Lotso la Badiri Trading & Projects

BIODIVERSITY ASSESSMENT REPORT

FOR THE PROPOSED TOWNSHIP DEVELOPMENT ON PORTION 1 OF THE RHENOSTERSPRUIT FARM NO. 908 JQ IN RUSTENBURG WITHIN THE JURISDICTION OF MOSES KOTANE LOCAL MUNICIPALITY IN THE NORTH WEST PROVINCE

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EXECUTIVE SUMMARY

Lotso La Badiri Trading and Projects has been appointed by Lesekha Consulting as an independent Environmental Assessment Practitioner (EAP) to undertake the biodiversity Study in order to advise the project on biological and environmental sensitivities surrounding the proposed township development in Rustenburg .The major aim of this document is elaborate on the perceived sensitivity of the receiving environment based on a brief site investigation and results of a desktop assessment of available information, informing the project with regards to potential fatal flaws, opportunities and constraints.

According to the vegetation maps of southern Africa (Mucina and Rutherford, 2006), the study area falls within the Zeerust Thornveld vegetation type. *Combretum imbere* a protected tree species was noted during the survey**.** The biodiversity of the area has already been substantially reduced due to ongoing pressures of developments and unsustainable resource use (overgrazing and hunting). Current land use for the area is frequent grazing by cattle of the local herders. The presence and dominance of *Aristida* spp *and Dichrostachys cinerea* are indictors of veld overgrazed and poor veld management.

The main impacts of the proposed development on the environment are loss of biodiversity, loss of agricultural land and loss of habitants. The direct impacts of the development of the Proposed township development on biodiversity was analysed in a desktop study and were to found to be generally medium low impacts provided the recommendations on the mitigation measures are adhered to. The site should be monitored for the presence of alien and invasive weed species, and ECO must be appointed to ensure that the mitigation measures in this report and the EMPr are adhered to.

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ABREVIATIONS AND ACRONYMS

BGIS	Biodiversity Information System
CBA	Critical Biodiversity Area
DEA	Department of Environmental Affairs
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
EMPR	Environmental Management Program Report
ENPAT	Environmental Potential Atlas
ESH	Environmental Safety and Health
GA	General Authorization
GIS	Geographic Information System
GN	Government Notice
I&AP	Interested and/or Affected Parties
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IUCN	International Union for Conservation of Nature
IWULA	Integrated Water Use License Application
MKLM	Moses Kotane Local Municipality
LED	Local Economic Development
MSA	Municipal Service Act
NDP	National Development Plan
NEM:BA	National Environmental Management: Biodiversity Act
NEMA	National Environmental Management Act (No. 107 of 1998) (as amended)
NEMAA	National Environmental Management Amendment Act

NEMWA	National Environmental Management: Waste Act (No. 59 of 2008)
NHRA	National Heritage Resources Act (No. 25 of 1999)
NSBA	National Spatial Biodiversity Assessment
NWA	National Water Act (No. 36 of 1998)
NWPBCA	North West Province Biodiversity Conservation Assessment
PPP	Public Participation Process
SAHRA	South African Heritage Resources Agency
SANBI	South Africa National Biodiversity Institute
SANS	South Africa National Standards
SDF	Spatial Development Framework
SDI	Spatial Development Initiative
SEA	Strategic Environmental Assessment
SEMP	Strategic Environmental Management Plan
SPLUMA	Spatial Planning and Land Use Management Act
ToR	Terms of Reference

GLOSSARY

Biodiversity	The number and variety of living organisms on earth, the millions of plants, animals, and micro-organisms, the genes they contain, the evolutionary history and potential they encompass, and the ecosystems, ecological processes, and landscapes of which they are integral parts.
Biodiversity feature	An element of biodiversity for which it is possible to set a quantitative conservation target, for example a vegetation type, a species or the spatial component of an ecological process.
Biodiversity pattern	The structure and composition of ecosystems
Biodiversity planning	Describes biodiversity conservation planning for regions defined using biological criteria.
Biodiversity process	Ecological processes and functions that sustain biodiversity
Biome	A broad ecological unit representing major life zones of large natural areas or the biological component of a large geographic region. Biomes are usually characterised by characterized by its distinctive vegetation and maintained by local climatic conditions.
Buffer zones	Areas of land in which development is strictly controlled.
Climate Change	Refers to the variation in the Earth's global climate or in regional climates over time. It describes changes in the variability or average state of the atmosphere over time scales ranging from decades to millions of years. These changes can be caused by processes internal to the Earth, external forces (e.g. variations in sunlight intensity) or, more recently, human activities.
Conservation	The management of human use of the biosphere so that it may yield the greatest sustainable benefit to current generation's while maintaining its potential to meet the needs and aspirations of future generations: Thus conservation is positive, embracing preservation,

	maintenance, sustainable utilisation, restoration, and enhancement of the natural environment
Conservation action	Includes but is not limited to the establishment or expansion of protected areas. Conservation action should include engaging with all major landowners and land-users across a range of socio-economic sectors, to increase awareness of priority areas for meeting conservation targets and to ensure that land management and land-uses in these priority areas support biodiversity conservation
Conservation assessment	The development of spatial data layers and the spatial analysis undertaken to identify options for meeting conservation targets. Conservation assessments should include the interpretation of this analysis for a wide range of stakeholders and evolutionary processes that sustain them. Conservation Planning involves conservation assessment plus the development of an implementation strategy and action plan.
Conservation planning	Planning at a range of spatial scales that aims to identify areas for biodiversity conservation, taking into account patterns of biodiversity and the ecological**.**
Degradation	The lowering of the quality of the environment through human activities, e.g. river degradation, soil degradation.
Ecological processes	Ecosystems work because they are kept alive by ecological processes such as pollination, nutrient cycling, disturbance (e.g. fire), and migration of species or soil maintenance. Ecological processes typically only functions well where natural vegetation remains, and in particular where the remaining vegetation is well connected with other nearby patches of natural vegetation. Loss and fragmentation of natural habitat severely threatens the integrity of ecological processes.

Ecology	The scientific study of the relations that living organisms have with respect to each other and their natural environment.
Ecosystem	The totality of factors of all kinds, living and non-living, which make up a particular environment; the complex of a biotic community and its abiotic, physical environment, functioning as an ecological unit in nature. Ecosystems provide direct and indirect benefits to humans, e.g. flood amelioration by naturally functioning wetlands, the oceans' regulation of the chemical composition of the atmosphere, and providing habitat for commercially exploited species
Ecosystem status	Ecosystem status of terrestrial ecosystems is based on the degree of habitat loss that has occurred in each ecosystem, relative to two thresholds: one for maintaining healthy ecosystem functioning, and one for conserving the majority of species associated with the ecosystem. As natural habitat is lost in an ecosystem, its functioning is increasingly compromised, leading eventually to the collapse of the ecosystem and to loss of species associated with that ecosystem.
Habitat fragmentation	Ecosystems and the species therein, need a certain amount of inter-connectivity for processes to continue. If a specific natural area is broken up into smaller pieces, eventually species disappear and certain functions are lost.
Habitat	The natural home and range of species of plants or animals.
Pollution	Pollution", as described by the Act is "the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it", inter alia: "less fit for any beneficial purpose for which it may reasonably be expected to be used; or harmful or potentially harmful to the welfare" "of human beings, to any aquatic or non-aquatic organisms, or to the resource quality."

Protected area	A legally established land or water area under either public or private ownership that is regulated and managed to achieve specific conservation objectives.
Red Data Book	Contains data on the threat to and rarity of plant and animals species. For each species, data is provided on rarity status, (i.e. endangered, vulnerable, rare, out-of-danger, and indeterminate), geographical distribution, population size, habitat, breeding rate and any conservation measures taken to protect the species.
Rehabilitation	Refers to re-instating the driving ecological forces (including hydrological, geomorphological and biological processes) that underlie a wetland, so as to improve the wetland's health and the ecological services that it delivers.
Restoration	The return of an ecosystem or habitat to its original community structure, natural complement of species, and natural functions.
Sustainable development	Development that meets the needs of both present and future development, equitably. In terms of the National Environmental Management Act 107 of 1998, sustainable development is the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations
Transformation	Refers to the adverse changes to biodiversity, typically habitats or ecosystems, through processes such as cultivation, forestry, drainage of wetlands, urban development or invasion by alien plants or animals. Transformation results in habitat fragmentation on (i.e. the breaking up of a continuous habitat, ecosystem, or land-use type into smaller fragments)

DECLARATION OF INDEPENDENCE

Lotso La Badiri Trading and Projects is fully independent and have no interest in the business nor receive any payment or benefit other than fair remuneration for the task undertaken as required in terms of the regulation. This report has been compiled by Lotso La Badiri Trading and Projects who has an extensive experience in investigating and Ecological and Biodiversity Assessments. The company has thoroughly investigated impacts that may negatively affect the site, including the fatal flaw and can attest to the information presented on this report as an actual situation at the proposed site.

