SPECIALIST REPORT ON THE ECOLOGY (FLORA AND FAUNA) FOR THE PROPOSED MOLETLANE PROSPECTING RIGHT IN THE CAPRICORN DISTRICT MUNICIPALITY NEAR LEBOWAKGOMO, LIMPOPO PROVINCE

An EOH Company

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ECOLOGICAL IMPACT ASSESSMENT

15 March 2016

Conducted on behalf of:
Moletlane Mining (Pty) Ltd

Centre for Environmental Management, Northwest University

Compiled by:
Dr. B.J. Henning (Ph.D Plant Ecology, Pr. Sci.Nat)

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GLOSSARY OF TERMS

Anthropogenic: of human creation

Alluvium (from the Latin, alluvius, from alluere, "to wash against") is loose, unconsolidated (not cemented together into a solid rock) soil or sediments, which has been eroded, reshaped by water in some form, and redeposited in a non-marine setting. Alluvium is typically made up of a variety of materials, including fine particles of silt and clay and larger particles of sand and gravel. When this loose alluvial material is deposited or cemented into a lithological unit, or lithified, it would be called an alluvial deposit.

Biome: Any major ecological community of organisms, usually characterized by a dominant vegetation type.

Biota: living things; plants, animals, bacteria

Bottomland: the lowlands along streams and rivers, on alluvial (river deposited) soil.

Ecologically sensitive ecosystem: One where relatively even minor disturbances may result in substantial and significant changes.

Ecosystems: Include living (e.g. plants, animals) and non-living (e.g. minerals, soil, water) components, which can be defined in terms of distinguishing characteristics (e.g. a wetland ecosystem, a freshwater ecosystem, a terrestrial ecosystem, a forest ecosystem, etc.).

Endemic or range-restricted species or ecosystem: One whose distribution is confined to a particular and often very limited geographical region.

Environment: Broadly covers our surroundings and the characteristics of those surroundings that influence our health and wellbeing. That is, the environment includes all living organisms (plants, animals and other life), the physical environment (land, water and air), as well as social, economic and cultural conditions. Sometimes we speak of 'the natural environment' and 'the built environment', to differentiate between natural and man-made systems.

Floristic: of flora (plants).

Floodplain: Wetland inundated when a river overtops its banks during flood events resulting in the wetland soils being saturated for extended periods of time.

Habitat: The place or type of site where an organism or population naturally occurs.

Indigenous: Native to a particular area.

Perched water table: the upper limit of a zone of saturation in soil, separated by a relatively impermeable unsaturated zone from the main body of groundwater.

Protected species or ecosystem: One that is protected by law from particular activities and land uses.

Seasonally wet soil: soil which is flooded or waterlogged to the soil surface for extended periods (>1 month) during the wet season, but is predominantly dry during the dry season.

Soil horizons: layers of soil that have fairly uniform characteristics and have developed through pedogenic processes; they are bound by air, hard rock or other horizons (i.e. soil material that has different characteristics).

Soil profile: the vertically sectioned sample through the soil mantle, usually consisting of two or three horizons (Soil Classification Working Group, 1991).

Soil saturation: the soil is considered saturated if the water table or **capillary fringe** reaches the soil surface (Soil Survey Staff, 1992).

Species: A group of plants, animals, micro-organisms or other living organisms that are morphologically similar; that share inheritance from common ancestry; or whose genes are so similar that they can breed together and produce fertile offspring.

Temporarily wet soil: The soil close to the soil surface (i.e. within 50 cm) is wet for periods > 2 weeks during the wet season in most years. However, it is seldom flooded or saturated at the surface for longer than a month.

Terrain unit classes: areas of the land surface with homogenous form and slope. Terrain may be seen as being made up of all or some of the following units: crest (1), scarp (2), midslope (3), footslope (4) and valley bottom (5).

Threatened species or ecosystem: Species/ Ecosystems that are at risk of going extinct in its natural range. It may be 'critically endangered' at extremely high risk, 'endangered' at very high risk, or 'vulnerable' at high risk. Species or ecosystems at low or no risk are not 'threatened', and fall into the 'near threatened' or 'least concern' categories.

Water regime: When and for how long the soil is flooded or saturated.

ABBREVIATIONS

Abbreviation	Description
ARC	Agricultural Research Council
CARA	Conservation of Agricultural Resources Act
C-Plan	Gauteng Conservation Plan
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Forestry and Fisheries
DD	Data Deficient
DEA	Department of Environmental Affairs
DME	Department of Minerals and Energy Affairs
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPR	Environmental Management Programme Report
EN	Endangered
ENPAT	Environmental Potential Atlas
GIS	Geographic Information Systems
GNCB	Gauteng Nature Conservation Bill
GPS	Geographical Positioning System
IDP	Integrated Development Plan
IUCN	World Conservation Union
LC	Least Concern
LEDET	Limpopo Department of Economic Development, Environment & Tourism
LR	Lower Risk
MAE	Mean Annual Evaporation
MAMSL	Meter Above Mean Sea Level
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
NEMA	National Environmental Management Act
NFA	National Forest Act
NWA	National Water Act
OL	Orange Listed
PQ4	Priority Quaternary Catchment
QDS	Quarter Degree Square
RDL	Red Data List
SADC	Southern African Development Community
SANBI	South African National Biodiversity Institute
Vu	Vulnerable
WHO	World Health Organisation

Declaration

I, Barend Johannes Henning, declare that -

- I act as the independent specialist;
- I will perform the work relating to the project in an objective manner, even if this results in views and findings that are not favourable to the project proponent;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this project, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998; the Act), regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in Regulation 8;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the project proponent and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the project; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority or project proponent;
- All the particulars furnished by me in this document are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

_____

SIGNATURE OF SPECIALIST

Company: Exigo Sustainability

Date: March 2016

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1 ASSIGNMENT

Exigo Sustainability was appointed by Moletlane Mining (Pty) Ltd to conduct an ecological study for the proposed Moletlane Prospecting Right Area. The report will consist of an assessment of the fauna, flora and ecological sensitivity for the proposed prospecting right area and the associated prospecting activities and infrastructure on the farms Groothoek 106KS, Rooiboschbaak 107KS, Zebedielas Location 123KS, Taaiboschlaagte 163KS, Volop 164KS, Gewenscht 165KS, Madras 566KS, Charlottes Dale 568KS, Charlottes Lust 569KS, The Smugglers Union 570KS, Keulen 565KS, Capricorn District Municipality, Lepelle-Nkumpi Local Municipality, Limpopo Province.

The assignment is interpreted as follows: Compile an ecological study on the flora (vegetation units), fauna and general ecology of the site according to guidelines and criteria set by the Limpopo Department of Economic Development, Environment & Tourism (LEDET). The study will include site surveys, detailed investigation, impact assessment and risk analyses. **In order to compile this, the following had to be done:**

1.1 INFORMATION SOURCES

The following information sources were obtained:

1. All relevant topographical maps, aerial photographs and information (previous studies and environmental databases) related to the ecological components in the study area;
2. Requirements regarding the fauna and flora survey as requested by the LEDET;
3. Legislation pertaining to the fauna and flora study as relevant;
4. Red data species list from the South African National Biodiversity Institute (SANBI).

1.2 SOUTH AFRICAN REGULATIONS GOVERNING THIS REPORT

1.2.1 National Environmental Management Act, 1998 (Act No. 107 of 1998) - Regulation No. R982

This report was prepared in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) Gazette No. 38282 Government Notice R. 982. Appendix 6 – Specialist reports includes a list of requirements to be included in a specialist report:

1. A specialist report or a report prepared in terms of these regulations must contain:
    a. Details of
        i. The specialist who prepared the report; and
        ii. The expertise of that specialist to compile a specialist report, including a curriculum vitae;

b. A declaration that the specialist is independent in a form as may be specified by the competent authority;

c. An indication of the scope of, and purpose for which, the report was prepared;

d. The date and season of the site investigation and the relevance of the season to the outcome of the assessment;

e. A description of the methodology adopted in preparing the report or carrying out the specialized process;

f. The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;

g. An identification of any areas to be avoided, including buffers;

h. A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;

i. A description of any assumptions made and any uncertainties or gaps in knowledge;

j. A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;

k. any mitigation measures for inclusion in the EMPr;

l. any conditions for inclusion in the environmental authorisation;

m. any monitoring requirements for inclusion in the EMPr or environmental authorisation

n. a reasoned opinion –

    i. As to whether the proposed activity or portions thereof should be authorised and

    ii. If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr and where applicable, the closure plan;

o. A description of any consultation process that was undertaken during the course of preparing the specialist report;

p. A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and

q. Any other information requested by the competent authority.

1.2.2 Conservation of Agricultural Resources Act (Act No. 43 of 1983)

Control of the utilization and protection of wetlands, soil conservation and all matters relating thereto; control and prevention of veld fires, control of weeds and invader plants, the prevention of water pollution resulting from farming practices and losses in biodiversity.

1.2.3 The National Environmental Management Act (NEMA) (Act No. 107 of 1998)

This Act embraces all three fields of environmental concern namely: resource conservation and exploitation; pollution control and waste management; and land-use planning and development. The environmental management principles include the duty of care for wetlands and special attention is given to management and planning procedures.

1.2.4 The Limpopo Environmental Management Act (2004)

This Act deals with the conservation of wild animals, fresh water fish and the conservation and protection of flora in the Limpopo Province. Animals and plants are both listed in the schedules with different degrees of protection afforded to each.

1.2.5 The National Environmental Management Biodiversity Act

- Lists ecosystems that are threatened or in need of national protection
- Links to Integrated Environmental Management process
- Must be taken into account in EMP and IDPs
- The Minister may make regulations to reduce the threats to listed ecosystems.

1.2.6 The National Forest Act (Act 84 of 1998)

The National Forest Act:

- Promotes the sustainable management and development of forests for the benefit of all;
- Creates the conditions necessary to restructure forestry in State Forests;
- Provide special measures for the protection of certain forests and protected trees;
- Promotes the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes.
- Promotes community forestry.

1.3 TERMS OF REFERENCE

The project is done according to the following:

1.3.1 Objectives

1. The primary aim of this project is to investigate options for enhancing and / or maintaining biodiversity to mitigate the impact of the proposed prospecting development and related infrastructure with the overall objective of preventing further loss of biodiversity. The end product would be a tool for promoting and lobbying for the recognition of the importance of species habitat and habitat conservation. Options available to maintain the current level of floral diversity include:
    a. Protection of native vegetation restored elsewhere in return for unavoidable clearing;
    b. Minimisation of habitat fragmentation;
    c. Minimisation of any threats to the native flora and fauna and their habitats during the constructional and operational phases of the developments and;
    d. Rehabilitation to establish plant communities / landscaping that will provide future habitat values.
2. To produce a clear and agreed species and habitat priorities for conservation actions. This includes the following:
    i. Determine the potential ecological impacts and actions the developments will have on the biodiversity on a species and habitat level;
    ii. Conduct a risk analyses of the impacts identified to determine the significance of the impacts on the fauna and flora of the study area;
    iii. Protection and enhancement of vegetation / habitats of high conservation value;
    iv. The retention of a substantial amount of native vegetation / habitat of adequate size and configuration to promote the conservation of the existing flora communities;
    v. The retention and / or creation of vegetation links, wildlife corridors and vegetation buffers wherever possible, subject to the appropriate bush fire risk management; and
    vi. The protection of water quality in the locality so as not to threaten native aquatic flora that rely on the watercourse for survival.
3. Provide recommendations on the ecological mitigation measures to be implemented

by the prospecting applicant and the way forward.

1.3.2 Scope

1. Detailed flora survey – in each vegetation type/plant community on site:
    a. After studying the aerial photograph identify specific areas to be surveyed and confirm location by making use of a Geographical Positioning System (GPS).
    b. Conduct a site visit and list the plant species (trees, shrubs, grasses, succulents and other herbaceous species of special interest) present for plant community and ecosystem delimitation.
    c. Identify potential red data plant species, possible encroacher species, medicinal plants of value and exotic plant species.
    d. Indicate suitable plant species that can be used for the landscaping around the proposed developments.
2. Plant community delimitation and description
    a. Process data (vegetation and habitat classification) to determine vegetation types on an ecological basis.
    b. Describe the habitat and vegetation.
3. Fauna scoping
    a. List the potential fauna (mammal species, red data birds, reptiles, amphibians, invertebrates) present linked to the specific potential habitats that occur as identified in the vegetation survey.
    b. Analyse the data and identify potential red data fauna species, as well as other endemic or protected species of importance.
    c. Indicate species mitigation measures and management measures to be implemented to prevent any negative impacts on the fauna of the area.
4. General
    a. Identify and describe ecologically sensitive areas. Create a sensitivity map to indicate specific sensitive areas based on various environmental parameters such as natural vegetation in a good condition, rockiness, slopes, floodlines etc.
    b. Identify problem areas in need of special treatment or management, e.g. bush encroachment, erosion, degraded areas, reclamation areas.

c. Make recommendations, impact ratings and risk assessments for each specific impact.

1.3.3 Limitations and assumptions

- In order to obtain a comprehensive understanding of the dynamics of the flora of the study area, surveys should ideally be replicated over several seasons and over a number of years. However, due to project time constraints such long-term studies are not feasible and this floral study was conducted over two seasons;
- The large study area did not allow for the finer level of assessment that can be obtained in smaller study areas. Therefore, data collection in this study relied heavily on data from representative, homogenous sections of vegetation units, as well as general observations, aerial photograph analysis, generic data and a desktop analysis;
- No access control applies to any of the farms relevant to this assessment but the areas demarcated for development were hard to reach due to their remote locations, especially in the mountainous regions. On site, smaller farm service roads provided access to all study areas;
- Visibility proved to be a constraint in encroached areas as well as the more pristine, riparian and mountainous areas where plant species might have been missed beneath the densely overgrown and obstructed by surface vegetation.

Thus, even though it might be assumed that survey findings are representative of the ecosystem of the Moletlane Project area, it should be stated that the possibility exists that individual plants species might have been missed due to the nature of the terrain (steep, mountainous slopes). Therefore, maintaining due cognisance of the integrity and accuracy of the ecological survey, it should be stated that the ecological resources identified during the study do not necessarily represent all the ecological resources present in the project area.

2 INTRODUCTION

South Africa has one of the world's greatest diversity of plant and animal species contained within one country, and is home to many species found nowhere else in the world. Terrestrial resources are rapidly disappearing however, due to conversion of natural habitat to farmland, forestry, human settlement, and industrial development. Some species are under threat from over-collection for medicinal, ornamental, and horticultural purposes.

Today it is widely recognised that it is of utmost importance to conserve natural resources in order to maintain ecological processes and life support systems for plants, animals and humans. Recent policies, international conventions, and community-based initiatives being carried out are aimed at improved conservation and more sustainable use of natural resources in future. To ensure that sustainable development takes place, it is therefore important that the environment is considered before local authorities approve any development.

Biodiversity and mines need to co-exist and find common ground. Biodiversity issues are very real and present a real crisis due to increased consumption and populations. It has also become evident that the biosphere cannot tolerate the current mode of economic growth. Massive change in behaviour is required in all sectors to achieve sustainable development. Mainstreaming biodiversity involves integrating the values and goals of biodiversity conservation into the economy (Cowling, 2005). The aim of mines today is to be good stewards of the environment and strive to leave the communities in which they work better than they found them (Godsell, 2005). Mines have huge conservation potential, as they own large amounts of land and only utilize a small portion for prospecting operations. It is therefore at the local level that prospecting and conservation can get integrated (Godsell, 2005). It is important to build into the prospecting decision framework the understanding that not all biodiversity can be restored, and this should influence prospecting decision-making. An ecosystem approach should be followed for planning and conservation and it should include a holistic biodiversity and livelihoods assessment (Coombes, 2005).

All components of any of the ecosystems (physical environment, vegetation, animals) of a site are interrelated and interdependent. A holistic approach is therefore imperative to effectively include any proposed development, utilisation and where necessary conservation of the given natural resources in an integrated development plan, which will address all the needs of the modern human population (Bredenkamp & Brown 2001). Ideally the area should be developed so that the quality of the resources does not decrease, as this would inevitably lead to ecosystem degradation and lower productivity. It is therefore necessary to make a thorough inventory of the plant communities at the site of the proposed development, their biota and their associated habitats (=ecosystems), in order to evaluate its potential for

development, or conservation. This inventory should then serve as a scientific and ecological basis for the planning exercises.

3 STUDY AREA

3.1 LOCATION AND DESCRIPTION OF ACTIVITY

The Moletlane project area is located approximately 300 km northeast of Johannesburg in the Limpopo Province of the Republic of South Africa. Access from Johannesburg to the project area is via the national N1 highway to the town of Mokopane and then via a tarred road (R518) towards Lebowakgomo (Figure 1). The project area is located within the Lepelle-Nkumpi Local Municipality, Capricorn District of the Limpopo Province, and includes the farms Groothoek 106KS, Rooiboschbaak 107KS, Zebedielas Location 123KS, Taaiboschlaagte 163KS, Volop 164KS, Gewenscht 165KS, Madras 566KS, Charlottes Dale 568KS, Charlottes Lust 569KS, The Smugglers Union 570KS and Keulen 565KS (Figure 2). Small townships (villages) occur throughout the project area as indicated in Figure 2, while certain sections of the farms being excluded from the application (Figure 2).

The planned boreholes for prospecting are located in the North-western section of the project area to the south of the Moletlane Township (Figure 2). The aerial map is indicated in Figure 3.

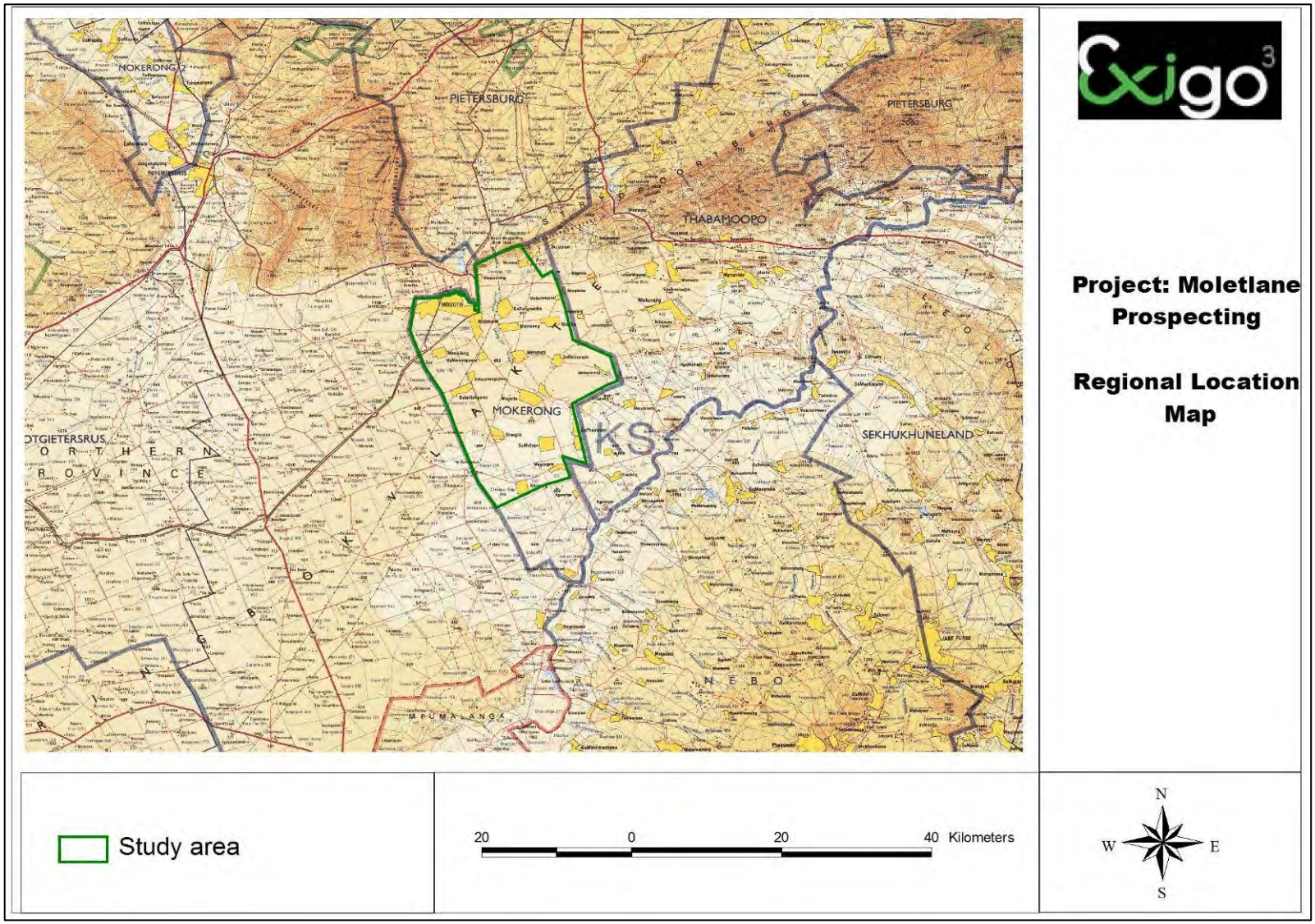

Figure 1. Regional locality Map of the proposed prospecting right area

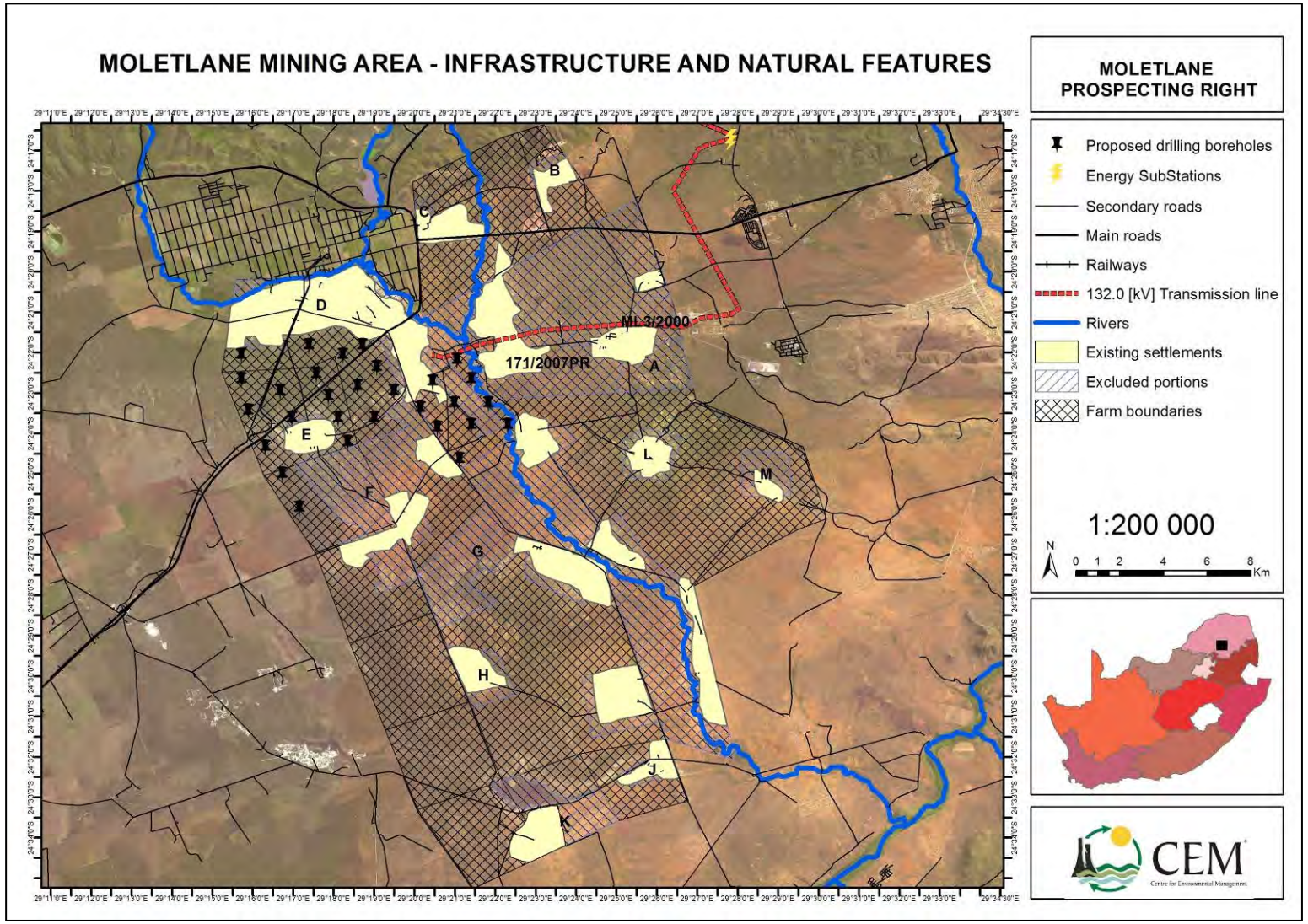

Figure 2. Infrastructure and survey area of the Moletlane Prospecting Right

Figure 3. Aerial Map of the project area

3.2 CLIMATE

Climate in the broad sense is a major determinant of the geographical distribution of species and vegetation types. However, on a smaller scale, the microclimate, which is greatly influenced by local topography, is also important. Within areas, the local conditions of temperature, light, humidity and moisture vary greatly and it is these factors which play an important role in the production and survival of plants (Tainton, 1981). In terrestrial environments, limitations related to water availability are always important to plants and plant communities. The spatial and temporal distribution of rainfall is very complex and has great effects on the productivity, distribution and life forms of the major terrestrial biomes (Barbour et al. 1987). Furthermore, aspects like topography, slope and altitude may further result in differences in precipitation and water availability to plants within the study area. The site falls within the summer rainfall region with very dry winters and frost that occurs fairly infrequent during winter (4 mean frost days per annum).

