

# TERRESTRIAL ECOLOGY ASSESSMENT OF THE PROPOSED MALELANE HOTEL SITE& PARK-AND-RIDE AREA



**March 2012**

Prepared for: Dereck Milburn  
V & L Landscape Architects  
PO Box 74648  
Lynwood Ridge 0040

Prepared by: Warren McClelland  
ECOREX Consulting Ecologists CC  
PO Box 57  
White River  
1240



## TABLE OF CONTENTS

Abbreviations .....	3
Declaration of Independence.....	3
1. INTRODUCTION .....	4
1.1 Background.....	4
1.2 Study Team .....	4
2. TERMS OF REFERENCE .....	4
3. STUDY AREA.....	5
3.1 Location.....	5
3.2 Physiography.....	5
3.3 Geology .....	5
3.4 Soils .....	6
3.5 Landuse.....	6
4. METHODS .....	8
4.1 Flora.....	8
4.2 Fauna.....	9
4.3 Ecological Importance and Sensitivity .....	9
5. BIODIVERSITY BASELINE DESCRIPTION .....	12
5.1 Flora.....	12
5.1.1 National Vegetation Types .....	12
5.1.2 Threatened Ecosystems.....	13
5.1.3 Centres of Plant Endemism .....	13
5.1.4 Threatened and Protected Flora .....	13
5.1.5 Vegetation Communities: Site 2 and Park-and-Ride Area .....	14
5.1.6 Vegetation Communities: Alternative Sites .....	17
5.1.7 Vegetation Communities: Road Realignment .....	18
5.2 Terrestrial Fauna.....	22
5.2.1 Mammals .....	22
5.2.2 Birds .....	22
5.2.3 Reptiles & Frogs .....	23
5.2.5 Terrestrial Fauna Importance Assessment.....	24
5.3 Perceived Biodiversity Value and Conservation Importance .....	25
6. KEY ISSUES .....	28
7. RECOMMENDATIONS.....	29
8. REFERENCES.....	30
9. APPENDICES .....	31
Appendix 1. Checklist of plants recorded in the study area .....	31
Appendix 2. List of confirmed fauna in study area .....	35
Appendix 3. Potentially occurring Red List Fauna.....	37
Appendix 4. Vegetation Community Photos.....	39
Appendix 5. Photos of Alternative Hotel Sites .....	41

## List of Tables

Table 1. Species-status scores in relation to conservation importance and local abundance. ....	9
Table 2. Significance of AFI Scores .....	10
Table 3. Species-status scores in relation to conservation importance of fauna. ....	11
Table 4. Significance of Conservation-importance Scores for Fauna .....	11
Table 5. Plant species of conservation concern potentially occurring in the study area .....	19
Table 6. Integrated Biodiversity Value / Conservation Importance of Vegetation Communities .....	26

## List of Figures

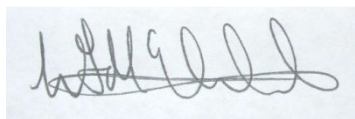
Figure 1. Location of Study Area .....	7
Figure 2. Vegetation communities represented in the study area (Site 2).....	20
Figure 3. Vegetation communities represented in the study area (park-and-ride site).....	21
Figure 4. Sensitivity Map of the study area .....	27

## Abbreviations

IBA	Important Bird Areas
mamsl	Metres Above Mean Sea Level
MPA	Mpumalanga Tourism & Parks Authority
NEMBA	National Environment Management: Biodiversity Act (No.10 of 2004)
SABAP	Southern African Bird Atlas Project
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks

## Declaration of Independence

We declare that we have been appointed as independent consulting ecologists with no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2006. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. Remuneration for our services by the proponent is not linked to approval by any decision-making authority responsible for authorising this development.



W.L.McClelland

16March 2011

# **1. INTRODUCTION**

## **1.1 Background**

SANParks has identified five possible sites for the Malelane Hotel Development. Interdesign Landscape Architects(ILA) approached ECOREX to provide the initialterrestrial ecology assessment of the developer's preferred site and to visit and assess the four other alternative sites,as well as the proposed road re-alignment and park-and-ride area.This was undertaken in September 2010 and January 2011. V & L Landscape then took over as the Environmental Assessment Practitioners for this project in 2011 and requested that ECOREX update the initial report.

## **1.2 Study Team**

**Warren McClelland** – Terrestrial Ecologist. Warren is the owner and director of ECOREX Consulting Ecologists CC, a consultancy of flora and vertebrate fauna specialists based in White River, Mpumalanga. He has been involved in specialist biodiversity assessments for a wide range of developments, particularly mining, throughout Southern and South-central Africa over the past 14 years. Countries of work experience outside of South Africa include Democratic Republic of the Congo, Zambia, Malawi, Mozambique, Namibia and Swaziland. Warren is the co-author of the highly acclaimed "Field Guide to the Trees & Shrubs of Mpumalanga & Kruger National Park" published in 2002, and is currently working on a field guide to the wildflowers of Mpumalanga.

# **2. TERMS OF REFERENCE**

- Describe the baseline terrestrial ecology of the impact footprint.
- Assess the Conservation Importance of the terrestrial habitats represented within the study area; this will include predicting which threatened species of fauna and flora potentially occur.
- Identify key issues that would be associated with the development.
- Make recommendations for mitigation measures.

### **3. STUDY AREA**

#### **3.1 Location**

The proposed Malelane Hotel Development is to take place within the Kruger National Park along the Crocodile River, which forms the park's southern boundary. SANParks has identified five possible sites for the Malelane Hotel Development (Figure 1):

Site 1: S25.440396 E31.521852

This is a rehabilitated area situated on the southern bank of the Matjulu River, about 200 metres upstream of the confluence with the Crocodile River.

Site 2: S25.419260 E31.555162

This is the developer's preferred choice and the site at which most fieldwork took place. It is situated along the bank of the Timfenene Stream, at its confluence with the Crocodile River.

Site 3: S25.461558 E31.534267

This is located immediately south of Malelane Gate along the banks of the Crocodile River.

Site 4: S25.456857 E31.527464

This is about 700 metres northwest of Malelane Gate along the banks of the Crocodile River.

Site 5: S25.460644 E31.533711

This site is located immediately northwest of Malelane Gate along the banks of the Crocodile River.

A park-and-ride area is located at Malelane Gate (Figure 1). A portion of the Renosterkoppies Road (S114) is also to be relocated as shown in Figure 2.

#### **3.2 Physiography**

The terrain is dominated by level plains with limited relief at tributaries of the Crocodile River. The altitude range is 276-300 mamsl. The study area falls within the Thickets of the Sabie and Crocodile Rivers landscape classification of Gertenbach (1983).

#### **3.3 Geology**

The geology of the study area is predominantly undifferentiated granite and gneiss of the Nondweni and Onverwacht Groups (Swazian erathem) with scattered dolerite intrusions<sup>1</sup>.

---

<sup>1</sup> AGIS, 2007. Agricultural Geo-Referenced Information System, accessed from [www.agis.agric.za](http://www.agis.agric.za) on 25 October 2010

### **3.4 Soils**

The study area falls within landtype Fb, dominated by Glenrosa and / or Mispah soil forms. Lime is rare or absent in upland soils but generally present in low-lying soils. Soils are either shallow, on hard or weathering rock, or deep red alluvial sandy clays<sup>2</sup>.

### **3.5 Landuse**

The dominant landuse in the study area is Protected Area, while the dominant landcover is Woodland, with Thicket & Bushland along drainage lines. Adjacent landcover (across the Crocodile River) is predominantly Cultivation (permanent, irrigated).