Mr. Seitlhamo prepared the biodiversity study, he is a qualified Ecologist; He managed and coordinated the Regional Ecologist of the Western parks, ecological services. He holds the BSc (Biology and Geography and Environmental sciences; BSc Honours (Geography and Environmental Science, GIS) and MSc in Environmental Sciences from the University of Witwatersrand.

Mr Seitlhamo holds a certificate in Project Management, Wetland training course from University of Pretoria continuing Education, Fire management tool. Southern Africa College and Vegetation management and monitoring Mr. Seitlhamo is a professional membership of Grassland Society of Southern Africa (GSAA), Southern African Wildlife Management Association (SAWMA) & IEEE Geo-Science and Remote Sensing Society (GRSS).The acquired qualifications and experience demonstrated that we are uniquely qualified to undertake this Biodiversity Study.

1. INTRODUCTION

Lotso la Badiri Trading and Projects has been appointed by Lesekha Consulting as an independent Environmental Assessment Practitioner (EAP) to undertake the Biodiversity Assessment Study for the Environmental Impact Assessment process for proposed township development on Portion 1 of The Rhenosterspruit Farm No. 908 JQ in Rustenburg within the Jurisdiction of Moses Kotane Local Municipality.

The biodiversity assessment of the study area included the survey on plants, mammals, birds, reptiles and any other sensitive areas such as habitats. The study also includes the investigation of the presence and potential occurrence of all Red Data flora and fauna species and also to provide any mitigation measures to minimize all perceived environmental impacts.

1.2 Project description

The Department of Local Government and Human Settlements intends to develop a township with basic services (water, electricity, sanitation and roads). The proposed township development will entail the following

Development of approximately 1520 units measuring

- Residential 1: Approximately 500m^2 (+/- 461 units, single dwelling (23.0343ha)
- Residential 2: Approximately 300m^2 (+/-1051units), single dwelling (31.5337 ha)
- Residential 3: three and four storey walk-ups with a density of approximately 151 dwelling units per hectare with approximately 214 dwelling units (1.4276ha)
- Public Open Space (13.1825ha)
- Educational facilities (3.3574ha)
- Business 1 (4.1472ha)
- Public Roads and Construction of internal road (22.7153ha)
- Water, sewage and electricity reticulation infrastructure

The extent of the site for the proposed development is approximately 150 hectares.

1.3 Scope of work

The following Scope of works is understood for the Biodiversity Assessment:

- Biodiversity assessment of the study area to evaluate the opportunities and constraints of the relevant proposed infrastructure;
- To determine if any fauna and flora species will be directly impacted upon by the proposed township development and associated infrastructure, this includes fauna and flora communities present, the state of these communities, identification of possible red data species.
- To provide mitigation measures for any environmental impacts that may occur due to the proposed project.

Figure 1: Rhenosterspruit Locality Map

2. METHODOLOGY

2.1 Methodology

2.1.1 Site Visit

A site visit was undertaken on the 4th and 5thof August 2018 to sample the species (fauna and flora) that are found on this site. During the survey, a walk-about was conducted to investigate the current status of the areas photographs of important features were taken and will be included in the report. The vegetation assessment was also consulted to provide information on plant species present within the footprint of the proposed development site.

2.1.2 Desktop Study

A detailed desktop assessment was conducted prior to the site visit and infield assessment. During this desktop assessment the broad habitats/ vegetation units were identified and demarcated to identify homogenous vegetation units. In addition, the following desktop studies in the form of literature overview and consultation of available databases were used to generate expected species lists and to ascertain the likelihood of the presence of SSC on site:

- Pretoria Computerized Information System Lists (PRECIS): This database provides taxonomic information for plant species occurring in southern Africa and follows the format of Germishuizen and Meyer, 2003. It is updated every two months and is supplied by the South African National Biodiversity Institute (SANBI). The PRECIS List is accessible on the Plants of Southern Africa (POSA) website;
- SIBIS: SABIF (South African Biodiversity Information Facility) established by the Department of Science and Technology (DST); and
- The Threatened Species Programme (TSP) listing in collaboration with the National Botanical Institute (NBI) was consulted to identify any SSC and/ or any Red Data Fauna and Flora Listed Species that may be present within the proposed site of development

Regional Biodiversity Planning documents were consulted, including:

- North West Biodiversity Sector Plan 2015; and

- North West Province Biodiversity Conservation Assessment, Technical Report 2009

2.13 Flora Assessment

A site specific and infield assessment was conducted on the 4th and 5th of August 2018. The infield vegetation assessment was conducted using randomly transects methods where the location of the sample plots were determined prior to infield assessment. Transects were then set infield and all species present within these transects were recorded. During this flora assessment all species encountered during random transects was recorded. Characterisation of vegetation in the study area in conjunction with an in-depth study including plant species lists, SSC and their locations, declared Alien and Invader Plant Species (AIPs) present and areas of sensitivity. In addition, all species of ethno botanical (medicinal or cultural use) importance were recorded. Species lists of all species recorded onsite were compiled and the following will be reported on:

- Red Data Listed plant species and/ or SSC recorded on site
- AIPs recorded on site (including their Invasive Categories according to the National Environmental Management: Biodiversity Act (NEM: BA);
- Dominant plant species recorded in each identified plant community; and

2.14 Fauna

A list of all potential fauna species was compiled by means of a desktop study and all potential red data listed species were highlighted. Site specific infield fauna surveys were conducted concurrently with vegetation surveys and all animals observed in the area were noted. The presence of fauna (including mammals, amphibians, reptiles, avifauna, and selected invertebrates) were evaluated using tracks, dung, ecological indicators, and visual sightings. Fauna lists were generated and discussed and related back to the floristic component of the area.

The current status of the faunal environment was determined and an evaluation of the extent of site-related effects in terms of certain ecological indicators, as well as

identification of specific important ecological attributes such as rare and endangered species, SSC, protected species, sensitive species and endemic species were made. The faunal environment and habitat was characterised in relation to biota and the extent of site related effects.

2.15 Mammals

Visual sightings and ecological indications were used to identify the mammal inhabitants of the study area; this includes scats, tracks and nesting sites such as burrows and dens. Scats found were collected (if required), photographed on scale and along with any tracks found were identified. For identification purposes a field guide Mammals of Southern Africa (Smithers, 2006) and Stuart's Field Guide to Mammals of Southern Africa (Stuart *et al.,* 2015) was used.
The following was recorded:

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

2.16 Avifaunal

The principal ornithological field survey technique was transecting counts. Transect counts were taken in sites representative of different avifauna habitat. A transect line was selected to reflect the general habitat conditions. Transect count procedures involve slow attentive walks along transects during which any bird seen or heard is identified and recorded.
The following were recorded:

- All birds encountered; and
- A list of rare and endangered species encountered.

Because the primary purpose of this work was to establish the presence of species, no distance or time limit was set, and hence any species seen or heard anywhere within the general vicinity of the proposed site was recorded. Visual identification was used to confirm calls of the less common species. Assessment of the conservation status of species

recorded focused on the various categories of Globally Threatened Species (IUCN 2016) and birds listed by the North West Biodiversity Sector Plan (NWBSP) 2015. South African Bird Atlas Project 1&2 (SABAP) was used to compile a list of possible species that might occur in the project area which falls within the QDS 2527 AC (Appendix B).

2.18 Information Sources

The following literature and databases were used for this flora and fauna assessment:

- Plants of Southern Africa (POSA) database (http://posa.sanbi.org/searchspp.php);
- IUCN Red Data List (2016);
- North West Biodiversity Sector Plan (2015);
- North West Province Biodiversity Conservation Assessment, Technical Report (2009);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (2016);
- The South African Red Data lists for mammals, birds, butterflies,

  The National Forests Act, 1998 (Act No. 84 of 1998) with regards to Protected Trees, and

  The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), Threatened and Protected Species

2.3Assumptions, Limitations and Gaps

This study is based on professional opinion, best practise guidelines and desktop study and therefore has intrinsic limitation regarding the level of the assessment. The study was conducted in August which is a dry season and large portion of the natural habitat was destroyed by veld fires limiting the species composition and also raised the question of the effect of frequency and timing of these fires on species composition and diversity.

