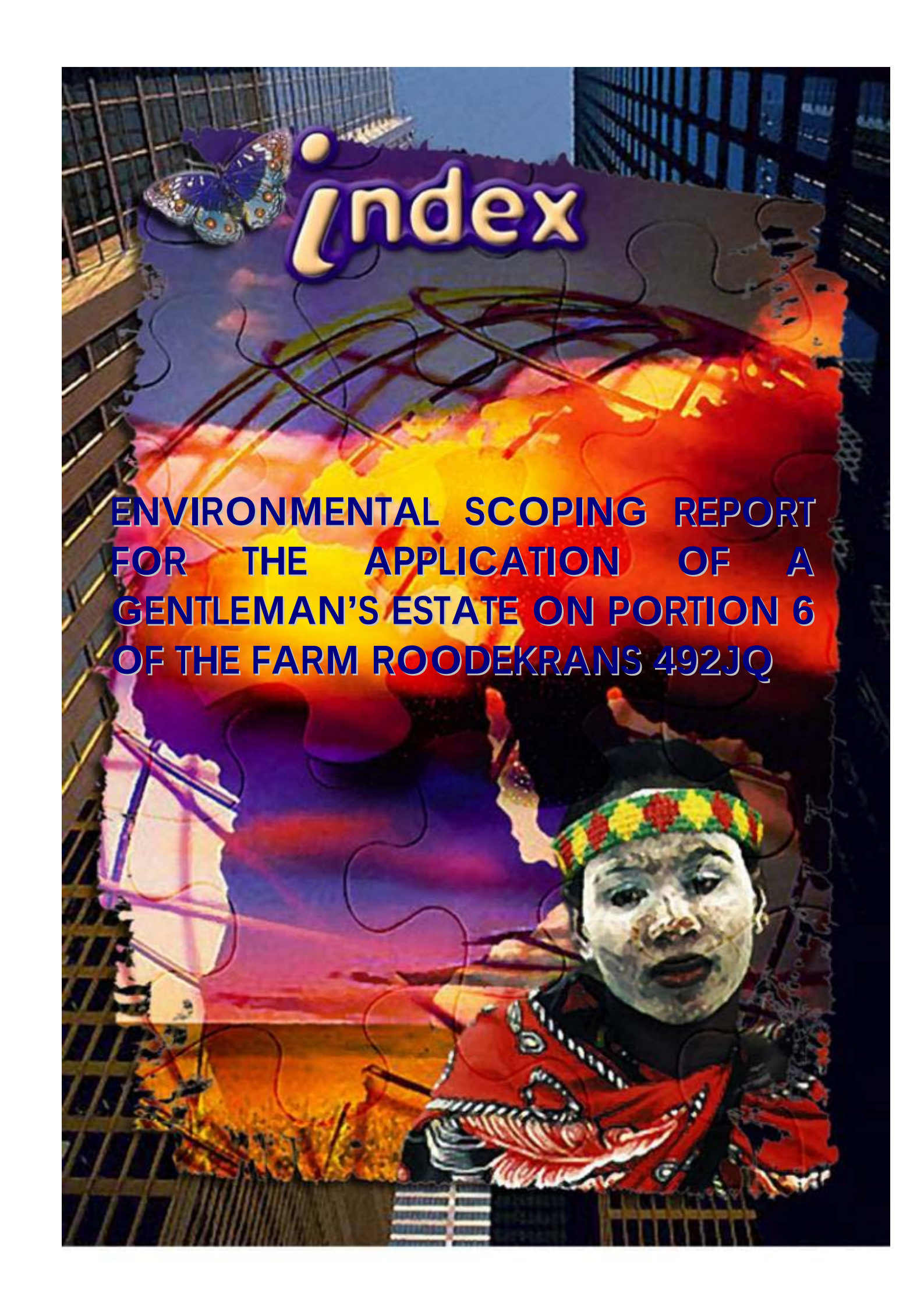


The background is a complex collage. At the top left, a blue and white butterfly is positioned near the word 'index'. The word 'index' itself is rendered in a stylized, 3D font with a purple outline and a yellow dot above the 'i'. Below this, a large, vibrant, abstract shape in shades of orange, yellow, and red dominates the center. In the bottom right corner, there is a portrait of a person wearing a traditional headband with colorful beads and a red garment with intricate patterns. The entire composition is set against a backdrop of dark, grid-like structures, possibly representing a city or a technical drawing.

index

**ENVIRONMENTAL SCOPING REPORT
FOR THE APPLICATION OF A
GENTLEMAN'S ESTATE ON PORTION 6
OF THE FARM ROODEKRANS 492JQ**

SCOPING REPORT

ENVIRONMENTAL SCOPING REPORT FOR THE APPLICATION OF A GENTLEMAN'S ESTATE ON PORTION 6 OF THE FARM ROODEKRANS 492JQ

CLIENT:

**REDCLIFF PRIVATE RESERVE (Pty) Ltd
P.O. BOX 1332
WITKOPPEN
2068**

ENVIRONMENTAL CONSULTANT

INDEX

**PO Box 96023
Waterkloof Village, 0145**

**(012) 346-6447 Fax: (012) 346-5670
eugene@iafrica.com**

NOVEMBER 2006

TABLE OF CONTENTS

TABLE OF CONTENTS	3
1. CONTACT DETAILS.....	4
1.1 Applicant	4
1.2 Environmental consultants.....	4
2. NATURE OF ACTIVITY OR DEVELOPMENT	4
2.1 Locality of the project	4
2.2 Project components	6
2.3 Regional connectivity.....	8
2.4 Services.....	9
3. EXISTING CONDITIONS.....	11
3.1 Climatic Conditions.....	11
3.2 Water	12
3.4 FAUNAL SURVEY	19
3.6 TSHWANE OPEN SPACE FRAMEWORK (TOSF).....	23
4. EVALUATION OF ALTERNATIVES.....	27
5. ENVIRONMENT IMPACT ASSESSMENT & MANAGEMENT PLAN.....	31
5.1 Assessment Method	31
5.2 IMPACT MITIGATION TABLES.....	32
5.3 CONCLUSIONS	38
ANNEXURE A: MAPS & DRAWINGS	41
ANNEXURE B: PUBLIC PARTICIPATION PROCESS	42
ANNEXURE C: NEWSPAPER ADVERTISEMENTS	44
ANNEXURE D: ON-SITE ADVERTISEMENT	46
ANNEXURE E: AGRICULTURAL POTENTIAL	47
ANNEXURE F: FAUNA SPECIES STUDY	48
ANNEXURE G: FLORA SPECIES STUDY	49
ANNEXURE H: SERVICES REPORT.....	50
ANNEXURE I: TRAFFIC IMPACT ASSESSMENT	51
ANNEXURE J: ENVIRONMENTAL MANAGEMENT PLAN	52

ENVIRONMENTAL SCOPING REPORT FOR THE APPLICATION OF A GENTLEMAN'S ESTATE ON PORTION 6 OF THE FARM ROODEKRANS 492JQ

1. CONTACT DETAILS

1.1 APPLICANT

REDCLIFF PRIVATE RESERVE (Pty) Ltd
P.O. BOX 1332
WITKOPPEN, 2068

Contact person: MR. Kon Keech

Tel. (011) 469 1553. Fax (011) 086 659 3233

1.2 ENVIRONMENTAL CONSULTANTS

INDEX
PO Box 96023
Waterkloof Village, 0145

Contact person Mr Eugene Gouws.

Tel (012) 356-6447 Fax (012) 346-5670 E-Mail: eugene@iafrica.com

2. NATURE OF ACTIVITY OR DEVELOPMENT

2.1 LOCALITY OF THE PROJECT

The project is located on Portion 6 of the farm Roodekrans 492 JQ and is situated in the Centurion Magisterial District, some 12.6 km north east of Dainfern, and east of the Lanseria Airport. Access to the development is off the M34 or R511, on 6 km of gravel road. The development is bounded by existing farms. The locality of the project is indicated in Figure 1.

Figure 1 Regional Locality

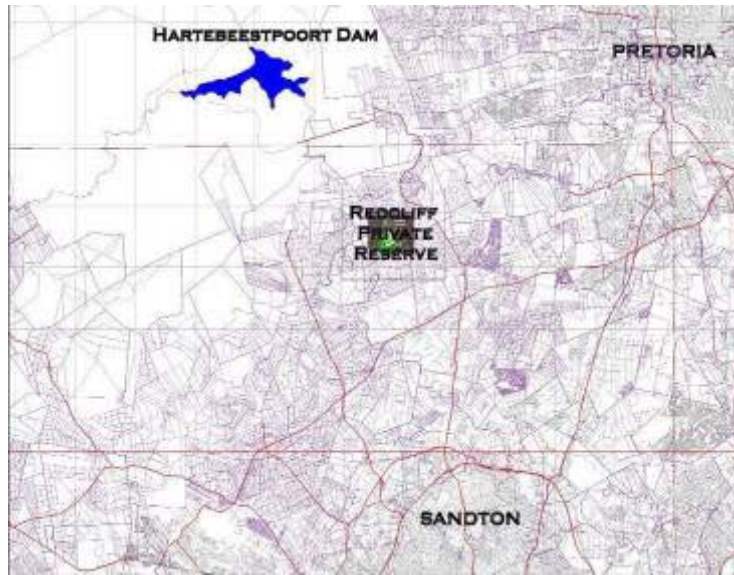


Figure 2 Locality

2.2 PROJECT COMPONENTS

The detail of the land is as follows:

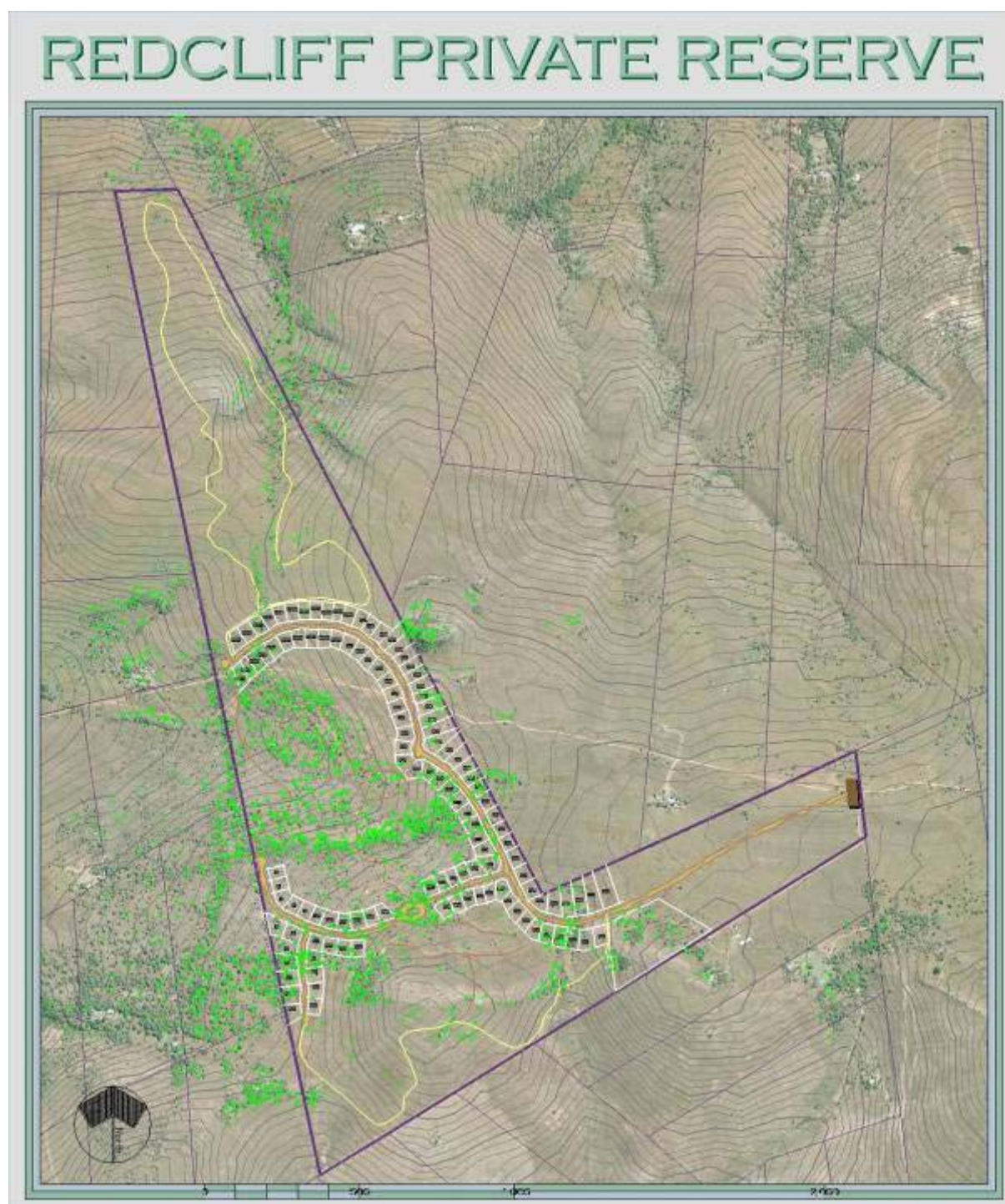
❖ Total area of portion	223 ha
❖ Proposed area of the housing development	40 ha
❖ Proposed area of the hospitality development	5 ha
❖ Number of stands	120
❖ Proposed coverage of the residential stands	22%
❖ Proposed coverage of the housing on the property	3,2%
❖ Proposed density	0,53 units/ha

The project entails the following:

- ❖ The establishment of a fenced nature area stocked with game
- ❖ 120 residential stands of about 2 500m² each;

- ❖ Hospitality – lodge and training facility;
- ❖ Services:
 - Internal Gravel Roads 22 500m2.
 - External Access road upgrading 36 000m2
 - Water reticulation
 - o Rising main 200m
 - o Domestic 3 600m
 - o Storage 1 Ml reservoir
 - Sewer reticulation
 - o Internal 4 000m
 - o Treatment works GES-RAS system
 - Stormwater Management Internal

Figure 2 Site development plan.

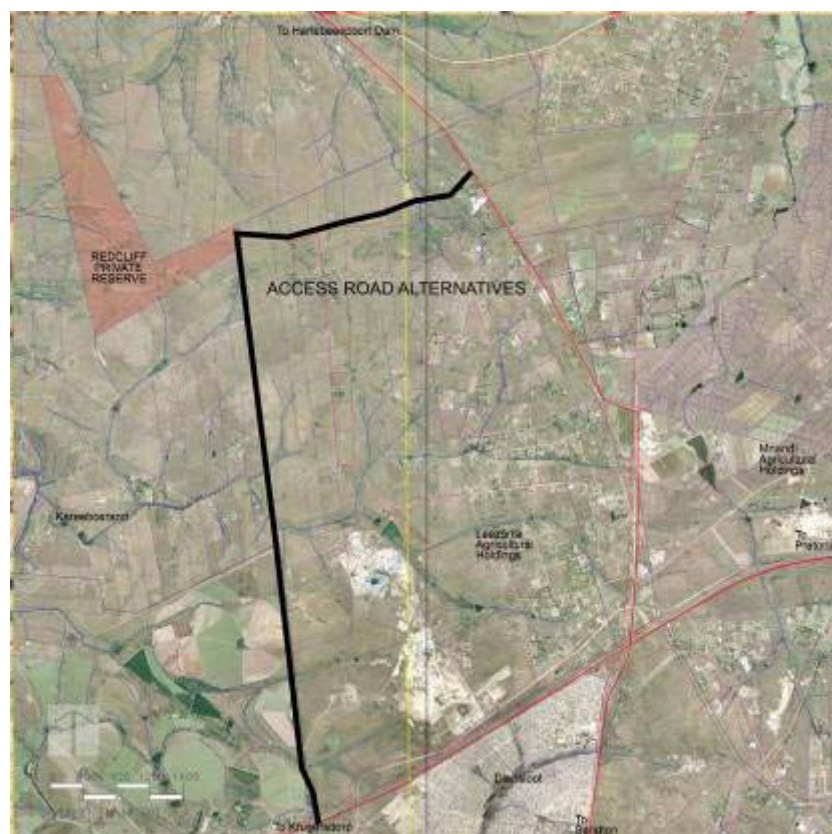


2.3 REGIONAL CONNECTIVITY

2.3.1 Roads

Main Access

The access road to the M34 will be upgraded from a gravel road, and constructed to the specifications of providing a dust free low maintenance roadway, by incorporating Ecobond stabilizer. Plans will be submitted to the City of Tshwane Metropolitan Municipality (Centurion) Roads Department for approval and wayleave, before construction commences. See Annexure for the Traffic Impact Assessment.

Figure 3 Alternative access roads**Internal roads**

All roads are considered as internal roads, and only serve the development. The proposed foundation layers are as follows:

Subbase	150mm G6 imported material stabilized and compacted to 95% Mod AASHTO
Roadbed	150mm rip and recompact insitu material to 93% Mod AASHTO

2.4 SERVICES

The design of Civil Engineering Services, are based on the “Guidelines for Engineering Services and Amenities” (Red Book) and design norms prescribed by the City of Tshwane Metropolitan Municipality (Centurion). All specifications as laid down in the SABS 1200 standard specification for Civil Engineering construction

2.4.1 Water reticulation:

Two existing boreholes are available on site and their rate of delivery is still to be confirmed. In discussion with the Geotechnical Engineer, it is proposed to drill a further borehole in the southeast corner of the development, where the anticipated groundwater level would be within 5 to 10m of the ground surface. It is proposed to link these boreholes to a rising main and pump to a storage area on the south of the development, which is the highest point of the development. It is proposed to erect a 1MI reservoir, with a chemical dosing plant and a booster pump. Subject to the tests of the borehole water, the dosing plant will be designed accordingly.

The proposed internal water reticulation will consist of uPVC Class 12 110mm diameter combined domestic and fire main pipe with spigot and socket couplings and thrust blocks.

All fire hydrants will be positioned to meet the requirements of the Rational Fire Design and the Emergency Services, and will be the Woodlands High Efficiency type.

The total estimated average demand would be in the order of 225,7kl/day, at an average demand of 1 850 litres/dwelling/day.

The development consists of 120 stands x 1 850 litres/stand/day x 4 = 888Kl., and a 1Ml reservoir would then allow for four to five days storage.

2.4.2 Disposal of waste generated on the property

Sewerage

It is proposed to install an onsite sewerage management system in the form of an installed infiltrator chamber system developed by P D & M Services in association with GES Environmental of Pretoria, and known as the GES-RAS System. The Department of Water Affairs and Forestry have approved this system installed on other locations, and the quality of the discharge after treatment can be discharged directly into a storage reservoir for use as irrigation water, and be circulated between the feature dams to be constructed in the development. The infiltrator chamber is installed underground and has the added advantage that there is no odour and is low maintenance unit. P D & M Services are the registered manufacturers of this system and will supply additional information if required. It must be noted that a license for this system for this development will have to be by DWAF.

The proposed internal sewer reticulation will consist of 160mm diameter Maincor Class 400 pipes. All manholes will be 1050mm diameter pre-cast rings, with concrete covers and frames and have sealed joints, at a maximum of 80m spacing.

The design flow for the development is as follows:

❖ Maximum development potential	120 units
❖ Discharge per stand	1250 litres/stand/day
❖ Peak factor	2.30
❖ Extraneous flow	15%
❖ Total wet weather design flow	403.36kl/day

Refuse disposal

A private waste removal company will be contracted to remove the refuse to an approved landfill site. The closest municipal landfill is the Kwaggasrand Landfill, 14 km to the northeast.

2.4.3 Stormwater

The total area of the development is 45 ha draining north and westwards to the natural watercourse. The watercourse to which the development will be discharging, is non-perennial in nature and only contain water after periods of rainfall.

Stormwater generated by the development will be managed as overland flow and roads will be protected in the form of armoflex where concentrated flows are encountered. Stone pitch channels will be constructed between the stands where flow has to be channelized for protection to proposed dwellings.

2.4.4 Electricity

Scope of the development

The Local Electrical Supply Authority is ESCOM with an existing extra High Voltage line directly to the East of the development.