The study area has a mean annual precipitation of 518mm. The rainy season extends over the summer months from October through to April, with the highest rainfall occurring during December and January. Precipitation is usually associated with thunderstorms. These sudden downpours pose some risk of flooding in low-lying areas, but most South African mines are exposed to this type of weather and precautionary measures are routine on these operations. Mean monthly temperatures for the area is 37.3˚C and -0.9˚C for January and June respectively. The temperatures are very mild and stable with a minimum variance between maximum and minimum making the area an ideal living place with regard to temperature.

3.3 VEGETATION TYPES

The development site lies within the Savanna biome which is the largest biome in Southern Africa, although the site itself is more representative of grassland. The Savanna Biome is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). The environmental factors delimiting the biome are complex and include altitude, rainfall, geology and soil types, with rainfall being the major delimiting factor. Fire and grazing also keep the grassy layer dominant.

Mucina & Rutherford classify the project area into 4 vegetation types (Figure 4) namely Springbokvlakte Thornveld, Central sandy Bushveld, Poung Dolomite Mountain Bushveld and Mamabolo Mountain Bushveld.

The major area of the prospecting right area is classified as Springbokvlakte Thornveld. This vegetation type is characterized by open to dense, low thorn Savanna dominated by *Acacia* species or shrubby grassland with a very low shrub layer. The Springbokvlakte Thornveld has an Endangered conservation status with only 1% statutorily conserved areas. About 49% of the area is transformed, including about 45% cultivated and 3% urban built-up areas. Several alien species are widely scattered throughout the vegetation type.

The Central Sandy Bushveld occurs in the southern section of the project area on slightly undulating plains and leached, sandy soils. The Central Sandy Bushveld has a vulnerable conservation status, with less than 3% statutorily conserved and about 24% that has been transformed. The landscape and vegetation features of this vegetation type include low undulating areas, sometimes between mountains, and sandy plains supporting tall, deciduous Terminalia sericea and Burkea africana woodland on deep sandy soils and low, broadleaved Combretum woodland on shallow rocky or gravelly soils. Species of Acacia, Ziziphus and Euclea are found on flats and lower slopes on eutrophic sands and some less sandy soils, while the grass-dominated herbaceous layer have a relatively low basal cover on dystrophic sands.

The Mamabolo Mountain Bushveld includes the far northern section of the Strydpoort Mountains. The Mamabolo Mountain Bushveld vegetation type is characterized by low mountains and rocky hills. The slopes are moderate to steep, and very rocky, covered by small trees and shrubs. Rock slabs or domes within this vegetation type are sparsely vegetated, and then mostly with a mixture of xerophytic or resurrection plants, with several succulents. This vegetation type has a least threatened conservation status with almost 8% that has been statutorily conserved, while about 6% has been transformed, including about 2% each of urban and built-up areas, plantations and cultivated land. Land uses of this vegetation type include grazing, wood harvesting and medicinal plant collection.

A small section at the foot of the Strydpoort Mountain Range forms part of the Poung Dolomite Mountain Bushveld. This vegetation type forms open to closed woodland with well-developed shrub layers and occur on low to high mountain slopes on various slope angles, aspects and altitude, especially along the western extension. The vegetation type has a Least Threatened conservation status with 16% statutorily conserved areas, and 6% of the area is transformed.

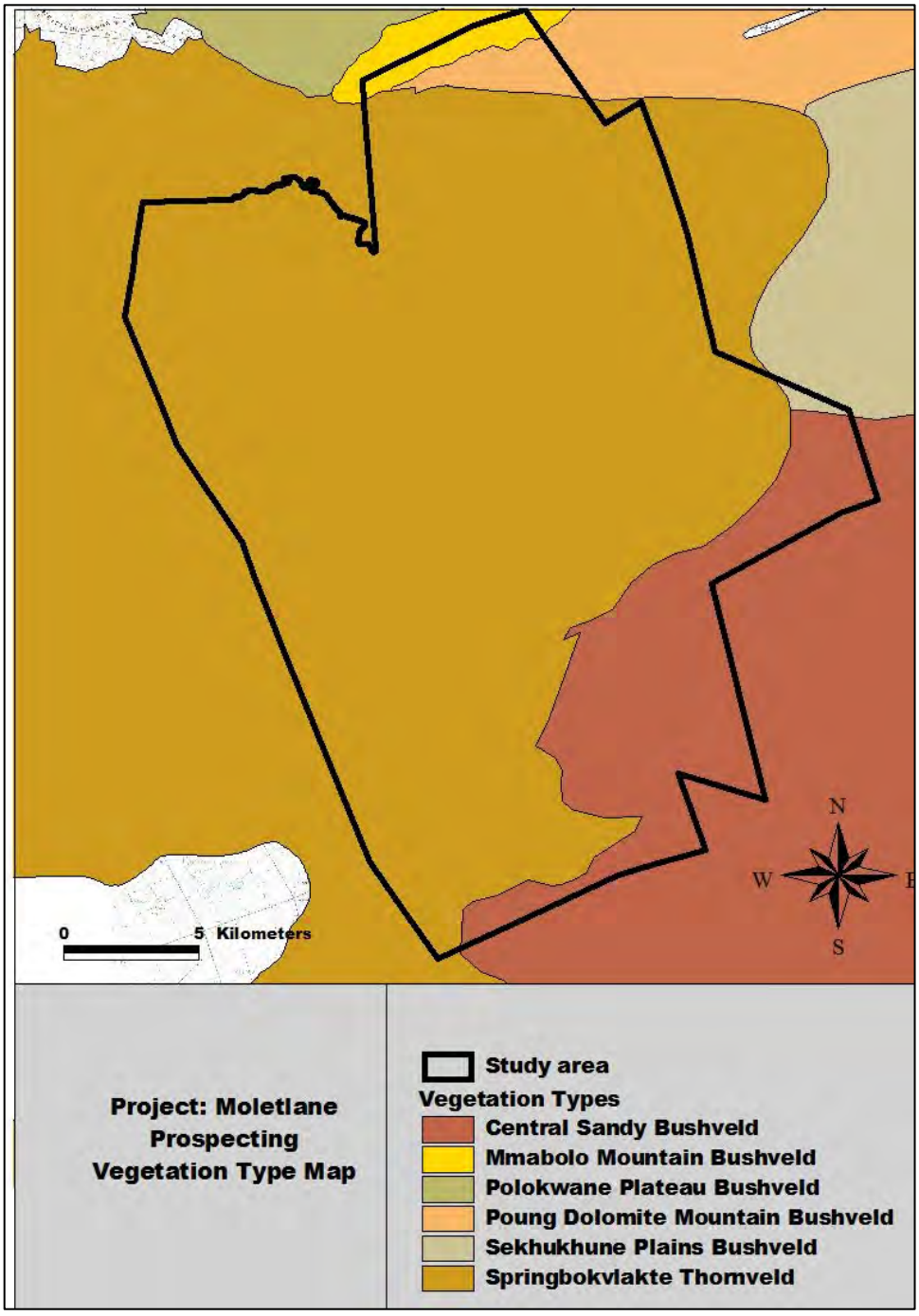

Figure 4. Vegetation Types of the project area (Mucina & Rutherford, 2006)

3.4 GEOLOGY AND SOIL TYPES

Geology is directly related to soil types and plant communities that may occur in a specific area (Van Rooyen & Theron, 1996). A Land type unit is a unique combination of soil pattern, terrain and macroclimate, the classification of which is used to determine the potential agricultural value of soils in an area.

The project area is located in the north-western sector of the Eastern Limb of the Bushveld Igneous Complex (BIC). The soils covering the study area can be grouped into different land types. A Landtype unit is a unique combination of soil pattern, terrain and macroclimate, the classification of which is used to determine the potential agricultural value of soils in an area. The landtypes, geology and associated soil types is presented in Table 2 below as classified by the Environmental Potential Atlas, South Africa (ENPAT, 2000). However, it must be noted that soil types are mostly determined by position on the landscape. A landtype map (figure 4) indicates the location of the landtypes in the area.

The plains within this land type are deemed to be covered predominantly by red-yellow apedal soils, with highly localized pockets of red-coloured, weakly structured clayey soils, and highly localized pockets of moderately structured clayey soils. The mountainous region is dominated by shallow, poorly developed soils and the substrate is often completely dominated by bedrock. The landtypes, geology and associated soil types is presented in Table 1 below as classified by the Environmental Potential Atlas, South Africa (ENPAT, 2000) while the location of the landtypes on the site is shown in figure 5.

Table 1. Landtypes, geology and dominant soil types of the proposed development site

Landtype	Soil	Geology
Ae101	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Karoo Sequence, Ecca Group; mudstone, shale and sandstone. Also diabase and dolerite.
Ae232	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Karoo Sequence, Letaba Formation; volcanic rocks and sandstone.
Ae340	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Karoo Sequence; fine-grained red to cream sandstone of the Clarens Formation and sandstone, grit, mudstone and siltstone of the Irrigasie Formation.
Ae340	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Karoo Sequence; fine-grained red to cream sandstone of the Clarens Formation and sandstone, grit, mudstone and siltstone of the Irrigasie Formation.
Ae341	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Coarse-grained grey to pink granite of the Nebo Granite, Bushveld Complex; overlain by alluvium along the Olifants River; occasional diabase and dolerite sills.
Ae345	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Basaltic lava with subordinate agglomerate and intercalated fine-grained sandstone, of the Drakensberg Formation, Karoo Supergroup.
Ae352	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	In the south and west, volcanic rocks and sandstone of the Letaba and Clarens Formations, Karoo Sequence; in the north and east, dolomite, chert, limestone and breccia of the Malmani Subgroup, Chuniespoort Group.

Landtype	Soil	Geology
Ae353	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Coarse-grained grey to pink granite of the Nebo Granite, Bushveld Complex with, in the west, shale, sandstone, grit and conglomerate of the Ecca Formation, Karoo Sequence. Also dolerite and diabase.
Ae354	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Coarse-grained grey to pink granite of the Nebo Granite, Bushveld Complex; alluvium along the Olifants River; occasional dolerite and diabase in the south.
Ae355	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Dolomite, chert, limestone, chert breccia with interbedded shale, sandstone and quartzite of the Malmani Subgroup, Chuniespoort Group.
Ae356	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Karoo Sequence, Letaba Formation; volcanic rocks and sandstone.
Ea148	One or more of: vertic, melanic, red structured diagnostic horizons, undifferentiated	Karoo Sequence, Letaba Formation; volcanic rocks and sandstone.
Fc476	Glenrosa and/or Mispah forms (other soils may occur), lime generally present in the entire landscape	Karoo Sequence, Letaba Formation; volcanic rocks and sandstone.
Ib293	Miscellaneous land classes, rocky areas with miscellaneous soils	Pretoria Group (quartzite, shale, limestone, hornfels, conglomerate and schist) and Chuniespoort Group (limestone, dolomite, chert, shale, quartzite, breccia and sandstone). Also lava and pyroclasts.
Ib293	Miscellaneous land classes, rocky areas with miscellaneous soils	Pretoria Group (quartzite, shale, limestone, hornfels, conglomerate and schist) and Chuniespoort Group (limestone, dolomite, chert, shale, quartzite, breccia and sandstone). Also lava and pyroclasts.

The following soil forms occur in these areas:

- Lime-poor Hutton soil between 0.4 and 1.2 m thick that has undergone a degree of leaching, containing up to 55% clay
- Both lime-poor and lime-rich Shortlands soil between 0.25 and 1.05 m thick that has undergone little or no leaching, containing between 35 and 55% clay
- Mainly non-red-coloured, both lime-poor and lime-rich Valsrivier soil between 0.8 and 1.2 m thick containing between 35 and 55% clay
- Localized pockets of non-red-coloured, lime-rich Swartland soil between 0.4 and 0.7 m thick containing between 35 and 55% clay;
- Shallow Glenrosa soils on the footslopes of the rocky ridges and outcrops,
- Poorly developed very shallow Mispah soils on the sloping areas of the ridges and

outcrops.

- Areas with large boulders and exposed bedrock often occur on the steeply sloping terrain of the mountainous terrain.

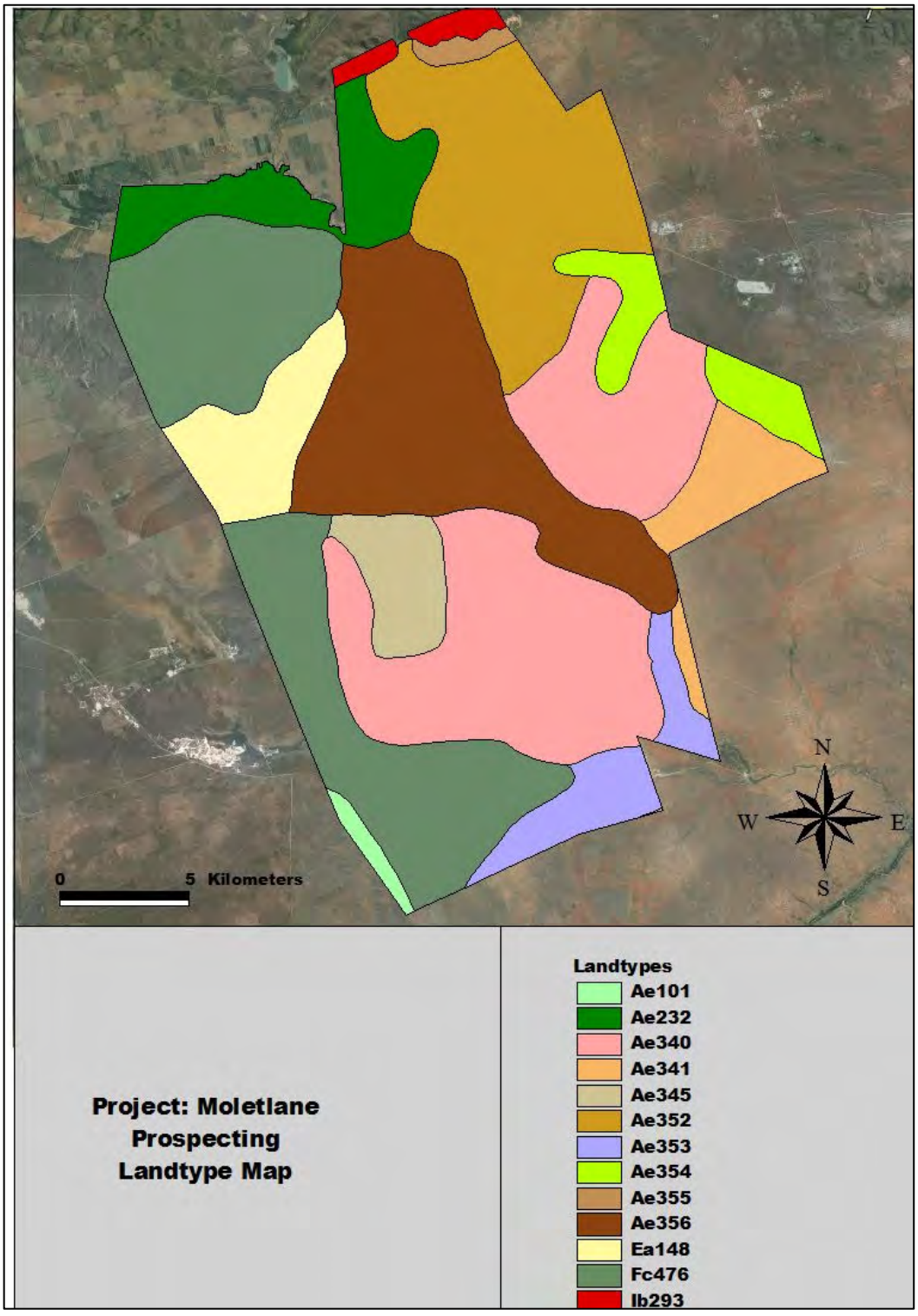

Figure 5. Landtype Map of the study area

3.5 HYDROLOGY AND DRAINAGE

The ecosystem integrity of surface waters has responded to different environmental impacts within the Limpopo Province and integrity scores range between poor and fair for the majority of systems studied within the Rivers Health Programme. Furthermore, it would seem that due to impacts on quality of water and flow regimes, the desired ecological state for the majority of systems could never again attain states higher than fair. Major rehabilitation of river banks, alien tree removal and removal of impoundments would be required to achieve this. The latter would not easily be attained due to the scarcity of water resources within the region and the critical need for water storage mechanisms.

At a basin or sub-basin scale, particularly in semi-arid and arid areas, priority is often placed on monitoring and management of water quantity. Equally important, however, is the monitoring and management of water quality (DWAF 2004). Water quality is often characterised in terms of the concentration of different chemicals in the water (Hatfield 2008). What determines “good” or “bad” water quality depends on the purpose of the assessment - for example, water with naturally elevated concentrations of some metals may be unsafe to drink, but still suitable for industrial uses. Assessment involves comparing measured chemical concentrations with natural, background, or baseline concentrations, and with guidelines established to protect human health or ecological communities.

The study area is located within Olifants Water Management Area (WMA), and is located in three Quaternary Catchment Areas (QCA) namely B52A, B51E and B51G (Figure 6). The area exhibits a weakly dendritic drainage pattern, mostly due to the very gentle slope. Storm water generally collects in areas where the natural topography has been disturbed, such as foot paths or dirt tracks, with surface water eventually draining into roads further downstream within Lebowakgomo and other townships. The main drainage channels include the Nkumpi River and its tributaries draining the proposed development area (Figure 6). These drainage channels form tributaries of the regionally important perennial Olifants River that lies to the east and south of the site. It must be noted that stream flow along the drainage channels occurs only during and directly after heavy precipitation events, and may continue for a short period directly after a particularly good rainy season. Small dams are located along the stream channels. Another feature of the southern section of the project area is the presence of wetlands or pans. These areas are biodiversity “hotspots” and the development of the pipeline in close proximity to these areas should be done with care. The study area is drained mainly by surface run-off (i.e.: sheetwash) with surface water flowing into non-perennial streams that cut through the proposed development area.

The drainage channels form part of the floodline zone the National Water Act (Act 36 of 1998) states the following regarding development within the 1: 100 year-flood line of any stream or river (Thompson, 2006):

Section 21(c):

> Impeding or diverting the flow of water in watercourses (including alteration of the hydraulic characteristics of flood events) requires licensing according to the Act

Section 21(i):

> Any action that may alter the bed, banks, courses or characteristics of watercourses (including flood events) requires licensing according to the Act, including:
>
> i. Widening or straightening of the bed or banks of a river to allow for the construction of a water supply pipeline, bridge, sports ground or housing development;
>
> ii. Altering the course of a river partially or completely (i.e.: river diversion) to be able to use or develop the area where the watercourse originally was.

3.6 TOPOGRAPHY

The regional topographical setting of the study area can be largely classified in the north as low mountainous terrain, while the remainder of the site can be described as plains with drainage channels. With the exception of occasional small anthills and erosion along the drainage channel of the non-perennial streams bisecting the site, the **plains section** of the study area does not exhibit significant topographical features. The only particular sensitive topographical features occur in the rocky mountainous regions on the steep, rocky slopes in the Strydpoort Mountains. The average elevation of the plains regions is 920mamsl, while the highest point in the Strydpoort Mountains is roughly at a height of 1280mamsl (Figure 6).

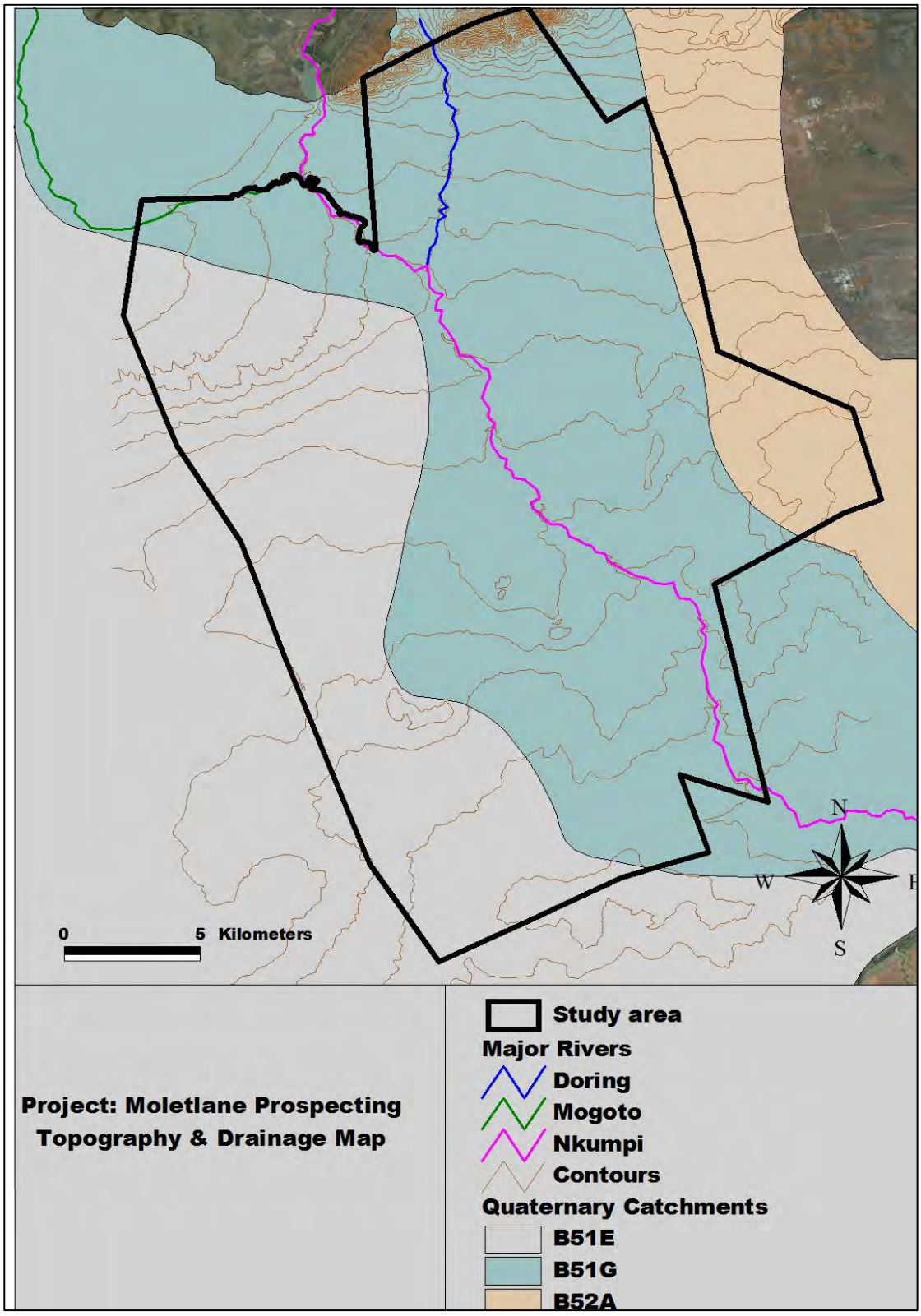

Figure 6. Topography and drainage map of the project area

4 METHODS

4.1 VEGETATION SURVEY

Two basic methods were used during the vegetation survey:

- Line transects were walked on the site surveyed to record the plant species present. Rare and threatened plant species and any botanically sensitive sites or habitats were searched for in the various vegetation units.
- The Braun-Blanquet survey technique to describe plant communities as ecological units was also used for this study. It allows for the mapping of vegetation and the comparison of the data with similar studies in the area.

The vegetation survey was conducted on site during March 2016. The vegetation was in a moderate to good condition and most species could be identified, although some species might have been missed as a result of the large site. No further surveys were necessary considering that the area received sufficient precipitation during the wet season to allow for the identification of most plants in the study area.