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

3. LEGISLATIVE REQUIREMENTS

The following section briefly examines the legislation that is relevant to the scope of the assessment**.**

3.1 Constitution of South Africa, Act No. 108 of 1996

Whereby everyone has the right to have the environment protected and conserved for the benefit of present and future generations. South Africa has rigorous and comprehensive environmental legislation aimed at preventing degradation of the environment, including damage to wetland systems. Development proposals within or near any Protected area are subject to thorough bio-physical and socio-economic assessment as mandatory processes of related legislation. These processes are required to prevent degradation of the environment and to ensure sustainable and environmentally conscientious development.

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

NEMA requires that measures are taken that "prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development." In addition:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied:
- That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in

management and planning procedures, *especially where they are subject to significant human resource usage and development pressure*.

3.3 National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004)

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected. The Draft National List of Threatened Ecosystems (Notice 1477 of 2009, Government Gazette No 32689, 6 November 2009) has been gazetted for public comment. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the NSBA 2004. NEMBA also deals with endangered, threatened and otherwise controlled species, under the TOPS Regulations (Threatened or Protected Species Regulations). The Act provides for listing of species as threatened or protected, under one of the following categories:

- **Critically Endangered:** any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered:** any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- **Vulnerable:** any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- **Protected species:** any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

3.4 National Forests Act (No. 84 of 1998)

The National Forests Act provides for the protection of forests as well as specific tree species, quoting directly from the Act: "*no person may cut, disturb, damage or destroy any*

protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated".

3.5 Conservation of Agricultural Resources Act (Act 43 of 1983)

The Conservation of Agricultural Resources Act provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species. The Conservation of Agricultural Resources Act defines different categories of alien plants and those listed under Category 1 are prohibited and must be controlled while those listed under Category 2 must be grown within a demarcated area under permit. Category 3 plants includes ornamental plants that may no longer be planted but existing plants may remain provided that all reasonable steps are taken to prevent the spreading thereof, except within the floodline of water courses and wetlands.

3.6 The National Water Act, Act 36 of 1998 (NWA)

It is important to note that water resources, including wetlands are protected under the National Water Act (Act No. 36 of 1998) (NWA). Protection‟ of a water resource, as defined in the Act entails:

- "Maintenance of the quality of the water resource to the extent that the water resource may be used in an ecologically sustainable way; prevention of the degradation of the water resource; and the rehabilitation of the water resource;"

  The inclusion of physical properties of a water resource within the definition of pollution entails that any physical alterations to a water body, for example the excavation of a wetland or changes to the morphology of a water body can be considered to be pollution. Activities which cause alteration of the biological properties of a watercourse, i.e., the fauna and flora contained within that watercourse are also considered pollution.

In terms of Section 19 of the Act owners / managers / people occupying land on which any activity or process undertaken that causes, or is likely to cause pollution of a water resource, must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring. These measures may include measures to, inter alia:

- "cease, modify, or control any act or process causing the pollution;
- comply with any prescribed waste standard or management practice;
- contain or prevent the movement of pollutants;
- remedy the effects of the pollution; and
- Remedy the effects of any disturbance to the bed and banks of a watercourse**."**

3.7 Environment Conservation Act

The Environmental Conservation Act (Act 73 of 1989) provides for the effective protection and controlled utilization of the environment. This Act has been largely repealed by NEMA, but certain provisions remain, in particular provisions relating to environmental impact assessments. The ECA requires that developers must undertake Environmental Impact Assessments (EIA) for all projects listed as a Schedule 1 activity in the ESIA regulations.

3.8 Protected Areas Act

The protected Areas Act (act no 57 of 2003) provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.

3.9 Convention of Biological Diversity

The Convention of Biological Diversity is an international legally binding treaty with three main goals; conserve biological diversity (or biodiversity); ensure sustainable use of its components and the fair and equitable sharing of benefits arising from genetic resources.

3.10 Convention on International Trade in Endangered Species

CITES is an international agreement between governments, drafted as a result of a resolution adopted in 1963 at a meeting of members of the International Union for Conservation of Nature (IUCN). The aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival and it accords varying degrees of protection to more than 33,000 species of animals and plants.

3.11Protected sites in terms of the National Heritage Resources Act, Act No. 25 of 1999

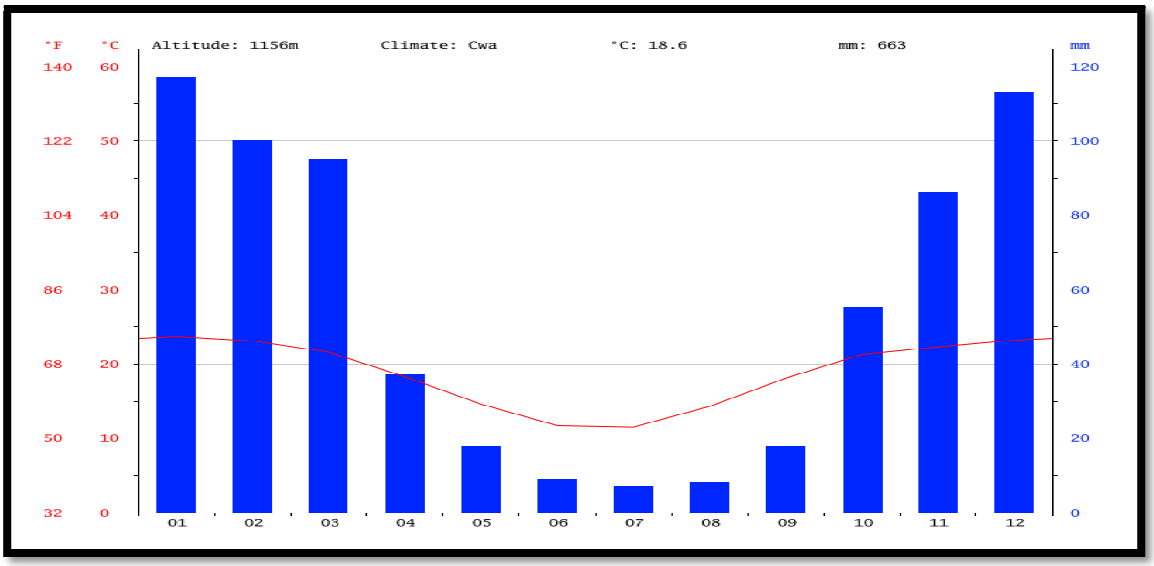
The National Heritage Resources Act provides for an integrated and interactive system for the management of the National Heritage Resources and empowers civil society to nurture and conserve their heritage resources so that they may be bequeathed to future generations. Furthermore, the act establishment the South African Heritage Resources Agency (SAHRA) in 1999. SAHRA is tasked with protecting heritage resources of national significance.