With the proposed 120 erven to be developed for the higher income group, the estimated electrical load calculations were based on 60% connections per unit of 42kVA and the remaining 40 % on 34kVA. This will be connected load per dwelling.

With ADMD factors, the total estimated load for the 125 dwellings will be 1,7MVA and when other buildings are added (eg. Clubhouse) the load could be taken at between 1,8 and 2 MVA.

Existing services

There is no existing electrical service from ESCOM available to the proposed development although ESCOM planning is to complete the upgrade of their electrical network by the end of 2007.

We were informed by the ESCOM planning engineer to proceed with an application for 2MVA to the proposed development in order for them to make the capacity available when their upgrade is complete.

Engineering design

The design for the external Electrical Engineering Services will be based on the current design standards used by ESCOM, the relevant SABS standards for electrical services, as well as Telkom where there service is installed.

- ❖ 185mm² table 19 11kV cable from the new ESCOM supply point through the development between the miniature substations.
- ❖ 500kVA and 315kVA 11 000/420Volt miniature substations in some of the private stands facing the roads.
- ❖ Low Voltage supply cables from the various mini-sub to the Low Voltage distribution and metering boxes in the pavement reserves.
- ❖ Street lighting may be installed in the form of straight galvanized poles with a mounting height of between 5 - 6m and spaced at intervals of between 35 and 45m and/or post top lighting with a mounting height of 3m and spaced at intervals of 18 - 25m.
- ❖ All the above equipment and materials will be in accordance with the relevant SABS standards.

3. EXISTING CONDITIONS

3.1 CLIMATIC CONDITIONS

3.1.1 Rainfall

The rainfall is typical of the Highveld's summer rainfall pattern, where more than 80% falls from October through to April. An average of 714 mm per year occurs in Pretoria of which 464mm is estimated as being available for crops.

3.1.2 Temperature

The project area is located between the Schurweberg and Witwatersberg and consequently, experience relatively low wind-speeds compared with the surrounding areas. Wind with moderately high speeds occurs from late winter to early summer.

3.1.3 Evaporation

The evaporation for the area is taken as similar to that experienced in Pretoria where a total of 2 413 mm evaporates from an American Class A pan. The maximum evaporation occurs in October. This is the main planting period for summer crops but is also when the rainy season commences.

The demand for irrigation water is highest in October when more than 230mm for the month are required.

3.1.4 Wind

Wind with moderately high speeds occurs from late winter to early summer (from September to November). Violent thunderstorms and rain occurs during this period.

3.2 WATER

3.2.1 Groundwater

According to the database of DWAF¹, groundwater can be expected at depths of less than 20 metres with an expected delivery of between 0 and 1 litre per second.

3.2.2 Surface water

The property primarily drains towards the west and to the north. There are two drainage lines: one that occurs in the centre of the property and a minor drainage line on the north-eastern portion of the site. Both are seasonal and flow only during or after heavy downpours.

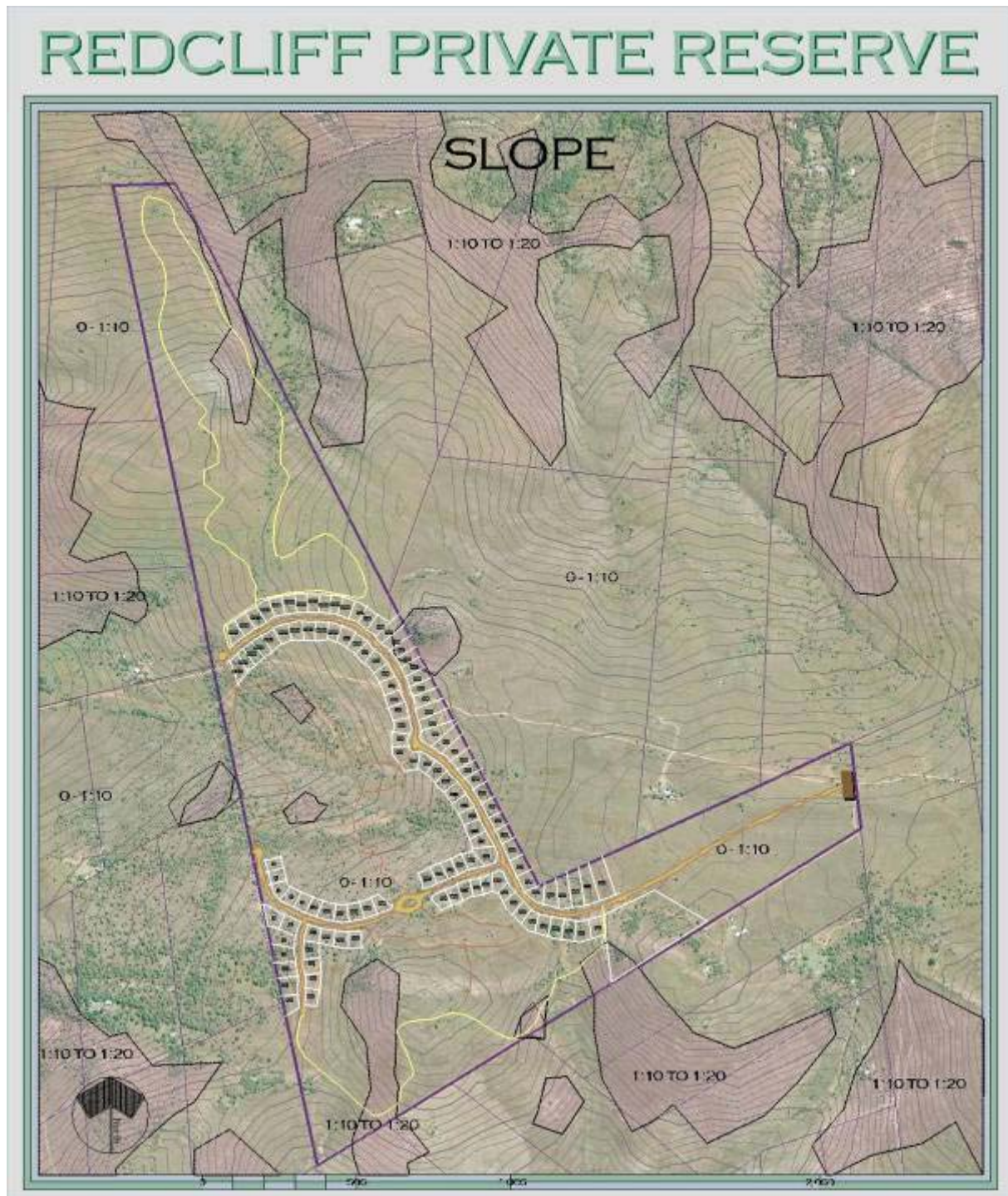
3.3 LAND & SOIL

3.3.1 Topography

The site is undulating with a slope generally less than 10%. Small portions occur with a slope between 1:10 and 1:20. There are no slopes on the property that exceed 1:5.

¹ More than 20 monitoring boreholes occur on or within 1000 metres of the property.

Figure 4 Topography - Slopes exceeding 20%

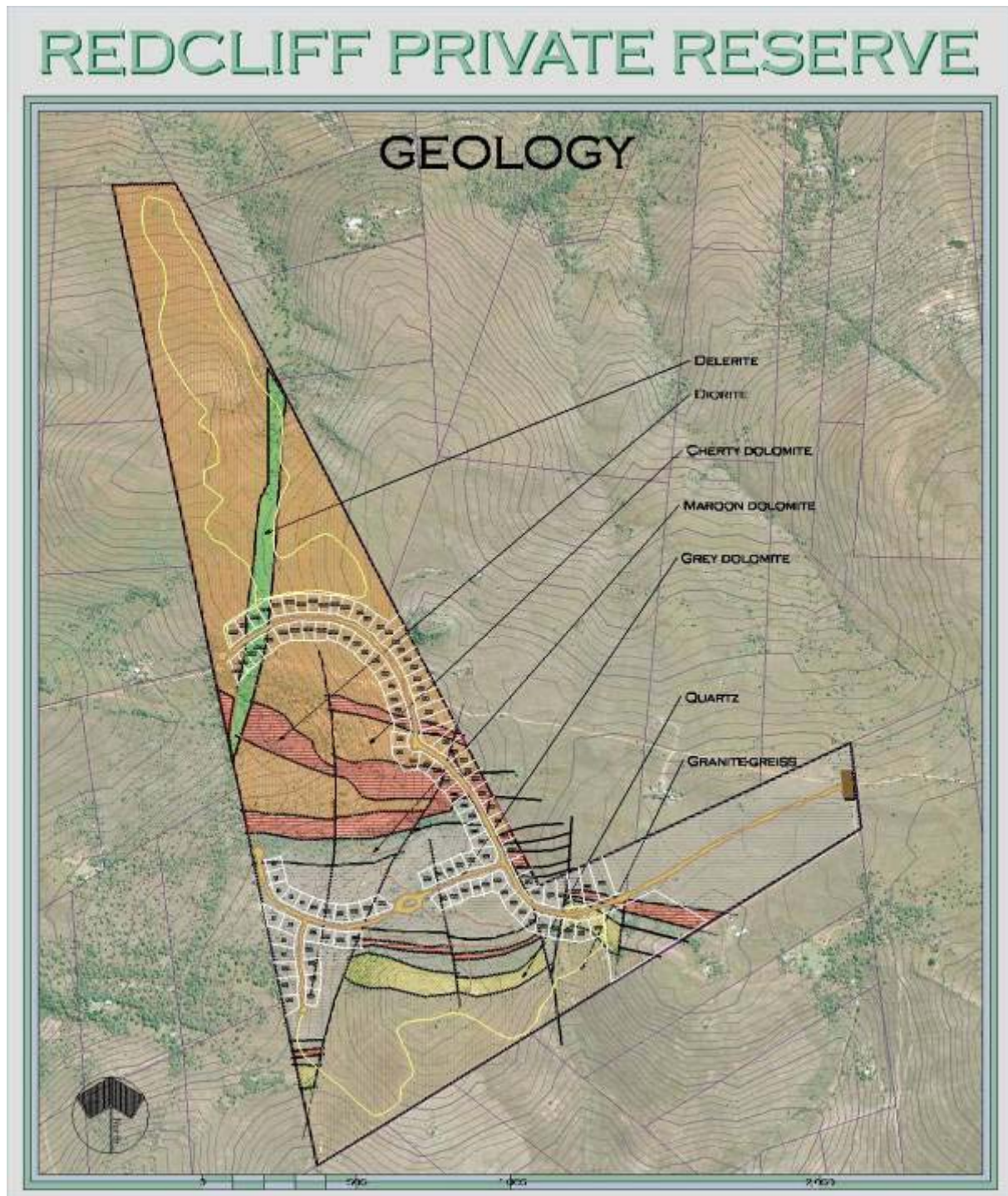


3.3.2 Geology²

The site is located on granite, Black Reef Quartzites, dolomite and chert of the Oaktree and Monte Christo Formations, Chuniespoort Group and their weathered soil derivatives. Residual dolomite (wad), chert, chert residuum and colluvial deposits overlie the dolomite bedrock. Diorite/Syenite sills and diabase dykes have intruded the dolomite. The distribution of these formations is shown on a simplified geological map:

² Intraconsult

Figure 5 Simplified geology



The geology occurs as follows:

- ❖ The southern sector of the site is underlain by granitic gneiss and schists that occupy approximately 10 per cent of the site.
- ❖ The overlying Black Reef Formation has an east west strike across the southern sector of the site and dips towards the north and occupies 2-5 per cent of the site. The Black Reef Formation defines the base of the dolomite basin.

- ❖ The remainder of the southern, central and northern sectors of the site is occupied by dolomite and chert of the Oaktree and Monte Christo Formations of the Chuniespoort Group. The dolomite typically outcrops and suboutcrops on the site.
- ❖ East- west striking sills of diorite are recorded in the dolomite.
- ❖ Roughly north-south striking dykes of diabase are mapped on the site.

The area has currently not been mapped from a geohydrological perspective and consequently the ground water compartments have not as yet been definitively determined. However, it is anticipated that the ground water level is located below the dolomite bedrock head.

Geotechnical analysis

The major area of the site is underlain by dolomite and chert of the Chuniespoort Group.

According to the concept township designs provided, the proposed residential component of the reserve will comprise Residential 1 stands typically 2 500 m² in extent and located in single rows along either side of the loop access roads. The residential component will constitute a small portion of the reserve. Field inspections show that the stands are largely located on areas of outcrop and sub-outcrop dolomite or sub-areas of diorite or dolerite.

The residential component will largely be located on the outcrop and sub- outcrop dolomite. Typically investigations elsewhere show that such geological settings classify as Inherent Risk Class 5 with sub-areas of Class 6. The Inherent Risk Class 5 areas may be considered for selected residential development. The areas underlain by intrusive will require assessment of the thickness of the intrusive and the nature of the subsurface conditions holistically.

Geotechnical recommendations

This preliminary assessment indicates that detailed investigations are merited on site for the proposed low-density residential development. Once the other principal environmental matters are addressed, it recommended that the residential component of the development plus all access roads and bulk infrastructure is subjected to detailed GFSH-2, Phase 1 level geotechnical investigations. These investigations will most likely involve:

- ❖ Undertaking appropriate geophysical surveys.
- ❖ The drilling of boreholes on every stand in the development.
- ❖ Trail hole investigations of the surficial soils and where necessary the dolomite bedrock head.
- ❖ Analysis of geological, geohydrological, geophysical and geomorphological data.
- ❖ Risk zonation
- ❖ Determination of the appropriate founding footprint for each residential structure.
- ❖ Provision of the NHBRC D designations.
- ❖ The determination of Soil Site Classes.
- ❖ The provision of appropriate water precautionary measures.
- ❖ The provision of founding solutions.

These detailed investigations will be required for final environmental ROD, the planning process and for approval by the Council for Geoscience and the NHBRC.

In the context of the anticipated Inherent Risk Classes on the site, it is essential that densities of the residential stands do not exceed those proposed by the NHBRC. The current densities are anticipated to be appropriate if the Inherent Risk Class is confirmed by the detailed footprint investigations.

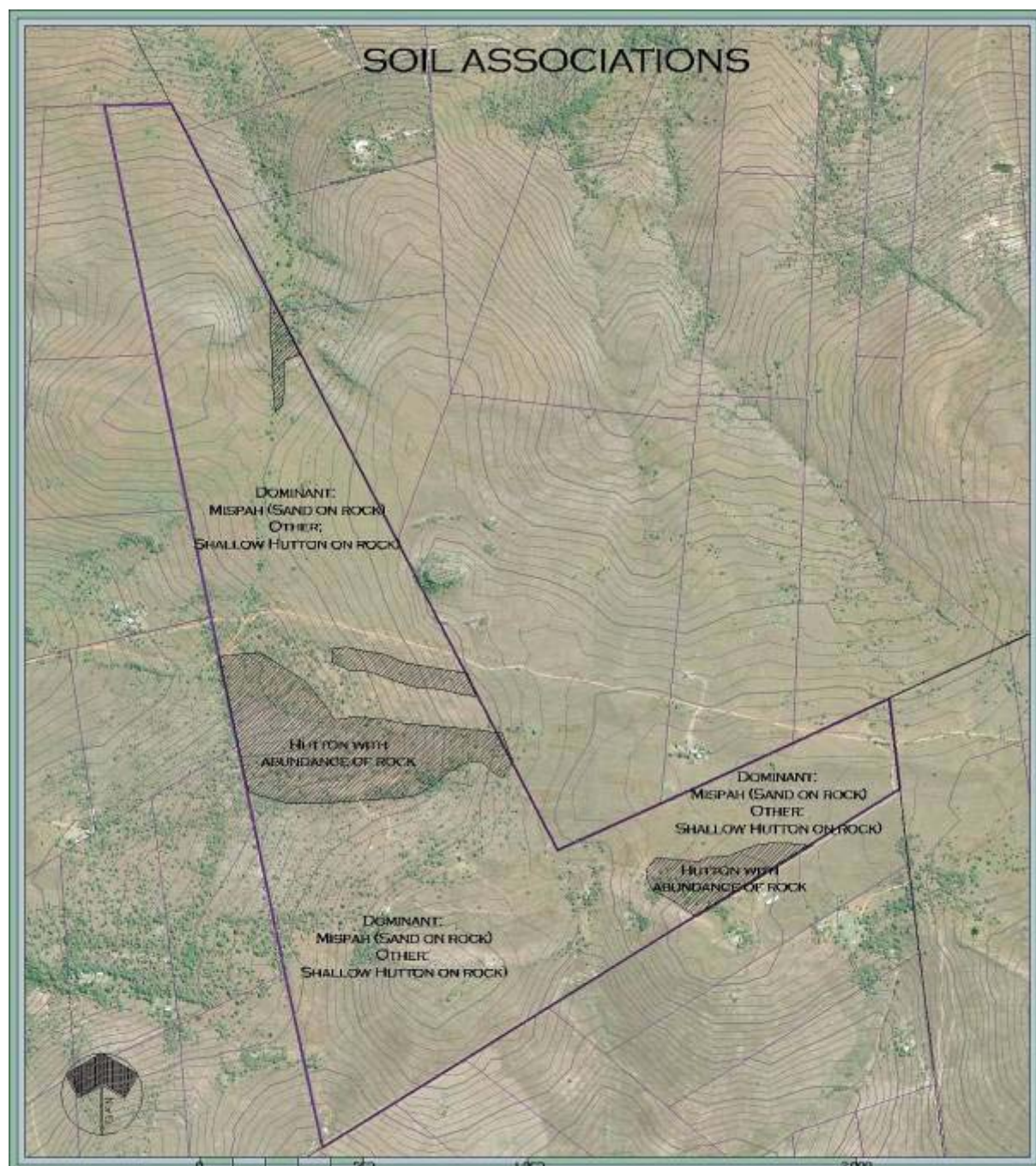
Based on this preliminary overview of the geotechnical conditions on site, the planning proposal of limited residential development (124 units) in a 200ha nature reserve is viewed as a potentially appropriate development concept in the geological setting. However detailed geotechnical investigations are essential to verify these preliminary perspectives

3.3.3 Soil analysis³

The revised soil classification system; A Taxonomic System for South Africa was used for basic classification and land-use recommendations.

Using the above information and by determining probable soil boundaries on aerial photographs and using a hand auger to verify the actual boundaries, a soil map was prepared. Emphasis was placed more on soil associations than actual soil series. The boundaries are presented in the Figure below:

Figure 6 Soil Associations



Two soil associations occur on the property:

³ See Agricultural Potential Assessment in the Annexures

Hutton with an abundance of boulders

The soil associated with the intrusive material – dolerite and diorite, has weathered to deep soil but with an abundance of boulders, especially in the area close to the water course. Due to the boulders, the agricultural potential is low.

Mispah and Hutton/R

The vast majority of the property consists of dolomite or quartzite outcrops with small pockets of shallow Hutton soil (less than 300mm deep) dispersed between deeper weathered materials. The agricultural potential is low.

3.4 VEGETATION⁴

3.4.1 Regional vegetation

The study area falls within the Grassland Biome classified by Acocks as Rocky Highveld Grassland (34). Stratification was done using habitat as the stratum forming each community. Within each community the factor contributing most to community composition was soil.

Cover values used (Braun Blanquet) are as follows:

5 = 75% - 100% canopy cover, 4 = 50% - 75% canopy cover, 3 = 25% - 50% canopy cover,

2b = 12% - 25% canopy cover, 2a = 5% - 12% canopy cover, 1 = 1% - 5% canopy cover, + = numerous individuals present, but < 1% cover and r = individual with negligible canopy cover..

3.4.2 Habitats

One semi aquatic and two terrestrial habitats were present in this study area.