4.1.1 Data recorded included:

Plant names used in this report are in accordance with Arnold & De Wet (1993), with the exception of a few newly revised species. A list of all plant species present, including trees, shrubs, grasses, forbs, geophytes and succulents were compiled. All identifiable plant species were listed. Notes were additionally made of any other features that might have an ecological influence as well as potential fauna habitat that might occur.

4.1.2 Red data species

A species list of the red data species previously recorded in the vicinity of the proposed development was obtained from the South African Biodiversity Institute (SANBI), South Africa as classified by the IUCN red data list categories.

4.1.3 Protected trees

A species list of the protected tree species was obtained from the Department of Forestry. These trees are listed by the NFA (Act 84 of 1998) as protected.

4.1.4 Protected plants

A list of protected and specially protected plants was obtained from the Limpopo Environmental Management Act.

4.1.5 Data processing

A classification of vegetation data was done to identify, describe and map vegetation types.

The descriptions of the vegetation units include the tree, shrub and herbaceous layers.

Conservation priority of each vegetation unit was assessed by evaluating the plant species composition in terms of the present knowledge of the vegetation of the Limpopo Province, as well as the Savanna Biome of South Africa. The following four conservation priority categories were used for each vegetation unit:

- High: Ecologically sensitive and valuable land with high species richness that should be conserved and no development allowed.
- Medium: Land that should be conserved but on which low impact development could be considered with the provision of mitigation measures.
- Medium-low: Land that has some conservation value but on which development could be considered with limited impact on the vegetation / ecosystem. It is recommended that certain sections of the vegetation be maintained.
- Low: Land that has little conservation value and that could be considered for developed with little to no impact on the vegetation / ecosystem.

4.2 FAUNA SURVEY

The fauna survey was conducted as follows:

- A site survey was done to identify potential habitats after identifying the vegetation units. Fauna observed on site or any specific indication of species was noted as confirmed in the species lists.
- A scoping survey was then conducted by comparing the habitat types identified with the preferred habitats of species occurring in the area.
- If necessary a detailed survey was then conducted by a specialist after consultation.

4.2.1 Data recorded included:

A list of all species of fauna and their status as observed on the site or that could potentially occur on the site. Notes were made of any specific sensitive or specialized habitats that occur on the site.

4.2.2 Red data species lists

A species list of the red data species of the different faunal classes was obtained from the following references:

- Red Data Book of the Mammals of South Africa (Friedman & Daly, 2004)
- The Atlas of the Southern African Birds - digital data on quarter degree grid data (Avian Demography Unit, University of Cape Town)
- Atlas and red data book of the frogs of South Africa, Lesotho and Swaziland (Minter et al. 2004)

- South African Red Data Book – Reptiles and Amphibians. National Scientific Programmes Report no. 151

4.2.3 Data processing

A comparison of the habitats (vegetation units) occurring on the property was made to the preferred habitats of the faunal species. In addition to species observed on the site, lists of the potential mammal, bird, reptile, amphibian and insect species were compiled and mitigating measures recommended if needed.

4.3 IMPACT ASSESSMENT PROCEDURE

An impact can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need.

The significance of the impacts will be determined through a synthesis of the criteria below (Plomp, 2004):

Probability. This describes the likelihood of the impact actually occurring:

Improbable:	The possibility of the impact occurring is very low, due to the circumstances, design or experience.
Probable:	There is a probability that the impact will occur to the extent that provision must be made therefore.
Highly Probable:	It is most likely that the impact will occur at some stage of the development.
Definite:	The impact will take place regardless of any prevention plans, and there can only be relied on mitigatory actions or contingency plans to contain the effect.

Duration. The lifetime of the impact

Short term:	The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
Medium term:	The impact will last up to the end of the phases, where after it will be negated.
Long term:	The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
Permanent:	Impact that will be non-transitory. Mitigation either by man or

natural processes will not occur in such a way or in such a time span that the impact can be considered transient.

Scale. The physical and spatial size of the impact

Local: The impacted area extends only as far as the activity, e.g. footprint.

Site: The impact could affect the whole, or a measurable portion of the above mentioned properties.

Regional: The impact could affect the area including the neighbouring residential areas.

Magnitude/ Severity. Does the impact destroy the environment, or alter its function.

Low: The impact alters the affected environment in such a way that natural processes are not affected.

Medium: The affected environment is altered, but functions and processes continue in a modified way.

High: Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Significance. This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.

Negligible: The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.

Low: The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.

Moderate: The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.

High: The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

The following weights will be assigned to each attribute:

Aspect	Description	Weight
Probability	Improbable	1
	Probable	2
	Highly Probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4
	Permanent	5
Scale	Local	1
	Site	2
	Regional	3
Magnitude/Severity	Low	2
	Medium	6
	High	8
Significance	**Sum(Duration, Scale, Magnitude) x Probability**	
	Negligible	<20
	Low	<40
	Moderate	<60
	High	>60

The significance of each activity will be rated without mitigation measures and with mitigation measures for the prospecting development.

4.4 SENSITIVITY ASSESSMENT

The ecological sensitivity of any piece of land is based on its inherent ecosystem service and overall preservation of biodiversity.

4.4.1 Ecological function

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

4.4.2 Conservation importance

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

4.4.3 Sensitivity scale

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

5 RESULTS

5.1 FLORA ASSESSMENT

The study area is characterized by two major landscapes namely moderately to steep rocky slopes associated with mountainous terrain, rocky outcrops and ridges; and low-lying valleys and plains on the flatter terrain. Vegetation units were identified during the ecological surveys according to plant species composition, previous land-use, soil types and topography. The state of the vegetation of the proposed development site varies from being natural (mountainous terrain) to completely modified (agricultural fields / old fields). The land-use in the area is dominated by small-scale subsistence farming by the local communities in the area. The mountainous areas and plains not used for small-scale crop cultivation are used for grazing by livestock. Mining activities occur in the project area at present, namely platinum mines and clay mines. The vegetation map also indicates the location of the local villages in the project area.

The vegetation communities identified on the on the proposed development site during the ecological surveys are classified as physiographic physiognomic units, where physiognomic refers to the outer appearance of the vegetation, and physiographic refers to the position of the plant communities in the landscape. The physiographic-physiognomic units will be referred to as vegetation units in the following sections. These vegetation units are divided in terms of the land-use and soil differences that had the most definitive influence on the vegetation units. Each unit is described in terms of its characteristics. A species list for the project area is included in Appendix A, while a detailed list for the quarter degree grid square is included in Appendix B. Photographs of each of the vegetation units and its woody structure is included. Seven main distinctions were made in terms of vegetation units of the study area, although some variations also occur within each vegetation unit. The aim of the study was to determine the suitability of the area from an ecological perspective for the proposed prospecting development.

5.1.1 Description of natural vegetation

After the initial ecological surveys of the study area, the analysis of the data resulted in the identification of seven major vegetation units on the proposed development site. The detailed species list for each vegetation unit is included in Appendix A. A vegetation map was also compiled (Figure 7).

The following vegetation units were identified:

1. Mountainous woodland:
    a. *Kirkia wilmsii – Combretum molle* mountain bushveld on rocky slopes;
    b. *Euphorbia ingens – Combetum apiculatum – Dichrostachys cinerea* footslopes;
2. *Senegallia mellifera* shrubveld on calcareous soils:

   a. *Grewia vernicosa – Boscia foetida – Senegallia mellifera* low shrubveld on calcareous soils;
   b. *Senegallia mellifera – Euclea undulata* woodland on calcareous floodplains / plains.
3. *Sclerocarya birrea – Combretum apiculatum – Dichrostachys cinerea* woodland on gravelly soils;
4. *Terminalia sericea – Dichrostachys cinerea* dense woodland on sandy soils;
5. Degraded woodland / grasslands associated with low-lying valleys / plains:
   a. Old fields / cultivated land;
   b. Degraded *Dichrostachys - Vachellia tortilis* woodland / secondary old fields;
   c. Degraded *Dichrostachys – Sclerocarya* woodland / secondary old fields;
   d. Degraded woodland / grassland in and around villages;
6. Vegetation associated with Major Rivers and its tributaries
   a. Floodplains;
   b. Valley bottom wetlands;
   c. Alluvial fans;
7. Depressions:
   a. Man-made dams;
   b. Pans (endorheic)

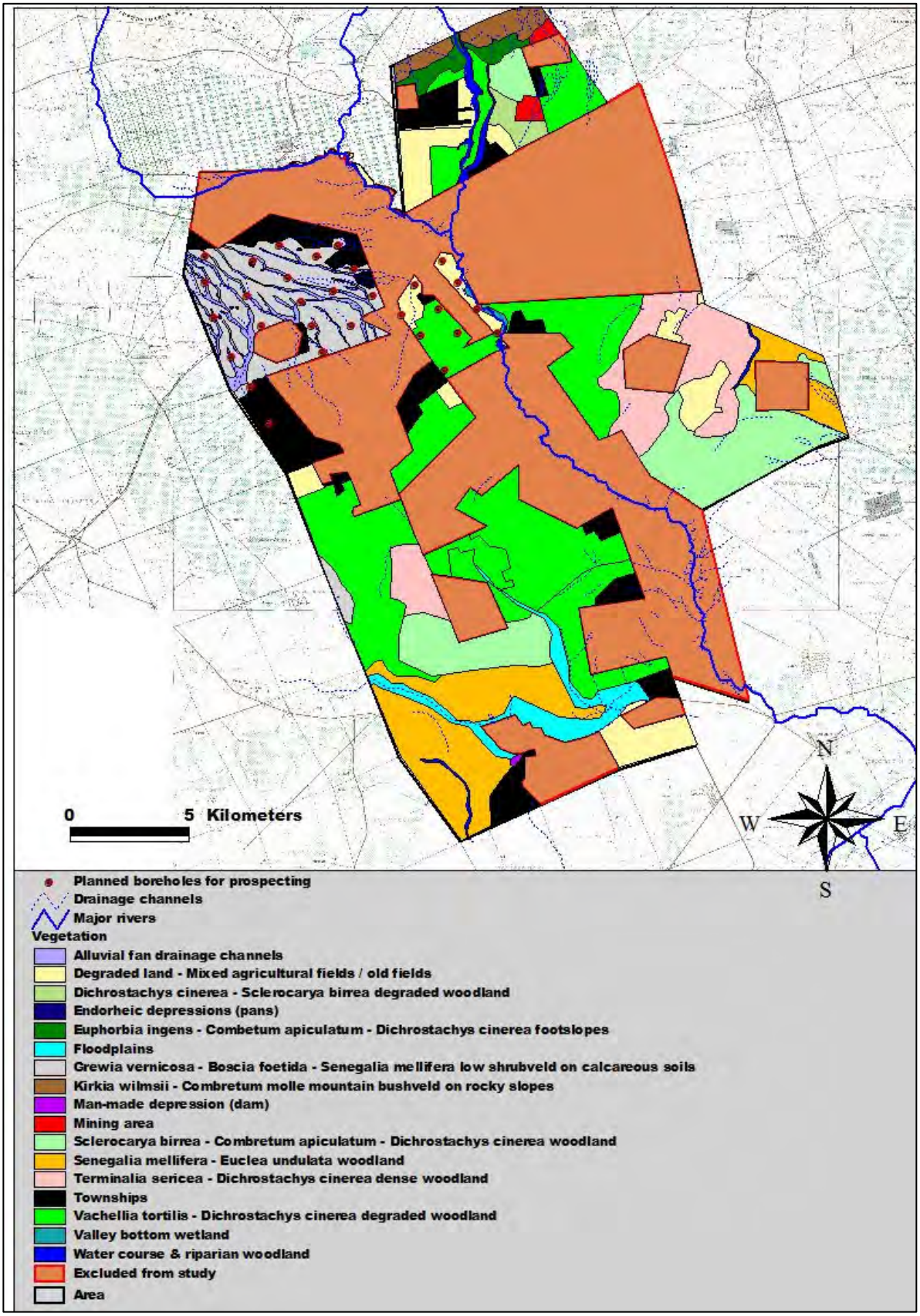

Figure 7. Vegetation Map of the study area

5.2 Mountainous woodland

Status:
Mixed woodland in a natural / slightly degraded state

Degree of disturbance
Low

Conservation Priority:
Medium - High

Soil	Shallow Mispah / Glenrosa soils derived from quartzite / sandstone	**Rockiness**	30-40%
Dominant spp.	*Kirkia wilmsii, Euphorbia ingens, Pseudolachnostylis maprouneifolia, Combretum apiculatum, Combretum molle*		

This vegetation unit forms part of the steep slopes, ravines and cliffs occurring throughout the mountainous areas in the northern section of the project area and is the most natural vegetation entity in the study area. Two major variations exist in terms of plant species composition namely the vegetation associated with the sloping terrain and the denser footslopes.

Rocky outcrops and ridges in the Savanna biome of South Africa are often habitats for red data and endemic species of an area, while also supporting a unique floral and faunal species composition. The habitat of the red data species potentially occurring in the quarter degree grid of the proposed development site is largely in this vegetation unit. This vegetation unit should be considered a high conservation priority. The potential red data species in combination with the rockiness, slope and state of the vegetation played an important role in determining the area to have a moderate - high sensitivity where limited development can be supported.

The landscape geomorphology represents moderately steep slopes derived from quartzite or norite. The terrain is rocky with the rockiness varying between 30 and 50%, which occur throughout the area. The soil pattern is mostly the Mispah soil form. Gertenbach (1987) describes rainfall as the single most important component of climate determining vegetation patterns, while Bothma (1996) stated that northern slopes are warmer than south facing slopes in South Africa, and subsequently drier, causing plants to have a higher rate of evapotranspiration. Therefore, plants that are adapted to drier conditions will grow on these slopes. Furthermore, aspects like the degree of slope will also determine the amount of surface runoff after precipitation and direct sunlight having direct effects on water availability

and sunlight for plants.

The woody layer forms an open woodland structure dominated by tall tree such as *Kirkia wilmsii, Euphorbia ingens* and *Pseudolachnostylis maprouneifolia*, while other medium sized trees such as *Combretum apiculatum* and *Combretum molle* are also prominent. The herbaceous layer consists of 20-40% cover abundance for the grasses and less than 1% locally for the forbs. Grasses are average about 1.2 m in height and forbs up to 50 cm.

A unique diversity of plant species occurs within this unit. The characteristics of both variations of this vegetation unit are presented in Table 2 below while the state of the vegetation is presented in Photograph 1 and 2:

Table 2. Botanical analysis and characteristics of mountain woodland

	***Kirkia wilmsii – Combretum molle* mountain bushveld on rocky slopes**	***Euphorbia ingens – Combetum apiculatum – Dichrostachys cinerea* footslopes**
Location:	Northern section of the project area	Footslopes of mountains in the northern section of the project area
State of the vegetation:	Pristine state	Encroached – moderately degraded
Characteristics	Open woodland with a well developed shrub layer.	Denser woodland with some shrubs present. Some serious encroachment has occurred in isolated areas.
Density of woody layer	Trees: 10-15% (avg. height: 3-6m) Shrubs: 5-10% (avg. height: 1-2m)	Trees: 15-25% (avg. height: 3-6m) Shrubs: 30-40% (avg. height: 1-2m)
Density of herbaceous layer	Grasses: 40-50% (avg. height: 1.2m) Forbs: <1 (avg. height: 0.5m)	Grasses: 20-30% (avg. height: 1.2m) Forbs: <1 (avg. height: 0.5m)
Sensitivity	High – steep rocky slopes with potential habitat for red data / endemic plant species	Medium-low – encroached areas on footslopes indicating degradation
Red data species	None observed	
Protected tree species	*Sclerocarya birrea* *Boscia albitrunca*	

The following recommendations can be made regarding the development in this plant community:

- The *Kirkia wilmsii – Combretum molle* mountain bushveld on rocky slopes vegetation unit has a High sensitivity due to the moderately steep slopes, high percentage rockiness and unique species composition observed in the area. The footslopes are in degraded state and classified as having a Medium-Low Sensitivity;
- Limited prospecting can be supported in the mountainous area, although steep slopes and areas with a high density in terms of rockiness should preferably be avoided;

- Access roads should be kept to existing roads, and when additional roads are necessary the roads should be developed in such a way on the **rocky slopes** to limit erosion to a minimum. If possible the more rocky areas should be avoided, and areas with large boulders should be kept in its natural state.
- The pristine state of this vegetation unit makes the conservation of sections of this woodland type in combination with vegetation from the surrounding areas as a corridor important.

- The prospecting development on a small footprint area can be supported in the area, provided the specific mitigation and rehabilitation measures stipulated under the specific impacts of the prospecting activities are adhered to.

Photograph 1. *Kirkia wilmsii – Combretum molle* mountain bushveld variation

Photograph 2. *Euphorbia ingens – Combretum apiculatum – Dichrostachys cinerea* footslopes

5.3 *Senegallia mellifera* shrubveld on calcareous soils

Status:
Microphyllous woodland in a slightly to moderately degraded state

Degree of disturbance
Medium

Conservation Priority:
Medium

Soil	Shallow calcareous soils derived from limestone (Glenrosa, Mispah soil forms)	**Rockiness**	20-30%
Dominant spp.	*Senegallia mellifera, Grewia vernicosa, Boscia foetida, Grewia flava, Aloe chabaudi,*		

This vegetation unit occurs on a slightly undulating to flat plain on limestone and can be divided into two variations. The north-western section of the project area is characterised by dense *Grewia vernicosa – Boscia foetida – Senegallia mellifera* low shrubveld on calcareous soils (Photograph 3). The vegetation unit is characterized by shallow, rocky soils that is slightly more clayey in the low-lying areas, while the woody structure forms a low, open shrubveld with scattered tree species that varies in density from slightly more open on the shallow soils to denser on the more fertile soils. Small drainage channels occur throughout the northern area and form an alluvial fan in the area between the shrubveld. Most of the prospecting boreholes are planned within this vegetation variation.

The area in the south of the project area is classified as *Senegallia mellifera – Euclea undulata* woodland on calcareous floodplains / plains (Photograph 4). This variation forms more open woodland dominated largely by *Senegallia mellifera*, with stands of *Euclea undulata* closer to the low-lying floodplains.

The diagnostic characteristic of this vegetation unit is the dominance of *Senegallia mellifera* (tree species), *Boscia foetida* (tree species), *Grewia flava* (Shrub) and *Grewia vernicosa (*shrub species*)*. The grass layer is directly proportional to the amount of rocks present on the surface and therefore seldom dense.

The characteristics of this vegetation unit are further described in table 3 below, while the typical woody structure and woody structure is indicated in photographs 2 and 3.

Table 3. Botanical analysis of *Senegallia mellifera* shrubveld

	***Grewia vernicosa – Boscia foetida – Senegallia mellifera* low shrubveld**	***Senegallia mellifera – Euclea undulata woodland on calcareous floodplains / plains***
Location:	North-western section of the project area	Southern section of project area
State of the vegetation:	Encroached – slightly to moderately degraded	Slightly degraded as a result of overgrazing
Characteristics	Dense shrubveld dominated by various microphyllous woodland species and broadleaf shrubs.	Open microphyllous woodland on plains and floodplains
Density of woody layer	Trees: 5-10% (avg. height: 3-6m) Shrubs: 40-60% (avg. height: 1-2m)	Trees: 5-15% (avg. height: 3-6m) Shrubs: 5-10% (avg. height: 1-2m)
Density of herbaceous layer	Grasses: 20-30% (avg. height: 1.2m) Forbs: <1 (avg. height: 0.5m)	Grasses: 30-40% (avg. height: 1.2m) Forbs: <1 (avg. height: 0.5m)
Sensitivity	Medium – indigenous woodland / shrubland in a slightly degraded state	
Red data species	None observed	
Protected tree species	*Sclerocarya birrea* (DAFF listed) *Boscia albitrunca* (DAFF listed) *Boscia foetida (*LEMA listed)	

The following recommendations can be made regarding the prospecting development in this plant community:

- The vegetation unit has a medium sensitivity due to the vegetation being in a slightly degraded state with a widespread distribution throughout the Savanna Biome;
- The calcareous soils are sensitive with a high erosion potential. Specific mitigation and management recommendations should be addressed considering the high erodibility potential of the soils (as discussed under section 6);
- The development in this section should be placed to minimally impede the natural drainage features of the area if possible. Should any of these areas be impede an IWUL should be obtained from DWA;

Photograph 3. ***Grewia vernicosa – Boscia foetida – Senegallia mellifera*** **low shrubveld**

Photograph 4. ***Senegallia mellifera – Euclea undulata*** **woodland on calcareous floodplains / plains**

5.4 *Sclerocarya birrea – Combretum apiculatum – Dichrostachys cinerea* woodland on gravelly soils

Status:
Encroached woodland

Need for rehabilitation
Medium

Conservation Priority:
Medium to Low

Soil	Shallow gravelly soils derived from gneiss	**Rockiness**	<1%
Dominant spp.	*Combretum apiculatum, Dichrostachys cinerea, Sclerocarya birrea, Strychnos madagascariensis*		

This vegetation unit occurs in the eastern and small pocket in the central section of the project area. The soils are mostly gravelly and derived from quartzite or gneiss. The woody layer is dominated by *Combretum apiculatum, Strychnos madagascariensis, Dichrostahcys cinerea* and *Sclerocarya birrea*. The habitat type can be considered degraded as a result of overgrazing which caused encroachment of the area by sickle bush.

Vegetation associated with encroached areas usually occurs in previously disturbed or overgrazed sites (Van der Meulen, 1979). Werger (1977) showed that when severe and prolonged overgrazing in the semi-arid savanna ecosystem occurs, the grass component is severely restricted in growth, or in moisture usage. More moisture remains thus available in the soil to be used by the woody plants, and the result is bush encroachment, a structural change towards more strongly woody vegetation. The present legislation under the Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983) (CARA), regulation 16, states that bush encroachers, which are indigenous plants, require sound management practices to prevent them from becoming problematic. Bush encroachment is a term used for "stands of plants such as sickle bush and various *Grewia* species where individual plants are closer to each other than three times the mean crown diameter". The encroachers themselves are not the problem, but they can be regarded as a symptom of poor land management practices. Therefore CARA does not outlaw these plants, but instead prescribes management practices aimed at preventing bush encroachment, and at combating it where it already occurs. If communities of plants from the list of indicators occur in the natural vegetation of an area, the land users have to take the necessary precautions to prevent the deterioration of their land to such an extent that bush encroachment takes place. In cases where bush encroachment has already taken place, the land users have to remove the cause of deterioration and combat the encroachment of indicator species. Among the prescribed measures are the uprooting, felling or cutting of plants, the judicious application of registered herbicides, livestock reduction and the correct utilization and protection of veld.

No red data species occurs; probably as a result of the habitat being different compared to the potential red data species habitat, although the protected marula trees should be considered a high conservation priority in this specific area. The state of the vegetation is indicated in photograph 5, while the characteristics of the variations of this vegetation unit are summarized in Table 4.

Table 4 Botanical analysis and characteristics of *Sclerocarya birrea – Combretum apiculatum – Dichrostachys cinerea* woodland

Vegetation characteristics	
State of the vegetation:	Encroached woodland with indigenous components
Need for rehabilitation	Medium
Conservation priority	Medium-low
Characteristics	Encroached woodland with natural elements
Density of woody layer	Trees: 10-15% (avg. height: 3-6m) Shrubs: 20-40% (avg. height: 1-2m)
Density of herbaceous layer	Grasses: 40-50% (avg. height: 0.8-1.2m) Forbs: <1% (avg. height: 0.8m)
Sensitivity	Medium-low
Red data species	None observed
Protected species	*Boscia albitrunca* *Sclerocarya birrea*

Photograph 5. *Sclerocarya birrea – Combretum apiculatum – Dichrostachys cinerea* woodland in the project area

The following specific recommendations for the area should be adhered to

- The vegetation unit is classified as having a medium sensitivity due its widespread occurrence in the Savanna Biome;
- The development could be supported in this vegetation unit. The protected tree species *Sclerocarya birrea* should be preserved as part of the landscaping, or alternatively a permit can be obtained from DAFF for the eradication of the species.

- The development can be supported in this vegetation unit provided the mitigation measures stipulated in section 6 of this report are considered.

5.5 *Terminalia sericea – Dichrostachys cinerea* dense woodland on sandy soils

Status:
Encroached shrubveld

Need for rehabilitation
Medium

Conservation Priority:
Medium to Low

Soil	Red-yellow apedal soils (Hutton) derived from gneiss	**Rockiness**	<1%
Dominant spp.	*Terminalia sericea, Grewia bicolor, Dichrostachys cinerea*		

This vegetation unit occurs mostly in the eastern section of the project area on very sandy soils (Clovelly soil form). The shrub layer is heavily encroached as a result of overgrazing by livestock from the local communities. The presence and dominance of silverclusterleaf in the woody layer indicate that the soils are more sandy and deep. Only individual protected marula trees and camel thorn trees occur in the area. The presence of a moderately to high percentage of pioneer grass species indicate the poor nutrient status of the soils. No red data plant species were observed in the area or could potentially occur. The average height and cover for the floral components is as follows:

No red data species occurs; probably as a result of the degraded state of the habitat being compared to the potential red data species habitat. The state of the vegetation is indicated in photograph 6, while the characteristics of the variations of this vegetation unit are summarized in Table 4.