4. BIOPHYSICAL ENVIRONMENT

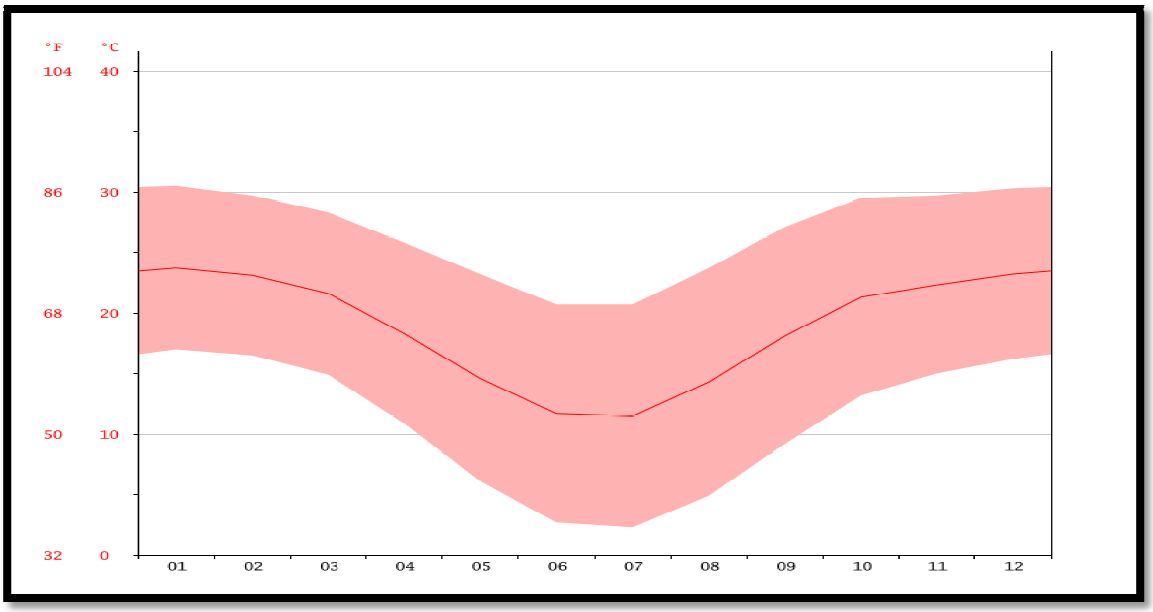
4.1 Climate

The MKLM can be described as a semi-arid area, with average annual precipitation in the region ranging between 300mm and 500mm. The annual evaporation rate ranges between 1800mm to 1900mm. The wettest month of the year is January, with an average monthly total rainfall of 132 mm. The driest month is July, with an average monthly total rainfall of 2 mm (Weather Bureau, 1997).Mean annual air temperatures range from 11,8°C in June/July to 23,8°C in January. Average daily maxima range from 20,4°C to 30,3°C, and

minima from 2,8°C to 17,2°C (Weather Bureau, 1997).The Lightening Ground Flash Density in the study area is between 5 to 7 strikes/km^2/year on a scale of 0 to 19 (2001 Eskom's LPATS system; Clara, 2001).



Graph1: Rainfall data (average) for Moses Kotane local Municipality, North West Province (200-2012



Graph 2: Temperature data (averages) for MKLM, North West Province (200-2012)

4.2 The Regional Vegetation

According to the Vegetation map of South Africa, Lesotho and Swaziland (Mucina and Rutherford, 2006), the study area falls within the Zeerust Thornveld vegetation type. This vegetation type extends from the plains of Lobatsi River in the west via Zeerust, Groot Marico and Mabaalstad to the flats between the Pilanesberg and the western end of the Magaliesberg in the east, and is an Endemic Vegetation type.

Vegetation consists of deciduous, open to dense short thorny woodland, dominated by *Senegalia* and *Vachellia* species (previous known as *Acacia*). The herbaceous layer is comprised predominantly of grasses on deep, high-base and some clay soils on plains and lowlands. Common and characteristic plant species for the Zeerust Thornveld vegetation type are listed in Table 4-1.

Table 4-1: Common and characteristic plant species of the Zeerust Thornveld vegetation type (Mucina and Rutherford, 2006)

Plant form	Species
Tall trees:	*Senegalia burkei* (d), *Vachellia erioloba* (d).
Small trees:	*Senegalia mellifera (d), Vachellia nilotica (d), Vachellia tortilis (d), Searsia lancea (d), Senegalia cinerea (d), Peltephorum africanum, Terminalia sericea*
Tall shrubs:	*Diospyros lycioides, Grewia flava, Mystroxylon aethiopicum*
Low shrubs:	*Agathisanthemum bojeri, Chaetecanthus costatus, Clerodendrum ternatum, Indigofera filipes, Searsia grandidens, Sida chrysantha, Stylosanthes fruticose*
Graminoids (grasses and sedges):	*Eragrostis lehmanniana (d), Panicum maximum (d), Aristida congesta, Cymbopogon pospichilii.*
Herbs:	*Blepharis integrifolia, Chamaecristua absus, C. mimosoides, Cleome maculate, Dicoma anomal, Kyphocarpa angustifolia, Limeum viscosum, Lophiocarpus tenuissimus*

4.3 Land use

Land use often determines land cover; it is an important factor contributing to the condition of the land. Different uses have varying effects on the integrity of the land. For the purpose of this assessment, land cover are loosely categorized into classes that represent natural habitat and land cover categories that originated from habitat degradation and transformation on a local or regional scale. Areas that are characterized by high levels of transformation and habitat degradation are generally more suitable for development purposes as it is unlikely that biodiversity attributes of conservation importance will be present or affected by development. Conversely, areas that are characterized by extensive untransformed and pristine habitat are generally not regarded suitable options for development purposes.

The site is currently being used for cattle grazing (agricultural). The grasslands have however mostly been altered by grazing, wood collection and trampling and waste dumping. Land uses observed in the areas surroundings the site of development fall mainly under the categories of communal and natural land as well as some agricultural activities. The commercial land uses are associated with the Mogwase town and suburbs.

4.4 Topography, Relief & Slopes

The MKLM lies on a fairly flat but undulating landscape intercepted by mountain ranges, hills and rocky outcrops (koppies). The Pilanesberg and Dwarsberg Mountains serve as the two prominent topographical features in MKLM. The two main drainage systems in the area are the Thulane and Kolobeng Rivers. Thulane River drains in a northerly direction from Madikwe Dam in the south-west of MKLM, to Bakgatla Dam in the north-west of MKLM. Kolobeng River drains in a north-easterly direction.Topographical heterogeneity is recognized as a powerful influence contributing to the high biodiversity of southern Africa. Landscapes composed of spatially heterogeneous abiotic conditions provide a greater diversity of potential niches for plants and animals than do homogeneous landscapes. The species richness and biodiversity has been found to be significantly higher in areas of geo-morphological heterogeneity. Ridges and rocky outcrops are characterized by high spatial variability due to the range of differing aspects, slopes and altitudes all resulting in differing soil (*e.g.* depth, moisture, temperature, drainage, nutrient content), light and

hydrological conditions. Temperature and humidity regimes of microsites vary on both a seasonal and daily basis. Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes. Variation in aspect, soil drainage and elevation/altitude has been found to be especially important predictors of biodiversity. There are two streams and a dam near the proposed site of development.