Table 1 Habitats

Habitat	Soil	Lithology	Disturbed
<u>Aquatic:</u>			
A: Moist grassland of valley	Floodplain deposits sandy-loam	Quaternary deposits originally of dolomitic origin or from weathered intrusive material	No
<u>Terrestrial:</u>			
B: Grassland slopes	Sandy loam	Dolomite	Yes- old house/ grazing
C: Rocky crest, grassland with few short trees	Sandy loam	Quartzite and Dolomite ridges	No

3.4.3 Description of communities⁵

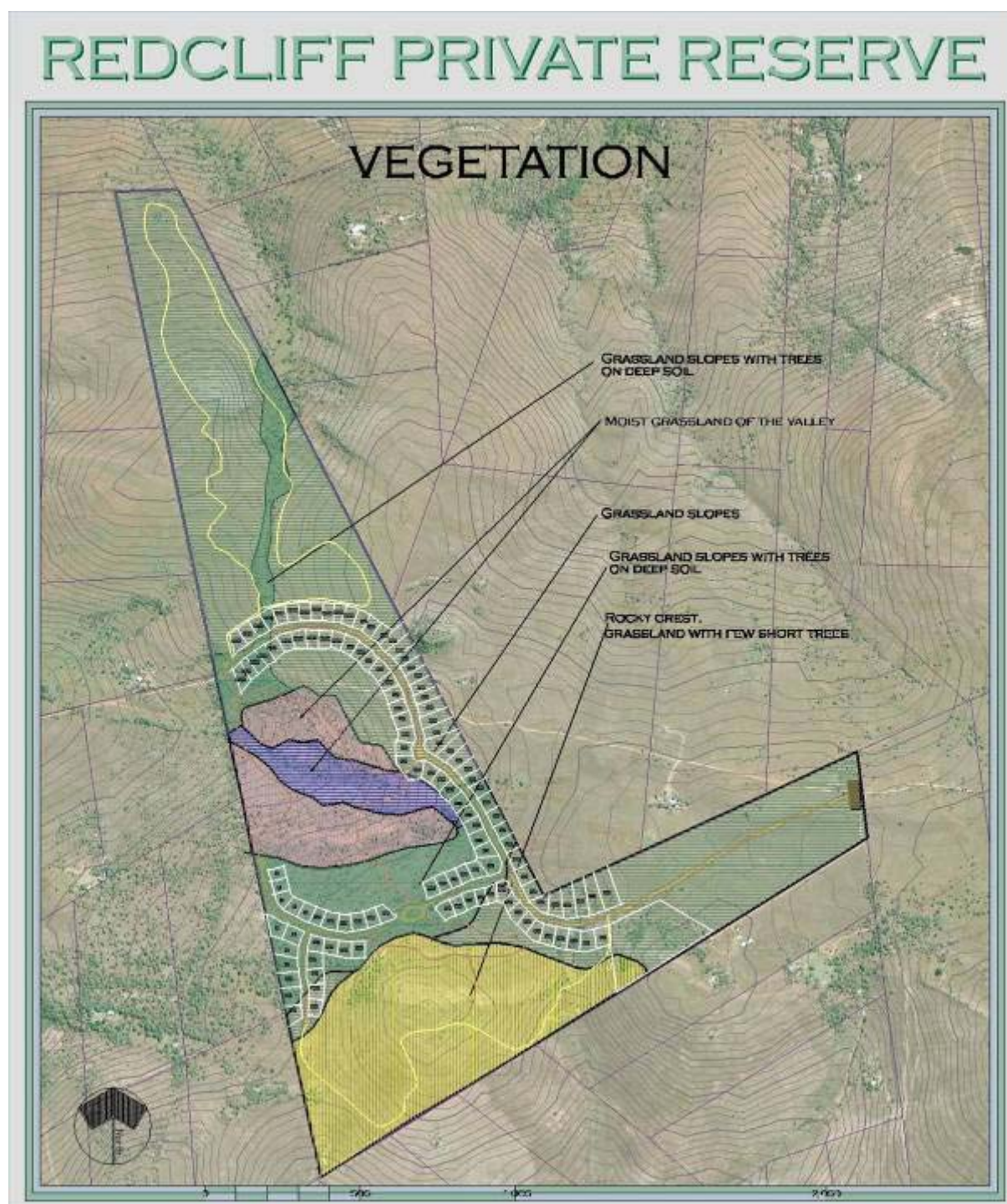
Moist grassland of valley

This site is situated in the valley and drainage is from south east to north west. No permanent water is to be found in the streamlet. The lithology comprises dolomite. Rocks of sizes of 20-50 cm are found at this site and rock cover is approximately 25 % of the total cover. Soil is a rich sandy-loam and is moist at this time of year. Slopes vary from 2° to 8°. This community is classified as a moist grassland savannah with trees at intervals. The vegetation is dominated by *Acacia caffra*, which grows singly or in groups throughout the valley. Other trees present are *Rhus lancea*, *Combretum hereroensis*, *Canthium gilfillanii* and *Vangueria infausta*. The dominant grasses are *Setaria phacelata* and *Loudetia simplex* with the primary invader *Tragus berteronianus* common as a result of past grazing practices.

⁴ Report by Ms Byrgoyne

⁵ See appendices for specie lists.

The site was scored 7/10 with few invaders and high species diversity. One Red List species (*Cleome conrathii*, specimen at PRE) was recorded at this site.



Grassland slopes.

This habitat primarily comprises tall grass with scattered herbs and few trees. There are few rocks and slopes are north-facing and gentle 4° to 6° with soil being a rich red loam. The vegetation is dominated by the grass *Hyparrhenia hirta* (close to 45% cover) reaching a height of ~1.1 m tall. Herbs are present with a ~9% cover (out of the 75% vegetation cover).

Acacia caffra trees are present but only as a few individuals which increase in number towards the lower slopes in the north west.

Most species recorded at this were indigenous species with a few species indicating poor practises in the past such as **Pennisetum clandestinum* (kikyu), **Cynodon dactylon* and *Tragus berteronianus*. The site was scored as 5/10 for condition, as its species composition was low but with a few alien invaders. No Red List species or rare species were recorded at this site.

Rocky crest, grassland with few short trees.

This habitat primarily comprises rocky outcrops of sandstone origin with few short trees interspersed at intervals. There is a high succulent component as would be expected of such a habitat. Rocks slope towards the north as expected in the Transvaal Supergroup with slopes north-facing and about 12° to 15° with soil being shallow sandy loam. Open bare rocky spots comprise 35% of the surface area. The dominant tree species is *Englerophytum magalismontanum* while the dominant grass species is *Loudetia simplex*.

Trees are present but only as a few individuals, never attaining great height due to habitat conditions.

Most species recorded at this were indigenous species. The site was scored as 8/10 for condition, as its species diversity was high with only few primary invaders. One Red List species (*Cleome conrathii*, specimen at PRE) was recorded at this site.

3.4.4 Conclusions

The grassland and woodland of this area is unique as dolomitic communities have unique species composition.

Development taking place should concentrate on the southern end (towards JHB) of the study area and mid-slopes below the rocky crest, grassland where the species diversity is lower than the woodland. Units can also be placed on the northwest side of the study area adjacent to the game fence. The Red List species, *Cleome conrathii*, is present in the woodland area and a buffer zone of an average of 100m should be maintained for its continued existence and having this species thus protected would be advantageous. This specific development with certain sites set aside for natural habitat is ideal for the protection of this species.

3.5 FAUNAL SURVEY⁶

3.5.1 Method

This faunal survey focused mainly on mammals, birds, reptiles and amphibians of the study area. The survey focused on the current status of threatened animal species occurring, or likely to occur within the study area, describing the available and sensitive habitats, identifying potential impacts resulting from the development and providing mitigation measures for the identified impacts.

Faunal data was obtained during a 2-day field survey of the proposed development site carried out on foot on the 10th and 11th November 2005.

All animals (mammals (larger), birds, reptiles and amphibians) seen or heard; were recorded. Use was also made of indirect evidence such as nests, feathers and animal tracks (footprints, droppings) to identify animals. The data was supplemented by previous surveys conducted in the area, literature investigations, personal records and historic data. Different habitats were explored to identify any sensitive or specialised species. Mammal names are as used by Skinner and Smithers (1990), bird names by Maclean (1992); reptile names by Branch (1998); amphibian names by Passmore and Carruthers (1995)

3.5.2 Prevailing ecological environment

The site is currently utilised as a game reserve and contains two residential houses and a bush camp. As the site is situated in a conservancy the majority of vegetation is natural except for alien vegetation around the existing residential houses (*Eucalyptus* sp., *Opuntia ficus-indica* and *Agave americana*) as well as around old ruins. Larger mammal species have been re-introduced including Gemsbok (*Oryx gazella*), Eland (*Taurotragus oryx*), Blesbok (*Damaliscus dorcas phillipsi*), Burchell's Zebra (*Equus*

⁶ Report by Clayton Cook. See Annaxure.

burchelli), Red Hartebeest (*Alcelaphus buselaphus*), Black Wildebeest (*Connochaetes gnou*), Giraffe (*Giraffa camelopardalis*), Impala (*Aepyceros melampus*) and Waterbuck (*Kobus ellipsiprymnus*).

Figure 7 A view of the proposed residential development area situated on the northern slopes of the site



3.5.3 RESULTS OF THE INITIAL FAUNAL SURVEYS

Mammals

According to the “South African Red Data Book of Terrestrial Mammals” (Smithers 1986) and Skinner and Smithers (1990), the study area falls within the distribution ranges of 4 species which are placed into one of known threatened species (Endangered, Vulnerable and Rare) as well as 2 species which are presently listed indeterminate or data deficient. As the site is situated in a large private conservancy the majority of mammals should be present.

HABITAT AVAILABLE FOR SENSITIVE OR ENDANGERED SPECIES

No sensitive or endangered mammals were recorded during the brief survey but suitable habitat occurs on the site and surrounding conservancy areas for certain rare or threatened mammal species. Although the site may be utilized by certain rare or endangered mammal species for breeding, foraging and exploratory movements it is highly unlikely that the proposed development area (northern slopes) forms critical habitat for any rare or threatened mammal species on the site.

Table 2 Mammal species of conservation importance possibly occurring on the site (using habitat availability as an indicator)

Common Name	Scientific Name	Conservation Status
Welwitsch's hairy bat	<i>Myotis welwitschii</i>	Indeterminate
Striped mouse	<i>Rhabdomys pumilio</i>	Data Deficient
White-Tailed Mouse	<i>Mystromys albicaudatus</i>	Vulnerable
South African Hedgehog	<i>Atelerix frontalis</i>	Rare
Aardwolf	<i>Proteles cristatus</i>	Rare

African Wild Cat	<i>Felis lybica</i>	Vulnerable
------------------	---------------------	------------

Avifaunal (bird) survey

A comprehensive bird species list requires intensive surveys compiled over several years. No actual avifaunal survey was undertaken and the list provided in the annexure is of species that have been recorded in the vicinity of the proposed site during the SA Bird Atlas Project. No threatened or rare birds were recorded during the brief survey but suitable habitat exists for several species.

Numbers of bird species in the area have declined due extensive grassland habitat degradation and transformation. Human activity has transformed grasslands in South Africa to a point where few pristine examples exist (Low & Rebelo 1996; Barnes 1998). Factors such as agricultural intensification, increased pasture management (overgrazing), decrease in grassland management and land-use alteration (urbanisation). Continuing pressure on grassland habitat are largely responsible for the decline of the following species.

HABITAT AVAILABLE FOR SENSITIVE OR ENDANGERED SPECIES

Several rare or threatened bird species may utilise the site for foraging and exploratory movements. These include the large raptors such as Secretarybird, Cape Vulture, Ayres' Eagle as well as certain storks (Marabou and Black), smaller raptors (Lesser Kestrel) as well as the Blackwinged Pranticole. Due to its large size and the fact that the site and certain surrounding grasslands are presently maintained as private conservancies (Rhenosterspruit and Birdsong) the possibility exists for the presence of Korhaans (Blue, Whitebellied and Blackbellied Korhaan). Although the site may be utilized by certain rare or endangered bird species for foraging and exploratory movements it is highly unlikely that the proposed development area forms critical habitat for any rare or threatened bird species.

Herpetological survey: reptiles and amphibians

No actual survey was undertaken due to incorrect time of the year for herpetological survey. Insufficient early summer rainfall resulted in only a few species of frog being active. Lists provided below have been compiled from personal records as well as data from the SAFAP (South African Frog Atlas Project) and can be considered as fairly comprehensive.

HABITAT AVAILABLE FOR SENSITIVE OR ENDANGERED SPECIES

Giant Bullfrog (*Pyxicephalus adspersus*)

The Giant Bullfrog is currently assigned as a near-threatened species (IUCN Red List category). No Giant Bullfrogs were observed during the brief survey as insufficient rain had fallen. Giant Bullfrogs have been recorded on the R511 adjacent to the site as well as from several localities to the east of the site. Giant Bullfrogs may occasionally utilise the site for foraging or migratory habitat but tend to avoid rocky and hilly areas. Giant Bullfrogs may utilize the open grassland habitat towards the southern boundary of the site for foraging and exploratory movements. It is highly unlikely that the proposed development area forms critical habitat for remaining Giant Bullfrogs

Reptiles

Reptiles are extremely secretive and difficult to observe during field surveys. The majority reptile species are sensitive to severe habitat alteration and fragmentation. Due to human presence in the area coupled with increased habitat destruction and disturbances to the south and west of the site are all causal factors in the alteration of reptile species occurring on the site and surrounding areas. Large areas of low-lying rock (weathered dolomite) on the hills and ridges, provides favourable refuges for certain snake and lizard species (rupicolous species). The indiscriminate killing of all snake species as well as the illegal collecting of certain species for private and the commercial pet industry reduces reptile populations especially snake populations drastically. The frequent burning of the site will have a high impact on remaining reptiles. Fires during the winter months will severely impact on the hibernating species, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

HABITAT FOR SENSITIVE OR ENDANGERED SPECIES

No endangered reptile species were recorded during the brief field survey or are likely to occur on the site. African Rock pythons listed in the Red Data Book for reptiles as "vulnerable" have been recorded from the Magaliesberg to the north of the site.

Insects and arachnids

No actual insect or invertebrate survey was conducted but incidental observations of observed arachnids and scorpions were documented. Several scorpion burrows were found on the loamy soil areas of the site especially along animal paths. Members of the scorpionid genus *Hadogenes* are adapted to living in narrow cracks and crevices in rocks. They are flattened and have long, slender pedipalps and tail, and cling to rock surfaces with such tenacity that they cannot be dislodged, so that scorpion collectors have to prise open the cracks with crowbars to secure specimens (Skaife 1979). No evidence of illegal reptile and arachnid collecting was observed throughout the site.

THREATENED SPECIES:

Gunning's Rock Scorpions (*Hadogenes gunningi*)

Hadogenes have such narrow habitat requirements that different species may be strictly separated by unsuitable conditions. A good example of this is *Hadogenes gunningi* with populations in the Magaliesberg being quite distinct from an *H. gracilis* population on rocky outcrops just 10 km to the north (Leeming 2003). *Hadogenes* are under great pressure from habitat destruction. Limited distributions and long life cycles and gestation periods make them extremely vulnerable. Lifespan in the wild is estimated at 25 to 30 years (Leeming 2003).

Favourable rocky habitat exists on the neighbouring hill outside the northern boundary (Koppiealleen) for Gunning's Rock Scorpions (*Hadogenes gunningi*). They are found throughout the Magaliesberg range and rocky outcrops in Gauteng. Although it mainly inhabits cracks and rock exfoliations a female specimen was personally discovered under a large slightly embedded rock to the east of the site (Gardener Ross Golf Estate). Due to its limited distribution, which is being encroached by highly urbanised areas, this scorpion is in special need of protection from urbanization, habitat destruction and transformation (Leeming 2003). The conservation of the hill on the site and on the neighbouring property (Koppiealleen) should conserve sufficient suitable habitat for rock scorpions and other rupicolous arachnids and scorpions in the area.

Conclusion and recommendations

The conservation of the seasonal tributary as well as sufficient open grassland with wooded pockets as well as the rocky ridges and hills should conserve the majority of suitable habitat for animal species found on the site and surrounding areas. It is imperative for the majority of animal species on the site that the hydrological regime of the seasonal tributary is maintained. Further alterations to the flow regime can have detrimental impacts on the river as well as the riparian vegetation. The introduction of larger mammals should follow strict carrying capacities determined by a qualified grassland ecologist or botanist. A natural fire regime should also be incorporated on the site and surrounding grassland areas. The possible connecting of this site with neighbouring sites to the north, east and the west should strongly be considered. This will increase the amount of area under private conservation control, which will directly benefit the majority of animal species in the area. The internal fences could be removed with a single electrified perimeter fence allowing increased migratory movements of larger animals.

3.6 LAND USE

3.6.1 Current land use of the property

The site is currently utilised as a game reserve. As the site is situated in a conservancy the majority of vegetation is natural except for alien vegetation around the existing residential houses (*Eucalyptus* sp, *Opuntia ficus-indica* and *Agave americana*) as well as around old ruins. Larger mammal species have been re-introduced including Gemsbok (*Oryx gazella*), Eland (*Taurotragus oryx*), Blesbok (*Damaliscus dorcas phillipsi*), Burchell's Zebra (*Equus burchelli*), Red Hartebeest (*Alcelaphus buselaphus*), Black Wildebeest (*Connochaetes gnou*), Giraffe (*Giraffa camelopardalis*), Impala (*Aepyceros melampus*) and Waterbuck (*Kobus ellipsiprymnus*).

The surrounding land use is predominantly conservation or dwellings. There are two proclaimed townships close to the proposed Redcliff Private Reserve: the Gardener Ross Golf & Country Estate some 5km to the east of the site and the Blair Atholl about 5km to the west.

The property borders the Rhenosterspruit Conservancy.

The guideline for development of open space in Greenways is the following:⁷

Ridges

- i. Class 1, 2, 3 and 4 Ridges (hereinafter referred to as “Ridges”) are strategically important Ecological Structuring Elements within the Tshwane Open Space network and must be conserved.
- ii. Ridges are defined as per the Gauteng Department of Agriculture, Conservation and Environment (GDACE) Departmental Policy on Ridges, 2004
- iii. The Gauteng Department of Agriculture, Conservation and Environment (GDACE) Departmental Policy on Ridges, 2004 must be used as a decision making and decision support tool in the evaluation of development applications.
- iv. No development can be supported on ridges if not compliant with the Gauteng Department of Agriculture, Conservation and Environment Departmental Policy on Ridges, 2004. However, the site specific relaxation of the required buffer area can be considered by the CTMM if supported by the outcomes of an EIA.
- v. The exercising of existing rights on private properties that is situated within a defined ridge, must be guided by Site Specific Sensitivity Analysis. However, when amendment of such rights is applied for, it will only be considered in terms of the findings of an Environmental Impact Assessment.
- vi. The CTMM must ensure the formal protection of publicly owned ridge systems through the implementation of all necessary legal processes and procedures.
- vii. Ridges must as far as is possible, be obtained as zoned “Public Open Space” during the development application process. Where not possible, the privately owned ridge’s conservation and management must be facilitated through an Alternative Service Delivery Mechanism or Partnership.
- viii. Conservation lines on privately owned ridges must be determined and established in accordance with the Gauteng Department of Agriculture, Conservation and Environment Departmental Policy on Ridges, 2004.

Protected Area

- i. Protected Areas are strategically important Ecological Structuring Elements within the Tshwane Open Space network and must be conserved.
- ii. CTMM managed conservation areas, designated by GDACE as Protected Areas, need to be formally declared as Protected Areas.
- iii. The management of Protected Areas must aim to maximise ecological functioning and environmental goods and service rendering and must facilitate the improved utilisation and exposure of such Open Space resources.
- iv. The Gauteng Department of Agriculture, Conservation and Environment (GDACE) Departmental Policy on Red Data Plants, 2004 must be used as a decision making and decision support tool in the evaluation of development applications. However, the site specific relaxation of the required buffer area can be considered by the CTMM if supported by the outcomes of an Environmental Impact Assessment.
- v. The Gauteng Department of Agriculture, Conservation and Environment (GDACE) Departmental Policy on Ridges, 2004 must be used as a decision making and decision support tool in the evaluation of development applications. However, the site specific relaxation of the required buffer area can be considered by the CTMM if supported by the outcomes of an Environmental Impact Assessment.
- vi. Alternative Service Delivery Partnerships within Protected Areas will only be considered after and in accordance with the outcomes of an SEA and/or EMF.

⁷ Quoted from PROPOSED TSHWANE OPEN SPACE FRAMEWORK VOLUME 3 IMPLEMENTATION STRATEGIES, 2007.