---

<sup>2</sup> AGIS, 2007. Agricultural Geo-Referenced Information System, accessed from [www.agis.agric.za](http://www.agis.agric.za) on 25 October 2010



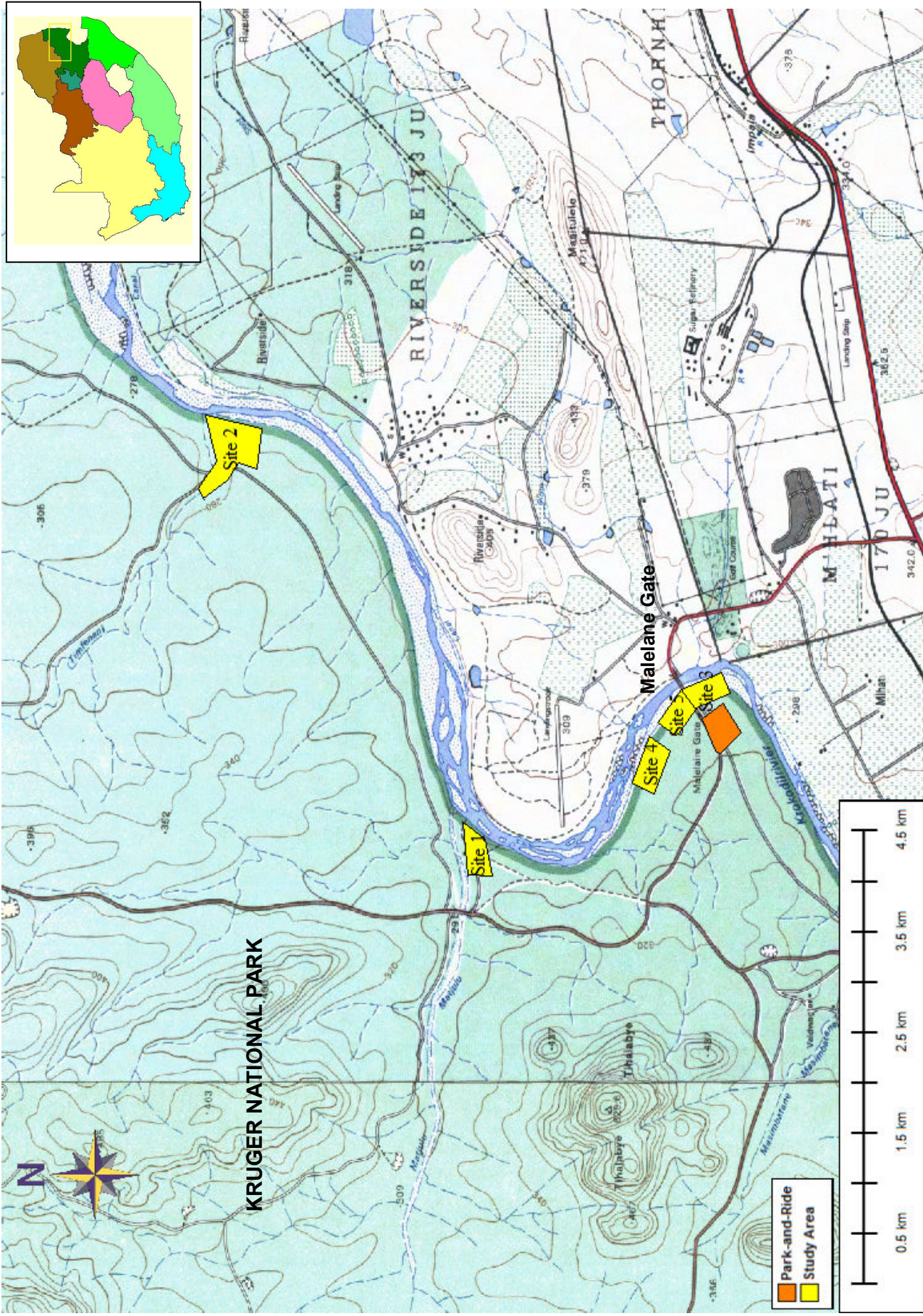


Figure 1. Location of Study Area

## 4. METHODS

### 4.1 Flora

Broad vegetation communities were identified using aerial imagery supplied by SANParks, and extent of transformation or degradation was assessed in order to determine representivity of vegetation types. The vegetation community boundaries were ground-truthed during two field visits (September 2010, February 2011) in order to confirm current position. Potentially occurring plant species of conservation concern were derived from species lists for the quarter-degree grids 2531AD and 2531 BC in the SANBI Plants of South Africa database (POSA), and from the PlantDat threatened species database of the MTPA. Likelihood of occurrence of these species was determined through personal field experience of those species and reference to individual accounts in Raimondo *et al.* (2009). Fieldwork was conducted by walking meandering transects and recording all plants and assessing their relative abundance. These transects were placed over landscape gradients that contained the highest number of microhabitats in order to maximize species detection and thus produce fairly comprehensive lists for each community (Appendix 1). Plant species were listed per vegetation community and the following cover-abundance classes were assigned to each plant species (after Kent & Coker, 1992):

Value	Braun-Blanquet cover
+	< 1%
1	1 – 5%
2	6 – 25%
3	26 – 50 %
4	51 – 75%
5	76 – 100%

Quadrats (100 m<sup>2</sup>) were also placed in each vegetation community in order to compare species richness between communities. All visible species were recorded in each quadrat and a cover-abundance value assigned to each. The locations of Red Data plant species were recorded using a Garmin 60CSx GPS and these localities were used to highlight where sensitive plant assemblages occurred.

All alternative hotel sites were briefly visited, the objective being to screen them for the presence of species of conservation concern. Only Site 2 was surveyed according to methods described above. GPS points for the proposed road realignment were provided by



ILA and were used to walk the route. Brief notes on flora were made during the walk and locations of all stream crossings, sodic sites and *Adenium* colonies were recorded on GPS.

## 4.2 Fauna

Threatened species data provided by MTPA for 2531 AD & BC were the basis for a list of potentially occurring threatened fauna (Appendix 4). Friedmann & Daly (2004) and Van Cakenberghe *et al.* (2009) were used to add potentially occurring threatened mammal species. Data from the current second Southern African Bird Atlas Project (SABAP2) were used to add potentially occurring Red Data birds. Minter *et al.* (2004) and data from the South African Reptile Conservation Assessment (SARCA) (accessed at <http://sarca.adu.org.za>), were used add potentially occurring threatened reptiles and frogs. Birds were surveyed on the meandering vegetation transects using Swarovski 10x42 EL binoculars. All species seen and heard were listed per vegetation community in order to illustrate bird-habitat associations. Because of the small size of the study area and brief period of fieldwork, no quantitative sampling was undertaken. Mammal, reptile and frog observations were made incidentally while surveying birds.

## 4.3 Ecological Importance and Sensitivity

The floristic importance of each vegetation community was ascertained in terms of an Associated Flora Index (AFI), after Deall (2003), modified to recognise higher values for the threat categories of Vulnerable, Endangered and Critically Endangered (Table 1). This index is derived from the summation of the species-status scores of constituent species. Such scores are assigned to plant species of conservation importance and are weighted in relation to local abundance and levels of importance (Table 1). The latter are based on criteria such as protection status, endemic status, and Red Data status in terms of Raimondo *et al.* (2009). Each vegetation community is then weighted according to whether it is representative of a threatened vegetation type as follows:

- Vulnerable vegetation types = weighting of 1.2
- Endangered vegetation types = weighting of 1.5
- Critically Endangered vegetation types = weighting of 1.8

The final weighted AFI score indicates the importance of that vegetation community for plant species of conservation concern (Table 2). Thus, an objective basis for assessing the significance of impacts on different vegetation communities at the local scale is derived.

**Table 1. Species-status scores in relation to conservation importance and local abundance.**

Conservation Importance	Local abundance <sup>3</sup>		
	Rare (+)	Frequent (1)	Abundant (2)
Red Data species (Critically Endangered)	6	7	8
Red Data species (Endangered)	5	6	7
Red Data species (Vulnerable)	4	5	6
Red Data species (DD, NT, LC)	3	4	5
Endemic species (En)	2	3	4
Protected species (Pr)	1	2	3

**Table 2. Significance of AFI Scores**

AFI Score	Significance
>30	High
26-30	High-Medium
21-25	Medium-High
16-20	Medium
11-15	Medium-Low
6-10	Low-Medium
0-5	Low

In order to objectively assess the importance of different vegetation communities for fauna species of conservation importance, each species was allocated a score based on its status (Red Data, endemic, protected) (Table 3). Vegetation communities were then merged into broad structural types, such as grassland, thicket or woodland. Each conservation importance score was weighted by a subjective probability of occurrence based on field observations of habitat condition and suitability (Appendix 3). Each vegetation community grouping was then rated according to the sum of these species scores, and this total was weighted by two criteria:

- **Potential to Support Biodiversity** (Very High = 1.8, High = 1.5, Moderate = 1.2, Low = 1.0)
- **Ecological Quality** (Pristine = 1.8, Moderately Disturbed = 1.5, Highly Disturbed = 1.2, Transformed = 1.0)

The significance of the weighted scores is indicated in Table 4. The weighted score for each vegetation community grouping indicates its relative importance for conservation-important fauna (Appendix 3).

<sup>3</sup> Based on the Braun-Blanquet cover-abundance scale

**Table 3. Species-status scores in relation to conservation importance of fauna.**

<b>Conservation Importance</b>	<b>Score</b>
Red Data species (CR)	6
Red Data species (EN)	5
Red Data species (VU)	4
Red Data species (DD,NT,LC)	3
Endemic	2
Protected	1

**Table 4. Significance of Conservation-importance Scores for Fauna**

<b>AVFI Score</b>	<b>Significance</b>
<b>Over 150</b>	<b>Very High</b>
<b>125-150</b>	<b>High</b>
<b>101-125</b>	<b>High-Medium</b>
<b>76-100</b>	<b>Medium-High</b>
<b>51-75</b>	<b>Medium</b>
<b>26-50</b>	<b>Medium-Low</b>
<b>10-25</b>	<b>Low-Medium</b>
<b>Less than 10</b>	<b>Low</b>

By integrating assessments of the floristic and faunal values of the different vegetation communities, an assessment of integrated conservation importance was made (Table 6). Conservation importance values were then mapped as an aid to development planning (Figure 4).