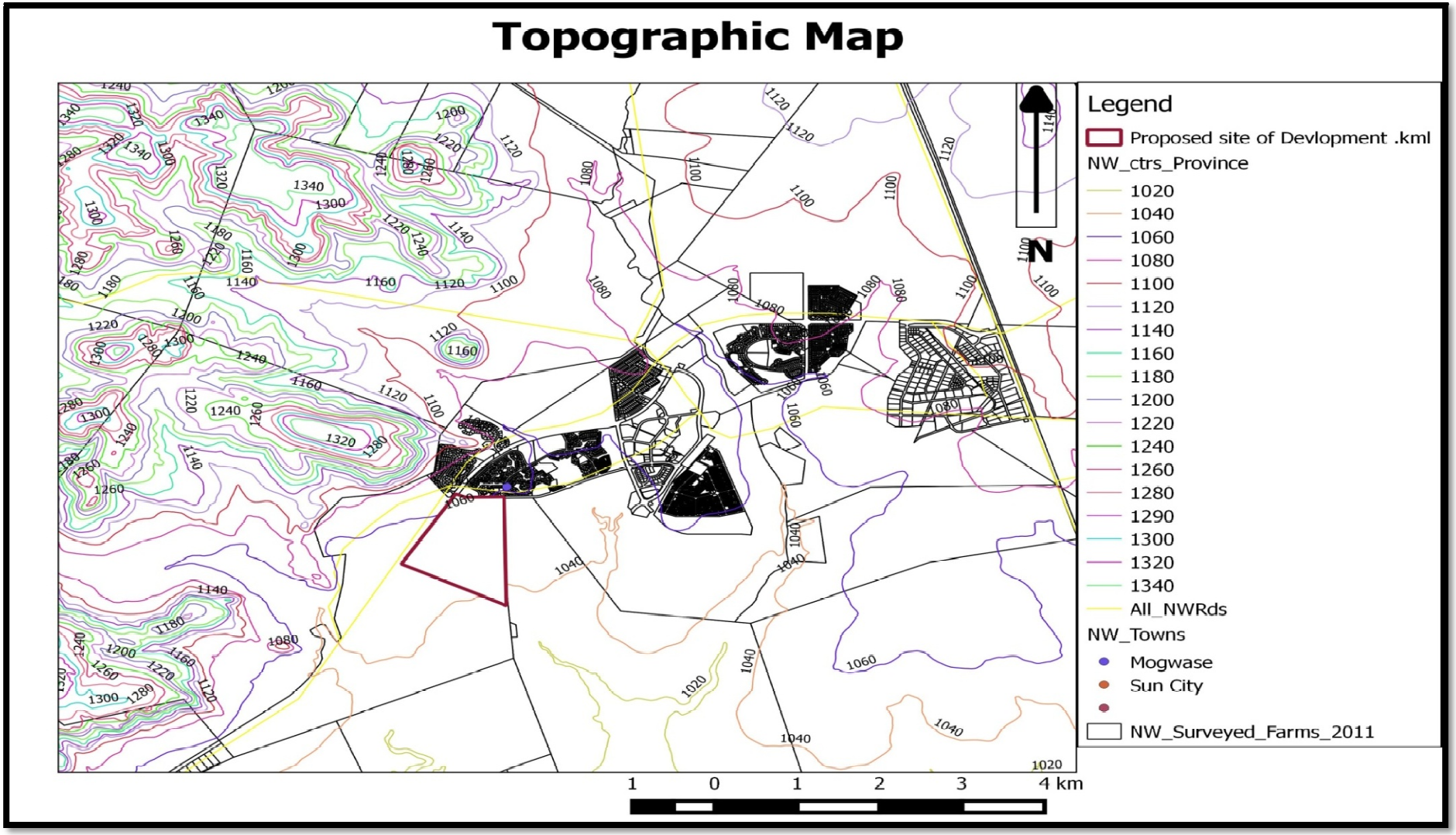


Figure 4.2: Topography of the area

3.6 Geology

The geology is underlain by mafic intrusive rocks of the Rustenburg Layered suite of the Bushveld Igneous rocks that include gabro, norite, pyroxenite and anorthosite. Some quartzites and shales associated with the Pretoria group part of the Transvaal supergroup.

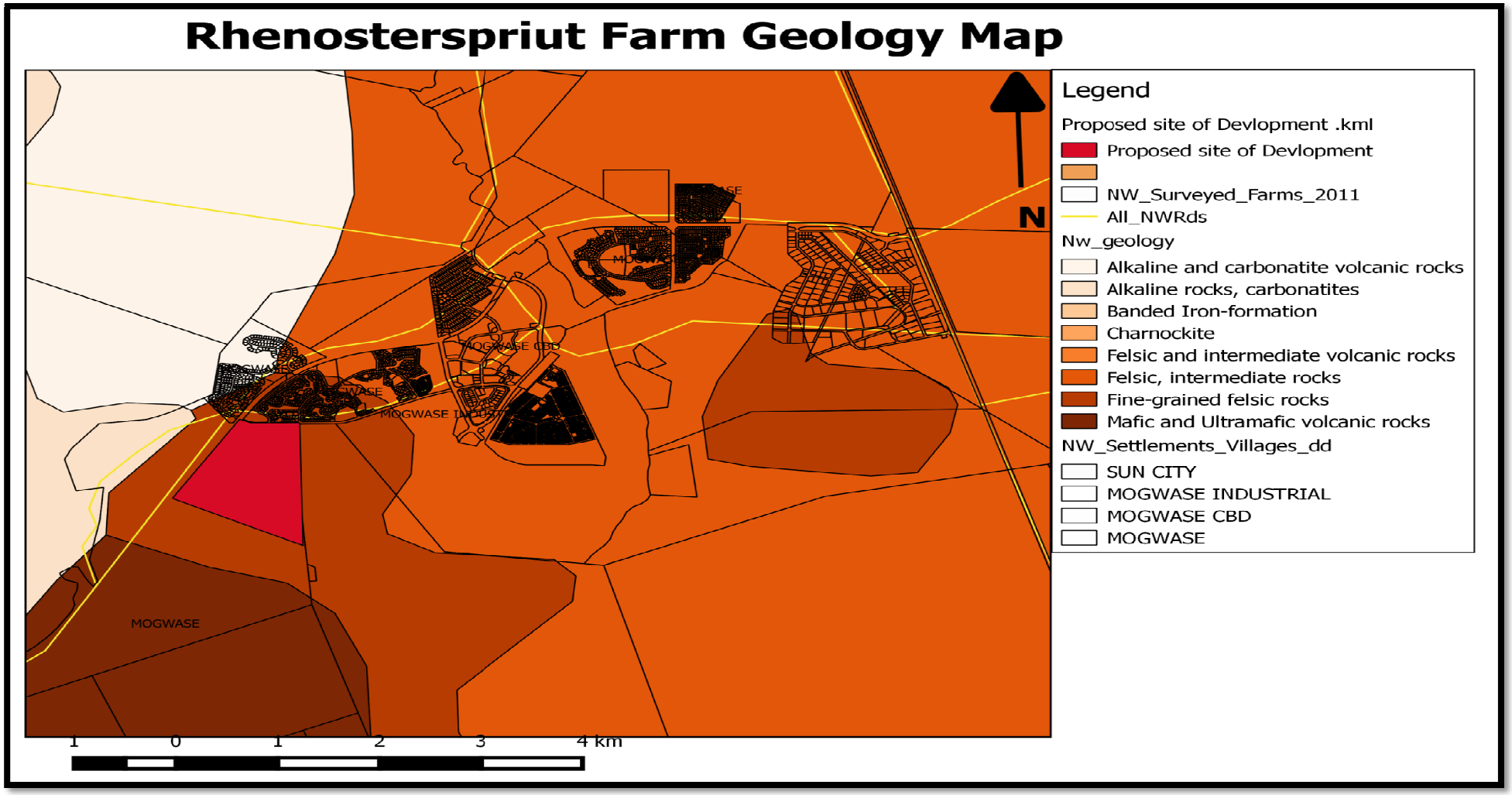


Figure 4.3 Geology of the site

5. RESULTS

5.1 Flora

Current land use for the proposed site of development area is frequent livestock grazing by local herders. People hunting were also observed during the survey. Waste dumping by residence of the adjacent Mabele A Podi residential area was also noted. The presence and dominance of *Aristida* spp. *and Dichrostachys cinerea* are indictors of veld that is overgrazed and poor veld management. Domestic livestock can have high impacts on natural vegetation, resulting in decreases to species richness and diversity.

The floristic unit of the site is the Zeerust Thornveld vegetation type. It consists of a floristic composition that is dominated by woody species with a fairly high richness that is reminiscent of the Zeerust Thornveld vegetation type across the site. The vegetation type consists of mesophyllous woodland consisting of *Combretum molle, C. zeyheri, Croton gratissimus* and *Searsia (Rhus) leptodictya*, including various microphyllous species such as *Acacia nilotica* and *A. tortilis*.

The graminoid and herbaceous layer is dominated by species that is typical of areas subjected to grazing as evidenced by the dominance of *Eragrostis rigidior, E. lehmanniana* and *Heteropogon contortus*. Noteworthy forb species include *Asparagus suaveolens, Felicia muricata, Sida chrysantha* and *Barleria bremekampii.*

Common species include *Dichrostachys cinerea, Aristida congesta barbicolis* and *Gymnosporea senegalensis*. It is important to note that despite the pressure of grazing, the bushveld area forms an important habitat for species such as small mammals and birds forming process areas that are vital to the functioning of the ecosystem.

Certain areas of the study areas have undergone pressure from livestock utilisation. Evidence of livestock was observed throughout most of the site and evidence of overgrazing was recorded in areas. Despite these impacts, the some parts study area showed a high diversity of grasses and tree species see pictures below.

Figure 5.1: Dense vegetation on the proposed site of development

Figure 5.1: Dense vegetation on the proposed site of development

5.2 Species of Special Concern

According to POSA (2016) no Red Data listed species have been recorded previously in the QDS 2527AC. However during this site visit *Boophane disticha (Poison bulb) (*Figure 5.3), declining under SA Red Data List and *Combretum imberbe* (Leadwood tree) (Figure 5.4) protected according to the list of Protected Tree Species under the National Forest Act, 1998 (Act No. 84 of 1998).

Figure 5.3: *Boophane disticha* (Poison bulb)

Figure 5.3: Combretum imberbe (Leadwood tree)

5.3 Fauna

The proposed site of development though in a near natural state it is very accessible to the community and the cattle herders. Some parts of the proposed site of development have been degraded by overgrazing and waste dumping, is assumed that these impacts have had a subsequent effect on the fauna species diversity and abundance. The findings of the fauna survey are used as a secondary reflection of the ecosystem health.

5.3.1 Mammals

Actual sightings, spoor, calls, dung and nesting sites, were used to establish the presence of mammals present on the proposed township development site. The evidence of dung and

spoor suggests that animals were present in the area although very few were recorded during this survey.

Species below have a high probability of occurring in the project area. See Table 5.5 below.