- vii. Integrated Environmental Management Plans must be drafted for each Protected Area, managed and maintained in line with such plans.
- viii. Proposed green nodes as indicated on the Regional Open Space network, are created at the confluence of green and blue typologies. Development interventions can be considered here if responsive towards high and medium-high site specific Open Space sensitivities identified through an Environmental Impact Assessment process; if the integration of such sensitivities within the Open Space network is facilitated and if the creation of such node is enabled.

A very small portion of the property is a Ridge as defined by C-Plan. The ridges on the property will be conserved and no development will take place on it as it is also environmentally sensitive

The property falls within an area defined as (GREEN NODES) by the Tshwane OSF. The development is to establish a gentleman's estate and has the objective of providing housing in a private nature reserve, thereby conserving the sensitive elements of the property.

3.8 ENVIRONMENTAL SENSITIVITY MAP

Environmental sensitivity is a product of social and biophysical properties of the site. The method used to determine sensitivity is a matrix with weighted indices.

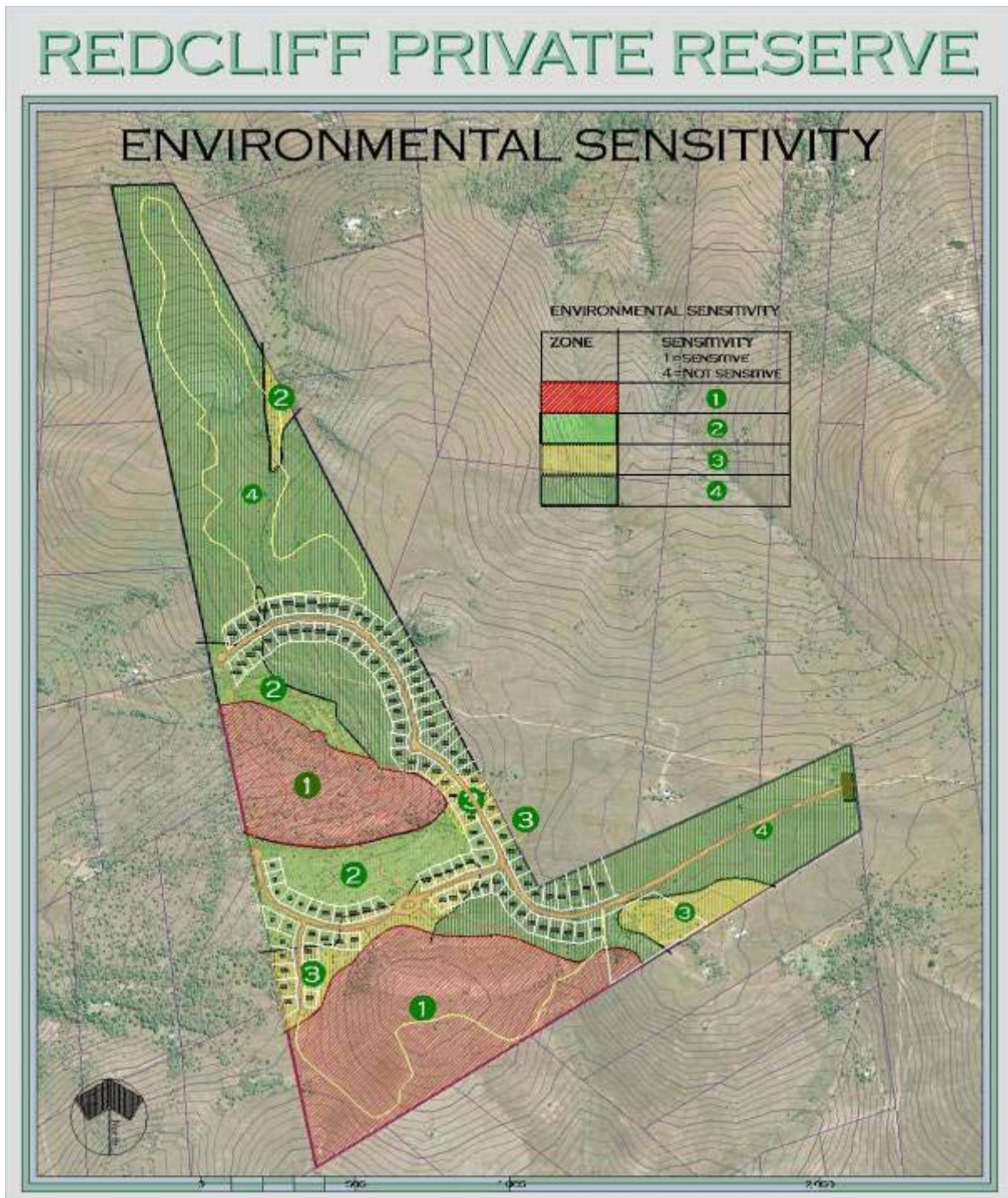
ENVIRONMENTAL ASPECT	DISCUSSION	PRIORITY ⁸
BIOPHYSICAL ASPECTS		
Vegetation / habitat	Moist grassland of valley	5
	Grassland slopes	1
	Rocky crest, grassland with few short trees.	5
Fauna	Seasonal tributary	4
	Grassland on the dolomite outcrops	1
	Wooded areas	3
	Rocky ridges	4
Geology / soil	Hutton with an abundance of boulders / Dolerite & diorite intrusions	2
	Mispah and Hutton/R / Dolomite & quartzite	0
Topography	Drainage line	5
	Slopes / ridges	5
	Areas with surface water flow	1

The weighted indices are indicated in the figure below. The results show the following:

- ❖ The southern portion of the property is sensitive due to vegetation and habitat sensitivity as well as the fact that it is an untransformed ridge. This is confirmed by C-Plan compiled by GDACE.
- ❖ The watercourse and surrounding moist grassland is sensitive due to vegetation and habitat sensitivity. This is also confirmed by C-Plan.
- ❖ The remaining area is not considered as being high sensitive or irreplaceable environments.

⁸ Priority indicates relative sensitivity ranging from 0, which is not sensitive to 5 being very sensitive.

Figure 10: Environmental sensitivity map



The Environmental sensitivity confirms the results of C-Plan 2 published by GDACE. The ridge on the southern portion of the property is indicated as being sensitive due to slope.

	IMPACT	INITIAL PROPOSAL	CURRENT PROPOSAL	"NO GO" OPTION
1.3	Impact on local authorities	The Tshwane Open Space Framework earmarked the area as green node that implies conservation. Town Planning has indicated that they would support the project providing the density is low	The Tshwane Open Space Framework earmarked the area as green node that implies conservation. Town Planning has indicated that they would support the project providing the density is low	he Tshwane Open Space Framework earmarked the area as green node that implies conservation
2	CONSTRUCTION AND OPERATIONAL PHASES			
2.1	LAND			
a	Soil contamination by oil, fuel, etc.	Controlled and /or accidental spills could cause pollution of water resources	Controlled and /or accidental spills could cause pollution of water resources. Sensitive areas are protected	No impact
b	Alteration & compaction of original soil	Modification of original soil conditions due to compaction by construction machinery and vehicles will result in an increase in stormwater runoff	Modification of original soil conditions due to compaction by construction machinery and vehicles will result in an increase in stormwater runoff. Sensitive areas are protected	Sensitive areas are protected
c	Change to landforms	No changes to landforms will take place.	No changes to landforms will take place.	No changes to landforms will take place.
2.2	WATER			
a	Possible ground water contamination	Pollution will occur mainly due to uncontrolled storage of fuel, chemicals and effluent.	Pollution will occur mainly due to uncontrolled storage of fuel, chemicals and effluent. Sensitive areas are protected	No impact
b	Change to stormwater flow	The duration and rate of discharge of stormwater impacts will increase.	The duration and rate of discharge of stormwater impacts will increase. Sensitive areas are protected	No impact
2.3	AIR			
a	Air pollution due to dust, smoke and odours.	Dust will be generated during the entire construction period. Activities such as land clearing and excavations will result in dust emissions, smoke and odours.	Dust will be generated during the entire construction period. Activities such as land clearing and excavations will result in dust emissions, smoke and odours.	No impact

	IMPACT	INITIAL PROPOSAL	CURRENT PROPOSAL	"NO GO" OPTION
b	Noise pollution and vibrations caused by construction machinery and vehicles.	Noise pollution and vibrations will be generated during the entire construction period.	Noise pollution and vibrations will be generated during the entire construction period.	No impact
2.4	BIOLOGICAL SYSTEMS			
a	Destruction of flora & wildlife habitat.	Small portions of sensitive habitat will be destroyed. The remainder of the property will be protected as private nature reserve	Sensitive habitat will be protected as private nature reserve	Sensitive habitat will be protected as private nature reserve
b	Landscape development	A new ecosystem will be created by the introduction of new plants in the gardens of the facility.	A new ecosystem will be created by the introduction of new plants in the gardens of the facility.	No impact
2.5	SOCIO-ECONOMY			
a	Perceptions.	No comments were received from IAP's as a result of advertisements	No comments were received from IAP's as a result of advertisements	No impact
b	Change in the aesthetic quality of environment	In the short term construction work will affect the aesthetic quality of the surrounding area.	In the short term construction work will affect the aesthetic quality of the surrounding area.	No impact
c	Security and safety of public as a result of loitering of job seekers	No impact	No impact	No impact
d	Danger to health and safety of workers and the public moving on site and on surrounding roads.	Construction vehicles will move on the site and dangerous conditions and activities will exist. Activities will have to comply with health and safety regulations.	Construction vehicles will move on the site and dangerous conditions and activities will exist. Activities will have to comply with health and safety regulations.	No impact
2.6	INFRASTRUCTURE			
a	Infrastructure development	Construction of access roads will improve accessibility that will benefit neighbours	Construction of access roads will improve accessibility that will benefit neighbours	No impact

There are both positive and negative impacts associated with all three the alternatives: The initial proposal will have negative environmental impacts as it will destroy sensitive habitat. However it would conserve the remaining area as open space. The current proposal will conserve habitat as open space

and sensitive habitat will be protected. Both these alternatives will have a positive impact in that it will improve the regional road network. The status quo will have no negative impacts except for the loss of the opportunity to upgrade the regional infrastructure.

5. ENVIRONMENT IMPACT ASSESSMENT & MANAGEMENT PLAN

The Environment Impact Assessment is for the preferred alternative only, i.e. establishment of a Gentleman's Estate and lodge with a restaurant.

5.1 ASSESSMENT METHOD

5.1.1 Identification of Impacts

An essential objective in determining the environmental implications of development proposals is the identification of potential positive and negative impacts. Environmental impacts were identified through a public participation process and specialist studies.

5.1.2 Assigning Significance

The following criteria were used to determine the significance of impacts:

Extent: Whether the impact will occur on the site, in a limited area (within 1 km of the site); locally (within 5 km of the site); regionally (within the region); nationally or internationally.

Duration: Whether the impact will be temporary (<1 year); short term (1 to 5 years); medium term (5 to 10 years); long term (longer than 10 years); or permanent.

Magnitude: The quantifiable effects of impacts, measured where possible against the appropriate standard for each respective environmental component. This includes existing standards, guidelines or expert judgement.

Evaluation: Using a combination of these criteria, impacts have been assigned a rating of high, medium, low, very low or no impact.

Significance ratings were defined using the following guidelines:

High: impacts will be of a high significance if **any one** of the following applies:

- ❖ the extent is national to international;
- ❖ the duration is long term to permanent;
- ❖ the magnitude will clearly be above accepted standards/guidelines.

Moderate: impacts will be of a moderate significance if **any one** of the following applies:

- ❖ the extent is local to regional;
- ❖ the duration is medium- to long term;
- ❖ the magnitude could be above accepted standards/guidelines.

Low: impacts will be of a low significance if the following apply:

- ❖ the extent is local;
- ❖ the duration is temporary to permanent;
- ❖ the magnitude could be above accepted standards/guidelines.

Very Low: impacts will be of a very low significance if the following apply:

- ❖ the extent is site-specific;
- ❖ the duration is temporary to permanent;
- ❖ the magnitude will be within accepted standards/guidelines.

No impact: a potential concern or impact, which, upon evaluation, is found to have no impact.

5.2 IMPACT MITIGATION TABLES

The impacts identified up to this stage are reflected in the following table.

Table 2: Impact identification and assessment & environmental management plan

	Impact	Description	Extent:	Duration:	Evaluation	Action / Mitigation
PLANNING PHASE						
1	Permissions	Acquire permissions from various authorities to commence with project:	Regional	Permanent	High	ACTION Legal requirements: land transfer, title deeds, conditions, ownership structure, etc; GDACE: Obtain Authorisation to commence with project; Town Planning Scheme: rezoning, rights, etc; Enter into services agreement with Local Authority; MITIGATION No mitigation required.
2	Expectations	Two major golf / housing estates are being developed in the area. The surrounding area is a conservancy with the objective of protecting natural resources.	Regional	Permanent	Low	ACTION Adjacent property owners must be informed of the development. MITIGATION No mitigation required.
3	Impact on local authorities	Local authorities must approve the development	Regional	Permanent	Moderate	ACTION Obtain planning permission and make provision for bulk services and road infrastructure. MITIGATION No mitigation required.
4	IAP's attitudes and concerns	IAP's must be informed of the project and allowed to raise concerns.	Local	Permanent	Low	ACTION IAP's were informed of the project. IAP's did not raise any concerns during the advertisement period. MITIGATION No further mitigation required
5	Regional connectivity	Assess connectivity with surrounding road networks.	Local	Permanent	Low	ACTION IAP's must be informed of the project. MITIGATION No further mitigation required

	Impact	Description	Extent:	Duration:	Evaluation	Action / Mitigation
CONSTRUCTION PHASE						
IMPACT ON LAND						
6	Soil contamination by oil, fuel etc.	Controlled and accidental spills could cause pollution and pose a health risk to communities. This impact is likely to occur on roads, the construction site and storage areas.	Local	Temporary	Low	ACTION The Developer must include mitigation measures in the Conditions of Contract of Contractors. MITIGATION Provide and protect the storage area by providing impervious surfaces and bunded areas; Educate labourers on the use of chemicals and pollutants; Provide dedicated impervious areas where pollution is likely to occur such as where the mixing of concrete will be done, where servicing of vehicles and equipment takes place, where chemicals and material is stored; Undertake regular inspections of vehicles and service areas.
7	Alteration & compaction of original soil	Modification of original soil conditions due to compaction by construction machinery and vehicles will result in an increase in stormwater runoff and loss of soil fertility and soil cover. This impact is likely to occur on roads, construction- and storage areas.	Local	Temporary	Moderate	ACTION The Developer must include mitigation measures in the Conditions of Contract of Contractors. MITIGATION Topsoil must be removed from the works area prior to construction and stored for later re-use during rehabilitation; Rehabilitation of the works areas must include ripping, fertilising and planting as soon as such areas are vacated.
8	Change to landforms	Change to landforms impacts on stormwater flow, erosion and aesthetics.	Local	Temporary	Low	ACTION The Developer must include mitigation measures in the Conditions of Contract of Contractors. MITIGATION A Stormwater management plan must be implemented.
IMPACT ON WATER						
9	Possible ground water contamination	Pollution will occur mainly due to uncontrolled storage of fuel, chemicals and effluent. This impact is likely to influence roads and construction areas.	Local	Temporary	Low	ACTION The Developer must include mitigation measures in the Conditions of Contract of Contractors. MITIGATION All areas where pollution may occur such as the materials storage areas must have an impervious surface and must be protected from flooding so as to prevent clean water from mixing with polluted water;

	Impact	Description	Extent:	Duration:	Evaluation	Action / Mitigation
10	Change to stormwater flow	The duration and rate of discharge of stormwater impacts on the ecology of the watercourse	Local	Permanent	High	ACTION Protect the stream channel and provide retention structures for the reduction of stormwater discharge. MITIGATION A Stormwater management plan must be implemented.
IMPACT ON AIR						
11	Air pollution due to dust, smoke and odours.	Dust will be generated during the entire construction period. Activities such as land clearing and excavations will result in dust emissions, smoke and odours. This impact is likely to influence roads and construction areas.	Local	Temporary	Low	ACTION The Developer must include mitigation measures in the Conditions of Contract of Contractors. MITIGATION There are no people that live in the area and therefore air pollution will not impact on IAP's. Dust may impact on animals. The minimum requirement is regular watering of exposed surfaces during dry spells when dust may be a problem.
12	Noise pollution and vibrations caused by construction machinery and vehicles.	Noise pollution and vibrations will be generated during the entire construction period. This impact is likely to influence roads and construction areas.	Local	Temporary	Low	ACTION The Developer must include mitigation measures in the Conditions of Contract of Contractors. MITIGATION Contractor must adhere to engine maintenance schedules Working hours must be planned to avoid the more sensitive evening and weekend periods; Regular liaison must take place with the neighbouring property owners to ensure that complaints regarding noise during the construction period are addressed and action taken.

	Impact	Description	Extent:	Duration:	Evaluation	Action / Mitigation
IMPACT ON BIOLOGICAL SYSTEMS						
13	Destruction of flora & wildlife habitat.	Sensitive habitats occur on the property which must be protected.	Local	Temporary	Moderate	ACTION The Developer must include ensure that contractors do not destroy sensitive habitats. MITIGATION Unless specifically approved by the relevant authority and included in the contract, the Contractor shall not remove, damage, disturb or pick flowers and plants; The Contractor shall take measures to protect all flora and fauna within the contractors camp and working areas, unless he has been specifically instructed them to be removed; The Contractor shall comply with all ordinances, Acts, by-laws and regulations pertaining to the protection of fauna and flora; Alien vegetation should be removed manually or mechanically, preferably before seed forming. Workers must be prevented from entering the sensitive zones such as the watercourse and adjacent areas and the quartzite ridge.
14	Landscape development	A new ecosystem will be created by the introduction of new plants in the gardens of the complex.	Local	Permanent	Moderate	ACTION The Developer must include mitigation measures in the Conditions of Contract of Contractors. MITIGATION Large trees must be retained wherever possible. Alien invasive plants must be removed manually or mechanically, preferably before seed forming; Herbicides, pesticides and other poisonous substances may only be used on site compliant to health legislation and only once the Landscape Architect or another competent person has approved it; Site landscaping must be sympathetic to the environment; Only non-invasive and indigenous plants should be used.

	Impact	Description	Extent:	Duration:	Evaluation	Action / Mitigation
IMPACT ON SOCIO-ECONOMIC ENVIRONMENT						
15	Perceptions.	Unhappiness is often based upon bad communication and a lack of information.	Local	Temporary	Low	ACTION The Developer must keep IAP's informed of the development. MITIGATION Set up a complaint office where problems can be reported. Monitor compliance with the Scoping Report.
16	Change in the aesthetic quality of environment	The construction work will not affect the aesthetic quality of the surrounding area.	Local	Temporary	Low	ACTION Address aesthetic issues in the design of infrastructure. MITIGATION No mitigation is required.
17	Security and safety of public as a result of loitering of job seekers	Temporary workers will be employed during construction. This may result in loitering.	Regional	Temporary	Moderate	ACTION Bus in workers. MITIGATION Clear signs must be displayed on site explaining that there are no vacant jobs so as to prevent prospective job seekers to loiter and congregate at the site during the construction period; Regular monitoring of the surrounding properties should take place to ensure that no squatting takes place. Occurrences should be reported to the Police for immediate action.
18	Danger to health and safety of people moving on site and on surrounding roads.	Construction vehicles will move on the site and dangerous conditions and activities will exist.	Local	Temporary	Low	ACTION The Developer must include mitigation measures in the Conditions of Contract of Contractors. MITIGATION Provide fencing and security gate to control access to work areas; Educate workers regarding the risks involved in entering the works areas; Erect suitable signage to warn public and personnel of dangers; Prevent access by the general public to the working areas; Establishing and ongoing health and safety education programme;

	Impact	Description	Extent:	Duration:	Evaluation	Action / Mitigation
INFRASTRUCTURE						
19	Increased traffic and potential for accidents	Hazardous driving conditions will develop where construction vehicles interfere with local traffic on existing roads.	Local	Temporary	Low	ACTION The Developer must include mitigation measures in the Conditions of Contract of Contractors. MITIGATION Upgrade the access road in accordance with the Traffic Impact Assessment. Educate drivers of construction vehicles.
OPERATIONAL PHASE						
20	Disruption of local traffic due to extra vehicles of residents	The development will result in additional traffic of existing roads.	Local	Permanent	Low	ACTION The number of additional vehicles that will use surrounding roads because of the development will increase. MITIGATION Adhere to the recommendations of the traffic impact study
21	Materials handling, use and storage		Local	Permanent	Local	ACTION The Property Owners Association (POA), representing all the owners must draw up an agreement that will provide for the management of the common property and to regulate activities. MITIGATION Each owner is responsible for ensuring that materials are handled, stored and used on site in accordance to procedures imposed by the EMP. Transport contractors must be informed of the procedures prior to materials being offloaded on site.
22	Waste management		Local	Permanent	Local	ACTION The Property Owners Association (POA), representing all the owners must enter into an agreement with a contractor to remove household refuse and to maintain the sewerage system. MITIGATION Monitor compliance.