## 5. BIODIVERSITY BASELINE DESCRIPTION

### 5.1 Flora

#### 5.1.1 National Vegetation Types

The study area is indicated in Mucina & Rutherford (2006) as being situated within two national vegetation types, namely Granite Lowveld and Malelane Mountain Bushveld. However, field data show that the hotel sites and park-and-ride area are within Granite Lowveld. Only Granite Lowveld is described in more detail below<sup>4</sup>:

##### *i. Granite Lowveld*

This vegetation type covers the lower-lying parts of Limpopo and Mpumalanga Provinces, into Swaziland and marginally into KwaZulu-Natal, much of it being found in the Kruger National Park. Topography is mostly level to undulating plains, with scattered low hills, with an altitudinal range of 250 – 700 masl. The major basement geology of the vegetation type is granite, gneiss and migmatite of the Swazian erathem. This geology weathers into sandy soils in the uplands and clay soils with high sodium content in the lowlands. Vegetation structure varies from tall shrubland with scattered trees to short closed woodland in the uplands, and dense thicket to open savannah in the bottomlands. A dense herbaceous layer is characteristic.

Dominant trees are *Acacia nigrescens*, *Acacia nilotica*, *Albizia harveyi*, *Combretum apiculatum*, *Combretum imberbe*, *Combretum zeyheri*, *Ficus stuhlmannii*, *Peltophorum africanum*, *Pterocarpus rotundifolius*, *Sclerocarya birrea subsp. cafra* and *Terminalia sericea*. The shrub layer is dominated by *Combretum hereroense*, *Dichrostachys cinerea*, *Euclea divinorum* and *Strychnos madagascariense*. The most common grasses are *Brachiaria nigropedata*, *Digitaria eriantha*, *Eragrostis rigidior*, *Melinis repens*, *Panicum maximum* and *Pogonarthria squarrosa*.

Granite Lowveld has a conservation status of **Vulnerable**, even though over 30% of the vegetation type is conserved in Kruger National Park and adjacent private game reserves. However, more than 20% has already been transformed through cultivation and human settlements (Mucina & Rutherford, 2006).

---

<sup>4</sup> Based on Mucina & Rutherford, 2006

### 5.1.2 Threatened Ecosystems

The study area is not situated within any threatened terrestrial ecosystem as listed in Notice 1477 of Government Gazette No. 32689 (6 November 2009)<sup>5</sup>.

### 5.1.3 Centres of Plant Endemism

The study area is not situated within any centre of plant endemism as described by Van Wyk & Smith (2001).

### 5.1.4 Threatened and Protected Flora

Eleven species that are listed in the latest Red List publication as having conservation concern<sup>6</sup> have been recorded in the quarter-degree grids 2531 AD & BC (Table 5). Six of these are considered to be threatened<sup>7</sup>, of which three have a status of **Critically Endangered**, the highest threat status that can be allocated. One of these, *Adenium swazicum*, was confirmed to occur at Site 2 and along the original proposed road realignment route during fieldwork. This species has been assessed as Critically Endangered because of a massive reduction in its global population and further interest in harvesting this species for the medicinal and horticultural trades; it is also protected under NEMBA. Two other Critically Endangered species have been recorded in the 2531 AD & BC (*Siphonochilus aethiopicus* and *Warburgia salutaris*), but neither are likely to occur (see Table 5). Three **Vulnerable** species have been recorded in the two grids. *Caesalpinia rostrata* occurs in similar habitat to the study area, but it is identifiable throughout the year and was not located during fieldwork; thus, it is unlikely to occur. The other two species (*Haworthia limifolia* and *Prunus africana*) are unlikely to occur because of unsuitable habitat and / or altitude (Table 5).

The remaining five species have been allocated a conservation status of Declining. One of these was possibly confirmed and two have a Moderate likelihood of occurrence. A *Crinum* species, most likely *Crinum stuhlmannii*, was found at the edge of sodic patches at Site 2. This conspicuous lily in the Amaryllidaceae family flowers from October to November and was thus not in flower during either survey. *Drimys altissima* is a small geophyte that grows in bushveld and thicket, often in the open. Its tall inflorescences are very visible from October

---

<sup>5</sup> SANBI & DEAT, 2009

<sup>6</sup> We follow the terminology of Raimondo *et al.* (2009); species of conservation concern are those that are important for South Africa's conservation decision-making processes and comprise all threatened species, as well as those with a status of Data Deficient, Near Threatened, Critically Rare, Rare and Declining.

<sup>7</sup> We follow the terminology of Raimondo *et al.* (2009); threatened species are those facing a high risk of extinction and are placed in the categories Critically Endangered, Endangered or Vulnerable.



to December, but it is difficult to locate when not flowering. *Eulophia speciosa* is an attractive orchid that grows in shade of trees in various bushveld and thicket types. It flowers from October to January and is easy to locate during this time, but difficult to locate when not flowering. This species was searched for along the Timfenene thickets in January but was not located and is probably not present within the hotel footprint at Site 2.

Five tree species that are protected under the National Forest Act (No.30 of 1998) were confirmed to occur within the proposed hotel sites and park-and-ride area during fieldwork: *Combretum imberbe*, *Sclerocarya birrea* subsp. *cafra*, *Philenoptera violacea*, *Balanitesmaughamii* and *Breonadialalicina*. Two species confirmed to occur within hotel site 2 are protected under the Mpumalanga Nature Conservation Act (No.10 of 1998), namely *Aloe spicata* and *Crinum* sp., and an additional species, *Spirostachys africana*, was confirmed at several sites along the proposed road re-alignment. A number of other species protected under this act potentially occur but were not found during fieldwork. These include other *Aloe* species, *Gladiolus* species, *Dioscorea* species, *Ammochariscoranica* and various orchid species.

#### **5.1.5 Vegetation Communities: Site 2 and Park-and-Ride Area**

Five vegetation communities were identified in the hotel (Site 2) and park-and-ride areas based on floristic composition and vegetation structure (according to the classification of Edwards, 1983). These are described in detail below:

##### **i. *Grewia-Dichrostachys* Closed Shrubland (Photo 1)**

This community covers the proposed Park-and-Ride area adjacent Malelane Gate, as well as parts of Sites 3, 4 and 5 (Figure 3). Vegetation structure is Low Closed Shrubland with scattered tall trees and a dense grass sward. The dominant and diagnostic large shrubs are *Dichrostachys cinerea* subsp. *africana* and *Grewia bicolor*. Other common shrubs are *Cordia ovalis*, *Grewia monticola*, *Euclea natalensis* subsp. *angustifolia* and *Gymnosporia glaucophylla*. Common grasses are *Heteropogon contortus*, *Aristida congesta* var. *congesta*, *Eragrostis rigidior* and *Panicum maximum*. The dominant scattered trees are *Sclerocarya birrea* subsp. *cafra* and *Acacia nigrescens*.

Vegetation is quite disturbed through trampling by elephant and high grazing and browsing pressure and small amounts of surface erosion are evident. No species of conservation concern were recorded, while three tree species protected under the National Forests Act (No.30 of 1998) were confirmed: *Sclerocarya birrea* subsp. *cafra*,

*Combretum imberbe* and *Philenoptera violacea*. *Grewia-Dichrostachys* Closed Shrubland has a **Low-Medium** significance for plant species of conservation importance.

ii. ***Grewia-Combretum* Closed Shrubland**(Photo 2)

This community is the dominant vegetation in the proposed hotel area at Site 2 (Figure 2) and covers an area of approximately 30.4 ha. Vegetation structure is Low Closed Shrubland with scattered trees and a dense grass sward. Dominant and diagnostic large shrubs are *Grewia bicolor*, *Combretum hereroense*, *Dichrostachys cinerea* subsp. *africana* and *Grewia monticola*. Scattered trees are *Acacia nigrescens*, *Acacia tortilis* and *Sclerocarya birrea* subsp. *cafra*. Dominant grasses are *Chloris virgata*, *Heteropogon contortus* and *Themeda triandra*. Scattered, less frequently encountered shrubs are *Ehretia amoena*, *Grewia villosa*, *Lippia javanica*, *Waltheria indica*, *Maerua parvifolia* and *Euclea divinorum*.