Table 5.5 Species that are likely to occur in the project area

Scientific Name	Common Name	Observation	Protection Status (IUCN 2016-2)/ NWBSP 2015
chrysophilus	Red Veld Rat	Burrows	Least Concerned
Atelerix frontalis	South African Hedgehog	Potential to occur on site	Friedmann and Daly, Near Threatened
Atilax paludinosus	Marsh Mongoose	Spoor	Least Concerned
Canis mesomelas	Black-backed Jackal	Spoor & scats	Least Concerned
Caracal caracal	Caracal	Personal Communication	Least Concerned
Cercopithecus pygerythrus	Vervet Monkey	Spoor, Observed	Least Concerned
Cryptomys hottentotus	African Mole-rat.	Soil heaps	Least Concerned
Galago senegalensis	Lesser Bush Baby	Personal Communication	Least Concerned
Galerella sanguinea	Slender Mongoose	Scats	Least Concerned
Genetta genetta	Genet	Personal Communication	Least Concerned
Hystrix africaeaustralis	Cape Porcupine	Diggings & quills	Least Concerned
Lepus saxatilis	Scrub Hare	Droppings	Least Concerned
Mastomys coucha	Multimammate Mouse	Droppings	Least Concerned
Mellivora capensis	Honey Badger	Potential to occur on site	Friedmann and Daly, Near Threatened
Parahyaena brunnea	Brown Hyaena	Potential to occur on site	Near Threatened

Scientific Name	Common Name	Observation	Protection Status (IUCN 2016-2)/ NWBSP 2015
Paraxerus cepapi	Tree Squirrel	Alarm call	Least Concerned
Sylvicapra grimmia	Common Duiker	Droppings & spoor	Least Concerned
Tatera leucogaster/brantsii	Highveld/Bushveld Gerbil	Burrows	Least Concerned

5.4 Avifauna

Birds have been viewed as good ecological indicators, since their presence or absence tends to represent conditions pertaining to the proper functioning of an ecosystem. Bird communities and ecological condition are linked to land cover. As the land cover of an area changes, so do the types of birds in that area (The Bird Community Index, 2007).

Land cover is directly linked to habitats within the study area. The diversity of these habitats should give rise to many different species. The bird species observed during the transect counts are listed in Table 5.6.

Table 5.6: Avifauna species recorded

Birds	Scientific Name	Protection Status (IUCN 2016-2)/ NWBSP 2015
Black Shouldered kite	*Elanus axillaris*	Not protected
Blacksmith Lapwing	*Vanellus armatus*	Not protected
Cape Turtle Dove	*Streptopelia capicola*	Provincially protected
Cape Glossy Starling	*Lamprotornis nitens*	Not protected
Fiscal Flycatcher	*Sigelus silens*	Not protected
Hadeda Ibis	*Bostrychia hagedash*	Not protected
Helmeted Guineafowl	*Numida meleagris*	Not protected
Laughing Dove	*Spilopelia senegalensis*	Provincially protected
Southern Grey-headed Sparrow	*Passer diffusus*	Not protected
Masked Weaver	*Ploceus velatus*	Not protected
Speckled Pigeon	*Columba guinea*	Not protected

Birds	Scientific Name	Protection Status (IUCN 2016-2)/ NWBSP 2015
Crested Barbet	*Trachyphonus vaillantii*	Not protected

Avifauna diversity was found to be very low, primarily due to the limited amount and diversity of habitat types available in the study area. No species of special concern were encountered, however the species indicated in Table 6.7 can possibly occur on site.

Table 6.7 Birds that can possibly occur on site

Species	Global Conservation Status (IUCN 2016)	National Conservation Status (SA Red Data 2016)	Preferred Habitat	Potential Likelihood of Occurrence
Anthropoides paradiseus (Blue Crane)	Vulnerable	Near-threatened	Prefers open grassland, open karroid veld, as well as wetland habitats.	Unlikely to occur
Alcedo semitorquata (Half-collared Kingfisher)	Least Concern	Near-threatened	Clear, fast-flowing streams with dense overhanging vegetation.	Unlikely to occur
Aquila rapax (Tawny Eagle)	Least Concern	Endangered	Lowveld and Kalahari savanna, especially game farming areas and reserves.	Regarded as an irregular foraging visitor on the study area.
Ciconia nigra (Black Stork)	Least Concern	Vulnerable	Breeds on steep cliffs within mountain ranges; forages	Vagrant on study area.

Species	Global Conservation Status (IUCN 2016)	National Conservation Status (SA Red Data 2016)	Preferred Habitat	Potential Likelihood of Occurrence
			on ephemeral wetlands.	
Circus ranivorus (African Marsh Harrier)	Least Concern	Endangered	Wetlands and vleis, breeds in extensive wetland systems with reedbed structure.	Unlikely to occur.
Coracias garrulus (European Roller)	Least Concern	Near-threatened	Open woodland and bushveld.	Common summer visitor
Falco biarmicus (Lanner Falcon)	Least Concern	Vulnerable	Varied, but prefers to breed in mountainous areas.	An occasional foraging visitor.
*Gorsachius leuconotus (*White-backed Night Heron*)*	Least Concern	Vulnerable	Clear well-vegetated perennial rivers. Prefers lowland rivers to Highveld rivers.	Unlikely to occur
Gyps africanus White-backed Vulture)	Critically Endangered	Critically Endangered	Breed on tall, flat-topped trees. Mainly restricted to large rural or game farming areas	Irregular and opportunistic foraging visitor.

Species	Global Conservation Status (IUCN 2016)	National Conservation Status (SA Red Data 2016)	Preferred Habitat	Potential Likelihood of Occurrence
Alcedo semitorquata (Half-collared Kingfisher)	Least Concern	Near-threatened	Clear, fast-flowing streams with dense overhanging vegetation.	Unlikely to occur
Aquila rapax (Tawny Eagle)	Least Concern	Endangered	Lowveld and Kalahari savanna, especially game farming areas and reserves.	Regarded as an irregular foraging visitor on the study area.
Ciconia nigra (Black Stork)	Least Concern	Vulnerable	Breeds on steep cliffs within mountain ranges; forages on ephemeral wetlands.	Vagrant on study area.
Circus ranivorus (African Marsh Harrier)	Least Concern	Endangered	Wetlands and vleis, breeds in extensive wetland systems with reedbed structure.	Unlikely to occur.
Coracias garrulus (European Roller)	Least Concern	Near-threatened	Open woodland and bushveld.	Common summer visitor
Falco biarmicus (Lanner	Least Concern	Vulnerable	Varied, but prefers to breed	An occasional foraging visitor.

Species	Global Conservation Status (IUCN 2016)	National Conservation Status (SA Red Data 2016)	Preferred Habitat	Potential Likelihood of Occurrence
Falcon)			in mountainous areas.	
*Gorsachius leuconotus (*White-backed Night Heron*)*	Least Concern	Vulnerable	Clear well-vegetated perennial rivers. Prefers lowland rivers to Highveld rivers.	Unlikely to occur
Gyps africanus White-backed Vulture)	Critically Endangered	Critically Endangered	Breed on tall, flat-topped trees. Mainly restricted to large rural or game farming areas	Irregular and opportunistic foraging visitor.
Leptoptilos crumeniferus (Marabou Stork)	Least Concern	Near-threatened	Varied, often near surface water or feeding on carcasses.	A vagrant to the study area.
Mirafra cheniana (Melodious Lark)	Near-threatened	Least Concern	A species with a preference for open dry "climax" *Themeda triandra* grassland or open primary grassland dominated by	A rare resident, probably absent.

Species	Global Conservation Status (IUCN 2016)	National Conservation Status (SA Red Data 2016)	Preferred Habitat	Potential Likelihood of Occurrence
			sour wiry grasses on well drained sandy substrates.	
*Mycteria ibis (*Yellow-billed Stork*)*	Least Concern	Endangered	Prefers shoreline habitat bordering large impoundments and extensive wetland systems.	Vagrant to the study area.
Oxyura maccoa (Maccoa Duck)	Near-threatened	Near-threatened	Large saline pans and shallow impoundments.	Unlikely to occur
Phoenicopterus minor (Lesser Flamingo)	Near-threatened	Near-threatened	Restricted to large saline pans and other inland water bodies.	Unlikely to occur
Phoenicopterus ruber Greater Flamingo)	Least Concern	Near-threatened	Restricted to large shallow pans and other inland water bodies.	Unlikely to occur
Polemaetus bellicosus (Martial Eagle)	Vulnerable	Endangered	Varied, from open karroid shrub to lowland	Vagrant to the study area.