	Impact	Description	Extent:	Duration:	Evaluation	Action / Mitigation
23	Landscaping					ACTION The Property Owners Association (POA), representing all the owners must draw up an agreement that will provide for the management of the common property and to regulate activities. MITIGATION Unless specifically approved, the owners and their guests shall not remove, damage, disturb or pick flowers and plants. They must further ensure that their contractors take measures to protect all flora and fauna within the property; Alien invasive plants should be removed manually or mechanically, preferably before seed forming; Herbicides, pesticides and other poisonous substances may only be used on site compliant to health legislation; Site landscaping must be sympathetic to the environment. Only non-invasive and indigenous plants should be used.

5.3 CONCLUSIONS

The impact evaluation established that, providing that the design criteria are followed and mitigation measures implemented, the following would be applicable:

5.3.1 Physical Impact

The impact on the physical environment relates to soil, geology and water. The most serious is contamination of water resources through accidental spills. Remedial measures and controls must form part of the conditions of contract of contractors.

Table 3 Summary of physical impacts

Category	Description or definition
Impact prediction	Minimal impact
Significance	Low: Will not have an influence on the decision, and can be mitigated as part of the normal construction procedures.
Duration	Short term: During construction.

5.3.2 Biological Impact

The biological impact of the proposed project is not seen as critical:

Table 4 Summary of biological impacts

Category	Description or definition
Impact prediction	The impact is mainly the removal of grass and scrub for the construction of buildings and the installation of services.
Significance	Low: Will not have an influence on the decision.
Duration	Short term: During construction.

5.3.3 Aesthetic impact

The aesthetic quality of the environment is determined by the extent of foreign structures occurring in the landscape. It has to do with the number of people that will look at that structure and from which vantage point. The impact can be described as:

Table 5 Summary of aesthetical impacts

Category	Description or definition
Impact prediction	No impact
Significance	No impact and should not have an influence on the decision.
Duration	Permanent: No impact.

5.3.4 Social impact

The consequences of the project on the surrounding communities relates to disruption to communities. As the construction period is relatively short, the social impact is minimal.

Table 3 Summary of social impacts

Category	Description or definition
Impact prediction	Positive impact
Significance	Low: Should not have an influence on the decision
Duration	Permanent: Improvement and maintenance of access roads.

ANNEXURES

ANNEXURE A: MAPS & DRAWINGS

ANNEXURE B: PUBLIC PARTICIPATION PROCESS

ANNEXURE C: NEWSPAPER ADVERTISEMENTS

ANNEXURE D: ON-SITE ADVERTISEMENT

ANNEXURE E: AGRICULTURAL POTENTIAL

ANNEXURE F: FAUNA SPECIES ASSESSMENT

ANNEXURE G: FLORA SPECIES ASSESSMENT

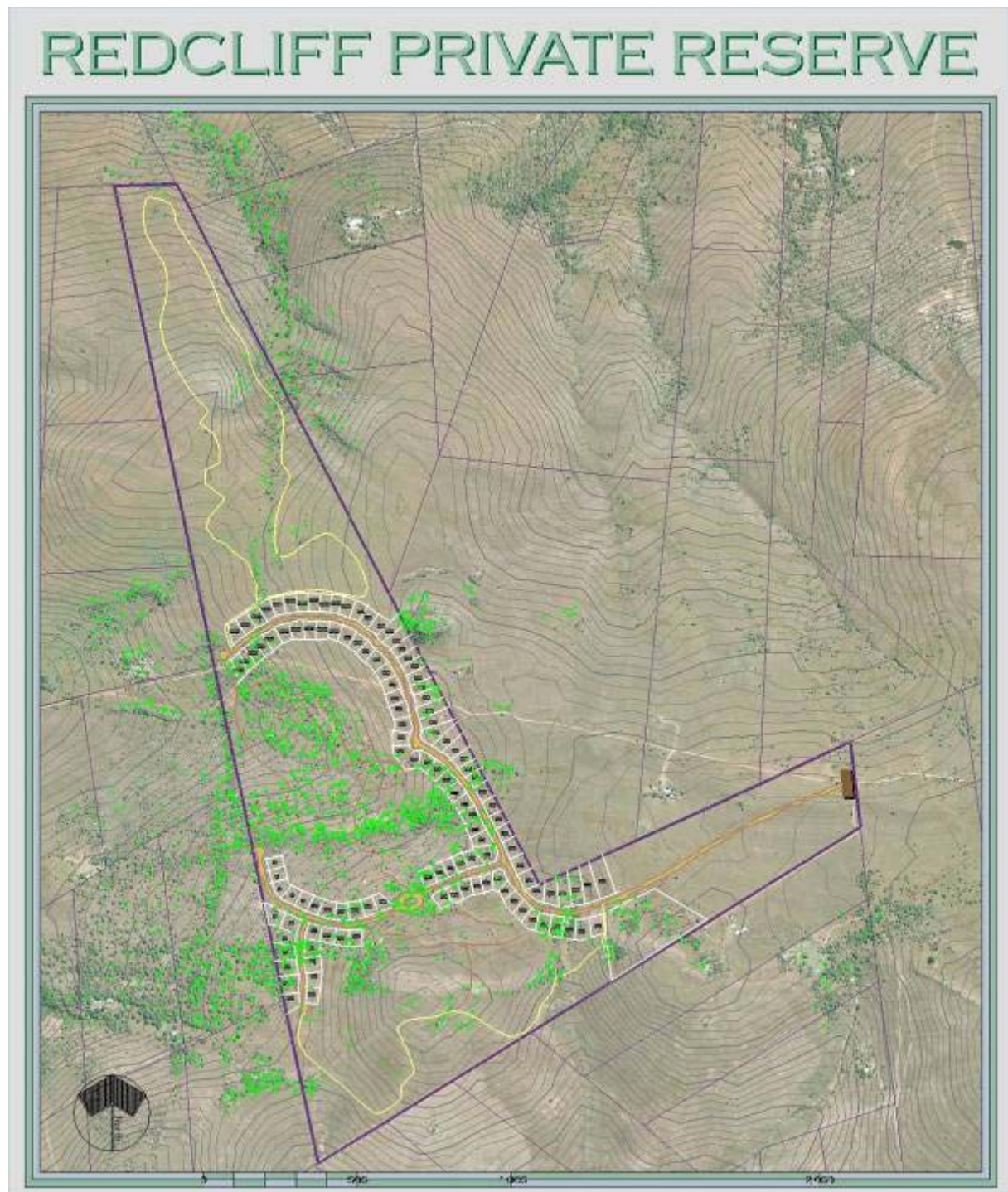
ANNEXURE H: SERVICES REPORT

ANNEXURE I: TRAFFIC IMPACT ASSESSMENT

ANNEXURE J: ENVIRONMENTAL MANAGEMENT PLAN

ANNEXURE K: GEOTECHNICAL INVESTIGATION

ANNEXURE A: MAPS & DRAWINGS



ANNEXURE B: PUBLIC PARTICIPATION PROCESS

1. PUBLIC PARTICIPATION PROCESS

The public participation process conducted for this Environmental Scoping included a press advertisement, on-site notices and contact with interested and affected parties (IAP's). Although the project was registered with GDACE in October 2005, a reference number assigned (GAUT 002/04-05/2119), a plan of study submitted to GDACE closely followed, the scoping report was not submitted to GDACE. The requirement of the DFA is that a Scoping report has to be completed. The DFA considers GDACE as IAP and is allowed to give comment and to be present at the DFA hearing. Consultation with neighbours and additional IAP consultation would also take place as part of the DFA application and the consultation required in terms of the DFA process.

Objectives

The public participation process had the following objectives:

- ❖ To inform IAP's of the proposed development;
- ❖ To provide an opportunity for IAP's to raise issues, concerns and suggestions;
- ❖ To promote transparency and an understanding of the project and its consequences;
- ❖ To serve as a structure for liaison and communication with IAP's; and
- ❖ To serve as data gathering mechanism for the Environmental Scoping Study.

The public participation process aims to promote a project process, which is both technically and financially feasible, as well as socially acceptable and desirable. It does not serve as a vehicle to quell opposition or to foster consensus among role-players.

2. METHOD / PROCESS FOLLOWED

An ongoing public participation process is usually proposed for developments of this nature, to establish a mechanism through which IAP's' inputs can be assimilated on an ongoing basis. For the purpose of this public participation process, the following activities were undertaken:

Identification and Registration of key Interested and Affected Parties (IAP's)

Various groupings of key Interested and Affected Parties (IAP's) were identified by means of a site visit and a networking approach. IAP's included, amongst others, representatives from various government departments (provincial and local), residents associations and private landowners. The IAP'S register is updated throughout the process.

3. BACKGROUND INFORMATION DOCUMENT (BID)

A Background Information Document (BID), including a registration sheet, was formulated and distributed to the IAP's on the database. The aim of the BID was to provide the IAP's with a brief overview of the proposed project and process to be followed and contained relevant information, such as the name of the proponent and the environmental consultant, a project description and an explanation of the EIA process. IAP's were invited to become part of the process and to list any concerns, issues and comments by returning the registration and comment sheet. The IAP's were also asked to list additional persons or organisations they thought should form part of the process.

4. PRESS ADVERTISEMENTS

In addition to the distribution of the BID and in accordance with the EIA regulations, the project was advertised in The Citizen and Die Beeld, both on 11 November 2005. The aim was to create an awareness of the project and to invite a broader range of IAP's to register.

5. SITE ADVERTISEMENT

On-site notices were placed on the fence of the property for a three-week period from the 11 November 2005.

6. ISSUES, COMMENTS AND CONCERNS RAISED

Following are the issues, comments and concerns raised by various IAP's through consultation and correspondence. Where possible concerns are addressed in the table, or alternatively reference is made to the relevant section in the Environmental Scoping report. Only one response was received from IAP's from the advertisements and on-site advertisements. IAP's would be allowed a further opportunity to comment on the proposal through the public participation process prescribed by the DFA.

Table 4: IAP's Comments

ISSUE RAISED BY	Contact person	Comment
City of Tshwane. Department of Housing, City Planning & Environmental Management	Ms Madelein Oosthuizen	Requires a corridor to allow for migration of plant and animal species. The application must comply with the Tshwane Open Space Framework. No development may take place on slopes steeper than 1:4 and ecologically sensitive areas have to be conserved.

7. SOCIAL RELATED CONCLUSIONS AND RECOMMENDATIONS

After liaison with interested and affected parties and specialist reporting on the biophysical conditions of the site and by the engineers looking at the services and road infrastructure, the following conclusions and recommendations can be made:

- The major concern identified, was the impact of traffic on local roads. The developer must upgrade roads and accesses to provincial roads.
- There is a need for ongoing information sharing and IAP's would like to be kept up to date regarding the various stages of the proposed development.

Effective communication from the start of the project could ensure that the landowners and businesses from the surrounding areas are well informed, which could in turn eliminate fears that are usually based on rumours and misinformation.

ANNEXURE C: NEWSPAPER ADVERTISEMENTS

Figure 11 Advertisement placed in The Citizen

The Citizen Friday 11 November 2005

LADIES EARN R28 000 PM+
Friendly Pvt house
Randburg, Work own
hours 072 832 5971
—MM003537

LADIES REQUIRED
082 7641 855
—MM003801

LITTLE HOLLAND
Naughty girls for fun
TEL: 312-0566/0208
More ladies req
Trant & accom avail
—MM003644

Free phone sex live
Live Sex PARTY
For men and women
082-2-399-399
FREE FREE FREE - 24H - STD VAS RATES

BARELY LEGAL
Vas Rates Free minutes do not apply
082 234 9069 Teen
082 234 9070 Teen
082 234 9071 Teen
082 234 9072 Teen
carries SEX TO 3414 CHARGED at R20
Persons SEX to 3723 charged at R250

MATURED INDIAN BUSTY
Full house, live street

PHONE SEX...24HRS
039 314 9269
086 111 4325
—MM003394

PRIMROSE NEW 21YR
Busty Blonde
072 451 9013
—MM003747

REAL BABES
24 HOURS LIVE
082 234 5353
083 919 4646
No Add Fees
VAS Rates.
No free mins

RUSSIAN PRINCESS
Exquisitely beautiful
brunette 315-4091
—MM003641

Sex Chat / Hot Line
083-9000-1111
083-9000-0099
Free minutes do not apply
Adults only - VAS rates apply

****SABRINA****
Sexy seductive &
petite
New in business
678 4908

INTIMATE MASSAGE
In sheer stockings
sensual discreet &
Very upmarket
Fourways
(011) 467-2312
www.lothlorian.co.za
—MM003633

MALE TO MALE
Naughty but Nice!
B/D, Toys, In/Out
Marc 011 887 2277

NAKED MASSAGE
084 405 3634 Springs
—MM003627

OZONE SPA + MAS.
082 267 7891
—AN004678

PETITE COLOURED
Judy Pvt
011 887-2285 Tvl

PHYSICAL MASSAGE CENTRE
Making u full of energy!
072 782 3288, Bruma
—AN004408

PROFESSIONAL MASSAGE
M2M also Joggers
massage
083 701 8843 E/rand
—MM003774

0852 Official Notices/

Ptn 6 Farm Roodekrans, Gauteng NOTICE
ENVIRONMENTAL IMPACT ASSESSMENT PROCESS, PROPOSED ESTABLISHMENT OF A WILDLIFE ESTATE ON PORTION 6 OF THE FARM ROODEKRANS 492-JQ, TSHWANE METHOPOLITAN MUNICIPALITY, GAUTENG. Notice is given in terms of the Environmental Impact Assessment Regulations: Regulations No. 1182 and No. 1183 of the Environmental Conservation Act (Act No. 73 of 1989, Sections 21, 22 & 26) of the intention to establish the Roodekrans Wildlife Estate on Portion 6 of the farm Roodekrans 492-JQ, in Gauteng.

Name of proponent: Seven Seasons Trading 118 (Pty) Ltd.'s Environmental consultant INDEX (Pty) Ltd. Locality: Portion 6 of the farm Roodekrans, Gauteng. To ensure that you are identified as an interested and/or affected party, please submit your name, contact information and interest in the project to the contact person given below. Ingrid Snyman or Eugene Gouws at INDEX, P O Box 26275, Monument Park, 0105, Tel: (012) 346-5307, Fax: (011) 460-4045, E-mail: index@iafrica.co.za. —ZW013737

0884

ANNEXURE D: ON-SITE ADVERTISEMENT

Figure 13 On site advertisement placed on 10 November 2005

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS PROPOSED ESTABLISHMENT OF A WILDLIFE ESTATE ON PORTION 6 OF THE FARM ROODEKRANS 492-JQ, TSHWANE METROPOLITAN MUNICIPALITY, GAUTENG Notice is given in terms of the Environmental Impact Assessment Regulations: Regulations No. 1182 and No. 1183 of the Environment Conservation Act (Act No. 73 of 1989, Sections 21, 22 & 26) of the intention to establish the Roodekrans Wildlife Estate on Portion 6 of the farm Roodekrans 492-JQ, in Gauteng. Name of proponent: Seven Seasons Trading 118 (Pty) Ltd.'s Environmental consultant: INDEX (Pty) Ltd. Locality: Portion 6 of the farm Roodekrans, Gauteng To ensure that you are identified as an interested and/or affected party, please submit your name, contact information and interest in the project to the contact person given below. _____ Ingrid Snyman or Eugene Gouws at INDEX P O Box 26275 Monument Park 0105 Tel: (012) 346-5307 Fax: (011) 460-4045 E-mail: index@iafrica.co.za

ANNEXURE E: AGRICULTURAL POTENTIAL

SPECIALIST STUDY: **AGRICULTURAL POTENTIAL**

- REDCLIFF PRIVATE RESERVE-

Compiled by: Index

Tel (012) 346 5307

index@iafrica.com



NOVEMBER 2006

<u>1.</u>	<u>INTRODUCTION</u>	<u>3</u>
<u>2.</u>	<u>PRESENT & PROPOSED LAND USE</u>	<u>3</u>
<u>3.</u>	<u>NATURAL ENVIRONMENT</u>	<u>4</u>
<u>3.1</u>	<u>CLIMATE</u>	<u>4</u>
<u>3.2</u>	<u>SOIL</u>	<u>4</u>
<u>3.3</u>	<u>SOIL POTENTIAL</u>	<u>5</u>
<u>4.</u>	<u>CONCLUSIONS & FINDINGS</u>	<u>6</u>
<u>5.</u>	<u>SOURCE DATA</u>	<u>6</u>

1. INTRODUCTION

In accordance with the Environmental Impact Assessment Regulations (Regulation 1182 and 1183 of the Environmental Conservation Act) the Department of Agriculture, Conservation and Environment requires an agricultural study as part of the EIA for the proposed development.

Index was requested to qualify the agricultural potential of land that will be impacted upon if the site is developed for Housing / Conservation.

The study will indicate the following:

- ❖ present land use,
- ❖ classification of soils,
- ❖ potential land uses as determined by soil conditions, climate, availability of water and socio-economic conditions

Site information:

- ❖ Size: 223HA
- ❖ Proposed use: Integrated residential and conservation
- ❖ Surrounding land use: Farm land and conservation

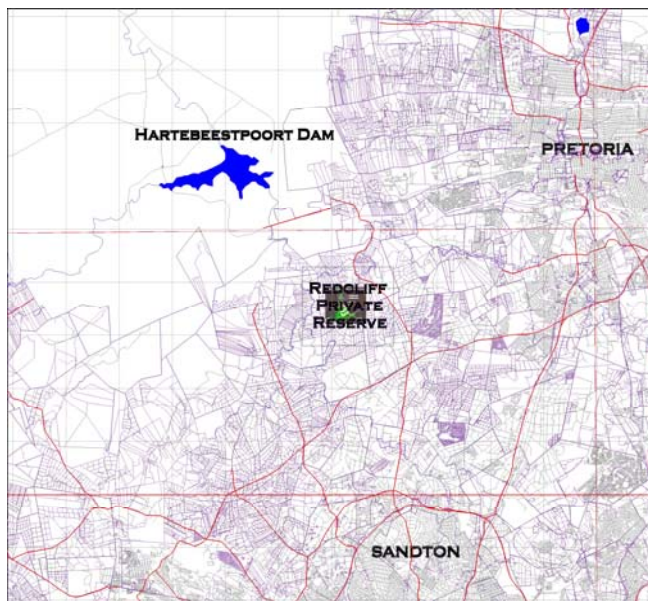


Figure 1. Locality map

2. PRESENT & PROPOSED LAND USE

The land is used for residential purposes and for livestock and game farming. A game ranch with housing is proposed.



3. NATURAL ENVIRONMENT

3.1 CLIMATE

❖ Rainfall

The rainfall is typical of the Highveld's summer rainfall pattern, where more than 80% falls from October through to April (refer to Figure 2). An average of 714 mm per year occurs of which 464mm is estimated as being available for crops. This is also the figure that was used in calculating the water requirement for irrigated crop production.

Irrigation of crops is required to obtain consistent high yields. Although rainfed crop production is practised, crop failure does sometimes occur. This is due to the highly variable distribution of both the monthly and annual rainfall.

❖ Temperature

The project area is located in the Schurweberg and consequently, experience relatively low wind-speeds compared with the surrounding areas.

