developments within such ecosystems. Of critical importance are specific long-term monitoring actions and an adaptive management system that can identify vectors of change and incorporate and implement the necessary mitigation actions at an early stage.

Plants influence many properties of riparian ecosystems (Richardson et al. 2007: In Ginsburg 2007):

- Through the process of evapotranspiration, riparian plants influence stream flow rates, ground water levels, and local climates. Rates of evapotranspiration and of groundwater use vary widely between plant species depending on factors such as rooting depth, leaf area, and ability to regulate stomatal conductance (Scott et al., 2000; Dahm et al., 2002: In Ginsburg 2007).
- Plants “influence the vertical patterns of moisture throughout the soil profile, with root architecture being one of the factors that influences zones of water uptake and patterns of ‘hydraulic redistribution’ of soil water (Burgess et al., 2001; Hultine et al., 2004: In Ginsburg 2007).
- Plant species that develop large or dense woody stems can reduce the velocity of floodwater and thus increase rates of local groundwater recharge, thereby influencing yet another aspect of the hydrological cycle.
- Plants directly and indirectly mediate many nutrient cycling processes, and, for example, can reduce levels of nitrogen and other minerals from stream or ground water (Schade et al., 2001: In Ginsburg 2007).
- Plants influence many properties of soils, such as salinity, organic matter, and C:N ratios, depending on their rate of litter production and on the chemical composition of the litter.
- With respect to stream geomorphology, plants influence rates of sedimentation (depending in part on the amount of biomass present in low strata) and resistance of soils to erosion during flood events (depending in part on root density).
- Plants that seasonally develop fine, dry fuel loads increase the probability of fire spread in riparian corridors (Brooks et al., 2004: In Ginsburg 2007).
- Plants also are fundamental in sustaining higher trophic levels in terrestrial and adjacent aquatic ecosystems. In addition to providing sources of food for granivores and herbivorous/detrital insects, birds, and mammals, they provide cover and nesting sites for many types of animals.

The impact of mine dewatering on the health of riparian vegetation cannot be assessed at this time due to the unavailability of the groundwater report.

9.3.2 Nutrient cycling (effects of plant composition and diversity on such processes)

The movement of elements and inorganic compounds that are essential to the functioning of the ecosystem is referred to as the nutrient cycle. These elements and compounds tend to circulate in ecosystems in characteristic pathways called biogeochemical cycles that can be characterised into sedimentary and gaseous types. The rate of exchange is an important parameter that ensures the appropriate functioning of the ecosystem (SANParks, 2003).

At a continental scale, ecologists divide the ecosystems of the seasonally dry tropics into wetter nutrient-poor (dystrophic) savannas growing on infertile soils and drier nutrient-rich (eutrophic) savannas growing on fertile soils (Bell 1982, Huntley 1982, In Ginsburg 2007). Although there is probably a continuum rather than a sharp divide, the concept has been useful because many ecosystem features and processes are correlated with the relative availability of water and nutrients not only at the continental scale but also at landscape and catenal scales (Timberlake & Childes 2004, In Ginsburg 2007).

Under a high rainfall regime, more water flows through the soil taking nutrients with it, and rates of weathering and leaching are high. In more arid areas, rainfall is lower, evaporation rates are higher, less rain flows through the soil and more nutrients remain. Nitrogen and phosphorus analyses are seldom undertaken in conventional soil surveys and there is no information on how levels of these key nutrients vary across the area (Timberlake & Childes 2004, In Ginsburg 2007).

Understanding the process of nutrient flows requires a wide array of information such as soil types, topography, soil erosion, vegetation characteristics, herbivory, water points and external inputs from human-mediated activities such as agriculture. Robertson (2005, In Ginsburg 2007) details the major pathways of nutrient input and nutrient loss in systems. Nutrient inputs include:

- litterfall & nutrient fall: litterfall (including leaves, fruits, fine material (frass mainly), flowers, wood or bark) and the seasonal variations in N, P, Mg & Ca.
- atmospheric deposition: Aerosols in the air plumes that recirculate over central and southern Africa may contribute significantly to nutrient budgets such as phosphorus in nutrient-poor systems. Additionally, termites may contribute to atmospheric fluxes of CO2 and CH4 (Jones 1990, In Ginsburg 2007).
- mineral weathering: various weatherable minerals provide a reserve of the cations Ca, Mg, and K to the soil. Apatite is the only mineral source of phosphorus. Robertson (2005, In Ginsburg 2007) says that rocks that are likely to contribute significantly to nutrient budgets are: basalt and fine-grained sedimentary rocks.
- nitrogen fixation: not all woody species are nodulated and capable of nitrogen fixation but many of the fine-leaved species characteristic of eutrophic savanna are. A general spatial pattern of these species exists - nodulating species on the valley bottoms and non-nodulating species on the crests. Mopane is not capable of nitrogen fixation. “Mycorrhizae associated with plant roots improve the uptake of phosphorus and micronutrients such as zinc, copper, boron and molybdenum from the soil. These fungal symbionts are associated with the majority of terrestrial plants; the non-mycorrhizal state is the exception. They are thought to be particularly important to plants growing in nutrient-poor soils” (Robertson 2005, In Ginsburg 2007),
- anthropogenic inputs (e.g. chemical fertilizers)

The four major pathways for nutrient loss are:

- biomass removal: sales of charcoal, wood, crops and livestock can lead to significant losses of nutrients, especially phosphorous (Robertson 2005, In Ginsburg 2007).
- wildfires: fire temperatures of > 300/C (most wildfires) = 3 - 69% of the phosphorus in plant material is volatilized. About ½ the nitrogen in biomass is volatilized if temperatures >200/C.

Only part of the volatilised phosphorus and nitrogen is transported long distances in fly ash, as some is deposited locally (Robertson 2005, In Ginsburg 2007). There was no evidence that occasional fires had a long term deleterious effect on soil nutrient cycling (Robertson 2005, In Ginsburg 2007).

- erosion: Robertson (2005, In Ginsburg 2007) suggests that sodic soils and soils derived from fine-grained Karoo sediments are subject to accelerated erosion. Soil erosion can be catalysed by wildlife or livestock stocking rates being inappropriate, by agriculture. Loss from cultivated fields can be significant on shallow soils derived from fine-grained sediments. Wind erosion is significant on seasonal pans where the vegetation has been removed by herbivores, and
- nutrient leaching beyond the rooting zone: may be occurring in irrigated agricultural areas, the dissolved mineral content of river water and erosion rates are indicators of leaching (Robertson 2005, In Ginsburg 2007).

Nutrient hotspots are where the levels of phosphorus and nitrogen are higher than in surrounding areas (Robertson 2005, In Ginsburg 2007) and can develop around water points where animals congregate and deposit nutrients, in termite mounds and under canopy trees.
There are a multitude of factors that influences the nutrient distribution in a landscape and ensure that nutrients are not evenly distributed and thus nutrient gradients and hotspots are created. Patterns of nutrient distribution and flows occur at different spatial layers (Robertson 2005, In Ginsburg 2007).

- landscape scale: cause of pattern is geomorphology (thousands of square kilometres), e.g. where the major river valleys with their associated alluvial deposits cut through savannas on less fertile soils.
- geological scale: cause of pattern is geology (hundreds of square kilometres), e.g. due to a diverse sedimentary history or to igneous intrusions.
- catenary scale: cause of pattern is soil processes, such as leaching and weathering (tens of kilometres), e.g. soils of different texture and fertility occur in a characteristic pattern from the crest to the bottom of the slope.
- local scale: cause of pattern is nutrient hotspots created by animals and human activities (tens of metres), e.g. nutrients and fine particles concentrated in termite mounds.

Important aspects to consider (SANParks 2003) and that can be influenced by development activities are:

- Accumulation of organic vegetative material.
- Deforestation / degradation of the riverine forest and its associated floodplain.
- Recycling pathways, which include the pathways via primary animal excretion, via microbial decomposition of detritus and the direct cycling via symbiotic micro-organisms.

9.3.3 Water cycles (inclusive of natural and artificial provision, flooding, soil deposition.

The Sand River system and riparian forest and associated plant communities are increasingly more under pressure from agricultural and infrastructure development. However, the status of the Sand River is classified as **Class B: largely natural and not threatened** (SANBI)

Riparian forests and associated plant communities have been identified as endangered plant community by many authors (De Beer, 2006). Coombes and Kemper (1992: In De Beer 2006) showed that changes in the water regime of the Limpopo River will have, and will continue to have serious implications on the present and future condition of the riparian forest, and the water limitation in the Limpopo River basin is showing the negative effects of high water pumping activities. The same can be applicable on the Sand River.

9.3.4 Other

Other important processes are:

- Carbon sequestration (important in both terrestrial and aquatic environments).
- Faunal utilization and associated seasonal effects of such utilization of riparian areas.
- Predator-prey interactions.
- Plant-herbivore interactions (inclusive of potential carrying capacity to maintain biodiversity).

10 Impact Assessment

10.1 Impact Assessment Methodology

.The objective of the assessment of impacts is to assess all the significant impacts that may arise as a result of the mining activities.

In accordance with Government Notice R.385 of 2006, promulgated in terms of Section 24 of the NEMA and the criteria drawn from the IEM Guidelines Series, Guideline 5: Assessment of Alternatives and Impacts, published by the DEAT (April 1998), specialists will be required to describe and assess the potential impacts in terms of the following criteria:

Nature of the impact

This is an evaluation of the type of effect the construction, operation and management of the proposed mining would have on the affected environment. This description should include what will be affected and the manner in which the impact will manifest itself.

Extent of the impact

The specialist must describe whether the impact will be: local (limited to the site and its immediate surroundings); or whether the impact will be at a regional or national scale.

Duration of the impact

The specialist must indicate whether the lifespan of the impact would be short-term (0-5 years), medium-term (6-10 years), long-term (>10 years) or permanent.

Intensity

This will be a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Does the activity destroy an element of the environment, alter its functioning, or render it only slightly altered? The specialist study must attempt to quantify the magnitude of the impacts and outline the rationale used.

Probability of occurrence

The specialist should describe the probability of the impact actually occurring and should be described as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will occur regardless of any prevention measures).

Degree of confidence in predictions

The specialist must state the degree of confidence (low, medium or high) he/she has in the predictions made for each impact, based on the available information and level of knowledge and expertise.

Significance

The overall significance of the impacts will be defined based on the result of a combination of the consequence rating and the probability rating, as defined above. The significance defines the level to which the impact will influence the proposed development and/or environment. It determines whether mitigation measures need to be identified and implemented or whether the resource is irreplaceable and/or the activity has an irreversible impact.

Mitigation measures

Appropriate mitigation measures in order to prevent an impact or to reduce its significance.

Table 10.1 below provides a summary of the criteria and the rating scales to be used. The assignment of ratings will be undertaken based on past experience of reports, the professional judgement of the specialist as well as through desktop research.

Subsequently, mitigation measures will be identified and considered for each impact and the assessment repeated in order to determine the significance of the residual impacts (the impact remaining after the mitigation measure has been implemented). The criteria that will be used to determine the significance of the residual impacts will include the following:

- Probability of the mitigation measure being implemented; and
- Extent to which the mitigation measure will impact upon the assessment criteria in Table 10.1**.**

The result of the above assessment methodology will be linked to authority decision-making by authorities in the following manner:

- **Low** – will not have an influence on the decision to proceed with the proposed project, provided that recommended mitigation measures to mitigate impacts are implemented;
- **Medium** – should influence the decision to proceed with the proposed project, provided that recommended measures to mitigate impacts are implemented; and
- **High** – would strongly influence the decision to proceed with the proposed project regardless of mitigation measures.

Table 10.1: Impact assessment criteria and rating scales

Criteria	Rating Scales
Nature	**Positive** **Negative** **Neutral**
Extent (the spatial limit of the impact)	**Local** (site-specific and/or immediate surrounding areas) **Regional** (provincial) **National** or beyond

Criteria	Rating Scales
Intensity (the severity of the impact)	**Low** (where the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected) **Medium** (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are negatively affected) **High** (where natural, cultural or social functions and processes are altered to the extent that the impact will temporarily or permanently cease; and valued, important, sensitive or vulnerable systems or communities are substantially affected)
Duration (the predicted lifetime of the impact)	**Short-term** (0 to 5 years) **Medium term** (6 to 15 years) **Long term** (16 to 30 years where the impact will cease after the operational life of the activity either because of natural processes or by human intervention) **Permanent**
Probability (the likelihood of the impact occurring)	Improbable (where the impact is unlikely to occur) Possible (where the possibility of the impact occurring is very low) Probable (where there is a good probability (< 50 % chance) that the impact will occur) Highly probable (where it is most likely (50-90 % chance) that the impact will occur) Definite (where the impact will occur regardless of any prevention) measures (> 90 % chance of occurring)
Significance (the consequence of the impact occurring coupled with the likelihood of the impact occurring)	Insignificant Very Low Low Medium High Very High
Reversibility (ability of the impacted environment to return to its pre-impacted state once the cause of the impact has been removed)	Low (impacted natural, cultural or social functions and processes will return to their pre-impacted state within the short-term) Medium (impacted natural, cultural or social functions and processes will return to their pre-impacted state within the medium to long term) High (impacted natural, cultural or social functions and processes will be permanent.
Confidence level (the specialist's degree of confidence in the predictions and/or the information on which it is based)	Low Medium High

10.2 Impacts to Vegetation and Flora

The following impacts to vegetation and flora are expected as a result of the proposed mining activity, although additional impacts may be identified during the ongoing site assessment:

1. Loss of vegetation
2. Loss of floral species of special concern
3. Increased risk of alien invasion
4. Increased risk of soil erosion
5. Disruptions to ecological corridors and loss of biodiversity conservation areas

10.2.1 Loss of vegetation

The mining activity will result in the removal of vegetation from the mining footprint. This could result in permanent or temporary loss of habitat for both dependant and localised floral and faunal species. Furthermore, it could result in loss of intact vegetation and habitat for populations of localised and endemic species.

10.2.2 Loss of floral species of special concern

Removal of natural vegetation in the areas where opencast mining will take place will influence various listed protected species. Listed protected species will be damaged or destroyed during construction or operation of the mine, which could have an impact on the population and survival of the species.

There are potentially more than 28 listed and legally protected species that could occur in the area whose habitat may be affected by the various mining activities. An additional 16 species, confirmed to occur in the region, might occur, even though some might only occur sporadically.
Different species, or categories of species, have different legal requirements in terms of actions to be taken and permit requirements and the specific circumstances, land ownership etc. and will determine actions that need to be taken in order to protect such species.
Potential impacts include:

- Destroy or damage of protected species.
- Influence on specific species population numbers and survival.

10.2.3 Increased risk of alien invasion

Disturbances relating to mining activities and post mining rehabilitation may increase the risk of localised infestations of alien species in disturbed areas. This could either be in the form of introduced new species or the spread of existing species.

10.2.4 Increased risk of soil erosion

Disturbances relating to mining activities and post mining rehabilitation may increase the risk of soil erosion in disturbed areas. This could both be as a result of loss of vegetation cover, or altered drainage patterns and storm-water runoff.

