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DEFINITIONS AND TERMS USED TO ASSESS IMPACTS

Extent:

This indicates the special area that may be affected by the impact and further describes the possibility that adjoining areas may be impacted upon. This includes four classes that are listed as follows:

- Local – Extending only as far as the site
- Limited – Limited to the site and it's immediate surrounds
- Regional – Extending beyond the immediate surrounds to affect a larger area
- National or international

Duration:

This refers to the period of the time that the impact may be operative for (i.e. the lifetime of the impact). This includes the following four classes that are listed as follows:

- Short – 0 – 5 years
- Medium – 5 – 15 years
- Long - > 15 years and/or where natural processes will return following the cessation of the activity or following human intervention
- Permanent – Where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient

Intensity:

This indicates whether the impact is likely to be destructive or have a lesser effect. Three such classes of intensity are defined and these are listed as:

- Low – Where natural, cultural and social functions and processes are not affected by the development
- Medium – Where natural, cultural and/or social functions and processes are affected by the development but can continue in a modified way
- High – Where natural, cultural and/or social functions and processes are altered to the extent that it will temporarily or permanently cease

Probability:

This refers to the likelihood of the impact actually occurring. The following four classes are used to describe the probability of the impact:

- None – The impact will not have an influence on the decision and requires no mitigation
- Medium – The impact is likely to have an influence on the decision and requires mitigation
- High – Mitigation is required and this may not be sufficient to ensure that the environment is not detrimentally affected by the proposed development

Significance:

The significance of the impact (i.e. whether it will lead to a marked change in the environment or not) is determined through a synthesis of the aspects produced in terms of their nature, intensity, extent and probability. Four classes of significance exist:

- None – The impact will not have an influence on the decision and requires no mitigation
- Low – Where it is likely to have an influence on the decision and requires mitigation
- Medium – Where it should have an influence on the decision unless it is mitigated
- High – Where it would influence the decision regardless of any possible mitigation.

Aquifer dependant ecosystems- ecosystems which depend on groundwater in, or discharge from, an aquifer. They are distinctive because of their connection to the aquifer and would be fundamentally altered in terms of their structure and functions if groundwater was no longer available.

Baseflow- the volume of water in the stream when at its minimum or base level of flow; this is the level to which the stream flow returns between storms; in climates with seasonal rainfall it is often treated as the dry season flow.

Groundwater Dependent Ecosystems- an ecosystem which depends on groundwater discharging from or contained within an aquifer, and is significantly altered by changes in the groundwater regime.

Runoff- the water in a stream after rain. In hydrology this refers to all the surface flow of water from a catchment in a stream or river; sometimes includes the sub-surface runoff. It is usually used to refer to the (volume of) surface water that leaves a catchment in a period of time.

Water course- a river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake or dam into which, or from which water flows; and any collection of water which the Minister may, by notice in the Gazette, declare to be a water course.

1. INTRODUCTION

TUA CONSERVA ENVIRONMENTAL & CONSERVATION SERVICES cc undertook the Ecological Assessment and Red Data Scan and surveys on portions of the farms Limpopo View 42 MT.

This was done over a period of time spanning from mid-winter (October 2016), through summer up to late summer (February 2017).

2 METHODS

The site was assessed during the various site visits when surveys during day and night were conducted. The following method was used during the assessment of the study site.

- The study site was assessed on foot.
- Survey was in the day, during surveys all sightings of species was noted. This included physical sightings, spoor, faeces and sound;
- Red Data fauna and flora information was obtained from available sources to identify the likely occurrence of any Red Data flora and fauna species in the area;
- Red data floral records were obtained from the National Botanical institute as well as a Precis list of plants occurring in the affected 1:50 000 quadrants;
- The *Atlas of Threatened Plant Species of the Transvaal* as compiled by the former Nature Conservation Division of the then Transvaal Provincial Administration, in 1985 was also used;
- Red Data flora species potentially occurring on the site were searched for;
- The plant communities were assessed.
- A faunal potential occurrence list was compiled using references and checklist from surveys in the area. Data from the writer as well as personal observations was used. Data from region was also used. The owner was also consulted.
- All identifiable floral and faunal species present were recorded. The levels of disturbance, species recorded and species considered likely to occur within this study site were factors used to inform the current ecological status of the assessed area;

- Red Data fauna species potentially occurring on the study site were assessed, in terms of available habitat and distribution of the species. Faunal species observed were noted;
- The ecological sensitivity of the site, envisaged impacts of the development and recommendations regarding mitigation measures have been provided;
- The quality of the vegetation is described as very good, good, moderate, poor and very poor according to the following criteria (see below).

Table 1: Conservation Value criteria used

Table 1: Conservation Value criteria used to evaluate the study site	
Very good	High species richness as compared to other similar vegetation types and units, no exotic vegetation, no human related disturbances, no invasive weedy vegetation. A specific Red Data plant occurs here. A plant/eco-system occurs here, which plays an important role in the survival of any Red Data faunal species.
Good	High species richness as compared to other similar vegetation types and units, low number of exotic vegetation, low human related disturbances, low number of invasive weedy vegetation
Moderate	Average species richness as compared to other similar vegetation types and units, exotic vegetation evident, human related disturbances observe, invasive weedy vegetation obvious
Poor	Poor species richness as compared to other similar vegetation types and units, lots of exotic vegetation evident, substantial human related disturbances observed, substantial invasive weedy vegetation obvious
Very poor	Very poor species richness as compared to other similar vegetation types and units, extensive exotic vegetation evident, extensive human related disturbances observed, extensive invasive weedy vegetation obvious

3. DESCRIPTION OF THE VEGETATION AND LAND USE

3.1 Vegetation

Biome: Savannah

Physiographic region: Limpopo valley

Veldtype: Acocks Veld Type no. 15, which is classified as Mopane veld. This Veldtype is well represented in declared conservation areas.

Low and Van Rebelo (1996) mentions that the study site falls within the area designated as the Mopane Bushveld vegetation type this vegetation type is situated in the Savanna Biome (Rutherford & Westfall 1994). The following species are identified as prominent indicators of this vegetation type:

- Woody Species : *Colophospermum mopane*, *Combretum imberbe*, *Acacia nigrescens* and *Lonchocarpus capassa*.
- Low Shrubs: *Dicrostachys cinerea*, *Grewia spp.* and *Boscia foetida*.
- Graminids: *Panicum coloratum*, *P. maximum*, *Bothriochloa radicans*, *Digitaria eriantha*.

The conservation status of the Mopane Bushveld is described as effectively entirely conserved by Low and Van Rebelo (1996). The Mapungubwe National Park, Musina Provincial Nature Reserve, Venetia Mine Conservancy and the private game farms is an indication of the conservation status in the direct area.