❖ Evaporation

The evaporation for the area is taken as similar to that experienced in Pretoria where a total of 2 413 mm evaporates from an American Class A pan. The maximum evaporation occurs in October. This is the main planting period for summer crops but is also when the rainy season commences.

The demand for irrigation water is highest in October when more than 230mm for the month are required.

❖ Wind

Wind with moderately high speeds occurs from late winter to early summer (from September to November). Violent thunderstorms and rain occurs during this period.

Wind damage to field crops is not expected but damage to deciduous fruit is common, especially during October and November.

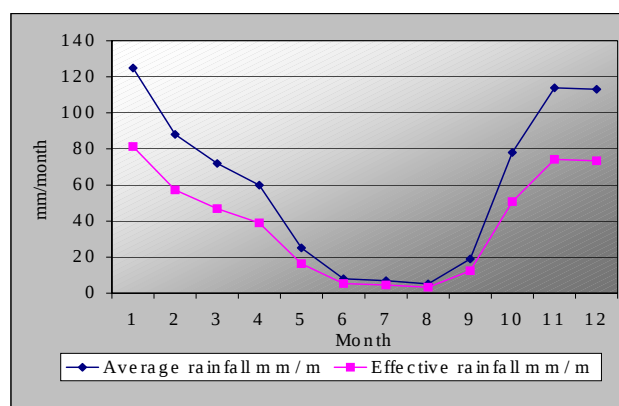


Figure 2. Monthly average rainfall at Schurweberg

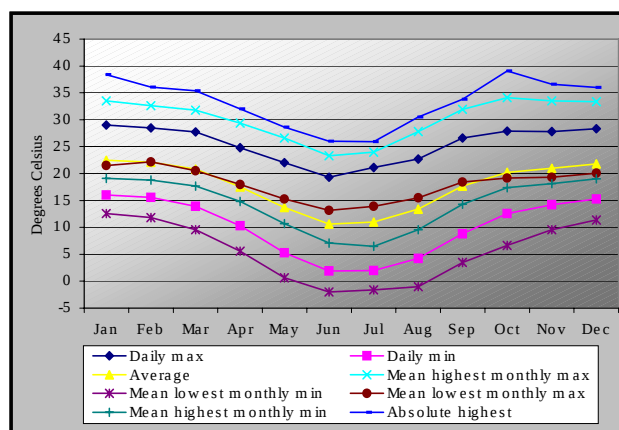


Figure 3. Temperature statistics for Schurweberg

3.2 SOIL

3.2.1 Soil description

The revised soil classification system; A Taxonomic System for South Africa was used for basic classification and land-use recommendations.

Most of the land on the property consists of shallow and rocky soil that occurs on dolomite and chert. Small, narrow bands of intrusive material yielded deeper red soil, but the abundance of rock and boulders renders it not suitable for cultivation.

The dominant soil forms that occur are as follows:

Table 1. Description of soil

Description		Depth (mm)
Red orthic topsoil overlying red apedal subsoil or partially weathered syenite. The soil profile is deeper than 600mm with an abundance of loose rock and boulders. The clay content is 18% to 25%. The soil is not arable because of the rock. Dominant soil forms are Shallow Hutton with rock and Glenrosa		300-800
Shallow grey / brown topsoil overlying dolomite. The clay content varies from 18% to more than 35%. The soil is not arable because it is too shallow with rocky. It is suitable for grazing land only. Dominant soil forms are Mispah, Glenrosa and shallow Hutton		<200

3.3 SOIL POTENTIAL

The National Department of Agriculture has identified the following soil forms and criteria for high potential agricultural land within Gauteng:

Agricultural land is considered to be of high potential if it may be cultivated in terms of Part 1 of the regulations of Conservation of Agricultural Resources Act 43 of 1983, and is-

- ❖ under permanent irrigation, or
- ❖ can be classified into one of the soil forms listed in Table 2, and
- ❖ the effective soil depth is equal to or greater than the minimum as stated in Table 2, and
- ❖ the average topsoil clay content falls within the limits as stated in Table 2.

Table 2 Soil classification of high potential agricultural for Centurion and Broederstroom topcadastral sheets

List of 1:50 000 sheets	Qualifying soil forms	Minimum effective soil depth	Topsoil clay content
2528CC Centurion	Avalon, Bainsvlei Bloemdal, Clovelly Glencoe, Hutton Oakleaf, Pinedene Shortlands, Tukulu	800 mm	10 – 35%
2527DD Broederstroom			

According to these criteria no portion of the property can be considered as high potential; firstly because it is shallower than 800mm and secondly, because it has rock that renders it useless for cultivation. The grazing capacity is also low for the same reason.

4. CONCLUSIONS & FINDINGS

The property consists mainly of shallow mountainous land that has limited potential for crop production. It has no arable land and due to the low carrying capacity for grazing, can only be considered as low potential farming land for livestock production; it is more suitable for game ranching

5. SOURCE DATA

The following data sources were consulted in the evaluation of the agricultural potential:

- i) Crafford, D J, Nott, R W, (1981). Yield formulas for summer crops of the Highveld Region. Technical Communication 169. Department of Agriculture.
- ii) Gauteng Agricultural Potential Atlas (GAPA). DACE.
- iii) Groundwater database of the Department of Water Affairs.
- iv) Weather Bureau, Department of Transport.
- v) Grazing capacity estimations. Department of Agriculture.
- vi) Internal report: Guidelines for the evaluation of land use potential. Index, 1998.
- vii) Survey of the soil and veld conditions. Index, 2005.
- viii) Field survey for soil and land conditions.

ANNEXURE F: FAUNA SPECIES STUDY.

PROPOSED (ROODEKRANS) REDCLIFF CONSERVANCY DEVELOPMENT

INITIAL FAUNAL SURVEY: HABITAT ASSESSMENT WITH SPECIAL REFERENCE TO AVAILABILITY OF SENSITIVE HABITATS



Compiled for INDEX Environmental by:

Mr C.L.COOK (MSc. Zool.)

Zoological Consultant: Specialist Herpetological Consultant

Cell No. 082 688 9585

Fax No. 015 268 2303

bullfrog@highveldmail.co.za

SUBMITTED: 26th NOVEMBER 2005

1. INTRODUCTION

The survey is based on initial site visits conducted on the 10-11th November 2005. The initial faunal survey focused on the describing of the available and sensitive habitats on the site with special reference to the current status of threatened species occurring, or likely to utilize the areas within the proposed site situated on the Roodekrans Game Reserve/conservancy. The site is approximately 223ha in extent. The proposed Redcliff Eco-Estate project involves the subdivision of the northern section of the site into approximately 120 residential stands. No development is proposed for the southern section of the site and it will be maintained as a conservation area. The site is situated in the Rhenosterspruit conservancy and neighbouring the Birdsong Conservancy. Properties to the south are presently utilised for agricultural activities. Several larger mammal species have been introduced onto the property.

1.1 Objectives of the initial faunal survey / habitat assessment

- To provide a description of threatened mammals, birds, reptiles and amphibians occurring on and in close proximity of the proposed development area (northern slopes).
- To describe the available habitats on site including areas of important conservation value or areas most likely to form important habitat for remaining threatened species.

1.2 Scope of study

- An initial faunal survey with special emphasis on the current status of threatened animal species (Red Data Species), within the proposed site and adjacent areas.
- An assessment of the ecological habitats, evaluating conservation importance and significance with special emphasis on the current status of threatened animal species (Red Data Species), within the proposed site and adjacent areas.
- Documentation of the findings of the study in a report.

1.3 Constraints and Limitations

- Limitation to a base-line ecological survey for only 2 days (10 hours) during the summer months (November) of the current 2005/2006 wet season.
- The majority of threatened species are seasonal only emerging after sufficient heavy summer rainfall.
- The majority of threatened species are extremely secretive and difficult to observe even during intensive field surveys conducted over several years.
- Limitation of historic data and available databases. Insufficient knowledge on detailed habitat requirements (migratory, foraging and breeding) of the majority of threatened species.
- The presence of threatened species on site is assessed mainly on habitat availability and suitability as well as desk research (literature, personal records and previous surveys conducted on the site and in similar habitats between; 1999-2005).

2. METHODS

This faunal survey focused mainly on mammals, birds, reptiles and amphibians of the study area. The survey focused on the current status of threatened animal species occurring, or likely to occur within the study area, describing the available and sensitive habitats, identifying potential impacts resulting from the development and providing mitigation measures for the identified impacts.

Faunal data was obtained during a 2day field survey of the proposed development site carried out on foot on the 10th and 11th November 2005. All animals (mammals (larger), birds, reptiles and amphibians) seen or heard; were recorded. Use was also made of indirect evidence such as nests, feathers and animal tracks (footprints, droppings) to identify animals. The data was supplemented by previous surveys conducted in the area, literature investigations, personal records and historic data. Different habitats were explored to identify any sensitive or specialised species. Mammal names are as used by Skinner and Smithers (1990), bird names by Maclean (1992);

reptile names by Branch (1998); amphibian names by Passmore and Carruthers (1995)

3. DESCRIPTION OF PREVAILING ECOLOGICAL ENVIRONMENT AND STUDY AREA

The site is currently utilised as a game reserve or private Roodekrans conservancy and contains existing residential houses (2) as well as a bush camp. As the site is situated in a conservancy the majority of vegetation is natural except for alien vegetation around the existing residential houses (*Eucalyptus sp.*, *Opuntia ficus-indica* and *Agave americana*) as well as around old ruins. Larger mammal species have been re-introduced including Gemsbok (*Oryx gazella*), Eland (*Taurotragus oryx*), Blesbok (*Damaliscus dorcas phillipsi*), Burchell's Zebra (*Equus burchelli*), Red Hartebeest (*Alcelephus buselaphus*), Black Wildebeest (*Connochaetes gnou*), Giraffe (*Giraffa camelopardalis*), Impala (*Aepyceros melampus*) and Waterbuck (*Kobus ellipsiprymnus*). No actual species lists of animals present on the site were determined due to time constraints for faunal survey as well as financial constraints.



Photo1. A view of the proposed residential development area situated on the northern slopes of the site.

GPS Locality of site: 25 ° 52'22"S 27 ° 58'28"E

Existing impacts on the site include:

- The site is fenced which restricts certain larger animal migration paths.
- Creation of an artificial seasonal dam on the seasonal tributary; which bisects the site. The dam is utilised as a drinking point for the larger mammal species.
- Changes in the hydrological flow regime of the seasonal tributary due to artificial embanking with a high earthen wall.
- Old ruins are found scattered inside the site.

- Existing residential houses (2) as well as a bush camp.
- Bank erosion along the seasonal tributary by certain animal paths as well as around the artificial dam.
- Introduction of alien vegetation including *Opuntia ficus-indica*, *Agave americana* and Eucalyptus.
- Bank erosion around artificially created seasonal dam.
- Secondary roads bisects the site as well as off road tracks (4x4).
- Frequent burning of surrounding open areas and grasslands.
- Removal of certain plant species during past agricultural activities (traditional medicinal plants; wood harvesting and collecting).

4. RESULTS OF THE INITIAL FAUNAL SURVEYS

4.1 MAMMALS

Table 1 Mammal species recorded during initial faunal survey and supplemented with previous field surveys conducted in similar habitat (2001-2005) and likely to occur on the site.

COMMON NAME	SCIENTIFIC NAME
Tomb Bat	<i>Taphozous mauritiamus</i>
Transvaal free-tailed Bat	<i>Tadarida ventralis</i>
Egyptian free-tailed Bat	<i>Tadarida aegyptiaca</i>
Cape Serotine Bat	<i>Eptesicus capensis</i>
Schreibers' Long-Fingered Bat	<i>Miniopterus schreibersii</i>
Yellow House Bat	<i>Scotophilus dinganii</i>
Reddish-grey Musk Shrew	<i>Crocidura cyanea</i>
Tiny Musk Shrew	<i>Crocidura fuscomurina</i>
Least Dwarf Shrew	<i>Suncus infinitesimus</i>
South African Hedgehog	<i>Atelerix frontalis</i>
Rock Elephant Shrew	<i>Elephantulus myurus</i>
Scrub Hare	<i>Lepus saxatilis</i>
*House Mouse	<i>Mus musculus</i>
Common Molerat	<i>Cryptomys hottentotus</i>
Woodland Dormouse	<i>Graphiurus murinus</i>
Rock Dormouse	<i>Graphiurus platyops</i>
Single Striped Mouse	<i>Lemniscomys rosalia</i>
Striped Mouse	<i>Rhabdomys pumilio</i>
Pygmy Mouse	<i>Mus minutoides</i>
Pouched Mouse	<i>Saccostomus campestris</i>
Multimammate Mouse	<i>Mastomys coucha</i>
Grey Pygmy Climbing Mouse	<i>Dendromus melanotis</i>
Chestnut Climbing Mouse	<i>Dendrobus mystacalis</i>
Red Veld Rat	<i>Aethomys chrysophilus</i>
*House Rat	<i>Rattus rattus</i>
Bushveld Gerbil	<i>Tatera leucogaster</i>
Highveld Gerbil	<i>Tatera brantsii</i>
Fat Mouse	<i>Steatomys pratensis</i>
Tree Squirrel	<i>Paraxerus cepapi</i>
Striped Polecat	<i>Ictonyx striatus</i>
Small-spotted Genet	<i>Genetta genetta</i>
Large-spotted Genet	<i>Genetta tigrina</i>
Dwarf Mongoose	<i>Helogale parvula</i>
Banded Mongoose	<i>Munogos mungo</i>

Yellow Mongoose	<i>Cynictis penicillata</i>
Slender Mongoose	<i>Galerella sanguinea</i>
White-Tailed Mongoose	<i>Ichneumia albicauda</i>
Lesser Bushbaby	<i>Galago moholi</i>
Black-backed Jackal	<i>Canis mesomelas</i>
Cape Porcupine	<i>Hystrix africaeaustralis</i>
Smith's Red Rock Rabbit	<i>Pronolagus saundersiae</i>
Springhare	<i>Pedetes capensis</i>
Rock Hyrax/Dassie	<i>Procavia capensis</i>
Warthog	<i>Phacochoerus aethiopicus</i>
Cape Fox	<i>Vulpes chama</i>
Caracal	<i>Felis caracal</i>
Common Duiker	<i>Sylvicapra grimmia</i>
Klipspringer	<i>Oreotragus oreotragus</i>
Steenbok	<i>Raphicerus campestris</i>
Kudu	<i>Tragelaphus strepsiceros</i>
Impala	<i>Aepyceros melampus</i>
Grey Rhebok	<i>Pelea capreolus</i>
Mountain Reedbuck	<i>Redunca fulvorufula</i>
Gemsbok	<i>Oryx gazelle</i>
Eland	<i>Taurotragus oryx</i>
Blesbok	<i>Damaliscus dorcas phillipsi</i>
Burchell's Zebra	<i>Equus burchelli</i>
Red Hartebeest	<i>Alcelephus buselaphus</i>
Black Wildebeest	<i>Connochaetes gnou</i> ,
Giraffe	<i>Giraffa camelopardalis</i>
Waterbuck	<i>Kobus ellipsiprymnus</i>
Chacma Baboon	<i>Papio cynocephalus ursinus</i>
Vervet Monkey	<i>Ceropithecus aethiops</i>

Field observations of larger mammal species recorded on the site and surrounding vicinity. The list is compiled from previous small mammal trapping in similar habitat as well as historic data (personal records, literature etc.). Species in bold have been introduced onto the site.

* exotic species

Habitat available for Sensitive or Endangered Species

According to the "South African Red Data Book of Terrestrial Mammals" (Smithers 1986) and Skinner and Smithers (1990), the study area falls within the distribution ranges of 4 species which are placed into one of known threatened species (Endangered, Vulnerable and Rare) as well as 2 species which are presently listed indeterminate or data deficient. As the site is situated in a large private conservancy the majority of mammals should be present. No sensitive or endangered mammals were recorded during the brief survey but suitable habitat occurs on the site and surrounding conservancy areas for certain rare or threatened mammal species. More comprehensive surveys undertaken over extended periods will deliver a more representative species list. Although the site may be utilized by certain rare or endangered mammal species for breeding, foraging and exploratory movements it is highly unlikely that the proposed development area (northern slopes) forms critical habitat for any rare or threatened mammal species on the site.

Table2. Mammal species of conservation importance possibly occurring on the site (using habitat availability as an indicator)

Common Name	Scientific Name	Conservation Status
Welwitsch's hairy bat	<i>Myotis welwitschii</i>	Indeterminate
Striped mouse	<i>Rhabdomys pumilio</i>	Data Deficient
White-Tailed Mouse	<i>Mystromys albicaudatus</i>	Vulnerable
South African Hedgehog	<i>Atelerix frontalis</i>	Rare
Aardwolf	<i>Proteles cristatus</i>	Rare
African Wild Cat	<i>Felis lybica</i>	Vulnerable

4.2 AVIFAUNAL (BIRD) SURVEY

A comprehensive bird species list requires intensive surveys compiled over several years. No actual avifaunal survey was undertaken and the list provided below is of species that have been recorded in the vicinity of the proposed site during the SA Bird Atlas Project. No threatened or rare birds were recorded during the brief survey but suitable habitat exists for several species (see Table3).

Numbers of bird species in the area have declined due extensive grassland habitat degradation and transformation. Human activity has transformed grasslands in South Africa to a point where few pristine examples exist (Low & Rebelo 1996; Barnes 1998). Factors such as agricultural intensification, increased pasture management (overgrazing), decrease in grassland management and land-use alteration (urbanisation). Continuing pressure on grassland habitat are largely responsible for the decline of the following species.

Table3. Red Data List bird species previously recorded from the grid square within which the study area is situated, and that occur or could possibly within or in the vicinity of the study area.

Robert's Nr.	Common Name	Scientific Name	Conservation Status According to the new (1994) IUCN Criteria
122	Cape Vulture	<i>Gyps coprotheres</i>	Vulnerable A1a,c,d; A2b,c,d; C1;C2b
183	Lesser Kestrel	<i>Falco naumanni</i>	Vulnerable A1,a,c,e
393	African Grass Owl	<i>Tyto capensis</i>	Vulnerable A2;C1
233	Whitebellied Korhaan	<i>Eupodotis cafra</i>	Vulnerable A1c;A2c;C1
84	Black Stork	<i>Ciconia nigra</i>	Near-threatenedA2c
89	Maraboustork	<i>Leptoptilos crumeniferous</i>	Near-threatened C1
118	Secretarybird	<i>Phoeniconaias minor</i>	Near-threatened A1c; A2c
138	Ayres' Eagle	<i>Hieraaetus ayresii</i>	Near-threatened A2c
234	Blackbellied Korhaan	<i>Eupodotis melanogaster</i>	Near-threatened A1a; A2c
238	Blue Korhaan	<i>Eupodotis caerulescens</i>	Near-threatened A2c

305	Blackwinged Pranticole	<i>Glareola nordmanni</i>	Near-threatened B2e; 3a,b
-----	------------------------	---------------------------	---------------------------

HABITAT AVAILABLE FOR SENSITIVE OR ENDANGERED SPECIES

Several rare or threatened bird species may utilise the site for foraging and exploratory movements. These include the large raptors such as Secretarybird, Cape Vulture, Ayres' Eagle as well as certain storks (Marabou and Black), smaller raptors (Lesser Kestrel) as well as the Blackwinged Pranticole. Due to its large size and the fact that the site and certain surrounding grasslands are presently maintained as private conservancies (Rhenosterspruit and Birdsong) the possibility exists for the presence of Korhaans (Blue, Whitebellied and Blackbellied Korhaan). Although the site may be utilized by certain rare or endangered bird species for foraging and exploratory movements it is highly unlikely that the proposed development area forms critical habitat for any rare or threatened bird species.

4.3 HERPETOLOGICAL SURVEY: REPTILES and AMPHIBIANS

No actual survey was undertaken due to incorrect time of the year for herpetological survey. Insufficient early summer rainfall resulted in only a few species of frog being active. Lists provided below have been compiled from personal records as well as data from the SAFAP (South African Frog Atlas Project) and can be considered as fairly comprehensive.

Table4. List of frog species recorded during current and previous surveys and of species likely to occur on the site.