Vegetation is quite disturbed through trampling by elephant. Fairly high levels of grazing and browsing pressure were evident during fieldwork, including evidence of large herbivores such as Black and White Rhinos. Several subpopulations of the **critically endangered** *Adenium swazicum* were located in this vegetation community. Twelve small colonies totalling 18 plants were found during the initial fieldwork, while an additional nine sites with 10 plants were located on small sodic soil patches along the Timfenene during January fieldwork. Each plant was buffered by 30 metres, which resulted in a continuous area of 1.5 ha and fragmented areas totalling 0.8 ha that need to be excluded from development (Figure 4). Several individuals of a *Crinum* species were located at the edges of a few sodic sites in this community. These could not be identified with certainty since the plants were not in flower in February. However, they could possibly be *Crinum stuhlmannii*, which is of conservation concern, having a status of Declining. Three tree species protected under the National Forests Act (No.30 of 1998) were confirmed: *Sclerocarya birrea* subsp. *cafra*, *Combretum imberbe* and *Philenoptera violacea*. *Grewia-Combretum* Closed Shrubland has **Medium-High** significance for plant species of conservation importance, while the immediate site of the *Adenium* plants is rated as **Very High** significance.

iii. ***Aloe-Euphorbia* Closed Woodland** (Photo 3)

This community is very localised and is confined to a small rocky outcrop above the Timfenene Stream at Site 2 (Figure 2), and covers only 0.1 ha. Vegetation structure is Low Closed Woodland with a broken canopy, probably due to skeletal soils only allowing trees to establish in certain places. Plants are noticeably adapted to xerophytic conditions, and the two dominant and diagnostic species are both succulent: *Aloe*

*spicata* and *Euphorbia tirucalli*. Several species are confined to this community, namely *Terminalia phanerophlebia*, *Ficus ingens*, *Aneilema* sp., *Cissus cactiformis*, *Ochna natalitia* and *Combretum collinum* subsp. *suluense*. This high level of fidelity is because of the unique microhabitat created by topography and rockiness. However, the only species with conservation importance located during fieldwork was *Aloe spicata*, which is protected under the Mpumalanga Nature Conservation Act (No.10 of 1998). This community was assessed as being of **Low** significance for species of conservation importance, although it forms important habitat for species unlikely to occur elsewhere in the study area.

iv. ***Ficus-Gymnosporia* Riparian Woodland** (Photo 4)

This community is confined to the banks of the Crocodile River at Site 2 and the banks of the Matjulu Stream at Site 1 (Figure 2). Vegetation structure is Tall Closed Woodland with a dense undergrowth of shrubs and a sparse grass layer. The dominant tree is *Ficus sycomorus*, while other canopy trees are *Diospyros mespiliformis*, *Kigelia africana*, *Trichilia aemetica* and *Combretum erythrophyllum*. *Combretum microphyllum* is a common climber into the canopy. The shrub layer is noticeably dominated by *Gymnosporia senegalensis*, with other common shrubs being *Euclea natalensis* subsp. *angustifolia*, *Cordia ovalis* and *Phyllanthus reticulatus*. *Panicum maximum* is the only common grass. This vegetation community was drastically reduced during the floods of 2000 and is still in fairly early stages of recovery. Heavy browse pressure and trampling of vegetation by elephants is particularly evident along the Crocodile River at Site 2 and the community is in a very disturbed ecological state. This woodland is much less disturbed along the Matjulu Stream at Site 1. Only one tree species protected under the National Forests Act (No.30 of 1998) was confirmed to occur, namely *Philenoptera violacea*. So while *Ficus-Gymnosporia* Riparian Woodland has a **Low** significance for plant species of conservation importance, it does have **High** functional importance for services such as flood attenuation and bank stabilisation and also forms important habitat for fauna.

v. ***Garcinia-Diospyros* Riparian Woodland** (Photo 5)

This community is confined to a narrow belt along the banks of the Timfenene River at Site 2 (Figure 2) and covers an area of approximately 2.3 ha. Vegetation structure is Tall Closed Woodland with a dense undergrowth of shrubs and tall grass. The dominant and diagnostic tree is *Garcinia livingstonei*, while other prominent canopy trees are *Diospyros mespiliformis*, *Schotia brachypetala* and *Manilkara mochisia*. *Acacia schweinfurthii* and *Grewia flavescens* are common climbers or scrambling shrubs. Other common shrubs are *Euclea natalensis* subsp. *angustifolia*, *Cordia ovalis* and *Gymnosporia maranguensis*.

*Panicum maximum* is an abundant grass along the outer edge of the vegetation community.

*Garcinia-Diospyros* Riparian Woodland is in a far less disturbed state than *Ficus-Gymnosporia* Riparian Woodland, although trampling of vegetation by elephants and other large herbivores is evident. Two tree species protected under the National Forests Act (No.30 of 1998) were confirmed to occur, namely *Philenoptera violacea* and *Breonadia salicina*. Even though this vegetation community has a **Low** significance for plant species of conservation importance, it does have **High** functional importance for services such as flood attenuation and bank stabilisation.

#### 5.1.6 Vegetation Communities: Alternative Sites

##### Site 1:

This is situated on a terrace above the Matjulu Stream, near the junction with the Crocodile River (Appendix 5). Tall trees form a fairly closed canopy woodland along the riparian fringe that is dominated by *Diospyros mespiliformis*, *Trichilia emetica*, *Sclerocarya birrea* subsp. *cafra*, *Kigelia africana* and *Ficus sycomorus*. Other scattered trees include *Philenoptera violacea*, *Peltophorum africanum*, *Balanites maughamii* and *Gardenia volkensii*. Undergrowth is dominated by woody shrubs, particularly *Euclea natalensis*, *Flueggea virosa*, *Gymnosporia senegalensis*, *Grewia monticola*, *Grewia bicolor*, *Cordia ovalis* and *Lippia javanica*.

##### Site 3:

This is located immediately south of Malelane Gate along the banks of the Crocodile River (Appendix 5). Tall riparian woodland is dominated by *Diospyros mespiliformis*, *Sclerocarya birrea* subsp. *cafra*, *Acacia nigrescens*, *Balanites maughamii* and *Philenoptera violacea*. The understory comprises mostly woody shrubs, particularly *Euclea natalensis*, *Combretum hereroense*, *Grewia hexamita*, *Flueggea virosa*, *Cordia ovalis* and *Hibiscus calyphyllus*. Herbaceous species include the invasive alien *Parthenium hysterophorus*, as well as *Senna* sp., *Zinnia peruviana* and *Sidea dregei*.

##### Site 4: S25.456857 E31.527464

This is about 700 metres northwest of Malelane Gate along the banks of the Crocodile River (Appendix 5). Vegetation has been very disturbed through browsing by large mammals, particularly elephant. Riparian trees are *Acacia nigrescens*, *Sclerocarya birrea* subsp.

*cafra*, *Acacia robusta* subsp. *clavigera* and *Combretum imberbe*, while *Grewia bicolor* and *Combretum hereroense* are common undergrowth species.

Site 5: S25.460644 E31.533711

This site is located immediately northwest of Malelane Gate along the banks of the Crocodile River (Appendix 5). Vegetation has been very disturbed through browsing by large mammals, particularly elephant. Scattered large trees on the terrace are *Sclerocarya birrea* subsp. *cafra*, *Diospyros mespiliformis*, *Philenoptera violacea* and *Euphorbia ingens*. Undergrowth is dominated by *Dichrostachys cinerea* subsp. *africana*, *Grewia bicolor* and *Combretum hereroense*.

#### **5.1.7 Vegetation Communities: Road Realignment**

The original proposed road realignment that was walked in February 2011 is described below. This route has subsequently been changed in order to limit the length of the realignment and to avoid numerous sensitive sodic patches and *Adenium* colonies. While this new route has not been walked by ECOREX, much of the vegetation appears to be similar on a high-resolution satellite image, but no sodic sites are visible.

The original route traversed patches of open *Acacia nigrescens* – *Sclerocarya birrea* Savannah and *Combretum hereroense* – *Themeda triandra* Woodland on plains, while crossing *Combretum apiculatum* Closed Woodland on low, rolling hills. Heavy clays and sodic patches have a characteristic dense low Shrubland that is dominated by *Euclea divinorum*, while non-perennial streams are characterised by *Spirostachys africanus*.