Table 5 Botanical analysis and characteristics of *Terminalia sericea – Dichrostachys cinerea* dense woodland

Vegetation characteristics	
State of the vegetation:	Encroached shrubveld with indigenous components
Need for rehabilitation	Medium
Conservation priority	Medium-low
Characteristics	Encroached woodland with natural elements
Density of woody layer	Trees: 10-15% (avg. height: 3-6m) Shrubs: 20-40% (avg. height: 1-2m)

Vegetation characteristics	
Density of herbaceous layer	Grasses: 20-30% (avg. height: 0.8-1.2m) Forbs: <1% (avg. height: 0.8m)
Sensitivity	Medium-low
Red data species	None observed
Protected species	None observed

Photograph 6. *Terminalia sericea – Dichrostachys cinerea* dense woodland in the project area

The following specific recommendations for the area should be adhered to

- The vegetation unit is classified as having a medium-low sensitivity due to the encroached state, although the indigenous components are still intact;
- The development can be supported in this vegetation unit provided the mitigation measures stipulated in section 6 of this report are considered.

5.6 Degraded woodland / grasslands

Status:
Degraded areas on site

Degree of disturbance
High

Conservation Priority:
Low

Soil	Red-yellow apedal soils in valleys / plains derived from quartzite / norite	**Rockiness**	<1%
Dominant spp.	*Vachellia tortilis, Dichrostachys cinerea, Cynodon dactylon, Aristida* species, exotic weeds		

The areas that are currently in a largely degraded state as a result of overgrazing, crop cultivation, old fields or anthropogenic influences are discussed as one vegetation unit based on the low sensitivity of the area and common state of degradation. The degraded areas occur throughout large areas of the low-lying plains and valleys of the study area and are characterized by three main variations namely:

- Small scale subsistence cultivated land (Photograph 7);
- Primary old fields (Photograph 8);
- Degraded *Vachellia tortilis* woodland / secondary old fields (Photograph 9, 10);
- Degraded *Dichrostachys – Sclerocarya* woodland / secondary old fields (Photograph 11);
- Degraded areas in and around villages (Photograph 12)

The cultivated land in the valleys and on the plains occurs mostly close to the villages and represents small patches of completely modified land (photograph 7). These areas do not represent a vegetation entity other than homogenous stands of crops and some exotic weeds and pioneer grasses. Therefore, no further discussion follows on the cultivated land considering that these areas represent zero sensitivity areas that is highly suitable for any prospecting development from an ecological perspective.

The old fields occur throughout the area and vary between primary and secondary old fields. When cultivated fields are left fallow, it results in a landscape mosaic of patches of secondary vegetation varying in age and dominated by various grass species (Moll, 1965). Different stages of succession occur in the old fields, and the most common old fields in the Savanna Biome and surroundings are the young old fields of 1-5 years old (Smits et al. 1999) dominated by the pioneer grass species of disturbed areas, *Cynodon dactylon* (Van Oudtshoorn, 1999). Secondary grassland communities may develop from this old field variation, dominated by the secondary grassland species directly related to man-made disturbances, *Hyparrhenia hirta*. These fields are still in an early successional state, although somewhat older (older than 5 years) with several grass species like *Hyperthelia dissoluta, Aristida junciformis, Aristida congesta s. congesta* and *Eragrostis rigidior*. The landscape and vegetation features of the primary old fields on the proposed prospecting development site include slightly undulating plains with a low tree cover (< 1%) and dense (60%) grass layer (photograph 8). The dominant species include *Aristida* species, *Eragrostis lehmanniana* and *Cenchrus ciliaris*, indicating previous agricultural/utilizing activities within these areas, while typical herbs/weeds include *Tagetes minuta* and *Bidens bipinnata*. The shrub layer (1 -

1,5m.) on the primary old fields covers 1 – 2%, while the forb layer covers 30% of the area. The soil in the area is red Hutton soils or black clayey soils.

The outer successional stage of old fields only starts after several years of abandonment when woody species start to invade. These secondary old fields are usually dominated by species such as *Dichrostachys cinerea, Vachellia tortilis* and *Ziziphus mucronata*. Where overgrazing occurs the encroacher *Dichrostachys cinerea* becomes dominant as is evident on certain areas of the site. The landscape and vegetation features of this unit include slightly undulating plains with Hutton soils. The tree layer (> 3m.) covers 5 -10%, while the shrub layer covers 10-15% (different variants) of the area. The grass layer is well developed with a 60 -70% cover, while the forb layer (0.2m.) covers 5 – 10% of the area. The dominant tree species in the area include *Vachellia tortilis and Dichrostachys cinerea* (photograph 9, 10). This vegetation unit is defined as a secondary old field variant/modified land which is evident from the higher tree cover/diversity as well as the higher shrub cover/diversity. Other degraded woodland areas represent a similar plant species composition and structure to the secondary old fields and is included in this vegetation unit based on these characteristics. Table 6 below indicates the botanical characteristics of this vegetation unit.

Table 6. Botanical analysis and characteristics of the degraded woodland / grassland

	Degraded grassland / old fields / cultivated land	**Degraded woodland / secondary old fields**
Location:	Throughout the area on the low-lying plains and valleys where the impact of grazing, crop cultivation and anthropogenic influences are apparent.	
State of the vegetation:	Completely modified to degraded	
Characteristics	Short, degraded grassland / cropfields	Open, degraded woodland to dense thickets with a well developed shrub layer in some areas and overgrazed herbaceous layer with many exotic weeds present.
Density of woody layer	Trees: <1% (avg. height: 3-6m) Shrubs: 1-2% (avg. height: 1-2m)	Trees: 5-10% (avg. height: 3-6m) Shrubs: 60-70% (avg. height: 1-2m)
Density of herbaceous layer	Grasses: 40-50% (avg. height: 1.2m) Forbs: 30% (avg. height: 0.5m)	Grasses: 20-70% (avg. height: 1.2m) Forbs: 5-10 (avg. height: 0.5m)
Sensitivity	Low sensitivity	
Red data species	None observed; no potential habitats	
Protected tree species	*Sclerocarya birrea* *Boscia albitrunca*	

No red data species were found as a result of the degraded state of the vegetation. The following general ecological observations and recommendations were made for the area:

- A large percentage of the land in question on the plains does not appear to be of high conservation importance due to the impact from previously cultivated land,

overgrazing and agricultural activities by the local communities. Most of the existing developed area consists of degraded grassland and woodland with occasional pockets of exotic tree stands. Much of the area is disturbed and used for grazing and cultivation purposes.

- The degraded areas have a low sensitivity due to the modified state of the vegetation.
- The local extent of the prospecting impact on the area would be low.

Photograph 7. Cultivated land in the project area (note the marula trees on fields not eradicated)

Photograph 8. Primary old fields

Photograph 9. Secondary old fields / degraded woodlands

Photograph 10. Degraded *Vachellia tortilis – Dichrostachys cinerea* woodland / secondary old fields

Photograph 11. Degraded *Sclerocarya – Dichrostachys cinerea* woodland / secondary old fields

Photograph 12. Degraded areas in villages

5.7 Vegetation associated with the major rivers and riparian areas

Status:
Dense, tall riparian woodland / floodplains

Degree of disturbance
Low to medium

Conservation Priority:
High

Soil	Soils vary from shallow, soils where channels cuts through rocky sections, to black clayey soils and alluvium on plains (Katspruit, Valsrivier, Rensburg soil form)	**Rockiness**	<1%
Dominant spp.	*Vachellia nilotica, Acacia galpinni, Faidherbia albida, Schotia brachypetala, Combretum imberbe, Gymnosporia senegalensis, Grewia flava*		

This vegetation unit includes the major river and riparian zones and smaller drainage channels found within the project area. The vegetation varies from being a completely closed woodland structure in certain section of the drainage channel to degraded grassland along some of the smaller drainage channels bisecting the villages. Typical woody species of the periphery of the drainage channels include species like *Vachellia nilotica, Acacia galpinni, Faidherbia albida, Schotia brachypetala* and *Combretum imberbe*, while the lower shrub stratum is often completely dominated by *Gymnosporia senegalensis, Senegalia ataxacantha* and *Grewia flava*. Where the channel cuts through rocky sections, several of the species associated with these rocky and gravelly areas discussed earlier can be found. The herbaceous component is well developed along the riverbanks mostly dominated by species such as *Panicum maximum*.

All of the rivers, tributaries and smaller drainage channels are non-perennial, although these drainage channels still play an important role as corridors for the remaining fauna of the area. Peripheral impacts should be avoided and subsequently a 30 meter buffer zone should be adapted around the drainage channels. Different variations of the drainage channels on the property include:

1. The Nkumpi River and Doring River is the most important rivers that bisect the study area from north to south flowing in a southerly direction. The vegetation associated with this main River system includes tall riparian woodland and degraded floodplains.

The Doring River actually present a water course that is highly eroded along its banks (Photograph 13), while the Nkumpi River system actually represents a wetland known as a channelled valley bottom system (Photograph 14). A channelled valley-bottom wetland is classified as a mostly flat valley-bottom wetland dissected by and typically elevated above a channel. Dominant water inputs to these areas are typically from the channel, either as surface flow resulting from overtopping of the channel bank/s or as interflow, or from adjacent valley-side slopes (as overland flow or interflow). Water generally moves through the wetland as diffuse surface flow, although occasional, short-lived concentrated flows are possible during flooding events. Small depressional areas within a channelled valley-bottom wetland can result in the temporary containment and storage of water within the wetland. Water generally exits in the form of diffuse surface flow and interflow, with the infiltration and evaporation of water from these wetlands also being potentially significant (particularly from depressional areas). The hydrodynamic nature of channelled valley-bottom wetlands is characterised by bidirectional horizontal flow, with limited vertical fluctuations in depressional areas (SANBI, 2009). The most abundant and most conspicuous plant species is hygrophilous grasses such as *Sporobolus africanus, Paspalum dilatatum, Andropogon eucomis, Eragrostis gummiflua* and *Setaria sphacelata*. Other plants associated with valley bottom channels are *Schoenoplectus corymbosus, Verbena bonariensis, Persicaria serrulata, Phragmites australis* and *Typha capensis*. Unfortunately, the valley bottom wetlands provide a distribution route for weeds and invading trees. Many of the usual weeds were recorded together with *Eucalyptus camaldulensis* (Red river gum), *Xanthium strumarium* (Large cocklebur) *Datura stramonium* and *Flaveria bidentis*. Weeds and invaders should be removed, as well as destruction of such plants in a safe place and manner.

2. The drainage channel in the southern section of the project area forms an open floodplain (Photograph 15). A floodplain is a flat or nearly flat land adjacent a stream or river that stretches from the banks of its channel to the base of the enclosing valley walls and experiences flooding during periods of high discharge. It includes the floodway, which consists of the stream channel and adjacent areas (riparian woodland) that carry flood flows, and the flood fringe, which are areas covered by the flood, but which do not experience a strong current. In other words, a floodplain is an area near a river or a stream which floods easily. Floodplains are made by a meander eroding sideways as it travels downstream. When a river breaks its banks and floods, it leaves behind layers of rock and mud. These gradually build up to create the floor of the flood plain. Floodplains generally contain unconsolidated sediments, often extending below the bed of the stream. These are accumulations of sand, gravel, loam, silt, and/or clay, and are often important aquifers, the water drawn from them being pre-filtered compared to the water in the river.

3. The vegetation associated with the smaller drainage channels in the northwestern section of the site represent an open floodplain known as an alluvial fan dominated by *Vachellia karroo* and other thornveld elements. An alluvial fan is a fan- or cone-shaped deposit of sediment crossed and built up by streams. If a fan is built up by debris flows it is properly called a debris cone or colluvial fan. These flows come from a single point source at the apex of the fan, and over time move to occupy many positions on the fan surface. Fans are typically found where a canyon draining from mountainous terrain emerges out onto a flatter plain, and especially along fault-bounded mountain fronts. The alluvial fans are also characterised by alluvium. Alluvium is loose, unconsolidated (not cemented together into a solid rock) soil or sediments, which has been eroded, reshaped by water in some form, and redeposited in a non-marine setting. Alluvium is typically made up of a variety of materials, including fine particles of silt and clay and larger particles of sand and gravel. When this loose alluvial material is deposited or cemented into a lithological unit, or lithified, it is called an alluvial deposit. These areas are currently in a degraded state as a result of erosion along its banks (Photograph 16).
4. The areas in the mountainous regions that cut through norite, quartzite and pyroxenite represent dykes and are also known as ravines. The woody structure forms open woodland to dense kloof vegetation along the steeper terrain.

Table 7 below indicates the botanical characteristics of this vegetation unit.

Table 7. Botanical analysis and characteristics of *Acacia – Dichrostachys* woodland

	Water courses / Riparian woodland	**Natural / Degraded floodplains / alluvial fans**
Location:	Drainage channels bisecting the area, with the most prominent river being the Nkumpi River and its main tributaries.	
State of the vegetation:	Varies from being in a pristne state along certain sections of the Nkumpi River, to more degraded closer to the villages where wood harvesting and overgrazing is evident	Mostly in a degraded state as a result of wood harvesting and overgrazing, although areas further away from anthropogenic influences and overgrazing is more pristine.
Characteristics	Tall ,riparian woodland with a well developed shrub layer (dense thickets in some areas) and a well developed herbaceous layer	Open to denser floodplains dominated by microphyllous species. Herbaceous layer varies from overgrazed to well developed in areas where degradation is less evident
Density of woody layer	Trees: 15-20% (avg. height: 3-18m) Shrubs: 10-15% (avg. height: 1-2m)	Trees: 10-15% (avg. height: 3-6m) Shrubs: 15-25% (avg. height: 1-2m)

	Water courses / Riparian woodland	Natural / Degraded floodplains / alluvial fans
Density of herbaceous layer	Grasses: 50-60% (avg. height: 1.2m) Forbs: 1-2% (avg. height: 0.5m)	Grasses: 40-50% (avg. height: 1.2m) Forbs: 1-2% (avg. height: 0.5m)
Sensitivity	High - flood line zones that play an important role as corridors for fauna as well as important catchments.	
Red data species	None observed	
Protected tree species	*Combretum imberbe* *Sclerocarya birrea* *Boscia albitrunca*	

Photograph 13. Typical riparian woodland associated with the Doring River

Photograph 14. Channelled valley bottom wetland associated with the Nkumpi River

Photograph 15. Floodplains in the southern section of project area

Photograph 16. Degraded channels that forms part of the alluvial fan in the project area

The following recommendations need to be adhered to considering this vegetation unit:

- The Nkumpi River and its tributaries as well as the floodplains should be considered a high sensitivity area. The development should not impact on the drainage channels and a floodline determination for the drainage channels should be done by a hydrological engineer. Based on the topography of the area and guidelines for determination of buffer zones around drainage channels in South Africa, small buffer zones (30 meters) should be adapted around the non-perennial drainage channels,
- Any prospecting activities that would include crossing of drainage channels by access

roads would need a water licence application to DWA. The location where roads cross the drainage channels should further be on the least sensitive area. The site should preferably be indicated by an ecologist after consultation by the engineers.

- The drainage channels play an important role as corridors for fauna and should be preserved as part of the larger ecosystem of the area.
- The drainage channels show signs of erosion in certain areas along its banks and these areas need to be rehabilitated as part of the development priorities. The drainage channels further provide breeding and foraging habitat for fauna. The catchment area directly adjacent to the Olifants River is an important catchment considering that water will often flow directly into the Olifants River.
- The following aspects should be considered as part of the layout of the proposed prospecting activities on the drainage channels:
    - Identify areas of historic or potential vulnerability, such as geologically unstable materials or areas subject to flooding.
    - Avoid problematic areas and avoid construction locations on the layout in areas of high natural hazard risk, such as landslides, rock-fall areas, steep slopes (over 60-70%), wet areas, saturated soils, etc.
    - Avoid or minimize construction in narrow canyon bottoms or on flood plains of rivers that will inevitably be inundated during major storm events.
    - Minimize changes to natural drainage patterns and crossings to drainages. Drainage crossings are potentially problematic, so they must be well designed. Changes to natural drainage patterns or channels often result in either environmental damage or failures.
    - Perform scheduled maintenance to be prepared for storms. Insure that culverts have their maximum capacity, ditches are cleaned, and that channels are free of debris and brush than can plug structures.
    - Typically keep cut and fill slopes as flat as possible and well covered (stabilized) with vegetation to minimize slumping as well as minimize surface erosion. Well-cemented but highly erosive soils may best resist surface erosion with near-vertical slopes that minimize the surface area exposed to erosion.
    - Use deep-rooted vegetation for biotechnical stabilization on slopes. Use a mixture of good ground cover plus deep-rooted vegetative species, preferably native species, to minimize deep-seated mass instability as well as offer surface erosion control protection.
    - Locate roads crossings on narrow sections of rivers and in areas of bedrock where possible. Avoid fine, deep alluvial deposits (of fine sand and silt) that are scour susceptible and problematic, or which otherwise require costly foundations.

5.8 Depressions

The depressions in the project area represent two variations namely man-made dams that form part of the modified channelled valley bottom wetlands are classified as exorheic depressions with channelled inflow (Photograph 17); and endorheic pans (Photograph 18) that occur in isolated areas of the project area.

A depression is classified as a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates. Dominant water sources are precipitation, ground water discharge, interflow and (diffuse or concentrated) overland flow. For 'depressions with channelled inflow', concentrated overland flow is typically a major source of water for the wetland, whereas this is not the case for 'depressions without channelled inflow'. Dominant hydrodynamics are (primarily seasonal) vertical fluctuations. Depressions may be flat-bottomed (in which case they are often referred to as 'pans') or round-bottomed (in which case they are often referred to as 'basins'), and may have any combination of inlets and outlets or lack them completely.

The two types of depressions that occur in the project area are characterised by the way water exits the systems. Water exits by means of evaporation and infiltration for endorheic depressions; and as concentrated surface flow in channels for exorheic depressions, although the primary means of water still exits as evaporation.

The vegetation associated with depressions is mostly sedges and bulrushes depending on the depth of the water and the substrate. Species such as *Persicaria serullata, Typha capensis, Schoenoplectus corymbosus, Ludwigia stolonifer* and *Leersia hexandra* mostly grow along the shallow edges of dams and pans in the project area on a muddy substrate.

Photograph 17. Man-made dam (depression) in the project area

Photograph 18. Endorheic depression (pan) in the project area

5.9 RECOMMENDATIONS & MANAGEMENT STRATEGIES FOR FLORA ON A SPECIES LEVEL

South Africa has been recognized as having remarkable plant diversity with high levels of endemism. The major threats to plants in the study area are urban expansion, non-sustainable harvesting, collecting, overgrazing/browsing, prospecting and agriculture. The objective of this section was to compile a list of plant species for which there is conservation concern. This included threatened, rare, declining, protected and endemic species. A list of red data plant species previously recorded in the study area was requested from SANBI for the quarter degree grid in which the proposed development is planned.

5.9.1 Red data Flora Species

The red data species potentially occurring in the grid squares of the study area is indicated in Table 8. No red data species was found in the area, although the potential habitats were surveyed to the extent representative of the area. The rocky habitats represent the most suitable habitat for most of the red data species described in the table below.

Table 8. List of red data plant species potentially occurring in the area

Species Name	IUCN Conservation status	Potential habitat	Potential occurrence in the area
Lydenburgia cassinoides	Near threatened	Rocky slopes, ravines	Medium, although none observed
Aneilema longirrhizum	Near threatened	Karroid low-lying areas	Low, due to degraded state of habitats
Euphorbia barnardii	Endangered	Rocky slopes / outcrops	Low, only isolated populations described in Sekhukuneland
Plectranthus porcatus	Vulnerable	Mountain slope. Well-drained, loam, stony soil.	Medium, although none observed

Species Name	IUCN Conservation status	Potential habitat	Potential occurrence in the area
Adenia fruticosa subsp. fruticosa	Near threatened	Rocky slopes / outcrops	Medium

5.9.2 Protected tree species

The National Forest Act (no.84 of 1998: National Forest Act, 1998) provides a list of tree species that are considered important in a South African perspective as a result of scarcity, high utilization, common value, etc. In terms of the National Forest Act of 1998, these tree species may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold – except under license granted by DWAF (or a delegated authority). Obtaining relevant permits are therefore required prior to any impact on these individuals. Taking cognizance of the data obtained from the field surveys, the following protected tree species occurs within the study area:

The following protected tree species occur in the area (Table 9) although these species only occur as individuals in their habitats:

Table 9. List of protected tree species found in the area

Tree species	Habitat
Combretum imberbe	Floodplains along drainage channels
Boscia albitrunca	Deep sandy soils
Sclerocarya birrea	Sandy soils on plateaus and undulating plains

Should any of these protected trees be impacted by the prospecting activities a permit application should also be preliminary submitted to Department of Forestry to eradicate these species.

5.9.3 Protected Plants (LEMA)

Plant species are also protected in the Limpopo Province according to the Limpopo Environmental Management Act. According to this ordinance, no person may pick, import, export, transport, possess, cultivate or trade in a specimen of a specially protected or protected plant species. The Appendices to the ordinance provide an extensive list of species that are protected, comprising a significant component of the flora expected to occur on site. Communication with Provincial authorities indicates that a permit is required for all these species, if they are expected to be affected by the proposed project.

After a detailed survey was conducted during March 2016, the following protected species listed in the ordinance was found in the footprint areas of the project area:

- *Aloe cryptopoda*;
- *Aloe chabaudi;*
- *Boscia foetida*.

5.9.4 Invasive alien species (CARA, 1983)

Invasive alien plants pose a direct threat not only to South Africa's biological diversity, but also to water security, the ecological functioning of natural systems and the productive use of land. They intensify the impact of fires and floods and increase soil erosion. Of the estimated 9000 plants introduced to this country, 198 are currently classified as being invasive. It is estimated that these plants cover about 10% of the country and the problem is growing at an exponential rate.

The Alien and Invasive Species Regulations (GNR 599 of 2014) are stipulated as part of the National Environmental Management: Biodiversity Act (10/2004). The regulation listed a total of 559 alien species as invasive and further 560 species are listed as prohibited and may not be introduced into South Africa. Below is a brief explanation of the four categories of Invasive Alien Plants as per the regulation.

Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.

Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.

Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.

Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Cat 3 plants to exist in riparian zones.

The fight against invasive alien plants is spearheaded by the Working for Water (WfW) programme, launched in 1995 and administered through the DWA. This programme works in partnership with local communities, to whom it provides jobs, and also with Government departments including the Departments of Environmental Affairs and Tourism, Agriculture, and Trade and Industry, provincial departments of agriculture, conservation and environment, research foundations and private companies.

WfW currently runs over 300 projects in all nine of South Africa's provinces. Scientists and field workers use a range of methods to control invasive alien plants. These include:

- Mechanical methods - felling, removing or burning invading alien plants.
- Chemical methods - using environmentally safe herbicides.
- Biological control - using species-specific insects and diseases from the alien plant's country of origin. To date 76 bio-control agents have been released in South Africa against 40 weed species.

- Integrated control - combinations of the above three approaches. Often an integrated approach is required in order to prevent enormous impacts.

Vehicles often transport many seeds and some may be of invader species, which may become established along the roads through the area, especially where the area is disturbed. The construction phase of the development will almost certainly carry the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that invasive alien species such as the seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.

Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project. The following alien invasives and exotic plant species were recorded on site during the surveys as stipulated in the Alien and Invasive Species Regulations (GNR 599 of 2014) (Table 10):

Table 10. List of exotic plant species of the study area

Species	Category
Cereus peruvianum	1b
Datura stramonium	1b
Eucalyptus camaldulensis	1b
Jacaranda mimosifolia	1b
Lantana camara	1b
Melia azedarach	1b
Opuntia ficus-indica	1b
Opuntia stricta	1b
Ricinus communis	2
Solanum mauritianum	1b
Solanum sisymbrifolium	1b
Tecoma stans	1b
Tithonia rotundifolia	1b
Verbena brasiliensis	1b
Xanthium strumarium	1b

5.9.5 General

An important aspect relating to the proposed development should be to protect and manage the biodiversity (structure and species composition) of the vegetation types which are represented on the proposed development site. Vegetation removal should be kept to the footprint areas of the proposed development. The unnecessary impact on the surrounding

woodland areas outside the prospecting footprint and plant development area should be avoided as far as possible.