3.2 Location and Land use

The facility is situated on the LIMPOPO VIEW 42 MT within MUSINA Local Municipality, Vhembe District, Limpopo Province

The co-ordinates (WGS84 - Lo 31°) of the project site are Latitude 22°21'32.50" and Longitude 30°17'44.83".

The farm is used mainly for game farming, agriculture practices is along the Limpopo River.

The farm LIMPOPO VIEW 42 MT is 1521.4112 ha in size. It is directly bordering onto the Limpopo River. A portion of the farm is cut-off by the district road with the cut-off portion situated between the road and Limpopo River. It is on the cut-off portion on which the development took place. Of this area ±12 ha was being actively cultivated for crops prior to the new clearing. The rest of the farm south of the road is used for game farming and hunting.

4. VEGETATION ASSESSMENT

4.1 Vegetation community

The study site supported one vegetation community (Figure 1), namely:

4.1.1 Mopane Bushveld Community

This vegetation community comprises of two distinct ecological structure sub-areas namely; Terrestrial Riverine vegetation along the drainage line and the *Mopane* veld.

The area is situated in transformed floodplain area. Management roads also traverse the area.



Figure 1: View of vegetation and human impact (road/fences)



Figure 2: View of vegetation removed
The ecological structure are discussed below



Figure 3: View of undisturbed area
Sub-area A: Watercourse

The un-named watercourse enters the project area from the south after crossing underneath the gravel district road. Open water was found not found to be common in summer months along the watercourse. This is the smallest

ecological sub-area. Trees found along the drainage line are found at various distances of between 1 and 20 meters of the drainage banks on both sides. Prominent trees and shrubs found along the drainage line banks include the following; *Colophospermum Mopane*, *Terminalis prunioides*, *Boscia albitrunca*, *Grewia bicolor*, *Grewia flavescens* and *Acacia spp.* The herbaceous layer included *Enneapogon cenchroides*, *Arsitda congesta*, *Panicum maximum*, *Setaria verticillata* as the most prominent grass species in this sub-area.

Ecological structure

The ecological structure for this plant community is dominated by *Colophospermum mopane* interspersed mostly with *Acacia spp.* with baobab trees and various shrubs. The habitat provided for wild life is marginal, due to location in close proximity to farming infrastructure, in this area as can be expected and confirmed by sightings and signs of spoor and droppings. The area is effectively used for migrating of smaller mammal species. This area had a Low-Moderate conservation value ascribed to it due to moderate species richness and low presence of exotic species.



Figure 4: Vegetation on watercourse bank



Figure 5: View of vegetation along military patrol road. This area will also be cleared.

Sub-area B: Mopane tree area

The Mopane ecological sub-area is situated throughout the project area ranging from large trees to shrub Mopane. It covers most of the farm Limpopo View. It had moderate cover with low species richness. The dominant tree species were *Colophospermum mopane*, *Terminalia prunioides*, *Boscia albitrunca*, *Lonchocarpus capassa* and *Acacia tortillis*. Shrubs recorded included *Boscia foetida* and *Grewia spp.* The area showed long-term impact on vegetation.

Ecological structure

The ecological structure for this plant community is dominated by *Colophospermum mopane*. Part of the *Colophospermum mopane* is represented in shrub form. Ground cover is sparse. No browse line was found. This area had a Low conservation value ascribed to it due to low-moderate species richness and low presence of exotic species.



Figure 6: View of small baobab tree

Table 2: List of woody, non-woody, grasses and sedges species recorded on project area

Category: *exotic species and ** protected and/or threatened species

Table 2: Woody, non-woody, grasses and sedges recorded

WOODY PLANTS	
Botanical name	Common name
<i>Acacia ataxacantha</i>	Flame thorn
<i>Acacia burkei</i>	Black Monkey-Thorn
<i>Acacia erubescens</i>	Blue thorn
<i>Aacia mellifera</i>	Black Thorn
<i>Acacia nigrescens</i>	Knobthorn
<i>Acacia robusta</i>	Brack thorn
<i>Acacia senegal</i>	Three-hook thorn
<i>Acacia tortillis</i>	Umbrella acacia
<i>Annona senegalensis</i>	Wild custard-apple
<i>Boscia albitrunca</i>	Shepherd's tree **
<i>Boscia foetida rehmannia</i>	Stink shepherd's tree
<i>Cassine transvaalensis</i>	Transvaal Saffron
<i>Colophospermum Mopane</i>	Mopane
<i>Combretum apiculatum</i>	Red bushwillow
<i>Combretum imberbe</i>	Leadwood **
<i>Combretum microphyllum</i>	Flame Creeper
<i>Commiphora edulis</i>	Rough-leaved corkwood
<i>Commiphora marlothi</i>	Paperbark corkwood

<i>Commiphora pyracanthoides</i>	Common corkwood
<i>Commiphora schimperi</i>	Glossy-leaved corkwood
<i>Cordia grandicalyx</i>	Round-leaved saucer-berry
<i>Datura stramonium</i>	Common thorn-apple *
<i>Dichrostachys cinerea</i>	Sickle bush
<i>Dovyalis caffra</i>	Kei-apple
<i>Elephantoriza burkei</i>	Sumach bean
<i>Eucleadivinatorum</i>	Magic guarri
<i>Euphorbia cooperi</i>	Transvaal candelabra tree **
<i>Ficus tetensis</i>	Small-leaved Rock Fig
<i>Gardenia volkensii</i>	Savanna gardenia
<i>Grewia bicolor</i>	White raisin
<i>Grewia flavescens</i>	Sandpaper raisin
<i>Gymnosporia senegalensis</i>	Red spike-thorn
<i>Hexalobus monopetalus</i>	Shakama plum
<i>Kirkia acuminata</i>	White seringa
<i>Lonchocarpus capassa</i>	Apple-leaf **
<i>Terminalia prunioides</i>	Lowveld Cluster-leaf
<i>Ximenia caffra</i>	Sourplum
<i>Ziziphus mucronata</i>	Buffalo-thorn

Non-woody plants	
Scientific name	Common name
<i>Abutilon austro-africanum</i>	NA
<i>Asparagus suaveolens</i>	Wild asparagus
<i>Asparagus cooperi</i>	NA
<i>Harpagophytum zeyheri</i>	
<i>Heliotropium steudneri</i>	
<i>Indigofera spp.</i>	
<i>Laggera decurens</i>	Silky Sage
<i>Peristrophe gillilandiorum</i>	
<i>Plumbago zeylanica</i>	
<i>Sansevieria aethiopica</i>	