**Table 5. Plant species of conservation concern potentially occurring in the study area**

Species	Red Data Status	Growth Form	Habitat	Likelihood	Reason
<i>Adenium swazicum</i>	CR	Dwarf shrub, succulent	Deep clay soils in short mixed thornveld	Confirmed	
<i>Boophane disticha</i>	Declining	Geophyte	Dry grassland and open bushveld	Low	Incorrect habitat
<i>Caesalpinia rostrata</i>	VU	Shrub	Along river valleys and drainage lines in bushveld	Low	Habitat present, but visible and identifiable through year; not located during fieldwork
<i>Crinum macowanii</i>	Declining	Geophyte	Mountain grassland and stony slopes or sandy flats	Unlikely	Incorrect habitat and altitude
<i>Crinum stuhlmannii</i>	Declining	Geophyte	Lowveld bushveld on deep sand	Possibly confirmed	Suitable habitat: non-flowering plants in study area possibly represent this species.
<i>Drimia altissima</i>	Declining	Geophyte	Dry bushveld and thicket	Moderate	Suitable habitat
<i>Eulophia speciosa</i>	Declining	Geophyte	Various bushveld and thicket types	Moderate	Suitable habitat
<i>Haworthia limifolia</i> var. <i>arcana</i>	VU	Succulent	Grassland on tops of hills and ridges	Unlikely	Incorrect habitat and altitude
<i>Prunus africana</i>	VU	Tree	Evergreen forest	Unlikely	Incorrect habitat and altitude
<i>Siphonochilus aethiopicus</i>	CR	Geophyte	Tall closed woodland or bushveld	Unlikely	Habitat too open; nearest records from Crocodile Gorge area
<i>Warburgia salutaris</i>	CR	Tree	Riverine forest, dry scarp forest, thickets in woodland	Unlikely	Limited habitat present, but visible and identifiable through year; not located during fieldwork

Figure 2. Sensitivities represented in the study area (Site 2)





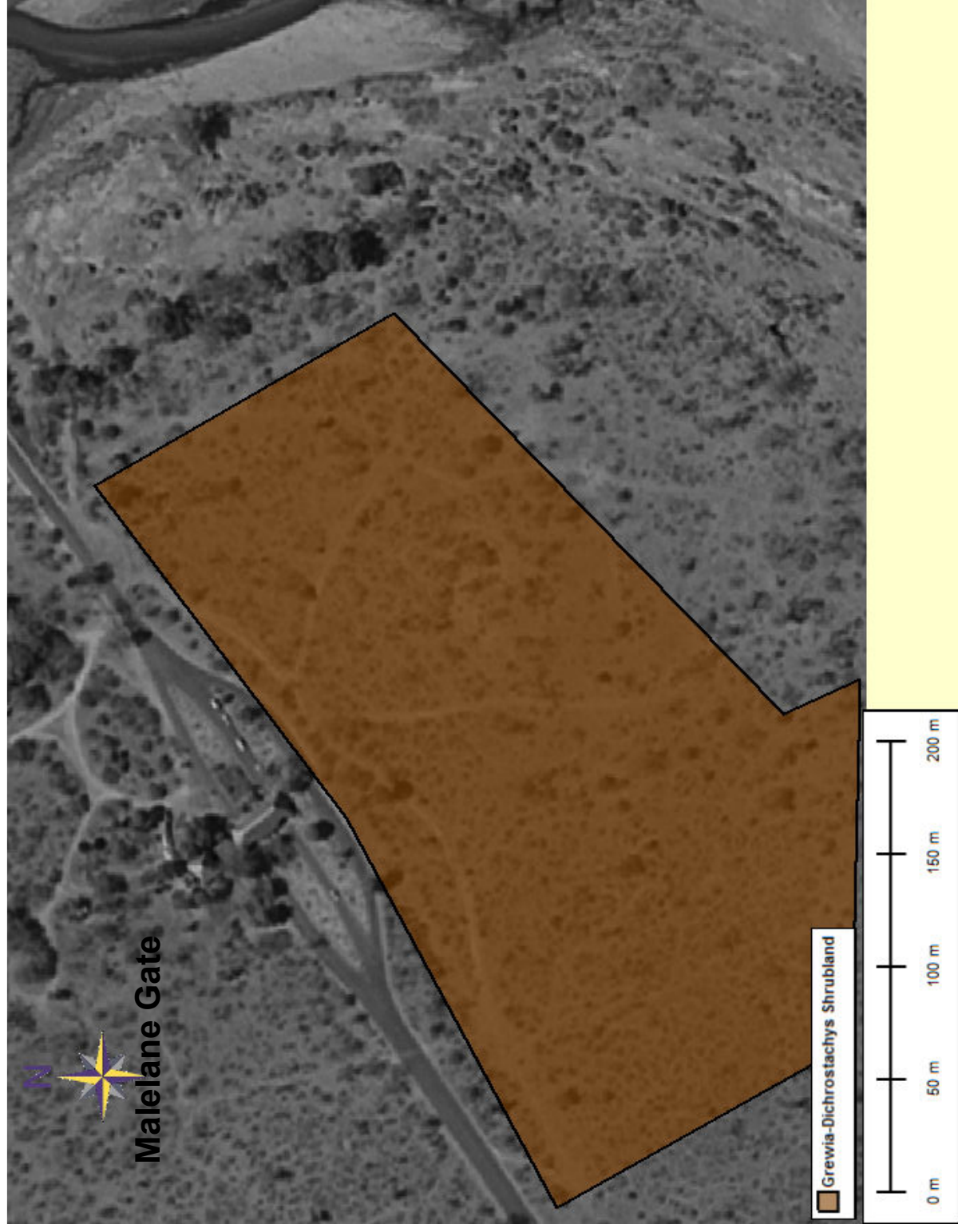


Figure 3. Vegetation communities represented in the study area (park-and-ride site)

## 5.2 Terrestrial Fauna

### 5.2.1 Mammals

While the savanna biome, in which the study area is situated, has high mammal diversity and a high number of Red Data species, the small size of the study area means that very few of these species are likely to be resident. However, many species are likely to move through and forage in the area, and construction activities are likely to have impacts beyond the boundaries of the study area (e.g. noise, dust).

An estimated 23 Red List mammal species potentially occur within the study area<sup>1</sup>, even if only moving through (Appendix 3). This includes species with provincial Red Data status that are not considered threatened nationally (e.g. Aardvark, Banded Mongoose). The most threatened species is African Wild Dog, which has a conservation status of Endangered. Five species have a status of Vulnerable, of which two (Black Rhinoceros and Lion) were confirmed in the study area. One Vulnerable species, Pangolin, has moderate chance of occurring, while two others (Cheetah, Juliana's Golden Mole) have a low likelihood of occurring.

The remaining Red List species either have a status of Near Threatened (6 species) or Data Deficient (9 species) (Appendix 3). These are species that either could soon qualify for threatened status or for which not enough data are available for an assessment of status to be made.

Eleven species occurring in the vicinity of the study area are protected under NEMBA, of which two are in the category Endangered (African Wild Dog, Black Rhinoceros), five in the category Vulnerable (Pangolin, Juliana's Golden Mole, Cheetah, Lion and Leopard) and four in the category Protected (White Rhinoceros, Spotted Hyaena, African Elephant, Honey Badger).

### 5.2.2 Birds

Data from the second Southern African Bird Atlas Project (SABAP2) which is currently underway, indicate very high species richness for the mapping units (pentads) around the study area. A pentad covers approximately 61 km<sup>2</sup> (8 km x 7.6 km) and the average species richness per pentad in the immediate vicinity of the study area is 248 species per pentad<sup>2</sup>. Numerous microhabitats associated with the Crocodile River contribute significantly to these

---

<sup>1</sup> Friedman & Daly, 2004

<sup>2</sup> Data accessed from <http://sabap2.adu.org.za> on 31 October 2010

high totals, and the species richness for terrestrial habitats would be much lower. However, because of the close proximity of the Crocodile River to the potential impact footprint, species confined to freshwater habitats have been included in the assessment.

Nineteen Red List bird species have been recorded recently within the two relevant pentads within the study area (2525\_3125 and 2525\_3130), with an additional 13 species confirmed from the MTPA threatened species database for the quarter-degree grids 2531 AD and BC. However, suitable habitat is only present for an estimated 23 species within the vicinity of the study areas (Appendix 3). The most threatened species is Saddle-billed Stork, which has a conservation status of **Endangered**; this species has recently been recorded breeding in a large riparian tree several hundred metres downstream of the hotel site<sup>1</sup>. Eleven Vulnerable species potentially occur, of which eight have been recently recorded from the study area pentad (Bateleur, Martial Eagle, Tawny Eagle, Hooded Vulture, White-backed Vulture, White-headed Vulture, Pel's Fishing Owl and Southern Ground Hornbill) and have a Moderate to High chance of occurring as foraging visitors. Pel's Fishing Owl is represented by a breeding pair that has been resident for 11 years downstream of Site 2; this is the only known pair on the Crocodile River<sup>2</sup>. Two species recorded in adjacent pentads forage over long distances (Lappet-faced and Cape Vultures) and thus also have a Moderate chance of occurring in the study area).