Common Name	Species	Breeding Requirements
Common River Frog	<i>Afrana angolensis</i>	Rivers and permanent water
Tremolo Sand Frog	<i>Tomopterna cryptotis</i>	Shallow permanent streams or vleis in grassland
Natal Sand Frog	<i>Tomopterna natalensis</i>	Shallow permanent streams or vleis in grassland
Bubbling Kassina	<i>Kassina senegalensis</i>	Open vleis, pans, dams in grassland
Common Caco	<i>Cacosternum boettgeri</i>	Marsh, vleis, inundated grassland
Guttural Toad	<i>Bufo gutturalis</i>	Open vleis, pans, ponds, dams, slow streams
Olive Toad	<i>Bufo garmani</i>	Open vleis, pans, ponds, dams, slow streams
Common Plattana	<i>Xenopus laevis</i>	Open vleis, pans, ponds, dams, slow streams
Red Toad	<i>Schismaderma carens</i>	Permanent or semi-permanent pools. Breeds in deep water (>30cm)
Giant Bullfrog	<i>Pyxicephalus adspersus</i>	Temporary shallow depressions and pans as well as shallow margins of dams. Also requires undisturbed open grassland for foraging and sandy soils for

		burrowing.
Banded Rubber Frog	<i>Phrynomerus bifasciatus</i>	Seasonal pools or dams.

HABITAT AVAILABLE FOR SENSITIVE OR ENDANGERED SPECIES

Giant Bullfrog (*Pyxicephalus adspersus*)

The Giant Bullfrog is currently assigned as a near-threatened species (IUCN Red List category). No Giant Bullfrogs were observed during the brief survey as insufficient rain had fallen. Giant Bullfrogs have been recorded on the R511 adjacent to the site as well as from several localities to the east of the site. Giant Bullfrogs may occasionally utilise the site for foraging or migratory habitat but tend to avoid rocky and hilly areas. Giant Bullfrogs may utilize the open grassland habitat towards the southern boundary of the site for foraging and exploratory movements. It is highly unlikely that the proposed development area forms critical habitat for remaining Giant Bullfrogs.

REPTILES

Reptile lists require intensive surveys conducted for several years. Reptiles are extremely secretive and difficult to observe during field surveys. The majority reptile species are sensitive to severe habitat alteration and fragmentation. Due to human presence in the area coupled with increased habitat destruction and disturbances to the south and west of the site are all causal factors in the alteration of reptile species occurring on the site and surrounding areas. Large areas of low-lying rock (weathered dolomite) on the hills and ridges, provides favourable refuges for certain snake and lizard species (rupicolous species). The indiscriminate killing of all snake species as well as the illegal collecting of certain species for private and the commercial pet industry reduces reptile populations especially snake populations drastically. The frequent burning of the site will have a high impact on remaining reptiles. Fires during the winter months will severely impact on the hibernating species, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

Table5. List of reptile species recorded during previous surveys as well as current survey.

Common Name	Scientific Name
Leopard Tortoise	<i>Geochelone pardalis</i>
Savannah Hinged Tortoise	<i>Knixys beliana</i>
Cape Skink	<i>Mabuya capensis</i>
Striped Skink	<i>Mabuya striata punctatissima</i>
Wahlberg's Snake-eyed Skink	<i>Panapsis wahlbergii</i>
Variable Skink	<i>Mabuya variata</i>
Cape Rough-scaled Lizard	<i>Ichnotropis capensis</i>
Flap-neck Chamaeleon	<i>Chamaeleo dilepis</i>
Transvaal Thick-toed gecko	<i>Pachydactylus affinis</i>
Cape Thick-toed Gecko	<i>Pachydactylus capensis</i>
Cape Dwarf Gecko	<i>Lygodactylus capensis</i>

Delalande's Sandveld Lizard	<i>Nucras lalandii</i>
Transvaal Grass Lizard	<i>Chamaesaura aenea</i>
Yellow-throated Plated Lizard	<i>Gerrhosaurus flavigularis</i>
Transvaal Girdled Lizard	<i>Cordylus vittifer</i>
Nile Monitor	<i>Varanus niloticus</i>
Rock or White-throated Monitor	<i>Varanus albigularis</i>
Southern Tree Agama	<i>Acanthocerus atricolis</i>
Ground Agama	<i>Agama aculeata aculeata</i>
Herald or red-lipped Snake	<i>Crotaphopeltis hotamboeia</i>
Rinkhals	<i>Haemachatus haemachatus</i>
Mole Snake	<i>Pseudapsis cana</i>
Rhombic Night Adder	<i>Causus rhombeatus</i>
Horned Adder	<i>Bitis caudalis</i>
Puffadder	<i>Bitis arietans</i>
Snouted Cobra	<i>Naja annulifera</i>
Mocambique Spitting Cobra	<i>Naja mossambica</i>
Common Egg Eater	<i>Dasypeltis scabra</i>
Brown water Snake	<i>Lycodonomorphus rufulus</i>
Brown House Snake	<i>Lamprophis fuliginosus</i>
Aurora House Snake	<i>Lamprophis aurora</i>
Cape Wolf Snake	<i>Lycophidion capense</i>
Spotted skaapsteker	<i>Psammophylax rhombeatus</i>
Striped Skaapsteker	<i>Psammophylax tritaeniatus</i>
Black-headed Centipede Eater	<i>Aparallactus capensis</i>
Spotted Bush Snake	<i>Philothamnus semivariegatus</i>
Boomslang	<i>Dispholidus typus</i>
Common Egg Eater	<i>Dasypeltis scabra</i>

HABITAT FOR SENSITIVE OR ENDANGERED SPECIES

No endangered reptile species were recorded during the brief field survey or are likely to occur on the site. African Rock pythons listed in the Red Data Book for reptiles as "vulnerable" have been recorded from the Magaliesberg to the north of the site.

4.4 INSECTS AND ARACHNIDS

No actual insect or invertebrate survey was conducted but incidental observations of observed arachnids and scorpions were documented. Several scorpion burrows were found on the loamy soil areas of the site especially along animal paths. Members of the scorpionid genus *Hadogenes* are adapted to living in narrow cracks and crevices in rocks. They are flattened and have long, slender pedipalps and tail, and cling to rock surfaces with such tenacity that they cannot be dislodged, so that scorpion collectors have to prise open the cracks with crowbars to secure specimens (Skaife 1979). No evidence of illegal reptile and arachnid collecting was observed throughout the site.



Photo2. *Opisthophthalmus glabifrons* scorpion was discovered in loamy soil under a large piece of wood toward the hill on the site.

Threatened species:

Gunning's Rock Scorpions (*Hadogenes gunningi*)

Hadogenes have such narrow habitat requirements that different species may be strictly separated by unsuitable conditions. A good example of this is *Hadogenes gunningi* with populations in the Magaliesberg being quite distinct from an *H.gracilis* population on rocky outcrops just 10 km to the north (Leeming 2003). *Hadogenes* are under great pressure from habitat destruction. Limited distributions and long life cycles and gestation periods make the extremely vulnerable. Lifespan in the wild is estimated at 25 to 30 years (Leeming 2003).

Favourable rocky habitat exists on the neighbouring hill outside the northern boundary (Koppiealleen) for Gunning's Rock Scorpions (*Hadogenes gunningi*). They are found throughout the Magaliesberg range and rocky outcrops in Gauteng. Although it mainly inhabits cracks and rock exfoliations a female specimen was personally discovered under a large slightly embedded rock to the east of the site (Gardener Ross Golf Estate). Due to its limited distribution, which is being encroached by highly urbanised areas, this scorpion is in special need of protection from urbanization, habitat destruction and transformation (Leeming 2003). The conservation of the hill on the site and on the neighbouring property (Koppiealleen) should conserve sufficient suitable habitat for rock scorpions and other rupicolous arachnids and scorpions in the area.

5. SENSITIVE ENVIRONMENTS/HABITATS ON THE SITE

Seasonal tributary with associated riparian zone

Rivers are longitudinal systems with impacts affecting both upstream and downstream habitat. The entire seasonal tributary and its associated riparian vegetation (*Acacia karroo*, *Acacia caffra*) must be considered as a sensitive habitat. No further vegetation removal must occur except for the removal of any invasive plant and tree species. Where invasive removals leave the soil exposed alternative indigenous vegetation should be introduced preventing further seeding and possible erosion and siltation. A suitable buffer zone should be incorporated along the entire seasonal tributary. The formation of any additional dams should be prevented on the seasonal tributary, as this will affect the natural hydrological regime further. Water abstraction from the seasonal tributary/river could potentially result in further habitat modification and degradation and should not be permitted without appropriate approval from authorities (DWAF). It is important that pollutants and contaminants from the proposed residential development due not result in deterioration in water quality.

Rocky Hills and scattered low lying rock outcrops

The entire hilly areas on the site and neighbouring northern property (Koppiealleen) offers important habitat for certain animal species and should be conserved and considered “no-go” or strictly managed areas throughout all stages of the current development and possible future developments. Wherever possible the low-lying weathered dolomite rock outcrops should be conserved. No rock material should be removed from the site or utilised for construction activities. Large scale commercial rock selling (horticultural purposes) could potentially result in major habitat destruction. Removed rocks can be utilised for horticultural activities on the site (formation of rockeries).

Wooded patches

Several clumps of indigenous tree species (Acacias) occur scattered on the site. These areas although low in vegetation diversity offer important habitat for arboreal animals (refuges, shade) and birds (nesting) on the site; and should be conserved and incorporated into the development. No large tree species should be destroyed wherever possible. Trees that have to be removed should either be replanted sufficiently away from the development or left as dead or decaying logs. Scattered logs and wood provide important refuges for several animal species including insects and arachnids, amphibians, reptiles and smaller mammals.

6. IMPACTS ON THE FAUNA OF THE SITE

At a local scale the study site and surrounding grasslands comprises important habitat for several animal species. The fauna associated with the site require the conservation and adequate grassland management throughout the site with adequate buffer zones along the seasonal tributary and rocky hills. An appropriate natural biological corridor connecting to similar habitats around the site on neighbouring properties should conserve the majority of suitable habitat for threatened species likely to occur in the area.

6.1 Destruction of habitat around proposed Redcliff Eco-Estate development

The proposed development will most likely result in a **Medium to High, short, medium and long-term negative impact** on the environment and

remaining faunal species directly affected by the habitat destruction or transformation (northern slopes). The proposed subdivision of properties should ideally be restricted to the northern section. This is due to the fact that several linear infrastructures such as roads, powerlines, sewer and water lines could potentially result in severe habitat destruction as well as habitat fragmentation. Roads are also detrimental for migratory species (road fatalities) as well as potential points of pollution (tyres, oils, petroleum etc) for the surrounding rivers. Increased powerlines could negatively impact on bird species colliding or from possible electrocution. The proposed residential area should ideally be interconnected by a single road, single sewer and water line running parallel to the road and will reduce potential impacts dramatically. Further, direct and indirect impacts include increased access and human presence into the Roodekrans (Redcliff) conservancy and disturbances of sensitive or secretive species associated with the rocky hill on the site and neighbouring properties. Increased human pressure and activities in these sensitive habitats (seasonal tributary and associated riparian vegetation, low lying rock outcrops, ridges and hills) could result in major environmental degradation if environmentally sensitive practices are not followed and maintained throughout all stages of the development.

Mitigation and Recommendations

During the **CONSTRUCTION** phase workers must be limited to areas under construction and access to the undeveloped areas, especially the surrounding hills and open grasslands must be strictly regulated (“no-go” areas during construction activities). During the operational phase it is important that the proposed activities in these areas are strictly managed. Low disturbance activities such as bird watching and hiking are recommended for these areas. Provision of adequate toilet facilities must be implemented to prevent the possible contamination of surface (seasonal tributary) and ground (borehole) water in the area. All temporary stockpile areas, litter and rubble must be removed on completion of construction. Certain exotic plant (*Agave americana*, *Opuntia ficus-indica*) and tree (*Eucalyptus*) species should be removed from the site to prevent further invasion. All exotic vegetation around the existing residential areas should be removed.

No animals should be intentionally killed or destroyed and poaching and hunting should not be permitted on the site. No air rifles or pellet guns should be permitted on the property. The baiting of selected predators (caracal and black-backed jackal) and subsequent capturing and possible destroying of caught animals is strongly condemned by the consultant.

The illegal collection of arachnids and scorpions as well as herpetofauna (reptiles and amphibians) for private and commercial pet industry must be strictly controlled and monitored. Evidence of illegal reptile collecting includes destroyed or damaged termite mounds, lifting and replacing of large rocks, logs or stumps etc.

6.2 Horticultural Activities

Landscape architects, and the developer, have an opportunity to conserve certain faunal biodiversity present on the site and possibly increase the biodiversity of certain animal species (birds). Vegetation has been reported to be the single most important habitat component for all species of animals.

Linked to this, is the preservation, maintenance and creation of tracts of

natural and ornamental vegetation in all stages of ecological succession, interconnected by corridors or green belts for escape, foraging, breeding and exploratory movements. Landscaping projects around residential areas are all too frequently characterized by exotic or indigenous (not to the area) trees, planted at the same time, at the same size and are spaced at regular centred settings. The resulting pattern and structure is one of limited vegetation diversity, trees of uniform size, even age stands and little or no under-story planting. Only a few species of animals (urban exploiters) will occupy these limited niches, leading to decreased faunal biodiversity.

Mitigation and recommendation

Horticultural activities should be severely restricted and only allowed around certain predetermined areas. Remaining indigenous bulbous geophytes should be retained or replanted where possible. Gardens or landscaped areas around the proposed development (limited), should be planted with indigenous (preferably using endemic or local species from the area) plants, shrubs and trees, which are water wise and require minimal horticultural practices. A species list of suitable species should be compiled for future property owners. The planting of exotic grasses (Kikuyu) should be prevented and non-invasive indigenous grasses should be used. No exotic invasive lawn species of grasses should be used around the seasonal tributary of the site or any areas that adjoin natural vegetation. Kikuyu *Pennisetum clandestinum* is expressly prohibited. A Re-vegetation and Rehabilitation Manual should be prepared for the use of contractors, landscape architects and groundsmen. Where herbicides are used to clear vegetation, specimen-specific chemicals should be applied to individual plants only. General spraying should be prohibited. All alien vegetation should be eradicated over a five-year period.

Invasive species (*Opuntia ficus-indica*, *Agave Americana*, *Eucalyptus*) should be given the highest priority.

Where the removal of alien species may leave spoil exposed, alternative indigenous species should be established before eradication takes place. Individual property owners should be encouraged to plant indigenous non-invasive plants. The attention of property owners must be drawn to the most recent Declared Weeds List (2001) in the *Conservation of Agricultural Resources Act* 43 of 1983 and the associated penalties and prohibitions. Horticultural activities such as fertilisers, herbicide and pesticide runoff, increase in alien vegetation and weedy species, dumping of refuse and building material must be strictly managed and be environmentally sensitive and should meet the following requirements:

- Limited to building environs and limited areas of proposed Redcliff Eco-estate.
- Limited irrigation by water-wise gardening (use local plants adapted to local conditions).
- Strict fertiliser, pesticide and herbicide control (limited usage)
- Invertebrate pests on the site should be controlled in the following manner:
- The least environmentally damaging insecticides must be applied. Pyrethroids and Phenylpyrazoles are preferable to Acetylcholines. Use insecticides that are specific to the pest (species specific) in question. The lowest effective dosages must be applied. Suppliers advice should be sought. Do not irrigate for 24 hours after applying insecticides in areas where there is a chance of contaminating water-courses or

dams, fungal pathogens should be used in preference to chemical insecticides.

- Reduction of weed and erosion by minimum tillage gardening practices (groundcovers and mulching better in all respects).
- No dumping of any materials in undeveloped open areas and neighbouring properties. Activities in the surrounding open undeveloped areas must be strictly regulated and managed.

6.3 Erosion and Surface runoff

Urban development is characterised by large areas of sealed surfaces such as roads, houses etc. Impermeable surface cover ranges from 15% to 60% of suburban areas to almost 100% in central business districts. Infiltration is considerably reduced with an increase in surface run-off. Run-off is generally discharged to surface water systems and often contains pollutants. Pollutants range from organic matter, including sediments, plant materials and sewage, to toxic substances such as heavy metals, oils and hydrocarbons. Construction activities associated with urban development can lead to massive short term erosion unless adequate measures are implemented to control surface run-off. Sheet erosion occurs when run-off surface water carries away successive thin layers of soil over large patches of bare earth. This type of erosion is most severe on sloping soils, which are weakly structured with low infiltration, which promotes rapid run-off. It occurs on the site where vegetation has been destroyed. Continual erosion in sheet-eroded slopes is a common cause of gully erosion. Gully erosion results from increased flow along a drainage line, especially where protective vegetation has been removed and soils are readily transported. A gully has steep, bare sides and is often narrow and deep. Once formed, a gully usually spreads upstream through continual slumping of soil at the gully head. Gully erosion can be associated with salting as the saline sub-soils are readily eroded.

Mitigation and recommendations

Vegetation plays a critical role in the hydrological cycle by influencing both the quantity and quality of surface run-off. It influences the quantity of run-off by intercepting rainfall, promoting infiltration and thus decreasing run-off. Vegetation can influence water quality in two ways: by binding soils thus protecting the surface layer, and by intercepting surface run-off thus buffering the pan against suspended and dissolved substances. When the speed of the run-off is reduced, suspended particles can settle out and dissolve substances, such as nutrients, can be assimilated by plants. The vegetation has a filtering effect. Storm-water and runoff should be channelled through natural grassland buffer areas (at least 25m) into seasonal retention ponds reducing the erosional force and the potential risk of contamination of the seasonal tributary. Storm-water retention dam/ponds should ideally be seasonal with limited reed invasion. Ponds should ideally contain shallow margins with seasonal hydrophilic grasses and sedges.

The timing of clearing activities is of vital importance. Clearing activities and earth scraping should preferably be restricted to the dry season in order to prevent erosion and siltation. The dry months are also the period when the majority of species are either dormant or finished with their breeding activities. Future soil stockpiling areas must follow environmentally sensitive practices and be situated a sufficient distance away from drainage areas. Severely eroded areas should be stabilised with gabions with sediment trapping material. The careful position of soil piles, and runoff control, during

all phases of development, and planting of some vegetative cover after completion (indigenous groundcover, grasses etc.) will limit the extent of erosion occurring on the site. Sufficient measures must be implemented to prevent the possible contamination of the seasonal tributaries surface water and surrounding groundwater.

6.4 Migratory Routes (Fencing)

The migratory movements of several animal (frog, reptile and mammal) species could be completely disrupted by the erection of numerous walls around properties, fences and road networks, which restrict natural movements between suitable foraging and breeding areas. This could potentially result in the disruption of natural gene flow between populations and could result in a high impact on the highly mobile species. Fencing off of residential areas and private property also plays a critical role in impeding the natural migration of the majority of animal species. A trade off thus exists between safety and security on the one hand and movement of animal species on the other.

Mitigation and recommendations

Ideally no internal fences should occur on the site and only an outer perimeter fence should be erected. If not fences should not restrict the natural migratory movements of certain animals. The preservation, maintenance and creation of tracts of natural vegetation (biological or migratory corridors) in all stages of ecological succession, interconnected by corridors or green belts for escape, foraging, breeding and exploratory movements around the site needs to be considered. It is critical that sufficient corridors are created along the seasonal rivers as well as similar habitat between the ridges and hills on the site and surrounding hills to the north and west. The proposed development should ensure that representative habitats occurring on the site are conserved as well as incorporating the natural features on the site and linking these habitats with the proposed migration/biological corridor.

6.5 Artificial Lighting

Artificial lighting will most likely result in a **moderate to high** negative short, medium and long- term impact on all nocturnal animal species. Numerous species will be attracted towards the light sources and this will result in the disruption of natural cycles, such as the reproductive cycle and foraging behaviour. The lights may destabilise insect populations, which may alter the prey base, diet and ultimately the well-being of nocturnal insectivorous fauna. The lights may attract certain nocturnal species to the area, which would not normally occur there, leading to competition between sensitive and the more common species.