Grasses and sedges	
Scientific name	Common name
<i>Andropogon gayanus</i>	Blue grass
<i>Andropogon chinensis</i>	Hairy blue grass
<i>Aristida congesta</i>	Tassel three-awn
<i>Aristida stipiata</i>	Longawned grass
<i>Aristida adscensionis</i>	Annual three-awn
<i>Cymbopogon plurinodis</i>	Narrow leaved turpentine grass
<i>Enteropogon macrostachyus</i>	Mopane grass
<i>Eragrostis rigidior</i>	Curly leaf
<i>Heteropogon contortus</i>	Spear grass
<i>Perotis patens</i>	Cat's tail

<i>Schizachyrium sanguineum</i>	Red autumn grass
<i>Schmidtia pappophoroides</i>	Sand quick
<i>Setaria verticillata</i>	Bur bristle grass
<i>Setaria sphacelata</i>	Creeping bristle grass
<i>Sporobolus panicoides</i>	Christmas tree grass
<i>Tragus berteronianus</i>	Carrot seed grass

4.2 Red Data Flora Assessment

Temperature and rainfall are important climatologically parameters in sustaining the physical environment and plays a significant role of determining the biotic environment of a specific area. Temperature and precipitation data are included for a better understanding and interpretation of the natural environment as found in the general area.

Red Data species were surveyed during the site visits. Hall, de Winter & Van Oosterhout (1980) listed 26 Red Data plant species in the quarter degree grid square within which the Transfrontier Park is situated. Van der Walt (2009) is quite correct in her mentioning that information on the occurrence and distribution of threatened and endemic species in the Limpopo Valley region is limited.

The following species is listed in the Interim Red List, March 2006, as compiled by the Threatened Species Programme (Van der Walt, 2009).

Table 3: Interim Red Data list

No	Botanical name	Common name
ENDANGERED		
1	<i>Plinthus rehmannii</i>	NA
RARE		
2	<i>Otholobium polyphyllum</i>	NA
3	<i>Peristrophe cliffordi</i>	NA
4	<i>Peristrophe decorticans</i>	NA
5	<i>Peristrophe gillilandiorum</i>	NA
LEAST CONCERNED		
5	<i>Barleria holubii</i>	Small-leaved Barleria
6	<i>Hermbstaedia capitata</i>	NA
7	<i>Hibiscus waterbergensis</i>	NA
8	<i>Psoralea repens</i>	NA

The habitat requirements and distribution of these species were scrutinized one by one during surveys to establish and confirm the presence on the site, none were

found. Species protected under the Limpopo Environmental Management Act, 2003 (Act No.107 of 2003) such as *Orbea carnos*, *O. rogersii* and *Tavaresia barklyi* was also not found on the project area.

A number of species that are considered protected in accordance to the National Forest Act 1998 (Act No 84 of 1998) were recorded. These species were:

- Baobab tree (*Adansonia digitata*)
- Shepherd's tree (*Boscia albetrunca*)
- Apple leaf (*Longocarpus capassa*)

Species that can have an effect on Red Data species, and other species, due to their ability to encroach is also listed according to the Conservation of Agriculture Resources, 1983 (Act No 43 of 1983). A total of seven (7) species were listed.

These species are:

- *Acacia karroo*
- *Acacia erubescens*
- *Colophospermum mopane*
- *Dichrostachys cinerea*
- *Grewia bicolour*
- *Grewia flavescens*

Not one of the species could be considered as a problem at this stage due to the contribution that they make to the provision of leaf foliage. One exotic species was found on the project area; Boxing Glove Cactus (*Cylindropuntia fulgida*).



Figure 7: Invader specie

4.3 Carrying capacity

The carrying capacity for Mopane veld according to an average rainfall at 355mm is 3 LSU/100ha for grazers and 10 LGU/100 ha. This is based on the data for Messina Agricultural Research Station.

4.4 Drainage lines

4.4.1 Background

The effect the crop development will have on the vegetation has to be considered on specie level and on community level. The watercourse has no base-flow between storms. The influence of the project on the flow of water and the effect on the vegetation seems however to be more of a pollution issue than a surface fluvial and hydrology concern. No signs of overflow could be discerned by vegetation growth caused by overflow towards the watercourse or indication of erosion.

4.4.2 Situation

The vegetation along the watercourse through the project area is stable.



Figure 8: View of watercourse with stable vegetation

The closer to the Limpopo river the vegetation structure does not alter to larger and denser vegetation associated where perennial water bodies are found. The integrity of the vegetation on the banks has to be preserved by the 32 meter buffer zone, this will prevent impact.

No signs of pollution from farming were found. The project is outside the 32 m off-set distance from the Limpopo River. The Border Protection System (BPS) is situated in the vegetation zone where the riparian and terrestrial vegetation is located. The project will have no on impact on the riparian vegetation.



Figure 9: View of terrain with riparian zone left on picture and project on right of road

The project is situated outside the 1:10 year floodzone.



Figure 10: Floodline 1 in 10 year

4.4.3 What can be expected?

Vegetation will be removed with the provision that protected species left intact. It was found at similar scenarios that the protected species survive and provide some form of habitat for arboreal species.

4.4.4 Conclusion

The vegetation, mainly transformed over time, does not include the vegetation on the banks. The vegetation does not represent vegetation communities of importance, such as riparian vegetation. Protected species was found to be left intact on the cleared area. Protected species was found in the area (adjoining to

the east) that is planned to be cleared in future. A 32 meter minimum buffer zone will protect the terrestrial vegetation associated with the watercourse.



Figure 11: Buffer zone along watercourse recommended

5. FAUNAL ASSESSMENT

With the proposed new crop farming habitat will be altered. Mostly terrestrial and arboreal species will be influenced. It can thus be expected that the biodiversity of the farm and in specific the project area will be marginally influenced as the expansion development is integrated with existing development.

On the other hand the question of what the development area will have on the current species. Normally it is found that species will disperse to surrounding areas. The project area has ample suitable habitat for all the species to move into. What is also a reality is that the lucerne crops will provide food for various species which results in conflict if not crops is not correctly managed by prevention measures such as electrification.

5.1 Mammals

5.1.1 Species status quo

Signs were present for various small mammal species including rodents, hare and small-, medium-and large herbivores. The study area border onto other farmland and animals, mainly animals that can creep beneath fences can be

expected to move between the properties surrounding the project area. Elephant also move into South Africa from Zimbabwe, especially in the dry winter months when food and water is scarce in Zimbabwe.

In Table 4 below a list is supplied of animals positively identified by the writer as well as species that were confirmed in their occurrence with the owner. The writer, Mr Claassens is known with this area since the 1980's and was the regional conservation director. Where no positive information was obtained the writers knowledge based on 36 years experience of the area as well as checklist on species for provincial reserves in the area was used as control. In Table 4 under column PRESENT the presence or occurrence of species is indicated by Y= positive identification by writer; N= no possibility of occurrence, due to management or financial constrains as well as isolation of the area; P= strong possibility of occurrence. Many of the smaller mammals, e.g. mongooses etc. were not listed. Species indicated with an asterisk (*) indicates movement into area form Zimbabwe.