10.2.5 Disruptions to ecological corridors and loss of biodiversity conservation areas.

Large scale mining activities may result in the permanent or temporary disruption of important faunal and floral ecological corridors. Important faunal movement corridors may be disrupted, which could affect the population and survival of these species, as well as associated floral species as a result of disrupted pollination and seed dispersal mechanisms.

10.2.6 Aridification of the area as a result of mine de-watering

Mining at Mopane will involve open cast mining along extended open cuts down to 200m below surface, along the southern bank of the Sand River north of Mopane village (Voorburg Section) and southwest of Mopane village (Jutland Section).

Groundwater flow will be intersected by these pits when below the water table. The water flowing into the pits will need to be pumped out (dewatered) for safe mining operations to continue. The water pumped from the pits will be used on the mine for process water in the plant and dust suppression. The dewatering will result in a lowering of the water table (cone of depression) around the mine pits, extending for up to 25 kilometres at the life of mine. This is because water is taken mostly from aquifer storage, as recharge in the area is low and unable to sustain the dewatering. The north-east striking faults such as the Voorburg and Jutland (Bosbokpoort) faults are far more transmissive resulting that the cone of depression is elongated along their axis.

Impacts as a result of this could be significant. These include:

- A reduction in water available for evapotranspiration. Groundwater dependant floral species (trees with deep root systems) could be affected as the water table drops. Riverine vegetation is mostly sustained from surface flows and water stored in the alluvial deposits, however shallow groundwater may be important during extended dry periods.
- Depletion of ground water potential in the regional scale may reduce pasture irrigation so that dryland grazing becomes more prevalent leading to increased overgrazing and degradation
- A drop in the water table will lead to a decrease in surface water run-off. This will lead to a significant decrease in aquatic faunal diversity
- Reductions of perched areas, these areas are good habitat for breading grounds for faunal species and act as eco tones with relatively high biodiversity at the local scale.

10.3 Impacts to Fauna

In relation to the propose mine development, certain impacts have been identified within the study area. After looking at the habitats and the associated faunal communities, the impacts have been rated both with and without recommended mitigation and management measures. Impacts are rated for the full life cycle of the proposed mining, and cumulative effects have also been taken into account. The following impacts have been identified:

1. Limited Food availability for Cape Vulture
2. Habitat destruction
3. Fragmentation of habitats
4. Faunal mortality through mining operations
5. Habitat creation (negative)

10.3.1 Limited food availability for Cape Vulture

The Cape Vulture is a scavenger of animal carcasses, as it relies on leftover food from kills made by large predators, such as lions. This bird also feeds off of animals which have died from natural causes and are thus natures' way of controlling animal carcasses. This bird has adapted to a life of flying extensive distances for food. As the proposed mining area falls within the birds feeding grounds, the large game will be removed due to the selling of the farms they inhabit. This will result in a decrease of food for the Cape Vulture.

The Blouberg Mountains (extension of the Soutpansberg Mountain Range) is home to the largest breeding colony of Cape Vultures in the world. They are attracted to this area due to the height and topography of the mountain, together with the food offered by the surrounding game farms. Cape vultures may have a 300 km foraging area surrounding their roosting sites.

Figure 10-1: Blouberg Mountain, one can see the vulture breeding ground on the right of the mountain.

Figure 10-2: Cape Vulture in fight.

10.3.2 Habitat destruction

Mining activities involve permanently disturbing the terrestrial faunal environment. The top soil will be removed together with the vegetation habitats, thus destroying the entire area which is

subjected to the mining operation. The mining activities will destroy existing habitats. Habitat destruction leads to the displacement of fauna.

10.3.3 Fragmentation of habitats

Even though certain areas will remain unaffected by the proposed mining operations, these small habitats may become isolated. Thus the ecological continuity will be disrupted by the proposed mining activities. Individual faunal species (within the proposed mining site) are generally familiar with their surroundings.

For example, tortoises know their home ranges, and other animals (such as caracal) are familiar with their territories and feeding grounds. Certain amphibian species may only make use of water sources for breeding (tadpoles) and spend the rest of their life-cycle away from water. During breeding times, these amphibians could be prevented from gaining access to water. Precocial bird species (such as guinea fowl) could be affected due to the disruption in the continuity of the ecological corridor, up until the flight feathers are fully developed. Precocial chicks are flightless and vulnerable to predators and mining (such as trenches and piled rocks) may trap chicks when being persued chase, thus increasing chick mortality unnaturally.

Mining activities (such as stock piling between faunal habitats) may alter critical behaviours, traits and survival technique, due to alteration, manipulation or destruction of the numerous corridors present within the proposed mining site. Certain faunal species may utilize specific corridors to gain for flight (escape) and to gain access to foraging and breeding areas. Since animals are creatures of habit, they are likely to get trapped or killed by new structures place inside their habitats if they are not familiar with the placement thereof.

Figure 10-3: Marsh terrapins trapped and killed in an electrical fence which separated two water bodies.

10.3.4 Faunal mortality through mining operations:

Frequent truck/vehicle road activity (in the proposed site) will result in mortality of vertebrates and invertebrates. Reptiles frequent open sandy/rocky areas to searching for food, bask in the sun during the day, or simply traversing through. Amphibians may cross over the mining area to reach wetlands from aestivation areas. Rain is a key factor influencing amphibians, as (in times of rainfall) amphibians are at their most mobile and vulnerable. These factors all contribute to the above fauna being subjected to this impact.

Figure 10-4: African Rock python killed by truck on road.

Figure 10-5: Horned adder killed on road by vehicle.

Photos of faunal mortalities have been provided in the report as examples of the types of mortalities to be expected.

Working machinery, blasting and conveyer belts, are additional factors which may contribute to faunal mortalities. It is likely that large birds (during flight) will collide into erected power lines/electrical cables or be electrocuted while roosting on said cables.

10.3.5 Habitat creation

Mining activities not only leads to habitat destruction, but can often create alternative habitats. However, habitat creation may indirectly lead to negative impacts. In this case, the creation of habitats often alters the natural balance for certain faunal species. Small crevices between rocks in stockpiles may lead to chambers which make excellent micro habitats for bees to set up a hive, bats to roost and reptiles to take up residence.

Loosely compacted rubble and stones stockpiled within the site may indirectly provide habitats for reptiles. Lizards and diurnal snakes will bask on the warm ground surface and retreat into this man-made habitat. Thus due to this artificial habitat, there will likely be an increase of reptiles near roads and stock piles, however temporary. Snakes are likely to use these artificial habitats as breeding grounds and lay their eggs between the stored materials (for example, the Natal Green Snake). Although not gregarious, this species is often found in large numbers within a relatively small area.

Figure 10-6: Potential swallow nest under a bridge

Temporary water accumulation after rains may occur in mined areas, and this offers temporary habitats for frogs and toad. These animals may be harmed by vehicle and machinery activity.

Birds such as swifts and swallows build mud nests under structures (such as bridges), thus if bridges are constructed, potential habitats are created. Large non-vegetated rock faces (mine pits) are likely to be created as a results of the proposed mining activities, which could offer breeding habitats for bee-eaters and certain owls. This can result in the harming of birds.

Table 10.2: Summary of Impacts.

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
CONSTRUCTION PHASE									
Loss of vegetation	-ve	Local	Permanent	Medium	Definite	High	Clearing of vegetation must be limited to the footprint and the minimum required to undertake construction activities; "No-go" areas must be demarcated clearly (using fencing and appropriate signage) before construction and mining commences and continued in a phased manner.	Indeterminate	Low
Loss of floral species of special concern	-ve	Local	Permanent	Medium	Definite	High	Vegetation clearing must be limited to the required development footprint. Permission must be obtained from the relevant authorities to destroy or remove any protected plant species. Relocation of protected flora to be undertaken with necessary permits by an appointed professional service provider timeously before construction commences	Indeterminate	Low (as a result of incomplete flora survey)
Increased risk of alien invasion	-ve	Local	Permanent	Low	Highly Probable	Medium	A long-term alien plant management plan to control invasive plant species must be implemented.	Low	High
Increased risk of soil erosion	-ve	Local	Permanent	Low	Highly Probable	Medium	Standard measures to minimise soil erosion to be implemented.	Low	High
Disruptions to	-ve	Local/Regional	Permanent	Medium	Definite	High	Road Reserves must be kept to a	Medium	Medium

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
ecological corridors and loss of biodiversity conservation areas							minimum width Access road design should be such that it does not impede these corridors unnecessarily. Final plans must be approved by a suitably qualified ecologist and relevant authorities Post construction areas not required during operational phase to be rehabilitated. Incorporate Regional Biodiversity Planning Guidelines requirement in proposed project layout.		
Aridification of the area as a result of mine de-watering	-ve	Local/Regional	Permanent	High	Highly probable	High	Direct mitigation measures are limited.	High	High
Limited Food availability for Cape Vulture	-ve	Local/Regional	Permanent	Medium	Highly probable	Medium	Direct mitigation measures are limited.	Low	Medium
Habitat destruction	-ve	Local	Permanent	Medium	Definite	Medium	Habitats near the construction site where no construction is to take place must be clearly demarcated as no-go areas. Search and rescue operations conducted before construction phase begins	Low	High
Fragmentation of habitats	-ve	Local/Regional	Permanent	Medium	Definite	High	Design measures to be implemented to allow migration of fauna (i.e. bridges, fencing, etc.). Connectivity must be maintained through mine design.	Medium	High
Faunal	-ve	Local	Long-term	Low	Definite	High	Placing of structures under roads to allow reptiles such as tortoises	Low	High

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions	Significance (with mitigation)	Confidence level
mortality through mining operations							and terrapins to cross under the road will promote corridor continuity. The design of culverts and pipes must allow for fauna to pass through and fencing and rail platform to steer fauna towards underpasses. Regular fence inspections need to be conducted to remove any snares. Prevent using electric and palisade where they may conflict with fauna, as far as is practically feasible		
Habitat creation (negative)	-ve	Local	Permanent	Low	Highly probable	Medium	Standard measures to minimise these risks should be implemented.	Low	High

11 Mitigation Measures

11.1 Environmental management system

The impacts of the coal mine (in terms of alteration and/or destruction of habitats, land capability and wetlands) can be significant within this semi-arid environment, where biotic and abiotic assemblages will take many years to recover. The duration of impacts will be medium to long term whilst its effect on biodiversity will endure for many more years (Braak, 2010). Because of the location of the mine, in relation to surrounding conservation initiatives, it is important that environmental responsibilities are demonstrated through the life-cycle of all activities, products and services. The environmental performance of an organization is of increasing importance to internal and external interested parties.

The ecosystems that we manage are not static – they are dynamic, both temporally and spatially. The complexity of ecosystem structure and function is well known and documented in literature. Furthermore changing socio-economic and political environments markedly impact upon conservation practices, conservation areas, management of proclaimed nature reserves and parks, developments within such areas and the sustainable utilisation of natural resources. Environmental management therefore operates in a multidimensional decision making environment that demands innovative approaches to management (Bestbier *et.al*., 1996).

Because of reasons mentioned above and the nature of the proposed development, it functions within international, national, provincial, and local levels and different stakeholders of all these sectors are involved. To address the different needs and expectations of stakeholders and for effective ecological, environmental and ecosystem management, is it necessary to incorporate an environmental management strategy and system.

An organization whose total management system incorporates an environmental management system has a strategy to balance and integrate economic and environmental interests and can achieve significant competitive advantages. It provides the organization with the opportunity to link environmental objectives and goals (targets) with specific financial outcomes and thus to ensure that resources are made available where they provide the most benefit in both financial and environmental terms (ISO 14000). The real value of an environmental management strategy is in the effective practical roll-out its stated policy, objectives and goals in action plans and procedures, and the measurement of the success or failure of such actions in meeting its objectives.

Such a management system provides order, consistency and continuity for organizations to address ecological and environmental concerns through the allocation of resources, assignment of responsibilities, and ongoing evaluation of practices, procedures and processes. Such an integrated approach helps protect human health and the environment from the potential impacts of the organisation's activities, products or services, and assist in maintaining and improving the quality of the environment. A systematic approach or strategy to deal with the ecological and environmental aspects is necessary. Therefore, a management system is a tool that enables an organization of any size or type to control the impact of its activities, products or services on the natural environment. An ongoing and interactive process is necessary. Such a management system also intends to establish transparency and accountability in terms of the responsibility accepted towards the sustainable management and development of its priceless assets. New developments, contracts and contractors, management activities, products, services etc. can continuously be incorporated.

The management system is therefore adaptable to changes, being environmental or any other changes. An environmental management system is that part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy, objectives and goals (ISO 14000).

The final and integrated environmental management plan should therefore rather be in the format of management procedures and technical procedures that specifically address the why, what, how, by whom and by when. These procedures should be of such a format that it is easy to understand, implement, review, adapt, and it should spell out how environmental management and monitoring should be conducted.

The process, system and procedures can only be effective if it is implemented, people are trained and informed of all aspects and somebody is tasked to make it work. Informed environmental advice/support is closely linked to the system/plan because advice is based on environmental data (historic & present) and on the ability to make predictions on the possible outcomes/impacts of management/development actions or the lack thereof. Capacity building is therefore an important integral part of the enrolment of the management process and system. Team building and motivation of personnel are critical for the success of management and included in capacity building.

Another important challenging characteristic of environmental management that has to be addressed is the sheer amount of aspects and information that have to be evaluated and managed. This aspect is clearly illustrated through all the specialist's reports. Such an amount of issue can only be successfully addressed in a short period of time, and be managed in the long term, through the implementation of a process and management system. Implementation of an environmental management process and system also make it possible to concurrently proceed with core functions of the mine.

The important recommendations to avoid or minimise negative impacts on flora and fauna as a result of the proposed mining project are summarised below:

11.2 Mitigation measures

11.2.1 General Measures

- Qualified herpetologist, small mammal expert, invertebrate specialists and ecologist must be appointed to identify rare and threatened species that may potentially occur and do occur in the study area.
- Lists of protected species and sensitive habitats must be compiled to guide development planning.
- Provision should be made in the water resource use demand for the rehabilitation process as rehabilitation in semi-arid areas may require artificial watering regimes.
- Planning and design changes should be made to mitigate the impact of the development on these species and sensitive habitats where possible.
- Detailed delineation of the wetlands and floodplain areas along the Sand River and tributaries must be done.
- Disturbance and building of infrastructure should be avoided within sensitive areas such as drainage lines, pans, near fountains, and rocky outcrops.

- All workers should be sensitised and environmental educational programmes should be launched to build capacity about the environmental management plan, sensitive habitats and protected species.
- A penalty clause for any environmental contraventions should be included in workers' service agreements.
- Biodiversity offset programs should be identified, developed and implemented, such as:
    - Offset of degradation / destruction of riparian wetlands in the open cast mining areas against restoration of degraded riparian wetlands alongside the Sand River.
    - Offset of terrestrial habitat destruction in open cast mine areas and influence on land-use potential, against land acquisition / co-funding / improvement of the conservation contribution of land and/or land-use activities within the Soutpansberg.
- Other conservation initiatives in the area should be supported and incorporated into the rehabilitation programmes.
- Biodiversity related BEE initiatives could be identified and could include aspects such as:
    - Vegetation cutting.
    - Mulching of vegetation for compost.
    - Firewood collection.
    - Erosion control.