5.10 FAUNA ASSESSMENT

5.10.1 Overview

A healthy environment is inhabited by animals that vary from micro-organisms to the birds and mammals. The species composition and diversity are often parameters taken into consideration when determining the state of the environment. A comprehensive survey of all animals is a time consuming task that will take a long time and several specialists to conduct. The alternative approach to such a study is to do a desktop study from existing databases and conduct a site visit to verify the habitat requirements and condition of the habitat. If any rare or endangered species are discovered in the desktop study that will be negatively influenced by the proposed development, specialist surveys will be conducted.

5.10.2 Results of desktop survey and site visits during March 2016

A survey was conducted during March 2016 to identify specific fauna habitats, and to compare these habitats with habitat preferences of the different fauna groups (birds, mammals, reptiles, amphibians) occurring in the quarter degree grid.

The number of mammal species supported by a plant community depends on several factors like the primary production, seasonal availability of resources, floral heterogeneity, diversity of plant structure, nature of the substratum and previous history (Delany, 1982). Each mammal species have a particular niche, which can be regarded as the sum of all ecological requirements of a species namely food, space, shelter and physical conditions. Mills & Hes (1997) stated that the distribution and abundance of animal species does not rigorously follow that of plant communities or biomes. Instead, mammal species seem to have certain preferences for a specific habitat type (Skinner & Smithers, 1990). Several authors have shown this preference of mammals to certain habitats through analysis (Beardall et al. 1984; Ben-Shahar, 1991; Dekker et al. 1996). Four major fauna habitats were observed in the area namely:

- Degraded grasslands;
- Savanna woodland (mixed)
- Riparian woodland and open water habitats
- Rocky habitats

The area represents microphyllous and broadleaf vegetation component with a diverse vegetation structure and height class. A detailed species list for the area is included in Appendix C, D and E.

5.10.2.1 Mammal Habitat Assessment and species survey

Large and medium sized mammals that occurred historically in the larger study area, are absent from the area, owing to anthropogenic impacts in recent centuries. Most of these larger antelope and predator species are today confined to game reserves and national parks in South Africa and therefore will not occur naturally in the study area. This loss of large species means that the mammal diversity at the site is far from its original natural state not only in terms of species richness but also with regards to functional roles in the ecosystem.

The majority of the habitat types on the respective study sites are fragmented. Therefore, the expected mammalian richness on these areas are considered low, although slightly higher richness values are expected from the more intact mountain habitats. Many of the bat species of conservation concern in the study area are cave-dependant for roosting. Any individuals that utilize the area would therefore either be foraging or migrating and would not be affected by the localized loss of habitat due to the development. The dominant species composition therefore comprises of widespread taxa with unspecialised life history traits.

Most mammal species are highly mobile and will move away during construction. The impact will also be low if one compares the footprint of the development and the overall range of individual species. It is therefore considered highly unlikely that the species will be affected negatively by the development of the prospecting area. The most important corridors that need to be preserved for free-roaming mammal species in the area include the natural vegetation associated with the mountains, woodland and riparian zones. The connectivity1 of the project site to the remainder of the larger area is poor due to other developments and roads. Of significance is the role of the river and riparian zone as zoogeographical dispersal corridor.

The use of trapping techniques was not deemed necessary due to the degraded state of the natural environment, although the development of the residential area will have a significant impact on any small mammal species that may occur within the study area.

Mammals are sensitive to disturbances and habitat destruction and degradation and as such the anticipated species diversity of the study area would be low. Settlement areas have negated the possibility of encountering any medium to large mammals. The presence of dogs as well as poaching activities (snares observed on site), poses a threat to the presence of mammals on sites. The mammals are mostly represented by generalised species such as rodents, scrub hares and smaller antelope (steenbok, common duiker) that will move through the area while foraging. The close proximity of the informal settlements does however place constant pressure on these mammal populations and many of these populations will eventually disappear from the area completely. The natural habitats associated with the mountainous terrain will still support populations of predators such as brown hyena and

1 C**onnectivity (habitat connectivity)** - Allowing for the conservation or maintenance of continuous or connected habitats, so as to preserve movements and exchanges associated with the habitat.

leopard, as well as herbivores such as kudu, bushbuck and klipspringer.

5.10.2.2 Avifaunal Habitat Assessment and species survey

Three major bird habitat systems were identified within the borders of the study site, namely degraded grassland (old fields), woodland (exotic and indigenous) and wetlands.

The majority of the natural grasslands and woodland in the area have been transformed into human settlements.

Most bird species identified within the study area are common species known to nest within or utilise the old fields, riparian woodland and microphyllous woodland habitat in the region and may be either permanently or occasionally present within the study area. The old fields represent short grassland that occurs throughout the study area. In general terms these open grassland patches could attract the Secretarybird, White-bellied Korhaans, and White Stork and Abdim's Stork. However, the close proximity to various residential areas and informal settlements means that disturbance levels in these areas are likely to be high due to humans, and hunting by dogs. The low reporting for these species is evidence of the impact that the surrounding communities are having on the birds that would, under optimum conditions, inhabit these open areas. The grassland patches are also a favourite foraging area for non Red Data game birds such as Swainson's Spurfowl and Helmeted Guineafowl. This in turn could attract large because of both the presence and accessibility of prey. Many habitat generalist species utilize this habitat type predominantly for foraging and hunting purposes. The disturbances of the topsoil layers also very often allow for greater foraging for insectivorous species. The farmland habitat type, however, is not a habitat type that is relied upon by any avifaunal species for survival.

According to Birdlife South Africa, the study area falls outside of any Important Bird Areas (IBA), identified within South Africa (www.birdlife.org.za).

The conservation status of many of the bird species that are dependent on wetlands reflects the critical status of wetland nationally, with many having already been destroyed. In the study area, man-made dams occur in the wetland area as well as the pans and seasonally flooded rivers. The valley bottom wetland on site does not hold water for long periods of the year.

5.10.2.3 Reptiles and Amphibians Assessment and species survey

There is a potential presence of some toads and sand frogs in the wetland areas on site, as they only need temporary pools for reproduction and the wetlands may provide suitable habitat. The dams that occur on the project area definitely improve conditions for dry-land amphibians. Amphibian species potentially occurring in the area include Common River Frog, Natal Sand Frog, Gutteral Toad, Raucous Toad and Bubbling Kassina. These species are non-threatened and widespread species, and as such the development will not have any impact on amphibian conservation within the region.

The degraded state of the area represent poor habitat for reptiles in general, although lizards and geckos associated with rural villages will occur in the area. Most of the snake species have moved away from the developed areas and only smaller species might occasionally be found in the village areas and thickets. Species such as the southern rock python, puff adder, boomslang, vine snake, spotted bush snake and several members of the green snakes (Philothamnus spp.) is expected to occur in the study area., although the presence of these snakes is dependant on the presence of their prey species (rodents, frogs etc.). The general habitat type for reptiles consists of open to dense bushveld, with limited available habitat for diurnally active and sit-and-wait predators, such as terrestrial skinks and other reptiles. Arboreal species are the more prominent components of the local herpetofauna.

The mountainous habitat and riverine woodland represent the most suitable habitat for a variety of reptile species. The reptiles of the study area include snakes, lizards, geckos and tortoises. Warmer, northern and west-facing slopes are the most suitable habitat for reptiles in the Mamabolo Mountain bushveld and Poung Dolomite mountain bushveld. In the absence or scarcity of dead termitaria, the small geckos listed are probably found on the walls of houses and in the rocky areas to the east of the site. All the aforementioned reptile species are common and widespread, and as such the development will not have any impact on reptile conservation within the region.

5.10.2.4 Red data species

According to the existing databases and field survey the following number of fauna species included in the IUCN red data lists can potentially be found in the study area (Table 11):

Table 11. Red data list of potential fauna for the study area

English Name	Conservation status	Probable habitat in area
BIRDS		
Cape Vulture	Vulnerable	Mountainous area / cliffs
Melodious Lark	Near threatened	Open grassland
Shortclawed Lark	Near threatened	Microphyllous woodland
Whitebellied Korhaan	Vulnerable	Open woodland
Lesser Kestrel	Vulnerable	Grasslands
Peregrine Falcon	Near threatened	Mountainous area
Yellowbilled Stork	Near threatened	Open water
Ayres' Eagle	Near threatened	Open woodland areas
Pallid Harrier	Near threatened	Marshy / Vlei areas
Corncrake	Vulnerable	Open grassland
Stanley's Bustard	Vulnerable	Open grassland / woodland

English Name	Conservation status	Probable habitat in area
Lanner Falcon	Near threatened	Mountainous area
Black Stork	Near threatened	Open grassland / woodland
Lappetfaced Vulture	Vulnerable	Dependant on carcasses
Old World Painted Snipe	Near threatened	Open water / dense riverine vegetation
Secretarybird	Near threatened	Open grassland / woodland
Martial Eagle	Vulnerable	Natural woodland
Grass Owl	Vulnerable	Closed grassland floodplains
Redbilled Oxpecker	Near threatened	Dependant on host species
Halfcollared Kingfisher	Near threatened	Ravine areas
Tawny Eagle	Vulnerable	Natural woodland
Whitebacked Night Heron	Vulnerable	Ravine areas
Pinkbacked Pelican	Vulnerable	Floodplain area
Marabou Stork	Near threatened	Natural woodland
Whitebacked Vulture	Vulnerable	Dependant on carcasses
African Marsh Harrier	Vulnerable	Wetland areas / open water
Greater Flamingo	Near threatened	Open water
Lesser Flamingo	Near threatened	Open water
African Finfoot	Vulnerable	Open water
MAMMALS		
South African Hedgehog	**Near threatened**	Savanna Bushveld
Brown Hyena	**Near threatened**	Savanna Bushveld
Serval	Near Threatened	Savanna Bushveld / tall grassland
Pangolin	Vulnerable	Savanna Bushveld
Rusty bat	Near threatened	Savanna, roosts in trees
Honey Badger	**Near threatened**	Savanna Bushveld
Temminck's Hairy Bat	Near Threatened	Savanna, roosts in trees / caves
Welwitsch's Hairy Bat	Near Threatened	Savanna, roosts in trees / caves
Rusty Bat	Near Threatened	Savanna, roosts in trees / caves
HERPETOFAUNA		
Black File Snake	Protected	
Southern African Python	Vulnerable	Rocky terrain, floodplains & savanna woodland

The cumulative negative impacts of the proposed prospecting activities on the fauna of the area will be low. Recommendations and mitigating measures need to be implemented to ensure the survival of these species other fauna habitats and feeding grounds as stipulated

below:

- Some of the red data and other mammal species have a low probability of occurring in the area as a result of the following:
    - The anthropogenic influences of crop cultivation and built-up land occurring in the area will cause some fauna to migrate from the area to more natural areas with less disturbance
    - The degraded and modified state of the old fields, cultivated land and encroached thickets vegetation is not suitable habitat for red data fauna species, and will only support general fauna such as birds, small antelopes and rodent species.
    - Habitat not being suitable or marginal
- If one considers the habitat descriptions of the red data species, some of them are limited in range or threatened as a direct result of habitat loss in the southern African subregion (e.g South African hedgehog), although many of the species in the table above are not limited by direct habitat loss due to their widespread occurrence (e.g martial eagles have large home ranges).
- The area in general is quite homogenous and therefore has a low potential for biodiversity considering the surrounding vegetation types, as well as the degraded areas. Rehabilitation of the degraded areas might improve faunal diversity in the area after the prospecting activities. Provided that proper rehabilitation will be conducted in an ecologically responsible way during and after prospecting, the prospecting activities might improve potential habitat for these threatened fauna on already modified and degraded areas.
- Development also won't influence the natural feeding and movement patterns of the existing fauna in the area. Peripheral impacts on the larger area should be avoided.
- The protection of different habitat types in the area will be important to ensure the survival of the different animals due to each species' individual needs and requirements. Sufficient natural corridor sections should be protected around the proposed development footprints to allow fauna to move freely between the different vegetation units on the property. The importance to protect the major riverine areas and the rocky mountainous regions as important corridors should be a high priority during the proposed prospecting development. In this regard the proposed prospecting development will aim to minimally impact on these areas and promote them as conservation areas.

The cumulative negative impact of the prospecting development on the fauna has the potential to be moderate. However, considering the following general mitigation and management actions taken on site, the impact on faunal populations should be low.

1. Where trenches pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during construction process.
2. A speed limit should be imposed on the access roads to minimize road kills. Speed humps should be constructed at strategic places along the access road to enforce lower speeds.
3. Roads should be designed without pavements to allow for the movement of small mammals.
4. Hunting, trapping, poisoning and shooting of animals should be prevented. This will necessitate negotiations with the local inhabitants and informal settlers.
5. Do not feed any wild animals on site.
6. Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the vulture birds of prey occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist.
7. Waste bins and foodstuffs should be made scavenger proof.
8. Control of vehicles in and out of the properties involved.
9. Monitoring of the environmental aspects should be done over the longer term to ensure that impacts are limited to a minimum during the constructional and operational phases. Monitoring of specific species such as pythons and specific bird species such as stork species and other water birds is necessary to ensure that this species would be unaffected over the longer term by the development. Information on the rare species should be provided to workers to make them more aware of these species and their behaviour.

6 POTENTIAL IMPACTS OF THE PROPOSED PROSPECTING OPERATION ON BIODIVERSITY AND MITIGATION MEASURES NEEDED

6.1 DIRECT HABITAT DESTRUCTION

6.1.1 Description of impact:

The proposed prospecting application will result in some loss of and damage to natural habitats, although not to the extent that a full-scale mining operation will have. Other infrastructure (other than the actual prospecting area) that will cause destruction of natural vegetation in the area include access roads and soil removed during the drilling of the boreholes, although in general this area will be no more than 25m x 25m. Rehabilitation of some areas would be possible but there is likely to be long-term damage in natural areas. The impact of the habitat destruction will be on the flora and fauna of the study area:

6.1.1.1 Destruction or loss of floral diversity or vegetation communities

The following major impacts of the prospecting development will potentially impact on the flora of the site:

- The clearance of vegetation during the prospecting activities will lead to the loss of individual plant species or even isolated populations of a particular plant species of significance (indigenous / protected species endemic to the area, e.g *Euphorbia barnardii*);
- The prospecting activities can impact on surrounding vegetation by dust and altered surface run-off patterns;
- The disturbance of the area could lead to an increase in the growth of alien vegetation;
- After the prospecting activities there should be no further impact on surrounding vegetation. The cleared areas should be re-vegetated;
- After prospecting, the vegetation composition will be different from the pre-prospecting condition considering the establishment of pioneer species on the rehabilitated areas.

6.1.1.2 Loss of faunal diversity through migration and decline in animal numbers

The following major impacts of the prospecting development will potentially impact on the faunal habitats of the site:

- Habitat loss and construction activities will force animals out of the construction area and animal numbers will decrease. In some cases isolated populations of threatened fauna might be totally removed from the area, although no such populations or knowledge thereof was found in the study area. This impact could also take place because of hunting and snaring of animals in natural areas not used for the

prospecting footprint areas;

- Loss of threatened, “near-threatened” and conservation important taxa: The anticipated loss of the natural woodland will result in the local displacement of some fauna species;
- Changes in the community structure: It is expected that the faunal species composition will shift, due to an anticipated loss in habitat surface area. In addition, it is predicted that more generalist species (and a loss of functional guilds) will dominate the study area. Attempts to rehabilitate will attract taxa with unspecialised and generalist life-histories. It is predicted that such taxa will persist for many years before conditions become suitable for succession to progress.

6.1.2 Mitigation measures:

- The removal of indigenous trees and shrubs should only occur on the footprint area of the prospecting site and not over the larger area. No trees may be trimmed or removed without the prior permission of the landowner. The clearing and damage of plant growth in these areas should be restricted to the footprint way leave area.
- Use existing facilities (e.g., access roads) to the extent possible to minimize the amount of new disturbance.
- The proposed prospecting site should avoid the protected trees and / or flora species that occur in the project area;
- Land clearing: minimize the extent and duration of land clearing;
- Rehabilitation: revegetate or stabilise all disturbed areas as soon as possible.
- All prospecting 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. Layouts should be adapted to fit natural patterns rather than imposing rigid geometries.
- The Environment Site Officer (ESO) should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. The ESO should enforce any measures that he/she deem 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.
- Clearly demarcate the entire prospecting footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area.
- Degraded / already impacted areas should be utilized as far as possible for the prospecting area. Construction activities should be restricted to the footprint area of the prospecting and ecological sensitive areas should be buffered. The vegetation impact will be minimal because of the relatively small area being prospected at a

time.

- Where trenches pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. This could be prevented by the closing of boreholes after prospecting activities have ceased;
- Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist.

6.2 HABITAT FRAGMENTATION

6.2.1 Description of impact:

The prospecting activties will result in limited natural movement patterns being disrupted and, to a varying degree depending on how different species react to these small barriers will result in the fragmentation of natural populations. The excavation of the area for prospecting will have a very small, though insignificant impact in fragmenting the habitats on the property. Such impacts would be short-term provided that proper rehabilitation methods are used after during decommissioning.

6.2.2 Mitigation measures:

- Use existing facilities (e.g., access roads, parking lots, graded areas) to the extent possible to minimize the amount of new disturbance.
- Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to the entire riparian zone during construction, including the ravines and smaller drainage channels or floodplains. Refer to the section under “Vegetation Units” for recommended buffer zones for the drainage channels in the area.
- During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place.
- Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas.

6.3 INCREASED SOIL EROSION AND SEDIMENTATION

6.3.1 Description of impact:

Prospecting may further result in widespread soil disturbance and is usually associated with

accelerated soil erosion, particularly in areas receiving high rainfalls. Soil, sediments and associated contaminants are transported into streams, rivers and other water bodies, resulting in the loss or alteration of habitats for aquatic organisms, as well as changes in water quality. Soil erosion also promotes a variety of terrestrial ecological changes associated with disturbed areas, including the establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous fauna and flora.

6.3.2 Mitigation measures:

- Cover disturbed soils as completely as possible, using vegetation or other materials;
- Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices.
- Protect sloping areas and drainage channel banks that are susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and Work Areas;
- Repair all erosion damage as soon as possible to allow for sufficient rehabilitation growth;
- Gravel roads must be well drained in order to limit soil erosion;
- The soils along the drainage channels and on the plains are expected to be potentially dispersive and as such prone to surface and sub-surface erosion and this needs to be taken into consideration for the proposed prospecting activities. Proper planning is needed to ensure that no prospecting sites is placed within the 1:100 year flood line, storm water management is planned and managed correctly and the erosion hazard is properly addressed in areas where soils are more susceptible to erosion.
- Have both temporary (during construction) and permanent erosion control plans.
    i. Temporary control plans should include:
        - silt fencing
        - temporary silt trap basins
        - short term seeding or mulching of exposed soil areas (particularly on slopes)
        - Limitations on access for heavy machinery and the storage of materials to avoid soil compaction.
    ii. Permanent erosion control plans should focus on the establishment of stable native vegetation communities.
- Repair all erosion damage as soon as possible and in any case not later than six months before the termination of the Maintenance Period to allow for sufficient rehabilitation growth.
- Do not allow surface water or storm water to be concentrated, or to flow down cut or

fill slopes or along pipeline routes without erosion protection measures being in place.

- Line overflow and scour channels with stone pitching along their length and at their points of discharge to prevent soil erosion. The point of discharge must be at a point where there is dense natural grass cover.
- Ensure that channels do not discharge straight down the contours. These must be aligned at such an angle to the contours that they have the least possible gradient.
- Temporary water diversion measures are to be designed and protected so that no undue scouring of river banks occurs.

6.4 SOIL AND WATER POLLUTION

6.4.1 Description of impact:

Construction work for the proposed prospecting will carry a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. Sewage and domestic waste are also potential contributors to this problem. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface or ground water, leading to potential medium/long-term impacts on fauna and flora.

Stream diversions and stockpiling could alter the characteristics of the drainage features. It could also increase the run-off during rain events. This will have an impact on downstream users of water from the river.

6.4.2 Mitigation measures:

- Water falling on areas polluted with oil/diesel or other hazardous substances must be contained. Any excess or waste material or chemicals should be removed from the site and discarded in an environmental friendly way. The ESO should enforce this rule rigorously.
- All construction vehicles should be inspected for oil and fuel leaks regularly and frequently, and that any vehicle showing signs of leaking should be serviced immediately.
- Vehicle maintenance yards must not be situated in any close proximity to water courses and all used oil and other waste products should be disposed of in an accepted way – preferably it should be removed from the site and recycled.
- Ensure that refuelling stations on site are constructed so as to prevent spillage of fuel or oil onto the soil, and put in place measures to ensure that any accidental spillages can be contained and cleaned up promptly.
- Sewage should either be treated in a suitable plant or removed from the site for treatment elsewhere.

6.5 SPREAD AND ESTABLISHMENT OF ALIEN INVASIVE SPECIES

6.5.1 Description of impact:

This is probably one of the most significant potential impacts from a terrestrial invertebrate perspective, and also may have very significant knock-on effects that could impact of virtually every aspect of the surrounding ecosystem. Vehicles often transport many seeds and some may be of invader species, which may become established along the road, especially where the area is disturbed. Invasive invertebrate species (e.g. the Argentine ant, Linepithema humile) are also regularly dispersed by vehicles.

The construction phase almost certainly carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that colonies of species such as Argentine ants or the seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.

Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project.

6.5.2 Mitigation measures:

- Institute strict control over materials brought onto site, which should be inspected for potential invasive invertebrate species and steps taken to eradicate these before transport to the site. Routinely fumigate or spray all materials with appropriate low-residual insecticides prior to transport to or in a quarantine area on site. The Argentine ant is nearly impossible to eradicate once it has established itself.
- Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish.
- Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds.
- Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented.

6.6 NEGATIVE EFFECT OF HUMAN ACTIVITIES

6.6.1 Description of impact:

An increase in human activity on the site and surrounding areas is anticipated. The risk of snaring, killing and hunting of certain faunal species is increased. Certain faunal species may be captured for selling to the pet trade. If staff compounds are erected for construction

workers, the risk of pollution because of litter and inadequate sanitation and the introduction of invasive fauna and flora are increased. The presence of construction workers or regular workers on site over a protracted period will result in a greatly increased risk of uncontrolled fires arising from cooking fires, improperly disposed cigarettes etc.

6.6.2 Mitigation measures:

- The minimum staff should be accommodated on the site. If practical, construction workers should stay in one of the nearby villages and transported daily to the site.
- If any staff accommodation 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. Adequate rubbish bins and sanitation facilities should be provided.
- The ECO should regularly inspect the site, including storage facilities and compounds and eradicate any invasive or exotic plants and animals.
- Maintain proper firebreaks around entire prospecting sites footprint.
- Educate construction workers regarding risks and correct disposal of cigarettes.

6.7 ROAD MORTALITY

6.7.1 Description of impact:

Large numbers of fauna are killed daily on roads. They are either being crushed under the tyres of vehicles in the case of crawling species, or by colliding with the vehicle itself in the case of avifauna or flying invertebrates. The impact is intensified at night, especially for flying insects, as result of their attraction to the lights of vehicles.

6.7.2 Mitigation measures:

- More fauna are normally killed the faster vehicles travel. A speed limit should be enforced (preferably 40 km/hour). It can be considered to install speed bumps in sections where the speed limit tends to be disobeyed. (Speed limits will also lessen the probability of road accidents and their negative consequences).
- Travelling at night should be avoided or limited as much as possible.

7 IMPACT ASSESSMENT MATRIX

Table 12 indicate the impacts described above and specific ratings of significance the impact will potentially have on the ecosystem during the proposed prospecting activities according to the layout plan of the prospecting development.:

Table 12. Impact assessment Matrix according to the proposed layout plan

Nr	Activity	Impact	P	D	S	M	Significance Before Mitigation		Mitigation Measures	P	D	S	M	Significance	
Prospecting activities (without mitigation)									**Prospecting activities (with mitigation)**						
1	Clearing of vegetation for prospecting, access roads etc.	Habitat destruction	5	3	1	6	50	Moderate	See section 6.1.2	2	3	1	2	12	Negligible
2	Clearing of vegetation for prospecting, access roads etc.	Habitat fragmentation	5	3	1	6	50	Moderate	See section 6.2.2	5	3	1	2	40	Negligible
3	Exposure of soils to rainfall and wind during construction	Soil erosion	5	5	2	6	65	High	See section 6.3.2	4	2	2	2	24	Low
4	Movement of vehicles on site during prospecting, sewage etc.	Spillages of harmful substances	4	4	3	6	52	Moderate	See section 6.4.2	4	3	2	2	28	Low
6	Continued movement of personnel and vehicles on and off the site during the prospecting, as well as occasional delivery of materials required for maintenance	Spread of alien invasive species	4	4	2	6	48	Moderate	See section 6.5.2	2	3	2	2	14	Negligible
7	Prospecting activities	Negative effect of human activities on flora	4	3	2	6	44	Moderate	See section 6.6.2	2	3	2	2	14	Negligible
8	Continued movement of personnel and vehicles on and off the site during the prospecting, as well as occasional delivery of materials required for maintenance	Fauna mortality on roads	4	3	2	6	44	Moderate	See section 6.7.2	4	3	2	2	28	Low

Aspect	Description	Weight
Probability	Improbable	1
	Probable	2
	Highly Probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4
	Permanent	5
Scale	Local	1
	Site	2
	Regional	3
Magnitude	Low	2
	Medium	6
	High	8
Significance		
	Negligible	<20
	Low	<40
	Moderate	<60
	High	>60

From the abovementioned tables the following can be concluded:

- The importance to mitigate the potential impacts during the actual prospecting implementation phases should be considered a high priority and this should be addressed as part of the EMP;
- The impact of the prospecting activities on the fauna and flora habitat on the area will be low considering the degraded state of the plains sections. These areas are more suitable for the layout plan and most of the impacts of the proposed prospecting activities will have a lower impact on the natural environment on the plains.
- Regional impacts such as soil and water pollution, soil erosion and sedimentation and spread of alien invasives will have a higher probability on the lower plains section due to the close proximity of the riverine areas and due to deeper, more erodible soils being present in the area.