Species	Global Conservation Status (IUCN 2016)	National Conservation Status (SA Red Data 2016)	Preferred Habitat	Potential Likelihood of Occurrence
			savanna.	
Sagittarius serpentarius (Secretarybird)	Vulnerable	Vulnerable	Prefers open grassland or lightly wooded habitat.	Uncommon and irregular foraging visitor.
Pterocles gutturalis (Yellow-throated Sandgrouse)	Least Concern	Near-threatened	Prefers open grassland or agricultural land on vertic soils	Unlikely to utilise study area, although known to fly overhead.
Torgos tracheliotus (Lappet-faced Vulture)	Endangered	Endangered	Lowveld and Kalahari savanna; mainly on game farms and reserves	Vagrant to the study area.
Tyto capensis (African Grass-owl)	Least Concern	Vulnerable	Prefers rank moist grassland that borders drainage lines or wetlands.	Unlikely to occur
Mycteria ibis (Yellow-billed Stork)	Least Concern	Endangered	Prefers shoreline habitat bordering large impoundments and extensive wetland systems.	Vagrant to the study area.
Oxyura maccoa (Maccoa Duck)	Near-threatened	Near-threatened	Large saline pans and	Unlikely to occur

Species	Global Conservation Status (IUCN 2016)	National Conservation Status (SA Red Data 2016)	Preferred Habitat	Potential Likelihood of Occurrence
			shallow impoundments.	

Species indicated in the table above all have historic records in the general area, species such as storks and birds of prey whom were recorded opportunistically. These depend on food items that must be available most often in areas such as reserves or game farms and will travel long distances to find these food items. These species are common in the nearby Pilansberg National Park and could frequent the proposed site of township development.

5.5 Important Bird Areas

An IBA is an area recognised as being globally important habitat for the conservation of bird populations. Currently there are about 10,000 IBAs worldwide. At present, South Africa has 124 IBA's, covering over 14 million hectares of habitat for our threatened, endemic and congregators birds. Yet only a million hectares of the total land surface covered by our IBA's is legally protected. The Birdlife SA IBA programme continues a programme of stewardship which will ultimately achieve formal protection (Birdlife, 2013). The Pilansberg National Park IBA occurs north of the project site.

Managed by North West Parks and Tourism Board, Pilanesberg National Park lies approximately 160 km north-west of Johannesburg. It covers a wide range of habitats, including vleis, lakes, streams, thick bush, broad-leaved and acacia woodland, koppies, open grasslands and former farmlands.

The site lies midway between the Cape Vulture (*Gyps coprotheres*) colonies in the Magaliesberg and the Waterberg and Cape Vultures periodically forage in it. Small numbers of White-backed Vulture (*G. africanus*) and Lappet-faced Vulture (*Torgos tracheliotus*) also occasionally visit it. Pilanesberg supports several breeding pairs of Verreauxs' Eagle (*Aquila verreauxii*), and other raptors, such as Wahlberg's Eagle (*Hieraaetus wahlbergi*), African Hawk Eagle (*Aquila spilogaster*), Brown Snake Eagle (*Circaetus cinereus*), Black-chested Snake Eagle (*C. pectoralis*) and Lanner Falcon (*Falco*

biarmicus), occur in small numbers. Individual Martial Eagles (*Polemaetus bellicosus*), Bateleurs (*Terathopius ecaudatus*) and Tawny Eagles (*Aquila rapax*) occasionally visit. Mankwe River holds small populations of African Finfoot (*Podica* senegalensis). White-backed Night Heron (*Gorsachius leuconotus*) is an occasional visitor. A large vlei with mixed grassland at the eastern end of Mankwe Dam provides habitat for African Grass Owl (*Tyto capensis*).

The surrounding woodland–grassland mosaic is known to hold Secretarybird (*Sagittarius serpentarius*) and Kori Bustard (*Ardeotis kori*). Other threatened species occasionally seen are European Roller (*Coracias garrulous)* and Yellow-throated Sandgrouse (*Pterocles gutturalis)*. Black Stork (*Ciconia nigra)*, Marabou Stork (*Leptoptilos crumeniferus)* and Yellow-billed Stork (*Mycteria ibis)* occur as occasional visitors. Other woodland specials include Monotonous Lark (*Mirafra passerine)*, Southern Pied Babbler (*Turdoides bicolor*) White-throated Robin-chat (*Cossypha humeralis)*, Kalahari Scrub Robin (*Erythropygia paean)*, Burnt-necked Eremomela (*Eremomela usticollis)*, Striped Pipit (*Anthus lineiventris)*, Barred Wren-Warbler (*Calamonastes fasciolatus)*, Marico Flycatcher (*Bradornis mariquensis)*, Crimson-breasted Shrike (*Laniarius atrococcineus)*, Great Sparrow (*Passer motitensis)*, Scaly-feathered Finch (*Sporopipes squamifrons)*, Violet-eared Waxbill (*Uraeginthus granatinus)*, Black-faced Waxbill (*Estrilda erythronotos)* and Shaft-tailed Whydah (*Vidua regia).*

6. IMPACT ASSESSMENT

6.1 Methodology

Any development (current or historic) or other activities in a natural system will impact on the surrounding environment, usually in a negative way. The purpose of this phase of the study was to identify and assess the significance of the impacts and to provide a description of the mitigation required so as to limit the perceived impacts on the natural environment.

5.1 Assessment Criteria

The environmental impacts are assessed with mitigation measures (WMM) and without mitigation measures (WOMM) and the results presented in impact tables which summarise

the assessment. Mitigation and management actions are also recommended with the aim of enhancing positive impacts and minimising negative impacts. The criteria against which these activities were assessed are discussed below.

Nature of the Impact

This is an appraisal of the type of effect the impact has on the environment. This description includes what would be affected and how and whether the impact is expected to be positive or negative.

Extent of the Impact

A description of whether the impact will be local, limited to the study area and its immediate surroundings, regional, or on a national scale.

Duration of the Impact

This provides an indication of whether the lifespan of the impact would be short term (0-5 years), medium term (6-10 years), long term (>10 years) or permanent.

Intensity / Magnitude

This indicates the degree to which the impact would change the conditions or quality of the environment. This was qualified as low, medium or high.

Probability of Occurrence

This describes the probability of the impact actually occurring. This is rated as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will occur regardless of any prevention measures).

Degree of Confidence

This describes the degree of confidence for the predicted impact based on the available information and level of knowledge and expertise. It has been divided into low, medium or high.

6.2 Nature of Anticipated and Likely Impacts

6.2.1 Direct Impacts

The largest extent of impacts within the biological environment is likely to result due to direct (physical) effects of land clearing activities and habitat loss. Direct impacts include any effect on the various habitat types, including locally endemic species, populations or individual species of conservation importance, as well as on overall species richness, diversity and abundance. These impacts include effects on genetic variability, population dynamics, overall species existence or health and on habitats important for species of conservation consideration. Loss of sensitive, restricted or protected habitat types are included in this category, but only on a local scale. These impacts are mostly measurable and easy to assess, as the effects thereof are immediately visible and can be determined to an acceptable level of certainty. Impacts of a direct nature include the following:

- Loss of plant taxa of conservation importance concern;
- Loss/ displacement of animal taxa of conservation importance;
- Loss of habitat associated with plant and animal taxa of conservation importance;
- Local depletion of plant taxa and reduction of phytodiversity;
- Local depletion/ displacement of faunal species and reduction of animal diversity;
- Loss of atypical, sensitive, conservation important habitat types or ecosystems of restricted abundance; and
- Loss and alteration of ecological processes and ecosystem services
- Loss of agricultural land

6.2.3 Indirect Impacts

In contrast, indirect impacts are not always immediately evident and can consequently not be measured at a specific moment in time; ‘spill-over effects’ are spatially and temporally removed from the actual activity and manifestations are typically subtle. The extent of the

effect is frequently at a scale that is larger than the actual site of impact, but usually restricted to a local scale (and not regional). A measure of estimation, extrapolation, or interpretation is therefore required to evaluate the importance of these impacts and is usually a factor of the sensitivity of the receiving surrounding environment. This type of impact typically results in adverse effects or deterioration of surrounding areas due to uncontrolled, development related activities.