11.2.2 Demarcation of Development:

- All development activities should be restricted to specific recommended areas. The Environment Site Officer (ESO) should demarcate and control these areas. Storage of road-building equipment, fuel and other materials should be limited to demarcated areas.
- Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area.
- Fencing of the entire designated open cast mining area to keep animals out of the area.
- Fence off the entire development footprint and institute strict access control to the portions of the owner-controlled property that are to remain undisturbed as soon as possible after initial site clearance.
- The fence should preferably be impermeable (for example a solid wall) to discourage invertebrates and small animals from entering the site. Normally solid perimeter walls are not recommended in order to facilitate the movement of invertebrates, but in the present case restriction of their movement into the area will be advantageous.
- Normally it is recommended that permeable fencing like palisade should be used as to not to hinder the movement of invertebrates, but in this case a solid fence around the mine pit is proposed. However, any fencing used in the development away from the mine should not be solid and should offer as little obstruction as possible to the movement of terrestrial and flying invertebrates.
- The minimum staff should be accommodated on site. If practical, construction workers should stay in one of the nearby villages and transported daily to the site.
- If any compound must be erected on the site, it should be fenced to prevent movement of people and animals into the surrounding areas which should be considered as 'no-go' areas for employees and machinery.
- During construction activities, including the power- and railway lines, wherever possible, work should be restricted to one area at a time to give birds, mammals, reptiles and amphibians an opportunity to move into undisturbed areas close to their natural habitat.
- Proper firebreaks should be made and maintained around the entire development footprint.

11.2.3 Training

- The ESO should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. He should enforce any measures that he deems necessary.
- Regular environmental training should be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation.
- The ESO should regularly inspect the site (including storage facilities and compounds) and eradicate any invasive or exotic plants and animals.
- Educate construction workers regarding risks and correct disposal of cigarettes.

11.2.4 Roads, railway line & conveyors

- The fragmentation effect of roads can be alleviated by placing underpasses at strategic points, to allow free and safe crossing of the road.
- Avoid use of different access routes during construction and operational phases.
- Vehicle access to servitudes must be limited to existing roads.
- All truck loads and railway wagons should be covered with tarpaulins.
- Overland conveyors should:
    - Be fully enclosed
    - Have solid flooring to contain any spillage and drain off to secure drying pond
    - Have adequate lighting
    - Have speed reduction traffic signs installed at road crossings
    - Be designed for zero spillage.
- Overland conveyor river crossings should:
    - Be fully enclosed
    - Have solid flooring to contain any spillage and drain off to secure drying pond
    - Be designed to protect ecosystems
    - Be designed to avoid flow restriction
    - Avoid all civil construction in river bed
- The risk of disturbance to and pollution of watercourses must be minimised during the construction process by careful control of site run-off.
- Allow for dust suppression in all head-ends, tail-ends and transfer points of all the conveyors.
- Conveyors must be assembled above concrete plinth and within a servitude with a service road and a storm water management along its length.
- Stream crossings of conveyors must be provided with bunded concrete floors (impervious floors designed to contain spillages) and must be linked to local pollution control systems.
- On long overland conveyors allow for belt turn-overs ensuring that the clean side of the conveyor belt faces ground level, hence eliminating any spillage along its length.
- Ensure that the approach to storm water management along the length of conveyors will be to minimise future flood risk.

11.2.5 Measures to minimise loss of vegetation, habitat and Species of Special Concern

- A detailed species rescue, relocation and re-introduction plan should be developed and implemented by a qualified person before excavations commence.
- Such plan should include the power and railway lines.
- This plan should address the following:
    - Harvesting of seeds from herbaceous and woody vegetation to be used in the nursery and future rehabilitation.

  - Intact removal of protected plant species and capture of protected faunal species under permit.
- Options to be considered for the above-mentioned protected and general floral and faunal specimens:
  - Feasibility of rescue operation.
  - Suitable translocation areas.
  - Translocation to suitable areas earmarked for restoration and rehabilitation, both on and off-site.
  - Use of removed plants in an indigenous nursery for future restoration and rehabilitation programs.
  - Translocation to other areas suitable for survival of the removed specimens.
- Proper habitat suitability assessments should be done before reintroductions to reduce the risk of mortalities in both source and destination populations.
- Rescue of as many as possible animals within, initially the eastern open cast mining areas for translocated to suitable areas.
- Establish an on-site nursery.
- A detailed plan should be developed before a nursery is established.
- This plan/s should at least address the following:
  - Licensing
  - Incorporation with existing nurseries e.g. in Musina etc.
  - Location
  - Water requirements
  - Resources
  - Expertise
  - Management
  - Staff
  - Finance (viability)
  - Capacity building
- A herpetologist should be appointed during the bush-clearing phases of the operation to collect relevant study and live herpetofauna material, in particular fossorial species.
- Collection and further propagation of vegetation suitable for future rehabilitation and restoration in an indigenous plant nursery.
- Clearing of vegetation must be limited to the impact footprint.
- Only the minimum vegetation required to undertake construction activities may be removed from the impact footprint.
- Any additional lay-down and similar areas that may be required outside of the development footprint should be sited in transformed or degraded areas.
- “No-go” areas must be clearly demarcated (using fencing and appropriate signage) before construction commences.
- Contractors and construction workers must be informed of the “no-go” areas and held accountable for any infringements that may occur.
- No access to the demarcated areas should be permitted during construction, and contractors must be informed of the location of these areas. A suitable control measure (such as a penalty system) must be implemented to discourage infringement by contractors.
- Activities including, but not restricted to the following, must not be permitted in designated “no-go” areas:
  - Dumping of any material during and after construction.
  - Turning of vehicles.
  - Trampling and urination by construction workers.
  - Lighting fires.

- Pre-construction site clearing must be kept to the required minimum.
- All vehicular/construction activities to be restricted to the demarcated construction area.
- Permission must be obtained from the relevant authorities to destroy or remove any protected plant species.
- Relocation of protected flora to be undertaken with necessary permits by an appointed professional service provider.
- Protected flora and, where possible, endemic flora must be removed from the affected site footprint to be safeguarded from destruction and relocated to either undeveloped areas or off-site in consultation with conservation authorities and relevant botanical specialists.
- Extensive plant rescue and relocation operation must be conducted timeously before any site clearing occurs, especially within areas having intact vegetation.
- Animals must be relocated to places similar to those where they were found.
- Animals which enter the construction zone must be relocated as soon as possible.
- A professional reptile handler must be appointed when removing and relocating reptiles.
- All fauna must be relocated to a similar place from where they were found.
- All fauna which enters the construction zone must be relocated as soon as possible.
- All materials (such as rocks) removed during the constructional phase must be kept aside and used later for the rehabilitation, and must not be left after construction is completed. This will be beneficial for the re-creation of habitat for small mammals.
- Construction materials that attract reptiles must not be left on site, this will increase the presence of reptiles.
- The placement of structures under roads will allow reptiles (such as tortoises and terrapins) to cross under the road. The design of culverts and pipes must allow for fauna to pass through. Fencing can be used to steer fauna towards underpasses. This will promote corridor continuity.
- All fauna that enters the construction zone must be relocated from the site as soon as possible.
- Care must be taken to ensure slow driving on the site and speed limits should be enforced, especially during periods of rainfall.
- Wet areas (as a result of construction) next roads should be avoided.
- Roads should not be aligned between adjacent wetlands or nearby aestivation sites unless the road is not directly on the ground surface. This must be done to decrease frog mortality during periods of rainfall.
- Vegetation alongside roads should be kept short to reduce mammal activity and increase visibility.
- All road kill must be removed to decrease the presence of scavengers which may also be harmed.
- Animals must not be killed.
- Access gates into the fenced off areas are to be closed at all times.
- The use of electric fencing should be prevented as far as is practically feasible.
- Fenced off areas that are directly adjacent to or within animal movement corridors must not have barbed wire strands or mesh. They must also provide facilities for smaller faunal species (tortoises) to pass through or must direct them to underpass or culvert areas.
- Palisade fences should not be used in areas where large mammals may be present.
- The workers on site must be educated about the laws protecting wildlife. Penalties should be used as a deterrent. Regular fence inspections need to be conducted to remove any snares.

11.2.6 Fauna and Flora Relocation and protection

- Before construction of infrastructure all protected species must be relocated in a similar process as proposed for the open pit areas.
- Corridors of natural vegetation should be left wherever possible to allow movement of smaller faunal species.

- Underpasses could be constructed under access roads to allow free movement of smaller animals.
- No areas should be denuded or disturbed unless crucial for construction.
- Where possible, natural vegetation should be kept to reduce soil erosion.
- A detailed vegetation and habitat rehabilitation plan should be developed and implemented by a suitably qualified person, preferably before construction commences.
- Rehabilitation of denuded or disturbed areas should be done as soon as activities in these areas have ceased.
- Rehabilitation should be done under supervision of a suitably qualified rehabilitation officer.
- No felling of trees should take place.
- No burning / removal of vegetation for firewood or catching of any animals should take place unless part of the environmental management plan.
- All declared exotic plants should be removed from the entire development area.
- All incidents and sightings of protected species within demarcated and fenced development areas should be monitored, documented and reported to the environmental officer who will remove these animals from harm's way.
- Electricity pylons should be adapted according to Eskom standards to reduce the risk of electrocution for raptors.

11.2.7 Measures to minimise disruptions and fragmentation of Ecological corridors

- Post construction rehabilitation and planting of trees in areas can promote an environment conductive to re-establishing a corridor for displaced fauna. Post construction areas not required during operational phase to be rehabilitated.
- Fencing and berms will serve to guide fauna (such as tortoises) towards road underpass areas.
- Construction of roads over stormwater drainage infrastructure must be designed so that the water is allowed to flow under the road to secure corridor continuity for amphibians, without exposing them to excessive vehicular traffic.
- Fencing of road reserves will reduce mortality rates of faunal species (mammals) and use of embankments may also serve to discourage mammals, reptiles and amphibians from crossing over roads. These will however disrupt the movement corridors of these species as well and allowances must be made for free movement corridors via culvert and preferably suitably placed open bridge structures along ecological corridors over drainage lines and rivers.
- Prevent using electric fencing as far as is practically feasible.
- Any areas disturbed or cleared for construction that are not required during operational phases are to be timeously and adequately rehabilitated under supervision of suitably qualified specialist to enhance corridor connectivity.
- These movement corridors must be revegetated appropriately to provide shelter to faunal species moving through the corridor.
- Riparian areas should be spanned as far as possible
- Disturbances to seep areas and wetland areas will require detailed surveying before any construction commences so that appropriate design measures can be implemented to facilitate lateral water flow, especially where roads may traverse such areas.
- Trade-offs and Biodiversity Offsets requirements must be considered to.
- Fire and alien management plan to be implemented during construction.
- Materials, such as rocks, removed during the constructional phase must be kept aside and used later for the rehabilitation. This will be beneficial for the re-creation of habitat for small mammals.
- Materials which will attract reptiles must not be left on site, this will increase the presence of reptiles.

- No areas should be denuded or disturbed unless crucial for operations and natural vegetation should be kept to reduce soil erosion.
- Rehabilitation of denuded or disturbed areas should be done as soon as activities in these areas have ceased.
- Vegetation clearing of the power- and railway line servitudes should consist of trimming, cutting and clearing the minimum amount of vegetation necessary for the safe electrical and transport operations of the power line and railway line.
- All servitude areas should be cleared and maintained only when necessary.
- Minimal disturbance must be caused to vegetation where such vegetation does not interfere with operation of the power- and railway lines.

11.2.8 Measures to minimise invasion of disturbed areas by alien invasive species

- A long-term alien plant management plan to control invasive plant species must be implemented to appropriately remove alien invasives during construction and operation. Particular care must be given to seed bearing material minimising potential spread into surrounding areas.
- The mine must be kept fee of alien species for its duration.
- Cleared alien vegetation must not be dumped on adjacent intact vegetation during clearing but should be temporarily stored in a demarcated area (in consultation with the relevant botanical specialist) until appropriate disposal/re-use has been identified.
- Cleared vegetation must be removed from site or mulched for use in rehabilitation of the rail and conveyor reserves cleared during construction. Any mulched material must be seed free.
- Any seed bearing alien plant material should be removed from site to prevent the spread of seed.
- Chopped indigenous brushwood can be used to stabilise steep areas that may be susceptible to erosion during clearing activities.
- Rehabilitation to be implemented in a phased manner directly after construction.

11.2.9 Measures to minimise accidental fire

- A fire management plan and awareness signage must be implemented as part of the EMP, including an action plan for accidental fires.
- Areas where dry grasses may accumulate of vegetation becomes moribund can be burned periodically under controlled conditions to reduce the risk of runaway fires.
- Grassy Road verges outside of rehabilitated areas can be regularly mowed to reduce risk.
- Flammable litter and discarded glass bottles should be removed regularly, especially along rail and conveyor reserves.
- Implement firefighting strategy as part of EMP, especially in cleared and maintained road and conveyor reserves.

11.2.10 Rehabilitation & reclamation:

- Develop detailed rehabilitation and reclamation plans.
- Such plans should define specific objectives and goals.
- Such plans should also focus on the ecosystem and ecosystem functioning and processes to restore / improve the resilience of the ecosystem.
- These plans should include monitoring methods such as Landscape Function
- An ongoing detailed vegetation and habitat rehabilitation plan should be implemented
- Removal and stockpiling of topsoil as prescribed in the soil rehabilitation program.

- Cutting down and stockpiling of suitable vegetation for use (where possible) in the restoration and rehabilitation program.
- Removal of the above-ground vegetation layer within the strips earmarked for immediate excavation and stockpiling this organic material to be mulched and used with the topsoil as compost in the restoration and rehabilitation program.
- Leaving vegetation intact in areas not earmarked for immediate excavation for as long as possible to assist in prevention of soil erosion and mitigation of noise and particle pollution.
- In-pit disposal of material should be done to obtain free-drainage in the final topography.
- Restoration of soil layers (as prescribed in the soil rehabilitation program) as soon as possible after excavation when a particular series of strips (e.g. 5 strips / 250m) is completed.
- Restoration of the vegetative layers immediately thereafter using the mulch, harvested seeds and plants from the indigenous plant nursery.
- Until the herbaceous (shorter period) and woody (longer period) vegetation layer is established, artificial watering of reclaimed areas should be applied.
- Water allocation for this process should be incorporated into water requirements.
- Implementation of the entire program must be coordinated and supervised by a suitably qualified rehabilitation officer.
- Concurrent rehabilitation and levelling of opencast pits should be done.
- Levelled areas should be reclaimed on an ongoing basis.
- Rehabilitate infrastructure areas post-mining.
- Any animals rescued or recovered during construction of the power and railway lines should be relocated in suitable habitat away from the power- and railway line infrastructure.
- Cleared vegetation can be used to form wood piles and logs and stumps. Dead or decaying wood piles should be created as these will provide valuable refuge areas especially due to the clearance of vegetation cover. Logs and stumps also provide important habitats for several reptile species as well as smaller mammals, amphibians, arachnids and scorpions. Eventually they can be reduced to compost by animals.
- Any lizards, geckos, agamids, monitors or snakes encountered should be allowed to escape to suitable habitat away from the construction site and power- and railway line disturbance. No reptile should be intentionally killed, caught or collected during any phase of the project.
- General avoidance of snakes is best if encountered. Snakes should not be intentionally harmed or killed and allowed free movement away from the area.
- Ensure that as far as possible no faunal species are disturbed, trapped, hunted or killed.