8 SENSITIVITY

Following the ecological surveys, the classification of the study area into different sensitivity classes and prospecting zones was based on information collected at various levels on different environmental characteristics. Factors which determined sensitivity classes were as follows:

- Presence, density and potential impact of prospecting on rare, endemic and protected plant species
- Conservation status of vegetation units
- Soil types, soil depth and soil clay content
- Previous land-use
- State of the vegetation in general as indicated by indicator species

Below included is the sensitivity map for the proposed prospecting project area (Figure 8). Only criteria applicable to the specific vegetation units were used to determine the sensitivity of the specific unit.

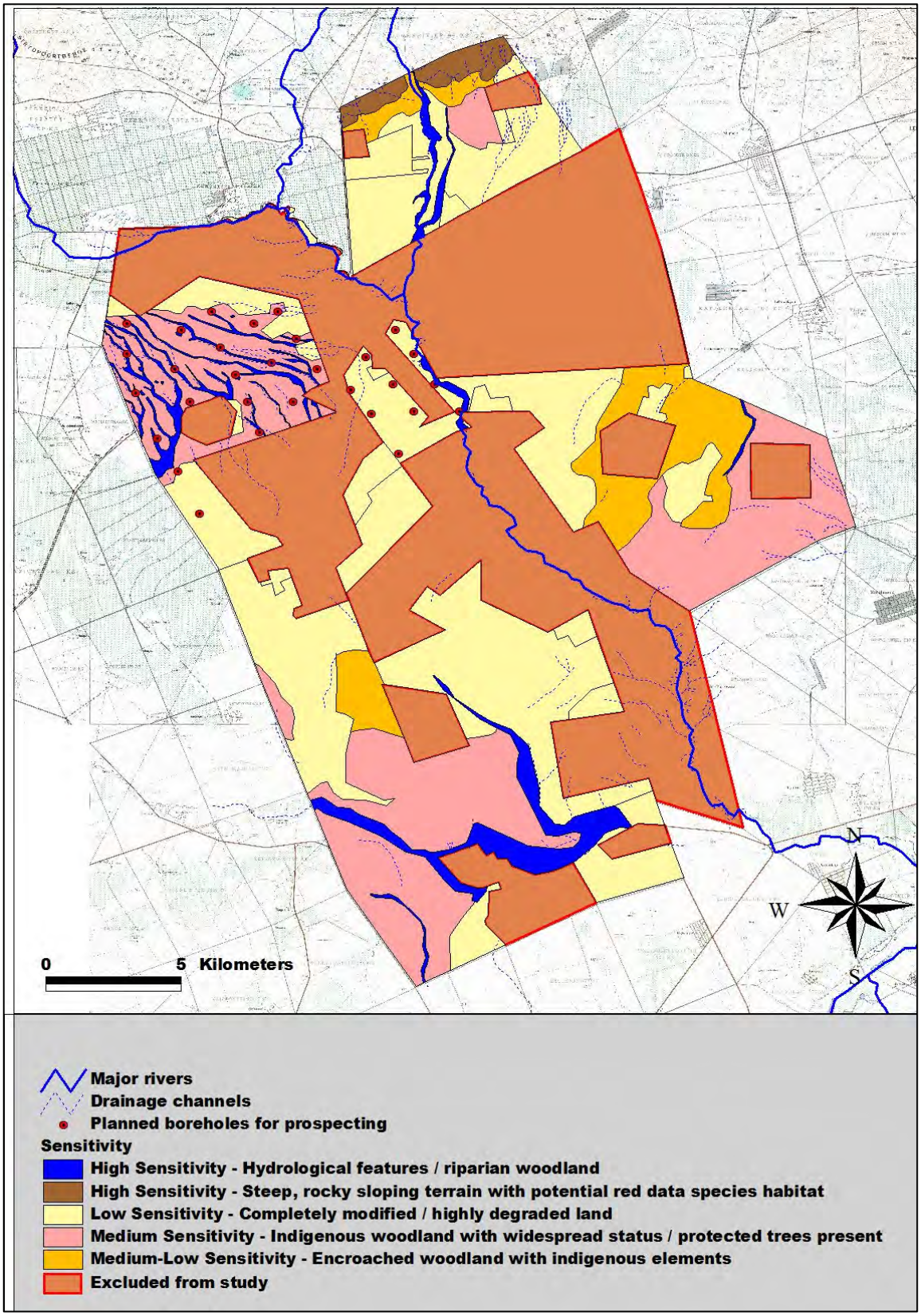

Figure 8. Sensitivity Map of the study area

9 CBA AREAS (LIMPOPO CONSERVATION PLAN)

9.1 Background description

Bioregional plans are one of a range of tools provided for in the National Environmental Management:Biodiversity Act (NEMBA) (No. 10 of 2004) that can be used to facilitate biodiversity conservation in priority areas outside the protected area network. The purpose of a bioregional plan is to inform land-use planning, environmental assessment and authorisations, and natural resource management, by a range of sectors whose policies and decisions impact on biodiversity.

This is done by providing a map of biodiversity priority areas or CBAs together with accompanying land-use planning and decision-making guidelines. The conservation plan applies a target driven systematic spatial biodiversity planning methodology to develop this map and it is based on the best available biodiversity and context data, and an explicit set of biodiversity conservation targets. The resultant map represents the minimum area necessary to maintain biodiversity pattern and ecological processes in the landscape, i.e. ecologically functional landscapes.

Bioregional plans are intended to feed into a range of multi-sectoral planning and assessment processes such as Environmental Management Frameworks (EMFs), Spatial Development Frameworks (SDFs), Strategic Environmental Assessments (SEAs), Environmental Impact Assessments (EIAs), Biosphere Reserves, and to support and streamline environmental decision-making. A bioregional plan is not in itself a multi-sectoral planning or assessment tool, but rather is the biodiversity sector's input into other planning and assessment processes.

This conservation plan is consistent with National Environmental Management Act (NEMA) principles and the NEMBA. It is designed to support integrated development planning and sustainable development by identifying an efficient set of CBAs that are required to meet national and provincial biodiversity objectives, in a configuration that is least conflicting with other land uses and activities. Where alternatives are available, the CBAs are designed to avoid conflict with existing IDPs, EMFs and SDFs in the region by favouring the selection of sites that are least conflicting with other land-uses.

Based on the Limpopo Conservation Plan, 40% of the province is designated as Critical Biodiversity Area. These CBAs have been split into CBA 1 and CBA 2 on the basis of selection frequency and the underlying characteristics of the biodiversity features which are being protected (i.e. location fixed features such as sites for CR species and flexible ones such as Least Cost Corridors). The majority of the CBAs in the province are CBA 1 (22 %), which can be considered "irreplaceable" in that there is little choice in terms of areas available to meet targets. If CBA 1 areas are not maintained in a natural state then targets cannot be achieved. CBA 2's are considered "optimal" as there is significant design involved in their identification, make up 18 % of the province. CBA 2's represent areas where there are spatial

options for achieving targets and the selected sites are the ones that best achieve targets within the landscape design objectives of the plan.

An additional 23% of the province is designated as Ecological Support Area. This category has also been split on the basis of land-cover into ESA 1 (16%) and ESA 2 (7%), with ESA 1 being in a largely natural state while ESA 2 areas are no longer intact but potentially retain significant importance from a process perspective (e.g. maintaining landscape connectivity). Other Natural Areas make up 20% of the province and just over 11% is designated as formal Protected Area. The relatively high portion of remaining natural habitats which have been designated in one of the priority categories is a function of the fully integrated terrestrial and freshwater assessment (i.e. unlike many provinces there is not a second additional map of freshwater priorities), the comprehensive corridor and climate change adaptation features, and the relatively poor overlap of features (i.e. priority areas for one taxa do not spatially correlate well with those of other taxa in most of the savanna areas).

9.2 Project specific classification

The Limpopo Conservation Plan categories for the proposed Moletlane Prospecting Right Area are presented in Figure 9. The following can be concluded regarding the prospecting development:

- Most of the planned borehole drilling site planned for the Moletlane Prospecting Right Area is located in areas with “No Natural Habitat Remaining with the mountainous areas and riparian areas classified as CBA1, CBA 2 and ESA 2 areas.
- The prospecting boreholes are planned in degraded areas classified as “No Natural Habitat Remaining. Although the proposed prospecting is a non-compatible land-use with the CBA zones, the Limpopo Conservation Plan stipulates that certain elements of these activities could be allowed subject to detailed impact assessment to ensure that developments were designed to maintain overall ecological functioning of CBAs. Alternative areas may need to be identified to ensure the CBA network still meets the required targets;

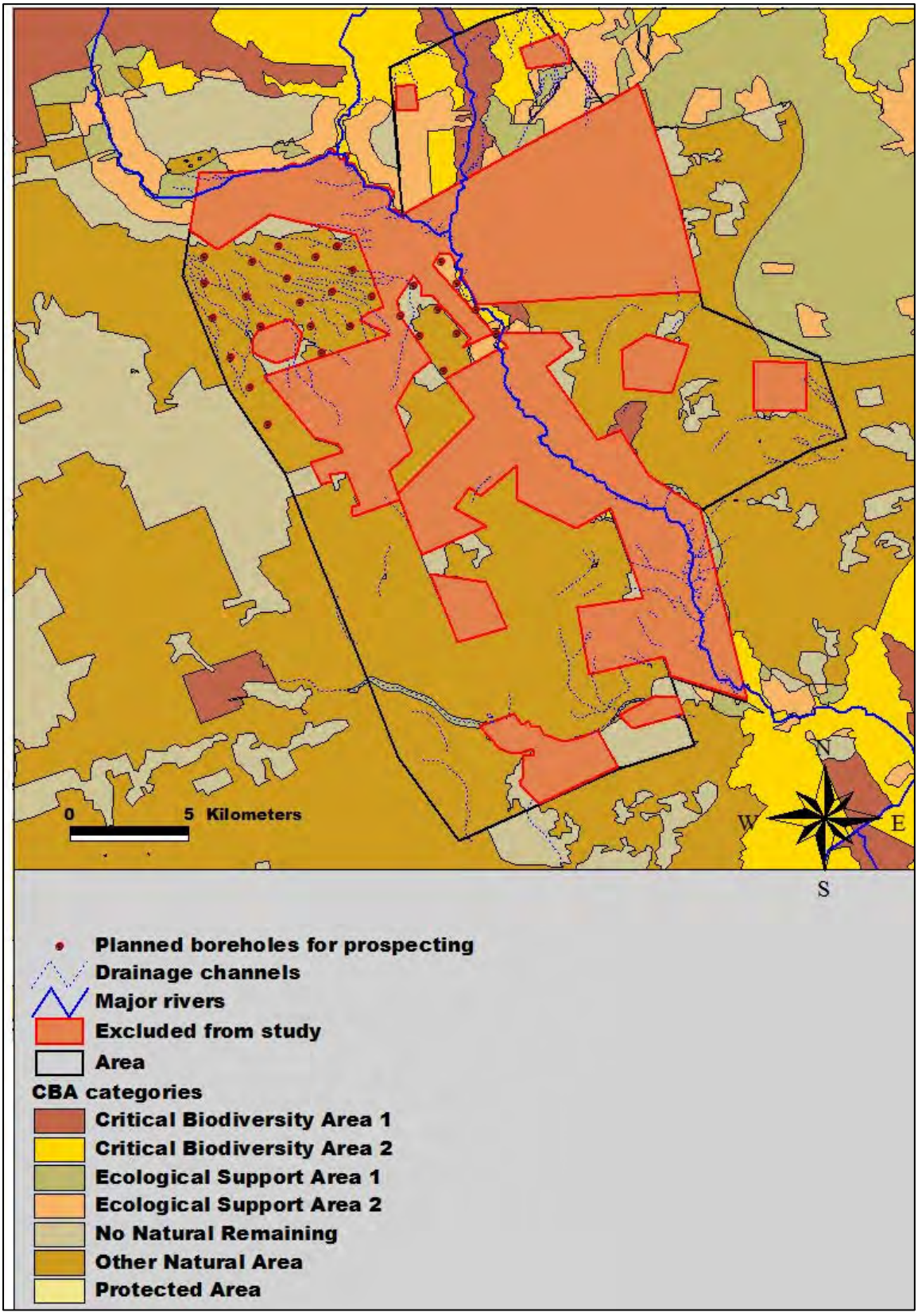

Figure 9. Limpopo CPv2 Map for the project area

9.3 CBA assessment

The Limpopo Conservation Plan Technical Report (2013) states clearly for all CBA 1 and CBA 2 areas that where development proposals other than the preferred biodiversity compatible land-uses are submitted in terms of the NEMA: EIA regulations or Land Use Planning Ordinance (LUPO):

- A Screening Exercise should be undertaken by a Biodiversity Specialist or Ecologist to verify the CBA map category on site;
- If the site is verified as a CBA, developments other than the preferred biodiversity compatible land uses should be investigated in detail and the mitigation hierarchy applied in full;
- If the application is pursued they should be informed by a specialist biodiversity assessment.

All of the above aspects were taken into consideration and the following was concluded:

- **CBA 1 area:** Most of the CBA 1 area is classified as having a High Sensitivity in the mountainous or riparian areas. The classification as CBA 1 area is therefore accepted. The following management should be implemented for these areas:
    - Maintain in a natural state with limited or no biodiversity loss.
    - Rehabilitate degraded areas to a natural or near natural state, and manage for no further degradation.
- **Impacted CBA 2 area**: Some of the CBA 2 area is classified as having a Low, Moderate-Low or Moderate Sensitivity. In this case the classification as CBA 2 area is also rejected if taking into consideration that the area has been extensively overgrazed, with very little sections with natural vegetation occurring other than encroached thickets. The degraded areas (low or moderate low sensitivity areas) should rather be classified as the category **No Natural Habitat Remaining,** while the **Moderate Sensitivity areas** should be classified as **Other Natural Areas** based on the fact that these areas occur as fragmented islands in the ecosystem with little or no connectivity to the larger area. **Recommendation: No further action is therefore required in terms of offset or conservation plans.** Strict adherence to Section 11 on Biodiversity Management Actions should however be implemented;
- **Natural CBA 2 areas:** The mountainous terrain is classified as CBA2 areas which are considered accurate. The following guidelines apply:
    - Loss of natural habitat should be minimized i.e. land in this category should be maintained as natural vegetation cover as far as possible;
    - These areas of land can act as possible biodiversity offset receiving areas;
    - Control of illegal activities (such as hunting and dumping), which impact biodiversity should be prioritized in CBA areas.

- **ESA2 area**: Similar to CBA 1 area addressed above within Low or Moderate-Low Ecological Sensitivity Zones and should subsequently be classified as the category No Natural Habitat Remaining

10 BIODIVERSITY MANAGEMENT ACTIONS

A management system has been developed to comply with the objectives and principles set out in this document. This system is based on the principle of managing the potential environmental impacts using the best available technology, not entailing excessive cost. In this way, the technology is effective, but does not seriously impair economic stability of the development. Management measures required for the prospecting activities which relates to biodiversity is presented in Table 13 below.

Table 13. Management measures required for prospecting activities

Aspect	Management principles	Management measures
Soils and land capability	To ensure that rehabilitation is done in a way that the minimum agricultural land is lost	• Vegetation should only be removed in areas designated for prospecting • The main aim of the rehabilitation should be to stabilize disturbed soils and return a sustainable vegetative cover over the prospected areas • Large, indigenous tree species need to be preserved as far as possible during the prospecting process. The prospecting area should not interfere with a clump of large trees that stand closely together. • Energy dissipaters should be constructed at points where there are concentrated discharges of water to the environment that can cause erosion. Energy dissipaters should also be placed within water channels to slow the speed of water. • Vehicle maintenance should be conducted in designated areas • Construction vehicles and machines must be maintained properly to ensure that oil spillages and leakages are kept to a minimum. • Proper refuelling and maintenance facilities for construction vehicles should be provided. These areas will be located on concrete surfaced areas with suitable drip trays. Bunded and lockable facilities should be provided for the storage of oil and lubricants. • Do not disturb more area than what is necessary for the prospecting activities. • Rehabilitate the land as soon as the disturbing activity has ceased.

Aspect	Management principles	Management measures
Natural vegetation	• To limit habitat disturbance • To rehabilitate disturbed areas with indigenous vegetation • To limit unnecessary habitat disturbance • To rehabilitate disturbed land with indigenous vegetation • To eradicate alien and invasive species	• Access to the site should be clearly demarcated. • Landscaping (if any) for the entire area should be undertaken with indigenous species endemic to the area. • Tall, indigenous tree species occurring on the site and in the general area should be preserved if possible at all. • The prospecting operation should preserve the large tree species and rehabilitate the herbaceous layer as stated in the ecological report. • Encroached areas should be cleared and rehabilitated after prospecting as improved faunal habitat. Monitoring of alien invasion and encroachment should be done over the longer term. • The landscape should be reshaped and allowed to be recolonized by grasses and pioneer weed species, although grasses could also be sown into the ground. • Construction teams and machinery should not be allowed outside the boundaries of the footprint of the prospecting. • The rehabilitated areas as well as areas managed by the company will be monitored on an annual basis to find invasive species and eradicate it. Invasive and alien plants should be identified and eradicated by implementation of an eradication programme. A monitoring program should be implemented afterwards to evaluate the success of the programme. • Landscaping should be with indigenous plants, endemic to the area.
Topography	• To limit impacts on land capability and the aesthetic quality of the environment • To reduce the negative visual impact of the prospecting activities residue deposits	• Ongoing rehabilitation and vegetation of the prospected areas must be done. • Final profile lines of rehabilitated areas must fit in with the character of the topography in the area. • Locate storm water diversion trenches to have the minimum impact on topography.
Soils	• To ensure that rehabilitation is done in a way that the minimum arable land is lost • To limit soil erosion and consequent degradation of soil and to limit soil, air and surface water pollution	• Procedure for soil pollution and handling of contamination-especially hydrocarbon contamination to be compiled. • Ongoing landscaping and vegetation – rehabilitation. • Vehicle maintenance only done in designated areas – spill trays, sumps to be used and managed according to the correct procedures.

Aspect	Management principles	Management measures
		• Vehicles and machines must be maintained properly to ensure that oil spillages are kept to a minimum. • Fuel and oil storage facilities should be bunded with adequate storm water management measures. • Implement rehabilitation program to curb existing erosion. • Maintenance and monitoring of erosion on an ongoing basis. • Soil contamination will be prevented by implementing mitigation measures as described under the sections dealing with Surface water and Groundwater.
Land use	• Limit development of incompatible land uses	Only the part necessary for prospecting would be used. The rest will be left undisturbed.
Animal life	• To limit habitat disturbance • To rehabilitate disturbed land	• Potential habitat for the fauna needs to be preserved as far as possible. • Monitoring procedures needs to be implemented to ensure that sensitive habitats are not negatively impacted on. • Birds should still be allowed to move from their feeding areas towards their breeding habitats and back. The prospecting activities won't have any significant impact on bird behaviour in this regard. • The habitat of the species classified as red data species or protected species under legislation needs to be preserved at all cost. • No animals may be captured, killed or hunted during the prospecting operational phase. • Corridors around the prospecting activities should be secured to ensure that small mammals can still move between habitat types surrounding the proposed prospecting sites. • Poisons for the control of rats and mice should only be used after approval by an ecologist. • A diverse collection of reptile species might occur in the area, and care should be taken during prospecting not to harm the surrounding potential habitats like outcrops outside the prospecting area. • Roads should be designed without pavements to allow for the movement of smaller animals because it creates a physical barrier.
Visual aspects	To limit negative visual impacts	• Rehabilitate areas when appropriate-and as

Aspect	Management principles	Management measures
	associated with the construction of the crushing and screening plant	soon as possible after prospecting is ended in that area. • Use screening vegetation to reduce the visual impact of the crushing and screening plant. • Screens must also be planted to screen the pit and limit the visual impact thereof. • Lights at night must shine inwards and down to present the smallest impact possible. • Dust mitigation must be done to limit the visual annoyance of dust.
Post-prospecting	• To leave all affected areas in a safe condition • To ensure that the prospecting areas rehabilitated according to prescriptions • To shape and prepare the rehabilitation areas to blend in with the surrounding environment. • To rehabilitate all disturbed areas to a suitable post closure land use • To comply to all the necessary post closure air, water quality objectives • To manage the social impact of closure on personnel who became redundant due to closure • To keep all the post closure monitoring in place and to ensure that the necessary reporting is done to the authorities and interested and affected parties	• Plant vegetation species for rehabilitation that will effectively bind the loose material and which can absorb run-off from the prospecting areas. • Rehabilitate all the land where infrastructure has been demolished. • Monitor the establishment of the vegetation cover on the rehabilitated sites to the point where it is self sustaining. • Protect rehabilitation areas until the area is self sustaining. • Monitor and manage invader species and alien species on the rehabilitated land until the natural vegetation can outperform the invaders or aliens. • Diversion trenches and storm water measures must be maintained • Water management facilities will stay operational and maintained and monitored until such a stage is reached where it is no longer necessary. • The prospecting areas will be shaped to make it safe.

11 DISCUSSION

Most development has an impact on the environment. In this case the area on which the prospecting footprint will be impact will be cleared, therefore directly impacting on the environment. At the end of the prospecting activties, rehabilitation measures will be implemented and natural vegetation will re-establish on the area. The prospecting will still have a moderate impact on the vegetation even though some of the areas have been completely modified. Detailed ecological (fauna habitat & flora) surveys were conducted during March 2016 to verify the ecological sensitivity and ecological components of the site at ground level.

Considering the results from the field surveys, mitigation needs to be implemented to reduce the impacts from Moderate or High (without mitigation) to Negligible or Low (with mitigation). This will prevent any negative impacts on the ecosystem and will in all probability allow the degraded areas to recover to an enhanced state compared to the current state of the site. Considering the Springbokvlakte Thornveld and Mountain Bushveld vegetation types to be under constant pressure from prospecting activities, the preservation of natural corridors in the area should be considered a high priority. This will ensure that the ecosystem will still function normally. A sensitivity analyses was conducted to identify the specific sensitive areas where management measures should be implemented. From these investigation and ecological surveys the following main observations was made:

- The vegetation of the plains where limited degradation has occurred and can be considered as being in a natural state has a medium sensitivity. The prospecting development can be supported in this area, although specific mitigation measures should be implemented to ensure that impacts are kept to a minimum.

- The degraded areas (old fields, cultivated land) as well as the areas surrounding the villages have a low sensitivity and have a low conservation priority. These areas are highly suitable for the prospecting development.

- The degraded land that still has some indigenous elements present and that occurs further away from already modified areas such as villages or cultivated land can be rehabilitated and therefore has a moderate to low sensitivity. Prospecting can be supported in this degraded and overgrazed area;

- The mountainous terrain and major drainage features in the area play an important role as corridors and are classified as having a HIGH sensitivity. These areas should preferably be avoided, although no prospecting is planned for these areas at present.

Although the prospecting will modify small areas, the impact on the ecosystem functioning will be limited if rehabilitation measures are implemented correctly through the development of a rehabilitation plan for the site. However, the impact should still be monitored during constructional

phase to prevent any negative impacts on the surrounding areas.

12 CONCLUSION

All aspects of the environment, especially living organisms, are vulnerable to disturbance of their habitat. If we can bring about a more integrated approach to living within our ecosystems, we are much more likely to save the fundamental structure of biodiversity. Positive contributions can be made even on a small scale such as within the proposed Moletlane Prospecting area. All stakeholders, such as business, government and environmental groups need to be involved to avoid a staggering loss of biodiversity in the decades and centuries ahead.

The prospecting activities will completely modify the natural vegetation and faunal habitats. The importance of rehabilitation and implementation of mitigation processes to prevent negative impacts on the environment during and after the development phase of the prospecting should be considered a high priority. The proposed site for the development does not occur in a unique vegetation entity on the lower lying plains in relation to the larger surrounding landscape, although the vegetation associated with the mountainous areas and the riverine areas are sensitive entities that provide valuable habitat features for a large variety of flora and fauna. These proposed corridors need to be considered high priority biodiversity management areas where limited impacts should occur.