Eleven Near Threatened species potentially occur, of which one (Red-billed Oxpecker) was confirmed during fieldwork. Seven others are closely associated with freshwater habitats (Appendix 3) and are unlikely to occur within the study area but could be impacted by the development through construction and heavy vehicle noise.

Thirteen bird species occurring within the vicinity of the study area are protected under NEMBA, of which seven are in the category Endangered (Cape, Hooded, White-backed and Lappet-faced Vultures, Saddle-billed Stork, Pink-backed Pelican and Pel's Fishing Owl), five in the category Vulnerable (White-headed Vulture, Tawny Eagle, Martial Eagle, Bateleur and Black Stork) and one in the category Protected (Southern Ground Hornbill).

### 5.2.3 Reptiles & Frogs

Eight threatened reptiles have been recorded from the general vicinity of the study area according to records in the MTPA database, although three of these (Barberton Girdled

---

<sup>1</sup> D. English, SANParks, *pers.comm.*

<sup>2</sup> S. Ronaldson, EWT, *pers.comm.*



Lizard, Haacke's Flat Gecko and Wilhelm's Flat Lizard) are closely associated with large rock outcrops and are thus unlikely to occur in the study area (Appendix 3). However, reptile conservation status is currently under review and the number could increase significantly. Only two of these species have national Red List status (Southern African Python and Nile Crocodile), both of which are classified as **Vulnerable**. The remaining three species possibly occurring have been allocated provincial Red List status of Vulnerable (Intermediate Shieldnose Snake) and Near Threatened (Giant Legless Skink and Turner's Gecko) by the MTPA. These species are thought to have a Low to Moderate chance of occurring.

No threatened frog species are likely to occur.

The only potentially occurring species protected under NEMBA are African Bullfrog, Nile Crocodile and Southern African Python.

#### **5.2.5 Terrestrial Fauna Importance Assessment**

The Associated Vertebrate Faunal Index calculated for Shrubland & Woodland (combined non-riparian habitats) was 127, which is **High** significance for fauna species of conservation concern (Appendix 3). The two riparian woodland habitats score 113, which is **High-Medium** significance and freshwater river habitat scores 95 (**Medium-High**).

### 5.3 Perceived Biodiversity Value and Conservation Importance

The Mpumalanga Biodiversity Conservation Plan (MBCP) (Ferrar & Lötter, 2007) is a spatial assessment of the conservation value of land in Mpumalanga and a decision support tool to assist planners and decision makers in sustainable land-use planning. The MBCP is regarded as the foundation for a provincial Biodiversity Conservation Strategy, as required by law. Mpumalanga's biodiversity has been ranked into seven categories by the MBCP (in descending order of importance):

- protected areas,
- irreplaceable areas,
- highly significant areas,
- important & necessary areas,
- ecological corridors,
- areas of least concern
- no natural habitat remaining

The MBCP is accompanied by land-use planning guidelines for each of the biodiversity conservation categories throughout the Province. In each category there are different landuse and development consequences. The guidelines relate to 15 different types of land uses, ranked according to their impact on biodiversity. The proposed hotel development would fall into land use type 4 ("Rural Recreational Development") which is in the category "Rural Land Uses that are more or less biodiversity friendly" (Ferrar & Lötter, 2007).

The entire study area is within a Protected Area, which holds the highest biodiversity importance with regards to the province meeting its biodiversity targets. The guidelines for developments within Protected Areas suggest restricting permissible land uses to Land Use types 1 and 2 only (Conservation Management and Extensive Game Farming), while allowing type 3 (Extensive Livestock Production) under restriction. Rural Recreational Development is **not considered a permissible land use type** within Protected Areas within the MBCP.

The study area is situated within Granite Lowveld, a threatened national vegetation type with a status of **Vulnerable**. One **Critically Endangered** plant species, *Adenium swazicum*, was confirmed to occur in several small colonies at Site 2. A *Crinum* species, most likely *Crinum stuhlmannii*, which has a status of Declining, was found at the edge of sodic patches at Site 2.

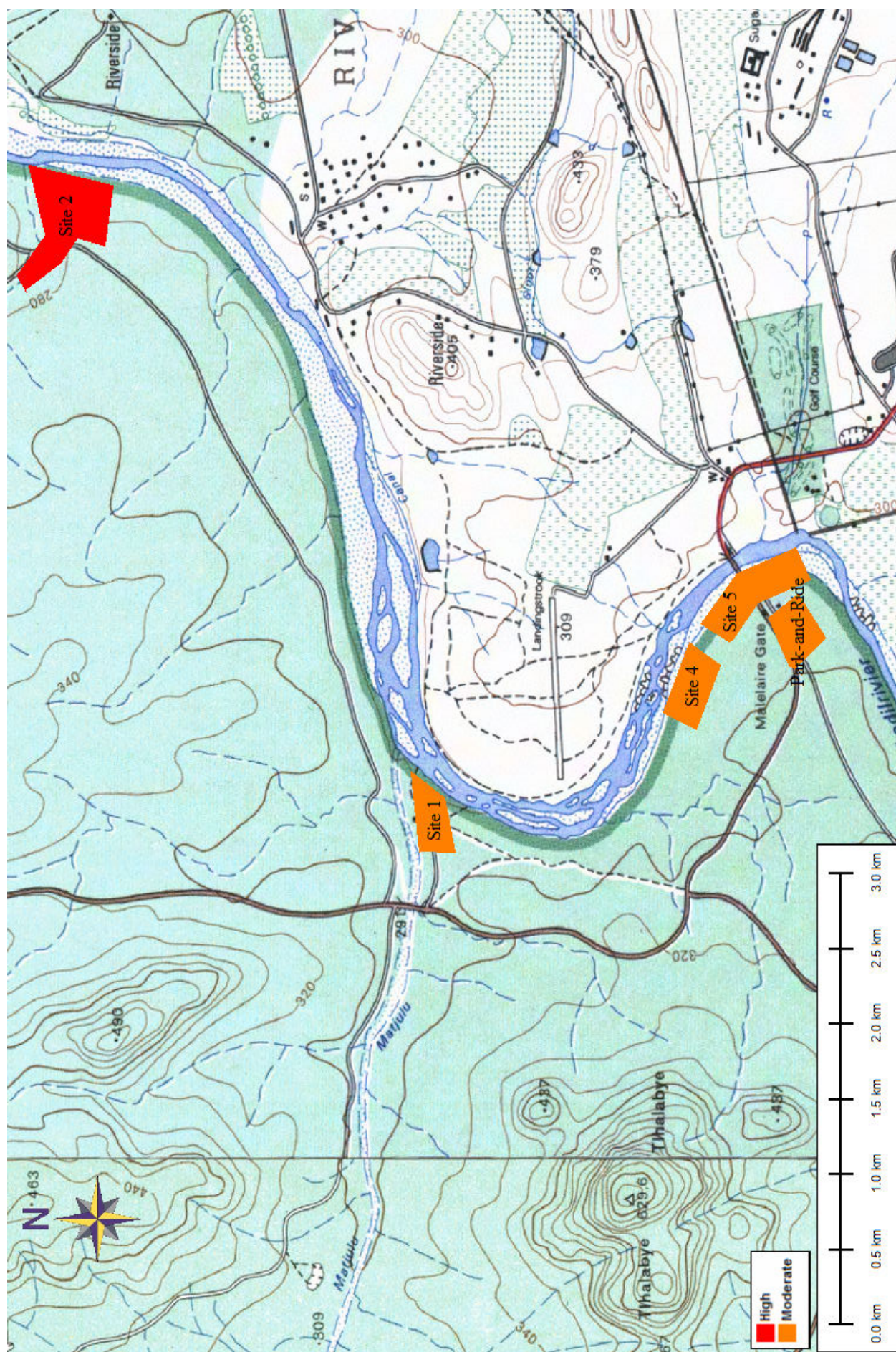
Much of the study area, which is entirely situated within a South African National Park, has been assessed as being of **High** value to Red List fauna (Figure 4), even though all sites have been heavily impacted by browsing, grazing and trampling by large herbivores. The vegetation communities were found to be of Low to Medium-High importance for flora of conservation concern (Table 6), a significantly lower value than for fauna. This is because of the low numbers of threatened plants potentially present. However, the vegetation is representative of Granite Lowveld, a Vulnerable vegetation type, and a healthy subpopulation of *Adenium swazicum* was located within Site 2. The importance of the buffered *Adenium* colonies within Site 2 is considered **Very High**, taking into consideration the extremely high risk of extinction faced by *Adenium swazicum*.