11.2.11 Mine Closure

- Specific programmes should be developed for continuation of rehabilitation and monitoring actions after mine closure.
- Specific programmes and actions should be developed for impacts that manifest and / or occur after mine closure.
- Specific funds should be allocated to implement aforementioned programmes.

12 EMP Recommendations and Monitoring

12.1 Objective

To provide generic guidelines for vegetation clearing and rehabilitation during all phases of mining.

12.2 Detailed Floral survey

It is recommended that further detailed floral surveys be conducted during the construction phase to determine additional species that may have been omitted and to clarify indeterminate species that may be resolved during their flowering seasons: Early-mid spring (September – November, after first rains) and late summer (March - April).

12.3 Vegetation clearing and relocation

12.3.1 Infrastructural Requirements

Vegetation clearing

- Once the final mine layout has been determined the botanist should be consulted and in association with the horticulturalist devise a plant relocation and vegetation clearing plan.
- Areas to be cleared of vegetation should be clearly demarcated before clearing commences.
- Areas should only be stripped of vegetation as and when required, especially grasses, to minimize erosion risk.
- Once demarcated the area to be cleared of vegetation should be surveyed by the vegetation clearing team under the supervision of the botanist and horticulturalist to identify and mark species suitable for rescue.
- Plants to be rescued should include both species of special concern requiring removal for relocation as well as species that would be suitable for use in rehabilitation.
- Depending on growth form this material should be appropriately removed from its locality and stored in the nursery holding areas or immediately relocated where it may be required elsewhere immediately.
- Small trees and shrubs (<1m in height) can often be rescued and planted temporarily in potting bags for later use.
- Arboreal species (orchids) should be collected attached to the substrate (i.e. branch) they are growing on and stored (hung) in a moist, lightly shaded nursery area for later relocation.
- Wherever possibly any seed material should be collected immediately and stored for later use, particularly species that occur in low numbers.
- Before any earthmoving activities are commenced any ripe grass seed should be collected (using a sickle or similar implement), dried and stored for use during regressing.
- Comprehensive notes should be kept as to the identification, habitat, and any potential biophysical requirements of plants, and any species of special concern removed for relocation should have a GPS locality recorded.
- Grass sods can also be collected for immediate use in any areas requiring revegetation.

- Once rescue and relocation activities have been completed, removal of large trees can commence, which should be done in consultation with local representatives so that useful timber can be identified and dealt with appropriately.
- It is recommended that wood be stored appropriately once felled, as it will be used for various activities such as construction, furniture-making and will be useful to local inhabitants for charcoal, firewood, etc.
- In outcrops, it is recommended that sufficient habitat (large boulders) be removed and appropriately stored for later reuse during reconstruction and revegetation of outcrops.
    - Attention must be given to aspect and shading when storing boulders so that any crevice growth will be shaded appropriately.
    - Care must be taken to minimize disturbance to vegetation on boulders.
- Before any topsoil removal commences, local inhabitants should be given the opportunity to salvage any remaining material, as it will minimize removal of similar material from surrounding areas.

Topsoil

- Sufficient topsoil must be stored for later use during decommissioning, particularly from outcrop areas.
- Topsoil shall be removed from all areas where physical disturbance of the surface will occur.
- All available topsoil shall be removed after consultation with the Botanist and horticulturalist prior to commencement of any operations.
- The removed topsoil shall be stored on high ground within the mining footprint outside the 1:50 flood level within demarcated areas.
- Topsoil shall be kept separate from overburden and shall not be used for building or maintenance of roads.
- The stockpiled topsoil shall be protected from being blown away or being eroded. The application of a suitable grass seed/runner mix will facilitate this and reduce the minimise weeds.

Road Construction

- Should a portion of the access road be newly constructed the following must be adhered to:
    - The route shall be selected that a minimum disturbance to natural vegetation under guidance of the ECO and botanical specialist;
    - Water courses and steep gradients shall be avoided as far as practical;
    - Adequate drainage and erosion protection in the form of cut-off berms or trenches shall be provided where necessary.
- No other routes shall be used by vehicles or personnel for the purpose of gaining access to the site.
- Newly constructed access roads shall be adequately maintained so as to minimise dust, erosion or undue surface damage.
- The liberation of dust into the surrounding environment shall be effectively controlled by the use of inter alia, water spraying and /or other dust-allaying agents. The speed of haul

trucks and other vehicles must be strictly controlled to avoid dangerous conditions, excessive dust or excessive deterioration of the road being used.

- The access roads to the quarry site must be strictly maintained during the operation process. Sections of the access road that erodes during the mining process shall be suitably rehabilitated upon completion of the project.

Operating Procedures in the Mining Area

- Grass and vegetation of the immediate environment, or adapted grass / vegetation will be re-established on completion of mining activities, where applicable.
- No firewood to be collected on site and the lighting of fires must be prohibited.
- Cognisance is to be taken of the potential for endangered species occurring in the area and appropriate measures must be implemented.

Excavations and Disturbed Areas

Whenever any excavation is undertaken, the following procedures shall be adhered to:

- Topsoil shall be handled as described in this EMP.
- The construction site will not be left in any way to deteriorate into an unacceptable state.
- Once overburden, rocks and coarse natural material have been placed in the waste pile, they will be profiled with acceptable contours (including erosion control measures), and the previous stored topsoil shall be returned to its original depth over the mine area.
- The area shall be fertilised if necessary to allow vegetation to establish rapidly. The site shall be seeded with a local or adapted indigenous seed mix in order to propagate the locally occurring flora.

Processing Plant and Waste Dumps

- Natural vegetation must not be disturbed unnecessarily in and around the mine area.
- Processing areas and waste piles shall be established within a clearly demarcated area.
- Where feasible, hedgerows should be strategically planted to trap and thus minimise dust.

Rehabilitation of Processing Areas

- Coarse material and overburden must only be stored in demarcated waste sites.
- On completion of mining, the surface of the processing areas especially if compacted due to hauling and dumping operations shall be scarified to a depth of at least 200 mm and graded to an even surface condition and the previously stored topsoil will be returned to its original depth over the area.
- The area shall be fertilised if necessary to allow vegetation to establish rapidly. The site shall be seeded with suitable grasses and local indigenous seed mix.

12.4 Rehabilitation and mine closure

A separate Rehabilitation Plan has been compiled and is not included in this report.

13 Knowledge Gaps and Red Flags

The following knowledge gaps exist at the time of finalisation of this report:

- All biodiversity surveys were only conducted in one season (dry winter season). An early spring (within a few weeks of the first rainfall) and mid to late summer sample is strongly recommended due to the scale of the project. This resulted in numerous constraints to sampling and the effectiveness of a applying a multivariate community analysis as per the terms of reference. Data collected is thus considered to be incomplete at this point in time and previous studies were relied upon to some extent.
- Referring to the IAIA guidelines and NEMA, this can be regarded as a fatal flaw:
    - 'Lack of information about the receiving environment to determine reliably whether impacts on biodiversity could be significant.'
    - 'A risk-averse and cautious approach should be taken where either information and/or the level of understanding is inadequate, where impacts are unprecedented or where there is inherent uncertainty as to the significance of impacts, or there is an element of substantial risk of irreversible impacts which could lead to irreplaceable loss of natural capital' - NEMA (Section 3.1)
- Limited access to farms and time available on some farms within the study are has limited the effectiveness and accuracy of vegetation mapping.
- The biodiversity specialist has not been involved in the mine layout pre planning and planning aspects of the EIA process.
- The farms Ancaster, BANFF, Cavan, Delft, Du Toit, Faure, Hermanus, Jutland, Pretorius, van de Byl, Verdun, Voorburg & Vrienden were fully surveyed as far as possible based on the access time available:
- The farms Vera small holdings, Ancaster and parts of the farm Voorburg were partly surveyed.
- The farms Cohen, Honeymoon, Krige, Bierman, Mons, Schalk, Stubbs, Ursa Minor, Scheveningen were not investigated.
- Lack of information regarding the impact of mine dewatering on groundwater and risks to vegetation at this point in time are regarded as a fatal flaw affecting this assessment.
- No invertebrate studies are available for the study area, but a limited study was undertaken based on observations and available literature. Light and pitfall traps were also tested but results were poor due to season.

14 Conclusions and Recommendations

Within the context of the original vegetation of the area, although largely intact or semi-intact, have in some areas been transformed and degraded predominantly through agricultural activities including cultivation of crops and pastures, livestock grazing and game farming. Alien plant infestation tends to be limited in extent and severity and isolated to a few areas.

- Sensitivity varies across the site, largely dependent on the level of transformation and degradation from a variety of activities, including historical agricultural activities, mostly being moderate (Bushveld) to High (Ridges and Riparian areas).
- Degradation in the form of invasive alien plant infestations tends to be very limited and patchy in the area
- Some degradation from agriculture is present in areas throughout the mining right application (MRA) area..
- Areas having a low sensitivity include areas transformed, severely degraded and heavily invaded areas, and areas having a low conservation status.

A number of ecological impacts have been identified to vegetation flora and fauna relating to the proposed MIne and the significance of each of these are summarised below:

14.1.1 Direct Loss of Vegetation

During construction, the various components of the proposed mine all require the clearing of land which will be almost irreversibly altered from the natural state.

14.1.2 Loss of Flora SSC and SSC habitat

During construction, the components of the proposed mine all require the clearing of vegetation which will result in the destruction of Species of Special Concern and SSC habitat. The loss of SSC habitat will therefore mostly occur during construction and will persist for the duration of the project, although post construction rehabilitation and natural regeneration is likely to occur in time.

14.1.3 Increased risk of alien plant invasion in disturbed areas

Alien plant species could be introduced during the construction and operational phases, especially along the access road reserves and areas disturbed during construction and mining.

14.1.4 Fragmentation of Ecological Corridors and disruption of Ecological processes as a result of artificial barriers

The components of the proposed mine all require the clearing of vegetation which will result in both the fragmentation of ecological corridors and artificial disruptions to ecological processes during the construction and the operational phases.

14.1.5 Faunal mortality as a result of bush clearing and earthmoving activities during site preparation

Site clearing (e.g. bush clearing and earthmoving activities during construction) will have a direct impact on less mobile reptiles and Invertebrates.

14.1.6 Habitat destruction may affect faunal diversity and composition

The construction of the proposed mine and related infrastructure (including roads) will permanently destroy existing habitats.

14.1.7 Road mortality of fauna from trucks, trains and other service/construction vehicles

Frequent truck/vehicle road and train activity will result in an increase in mortality of reptiles. The road and railway line infrastructure associated with the proposed mine.

Fauna may enter fenced off areas and get trapped. Electrified fences can also be dangerous to mammals, tortoises and larger reptiles such as water monitor lizards which can be electrocuted.

Workers may set snares to trap animals for food during construction and operational phases, which could result in faunal mortalities or severe disabilities.

14.2 General recommendations

- A detailed floral survey of all affected outcrops must be done before any commencement of mining. This can be undertaken in parallel to preparation, relocation and construction activities.
- Comprehensive rescue and storage in a suitable constructed nursery and storage area of plants deemed to be requiring either rescue for replanting and plants that will be useful during rehabilitation.
- A faunal search and rescue plan must be implemented.
- Detailed Revegetation and Rehabilitation Plan to be conducted during mine construction, operations and decommissioning.
- Long-Term Monitoring programme to be initiated during construction and conducted during operations and after mine closure for a suitable time period.
- An annual/bi-annual audit should be conducted to assess the various facets relating to vegetation by a qualified botanist.

14.2.1 Guidelines for inclusion in the Environmental Management Programme (EMP):

- The development of a plant relocation plan must be incorporated into the EMP and submitted with permit applications. Comprehensive rescue for plants deemed to require rescue for replanting, and for plants that will be useful during rehabilitation.
- The Mining EMP should contain clear guidelines for clearing of vegetation where construction activities are to commence.
- The MIning EMP must contain management measures to be implemented during operation of the mine operation. These measures should cover alien plant control and fire management plans.

- A detailed revegetation and rehabilitation plan must be implemented during the post-construction, operational and decommissioning phases.
- Since the site is located in a catchment area, activities may have an impact on downstream areas. Removal of alien vegetation, rehabilitation of natural vegetation and long-term erosion management are important aspects that must be addressed in the EMP.

14.2.2 "No-Go" Areas

- "No-go" areas must be demarcated clearly (using fencing or appropriate measures and signage) before construction commences.
- Contractors and construction workers must be informed of the "no-go" areas and held accountable for any infringements that may occur.
- No access to the demarcated areas should be permitted during construction and contractors must be informed of the location of these areas. A suitable control measure (such as a penalty system) must be implemented to discourage infringement by contractors.

14.2.3 Plant Relocation Plan and Species of Special Concern Search and Rescue

- A suitable timeframe must be allowed *before* construction commences to undertake the plant rescue and relocation operation. This must be implemented for the duration of the mining operation;
- Plants that can be used during rehabilitation should be identified and stored appropriately off-site for use after construction and alien vegetation clearing;
- Plants identified as being suitable for relocation can either be removed from the site or replanted within areas requiring rehabilitation.

14.2.4 Permit applications for the destruction, relocation and/or removal of protected plant species

- Species indicated as being protected would require permits from the respective department **before** any site clearing/removal commences.
- The person or organisation responsible for the relocation of these plant species must work in advance of the vegetation clearing team, and locate as well as relocate individual plant specimens.
- All individuals of the protected indigenous species should be avoided if possible, if not they should be translocated or utilized during rehabilitation and landscaping. If neither is possible permits will be required to either trim or remove individuals.
- Removed plants must be excavated by hand in such a way that the plants, especially the roots are not damaged.
- Plants should be temporarily planted out either in plastic bags or in-situ in an area that is not affected by the proposed development. Should bags be used, they shall be large enough to contain the entire plant's root system. Bags must be filled with local top soil material. Plants must be watered regularly, protected from damage and otherwise maintained to ensure healthy growth.
- On completion of the civil work the plants must be re-planted out in scattered clumps at areas on the site to be rehabilitated as directed by a suitably qualified specialist.
- Individuals of all removed species will need to be housed in a nursery until such time as relocation areas have been identified.