Provided that the proposed prospecting area is consistent with the sensitivity map and take all the mitigation measures into consideration stipulated in this report, the planned prospecting development can be supported.

13 REFERENCES

Acocks, J.P.H. 1988. Veld types of South Africa, 3rd ed. Memoirs of the Botanical Survey of South Africa. 57: 1–146.

Branch, B. (1998).Field guide to snakes and other reptiles of Southern Africa.Struik Publishers. Cape Town.

Bredenkamp, G.J. & Brown, L.R. 2001. Vegetation – A reliable ecological basis for environmental planning. Urban Greenfile Nov-Dec 2001: 38-39.

Briza publications. 2001. Problem plants of South Africa. Pretoria.

Enpat, 2000.Environmental Potential Atlas.Department of Environmental Affairs and Tourism, Pretoria.

Fabian, A & Germishuizen, G. 1997. Wild flowers of Northern South Africa. Fernwood Press.

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

Germishuizen, G. and Clarke, B. (2003). Illustrated Guide to the Wildflowers of Northern South Africa. Briza Publications, Pretoria

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V., and Brown, C.J. (1997).The Atlas of Southern African Birds.Vol 1 & 2. BirdLife South Africa, Johannesburg.

Mucina L., Rutherford M.C. & Powrie L.W. (eds) (2005). Vegetation Map of South Africa, Lesotho and Swaziland, 1:1000000 scale sheet maps.

Mucina, L & Rutherford, M. C. 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19, SANBI, Pretoria.

Manning, J. 2001. South African Wild Flower guide: Eastern Cape. NBD / Paarl Print, Cape Town.

Manning, J. (2003). Photographic Guide to the Wildflowers of South Africa. Briza Publications.

Pretoria.

Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. and Kloepfer, D. (2004).Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. Smithsonian Institute, Washington, DC.

Onderstall, J. (1996). Wild Flower Guide for Mpumalanga and Northern Province. DynamicAd. Nelspruit.

Palgrave, M.C. (2002). Trees of Southern Africa.Struik Publishers.Cape Town.

Pooley, E. 1998. A field guide to wild flowers of Kwazulu Natal and the Eastern Region. Natal Flora Publications Trust.

Smithers, R.H.N. (1983). Soogdiere van die Suider-Afrikaanse Substreek. Universiteit van Pretoria. Pretoria

Van Der Merwe, C. R. 1952. Soil Groups and subgroups of South Africa. Science Bulletin356.

Van Wyk, B & Malan, S. 1988. Field Guide to the wild flowers of the Highveld. Struik Publishers.

Van Wyk, B. & Van Wyk, P. 1997. Field Guide to Trees of Southern Africa. Struik Publishers. Cape Town.

Van Oudtshoorn, F. (1991) Gids tot grasse van Suid Afrika. Briza Publikasies. Pretoria.

WERGER, M.J.A. 1978. Biogeography and Ecology of Southern Africa. Monographie Biologicae vol. 31. Junk, The Hague.

WHITE, F. 1983. The vegetation of Africa: a descriptive memoir to accompany the UNESCO/AETFAT/UNSO vegetation map of Africa. UNESCO, Paris, France.

APPENDIX A. PLANT SPECIES LISTS

1. Mountain bushveld

Woody species
Senegalia burkei
Senegalia caffra
Vachellia nilotica
Senegalia senegalensis
Vachellia tortilis
Aloe marlothii
Boscia albitrunca
Boscia foetida
Combretum apiculatum
Commiphora marlothii
Commiphora mollis
Commiphora pyracanthoides
Commiphora pyracanthoides
Commiphora tenuipetiolata
Croton gratissimus
Croton menyhartii
Dalbergia melanoxylon
Dichrostachys cinerea
Dodonaea angustifolia
Dombeya burgessiae
Dombeya rotundifolia
Ehretia rigida
Euphorbia cooperi
Euphorbia tirucalli
Ficus abutifolia
Grewia bicolor
Grewia flava
Grewia flavescens
Grewia vernicosa
Grewia villosa
Hexalobus monopetalus
Kirkia wilmsii
Ochna pretoriensis
Pappea capensis
Peltophorum africanum
Psydrax livida
Sclerocarya birrea
Searsia magalismontana
Sterculia rogersii
Tinnia rhodesiana
Triaspis glaucophylla
Ximenia americana
Zanthoxylum capensis
Ziziphus mucronata

Grasses
Aristida spp.
Brachiaria nigropedata
Cymbopogon excavates
Digitaria eriantha
Enneapogon scoparius
Enteropogon macrostachys
Eragrostis lehmanniana
Eragrostis rigidior
Heteropogon contortus
Melinis repens
Panicum maximum
Schmidtia pappophoroides
Setaria lindenbergiana
Stipagrostis uniplumis
Themeda triandra
Trichoneura grandiglumis
Urochloa mosambicensis
Urochloa panicoides

Herbs/Forbs
Abutilon angulatum
Abutilon angulatum
Achyranthes aspera
Aloe castanea
Aloe cryptopoda
Barleria obtusa
Barleria pretoriensis
Blepharis subvolubilis
Cereus jamacaru
Coccinia adoense
Commelina africana
Convolvulus sagittatus
Cucumis zeyheri
Dicliptera eeni
Euphorbia schinzii
Fimbrystylis hispidula
Gomphrena celasoides
Hermbstaedtia odorata
Indigofera daleioides
Ipomoea obscura
Jamesbrittenia aurentiaca
Kalanchoe paniculata
Lantana rugosa
Melhania prostrata
Ocimum americanum
Opuntia ficus-indica
Pavonia burchelli

Pellaea calomelanos
Plectranthus madagascariensis
Sarcostemma viminale
Schkuria pinnata
Sida alba
Silene burchelli
Solanum incanum
Stylochiton natalense
Thesium utile
Waltheria indica
Zansevieria hyacinthoides

2. Degraded grassland / woodland

Woody species
Vachellia karroo
Senegallia mellifera
Vachellia nilotica
Senegalia senegalensis
Vachellia tortilis
Aloe marlothii
Balanites maughammi
Boscia albitrunca
Boscia albitrunca
Boscia foetida
Commiphora mollis
Commiphora pyracanthoides
Dalbergia melanoxylon
Dichrostachys cinerea
Grewia bicolor
Grewia flava
Grewia flavescens
Sclerocarya birrea
Spiorstachys africana
Ziziphus mucronata

Grasses
Aristida spp.
Brachiaria deflexa
Brachiaria serrata
Chloris virgata
Cynodon dactylon
Enneapogon scoparius
Eragrostis lehmanniana
Melinis repens
Panicum maximum
Pennisetum clandestinum
Schmidtia pappophoroides
Sporobolus africanus

Sporobolus pyramidalis
Urochloa mosambicensis
Urochloa panicoides

Herbs/Forbs
Achyranthes aspera
Agave sessilana
Aloe cryptopoda
Aptosimum lineare
Bidens pilosa
Cadaba apylla
Coccinia adoense
Commelina erecta
Crabbea hirsuta
Cucumis zeyheri
Dicerocarium eriocarpum
Euphorbia schinzii
Felicia muricata
Geigeria burkei
Gomphocarpus fruticosus
Gomphrena celasoides
Heliotropium steudneri
Hermannia spp.
Hermbstaedtia odorata
Ipomoea purpurea
Kohautia virgata
Leonotis leonorus
Lippia javanica
Neurautanenia ficifolius
Opuntia ficus-indica
Sansevieria pearsonni
Senna italica
Sesamum triphyllum
Solanum incanum
Solanum panduriforme
Tagetes minuta
Thesium utile
Ursinia nana
Viscum rotundifolium
Waltheria indica
Xanthium strumarium

3. Vegetation associated with the major rivers and pans

Woody species
Senegalia ataxacantha
Acacia galpinni
Vachellia karroo
Vachellia nilotica

Vachellia tortilis
Albizia versicolor
Boscia albitrunca
Boscia foetida
Carissa bispinosa
Combretum imberbe
Dalbergia melanoxylon
Dichrostachys cinerea
Diospyros lycioides
Euclea undulata
Faidherbia albida
Flueggia virosa
Gardenia volkensii
Grewia bicolor
Grewia flava
Grewia flavescens
Gymnosporia buxifolia
Gymnosporia senegalensis
Hippocratea longipetiolata
Jatropha gossypifolia
Nicotiana glauca
Pappea capensis
Plumbago auriculata
Schotia brachypetala
Sclerocarya birrea
Searsia engleri
Searsia pyroides
Sesbania spp.
Ximenia americana
Ziziphus mucronata

Grasses
Aristida spp.
Cynodon dactylon
Eragrostis trichophora
Fingerhutia africana
Heteropogon contortus
Panicum deustum
Panicum maximum
Phragmites australis
Schmidtia pappophoroides
Setaria sphacelata
Sporobolus africanus
Sporobolus iocladus
Urochloa panicoides

Herbs/Forbs
Agrimonia procera
Aptosimum lineare

Asparagus suaveolens
Coccinia adoense
Conyza bonariensis
Cucumis zeyheri
Cyanotis speciosa
Datura stramonium
Flaveria bidentis
Geigeria burkei
Gomphocarpus fruticosus
Hermbstaedtia linearis
Hibiscus callyphyllus
Kalanchoe paniculata
Opuntia ficus-indica
Pavonia burchelli
Schkuria pinnata
Sida alba
Solanum panduriforme
Tribulus terrestris
Xanthium strumarium
Zansevieria hyacinthoides

4. *Senegallia mellifera woodland*

Woody species
Acacia grandicornouta
Vachellia karroo
Senegallia mellifera
Senegallia mellifera
Vachellia nilotica
Senegalia senegalensis
Vachellia tortilis
Aloe marlothii
Balanites maughammi
Boscia albitrunca
Boscia foetida
Commiphora pyracanthoides
Croton menyharti
Dalbergia melanoxylon
Dichrostachys cinerea
Gardenia volkensii
Grewia bicolor
Grewia flava
Grewia vernicosa
Grewia villosa
Hippocratea longipeteolata
Kirkia wilmsii
Mundulea sericea
Peltophorum africanum

Sclerocarya birrea
Sterculia rogersii
Ximenia americana
Ziziphus mucronata

Grasses
Aristida spp.
Digitaria eriantha
Enneapogon scoparius
Eragrostis lehmanniana
Eragrostis trichophora
Panicum maximum
Schmidita pappophoroides
Stipagrotis uniplumis

Herbs/Forbs
Achyranthes aspera
Aloe cryptopoda
Crabbea hirsita
Dicerocarium eriocarpum
Euphorbia schinzii
Felicia muricata
Geigeria burkei
Kalanchoe paniculata
Kalanchoe thyrsiflora
Opuntia ficus-indica
Plectranthus madagascariensis
Polygala hottentotta
Selaginella dregei
Sepupia cana
Sida alba
Solanum supinum
Thesium utile
Waltheria indica
Zansevieria pearsonii

APPENDIX B –PLANT SPECIES LIST FOR QUARTER DEGREE GRID SQUARE

Family	Species	Threat status	Growth forms
LORANTHACEAE	Agelanthus natalitius (Meisn.) Polhill & Wiens subsp. zeyheri (Harv.)	LC	Parasite, shrub, succulent
ASPHODELACEAE	Aloe greatheadii Schönland var. greatheadii	LC	Herb, succulent
AMARANTHACEAE	Amaranthus thunbergii Moq.	LC	Herb
ANNONACEAE	Annona senegalensis Pers. subsp. senegalensis	LC	Shrub, tree
RUBIACEAE	Anthospermum rigidum Eckl. & Zeyh. subsp. rigidum	LC	Dwarf shrub
POACEAE	Aristida congesta Roem. & Schult. subsp. barbicollis (Trin. & Rupr.)	LC	Graminoid
ASPARAGACEAE	Asparagus cooperi Baker	LC	Dwarf shrub, shrub
ASPARAGACEAE	Asparagus setaceus (Kunth) Jessop	LC	Shrub
ASPARAGACEAE	Asparagus suaveolens Burch.	LC	Shrub
FABACEAE	Bolusanthus speciosus (Bolus) Harms	LC	Tree
CAPPARACEAE	Boscia foetida Schinz subsp. rehmanniana (Pestal.) Toelken	LC	Tree
POACEAE	Bothriochloa insculpta (Hochst. ex A.Rich.) A.Camus	LC	Graminoid
POACEAE	Brachiaria nigropedata (Ficalho & Hiern) Stapf	LC	Graminoid
POACEAE	Bromus diandrus Roth	Not Evaluated	Graminoid
POACEAE	Chloris gayana Kunth	LC	Graminoid
POACEAE	Chloris virgata Sw.	LC	Graminoid
CUCURBITACEAE	Citrullus lanatus (Thunb.) Matsum. & Nakai	LC	Climber, herb, succulent
LAMIACEAE	Clerodendrum glabrum E.Mey.	LC	Shrub, tree
CUCURBITACEAE	Coccinia sessilifolia (Sond.) Cogn.	LC	Climber, herb, succulent
COMBRETACEAE	Combretum molle R.Br. ex G.Don	LC	Tree
BURSERACEAE	Commiphora schimperi (O.Berg) Engl.	LC	Shrub, tree
FABACEAE	Crotalaria sphaerocarpa Perr. ex DC. subsp. sphaerocarpa	LC	Herb
CUCURBITACEAE	Cucumis africanus L.f.	LC	Herb
CUCURBITACEAE	Cucumis anguria L. var. longaculeatus J.H.Kirkbr.	LC	Climber, herb
POACEAE	Cymbopogon pospischilii (K.Schum.) C.E.Hubb.	Not Evaluated	Graminoid
CYPERACEAE	Cyperus usitatus Burch.	LC	Cyperoid, geophyte, herb, mesophyte
VITACEAE	Cyphostemma spinosopilosum (Gilg & M.Brandt) Desc.	LC	Scrambler, succulent
POACEAE	Dactyloctenium aegyptium (L.) Willd.	LC	Graminoid
POACEAE	Digitaria argyrograpta (Nees) Stapf	LC	Graminoid
EBENACEAE	Diospyros lycioides Desf. subsp. lycioides	LC	Shrub
EBENACEAE	Diospyros lycioides Desf. subsp. sericea (Bernh.) De Winter	LC	Shrub, tree
ACANTHACEAE	Dyschoriste rogersii S.Moore	LC	Dwarf shrub, shrub
BORAGINACEAE	Ehretia rigida (Thunb.) Druce subsp. nervifolia Retief & A.E.van Wyk	LC	Shrub
FABACEAE	Elephantorrhiza elephantina (Burch.) Skeels	LC	Dwarf shrub, shrub, suffrutex
POACEAE	Elionurus muticus (Spreng.) Kunth	LC	Graminoid
POACEAE	Eragrostis barbinodis Hack.	LC	Graminoid
POACEAE	Eragrostis superba Peyr.	LC	Graminoid
POACEAE	Eragrostis viscosa (Retz.) Trin.	LC	Graminoid
LORANTHACEAE	Erianthemum ngamicum (Sprague) Danser	LC	Parasite, shrub, succulent
EBENACEAE	Euclea crispa (Thunb.) Gürke subsp. crispa	LC	Shrub, tree
EBENACEAE	Euclea natalensis A.DC. subsp. angustifolia F.White	LC	Shrub, tree

Family	Species	Threat status	Growth forms
EBENACEAE	Euclea undulata Thunb.	LC	Shrub, tree
ORCHIDACEAE	Eulophia leachii Greatrex ex A.V.Hall	LC	Geophyte, herb, succulent
ORCHIDACEAE	Eulophia ovalis Lindl. var. bainesii (Rolfe) P.J.Cribb & la Croix	LC	Geophyte, herb
ORCHIDACEAE	Eulophia speciosa (R.Br. ex Lindl.) Bolus	Declining	Geophyte, herb, succulent
EUPHORBIACEAE	Euphorbia enormis N.E.Br.	LC	Shrub, succulent
EUPHORBIACEAE	Euphorbia maleolens E.Phillips	LC	Dwarf shrub, shrub, succulent
POACEAE	Eustachys paspaloides (Vahl) Lanza & Mattei	LC	Graminoid
ASTERACEAE	Felicia mossamedensis (Hiern) Mendonça	LC	Herb
MORACEAE	Ficus abutilifolia (Miq.) Miq.	LC	Shrub, tree
MORACEAE	Ficus salicifolia Vahl	LC	Tree
POACEAE	Fingerhuthia africana Lehm.	LC	Graminoid
PHYLLANTHACEAE	Flueggea virosa (Roxb. ex Willd.) Voigt subsp. virosa	LC	Shrub, tree
COLCHICACEAE	Gloriosa superba L.	LC	Climber, geophyte
MALVACEAE	Gossypium herbaceum L. subsp. africanum (Watt) Vollesen	LC	Shrub
MALVACEAE	Grewia vernicosa Schinz	LC	Dwarf shrub, shrub
ASTERACEAE	Helichrysum nudifolium (L.) Less. var. nudifolium	LC	Herb
RHAMNACEAE	Helinus integrifolius (Lam.) Kuntze	LC	Climber, shrub
BORAGINACEAE	Heliotropium giessii Friedr.-Holzh.	LC	Herb
BORAGINACEAE	Heliotropium strigosum Willd.	LC	Herb
MALVACEAE	Hermannia lancifolia Szyszyl.	LC	Herb
MALVACEAE	Hibiscus praeteritus R.A.Dyer	LC	Herb
MALVACEAE	Hibiscus trionum L.		Herb
VIOLACEAE	Hybanthus enneaspermus (L.) F.Muell. var. enneaspermus	Not Evaluated	Herb
POACEAE	Hyparrhenia hirta (L.) Stapf	LC	Graminoid
HYPOXIDACEAE	Hypoxis rigidula Baker var. rigidula	LC	Geophyte, herb
FABACEAE	Indigofera circinnata Benth. ex Harv.	LC	Dwarf shrub, herb
FABACEAE	Indigofera heterotricha DC.	LC	Dwarf shrub, herb
CONVOLVULACEAE	Ipomoea adenioides Schinz var. adenioides	LC	Dwarf shrub, shrub
CONVOLVULACEAE	Ipomoea magnusiana Schinz	LC	Herb
CONVOLVULACEAE	Ipomoea oblongata E.Mey. ex Choisy	LC	Herb, succulent
CONVOLVULACEAE	Ipomoea papilio Hallier f.	LC	Herb
CONVOLVULACEAE	Ipomoea sinensis (Desr.) Choisy subsp. blepharosepala	LC	Climber, herb
KIRKIACEAE	Kirkia wilmsii Engl.	LC	Tree
CYPERACEAE	Kyllinga alba Nees	LC	Cyperoid, herb, mesophyte
VERBENACEAE	Lantana rugosa Thunb.	LC	Shrub
HYACINTHACEAE	Ledebouria marginata (Baker) Jessop	LC	Geophyte
POACEAE	Leptochloa eleusine (Nees) Cope & N.Snow	LC	Graminoid
VERBENACEAE	Lippia javanica (Burm.f.) Spreng.	LC	Shrub
MAESACEAE	Maesa lanceolata Forssk.	LC	Shrub, tree
MALVACEAE	Melhania transvaalensis Szyszyl.	LC	Dwarf shrub
MALVACEAE	Melhania virescens (K.Schum.) K.Schum.	LC	Dwarf shrub

Family	Species	Threat status	Growth forms
POACEAE	Microchloa caffra Nees	LC	Graminoid
OLEACEAE	Olea europaea L. subsp. africana (Mill.) P.S.Green	LC	Shrub, tree
ANACARDIACEAE	Ozoroa insignis Delile subsp. reticulata (Baker f.) J.B.Gillett		Shrub, tree
POACEAE	Panicum coloratum L. var. coloratum	LC	Graminoid
POACEAE	Panicum maximum Jacq.	LC	Graminoid
RUBIACEAE	Pavetta schumanniana F.Hoffm. ex K.Schum.	LC	Shrub, tree
FABACEAE	Pterocarpus rotundifolius (Sond.) Druce subsp. rotundifolius	LC	Shrub, tree
PEDALIACEAE	Pterodiscus speciosus Hook.	LC	Succulent, suffrutex
APOCYNACEAE	Raphionacme velutina Schltr.	LC	Geophyte, herb, succulent
FABACEAE	Rhynchosia spectabilis Schinz	LC	Dwarf shrub, herb, shrub
POACEAE	Schizachyrium jeffreysii (Hack.) Stapf	LC	Graminoid
ANACARDIACEAE	Sclerocarya birrea (A.Rich.) Hochst. subsp. caffra (Sond.) Kokwaro	LC	Tree
ANACARDIACEAE	Searsia dentata (Thunb.) F.A.Barkley	LC	Shrub, tree
ANACARDIACEAE	Searsia engleri (Britten) Moffett	LC	Shrub, tree
GENTIANACEAE	Sebaea erosa Schinz	LC	Herb
POACEAE	Setaria incrassata (Hochst.) Hack.	LC	Graminoid
POACEAE	Setaria sphacelata (Schumach var. torta (Stapf) Clayton	LC	Graminoid
POACEAE	Setaria sphacelata (Schumach.) var. sphacelata	LC	Graminoid
POACEAE	Setaria verticillata (L.) P.Beauv.	LC	Graminoid
MALVACEAE	Sida dregei Burtt Davy	LC	Dwarf shrub, herb
POACEAE	Sporobolus fimbriatus (Trin.) Nees	LC	Graminoid
STRYCHNACEAE	Strychnos spinosa Lam. subsp. spinosa	LC	Shrub, tree
LORANTHACEAE	Tapinanthus oleifolius (J.C.Wendl.) Danser	LC	Parasite, shrub, succulent
FABACEAE	Teramnus labialis (L.f.) Spreng. subsp. labialis	LC	Climber, herb
ACANTHACEAE	Thunbergia neglecta Sond.	LC	Herb, scrambler
POACEAE	Tragus berteronianus Schult.	LC	Graminoid
CELTIDACEAE	Trema orientalis (L.) Blume	LC	Shrub, tree
POACEAE	Tricholaena monachne (Trin.) Stapf & C.E.Hubb.	LC	Graminoid
POACEAE	Trichoneura grandiglumis (Nees) Ekman	LC	Graminoid
TURNERACEAE	Tricliceras longepedunculatum (Mast.) R.Fern. var. longepedunculatum	LC	Herb
POACEAE	Tristachya rehmannii Hack.	LC	Graminoid
POACEAE	Urochloa oligotricha (Fig. & De Not.) Henrard	LC	Graminoid
RUBIACEAE	Vangueria madagascariensis J.F.Gmel.	LC	Shrub, tree
ASTERACEAE	Vernonia fastigiata Oliv. & Hiern	LC	Herb
VISCACEAE	Viscum combreticola Engl.	LC	Parasite, shrub, succulent
VISCACEAE	Viscum verrucosum Harv.	LC	Parasite, shrub, succulent
MALVACEAE	Waltheria indica L.	LC	Herb
OLACACEAE	Ximenia americana L. var. microphylla Welw. ex Oliv.	LC	Shrub, tree
OLACACEAE	Ximenia caffra Sond. var. caffra	LC	Shrub, tree
OLACACEAE	Ximenia caffra Sond. var. natalensis Sond.	LC	Shrub, tree

APPENDIX C. BIRD SPECIES LIST

Rob	English Name	Map Status
1	Ostrich	R-C
6	Great Crested Grebe	R-U
8	Dabchick	R-VC
50	Pinkbacked Pelican	R-U
55	Whitebreasted Cormorant	R-VC
58	Reed Cormorant	R-VC
60	Darter	R-U
62	Grey Heron	R-C
63	Blackheaded Heron	R-VC
64	Goliath Heron	R-U
65	Purple Heron	R-C
66	Great White Egret	R-C
67	Little Egret	R-C
68	Yellowbilled Egret	R-U
69	Black Egret	R-U
71	Cattle Egret	R-A
72	Squacco Heron	R-C
74	Greenbacked Heron	R-U
76	Blackcrowned Night Heron	R-U
77	Whitebacked Night Heron	R-U
78	Little Bittern	R-U
79	Dwarf Bittern	BM-U
81	Hamerkop	R-VC
83	White Stork	NBM-C
84	Black Stork	R-C
85	Abdim's Stork	NBM-U
89	Marabou Stork	R-U
90	Yellowbilled Stork	NBM-U
91	Sacred Ibis	R-VC
92	Bald Ibis	E-C
93	Glossy Ibis	R-U
94	Hadeda Ibis	R-VC
95	African Spoonbill	R-U
96	Greater Flamingo	R-U
97	Lesser Flamingo	R-U
99	Whitefaced Duck	R-VC
100	Fulvous Duck	R-U
101	Whitebacked Duck	R-U
102	Egyptian Goose	R-VC
104	Yellowbilled Duck	R-U
105	African Black Duck	R-C
106	Cape Teal	R-U
107	Hottentot Teal	R-U