**Table 6. Integrated Biodiversity Value / Conservation Importance of Vegetation Communities**

	<i>Grewia-Dichrostachys</i> Shrubland (Park-and-Ride)	<i>Aloe-Euphorbia</i> Closed Woodland	<i>Grewia-Combretum</i> Shrubland	<i>Ficus-Gymnosporia</i> Riparian Woodland	<i>Garcinia-Diospyros</i> Riparian Woodland	Rivers
<b>Flora Conservation Importance</b>	LOW-MED	LOW	MED-HIGH	LOW	LOW	LOW
<b>Vertebrate Fauna Conservation Importance</b>	HIGH	HIGH	HIGH	HIGH-MED	HIGH-MED	MED-HIGH
<b>Integrated Conservation Importance</b>	HIGH	HIGH	HIGH	HIGH-MED	HIGH-MED	MED-HIGH

All five hotel sites were visited during fieldwork. Detailed fieldwork took place at Site 2, the developer's preferred site, while the other sites were merely screened for species of conservation concern. Site 2 is significantly more sensitive than any of the other sites because of the presence of critically endangered flora and sensitive sodic soil patches.





**Figure 4. Sensitivity Map of the study area**

## 6. KEY ISSUES

- **Disturbance of *Adenium swazicum* subpopulation**

This would be in conflict with Section 50 of the National Environmental Management: Protected Areas Act (No. 57 of 2003), as amended in NEMPA Act No. 31 of 2004, which states that “An activity allowed in terms of subsection (1) (a) or (b) may not negatively affect the survival of any species in or significantly disrupt the integrity of the ecological systems of the park, nature reserve or world heritage site.”

The guidelines for EIA recommendations for critically endangered plants are that no further habitat loss should be permitted (Raimondo *et al.*, 2009). Removal of individuals of a threatened plant species for ex situ conservation is not considered an acceptable conservation measure by the South African National Biodiversity Institute and should not be recommended in biodiversity specialist studies as a mitigation measure (Raimondo *et al.*, 2009).

This impact is most relevant to Site 2.

- **Location of Site within a Protected Area**

If the construction of the hotel results in loss of any species or disruption of integrity of ecological systems, then the activity will be in conflict with Section 50 of the National Environmental Management: Protected Areas Act (No. 57 of 2003), as amended in NEMPA Act No. 31 of 2004.

This impact is relevant to all sites.

- **Location of Accommodation Units within Riparian Zone**

Any destruction of riparian vegetation could impact on the functional integrity of the riparian belt, including functions such as riverbank stabilization and flood attenuation.

While this impact is relevant to all hotel sites, the potential for destruction of riparian vegetation is highest at sites 1, 2 and 3.

- **Disturbance of Breeding Seasons of Red List species during Construction**

Construction activities and noise could be disruptive to the breeding season of species breeding within or adjacent the study area. Of particular concern is the pair of Saddle-billed Storks that have a nest in a tree several hundred metres downstream of the hotel site 2. In addition, a pair of Pel's Fishing Owl has been resident more than a kilometer downstream of the same hotel site. This pair is less likely to be disturbed than the storks because of increased distance from disturbance and since the nest site is not visible from site 2. This impact is most relevant to site 2, although sufficient riparian vegetation is present at sites 1 and 3 for certain threatened species to be resident.

*Other Potential Impacts are:*

Destruction of Vegetation within a Threatened Vegetation Type

Potential Poaching by Construction Team

Loss of nocturnal fauna through roadkills (night driving by staff)

## **7. RECOMMENDATIONS**

- No construction activities to take place within the buffered *Adenium* populations or any sodic soil patches; this area should be fenced off during construction and adequately protected during operation. No translocation of individuals from this area. However, if other individuals uncovered during construction, then these should be relocated to the buffered zone.
- Each hotel unit should be constructed outside of the riparian zones of the Crocodile River and Timfenene Stream (as indicated in Figure 4). Units should be limited to one side of the stream only, in order to maintain ecological connectivity of the habitat.
- Any construction activity should take place from March to August in order to avoid disrupting the egg-laying period of the Saddle-billed Stork pair that is nearby the hotel site.
- A detailed survey of the alternative hotel sites needs to be undertaken in order to accurately compare the potential impacts associated with development of each site.



## 8. REFERENCES

- Barnes, K.N. 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho & Swaziland. BirdLife South Africa, Johannesburg.
- Edwards, D. 1983. A broad-scale structural classification of vegetation for practical purposes. *Bothalia* 14:705-712.
- Ferrar, A. & Lötter, M.C. 2007. Mpumalanga Biodiversity Conservation Plan. Mpumalanga Parks Board, Nelspruit.
- Friedmann, Y. & 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.
- Gertenbach, W.P.D. 1983. Landscapes of the Kruger National Park. *Koedoe* 26:9-121.
- Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. 1997. The Atlas of Southern African Birds. Vols.1-2. BirdLife South Africa, Johannesburg.
- Kent, M. & Coker, P. 1992. Vegetation Description and Analysis: a practical approach. John Wiley & Sons, London.
- Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. & Kloepfer, D. 2004. Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series No.9. Smithsonian Institution, Washington, DC.
- Mucina, L. and Rutherford, M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- Raimondo, D., Von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C., Kamundi, D.A. & Manyama, P.A. (eds) 2009. Red List of South African Plants 2009. *Strelitzia* 25. South African National Biodiversity Institute, Pretoria.
- SANBI & DEAT. 2009. Threatened Ecosystems in South Africa: Descriptions and Maps. DRAFT for Comment. South African National Biodiversity Institute, Pretoria, South Africa.
- Van Cakenberghe, V., Kearney, T.C. and Seamark, E.C.J. 2006. African Chiroptera Report. African Chiroptera Project, Pretoria.
- Van Wyk, A.-E. & Smith, G. 2001. Floristic Centres of Endemism in Southern Africa. Umdaus.

## 9. APPENDICES

Appendix 1. Checklist of plants recorded in the study area

Species	Family	Growth Form	Red Data Status	Endemic	Protected	<i>Grewia-Dichrostachys</i> Shrubland (Park-and-Ride)	<i>Ficus-Gymnosporia</i> Riparian Woodland	<i>Garcinia-Diospyros</i> Riparian Woodland	<i>Aloe-Euphorbia</i> Closed Woodland	<i>Grewia-Combretum</i> Shrubland
<i>Abutilon</i> sp.	Malvaceae	Herb				+				+
<i>Acacia grandicornuta</i>	Fabaceae	Tree				1	1			
<i>Acacia nigrescens</i>	Fabaceae	Tree				2	+		+	2
<i>Acacia robusta</i> subsp. <i>clavigera</i>	Fabaceae	Tree					1			
<i>Acacia schweinfurthii</i>	Fabaceae	Tree						2		
<i>Acacia tortilis</i>	Fabaceae	Tree				1				2
<i>Achyranthes aspera</i>	Amaranthaceae	Herb						+		
<i>Actinopteris radiata</i>	Pteridaceae	Fern							+	
<i>Adenium swazicum</i>	Apocynaceae	Succulent	CR	Yes	NEMBA					1
<i>Albizia harveyi</i>	Fabaceae	Tree				1				
<i>Albucaglauca</i>	Hyacinthaceae	Geophyte				+				
<i>Aloe spicata</i>	Asphodelaceae	Succulent			MNCA				3	
<i>Anellema</i> sp. (no flowers)	Commelinaceae	Herb							1	
<i>Antidesma venosum</i>	Phyllanthaceae	Shrub						+		
<i>Aptosimum lineare</i> var. <i>lineare</i>	Scrophulariaceae	Herb				+				
<i>Aristida congesta</i> var. <i>congesta</i>	Poaceae	Grass				1				
<i>Aristolochia littoralis</i> *	Aristolochiaceae	Climber					+			
<i>Asparagus buchananii</i>	Asparagaceae	Climber						+		

[illegible]

[illegible]