Table 4: List of animals identified or verified

SCIENTIFIC NAME	COMMON NAME	PRESENT
<i>Pappio ursinus</i>	Baboon	Y
<i>Syncerus caffer</i>	Buffalo*	N
<i>Tragelaphus scriptus</i>	Bushbuck*	Y
<i>Potamochoerus larvatus</i>	Bushpig*	P
<i>Sylvicapra grimmia</i>	Common Duiker*	Y
<i>Acinonyx jubatis</i>	Cheetah	N
<i>Tragelaphus oryx livingstonii</i>	Eland*	Y
<i>Loxodonta africana africana</i>	Elephant*	N
<i>Oryx gazella</i>	Gemsbok	N
<i>Camelopardus giraffe</i>	Giraffe	P
<i>Hippopotamus amphibius</i>	Hippopotamus	N
<i>Aepyceros melampus</i>	Impala	Y
<i>Oreotragus oreotragus</i>	Klipspringer	N
<i>Tragelaphus strepsiceros</i>	Kudu*	Y
<i>Panthera pardalus</i>	Leopard	Y
<i>Panthera leo</i>	Lion Free roaming*	N
<i>Cercopithecus aethiops</i>	Monkey Vervet	Y
<i>Tragelaphus angasi</i>	Nyala*	N
<i>Struthio camelus</i>	Ostrich	N
<i>Raphicerus sharpie</i>	Sharp's Grysbok	N

<i>Hippotragus equinus</i>	Roan	N
<i>Hippotragus niger</i>	Sable	N
<i>Raphicerus campestris</i>	Steenbok	Y
<i>Phacochoerus africanus</i>	Warthog*	Y
<i>Kobus ellipsiprymnus</i>	Waterbuck	Y
<i>Connochaetus taurinus</i>	Wildebeest Blue	Y
<i>Equus burchellii</i>	Zebra	Y
<i>Manis temminckii</i>	Pangolin	P
<i>Orycteropus afer</i>	Aardvark	P
<i>Mellivora capensis</i>	Badger	P
<i>Canis mesomelas</i>	Black-backed Jackal	Y
<i>Otocyon megalotis</i>	Bat-eared Fox	P
<i>Crocuta crocuta</i>	Spotted hyaena*	Y
<i>Crocuta brunnea</i>	Brown hyaena	P
<i>Felis serval</i>	Serval	N
<i>Felis caracal</i>	Caracal	P
<i>Proteles cristatus</i>	Aardwolf	P
<i>Felis lybica</i>	African Wild Cat	P
<i>Genetta genetta</i>	Small-spotted Genet	Y
<i>Genetta tigrina</i>	Large-spotted Genet	Y
<i>Galago senegalensis</i>	Bushbaby	Y
<i>Otolemur crassicaudatus</i>	Thick-tailed Galago	P

5.1.2 Red Data Species

In Table 5 below a list of mammals is supplied as identified in the surveys on using available literature and references.

Potential Red Data mammals of the study area are listed below.

SARDB / IUCN (World Conservation Union): CR = Critically Endangered, E = Endangered, VU = Vulnerable, NT = Lower Risk near threatened, DD = Data Deficient

Table 5: Potential Red Data mammals

SCIENTIFIC NAMES	COMMON NAMES	SARDB	ENDEM	Does suitable habitat occur on Site?	Probability of the species occurring on site? (High/Medium/Low)
ORDER ARTIODACTYLA/PERISSODACTYLA/PROBOSCIDE					
<i>Raphicerus sharpie</i>	Sharp's Grysbok	NT	No	No	Low
ORDER CARNIVORA					

<i>Hyaena brunnea</i>	Brown hyaena	NT	No	Yes	Low
<i>Leptailurus serval</i>	Serval	NT	No	No	Low
<i>Mellivora capensis</i>	Honey badger	NT	No	Yes	Medium
<i>Crocuta crocuta</i>	Spotted hyaena	NT	No	Yes	Medium
<i>Lycaon pictus</i>	Wild dog	E	No	No	Low
<i>Acinonyx jubatis</i>	Cheetah	VU	No	No	Low
<i>Pantera leo</i>	Lion	VU	No	Yes	Low
<i>Panthera pardus</i>	Leopard	LC	No	Yes	Medium
ORDER HYRACOIDEA					
<i>Procavia capensis</i>	Rock Hyrax	LC	No	No	Low
<i>Crocidura hirta</i>	Lesser Red Musk Shrew	DD	No	No	Low
ORDER INSECTIVORA					
<i>Atelerix frontalis</i>	South African hedgehog	NT	No	Grassland and open thornveld	Low
ORDER LAGOMORPHA					
<i>Lepus saxatilis</i>	Scrub hare	LC	No	Yes	High (Positive)
<i>Pronolagus randensis</i>	Jameson's Red Rock Rabbit	LC	No	No	Low
ORDER MACROSCELIDEA/PHOLIDOTA/TUBULIDENTATA					
<i>Manis temminckii</i>	Pangolin	VU	No	No	Low
<i>Orycteropus afer</i>	Aardvark	LC	No	No	Low
ORDER PRIMATA					
<i>Cercopithecus aethiops pygerythrus</i>	Vervet monkey	LC	No	Yes	High (Positive)
<i>Galaogo moholi</i>	Southern Lesser Galago	LC	No	Yes	High
<i>Otolemur crassicaudatus</i>	Thick-tailed Bushbaby	LC	No	Yes	Low
<i>Papio ursinus</i>	Chacma baboon	LC	No	Yes	High (Positive)
ORDER RODENTIA					
<i>Dasymys incomtus</i>	Water rat	NT	No	No	Low

5.1.3 Habitat description

The farm has been used over nearly 70 years, and longer, for farming activities consisting mainly for cattle and goats. With the advent of game farming the farm was eventually fenced for game in the middle-to-late 1970's. The habitat is mainly flat deciduous woodland sloping upwards away from the river. The

drainage lines are shallow drainage lines only filled with water and flowing when the area receives heavy downpours in the summer months. The remaining veld consists mainly of *Mopane* veld some of which is shrub veld.

No management plan exists. The focus is mainly on crop farming on the portion along the river.

5.1.4 Habitat assessment

The habitat has been moderately altered over time. The portion is too small to be managed as economic game unit; the meaning is thus that it cannot sustain itself for extensive game farming. The smallest economic unit should be 5000 ha for this area (Snyman, 1991). Habitat is however suitable for most of the species mentioned above. The constraints are the small areas, no permanent water, the isolation and the type of management implemented. The area is also in FMD control area.