In addition, the ecological functionality of the immediate and surrounding area could be adversely affected by development, with particular reference to the ecological interaction between plants and animals. Lastly, one of the most important impacts of indirect measures is represented by the alteration of biophysical characteristics of the surrounding areas through the introduction and proliferation of plants with an exotic nature or encroachment characteristics. Impacts of an indirect nature include the following:

- Impacts on habitat types that are associated with plants and animals of conservation importance (decreased habitat quality of surrounding areas due to peripheral impacts such as spillages, litter, increased erosion, contaminants, etc.);
- Alteration of faunal assemblages and community structures in surrounding areas (temporary displacement);
- Altered quality and ecological functionality (including fire, erosion) of surrounding natural habitat;
- Decreased aesthetic appeal of the landscape; and
- Exacerbated encroachment of invasive, exotic and encroacher plant species.

6.2.4 Cumulative Impacts

Lastly, impacts of a cumulative nature places direct and indirect impacts of this projects into a regional and national context, particularly in view of similar or resultant developments and activities in the region. Impacts of a cumulative nature typically adversely affect the local and regional conservation status of plant and animal taxa and protected habitat types as well as local and regional fragmentation levels, but also issues such as increased exploitation due to the exacerbation of anthropogenic activities on a local scale.

These impacts are notoriously problematic to control or prevent and frequently require huge financial commitments to mitigate. Impacts of a cumulative nature typically include the following:

- Increased plundering of natural resources due to increased human encroachment;
- Exacerbation of existing levels of habitat fragmentation and isolation; and
- Cumulative impacts on local/ regional and national conservation targets and obligations (loss of natural grassland habitat).

6.2.5 Mitigation Measures

Impacts	Mitigation
Potential Floristic impacts on the proposed site	• Laydown areas, stockpiles, vehicle parking areas, road infrastructure, access roads, turning circles, maintenance areas, etc., should be planned and operated within areas of low sensitivity, also situated away from sensitive biodiversity areas and receptors. • Demarcate areas of high and medium-high floristic sensitivity by means of semi permanent means (fencing). Demarcation should be periodically inspected by the ECO in order to ensure that fencing remain intact. • Compile and implement a botanical monitoring plan that aims to establish the success, and build on, implemented mitigation measures. This monitoring protocol should be effected at least biannually (early summer, late summer) in order to identify impacts, recommend actions and ensure compliance; • Disturbance of vegetation must be limited only to areas of construction; • Removal of vegetation/ plants within natural habitat shall be avoided until such time as soil stripping is required; • The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens

	(even within the demarcated working area) shall be removed, damaged or tampered with, unless agreed to by the ECO; • Exposed surfaces must be re-vegetated or stabilised as soon as is practically possible by means of a typical rehabilitation plant mixture that blends in with the surrounding environment. The grass mix should consist of indigenous grasses adapted to the local environmental/ climatic conditions; • Revegetated areas should be temporarily fenced to prevent damage by grazing animals; • Monitoring the potential spread of declared weeds and invasive alien vegetation to neighbouring land and vice versa and protecting the agricultural resources and soil conservation works are regulated by the Conservation of Agricultural Resources Act (No 43 of 1983) and must be addressed on a continual basis, through an alien vegetation control and monitoring programme; • Prevent contamination of natural grassland and from activities or any source of pollution; • Treatment of weeds and invasive species by means of herbicides and chemicals is not recommended as a result of the proximity to a water body.
Potential Faunal impacts on the proposed site.	• Avoid any surface disturbances within areas of high and medium-high faunal sensitivity habitat types. It must be ensured that none of the construction activities influence the natural faunal habitats of the study area; • The natural faunal habitats of the study area must be clearly demarcated to ensure that no unauthorized entry occurs; • All activities must be limited to daylight hours to mitigate impacts on sensitive nocturnal faunal assemblages; • No trapping, snaring or otherwise killing of animals should be allowed on or near the construction site; it is the

	responsibility of the construction site manager to ensure that this is enforced; • Ensure that a competent snake handler and capturing equipment is available at all times to remove snakes from the site and release captured animals in nearby suitable habitat; • No pets are allowed on the construction sites; species such as cats are known to decimate small animal populations; • Due care must be taken to ensure that no leakages of foreign materials (diesel, fuel, oil, etc.) . • The ECO should ensure continual record keeping of all animal observations on site, with particular reference to snakes, aquatic mammals and other conservation important animals; • Compile and implement a faunal monitoring programme, the protocol of which should be effected at least biannually (early summer, late summer) in order to establish the continued persistence of animals on the adjacent sensitive areas, adherence to EMPr guidelines, the identification of impacts and guidance for mitigation measures; • Burning- as general rule, burning (veld fires) is NOT allowed, especially during the Grass-owl breeding season between March and June. However, the vegetation structure and composition should be monitored on an annual basis to determine if the habitat meets the breeding requirements of Grass-owls. If the habitat is found to be sub-optimal or moribund and only when the area is not utilised by owls, it is recommended that the site be burned in spring after the first rains (to promote a cold burn of the graminoid cover). • Alien and invasive weeds – The area site should be monitored for the presence of alien and invasive weed species (such as *Acacia mearnsii, Melia azedarach, Opuntia ficus-indica,Eucapyptus* species, and *Cirsium vulgare*). All

	individuals of these species should be eradicated by means of manual labour and appropriate removal methods.
Biodiversity	• Appropriate dust control measures must be in place to limit the effects of dust pollution on the surrounding areas to acceptable levels. • No roads should be allowed within ecologically sensitive areas; • Areas subjected to land clearance must be kept to a minimum; • Appoint an Environmental Control Officer (ECO) prior to commencement of construction. Responsibilities should include, but not necessarily be limited to, ensuring adherence to authorisation requirements, EMPr guidelines, guidance of activities, planning, reporting; • The ECO must take appropriate action if the specifications contained in the EMPr are not followed; • No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required; • Prevent all open fires; • Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited; • The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames, which could result in veld fires, or constitute a hazard and should be guided by safe practice guidelines; • The use of fire as a management tool in ecologically sensitive areas should be guided and instructed by a qualified ecologist and based on results and recommendations of a biodiversity monitoring protocol; • Provide demarcated fire-safe zones, facilities and suitable

	fire control measures; • Cleared vegetation and debris that has not been utilised will be collected and disposed of to a suitable waste disposal site; it will not be burned on site; • Remove and store topsoil separately in areas where excavation/ degradation takes place. Topsoil should be used for rehabilitation purposes in order to facilitate re-growth of species that occur naturally in the area; • Stored topsoil will be free of deleterious matter such as large roots, stones, refuse, stiff or heavy clay and noxious weeds, which would adversely affect its suitability for planting; • No spoil material will be dumped outside the defined site; • Provide temporary on-site ablution, sanitation, litter and waste management and hazardous materials management facilities; • Abluting anywhere other than in provided toilets shall not be permitted. Under no circumstances shall use of the veld be permitted. • Prevent any and all defacement of natural features, no permanent markings (paint, concrete, etc) shall be allowed. Temporary markings should be environmentally-friendly; • Develop and implement a dedicated hydro-carbon spill action plan, which shall include prevention (drip trays, bunding, etc.) and reactionary (spill kits, biological cleaning agents, etc.).
Loss of agricultural land	• Site rezoning must be done with the Municipality • Residence must be allowed to grow vegetables for both domestic and commercial use. • Alternative grazing sites must be identified.

8. CONCLUSION AND RECOMMENDATION

Biodiversity assessment was conducted to evaluate the opportunities and constraints of the relevant proposed infrastructure and to determine if any fauna and flora species will be directly impacted upon by the proposed township development and associated infrastructure, this included fauna and flora communities present on site.

A detailed desktop assessment was conducted prior to the site visit and infield assessment. A vegetation assessment was conducted using randomly transects methods where the location of the sample plots were determined prior to infield assessment. For fauna visual sightings and ecological indications were used to identify the mammal inhabitants of the study area; this includes scats, tracks and nesting sites such as burrows and dens.

The proposed site of development is in within the Zeerust Bushveld which according to (Mucina and Rutherford, 2006) is threatened. The biodiversity of the area has already been substantially reduced due to ongoing pressures of developments and unsustainable resource use (overgrazing and hunting). The main impacts of the proposed development on the environment are loss of biodiversity, loss of agricultural land and loss of habitants. The direct impacts of the development of the Proposed township development on biodiversity was analysed in a desktop study and were to found to be generally medium low impacts provided the recommendations on the mitigation measures are adhered to. The site should be monitored for the presence of alien and invasive weed species, and ECO must be appointed to ensure that the mitigation measures in this report and the EMPr are adhered to. A 30 m buffer must be allowed from the stream and the water body on site.

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