## Appendix 2. List of confirmed fauna in study area

Common Name	Scientific Name	Red Data Status	Protected	Shrubland & Closed Woodland	Riparian Woodland	River
<b>Mammals</b>						
African Elephant	<i>Loxodonta africana</i>		NEMBA	x		x
Black Rhinoceros	<i>Dicerosbicornis</i>	VU	NEMBA	x		
Burchell's Zebra	<i>Equusburchelli</i>			x		
Greater Kudu	<i>Tragelaphusstrepsiceros</i>			x	x	
Lion	<i>Pantheraleo</i>	VU	NEMBA	x		
White Rhinoceros	<i>Ceratotheriumsimum</i>		NEMBA	x		
Subtotal	6	2	4	6	1	1
<b>Birds</b>						
African Fish Eagle	<i>Haliaeetusvocifer</i>				x	x
African Hoopoe	<i>Upupa africana</i>			x		
African Jacana	<i>Actophilornis africanus</i>					x
African Palm Swift	<i>Cypsiurusparvus</i>			x		x
African Pied Wagtail	<i>Motacillaaguimp</i>					x
Arrow-marked Babbler	<i>Turdoidesjardinei</i>			x	x	
Black-backed Puffback	<i>Dryoscopuscubla</i>				x	
Black-collared Barbet	<i>Lybiustorquata</i>			x	x	
Black-headed Oriole	<i>Orioluslarvatus</i>			x	x	
Blacksmith Lapwing	<i>Vanellusarmatus</i>					x
Black-winged Stilt	<i>Himantopus himantopus</i>					x
Brown Snake Eagle	<i>Circaetuscinereus</i>			x	x	
Brown-crowned Tchagra	<i>Tchagra australis</i>			x		
Brown-headed Parrot	<i>Poicephaluscryptoxanthus</i>			x	x	
Brown-hooded Kingfisher	<i>Halcyon albiventris</i>			x	x	
Brubru	<i>Nilusafer</i>			x		
Burchell's Coucal	<i>Centropusburchelli</i>				x	
Common Scimitarbill	<i>Rhinopomastuscyanomelas</i>			x		
Common Waxbill	<i>Estrildaastrild</i>			x	x	x
Crested Barbet	<i>Trachyphonusvaillantii</i>			x	x	
Dark-capped Bulbul	<i>Pycnonotusbarbatus</i>			x	x	
Egyptian Goose	<i>Alopochenaegyptiacus</i>					x
Emerald-spotted Dove	<i>Turturchalcospilos</i>			x	x	
Glossy Starling	<i>Lamprotornisnitens</i>			x		
Greater Honeyguide	<i>Indicator indicator</i>			x		
Green-backed Camaroptera	<i>Camaroptera brachyura</i>				x	



Grey Go-away Bird	<i>Corythaixoidesconcolor</i>			x	x	
Hadedda Ibis	<i>Bostrychiahagedash</i>			x	x	x
Helmeted Guineafowl	<i>Numidameleagris</i>			x	x	x
Klaas's Cuckoo	<i>Chrysococcyxklaas</i>			x	x	
Laughing Dove	<i>Streptopeliasenegalensis</i>			x		
Lesser Striped Swallow	<i>Hirundoabyssinicus</i>			x		
Lilac-breasted Roller	<i>Coraciascaudatus</i>			x		
Little Bee-eater	<i>Merops pusillus</i>			x	x	
Little Swift	<i>Apusaffinis</i>			x	x	x
Natal Francolin	<i>Pternistis natalensis</i>			x	x	
Purple-crested Turaco	<i>Gallirexporphyreolophus</i>				x	
Rattling Cisticola	<i>Cisticola cheniana</i>			x		
Red-billed Firefinch	<i>Lagonostictasenegala</i>			x	x	x
Red-eyed Dove	<i>Streptopeliasemitorquata</i>			x	x	
Red-faced Mousebird	<i>Urocoliusindicus</i>			x	x	
Reed Cormorant	<i>Phalacrocorax africanus</i>					x
Scarlet-chested Sunbird	<i>Chalcomitrasenegalensis</i>			x	x	
Sombre Greenbul	<i>Andropadusimportunus</i>				x	
Southern Grey-headed Sparrow	<i>Passer diffusus</i>			x		
Spectacled Weaver	<i>Ploceusocularis</i>			x		
Tawny-flanked Prinia	<i>Priniasubflava</i>			x	x	x
Trumpeter Hornbill	<i>Bycanistesbucinator</i>				x	
Village Weaver	<i>Ploceuscucullatus</i>			x	x	x
Water Thick-knee	<i>Burhinusvermiculatus</i>					x
White Helmetshrike	<i>Prionopsplumatus</i>			x		
White-bellied Sunbird	<i>Cinnyristalatala</i>			x	x	
White-browed Scrub-Robin	<i>Cercotrichaleucophrys</i>			x	x	
White-faced Duck	<i>Dendrocygnaviduata</i>					x
White-fronted Bee-eater	<i>Meropsbullockoides</i>				x	x
White-winged Widowbird	<i>Euplectesalbonotatus</i>					x
Wire-tailed Swallow	<i>Hirundosmithii</i>					x
Yellow-billed Egret	<i>Egrettaintermedia</i>					x
Yellow-breasted Apalis	<i>Apalis flavida</i>			x	x	
Subtotal	59	0	0	40	34	21
<b>Reptiles</b>						
Rainbow Skink	<i>Trachylepis margaritifer</i>			x	x	
Subtotal	1	0	0	1	1	0
<b>Frogs</b>						
Dwarf Puddle Frog	<i>Phrynobatrachus mababiensis</i>				x	x
Subtotal	1	0	0	0	1	1
<b>TOTAL</b>	67	2	4	47	37	23

### Appendix 3. Potentially occurring Red List Fauna

Common Name	Scientific Name	Red Data Status	Endemic	Protected	Conservation Importance Score	Subjective Probability of Occurrence#	Shrubland & Woodland	Riparian Woodland	Rivers
<b>Mammals</b>									
Aardvark	<i>Orycteropus afer</i>	NT*		MNCA	4	0.5	2		
African Elephant	<i>Loxodonta africana</i>	LC		NEMBA	1	1.0	1	1	1
Banded Mongoose	<i>Mungos mungo</i>	NT*			3	0.8	2.4	2.4	
Black Rhinoceros	<i>Dicerorhinus</i>	VU		NEMBA	5	1.0	5		
Bushveld Gerbil	<i>Tateraleucogaster</i>	DD			3	0.8	2.4	2.4	
Cheetah	<i>Acinonyx jubatus</i>	VU		NEMBA	5	0.2	1	1	
Greater Dwarf Shrew	<i>Suncus lixus</i>	DD			3	0.5	1.5	1.5	
Honey Badger	<i>Mellivora capensis</i>	NT		NEMBA	4	0.8	3.2	3.2	
Juliana's Golden Mole	<i>Neamblysomus julianae</i>	VU	SA	NEMBA	7	0.2	1.4		
Leopard	<i>Panthera pardus</i>	NT*		NEMBA	4	0.8	3.2	3.2	3.2
Lesser Grey-brown Musk Shrew					3	0.5	1.5	1.5	
Lesser Red Musk Shrew	<i>Crocidura silacea</i>	DD			3				
Lion	<i>Crocidura hirta</i>	DD			3	0.5	1.5	1.5	
Meller's Mongoose	<i>Pantheraleo</i>	VU		NEMBA	5	1.0	5	5	5
Pangolin	<i>Rhynchogale melleri</i>	DD			3	0.2	0.6		
Reddish-grey Musk Shrew	<i>Manis temminckii</i>	VU		NEMBA	5	0.5	2.5		
Side-striped Jackal	<i>Crocidura cyanea</i>	DD			3	0.5	1.5	1.5	
Single-striped Mouse	<i>Canis adustus</i>	NT			3	0.2	0.6	0.6	
Spotted Hyaena	<i>Lemniscomys rosalia</i>	DD			3	0.5	1.5	1.5	
Tiny Musk Shrew	<i>Crocuta crocuta</i>	NT		NEMBA	4	0.8	3.2	3.2	3.2
White Rhinoceros	<i>Crocidura fuscomurina</i>	DD			3	0.5	1.5	1.5	
Wild Dog	<i>Ceratotherium simum</i>	LC		NEMBA	1	0.5	0.5		
Woodland Mouse	<i>Lycanopictus</i>	EN		NEMBA	6	0.5	3	3	3
Subtotal	<i>Grammomys dolichurus</i>	DD			3	0.5	1.5	1.5	
		23	1	12			47.5	35.5	15.4
<b>Birds</b>									
Bateleur	<i>Terathopius ecaudatus</i>	VU		NEMBA	5	0.8	4	4	
Black-bellied Bustard	<i>Lissotis melanogaster</i>	NT			3	0.5	1.5		
Black Stork	<i>Ciconia nigra</i>	NT		NEMBA	4	0.2			0.8
Cape Vulture	<i>Gyps coprotheres</i>	VU		NEMBA	5	0.2	1		
Half-collared Kingfisher	<i>Alcedosemitorquata</i>	NT			3	0.2			0.6



#### Appendix 4. Vegetation Community Photos



Photo 1. *Grewia-Dichrostachys* Closed Shrubland



Photo 2. *Grewia-Combretum* Closed Shrubland



Photo 3. *Aloe-Euphorbia* Closed Woodland



Photo 4. *Ficus-Gymnosporia* Riparian Woodland





**Photo 5. *Garcinia-Diospyros* Riparian Woodland**



**Appendix 5. Photos of Alternative Hotel Sites**



**Site 1**



**Site 3**



**Site 4**



**Site 5**