5.1.5 Habitat after extension

Significant alteration to habitat will take place on the proposed cleared areas. Some species will be influenced negatively, however in a minor proportion due to size of the project area. Smaller species will however benefit.

5.1.6 Birds

The types of habitat found on the project area are trees along the drainage line and deciduous wooded savanna. The main part of the project area can be described as homogeneous habitat with no permanent water except from the Limpopo River and the dams away from the project area. While no detailed bird assessment was conducted for the site, notes were made during the various site visits (day and night) of birds seen.

Important bird information for Limpopo Province

Southern African BIRDS	-	887 species
Limpopo	-	587 species = 66% of SA birds
Southern African endemics	-	149 species
Only Limpopo in SA	-	20 species
SA RED DATA	-	125 species
Limpopo RED DATA	-	74 of the 125 species
<u>SA Critically endangered</u>	-	5 species
Limpopo “	-	3 of the 5 species
Endangered in SA	-	11 species
Endangered in Limpopo	-	3 of 11 species
Vulnerable in SA	-	43 species

Endangered in Limpopo	-	22 of 43 species
Near threatened in SA	-	64 species
Endangered in Limpopo	-	39 of 64 species

Table 6: Important Birding Areas

NUMBER	NAME	SIZE = Ha	COORDINATES SOUTH	COORDINATES EAST	PROTECTION STATUS
SA001	Mapungubwe NP	2500	22°13'	29°19'	Fully
SA002	Kruger Park NP & Adjacent areas	2 142 528	22°23'-26°	30°50' - 32° 02'	Fully
SA003	Soutpansberg	260 000	22° 57'	29° 20' – 30° 30'	Partially
SA004	Blouberg	30 000	23° 07'	28° 52' – 29° 03'	Partially
SA005	Wolkberg	65 000	23° 38'	29° 50' – 30° 15'	Partially
SA006	Pietersburg Nat. Reserve	3 200	23° 56'	29° 30'	Fully
SA007	Waterberg System	375 000	24° 10' – 24° 25'	27° 30' – 28° 40'	Partially
SA008	Nylriver & Floodplain	16 000	24° 39'	28° 42'	Partially
SA009	Northern Turf Thornveld	50 000	24° 43' – 24° 56'	27° 10' – 27° 30'	Unprotected

Of the nine IBA's in Limpopo province, three areas, namely SA001, SA003 and SA004 are in near proximity to the project area. The Limpopo River can be considered as important on its own as well as the artificial habitat created by irrigation dams along the river.

5.2.1 Species Status quo

A number of common bird species were observed during those visits to the project area, such as Helmeted guineafowl (*Numida meleagris*), Gymnogene (*Polyboroides typus*), European bee-eater (*Merops apiaster*), Diederick cuckoo (*Chrysococcyx caprius*), Greyheaded bush shrike (*Malaconotus blanchoti*), Whitenecked raven (*Corvus albicollis*) and Klaas's Cuckoo (*Chrysococcyx klaas*), Spotted Sandgrouse (*Pterocles burchelli*), Ground Hornbill (*Bucorvus leadbeateri*) and Kori Bustard (*Ardeotis kori*)

No exotic species (mynah and mallard) most commonly found in Limpopo province was encountered in the area.

5.2.2 Red Data Species

Potential Red Data Birds of the study area are listed below.

SARDB / IUCN (World Conservation Union): CR = Critically Endangered, E = Endangered, VU = Vulnerable, NT = Lower Risk near threatened, DD = Data Deficient

The list of Red Data birds recorded in or around the project area. An indication is provided if suitable habitat occurs on the site. The possibility for their occurrence in the future should the project proceed is also mentioned.

Table 7: Potential Red Data Birds species

SCIENTIFIC NAMES	COMMON NAMES	ENDEM	Does suitable habitat occur on Site?	Probability of the species occurring on site? (High/Medium/Low)
ENDANGERED				
<i>Epphippiorhynchus senegalensis</i>	Saddlebilled Stork	N	N	Low
VULNERABLE				
<i>Polemaetus bellicosus</i>	Martial Eagle	N	Y	High
<i>Circus ranivorus</i>	African marsh Harrier	N	N	Low
<i>Polemaetus bellicosus</i>	Martial Eagle	N	Y	High
<i>Aquila rapax</i>	Tawny Eagle	N	Y	High
<i>Gyps coprotheres</i>	Cape Vulture	N	Y	High
<i>Torgos tracheliotus</i>	Lappetfaced vulture	N	Y	High
<i>Trigonoceps occipitalis</i>	Whiteheaded Vulture	N	Y	High
<i>Polemaetus bellicosus</i>	Martial Eagle	N	Y	High
<i>Terathopius ecaudatus</i>	Bateleur	N	Y	High
<i>Ardeotis kori</i>	Kori Bustard	N	Y	High
<i>Bucorvus leadbeateri</i>	Ground Hornbill	N	Y	High
<i>Buphagus africanus</i>	Yellowbilled Oxpecker	N	Y	Low
NEAR THREATENED				
<i>Leptoptilos crumeniferus</i>	Marabou Stork	N	Y	Medium
<i>Hieraaetus ayresii</i>	Ayre's Eagle	N	Y	Low
<i>Circus pygargus</i>	Pallid Harrier	N	N	Low
<i>Sagittarius serpentarius</i>	Secretary Bird	N	Y	High
<i>Buphagus erythrorhynchus</i>	Redbilled oxpecker	N	Y	High (Positive)

No endangered species (not likely to occur on the project area due to current habitat), 11 of the vulnerable species for Limpopo province have the potential to occur on the area on a permanent, semi-permanent or seasonal basis. For the Near Threatened species a total of 4 of the species occurring in Limpopo province have the potential to occur on the area on a permanent, semi-permanent or seasonal basis.

5.2.3 Habitat description

The types of habitat found on the project area are deciduous wooded savanna. The main part of the project area can be described as homogeneous habitat with no permanent water except one watering point. The project area is situated approximately 40m directly south of the Limpopo River placing it close enough for avian species to move between the two areas.

5.2.4 Habitat assessment

The present high human interference on the project area does not allow for suitable habitat for threatened species visiting the area. The game farming areas to the east, inland-south and Kruger National Park National Park to the east contributed to species visiting the area. The area is considered as an Important Birding Area. The savannah is rated as third most important vegetation type for threatened species (Barnes, p11; 2000). The importance for threatened species for the area is further highlighted with the presence of the rivers that is considered as the second most important vegetation type for threatened species.

5.2.5 Habitat after extension

The impact by the extension will not influence the area as an Important Birding Area.