14.2.5 Rehabilitation potential and processes

- A detailed environmental rehabilitation specification guideline should be compiled and included in the mining EMP.

14.2.6 Alien Vegetation Management Plan

- An alien vegetation removal programme must be implemented to remove alien vegetation from within areas that have been rehabilitated after construction is completed and should run concurrently with construction activities;
- Specific eradication and management procedures should be stipulated in the EMP in terms of the methods to be implemented to remove and control the various alien invasive species as they tend to require species specific techniques. Introduced *non-indigenous* weed species do not require removal but management is advised to prevent proliferation as a result of disturbance (i.e. on road verges, etc).
- Cleared alien vegetation must not be dumped on adjacent intact vegetation during clearing but should be temporarily stored in a demarcated area until appropriate disposal/re-use has been identified (in consultation with the relevant botanical specialist);
- Cleared vegetation must be removed from site or mulched for use in rehabilitation of the rail and conveyor reserves cleared during construction. Any mulched material must be seed free.
- Any seed bearing alien plant material should be removed from site to prevent the spread of seed.
- Chopped indigenous brushwood can be used to stabilise steep areas that may be susceptible to erosion during clearing activities;
- A suitable revegetation or rehabilitation plan must be implemented after alien vegetation clearing.
- A long-term alien vegetation maintenance plan, including monitoring and removal of new invasive plants, must be designed and implemented in conjunction with a suitably qualified expert.

14.2.7 River/stormwater crossings

- Bridge and culvert design must be such that it minimises impact to the riparian areas with minimal alterations to water flow and must permit the movement of fauna;
- Bridge/culvert construction must be completed as timeously as possible and efforts must be in place to minimise the erosion risk and sedimentation of the stream during construction, especially during high rainfall events.

14.2.8 Fauna

- The mining and “no-go” areas must be clearly marked.
- Search and rescue operations conducted before construction phase begins.
- Animals must be relocated to places similar to those where they were found;
- Animals which enter the construction zone must be relocated as soon as possible.
- A professional reptile handler must be appointed when removing and relocating a reptile.
- Construction of roads over stormwater drainage infrastructure must be designed so that the water is allowed to flow under the road, this will secure corridor continuity for amphibians
- Railway line design should be such that it does not impede these corridors unnecessarily or completely;
- Prevent using electric fencing as far as is practically feasible.
- Placing of structures under roads to allow reptiles such as tortoises and terrapins to cross under the road will promote corridor continuity.
- Materials, such as rocks, removed during the constructional phase must be kept aside and used later for the rehabilitation. This will be beneficial for the re-creation of habitat for small mammals.
- Materials which will attract reptiles must not be left on site, this will increase the presence of reptiles
- Care must be taken to ensure slow driving on the site; speed limits should be enforced, especially during rainfall periods.

- Do not encourage wet areas, through construction, next to the road; or a road between two wetlands closely connected to aestivation sites unless the road is not directly on the ground surface.
- Keep the grass/vegetation short next to the road to reduce mammal activity near the road. This will also allow the vehicle driver and mammal to see the danger early enough to avoid a negative impact.
- Already killed animals must be removed from the road as this will attract scavengers which may also be harmed on the road.
- Do not feed animals on or near the roads. Conditions in the EMP should pay attention to this impact. Strict control by the appointed EO must ensure that this impact is addressed.

14.2.9 Fencing, bridges and culverts

- For internal fencing site fencing:
    - The type of fencing to be used is expected to be 6 to 8 strand wire "stock" fence with a height of approximately 1.35 to 1.5 m. There will be a spacing of approximately 300 mm between the strands and the distance between the bottom strands can vary to allow animals to pass through, but will keep out cattle and sheep. 75 mm vermin proof diamond diagonal mesh and barbed wire are optional.
- For external site fencing:
    - Security Palisade fencing can be used around internal facilities but standard game fencing (2,4 m high with 21 fence wires) should be used rather than palisade fencing for external security fencing or where wildlife may be present.
- Box culverts as drainage line crossing structures over drainage lines should be at least 3 m wide and 2 m high where possible.
- Lattice type structure bridges (faunal underpasses) are also proposed over gulleys and drainage lines along ecological corridors. These should have a span of approximately 20 m to allow for a continuity of the open space system corridor and for small animals to pass through
- Open bridge structures are far superior regarding promoting and allowing the free movement of fauna as compared to 30 – 50 m long Box culverts and will significantly reduce the disruption and fragmentation of corridors to acceptable levels. The use of lattice structures are required to mitigate impacts to open space.
- Post construction rehabilitation and planting of trees in areas around the lattice bridges can promote an environment conductive to re-establishing a corridor for displaced fauna. Post construction areas not required during operational phase to be rehabilitated.
- Fencing and railway line berms will serve to guide fauna (such as tortoises) towards underpass areas.

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16 Appendix 1: Flora Species Lists

The flora species list is incomplete due to seasonal sampling constraints and is based on limited information from dry winter site survey and previous studies conducted within the study area (farm Voorburg).

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	PRESENCE
Trees				
Fabaceae	*Acacia gerrardii*	Red Thorn	LC	C
Fabaceae	*Acacia grandicornuta*	Horned Thorn	LC	C
Fabaceae	*Acacia karroo*	Sweet Thorn	LC	C
Fabaceae	*Acacia nigrescens*	Knob Thorn	LC	C
Fabaceae	*Acacia senegal* var. *leiorhachis*	Slender Three-hook Thorn	LC	C
Fabaceae	*Acacia tortilis*	Umbrella Thorn	LC	C
Malvaceae	*Adansonia digitata*	Baobab	NFA, LEMA12	C
Fabaceae	*Albizia anthelmintica*	Worm-bark False-thorn	LC	C
Fabaceae	*Albizia harveyi*	Common False-Thorn	LC	C
Balanitaceae	*Balanites pedicellaris*	Small Green Thorn	LC	C
Rhamnaceae	*Berchemia discolour*	Brown Ivory	LC	C
Capparaceae	*Boscia albitrunca*	Shepherd's Tree	NFA	C
Capparaceae	*Boscia foetida* subsp. *rehmanniana*	Stink-bush	LC	C
Fabaceae	*Cassia abbreviata subsp. beareana*	Long-tail Cassia (Sjambok Pod)	LC	C
Fabaceae	*Colophospermum mopane*	Mopane	LC	C
Combretaceae	*Combretum apiculatum*	Red Bushwillow	LC	C
Combretaceae	*Combretum imberbe*	Leadwood	NFA	C
Burseraceae	*Commiphora glandulosa*	Tall Common Corkwood	LC	C
Burseraceae	*Commiphora mollis*	Velvet-leaved Corkwood	LC	C
Burseraceae	*Commiphora neglecta*	Sweet-root Corkwood	LC	C
Burseraceae	*Commiphora tenuipetiolata*	White-stem Corkwood	LC	C
Burseraceae	*Commiphora viminea*	Zebra-bark Corkwood	LC	C
Fabaceae	*Faidherbia albida*	Ana-tree	LC	C
Moraceae	*Ficus abutilifolia*	Large-leaved Rock Fig	LC	C
Moraceae	*Ficus sycomorus*	Sycamore Fig	LC	C
Moraceae	*Ficus tettensis*	Small-leaved Rock Fig	LC	C
Rubiaceae	*Gardenia volkensii*	Savanna gardenia	LC	C
Hernandiacea	*Gyrocarpus americanus*	Propeller tree	LC	C
Kirkiaceae	*Kirkia acuminata*	White Seringa	LC	C
Anacardiaceae	*Lannea schweinfurthii var*	False Marula	LC	C

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	PRESENCE
	stuhlmannii			
Capparidaceae	*Maerua angolensis*	Bead-bean Tree	LC	C
Sapindaceae	*Pappea capensis*	Jacket-plum	LC	C
Fabaceae	*Philenoptera violacea*	Apple-leaf	LC	C
Salvadoraceae	*Salvadora australis*	Narrow-leafed mustard tree	LC	C
Fabaceae	*Schotia brachypetala*	Weeping Boer-bean	LC	C
Anacardiaceae	*Sclerocarya birrea subsp. caffra*	Marula	NFA	C
Euphorbiaceae	*Spirostachys africana*	Tamboti	LC	C
Sterculiaceae	*Sterculia rogersii*	Common Star-chestnut	LC	C
Fabaceae	*Xanthocercis zambesiaca*	Nyala tree	LC	C
Rhamnaceae	*Ziziphus mucronata* subsp. *mucronata*	Buffalo-thorn	LC	C
Shrubs				
Fabaceae	*Acacia erubescens*	Blue Thorn	LC	C
Fabaceae	*Acacia exuvialis*	Flaky-bark Thorn	LC	C
Acanthaceae	*Anisotes rogersii*	Limpopo Anisotis	LC	C
Capparaceae	*Cadaba termitaria*	Grey-leaved Wormbush	LC	C
Capparaceae	*Capparis tomentosa*	Wooly Caper-bush	LC	C
Bignoniaceae	*Catophractes alexandri*	Trumpet thorn	LC	C
Burseraceae	*Commiphora africana*	Hairy corkwood	LC	C
Burseraceae	*Commiphora pyracanthoides*	Common corkwood	LC	C
Boraginaceae	*Cordia monoica*	Sandpaper Saucer-berry	LC	C
Boraginaceae	*Cordia ovalis*	Satin-bark Saucer-berry	LC	C
Euphorbiaceae	*Croton menyharthii*	Rough-leaved Croton	LC	U
Fabaceae	*Dichrostachys cinerea*	Sickle Bush	LC	C
Phyllanthaceae	*Flueggea virosa*	White-berry Bush	LC	U
Rubiaceae	*Gardenia resiniflua*	Resin Gardenia	LC	C
Malvaceae	*Grewia bicolor*	White Raisin	LC	C
Malvaceae	*Grewia flavescens*	Sandpaper Raisin	LC	C
Malvaceae	*Grewia monticola*	Silver Raisin	LC	C
Malvaceae	*Grewia villosa*	Mallow Raisin	LC	C
Celastraceae	*Gymnosporia buxifolia*	Common Spikethorn	LC	C
Fabaceae	*Mundulea sericea*	Cork-bush	LC	U
Ochnaceae	*Ochna inermis*	Stunted Plane	LC	U
Asteraceae	*Pechuel-loeschea leubnitziae*	Stinkbush	LC	U
Bignoniaceae	*Rhigozum zambesiacum*	Mopani Pomegranate	LC	C
Anacardiaceae	*Rhus gueinzii*	Thorny Karree	LC	C
Combretaceae	*Terminalia prunioides*	Lowveld Cluster-leaf	LC	C

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	PRESENCE
Lamiaceae	*Tinnea rhodesiana*	Brown Tinnea	LC	C
Olacaceae	*Ximenia americana*	Blue Sourplum	LC	C
Olacaceae	*Ximenia caffra*	Sourplum	LC	C
Grasses				
Poaceae	*Aristida adscensionis*	Annual Three-awn	LC	C
Poaceae	*Aristida congesta subsp. barbicollis*	Spreading Three-awn	LC	C
Poaceae	*Aristida congesta subsp. congesta*	Tassel Three-awn	LC	C
Poaceae	*Bothriochloa insculpta*	Pinhole Grass	LC	C
Poaceae	*Cenchrus ciliaris*	Blue Buffalo Grass	LC	C
Poaceae	*Danthoniopsis dinteri*	Rock Grass	LC	U
Poaceae	*Digitaria eriantha*	Finger Grass	LC	C
Poaceae	*Enneapogon cenchroides*	Nine-awned Grass	LC	U
Poaceae	*Enteropogon macrostachys*	Mopane Grass	LC	C
Poaceae	*Eragrostis heteromera*	Bronze Love Grass	LC	U
Poaceae	*Eragrostis lehmanniana*	Lehmann's Love Grass	LC	U
Poaceae	*Eragrostis rigidior*	Broad-leaved Curly Leaf	LC	U
Poaceae	*Eragrostis trichophora*	Hairy Love Grass	LC	U
Poaceae	*Fingerhuthia africana*	Thimble Grass	LC	U
Poaceae	*Heteropogon contortus*	Spear Grass	LC	C
Poaceae	*Melinis repens*	Natal Red Top	LC	C
Poaceae	*Microchloa caffra*	Pincushion Grass	LC	U
Poaceae	*Oropetium capense*	Dwarf Grass	LC	U
Poaceae	*Panicum maximum*	Guinea Grass	LC	C
Poaceae	*Phragmites australis*	Common Reed	LC	C
Poaceae	*Schmidtia pappophoroides*	Sand Quick	LC	C
Poaceae	*Stipagrostis uniplumis*	Silky Bushman Grass	LC	C
Poaceae	*Tetrapogon tenellus*		LC	*U*
Poaceae	*Tragus berteronianus*	Common Carrot-seed Grass	LC	C
Forbs				
Acanthaceae	*Barleria senensis*	Mozambique Barleria	LC	C
Acanthaceae	*Blepharis subvolubilis* subsp. *subvolubilis*	Eyelash flower	LC	C
Asteraceae	*Geigeria acaulis*	Rosulate Geigeria	LC	U
Euphorbiaceae	*Jatropha spicata*	Rocky Jatropha	LC	C
Velloziaceae	*Xerophyta retinervis*	Monkeys tail	LC	U

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	PRESENCE
Climbers				
Capparaceae	*Capparis tomentosa*	Woolly Caper-bush	LC	C
Succulents				
Vitaceae	*Cissus cactiformis*	Cactus vine	LC	C
Apocynaceae	*Adenium multiflorum*	Impala Lily	LEMA12	C
Euphorbiaceae	*Euphorbia cooperi*	Transvaal candelabra tree	LC	C
Euphorbiaceae	*Euphorbia schinzii*		LC	*C*
Dracaenaceae	*Sansevieria aethiopica*	Common bowstring hemp	LC	C
Pedaliaceae	*Sesamothamnus lugardii*	Transvaal Sesame Bush	LC	C
Lianas				
Combretaceae	*Combretum mossambiscense*	Knobbly Creeper	LC	U
Dwarf shrubs				
Asparagaceae	*Asparagus cooperi*	Haakdoring	LC	C
Sedges				
Cyperaceae	*Cyperus sexangularis*	Matjiesgoed	LC	C

17 Appendix 2: Faunal Species lists

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
MAMMALS				
Bathyergidae	*Cryptomys hottentotus*	Hottentotus African Mole-rat	LC	N
Bovidae	*Aepyceros*	No common name	LC	N
Bovidae	*Alcelaphus buselaphus*	Red Hartebeest	LC	N
Bovidae	*Connochaetes taurinus taurinus*	Blue Wildebeest	LC	O
Bovidae	*Damaliscus lunatus lunatus*	Tsessebe	EN	N
Bovidae	*Hippotragus equinus*	Roan Antelope	VU	O
Bovidae	*Hippotragus nigerniger*	Sable Antelope	VU	O
Bovidae	*Kobus ellipsiprymnus ellipsiprymnus*	Water buck	LC	O
Bovidae	*Oreatragus oreatragus*	Klipspringer	LC	O
Bovidae	*Oryx gazelle*	Gemsbok	LC	N
Bovidae	*Raphicerus campestris*	Steenbok	LC	O
Bovidae	*Raphicerus sharpei*	Sharp's Grysbok	LC	N
Bovidae	*Redunca arundinum*	Reedbuck	LC	O
Bovidae	*Sylvicarpra grimmia*	Common duiker	LC	O
Bovidae	*Syncerus caffer*	Cape Buffalo	LC	N
Bovidae	*Taurotragus oryx*	Eland	LC	O
Bovidae	*Tragelaphus angasii*	Nyala	LC	O
Bovidae	*Tragelaphus scriptus*	Bushbuck	LC	O
Bovidae	*Tragelaphus strepsiceros*	Kudu	LC	O
Canidae	*Canis mesomelas*	Black-backed Jackal	LC	O