Rob	English Name	Map Status
108	Redbilled Teal	R-U
109	Pintail	V #
112	Cape Shoveller	E-U
113	Southern Pochard	R-U/C
114	Pygmy Goose	R-U
115	Knobbilled Duck	R-C
116	Spurwinged Goose	R-C
117	Maccoa Duck	R-U
118	Secretarybird	R-C
120	Egyptian Vulture	V #
122	Cape Vulture	E-C
123	Whitebacked Vulture	R-U
124	Lappetfaced Vulture	R-C
126	Black Kite	NBM-U
126.1	Yellowbilled Kite	BM-C
127	Blackshouldered Kite	R-VC
128	Cuckoo Hawk	R-U
130	Honey Buzzard	NBM-U
131	Black Eagle	R-C
132	Tawny Eagle	R-U
133	Steppe Eagle	NBM-U
135	Wahlberg's Eagle	BM-U/C
136	Booted Eagle	NBM-U
137	African Hawk Eagle	R-C
138	Ayres' Eagle	NBM-U
140	Martial Eagle	R-C
142	Brown Snake Eagle	R-C
143	Blackbreasted Snake Eagle	R-C
148	African Fish Eagle	R-U/C
149	Steppe Buzzard	NBM-C
152	Jackal Buzzard	E-U/VC
154	Lizard Buzzard	R-C
156	Ovambo Sparrowhawk	R-U
157	Little Sparrowhawk	R-U
158	Black Sparrowhawk	R-C
159	Little Banded Goshawk	R-U
160	African Goshawk	R-C
161	Gabar Goshawk	R-C
162	Pale Chanting Goshawk	E-U
164	Eurasian Marsh Harrier	NBM-U
165	African Marsh Harrier	R-U
166	Montagu's Harrier	NBM-U
167	Pallid Harrier	NBM-U
169	Gymnogene	R-C

Rob	English Name	Map Status
170	Osprey	NBM-U
171	Peregrine Falcon	NBM-U
172	Lanner Falcon	R-C
173	Northern Hobby Falcon	NBM-C
179	Western Redfooted Kestrel	NBM-U
180	Eastern Redfooted Kestrel	NBM-U/C
181	Rock Kestrel	R-U
182	Greater Kestrel	R-U
183	Lesser Kestrel	NBM-C
188	Coqui Francolin	R-C
189	Crested Francolin	R-VC
191	Shelley's Francolin	R-C
196	Natal Francolin	E-U/VC
199	Swainson's Francolin	E-VC
200	Common Quail	R-U
201	Harlequin Quail	BM-U
203	Helmeted Guineafowl	R-VC
205	Kurrichane Buttonquail	R-U
208	Blue Crane	E-U
210	African Rail	R-C
211	Corncrake	NBM-U
212	African Crake	BM-U
213	Black Crake	R-C
214	Spotted Crake	Rare
215	Baillon's Crake	R-U
217	Redchested Flufftail	R-U
223	Purple Gallinule	R-U
226	Common Moorhen	R-C
227	Lesser Moorhen	BM-U
228	Redknobbed Coot	R-C
229	African Finfoot	R-U
231	Stanley's Bustard	NBM-U
233	Whitebellied Korhaan	E-U/C
237	Redcrested Korhaan	E-VC
239.1	Whitewinged Korhaan	E-VC
240	African Jacana	R-U
242	Old World Painted Snipe	R-C
245	Ringed Plover	NBM-U
248	Kittlitz's Plover	R-C
249	Threebanded Plover	R-VC
252	Caspian Plover	NBM-U/C
255	Crowned Plover	R-VC
258	Blacksmith Plover	R-VC
260	Wattled Plover	R-U/VC

Rob	English Name	Map Status
264	Common Sandpiper	NBM-C
265	Green Sandpiper	NBM-U
266	Wood Sandpiper	NBM-C
269	Marsh Sandpiper	NBM-C
270	Greenshank	NBM-C
272	Curlew Sandpiper	NBM-C
274	Little Stint	NBM-C
281	Sanderling	NBM-U
284	Ruff	NBM-U
286	Ethiopian Snipe	R-U
290	Whimbrel	NBM-U
294	Pied Avocet	R-U
295	Blackwinged Stilt	R-C
297	Spotted Dikkop	R-C
300	Temminck's Courser	R-C
303	Bronzewinged Courser	NBM-U
315	Greyheaded Gull	R-U
338	Whiskered Tern	BM-U/C
339	Whitewinged Tern	NBM-C
347	Doublebanded Sandgrouse	E-C
348	Feral Pigeon	R-C
349	Rock Pigeon	R-VC
350	Rameron Pigeon	R-U
352	Redeyed Dove	R-VC
354	Cape Turtle Dove	R-A
355	Laughing Dove	R-A
356	Namaqua Dove	R-VC
358	Greenspotted Dove	R-A
361	African Green Pigeon	R-U
373	Grey Lourie	R-A
374	Eurasian Cuckoo	NBM-U
375	African Cuckoo	BM-U
377	Redchested Cuckoo	BM-C
378	Black Cuckoo	BM-U
380	Great Spotted Cuckoo	BM-U
381	Striped Cuckoo	BM-U
382	Jacobin Cuckoo	BM-C
385	Klaas's Cuckoo	BM-U
386	Diederik Cuckoo	BM-C
391	Burchell's Coucal	R-VC
392	Barn Owl	R-C
393	Grass Owl	R-U
395	Marsh Owl	R-C
396	African Scops Owl	R-C

Rob	English Name	Map Status
397	Whitefaced Owl	R-C
398	Pearlspotted Owl	R-C
400	Cape Eagle Owl	R-U
401	Spotted Eagle Owl	R-C
402	Giant Eagle Owl	R-U
404	Eurasian Nightjar	NBM-U
405	Fierynecked Nightjar	R-C
406	Rufouscheeked Nightjar	BM-C
408	Freckled Nightjar	R-VC
411	Eurasian Swift	NBM-U
412	Black Swift	BM-U
415	Whiterumped Swift	BM-C
416	Horus Swift	BM-U
417	Little Swift	R-VC
418	Alpine Swift	BM-C
421	Palm Swift	R-C
424	Speckled Mousebird	R-VC
425	Whitebacked Mousebird	E-C
426	Redfaced Mousebird	R-VC
428	Pied Kingfisher	R-C
429	Giant Kingfisher	R-U
430	Halfcollared Kingfisher	R-U
431	Malachite Kingfisher	R-U
432	Pygmy Kingfisher	BM-C
433	Woodland Kingfisher	BM-U
435	Brownhooded Kingfisher	R-VC
437	Striped Kingfisher	R-VC
438	Eurasian Bee-eater	NBM-VC
441	Carmine Bee-eater	NBM-U
443	Whitefronted Bee-eater	R-C
444	Little Bee-eater	R-VC
445	Swallowtailed Bee-eater	R-U
446	Eurasian Roller	NBM-C
447	Lilacbreasted Roller	R-VC
449	Purple Roller	R-C
451	African Hoopoe	R-VC
452	Redbilled Woodhoopoe	R-VC
454	Scimitarbilled Woodhoopoe	R-VC
457	Grey Hornbill	R-C/VC
458	Redbilled Hornbill	R-U
459	Southern Yellowbilled Hornbill	E-VC
464	Blackcollared Barbet	R-VC
465	Pied Barbet	E-VC
470	Yellowfronted Tinker Barbet	R-VC

Rob	English Name	Map Status
473	Crested Barbet	R-VC
474	Greater Honeyguide	R-C
476	Lesser Honeyguide	R-U
478	Sharpbilled Honeyguide	R-U
481	Bennett's Woodpecker	R-U
483	Goldentailed Woodpecker	R-C
486	Cardinal Woodpecker	R-C
487	Bearded Woodpecker	R-U
489	Redthroated Wryneck	R-U
492	Melodious Lark	E-U
493	Monotonous Lark	E-U
494	Rufousnaped Lark	R-VC
496	Flappet Lark	R-U
497	Fawncoloured Lark	R-U
498	Sabota Lark	E-VC
501	Shortclawed Lark	E-U
506	Spikeheeled Lark	E-U
507	Redcapped Lark	R-U
515	Chestnutbacked Finchlark	R-C
518	Eurasian Swallow	NBM-VC
520	Whitethroated Swallow	BM-C
523	Pearlbreasted Swallow	R-U
524	Redbreasted Swallow	BM-C
526	Greater Striped Swallow	BM-VC
527	Lesser Striped Swallow	BM-VC
528	South African Cliff Swallow	NBM-U
529	Rock Martin	R-VC
530	House Martin	NBM-U
532	Sand Martin	NBM-U
533	Brownthroated Martin	R-C
534	Banded Martin	BM-U
538	Black Cuckooshrike	R-C
541	Forktailed Drongo	R-A
543	Eurasian Golden Oriole	NBM-U
545	Blackheaded Oriole	R-VC
547	Black Crow	R-VC
548	Pied Crow	R-A
552	Ashy Tit	E-C
554	Southern Black Tit	E-VC
557	Cape Penduline Tit	E-U
558	Grey Penduline Tit	R-U
560	Arrowmarked Babbler	R-VC
568	Blackeyed Bulbul	R-A
569	Terrestrial Bulbul	R-C

Rob	English Name	Map Status
572	Sombre Bulbul	R-VC
576	Kurrichane Thrush	R-VC
580	Groundscraper Thrush	R-VC
581	Cape Rockthrush	E-C
583	Shorttoed Rockthrush	E-U
586	Mountain Chat	E-C
587	Capped Wheatear	R-U
588	Buffstreaked Chat	E-C
589	Familiar Chat	R-C
593	Mocking Chat	R-C
595	Anteating Chat	E-U
596	Stonechat	R-VC
601	Cape Robin	R-VC
602	Whitethroated Robin	E-C
613	Whitebrowed Robin	R-VC
615	Kalahari Robin	E-VC
619	Garden Warbler	NBM-U
620	Whitethroat	NBM-U
621	Titbabbler	E-VC
625	Icterine Warbler	NBM-U
626	Olivetree Warbler	NBM-U
628	Great Reed Warbler	NBM-U
631	African Marsh Warbler	R-C
633	Eurasian Marsh Warbler	NBM-U
634	Eurasian Sedge Warbler	NBM-U
635	Cape Reed Warbler	R-C
638	African Sedge Warbler	R-C
643	Willow Warbler	NBM-C
645	Barthroated Apalis	R-VC
648	Yellowbreasted Apalis	R-VC
651	Longbilled Crombec	R-VC
653	Yellowbellied Eremomela	R-C
655	Greencapped Eremomela	R-U
656	Burntnecked Eremomela	R-C
657.1	Greybacked BleatingWarbler	R-VC
658	Desert Barred Warbler	E-U
661	Grassbird	E-C
664	Fantailed Cisticola	R-C
665	Desert Cisticola	R-C
666	Cloud Cisticola	R-U
667	Ayres' Cisticola	R-U
671	Tinkling Cisticola	R-U
672	Rattling Cisticola	R-VC
677	Levaillant's Cisticola	R-VC

Rob	English Name	Map Status
679	Lazy Cisticola	R-U
681	Neddicky	R-C
683	Tawnyflanked Prinia	R-VC
685	Blackchested Prinia	E-VC
689	Spotted Flycatcher	NBM-C
691	Bluegrey Flycatcher	R-C
693	Fantailed Flycatcher	R-U
694	Black Flycatcher	R-C
695	Marico Flycatcher	E-VC
696	Pallid Flycatcher	R-C
698	Fiscal Flycatcher	E-VC
700	Cape Batis	R-VC
701	Chinspot Batis	R-VC
706	Fairy Flycatcher	NBM-C
710	Paradise Flycatcher	BM-VC
711	African Pied Wagtail	R-U
713	Cape Wagtail	R-U/VC
714	Yellow Wagtail	NBM-C
716	Grassveld Pipit	R-VC
717	Longbilled Pipit	R-U
718	Plainbacked Pipit	R-U
719	Buffy Pipit	R-U
720	Striped Pipit	R-U
722	Tree Pipit	NBM-U
723	Bushveld Pipit	R-U
727	Orangethroated Longclaw	E-VC
731	Lesser Grey Shrike	NBM-C
732	Fiscal Shrike	R-A
733	Redbacked Shrike	NBM-VC
735	Longtailed Shrike	R-VC
736	Southern Boubou	E-VC
739	Crimsonbreasted Shrike	E-VC
740	Puffback	R-A
741	Brubru	R-VC
743	Threestreaked Tchagra	R-VC
744	Blackcrowned Tchagra	R-VC
747	Gorgeous Bush Shrike	R-VC
748	Orangebreasted Bush Shrike	R-VC
751	Greyheaded Bush Shrike	R-VC
753	White Helmetshrike	R-VC
754	Redbilled Helmetshrike	R-C
756	Whitecrowned Shrike	E-VC
760	Wattled Starling	R-VC
761	Plumcoloured Starling	BM-VC

Rob	English Name	Map Status
764	Glossy Starling	E-VC
769	Redwinged Starling	R-VC
772	Redbilled Oxpecker	R-U
774	Gurney's Sugarbird	E-U
775	Malachite Sunbird	R-U
779	Marico Sunbird	R-VC
785	Greater Doublecollared Sunbird	E-U
787	Whitebellied Sunbird	R-VC
792	Black Sunbird	R-VC
796	Cape White-eye	E-VC
799	Whitebrowed Sparrowweaver	R-VC
801	House Sparrow	R-VC
802	Great Sparrow	R-C
803	Cape Sparrow	E-A
804	Southern Greyheaded Sparrow	E-VC
805	Yellowthroated Sparrow	R-C
806	Scalyfeathered Finch	E-VC
807	Thickbilled Weaver	R-U
810	Spectacled Weaver	R-VC
811	Spottedbacked Weaver	R-VC
813	Cape Weaver	E-U
814	Masked Weaver	R-VC
815	Lesser Masked Weaver	R-U
819	Redheaded Weaver	R-U
820	Cuckoofinch	BM-U
821	Redbilled Quelea	R-VC
824	Red Bishop	R-VC
826	Golden Bishop	R-C
827	Yellowrumped Widow	R-VC
829	Whitewinged Widow	R-C
831	Redcollared Widow	R-U
832	Longtailed Widow	R-VC
833	Goldenbacked Pytilia	R-U
834	Melba Finch	R-VC
840	Bluebilled Firefinch	R-U
841	Jameson's Firefinch	R-C
842	Redbilled Firefinch	R-C
844	Blue Waxbill	R-A
845	Violeteared Waxbill	E-VC
846	Common Waxbill	R-VC
847	Blackcheeked Waxbill	R-C
850	Swee Waxbill	E-U
852	Quail Finch	R-C
854	Orangebreasted Waxbill	R-C

Rob	English Name	Map Status
855	Cutthroat Finch	R-C
856	Redheaded Finch	E-U
857	Bronze Mannikin	R-VC
860	Pintailed Whydah	R-VC
861	Shafttailed Whydah	E-VC
862	Paradise Whydah	R-VC
864	Black Widowfinch	R-U
865	Purple Widowfinch	R-U
867	Steelblue Widowfinch	R-C
869	Yelloweyed Canary	R-VC
870	Blackthroated Canary	R-VC
872	Cape Canary	R-U
878	Yellow Canary	E-U
881	Streakyheaded Canary	R-C
884	Goldenbreasted Bunting	R-VC
885	Cape Bunting	R-U
886	Rock Bunting	R-VC
887	Larklike Bunting	E-U

R=RESIDENT; E=ENDEMIC; BM=BREEDING MIGRANT; NBM=NON-BREEDING MIGRANT; V=VAGRANT; A=ABUNDANT; VC=VERY COMMON; C=COMMON; U=UNCOMMON; R=RARE

APPENDIX C MAMMAL SPECIES LIST

Scientific name	Vernacular name	Conservation status	Probability of occurrence
Acomys spinosissimus	Spiny Mouse	Least Concern	High
Aepyceros melampus	Impala	Least Concern	High
Aethomys ineptus	Tete Veld Rat	Least Concern	Moderate
Atelerix frontalis	South African Hedgehog	**Near threatened**	Moderate-High
Canis mesomelas	Black-backed Jackal	Least Concern	High
Caracal caracal	Caracal	Least Concern	Moderate
Cercopithecus aethiops pygerythrus	Vervet Monkey	Least Concern	High
Civettictis civetta	African Civet	Least Concern	Moderate
Crocidura cyanea	Reddish-grey Musk Shrew	Data deficient	High
Crocidura hirta	Lesser Red Musk Shrew	Data deficient	High
Cryptomys hottentotus	Common Molerat	Least Concern	High
Elephantulus myurus	Rock Elephant-shrew	Least Concern	High
Epomophorus wahlbergi	Wahlberg's Epauletted Fruit Bat	Least Concern	High
Felis silvestris	African Wild Cat	Least Concern	High
Galago moholi	Lesser Bushbaby	Least Concern	Moderate -High
Galerella sanguinea	Slender Mongoose	Least Concern	High
Genetta genetta	Small-spotted Genet	Least Concern	High
Genetta tigrina	Large-spotted Genet	Least Concern	High
Graphiurus murinus	Woodland Dormouse	Least Concern	High
Graphiurus platyops	Rock Dormouse	Data deficient	Moderate-High
Hyaena brunnea	Brown Hyaena	**Near threatened**	Moderate
Hystrix africaeaustralis	Cape Porcupine	Least Concern	High
Ictonyx striatus	Striped Polecat	Least Concern	Moderate -High
Lemniscomys rosalia	Single-striped Mouse	Data deficient	High
Lepus saxatilis	Scrub Hare	Least Concern	High
Mastomys coucha	Multimammate Mouse	Least Concern	High
Mellivora capensis	Honey Badger	**Near threatened**	Moderate-High
Miniopterus schreibersii	Schreiber's Long-fingered Bat	**Near threatened**	Low-moderate
Mungos mungo	Banded Mongoose	Least Concern	Moderate -High
Mus minutoides	Pygmy mouse	Least Concern	High
Myotis welwitschii	Welwitsch's Hairy Bat	**Near threatened**	Moderate -High
Neoromicia capensis	Cape Serotine Bat	Least Concern	High
Nycteris thebaica	Common Slit-faced Bat	Least Concern	High
Oreotragus oreotragus	Klipspringer	Least Concern	High
Orycteropus afer	Aardvark	Least Concern	Moderate -High
Otomys angoniensis	Angoni Vlei Rat	Least Concern	Moderate
Panthera pardus	Leopard	Least Concern	High
Papio ursinus	Chacma Baboon	Least Concern	High
Paraxerus cepapi	Tree squirrel	Least Concern	High
Phacochoerus africanus	Warthog	Least Concern	High
Pipistrellus hesperidus	Kuhl's Pipistrelle	Least Concern	High
Pipistrellus rusticus	Rusty Bat	**Near threatened**	Moderate
Potamochoerus porcus koiropotamus	Bushpig	Least Concern	Low-moderate
Procavia capensis	Rock Dassie	Least Concern	Moderate

Scientific name	Vernacular name	Conservation status	Probability of occurrence
Proteles cristatus	Aardwolf	Least Concern	Low-moderate
Raphicerus campestris	Steenbuck	Least Concern	High
Redunca fulvorufula	Mountain Reedbuck	Least Concern	High(visual observation)
Rhabdomys pumilio	Striped Mouse	Least Concern	Moderate -High
Rhinolophus simulator	Bushveld Horseshoe Bat	Least Concern	High
Saccostomus campestris	Pouched Mouse	Least Concern	High
Scotophilus dinganii	Yellow House Bat	Least Concern	High
Staetomys pratensis	Fat mouse	Least Concern	High
Suncus lixus	Greater Dwarf Shrew	Data deficient	Moderate
Sylvicapra grimmia	Common Duiker	Least Concern	High
Tadarida aegyptiaca	Egyptian Free-tailed Bat	Least Concern	High
Taphozous mauritianus	Mauritian Tomb Bat	Least Concern	High
Tatera leucogaster	Bushveld Gerbil	Data deficient	High
Thallomys paedulcus	Tree Rat	Least Concern	High
Thryonomys swinderianus	Greater Cane Rat	Least Concern	Moderate
Tragelaphus strepsiceros	Kudu	Least Concern	High

APPENDIX D AMPHIBIAN LIST

Scientific name	Vernacular name	Conservation status	Probability of occurrence
Afrana angolensis	Common River Frog	Widespread	High
Breviceps adspersus	Bushveld Rain Frog	Widespread	High
Bufo garmani	Eastern Olive Toad	Common/Widespread	High
Bufo gutturalis	Guttural Toad	Widespread/adaptable	High
Cacosternum boettgeri	Boettger's Caco	Not threatened	High
Hyperolius marmoratus	Painted Reed Frog	Widespread	High
Kassina senegalensis	Bubbling Kassina	Widely distributed	High
Phrynobatrachus natalensis	Snoring Puddle Frog	Abundant	High
Phrynomantis bifasciatus	Banded Rubber Frog	Common/Widespread	High
Ptychadena anchietae	Plain Grass Frog	Widespread	High
Schismaderma carens	Red Toad	Not threatened	High
Tomopterna cryptotis	Tremelo Sand Frog	Widespread/abundant	High
Tomopterna natalensis	Natal Sand Frog	Widespread	High

APPENDIX E REPTILE LIST

Scientific name	Vernacular name	Conservation status	Probability of occurrence
Acanthocercus atricollis	Southern Tree Agama	Common	High
Agama aculeata distanti	Ground Agama	Common	High
Aparallactus capensis	Cape Centipede Eater	Common	High
Aspidelaps scutatus	Shield-nose Snake	Common	Moderate
Atractaspis bibronii	Southern or Bibron's Burrowing Asp	Common	High
Bitis arietans	Puff Adder	Common	High
Causus rhombeatus	Common or Rhombic Night Adder	Common	High
Chamaeleo dilepis	Flap-neck Chameleon	Common	High
Crotaphopeltis hotamboeia	Herald/Red-lipped Snake	Common	High

Scientific name	Vernacular name	Conservation status	Probability of occurrence
Dasypeltis scabra	Common or Rhombic Egg Eater	Common	High
Dendroaspis polylepis	Black Mamba	Common	High
Dispholidus typus	Boomslang	Common	High
Geochelone pardalis	Leopard Tortoise	Common	High
Gerrhosaurus flavigularis	Yellow-throated Plated Lizard	Common	High
Gerrhosaurus validus	Giant Plated Lizard	Common	Low-moderate
Hemidactylus mabouia	Moreau's Tropical House Gecko	Common	High
Homopholis wahlbergii	Wahlberg's Velvet Gecko	Common	Moderate
Ichnotropis capensis	Cape Rough-scaled Lizard	Common	High
Ichnotropis squamulosa	Common Rough-scaled Lizard	Common	High
Kinixys lobatsiana	Lobatse Hinged Tortoise	Common	High
Lamprophis fuliginosus	Brown House Snake	Common	High
Leptotyphlops conjunctus	Eastern Thread Snake	Common	High
Leptotyphlops scutifrons	Peters' Thread Snake	Common	High
Lycodonomorphus rufulus	Common Brown Water Snake	Common	High
Lycophidion capense	Cape Wolf Snake	Common	High
Lygodactylus capensis	Cape Dwarf Gecko	Common	High
Mabuya capensis	Cape Skink	Common	High
Mabuya striata	Striped Skink	Common	High
Mabuya varia	Variable Skink	Common	High
Mehelya nyassae	Black File Snake	**Protected**	High
Monopeltis infuscata	Dusky Spade-snouted Worm Lizzard	Common	Moderate - High
Naja annulifera	Snouted Cobra	Common	High
Naja mossambica	Mozambique Spitting Cobra	Common	High
Nucras holubi	Holub's Sandveld Lizard	Common	High
Panaspis sp.	Spotted-neck Snake-eyed Skink	Common	Moderate
Panaspis wahlbergii	Wahlberg's Snake-eyed Skink	Common	High
Pelomedusa subrufa	Marsh or Helmeted Terrapin	Common	High
Philothamnus hoplogaster	Green Water Snake	Common	Moderate - High
Philothamnus semivariegatus	Spotted Bush Snake	Common	High
Psammophis subtaeniatus	Stripe-bellied Sand Snake	Common	High
Psammophylax tritaeniatus	Striped Skaapsteker	Common	High
Pseudaspis cana	Mole Snake	Common	Moderate - High
Python natalensis	Southern African Python	**Vulnerable**	High
Rhinotyphlops lalandei	Delalande's Beaked Blind Snake	Common	High
Telescopus semiannulatus	Eastern Tiger Snake	Common	High
Thelotornis capensis	Twig/Vine Snake	Common	High
Varanus albigularis	Rock/White-throated Monitor	Common	High
Varanus niloticus	Nile/Water Monitor	Common	Moderate - High