5.2 Herpetological survey

A variety of natural habitat including good cover and rocky habitat is available for reptiles. A number of common reptile species can be expected to occur on the site, including Puff adders (*Bitis arietans*), Rhombic night adders (*Causus rhombeatus*), Rinkhals (*Hemachatus haemachatus*), Brown house snake (*Lamprophis fuliginosus*), Ground agama (*Agama aculeate*), Leopard tortoise (*Geochelone pardalis*), Flap-neck chameleon (*Chamaeleo dilepis*) and Striped skinks (*Trachylepis striata*).

5.3.1 Species Status Quo

Reptile lists provided are for the species most likely to occur on the study site using alternative habitats as indicators for reptile fauna present on the site. As control the reptile list for the Messina-, Langjan Provincial nature Reserves and Mapungubwe National Park (formerly the Vhembe Provincial Nature Reserve) were used.

Table 8: Herpetofaunal checklist

TORTOISES AND TERRAPINS		
NO	SCIENTIFIC NAMES	COMMON NAMES
1	<i>Geochelone pardalis</i>	Leopard Tortoise
2	<i>Kinixys spekii</i>	Bell's Hinged Tortoise
LIZARDS		
1	<i>Afroedura t. transvaalica</i>	Transvaal Gecko
2	<i>Hemidactylus mabouia</i>	Moreau's Tropical House Gecko
3	<i>Lygodactylus c. capensis</i>	Cape Dwarf Gecko
4	<i>L. stevensoni</i>	Stevenson's Dwarf Gecko
5	<i>L. bradfieldi</i>	Bradfield's Dwarf Gecko
6	<i>Ptenopus g. garrulus</i>	Barking Gecko
7	<i>Pachydactylus punctatus</i>	Speckled Gecko
8	<i>Pachydactylus tigrinus</i>	Tiger Gecko
9	<i>P. c. capensis</i>	Cape Gecko
10	<i>P. bibronii</i>	Bibron's Gecko
11	<i>Agama atricollis</i>	Tree Agama
12	<i>A. armata</i>	Not available
13	<i>Chamaeleo d. dilepis</i>	Flap-necked Chameleon
14	<i>Scelotus limpopoensis albiventris</i>	Limpopo Dwarf Burroughing Skink
15	<i>Mabuya quinquetaeniata margaritifera</i>	Rainbow Skink
16	<i>Mabuya capensis</i>	Cape Skink
17	<i>Mabuya variegata punctulata</i>	Speckled Skink
18	<i>M. varia</i>	Variable Skink
19	<i>M.s. striata</i>	Striped Skink
20	<i>Lygosoma s. sundavallii</i>	Sundevall's Writhing Skink
21	<i>Panaspis wahlbergii</i>	Wahlberg's Snake-eyed skink
22	<i>Acontias percivalli occidentalis</i>	Percival's Legless Skink
23	<i>Nucras ornata</i>	NA spesie naam verander
24	<i>Nucras taeniolata holubi</i>	Ornate Longtailed Lizard
25	<i>N. intertexta</i>	Spotted Longtailed Lizard
26	<i>Heliobolus lugubris</i>	Bushveld Lizard
27	<i>Pedioplanus l. lineoocellata</i>	Spesie naam verander
28	<i>Ichnotropis squamulosa</i>	Common Rough-scaled Lizard
29	<i>Cordylus tropidosternum jonesi</i>	Tropical Girdled Lizard
30	<i>Platysaurus intermedius rhodesians</i>	Common Flat Lizard
31	<i>Platysaurus i. Intermedius</i>	Common Flat Lizard
32	<i>Gerrhosaurus v. validus</i>	Giant Plated Lizard
33	<i>G. flavigularis</i>	Yellow-throated Plated Lizard
34	<i>G. nigrolineatus</i>	Black-striped Plated Lizard
35	<i>Varanus albigularis</i>	Rock or white-throated Monitor
36	<i>V.n. niloticus</i>	Nile or Water Monitor
37	<i>Monopeltis s. sphenorhynchus</i>	Slender Spade-snouted Worm Lizard
SNAKES		
NO	SCIENTIFIC NAMES	COMMON NAMES
1	<i>T. s. schlegelii</i>	Schlegels' Blind Snake
2	<i>Leptotyphlops longicaudus</i>	Long-tailed Thread Snake
3	<i>Python sebae natalensis</i>	African Rock Python
4	<i>Lamprophis fuliginosus</i>	Brown House Snake
5	<i>Lycophidion c. capense</i>	Cape Wolf snake
6	<i>Mehelya capensis</i>	Cape File Snake
7	<i>M. nyassae</i>	Black File Snake
8	<i>Pseudaspis cana</i>	Mole Snake
9	<i>Psammophylax tritaeniatus</i>	Striped Skaapsteker
10	<i>Rhamphophis oxyrhynchus rostratus</i>	Rufous Beaked Snake

11	<i>Psammophis s. subtaeniatus</i>	Stripe-bellied Sand Snake
12	<i>P. angolensis</i>	Dwarf Sand Snake
13	<i>P. jallae</i>	Jalla's Sand Snake
14	<i>Aparallactus capensis</i>	Cape Centipede Eater
15	<i>Atractaspis bibronii</i>	Southern or Bibron's Burrowing Asp
16	<i>Philothamnus s. semivariatus</i>	Spotted Bush Snake
17	<i>Crotaphopeltis hotamboeia</i>	Herald or Red-lipped Snake
18	<i>Telescopus s. semiannulatus</i>	Eastern Tiger Snake
19	<i>Dispholidus t. typus</i>	Boomslang
20	<i>Thelotornis c. capensis</i>	Bird or Twigg Snake
21	<i>Dasyplectis scabra</i>	Common or Rhombic Egg Eater
22	<i>Elapsoidea sundevallii longicauda</i>	Sundevall's Garter Snake
23	<i>Aspidelaps s. scutatus</i>	Shield-nose Snake
24	<i>Naja haje annulifera</i>	Egyptian Cobra
25	<i>N. mossambica</i>	Mozambique Spitting Cobra
26	<i>Dendroaspis polylepis</i>	Black Mamba
27	<i>Causus rhombeatus</i>	Common Night Adder
28	<i>Bitis caudalis</i>	Horned Adder
29	<i>Bitis a. arietans</i>	Puff Adder

5.3.2 Red Data Reptile Species

Red Data Species as listed by McLachlan (1978) indicates that the following species occur.

Table 9: Red Data herpetofauna likely to occur

SCIENTIFIC NAMES	COMMON NAMES	PRESENCE
VULNERABLE		
<i>Python sebae</i>	African Rock Python	Possible
<i>Varanus exanthematicus</i>	Veld Monitor	Possible
<i>Varanus niloticus</i>	Water Monitor	Possible

Three of the three vulnerable species could most probably be present on the project area. The habitat is suitable for all.