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Canidae	*Lycaon pictus*	African Wild Dog	EN	N
Cercopithecidae	*Cercopithecus aethiops pygerythrus*	Vervet Monkey	LC	O
Cercopithecidae	*Papio ursinus*	Chacma Baboon	LC	O
Elephantidae	*Loxodonta Africana*	African Elephant	LC	N
Emballonuridae	*Taphozous mauritianus*	Mauritian Tomb Bat	LC	N
Equidae	*Equus burchellii*	Plains Zebra	LC	O
Erinaceidae	*Atelerix frontalis*	South African Hedgehog	Protected (TOPS) NT	N
Felidae	*Acinonyx jubatus*	Cheetah	VU	N
Felidae	*Caracal caracal*	Caracal	LC	N
Felidae	*Felis silvestris cafra*	African wild cat	LC	N
Felidae	*Leptailurus serval*	Serval	NT	N
Felidae	*Panthera leo*	Lion	VU	N
Felidae	*Panthera pardus*	Leopard	NT	N
Galagidae	*Galago moholi*	Southern Lesser Galago	LC	N
Giraffidae	*Giraffa camelopardalis camelopardalis*	Giraffe	LC	O
Herpestidae	*Atilax paludinosus*	Marsh mongoose	LC	N
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	LC	O
Herpestidae	*Galerella sanguinea*	Slender Mongoose	LC	N
Herpestidae	*Helogale parvula*	Dwarf Mongoose	LC	N
Herpestidae	*Ichneumia albicauda*	White-tailed Mongoose	LC	N
Herpestidae	*Mungos mungo*	Banded Mongoose	LC	O
Hipposideridae	*Hipposideros caffer*	Leaf-nosed Bat	LC	N
Hyaenidae	*Crocuta crocuta*	Spotted Hyaena	NT	N
Hyaenidae	*Hyaena brunnea*	Brown Hyaena	NT	O
Hyaenidae	*Proteles cristatus*	Aardwolf	LC	N

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Hyaenidae	*Hystrix africaeaustralis*	Cape porcupine	LC	O
Leporidae	*lepus saxatilis*	Scrub hare	LC	O
Leporidae	*Pronolagus randensis*	Jameson's red-rock rabbit	LC	N
Pedetidae	*Pedetes capensis*	Springhare	LC	N
Pteropodidae	*Epomophorus wahlbergi*	Wahlberg's Epauletted Fruit Bat	LC	N
Lorisidae	*Otolemurcrassicaudatus*	Thick-tailed Bush Baby	LC	N
Macroscelididae	*Elephantulus myurus*	Eastern Rock Elephant-shrew	LC	N
Macroscelididae	*Elephantulus brachyrynchus*	Short Snouted Elephant-shrew	LC	N
Manidae	*Manis Temminckii*	Ground Pangolin	VU	N
Molossidae	*Tadarida aegyptiaca*	Egyptian Free-tailed Bat	LC	N
Muridae	*Tateraleuco gaster*	Bushveld Gerbil	LC	N
Muridae	*Acomys spinosissimus*	Spiny Mouse	LC	N
Muridae	*Mus minutoides*	Pygmy mouse	LC	N
Muridae	*Lemniscomys rosalia spinalis*	Single- stripe grass mouse	LC	N
Muridae	*Rhabdomys pumilio graduate*	Four-striped grass mouse	LC	O
Muridae	*Mastomys nigricauda/paedulus*	Black-tailed Tree Rat	LC	N
Muridae	*Aethomy sineptus*	Tete Veld Rat	LC	N
Muridae	*Micaelamys namaquensis*	Namaqua Rock Mouse	LC	N
Muridae	*Otomys angoniensis*	Angoni Vlei-Rat	LC	N
Muridae	*Tatera Leucogaster*	Bushveld Gerbil	LC	N
Muridae	*Tatera brantsii*	Highveld Gerbil	LC	N
Muridae	*Saccostomus capensis*	Pouched Mouse	LC	N
Muridae	*Dendromus melanotus*	Grey-climbing Mouse	LC	N
Muridae	*Steatomys pratensis*	Fat Mouse	LC	N
Muridae	*Mastomys coucha*	Southern Multimammate Mouse	LC	N
Muridae	*Cricetomys gambianus*	Giant Rat	VU	N

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Mustelidae	*Aonyx capensis*	CapeClaw-less Otter	LC, TOPS	N
Mustelidae	*Ictonyx striatus*	Striped Polecat	LC	N
Mustelidae	*Mellivora capensis*	Honey Badger	NT	N
Mustelidae	*Poecilogale albinucha*	African Striped Weasel	LC	N
Myoxidae	*Grahpiurus platyops*	Rock Dormouse	LC	N
Myoxidae	*Grahpiurus murinus*	Woodland Dormouse	LC	N
Nycteridae	*Nycteris thebaica*	Egyptian Slit-Faced Bat	LC	N
Orycteropodidae	*Orycteropus afer*	Aardvark	LC	N
Pteropodidae	*Epomophorus gambianus crypturus*	Gambian Epauletted Fruit Bat	LC	N
Rhinocerotidae	*Ceratotherium simum*	White Rhinoceros	LC	N
Rhinocerotidae	*Diceros bicornis michaeli*	Blach Rhinoceros	CE	N
Rhinolophidae	*Rhinolophus clivosus*	Goeffroy's Horseshoe Bat	NT	N
Rhinolophidae	*Rhinolophus darlingi*	Darling's Horseshoe Bat	NT	N
Rhinolophidae	*Rhinolophus Hildebrandtii*	Hildebrandt's Horseshoe Bat	NT	N
Rhinolophidae	*Rhinolophus simulator*	Bushveld Horseshoe Bat	LC	N
Sciuridae	*Paraxerus cepapi*	Tree Squirrel	LC	O
Sciuridae	*Xerus inauris*	South -African Ground Squirrel	LC	N
Soricidae	*Suncus lixus gratulus*	Greater Dwarf-shrew	LC	N
Soricidae	*Crocidura mariquensis*	Swamp Musk Shrew	LC	N
Soricidae	*Crocidura fuscomurina*	Tiny Musk Shrew	LC	N
Soricidae	*Crocidura cynnea*	Reddish-grey Musk Shrew	LC	N
Soricidae	*Crocidura silacea*	Lesser grey-brown Musk Shrew	LC	N
Soricidae	*Crocidura hirta*	Lesser Red Musk Shrew	LC	N
Suidae	*Phacochoerus africanus*	Warthog	LC	O
Suidae	*Potamochoerus porcus koiropotamus*	Bushpig	LC	O
Vespertilionidae	*Mimiopterus schriebersii*	Schreiber's Long-fingered Bat	NT	N

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Vespertilionidae	*Pipistrellus rusticus*	Pipistrelle	LC	N
Vespertilionidae	*Neoromicia capensis*	Cape Serotine Bat	LC	N
Vespertilionidae	*Scotophilusdinganii*	African Yellow Bat	LC	N
Vespertilionidae	*Scotophilus viridis*	Greenish Yellow Bat	LC	N
Viveridae	*Civettictis civetta*	African Civet	LC	N
Viveridae	*Genetta genetta*	Small-spotted Genet	LC	O
Viveridae	*Genetta maculata*	South African Large-spotted Genet	LC	N
Hipposideridae	*Cloeotis percivali*	Short eared Trident Bat	CE	N
Canidae	*Otocyon megalotis*	Bat eared fox	LC	O
Bovidae	*Connochaetes gnou*	Black Wildebeest	TOPS	N
BIRDS				
Podicipedidae	*Tachybaptus ruficollis*	Little grebe	LC	O
Phalacrocoracidae	*Phalacrocorax carbo*	White-breasted Cormorant	LC	O
Phalacrocoracidae	*Phalacrocorax africanas*	Reed Cormorant	LC	O
Anhingidae	*Anhinga rufa*	African Darter	LC	O
Ardeidae	*Ardea cinerea*	Grey heron	LC	O
Ardeidae	*Ardea melanocephala*	Black-headed Heron	LC	O
Ardeidae	*Ardea goliath*	Goliath Heron	LC	O
Ardeidae	*Egretta alba*	Great egret	LC	O
Ardeidae	*Egretta garzetta*	Little egret	LC	O
Ardeidae	*Egretta ardesiaca*	Black Heron	LC	N
Ardeidae	*Bubulcus ibis*	Cattle Egret	LC	O
Ardeidae	*Ardeola ralloides*	Squacco Heron	LC	N
Ardeidae	*Butorides striata*	Green-backed Heron	LC	N
Scopidae	*Scopus umbretta*	Hammerkop	LC	O

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Ciconiidae	*Ciconia ciconia*	White Stork	LC	O
Ciconiidae	*Ciconia nigra*	Black Stork	NT	N
Ciconiidae	*Ciconia abdimii*	Abdim's Stork	LC	N
Ciconiidae	*Ephippiorhynchus senegalensis*	Saddle-Billed Stork	EN	N
Ciconiidae	*Leptoptilos crumeniferus*	Marabou Stork	NT	N
Ciconiidae	*Mycteria ibis*	Yellow-billed Stork	NT	N
Threskiornithidae	*Bostrychia hagedash*	Hadeda Ibis	LC	O
Threskiornithidae	*Platalea alba*	African spoonbill	LC	O
Dendrocygnidae	*Dendrocygna viduata*	White-faced Duck	LC	O
Dendrocygnidae	*Alopochen aegyptiaca*	Egyptian goose	LC	O
Anatidae	*Anas erythrorhyncha*	Red-billed teal	LC	O
Anatidae	*Sarkidiornis melanatos*	Comb Duck	LC	N
Sagittaridae	*Sagittarius serpentarius*	Secretary Bird	NT	O
Accipitridae	*Gyps coprotheres*	Cape Vulture	VU	N
Accipitridae	*Gyps africanas*	White-backed Vulture	VU	N
Accipitridae	*Torgos tracheliotus*	Lappet-faced Vulture	VU	N
Accipitridae	*Milvus migrans*	Black Kite	LC	N
Accipitridae	*Milvus aegyptius*	Yellow-billed Kite	LC	O
Accipitridae	*Elanus caeruleus*	Black-shouldered Kite	LC	O
Accipitridae	*Aquila verreauxii*	Verreaux's Eagle	LC	N
Accipitridae	*Aquila rapax*	Tawny Eagle	VU	N
Accipitridae	*Aquila pomarina*	Lesser spotted Eagle	LC	N
Accipitridae	*Aquila wahlbergi*	Wahlberg's Eagle	LC	N
Accipitridae	*Aquila spilogaster*	African Hawk-eagle	LC	N
Accipitridae	*Polemaetus bellicosus*	Martial Eagle	VU	O
Accipitridae	*Circaetus cinereus*	Brown Snake-eagle	LC	O

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Accipitridae	Circaetus pectoralis	Black -chested Snake-eagle	LC	O
Accipitridae	*Terathopius ecaudatus*	Bateleur	VU	N
Accipitridae	*Haliaeetus vocifer*	African Fish-eagle	LC	O
Accipitridae	*Buteo vulpinus*	Steppe Buzzard	LC	O
Accipitridae	*Kaupifalco monogrammicus*	Lizard Buzzard	LC	N
Accipitridae	*Accipiter minullus*	Little Sparrowhawk	LC	N
Accipitridae	*Accipiter badius*	Shikra	LC	N
Accipitridae	*Melierax gabar*	Gabar Goshawk	LC	N
Accipitridae	*Melierax canorus*	Southern Pale Chanting Goshawk	LC	O
Accipitridae	*Melierax metabates*	Dark Chanting Goshawk	LC	N
Accipitridae	*Polyboroides typus*	African Harrier -Hawk	LC	N
Falconidae	*Falco peregrines*	Peregrine Falcon	NT	O
Falconidae	*Falco biarmicus*	Lanner Falcon	NT	O
Falconidae	*Falco amurensis*	Amur Falcon	LC	N
Phasianidae	*Dendroperdix sephaena*	Crested Francolin	LC	N
Phasianidae	*Pternistis natalensis*	Natal Spurfowl	LC	N
Phasianidae	*Pternistris swainsonii*	Swainson's Spurfowl	LC	N
Phasianidae	*Coturnix coturnix*	Common Quail	LC	O
Phasianidae	*Coturnix delegorguei*	Harlequin Quail	LC	N
Numididae	*Numida meleagris*	Helmeted Guineafowl	LC	O
Turnicidae	*Turnix sylvaticus*	Kurrichane Buttonquail	LC	N
Turnicidae	*Amaurornis flavirostris*	Black crake	LC	N
Otididae	*Ardeotis Kori Vulnerable*	Kori Bustard	LC	O
Otididae	*Korhaan Lophotis ruficrista*	Red-crested korhaan	LC	N
Jacanidae	*Actophilornis africanas*	African jacana	LC	N
Rostratulidae	*Rostratula benghalensis*	Greater Painted -snipe	NT	N

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Charadriidae	*Charadrius tricollaris*	Three-banded Plover	LC	O
Charadriidae	*Vanellus coronatus*	Crowned Lapwing	LC	O
Charadriidae	*Vanellus armatus*	Blacksmith Lapwing	LC	O
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper	LC	O
Scolopacidae	*Tringa glareola*	Wood Sandpiper	LC	N
Scolopacidae	*Tringa glareola*	Common Greenshank	LC	N
Scolopacidae	*Philomachus pugnax*	Ruff	LC	N
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	LC	O
Burhinidae	*Burhinus capensis*	Spotted Thick-knee	LC	O
Burchinidae	*Burhinus vermiculatus*	Water Thick-knee	LC	O
Glareolidae	*Rhinoptilus chalcopterus*	Bronze- winged Courser	LC	N
Pteroclidae	*Pterocles bicinctus*	Double -banded sandgrouse	LC	N
Columbidae	*Columba guinea*	Speckled Pigeon	LC	N
Columbidae	*Streptopelia semitorquata*	Red-eyed Dove	LC	O
Columbidae	*Streptopelia decipiens*	African Mourning Dove	LC	N
Columbidae	*Streptopelia capicola*	Cape Turtle-dove	LC	O
Columbidae	*Streptopelia senegalensis*	Laughing Dove	LC	O
Columbidae	*Oena capensis*	Namaqua Dove	LC	O
Columbidae	*Turtur chalcospilos*	Emerald-spotted Wood-dove	LC	O
Columbidae	*Treron calvus*	African Green-pigeon	LC	N
Psittacoides	*Poicephalus meyeri*	Meyer's Parrot	LC	N
Musophagidae	*Corythaixoides concolor*	Grey Go-away-bird	LC	O
Cuculidae	*Cuculus gularis*	African Cuckoo	LC	N
Cuculidae	*Cuculus solitaries*	Red-chested Cuckoo	LC	N
Cuculidae	*Cuculus clamosus*	Black Cuckoo	LC	N
Cuculidae	*Clamator levaillantii*	Lavaillant's Cuckoo	LC	N