5.3.3 Habitat description

A low variety of natural habitat including watercourse habitat and semi-arid savannah provide habitat and conditions suitable for reptiles. Permanent water habitat is available in the inland dams and Limpopo River.

5.3.4 Habitat assessment

The species is found mainly along the Limpopo River.

5.3.5 Habitat after extension

No influence on reptiles is expected to occur.

5.3 Amphibians

Breeding of African frogs is strongly dependant on rain, especially in the drier parts of the country where surface water only remains for a short period. The majority of frog species in the drier regions of Limpopo province are classified as explosive breeders. As the survey was undertaken in the mid-and-late winter period, no species were recorded.

5.4.1 Species Status Quo

The list below provided are for the species most likely to occur on the study site using alternative habitats as indicators for reptile fauna present on the site. As control the reptile list for the Messina-, Langjan Provincial nature Reserves and Mapungubwe National Park (formerly the Vhembe Provincial Nature Reserve) were used.

Table 10: List of possible amphibians occurring on project area

No	Scientific name	Common name
1	<i>Bufo gutturalis</i>	Guttural Toad
2	<i>Schismaderma carens</i>	Red Toad
3	<i>Breviceps a. adspersus</i>	Bushveld Rain Frog
4	<i>Phrynomerus bifasciatus</i>	None
5	<i>Tomopterna cryptotus</i>	Tremolo Sand Frog
6	<i>Rana angolensis</i>	None
7	<i>Cacosternum boettgeri</i>	Common Caco
8	<i>Chiromantis xerampelina</i>	Foam Nest Frog
9	<i>Kassina senegalensis</i>	Bubbling Kassina
10	<i>Phrynomantis bifasciatus</i>	Banded Rubber Frog
11	<i>Hemisis marmoratus</i>	Mottled Shovel-nosed Frog
12	<i>Chiromantis xerampelina</i>	Foam nest Frog
13	<i>Hildebrandtia ornate</i>	Ornate Frog
14	<i>Tomopterna mamorata</i>	Russet-backed Sand Frog
15	<i>Bufo maculates</i>	Flat-backed Toad
16	<i>Bufo garmani</i>	Eastern Olive Toad

5.4.2 Red Data Species

No Red Data Species could be identified that could possibly occur on the project area.

5.4.3 Habitat Description

The habitat consists of dry Mopane veld and the natural watercourse where water is only present during the rainy period. The irrigation dams provide and support living organism's dependant on water, e.g. fish and amphibians.

5.4.4 Habitat Assessment

The watercourse is an ephemeral stream (a stream that only flows when it storms) with no pools were water can provide habitat, seasonally, for

amphibians, the Limpopo river provide habitat to successfully complete their lifecycles.

5.4.5 Habitat after extension

Habitat will be altered but the extend is local on of Low importance.

6 IMPACTS AND MITIGATION MEASURES

6.1 Potential Impacts of the development

The following impacts may potentially occur.

6.1.1 Loss of habitat/eco-systems

The entire *Mopane Bushveld community* on the project area were considered to have low to moderate conservation values based on the low species richness and composition of the vegetation recorded. As a result of this the unit provide minimum habitat to a number of common and threatened fauna species.

Large trees and most protected species along the watercourse is not influenced. Mainly Mopane trees will be lost. Protected trees were left intact.

In summary the impact of the project on the available habitat on the project area will be of Local extent, Permanent duration, Low intensity and Medium probability. The significance of the loss of habitat will be Medium without mitigation and Low with mitigation during the construction phase. During the operational phase, impacts will be Low with or without mitigation.

Impact Summary Matrix

Phase	Significance of Impact				
	None	Low	Medium	High	With Mitigation
Construction			√		Low
Operational		√			Low

6.1.2 Impact on loss of sensitive species

The impacts are low with one protected tree species identified on the footprint.

In summary, the impact of development on the loss of sensitive species is likely to be of Local extent, short duration, Low intensity and Medium probability. The significance of potential impacts on sensitive species loss will be Low without mitigation and Low with mitigation during the construction phase. During the

operational phase such impacts are expected to be None with or without mitigation measures.

Impact Summary Matrix

Phase	Significance of Impact				
	None	Low	Medium	High	With Mitigation
Construction		√			Low
Operational	√				None

6.1.3 Impacts on habitat/rural connectivity and open space

The site is located between two manmade structures, e.g. the BPS and district road and is isolated with natural areas and farmland (game farms) bordering the site to the west, east and south across the roads.

Connectivity to the surrounding land is not good. The two manmade structures mentioned above isolate the project area from surrounding areas in a lesser manner.

The impact of development on connectivity is likely to be of Local extent, Short duration, Medium intensity and Medium probability. The significance of the loss in connectivity will be Low without mitigation and Low with mitigation during the construction phase. During the operation phase the significance will be none with or without mitigation. The significance of the impacts (positive) during the operation phase will be low with or without mitigation.

Impact Summary Matrix

Phase	Significance of Impact				
	None	Low	Medium	High	With Mitigation
Construction		√			Low
Operational		√			None

6.1.4 Impacts associated with construction activities

Construction activities will affect present habitat and species compositions directly through the alteration and disturbance of habitat, the displacement and probable destruction of species. Secondary impacts, such as the generation of noise and dust, are likely to displace some faunal species temporarily (particularly common bird species). Mitigation measures to minimise the impact on species and their habitats, as listed under Mitigation Measures, must be implemented during this phase. Protected

tree species was left intact and the proposed phased extension the species can also be left in-situ.

In summary, the impact associated with construction activities is likely to be of Local extent, Short duration, Medium intensity and have a Medium probability. The significance of such impacts will be Low without mitigation, and Low with mitigation.

Impact Summary Matrix

Phase	Significance of Impact				
	None	Low	Medium	High	With Mitigation
Construction		√			Low

6.2 Mitigation measures

Mitigation Measures for watercourse

- Indigenous tree and bush clumps occurring on the project area, and adjoining the footprint, must be protected as far as possible. This is due to the potential of these trees providing habitat for faunal species, particularly birds and invertebrates. Practical buffer area zonation on both sides of the watercourse must be decided on before planning for construction starts.

Mitigation Measures for the protected floral species

- Trees, shrubs and forbs should be protected during construction and incorporated into the development. Alternatively these species should be removed and transplanted into open space areas.
- Should any other protected or Red Listed plant species be encountered, these should be recorded and treated similarly to those mentioned above.

Mitigation Measures for the invasive floral species

- Have to be removed before construction commences.
- Proof of removal (photos) and description (photos) of destruction should be kept as record.

Mitigation Measures for the fauna conservation

- The site should not be fenced when construction start to allow for the dispersal of fauna to surrounding natural areas.
- Before clearing of vegetation or grubbing is done the area will be visually inspected by the environmental control practitioner for the project.

- After bush clearing the project areas must be fenced with a game fence and electrified. The BPR should not be fenced into the project area. This means that a game fence should be placed south of the BPS.

Mitigation Measures for the Construction Phase

- Exotic invasive species should be removed.
- Before construction starts, construction workers should be educated with regards to littering, ad hoc veld fires and dumping.

6. CONCLUSION

The site is predominantly moderately-to-highly modified showing signs of human activities.

The elements with the highest conservation value on the site were the Madibohloka watercourse largely due to the likelihood of sensitive species occurring in this area.

The proposed project on the above mentioned areas are not considered to be a no go to the project mainly due to the area having been altered to a high degree by past agricultural activities and the extent of the project area. The availability of similar habitats under conservation protection in the immediate surrounds however also affected the views in this report but not significantly.

A habitat assessment and literature assessment allowed for the listing of several red data fauna species that could potentially occur on the site, although none of the species were found it is still mandatory to ensure that a knowledgeable environmental-and conservation person with experience is used on the project. The close proximity of substantial tracks of natural land in the form of game farms, to the south, as well as the Mapungubwe National Park, to the east, and game farms to the south, allow for various faunal (common and sensitive) species to move in and out of the area. Most of the red data species listed are not local habitat bound and will be able to disperse slowly off the site as construction happens to similar habitat in the surroundings.

7. RECOMMENDATIONS

It is recommended that the following is incorporated in the EIAR:

- 8.1 That the mitigation measures in this report is incorporated in the environmental impact assessment report;

- 8.2 That all mitigated and other issues are incorporated and implemented through an environmental management plan.
- 8.3 That the recommendation in this report is implemented.
- 8.4 That the environmental management plan is implemented and updated with such information as deemed necessary.
- 8.5 That an environmental control officer (ECO) is appointed for the project before commencement of the project the pre-construction-, construction- and rehabilitation phase.

J. Claassens

REFERENCES

- Acocks, J.P.H. 1988. Veld Types of South Africa. Memoirs of the Botanical Survey of South Africa N. 57. Botanical Research Institute.
- Barnes, K.N. (ed.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Bird Life South Africa, Johannesburg
- Branch, W.R. 1998. Field Guide to Snakes and other reptiles of Southern Africa. Struik Publishers, Caper Town.
- Branch, W.R. 1988 (ed.) South African Red Data Book – Reptiles and Amphibians, S.A. National Scientific Programmes Report No 151.
- Bromilow, C. 1995. Problem Plants of South Africa. Briza Publications, Pretoria
- Carruthers, V. 2001. Frogs and Frogging in Southern Africa. Struik Publishers. ISBN 1-86872-607-X.
- Colvin C, D le Maitre, I. Saayamn, S. Hughes. 2007. An Introduction to Aquifer Dependent Ecosystems in South Africa. Water Researc Commission. Report TT 301/07.
- Freeman N. M. and K. Rowntree. 2005. Our Changing Rivers. An introduction to the science and practice of Fluvial Geomorphology. Water Research Commission. Report No TT238/05.
- Friedman, Y. and Daly B. (editors), 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.
- GDACE 1995. Assignment of the Nature Conservation Ordinance, 1983., of the Former Province Transvaal, to Certain Provinces under Section 235 (8) of the Constitution of the Republic of South Africa 1993; No. 22.
- Golding, J. Editor. 2002. Southern African Plant red Data List. Southern African Botanical Diversity Network Report No. 14. SABONET, Pretoria.
- Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. (eds.) 1997. The Atlas of Southern African Birds, Vol. 1 & 2. Bird Life South Africa, Johannesburg
- Maclean, G.L. 1993. Roberts' Birds of Southern Africa. John Voelcker Bird Book Fund, Cape Town

- Mills, G. & Hes, L. 1997. The complete book of Southern African Mammals. Struik Winchester, Cape Town, RSA
- McLachlan, G. R. 1978. South African Red Data Book: Reptiles and Amphibians. SANC Programmes Report No. 23.
- Mucina, L. & Rutherford, M.C. (eds.) 2006. The Vegetation of South Africa, Lesotho and Swaziland, *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- Onderstall, J. 1984. South African Wild Flower Guide: Transvaal, Lowveld and Escarpment including the Kruger National Park, Botanical Society of South Africa, Cape Town
- Passmore, N.I. & Carruthers, V.C. 1995. South African Frogs a Complete Guide. Southern Book Publishers, Witwatersand University Press, Johannesburg
- Raimondo, D., L. von Staden, W. Foden, J. E. Victor, N. A. Helme, R. C. Turner, D. A. Kamundi, P. A. Manyama. 2009. Red List of south Africa Plants. SANBI.
- Rutherford, M.C. and Westfall, R.H. 1994. Biomes of Southern Africa: an objective categorization. National Botanical Institute, Pretoria.
- Schmidt, E., Lotter, M. & McClelland, W. 2002. Trees and Shrubs of Mpumalanga and Kruger National Park, Jacana, Johannesburg
- Skinner, J.D. & Smithers, R.H.N. 1990. The Mammals of the Southern African Subregion. University of Pretoria, Pretoria, RSA.
- Smithers, R.H.N. 1986. South African Red Data Book – Terrestrial Mammals. S.A. National Scientific Programmes Report no 125. Pretoria
- Snyman, D. D. 1991. Drakragnorme vir Wildplase in die Mopanieveld, Noord van die Soutpansberg. Navorsing Sentrum vir Weiding. Departement van Landbou- Ontwikkeling.
- South African National Botanical Institute: Precise Lists for the Quarter Degree Grids 2530 AB and 2530 BA
- South African National Parks. 2006. Mapungubwe National Park: Park Management Plan. October 2006.
- Transvaal Provincial Administration: Nature Conservation Division. 1985. Atlas of the Threatened Plant Species of the Transvaal.
- Transvaal Provincial Administration: Nature Conservation Division. 1993. A Herpetological Survey of the Transvaal Provincial Reserves.

Van der Walt, R. 2009. Wild Flowers of the Limpopo Valley. Retha van der walt, Ludwiglust Game Farms. ISBN 978-0-620-43949-7.

Van Oudtshoorn, F. 1999. Guide to Grasses of Southern Africa. Briza Publications, Pretoria

Van Wyk, B., Van Oudtshoor, B. & Gericke, N. 1997. Medicinal Plants of South Africa. Briza. Pretoria

Van Wyk, B. and Malan, S. 1988. Field Guide to the Wild Flowers of the Witwatersrand and Pretoria Region. Struik Publishers, Cape Town

Van Wyk, B. and Van Wyk, P. 1998. Field Guide to the Trees of Southern Africa. Struik Publishers, Cape Town