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Cuculidae	*Clamator glandarius*	Great Spotted Cuckoo	LC	N
Cuculidae	*Clamator jacobinus*	Jacobin Cuckoo	LC	N
Cuculidae	*Chrysococcyx klaas*	Klaas's Cuckoo	LC	N
Cuculidae	*Chrysococcyx caprius*	Diderick Cuckoo	LC	N
Centropodidae	*Centropus burchellii*	Burchell's Coucal	LC	O
Tytonidae	*Typo alba*	Barn Owl	LC	N
Strigidae	*Otus senegalensis*	African Scops –Owl	LC	N
Strigidae	*Ptilopsis granti*	Southern White-faced Scops-Owl	LC	N
Strigidae	*Glaucidium perlatum*	Pearl-spotted Owlet	LC	N
Strigidae	*Glaucidium perlatum*	African Barred Owlet	LC	N
Strigidae	*Bubo africanas*	Spotted Eagle - Owl	LC	O
Strigidae	*Bubo lacteus*	Verreaux's Eagle-Owl	LC	N
Caprimulgidae	*Caprimulgus europaeus*	European Nightjar	LC	O
Caprimulgidae	*Caprimulgus pectoralis*	Fiery-necked Nightjar	LC	O
Caprimulgidae	*Caprimulgus rufigena*	Rufous-cheeked Nightjar	LC	N
Caprimulgidae	*Caprimulgus tristigma*	Freckled Nightjar	LC	N
Caprimulgidae	*Caprimulgus fossii*	Square-tailed Nightjar	LC	N
Apodidae	*Apus apus*	Common Swift	LC	O
Apodidae	*Apus barbatus*	African Black Swift	LC	N
Apodidae	*Apus caffer*	White-rumped Swift	LC	N
Apodidae	*Apus affinis*	Little Swift	LC	O
Apodidae	*Tachymarptis melba*	Alpine Swift	LC	N
Apodidae	*Cypsiurus parvus*	African Palm-swift	LC	N
Collidae	*Colius Striatus*	Speckled Mousebird	LC	O
Collidae	*Urocolius indicus*	Red-faced Mousebird	LC	O
Cerylidae	*Ceryle rudis*	Pied Kingfisher	LC	O

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Cerylidae	*Megaceryle maximus*	Giant Kingfisher	LC	N
Alcedinidae	*Alcedo cristata*	Malachite Kingfisher	LC	N
Alcedinidae	*Ispidina picta*	African Pygmy – kingfisher	LC	N
Dacelonidae	*Halcyon senegalensis*	Woodland Kingfisher	LC	N
Dacelonidae	*Halcyon albiventris*	Brown-hooded Kingfisher	LC	O
Dacelonidae	*Halcyon leucocephala*	Grey-headed Kingfisher	LC	N
Dacelonidae	*Halcyon chelicuti*	Striped Kingfisher	LC	N
Meropidae	*Merops apiaster*	European Bee-eater	LC	N
Meropidae	*Merops nubicoides*	Southern Carmine Bee-eater	LC	N
Meropidae	*Merops Bullockoides*	White-fronted Bee-eater	LC	O
Meropidae	*Merops pusillus*	Little Bee-eater	LC	N
Meropidae	*Merops hirundineus*	Swallow-tailed Bee-eater	LC	N
Coraciidae	*Coracias garrulous*	European Roller	LC	N
Coraciidae	*Coracias caudatus*	Lilac-breasted Roller	LC	O
Coraciidae	*Coracias naevius*	Purple Roller	LC	N
Coraciidae	*Eurystomus glaucurus*	Broad-billed Roller	LC	N
Upupidae	*Upupa Africana*	African Hoopoe	LC	O
Phoeniculidae	*Phoeniculus purpureus*	Green Wood-hoopoe	LC	N
Rhinopomastidae	*Rhinopomastus cyanomelas*	Common Skimitarbill	LC	N
Bucerotidae	*Tochus nasutus*	African Grey Hornbill	LC	N
Bucerotidae	*Tochus erythrorhynchus*	Red-billed Hornbill	LC	O
Bucerotidae	*Tochus leucomelas*	Southern Yellow-billed Hornbill	LC	N
Bucorvidae	*Bucorvus leadbeateri Vulnerable*	Southern Ground Hornbill	LC	N
Lybiidae	*Lybius torquatus*	Black-collared Barbet	LC	O
Lybiidae	*Tricholaema leucomelas*	Acacia Pied Barbet	LC	N
Lybiidae	*Tricholaema vaillantii*	Crested Barbet	LC	N

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Indicatoridae	*Indicator Indicator*	Greater Honeyguide	LC	N
Indicatoridae	*Indicator minor*	Lesser Honeyguide	LC	N
Indicatoridae	*Prodotiscus regulus*	Brown-backed Honeybird	LC	N
Picidae	*Campethera bennettii*	Bennett's Woodpecker	LC	N
Picidae	*Campethera abingoni*	Golden-tailed Woodpecker	LC	N
Picidae	*Dendropicos fuscescens*	Cardinal Woodpecker	LC	N
Picidae	*Dendropicos namaquus*	Beared Woodpecker	LC	N
Alaudidae	*Mirafra passerine*	Monotonous Lark	LC	N
Alaudidae	*Mirafra africana*	Rufous-naped Lark	LC	N
Alaudidae	*Calendulauda sabota*	Sabota Lark	LC	N
Alaudidae	*Pinarocorys nigricans*	Dusky Lark	LC	N
Alaudidae	*Calandrella cinerea*	Red-capped Lark	LC	N
Alaudidae	*Eremopterix leucotis*	Chestnut-backed Sparrowlark	LC	N
Hirundinidae	*Hirundo rustica*	Barn Swallow	LC	N
Hirundinidae	*Hirundo smithii*	Wire-tailed Swallow	LC	N
Hirundinidae	*Hirundo dimidiate*	Pearl-breasted Swallow	LC	N
Hirundinidae	*Hirundo semirufa*	Red-breasted Swallow	LC	N
Hirundinidae	*Hirundo cucullata*	Greater Striped Swallow	LC	O
Hirundinidae	*Hirundo abyssinica*	Lesser Striped Swallow	LC	O
Hirundinidae	*Hirundo fuligula*	Rock Martin	LC	N
Hirundinidae	*Delichon urbicum*	Common House -Martin	LC	O
Campephagidae	*Campephaga flava*	Black Cuckooshrike	LC	N
Dicruridae	*Dicrurus adsimilis*	Fork-tailed Drongo	LC	O
Oriolidae	*Oriolus auratus*	Eurasian Golden Oriole	LC	O
Oriolidae	*Oriolus larvatus*	Black-headed Oriole	LC	O
Corvidae	*Corvus albus*	Pied crow	LC	O

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Paridae	*Parus niger*	Southern Black Tit	LC	N
Sylviidae	*Turdoides jardineii*	Arrow-marked Babbler	LC	N
Sylviidae	*Turdoides bicolor*	Southern Pied Babbler	LC	N
Pycnonotidae	*Pycnonotus tricolor*	Dark-capped Bulbul	LC	N
Pycnonotidae	*Phyllastrephus terrestris*	Terrestrial Brownbul	LC	N
Pycnonotidae	*Chlorocichla flaviventris*	Yellow-bellied Greenbul	LC	N
Muscicapidae	*Turdus libonyanus*	Kurrichane Thrush	LC	N
Muscicapidae	*Psophocichla litsitsirupa*	Groundscraper Thrush	LC	N
Muscicapidae	*Cercomela familiaris*	Familiar Chat	LC	N
Muscicapidae	*Thamnolaea cinnamomeiventris*	Mocking Cliff-chat	LC	N
Muscicapidae	*Saxicola torquatus*	African Stone-chat	LC	N
Muscicapidae	*Cossypha heuglini*	White-browed Robin-chat	LC	N
Muscicapidae	*Cossypha humeralis*	White-throated Robin-chat	LC	N
Muscicapidae	*Cercotrichas leucophrys*	White-browed Scrub-Robin	LC	N
Muscicapidae	*Cercotrichas paean*	Kalahari Scrub-Robin	LC	N
Sylviidae	*Parisoma Subcaeruleum*	Chestnut-vented Tit-Babbler	LC	N
Sylviidae	*Hippolais olivetorum*	Olive –tree Warbler	LC	N
Sylviidae	*Acrocephalus baeticatus*	African Reed-Warbler	LC	N
Sylviidae	*Phylloscopus trochilus*	Willow Warbler	LC	N
Sylviidae	*Eremomela icteropygialis*	Yellow-bellied Eremomela	LC	N
Sylviidae	*Apalis flavida*	Yellow-breasted Apalis	LC	N
Sylviidae	*Sylvietta rufescens*	Long-billed Crombec	LC	N
Sylviidae	*Eremomela usticollis*	Burnt-necked Eremomela	LC	N
Cisticolidae	*Camaroptera brevicaudata*	Grey-backed Camaroptera	LC	N
Sylviidae	*Calamonastes faciolatus*	Barred Wren -Warbler	LC	N
Cisticolidae	*Cisticola aridulus*	Desert Cisticola	LC	N

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Cisticolidae	*Cisticola chiniana*	Rattling Cisticola	LC	N
Cisticolidae	*Cisticola erythrops*	Red-faced Cisticola	LC	N
Cisticolidae	*Cisticola fulvicapilla*	Neddicky	LC	N
Cisticolidae	*Prinia subflava*	Tawny-flanked Prinia	LC	N
Muscicapidae	*Muscicapa striata*	Spotted Flycatcher	LC	N
Muscicapidae	*Muscicapa caerulescens*	Ashy Flycatcher	LC	N
Muscicapidae	*Myioparus plumbeus*	Grey -Tit Flycatcher	LC	N
Muscicapidae	*Melaenoris pammelaina*	Southern Black Flycatcher	LC	N
Muscicapidae	*Bradornis mariquensis*	Marico Flycatcher	LC	N
Malaconotidae	*Batis molitor*	Chinspot Batis	LC	N
Monarchidae	*Terpsiphone viridis*	African Paradise-Flycatcher	LC	N
Motacilidae	*Motacilla aguimp*	African Pied Wagtail	LC	N
Motacilidae	*Motacilla capensis*	Cape Wagtail	LC	O
Motacilidae	*Anthus cinnamomeus*	African Pipit	LC	N
Laniidae	*Lanius minor*	Lesser Grey Shrike	LC	N
Laniidae	*Lanius collaris*	Common Fiscal	LC	N
Laniidae	*Lanius collurio*	Red-backed Shrike	LC	N
Malaconotidae	*Corvinella melanoleuca*	Magpie Shrike	LC	N
Malaconotidae	*Laniarius aethiopicus*	Tropical Boubou	LC	N
Malaconotidae	*Dryoscopus cubla*	Black-backed Puffback	LC	O
Malaconotidae	*Nilaus afer*	Brubru	LC	N
Malaconotidae	*Tchagra australis*	Brown-crowned Tchagra	LC	N
Malaconotidae	*Tchagra senegalus*	Black-crowned Tchagra	LC	N
Malaconotidae	*Telophorus sulfureopectus*	Orange-breasted Bush Shrike	LC	O
Malaconotidae	*Malaconotus blachoti*	Grey-headed Bush Shrike	LC	N
Malaconotidae	*Prionops plumatus*	White-crested Helmet Shrike	LC	N

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Malaconotidae	*Prionops retzii*	Retz's Helmet Shrike	LC	N
Malaconotidae	*Eurocephalus anguitimens*	Southern White-crowned Shrike	LC	N
Sturnidae	*Creatophora cinerea*	Wattled Starling	LC	O
Sturnidae	*Cinnyricinclus leucogaster*	Violet-backed Starling	LC	N
Sturnidae	*Lamprotornis nitens*	Cape Glossy Starling	LC	O
Sturnidae	*Lamprotornis chalybaeus*	Greater Blue-eared Starling	LC	N
Sturnidae	*Onychognathus morio*	Red-winged Starling	LC	O
Sturnidae	*Buphagus erythrorhynchus Neat Threatened*	Red-billed Oxpecker	LC	N
Nectariniidae	*Cinnyris mariquensis*	Marico Sunbird	LC	N
Nectariniidae	*Cinnyris talatala*	White-bellied Sunbird	LC	N
Nectariniidae	*Chalcomitra senegalensis*	Scarlet-chested Sunbird	LC	N
Nectariniidae	*Hedydipna collaris*	Collared Sunbird	LC	O
Zosteropidae	*Zosterops virens*	Cape White-eye	LC	O
Ploceidae	*Bubalornis niger*	Red-billed Buffalo-weaver	LC	O
Ploceidae	*Plocepasser mahali*	White-browed Sparrow-weaver	LC	N
Passeridae	*Passer domesticus*	House Sparrow	LC	O
Passeridae	*Passer melanurus*	Cape Sparrow	LC	O
Passeridae	*Passer diffuses*	Southern Grey-headed Sparrow	LC	N
Passeridae	*Petronia superciliaris*	Yellow-throated Petronia	LC	N
Ploceidae	*Sporopipes squamifrons*	Scaly Feathered Finch	LC	N
Ploceidae	*Ploceus ocularis*	Spectacled Weaver	LC	O
Ploceidae	*Ploceus cucullatus*	Village Weaver	LC	N
Ploceidae	*Ploceus velatus*	Southern Masked- Weaver	LC	O
Ploceidae	*Ploceus intermedius*	Lesser Masked- Weaver	LC	N
Ploceidae	*Anaplectes melanotis*	Red-headed Weaver	LC	N
Ploceidae	*Quelea quelea*	Red-billed Quelea	LC	N

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Ploceidae	*Euplectes orix*	Southern Red Bishop	LC	O
Ploceidae	*Euplectes albonotatus*	White- winged Widowbird	LC	N
Estrildidae	*Pytilia melba*	Green-winged Pytilia	LC	N
Estrildidae	*Lagonosticta rhodopareia*	Jameson's Firefinch	LC	N
Estrildidae	*Lagonosticta senegala*	Red-billed Firefinch	LC	N
Estrildidae	*Uraeginthus angolensis*	Blue Waxbill	LC	O
Estrildidae	*Granatina granatina*	Violet-eared Waxbill	LC	N
Estrildidae	*Estrilda astrild*	Common Waxbill	LC	N
Estrildidae	*Estrilda erythronotos*	Black-faced Waxbill	LC	N
Estrildidae	*Amadina fasciata*	Cut-throat Finch	LC	N
Estrildidae	*Amandina erythrocephala*	Red-headed Finch	LC	N
Viduidae	*Vidua macroura*	Pin-tailed Whydah	LC	N
Viduidae	*Vidua regia*	Shaft-tailed Whydah	LC	N
Viduidae	*Vidua paradisaea*	Long-tailed Paradise- Whydah	LC	N
Viduidae	*Vidua chalybeate*	Village Indigobird	LC	N
Fringilidae	*Crithagra mozambicus*	Yellow-fronted Canary	LC	N
Fringilidae	*Crithagra atrogularis*	Black-throated Canary	LC	N
Fringilidae	*Crithagra flaviventris*	Yellow Canary	LC	N
Fringilidae	*Crithagra gularis*	Streaky-headed Seedeater	LC	N
Fringilidae	*Emberiza flaviventris*	Golden-breasted Bunting	LC	N
Fringilidae	*Emberiza tahapisi*	Cinnamon-breasted Bunting	LC	N
REPTILES				
Agamidae	*Acanthocercus atricollis atricollis*	Southern tree agama	LC (SARCA)	N
Agamidae	*Agama aculeate distanti*	Distant's ground agama	NT	O
Agamidae	*Agama armata*	Peters' ground agama	LC (SARCA)	O
Agamidae	*Agama atra*	Southern rock agama	LC (SARCA)	O

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Amphisbaenidae	*Chirindialangi occidentalis*	Soutpansberg worm lizard	DD (SARCA)	N
Amphisbaenidae	*Monopeltis infuscate*	Dusky Worm lizard	LC (SARCA)	N
Amphisbaenidae	*Monopeltis sphenorhynchus*	Slender worm Lizard	LC (SARCA)	N
Atractaspididae	*Amblyodipsas microphthalma nigra*	Soutpansberg purple glossed snake	DD	N
Atractaspididae	*Amblyodipsas polylepis polylepis*	Common purple glossed snake	LC (SARCA)	N
Atractaspididae	*Aparallactus capensis*	Blackheaded Centipede eater	LC (SARCA)	N
Atractaspididae	*Atractaspis bibronii*	Bibron's Stiletto snake	LC (SARCA)	O
Atractaspididae	*Xenocalamus bicolor lineatus*	Striped Quill-snouted snake	LC (SARCA)	N
Boidae	*Python natalensis*	Southern African Python	VU (Branch) NT (SARCA) TOPS	O
Chamaeleonidae	*Bradypodion transvaalense*	Wolkberg Dwarf Chameleon	DD	N
Chamaeleonidae	*Chamaeleo dilepis dilepis*	Common Flap-neck Chameleon	LC (SARCA)	O
Colubridae	*Boaedon/Lamprophis capensis*	Brown house Snake	LC (SARCA)	O
Colubridae	*Crotaphopeltis hotamboeia*	Red Lipped Herald Snake	LC (SARCA)	O
Colubridae	*Dasypeltis inornata*	Southern Brown egg-eater	LC (SARCA)	N
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	LC (SARCA)	O
Colubridae	*Dispholidus typus typus*	Boomslang	LC (SARCA)	O
Colubridae	*Duberria lutrix lutrix*	South African Slug-eater	LC (SARCA)	N
Colubridae	*Gonionotophis/ Mehelya capensis capensis*	Common/Cape File Snake	LC (SARCA)	N
Colubridae	*Gonionotophis/ Mehelya nyassae*	Black File Snake	LC (SARCA)	N
Colubridae	*Hemirhagerrhis nototaenia*	Eastern Bark Snake	LC (SARCA)	N
Colubridae	*Lamprophis guttatus*	Spotted House Snake	LC (SARCA)	N
Colubridae	*Lycodonomorphus rufulus*	Brown Water Snake	LC (SARCA)	N
Colubridae	*Lycophidion capensis capensis*	Cape Wolf Snake	LC (SARCA)	N
Colubridae	*Lycophidion variegatum*	Variegated Wolf Snake	LC (SARCA)	O

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Colubridae	*Philothamnus hoplogaster*	South Eastern Green Snake	LC (SARCA)	O
Colubridae	*Philothamnus natalensis occidentalis*	Western Natal Green Snake	LC (SARCA)	N
Colubridae	*Philothamnus semivariegatus*	Spotted Bush Snake	LC (SARCA)	O
Colubridae	*Prosymna bivittata*	Two Striped Shovel-snout	LC (SARCA)	N
Colubridae	*Prosymna lineate*	Lined Shovel-snout	LC (SARCA)	N
Colubridae	*Psammophis angolensis*	Dwarf Sand Snake	LC (SARCA)	N
Colubridae	*Psammophis brevirostris*	Short-snouted Grass Snake	LC (SARCA)	N
Colubridae	*Psammophis crucifer*	Cross-marked Sand Snake	LC (SARCA)	O
Colubridae	*Psammophis jallae*	Jalla's Sand Snake	LC (SARCA)	N
Colubridae	*Psammophis mossambicus*	Olive Grass Snake	LC (SARCA)	O
Colubridae	*Psammophis subtaeniatus*	Western Yellow-bellied Sand Snake	LC (SARCA)	O
Colubridae	*Psammophis trinasalis*	Fork-marked Sand Snake	LC (SARCA)	O
Colubridae	*Psammophylax tritaeniatus*	Striped Grass Snake/Striped Skaapsteker	LC (SARCA)	O
Colubridae	*Pseudaspis cana*	Mole Snake	LC (SARCA)	O
Colubridae	*Rhamphiophis rostratus*	Rufous Beaked Snake	LC (SARCA)	O
Colubridae	*Telescopus semiannulatus semiannulatus*	Eastern Tiger Snake	LC (SARCA)	O
Colubridae	*Thelotornis capensis capensis*	Southern Twig Snake	LC (SARCA)	N
Cordylidae	*Chamaesaura aenea*	Coppery Grass Lizard	LC (SARCA)	N
Cordylidae	*Chamaesaura anguina anguina*	CapeGrass Lizard	LC (SARCA)	N
Cordylidae	*Chamaesaura macrolepis*	Large-scaled Grass Lizard	LC (SARCA)	N
Cordylidae	*Cordylus jonesii*	Jones' Girdled Lizard	LC (SARCA)	N
Cordylidae	*Cordylus vittifer*	Common Girdled Lizard	LC (SARCA)	O
Cordylidae	*Platysaurus intermedius intermedius*	Common Flat Lizard	LC (SARCA)	O
Cordylidae	*Platysaurus intermedius rhodesianus*	Zimbabwe Flat Lizard	LC (SARCA)	O
Cordylidae	*Platysaurus relictus*	Soutpansberg Flat Lizard	NT (SARCA)	N

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Cordylidae	*Smaugwarreni depressus*	Flat Girdled Lizard	LC (SARCA)	N
Elapidae	*Aspidelaps scutatus scutatus*	Speckled Shield Cobra/Shield nose Snake	LC (SARCA)	O
Elapidae	*Dendroaspis polylepis*	Black Mamba	LC (SARCA)	O
Elapidae	*Elapsoidea sundevallii longicauda*	Long-tailed Garter Snake	LC (SARCA)	N
Elapidae	*Naja annulifera*	Snouted cobra	LC (SARCA)	O
Elapidae	*Naja mossambica*	Mozambique Spitting Cobra	LC (SARCA)	O
Gekkonidae	*Afroedura sp*	Afro Gecko	Not know as not yet described	O
Gekkonidae	*Afroedura transvaalica*	Zimbabwe Flat Gecko	LC (SARCA)	O
Gekkonidae	*Chondrodactylus turneri*	Turner's Gecko	LC (SARCA)	O
Gekkonidae	*Colopus wahlbergii wahlbergii*	Kalahari Ground Gecko	LC (SARCA)	N
Gekkonidae	*Hemidactylus mabouia*	Common Tropical House Gecko	exotic	O
Gekkonidae	*Homopholis mulleri*	Muller's Velvet Gecko	VU (SARCA)	N
Gekkonidae	*Homopholis wahlbergii*	Wahlberg's Velvet Gecko	LC (SARCA)	N
Gekkonidae	*Lygodactylus capensis capensis*	Common Dwarf Gecko	LC (SARCA)	O
Gekkonidae	*Lygodactylus nigropunctatus incognitus*	Cryptic Dwarf Gecko	VU (SARCA)	N
Gekkonidae	*Lygodactylus ocellatus soutpansbergnesis*	Soutpansberg Dwarf Gecko	VU(SARCA)	N
Gekkonidae	*Pachydactylus affinis*	Transvaal Gecko	LC (SARCA)	N
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	LC (SARCA)	O
Gekkonidae	*Pachydactylus punctatus*	Speckled Gecko	LC (SARCA)	O
Gekkonidae	*Pachydactylus tigrinus*	Tiger Gecko	LC (SARCA)	O
Gekkonidae	*Pachydactylus vansoni*	Van Son's Gecko	LC (SARCA)	N
Gekkonidae	*Ptenopus garrulu sgarrulus*	Common Barking Gecko	LC (SARCA)	O
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	LC (SARCA)	O
Gerrhosauridae	*Gerrhosaurus major major*	Rough-scaled Plated Lizard	LC (SARCA)	N

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Gerrhosauridae	*Gerrhosaurus validus validus*	Common Giant Plated Lizard	LC (SARCA)	O
Lacertidae	*Australolacerta rupicola*	Soutpansberg Rock Lizard	NT(SARCA)	N
Lacertidae	*Heliobolus lugubris*	Bushveld Lizard	LC (SARCA)	O
Lacertidae	*Ichnotropis squamulosa*	Common Rough-scaled Lizard	LC (SARCA)	N
Lacertidae	*Nucras holubi*	Sandveld Lizard	LC (SARCA)	O
Lacertidae	*Nucras intertexta*	Spotted Sandveld Lizard	LC (SARCA)	O
Lacertidae	*Nucras lalandii*	Delalande's Sandveld Lizard	LC (SARCA)	O
Lacertidae	*Pedioplanis lineoocellata lineoocellata*	Spotted Sand Lizard	LC (SARCA)	N
Leptotyphlopidae	*Leptotyphlops incognitus*	Incognito Thread Snake	LC (SARCA)	N
Leptotyphlopidae	*Leptotyphlops scutifrons scutifrons*	Peter's Thead Snake	LC (SARCA)	N
Leptotyphlopidae	*Myriopholus longicauda*	Long-tailed Thread Snake	LC (SARCA)	O
Scincidae	*Acontias cregoi*	Blind Legless Skink	LC (SARCA)	N
Scincidae	*Acontias kgalagadi subtaeniatus*	Stripe-bellied Blind Legless Skink	DD(SARCA)	N
Scincidae	*Acontias plumbeus*	Giant Legless Skink	LC (SARCA)	N
Scincidae	*Afroablepharus maculicollis*	Spotted-neck Snake-eyed Skink	LC (SARCA)	N
Scincidae	*Afroablepharus wahlbergii*	Wahlberg's Snake-eyed Skink	LC (SARCA)	N
Scincidae	*Mochlus sundevallii sundevallii*	Sundevill's Writhing Skink	LC (SARCA)	N
Scincidae	*Scelotes limpopoensis*	Limpopo Dwarf Burrowing Skink	Threatened (SARCA)	N
Scincidae	*Trachylepis capensis*	Cape Skink	LC (SARCA)	O
Scincidae	*Trachylepis margaritifer*	Rainbow Skink	LC (SARCA)	O
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	LC (SARCA)	N
Scincidae	*Trachylepis punctulata*	Speckled Sand Skink	LC (SARCA)	O
Scincidae	*Trachylepis striata*	Striped Skink	LC (SARCA)	N
Scincidae	*Trachylepis varia*	Variable Skink	LC (SARCA)	O
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	LC (SARCA)	O

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
			CITIES	
Testudinidae	*Kinixys spekii*	Speke's Hinged Tortoise	LC (SARCA)	N
Typhlopidae	*Afrotyphlops bibronii*	Bibron's Blind Snake	LC (SARCA)	O
Typhlopidae	*Megatyphlops schlegelii*	Schlegel's Beaked Blind Snake	LC (SARCA)	N
Varanidae	*Varanus albigularis albigularis*	Rock monitor	LC (SARCA)	O
Viperidae	*Bitis arietans arietans*	Puff Adder	LC (SARCA)	O
Viperidae	*Bitis caudalis*	Horned Adder	LC (SARCA)	O
Viperidae	*Causus defilippii*	Snouted Night Adder	LC (SARCA)	N
Viperidae	*Causus rhombeatus*	Rhombic Night Adder	LC (SARCA)	O
AMPHIBIANS				
Brevicipitidae	*Breviceps adspersus*	Bushveld rain frog	LC	O
Brevicipitidae	*Breviceps sylvestris*	Northern forest rain frog	EN	O
Bufonidae	*Amietophrynus garmani*	Eastern Olive Toad	LC	N
Bufonidae	*Amietophrynus gutturalis*	Guttural Toad	LC	O
Bufonidae	*Amietophrynus maculates*	Flat-backed Toad	LC	N
Bufonidae	*Amietophrynus rangeri*	Raucous Toad	LC	O
Bufonidae	*Poyntonophrynus fenoulheti*	Northern Pygmy Toad	LC	N
Bufonidae	*Schismadermacarens*	Red Toad	LC	O
Hemisotidae	*Hemisus marmoratus*	Mottled shovel-nosed frog	LC	N
Hyperoliidae	*Hyperolius marmoratus*	Painted reed frog	LC	O
Hyperoliidae	*Kassina senegalensis*	Bubbling kassina	LC	N
Macrohylidae	*Phrynomantis bifasciatus*	Banded Rubber Frog	LC	N
Phrynobatrachidae	*Phrynobatrachus mababienis*	Dwarf puddle frog	LC	N
Phrynobatrachidae	*Phrynobatrachus natalensis*	Snoring Puddle Frog	LC	N
Pipidae	*Xenopus laevis*	Common Platanna	LC	O
Ptychadenidae	*Ptychadena anchietae*	Plain grass frog	LC	N

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	STATUS	OBSERVED
Pyxicephalidae	*Amietia angolensis*	Common or Angola River frog	LC	N
Pyxicephalidae	*Cacosternum boettgeri*	Boettger's caco	LC	O
Pyxicephalidae	*Pyxicephalus adspersus*	Giant Bull Frog	LC	O
Pyxicephalidae	*Pyxicephalus edulis*	African Bull Frog	LC	N
Pyxicephalidae	*Strongylopus fasciatus*	Striped Stream Frog	LC	O
Pyxicephalidae	*Strongylopus grayii*	Clicking Stream Frog	LC	O
Pyxicephalidae	*Tomopterna cryptotis*	Tremelo Sand Frog	LC	O
Pyxicephalidae	*Tomopterna natalensis*	Natal Sand Frog	LC	N
Pyxicephalidae	*Tomopterna marmorata*	Russet-backed Sand Frog	LC	N
Rhacophoridae	*Chiromantis xerampelina*	Southern Foam nest Frog	LC	O