Mitigation and recommendations

During the construction phase, artificial lighting must be restricted to areas under construction and not directed towards the rivers and the open grasslands around the hill in order to minimize the potential negative effects of the lights on the natural nocturnal activities. Where lighting is required for safety or security reasons, this should be targeted at the areas requiring attention. Lighting should not be directed into the natural buffer zones or biological corridors as this could reduce the long-term effects of local artificial lights on the natural environment. Yellow sodium lights should be prescribed as they do not attract as many invertebrates (insects) at night and will not

disturb the existing wildlife. Sodium lamps require a third less energy than conventional light bulbs.

6.6 Threatened animals

At a local scale the study site and surrounding grasslands comprises important habitat for several animal species and possible certain rare or threatened species.

Mitigation and recommendations

As a precautionary mitigation measure it is recommended that the developer and construction contractor as well as an independent environmental control officer should be made aware of the possible presence of certain threatened animal species prior to the commencement of construction activities. A qualified botanist as well as zoologist prior to vegetation clearance should conduct a final investigation of the proposed development area. Rescued plants and animals can be relocated in suitable habitat away from the affected area. In the event that any of the above-mentioned species are discovered GDACE should be informed and activities surrounding the site suspended until further investigations have been conducted. If Bullfrogs are unearthed during any phase of the development, a herpetologist specialising in Bullfrogs should immediately be brought to the site to evaluate the importance of the record and recommend mitigation measures where necessary.

6.7 Exotic Animals

The introduction and invasion of exotic ducks, cats, dogs, rabbits and birds (mynas) must be prevented as they have negative impacts on remaining animal species.

Mitigation and Recommendation

Ideally no domestic animals should be allowed in the proposed development. If allowed, cats and dogs should ideally be neutered or spayed, preventing unwanted litters and restricted to the residential areas. No exotic animals should be allowed in the undeveloped open areas on the site and surrounding properties. All exotic animals entering these sensitive habitats should be humanely as possible removed from the site. Alien fish species such as mosquito fish, Bass and Carp should not be introduced to the artificial dam or stormwater retention ponds.

7. CONCLUSION AND RECOMMENDATIONS

Any proposed development in the Redcliff (Roodekrans) Conservancy must be placed sufficient away from the sensitive habitats (seasonal tributary, rocky ridges and hills). Ideally the development should be restricted to the selected site in disturbed grassland **on the northern sections of the site**. This will result in higher density residential stands connected by a single road and linear infrastructures (roads, powerlines, sewer and water lines). The creation of a single residential block will significantly reduce the amount of linear infrastructures as well as habitat destruction and fragmentation. An intensive faunal survey should be undertaken on the selected site prior to vegetation clearance to determine the presence of animal refuges such as burrows, loose rock, logs, stumps and termite mounds etc. A rescue and recovery programme should be undertaken; with recovered animals released in suitable habitat away from the development.

The conservation of the seasonal tributary as well as sufficient open grassland with wooded pockets as well as the rocky ridges and hills should

conserve the majority of suitable habitat for animal species found on the site and surrounding areas. It is imperative for the majority of animal species on the site that the hydrological regime of the seasonal tributary is maintained. Further alterations to the flow regime can have detrimental impacts on the river as well as the riparian vegetation. The introduction of larger mammals should follow strict carrying capacities determined by a qualified grassland ecologist or botanist. A natural fire regime should also be incorporated on the site and surrounding grassland areas. The possible connecting of this site with neighbouring sites to the north, east and the west should strongly be considered. This will increase the amount of area under private conservation control, which will directly benefit the majority of animal species in the area. The internal fences could be removed with a single electrified perimeter fence allowing increased migratory movements of larger animals.

8. REFERENCES

- ACOCKS, J.P.H. (1988). *Veld Types of South Africa*. Memoirs of the Botanical Survey of South Africa, No.57: 1-146. Botanical Research Institute, Pretoria.
- BARNES, K.N. (ed.) (2000). *The Escom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. Birdlife South Africa, Johannesburg.
- BRANCH, W.R. (1988). *Field Guide to the Snakes and other Reptiles of Southern Africa*. Struik Publishers, Cape Town.
- CARRUTHERS, V.C. (2001). *Frogs and Frogging in South Africa*. Struik Publishers, Cape Town.
- CARRUTHERS, V.C. (1990). *The Magaliesberg*. Southern Book Publishers, Johannesburg.
- COOK, C.L. (1997). *Aspects of the breeding biology and ecology of the Giant Bullfrog Pyxicephalus adersus*. Unpublished MSc. Thesis, University of Pretoria, Pretoria.
- Cook, C.L. (2005). Initial faunal survey for the proposed Riversong Development. Unpublished survey for Bohlweki Environmental.
- DE GRAAF, G. (1981). *The rodents of southern Africa*. Butterworth Press, Pretoria.
- JACOBSEN, N.H.G. (1989). A herpetological survey of the Transvaal. Unpublished Ph.D. thesis, University of Natal, Durban.
- LOW, A.B. and REBELO, A.G. (1998). *Vegetation of South Africa, Lesotho and Swaziland*. D.E.A.&T., Pretoria.
- PASSMORE, N.I. and CARRUTHERS, V.C. (1995). *Frogs of South Africa. A Complete Guide*. Wits University Press, Witwatersrand.
- ROBERTS, A. (1951). *The mammals of South Africa*. Central News Agency, Cape Town.
- SIEGFIED, W.R. (1989). *Preservation of species in southern African nature reserves*. In: Huntley, B.J. (Ed). *Biotic Diversity in Southern Africa*, 186-201. Cape Town: Oxford University Press.
- SKINNER, J.D. and SMITHERS, R.H.N. (1990). *The Mammals of the Southern African Subregion*. University of Pretoria, Pretoria.
- SMITHERS, R.H.N. (1986). *South African Red Data Book-Terrestrial Mammals*. South African National Scientific Programmes Report No.125: 1-214.
- WHITTINGTON-JONES. C. (2003) Gauteng biodiversity gap analysis project: ornithology and herpetology layer. Unpublished report.

ANNEXURE G: FLORA SPECIES STUDY

Preliminary study of the Vegetation of the farm Roodekrans

Methodology

The study area falls within the Grassland Biome classified by Acocks as Rocky Highveld Grassland (34). Stratification was done using habitat as the stratum forming each community. Within each community the factor contributing most to community composition was soil.

Cover values used (Braun Blanquet) are as follows:

5 = 75% - 100% canopy cover, 4 = 50% - 75% canopy cover, 3 = 25% - 50% canopy cover, 2b = 12% - 25% canopy cover, 2a = 5% - 12% canopy cover, 1 = 1% - 5% canopy cover, + = numerous individuals present, but < 1% cover and r = individual with negligible canopy cover.

An * denotes weeds, invaders, or exotic plants, ^R*Cleome conrathii* denotes Red Listed species.

Habitats

One semi aquatic and two terrestrial habitats were present in this study area.

Table 1: Habitats recognized within the Roodekrans area

Habitat	Soil	Lithology	Disturbed
<u>Aquatic:</u>			
A: Moist grassland of valley	Floodplain deposits sandy-loam	Quaternary deposits originally of dolomitic origin	No
<u>Terrestrial:</u>			
B: Grassland slopes	Sandy loam	Dolomite	Yes- old house/ grazing
C: Rocky crest, grassland with few short trees	Sandy loam	Sandstone & metamorphosed shale	No

Descriptions of communities

A: Moist grassland of valley

This site is situated in the valley and drainage is from south east to north west. No permanent water is to be found in the streamlet. The lithology comprises dolomite. Rocks of sizes of 20-50 cm are found at this site and rock cover is approximately 25 % of the total cover. Soil is a rich sandy-loam

and is moist at this time of year. Slopes vary from 2° to 8°. This community is classified as a moist grassland savannah with trees at intervals. The vegetation is dominated by *Acacia caffra*, which grows singly or in groups throughout the valley. Other trees present are *Rhus lancea*, *Combretum hereroensis*, *Canthium gilfillanii* and *Vangueria infausta*. The dominant grasses are *Setaria phacelata* and *Loudetia simplex* with the primary invader *Tragus berteronianus* common as a result of past grazing practices.

Plant species recorded at this site are listed below. The site was scored 7/10 with few invaders and high species diversity.

One Red List species (*Cleome conrathii*, specimen at PRE) was recorded at this site. This species is listed as

Species of moist grassland savannah (valley)	Cover	Species	Cover
Shrub:			
<i>Acacia caffra</i>	2b	Herbs:	
<i>Rhus lancea</i>	1	<i>Hypoxis rigidiuscula</i>	+
<i>Combretum hereroensis</i>	r	<i>Eriospermum</i> sp. (sterile)	+
<i>Canthium gilfillanii</i>	r	<i>Commelina bengalensis</i>	+
<i>Vangueria infausta</i>	+	<i>Lannea edulis</i>	+
<i>Rhus pyroides</i>	+	<i>Cheilanthes hirta</i>	1
<i>Dichrostachys cinerea</i>	1	<i>Senecio</i> sp. (sterile)	+
<i>Euclea crispa</i>	+	<i>Lippia rehmannii</i>	+
<i>Gymnosporia buxifolia</i>	+	<i>Helichrysum</i> sp. (sterile)	+
<i>Strychnos pungens</i>	+	<i>Blepharis</i> sp.	+
<i>Ochna pulchra</i>	1	<i>Xerophytia retinervis</i>	+
<i>Xanthoxylum capense</i>	r	<i>Evolvulus alsinoides</i>	+
<i>Celtis africana</i>	r	* <i>Schkuria pinnata</i>	+
<i>Ozoroa paniculosa</i>	+	<i>Polygala uncinata</i>	+
<i>Curtissia dentata</i>	r	<i>Selaginella kraussiana</i>	+
<i>Comretum molle</i>	r	<i>Commelina africana</i>	+
<i>Grewia flava</i>	r	<i>Bulbostylis burchelliana</i>	r
		<i>Lamiaceae</i> sp. (sterile)	+
Grasses & sedges:		^R <i>Cleome conrathii</i>	+
<i>Setaria phacelata</i>	2a	<i>Vernonia oligocephala</i>	+
<i>Loudetia simplex</i>	2b	<i>Parinari capensis</i> subsp. <i>capensis</i>	+
<i>Heteropogon contortus</i>	2a	<i>Elephantorrhiza elephantina</i>	+
<i>Aristida junciformis</i>	r	<i>Solanum panduriforme</i>	+
<i>Tragus berteronianus</i>	1	<i>Asclepias fruticosus</i>	r
<i>Themeda triandra</i>	+	<i>Berkheya</i> sp.	+
<i>Eragrostis capensis</i>	r	<i>Heliotropium</i> sp.	+
<i>Trichoneura grandiglumis</i>	r	<i>Rhoissicus tridentata</i>	+
<i>Alloteropsis semialata</i>	r	<i>Dipcadi viride</i>	+
<i>Imperata cylindrica</i>	+	<i>Boophane disticha</i>	+
<i>Andropogon</i> sp.	+	<i>Pearsonia sessilifolia</i>	+
		<i>Cleome monophylla</i>	+
Succulents:	+	* <i>Agave</i> sp.	r
<i>Euphorbia shinzii</i>	1	<i>Felicia muricata</i>	r
<i>Kalanchoe thyrsiiflora</i>	r	<i>Chascanum</i> sp.	r
<i>Orbea lutea</i>	r		+

B: Grassland slopes.

This habitat primarily comprises tall grass with scattered herbs and few trees. There are few rocks and slopes are north-facing and gentle 4° to 6° with soil being a rich red loam. Open bare spots comprise less than 5% of the surface area. The vegetation is dominated by the grass *Hyparrhenia hirta* (close to 45% cover) reaching a height of ~1.1 m tall. Herbs are present with an ~9% cover (out of the 75% vegetation cover).

Acacia caffra trees are present but only as a few individuals which increase in number towards the lower slopes in the north west.

Most species recorded at this were indigenous species with a few species indicating poor practises in the past such as **Pennisetum clandestinum* (kikyu), **Cynodon dactylon* and *Tragus berteronianus*. The site was scored as 5/10 for condition, as its species composition was low but with a few alien invaders. No Red List species or rare species were recorded at this site.

Species of the grassland slopes	Cover	Species	Cover
Trees & Shrubs:		<i>*Pseudognaphalium oligandrum</i>	r
<i>Acacia caffra</i>	r	<i>Sida rhobifolia</i>	1
<i>Rhus lancea</i>	1	<i>Alysicarpus rugosus</i>	+
<i>Vangueria infausta</i>	+	<i>Hypericum</i> sp. (sterile)	r
<i>Rhus pyroides</i>	+	<i>Medicago</i> sp. (sterile)	+
<i>Euclea crispa</i>	+	<i>Euryops</i> sp. (sterile)	+
		<i>Lotononis</i> sp. (sterile)	+
Grasses & sedges:		<i>Rhynchoia monophylla</i>	+
<i>Themeda triandra</i>	1	<i>*Tagetes minuta</i>	+
<i>Hyparrhenia hirta</i>	1	<i>Scabiosa columbaria</i>	+
<i>Perotis patens</i>	1	<i>*Oenothera rosea</i>	+
<i>Eragrostis capensis</i>	+	<i>Hypoxis rigidula</i>	+
<i>Eragrostis curvula</i>	+	<i>Becium obovatum</i>	+
<i>*Pennisetum clandestinum</i> (kikyu)	+	<i>Polygalla hottentottica</i>	+
<i>Setaria sphacelata</i>	+	<i>Asparagus setaceus</i>	+
<i>Bulbostylia humilis</i>	+	<i>Thesium racemosum</i>	+
<i>Mellinis repens</i>	+	<i>Tulbachia</i> sp. (sterile)	+
<i>*Cynodon dactylon</i>	+	<i>Helichrysum rugulosum</i>	+
<i>Heteropogon contortus</i>	1	<i>Nemesia fruticans</i>	+
	+	<i>Pentanisia pruneloides</i>	+
	1	<i>Kohautia amatymbica</i>	+
Succulents:	1	<i>Nidorella anomala</i>	+
<i>Orbea lutea</i>		<i>Pollichia campestris</i>	r
<i>Euphorbia shinzii</i>		<i>Tephrosia capensis</i>	+
<i>Kalanchoe thyrsiiflora</i>		<i>*Tagetes minuta</i>	
Herbs:		<i>Plantago lanceolata</i>	+
	1	<i>Rhynchosia monophylla</i>	+
<i>Chaetacanthus</i> sp.	+	<i>Stoebe vulgaris</i>	+
<i>Helichrysum pilosellum</i>	+	<i>Indigofera sanguinea</i>	1
<i>Asclepias fruticosus</i>	+	<i>Lantana rugosa</i>	+
	+		+

C: Rocky crest, grassland with few short trees.

This habitat primarily comprises rocky outcrops of sandstone origin with few short trees interspersed at intervals. There is a high succulent component as would be expected of such a habitat. Rocks slope towards the north as expected in the Transvaal Supergroup with slopes north-facing and about 12° to 15° with soil being shallow sandy loam. Open bare rocky spots comprise 35% of the surface area. The dominant tree species is *Englerophytum magalismontanum* while the dominant grass species is *Loudetia simplex*.

Trees are present but only as a few individuals, never attaining great height due to habitat conditions.

Most species recorded at this were indigenous species The site was scored as 8/10 for condition, as its species diversity was high with only few primary invaders. One Red List species (*Cleome conrathii*, specimen at PRE) was recorded at this site.

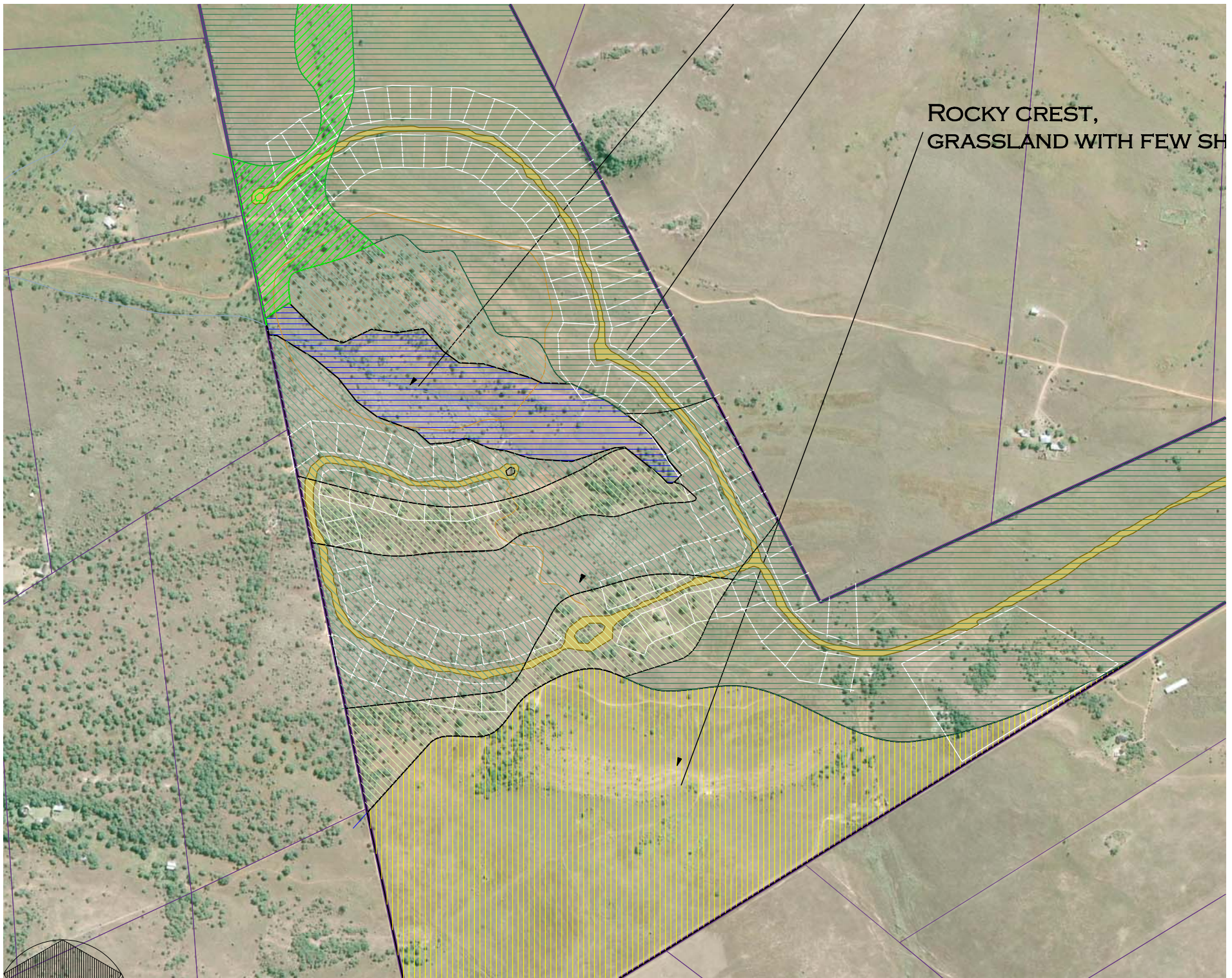
Species of the rocky crest, grassland	Cover	Species	Cover
Trees & Shrubs:			
<i>Acacia caffra</i>	r	Herbs:	
<i>Englerophytum magalismontanum</i>	2b	<i>Rhynchoia totta</i>	+
<i>Vangueria infausta</i>	1	<i>Indigofera hedyantha</i>	r
<i>Ochna pulchra</i>	1	<i>Hypoxis rigidula</i>	+
<i>Dichrostachys cinerea</i>	+	<i>Asclepias fruticosus</i>	+
<i>Rhus lancea</i>	+	<i>Melolobium burchellii</i>	1
		<i>Lotononis</i> sp. (sterile)	+
Grasses & sedges:		<i>*Pseudognaphalium oligandrum</i>	r
<i>Loudetia simplex</i>		<i>Kohautia amatymbica</i>	+
<i>Themeda triandra</i>		<i>Rhynchoia capensis</i>	+
<i>Hyparrhenia hirta</i>	2b	<i>*Tagetes minuta</i>	+
<i>Heteropogon contortus</i>	2a	<i>Helichrysum rugulosum</i>	1
<i>Melinis repens</i>	2a	<i>Nemesia fruticans</i>	+
<i>Bulbostylia humilis</i>	1	<i>Xerophytia retinervis</i>	+
<i>Eragrostis capensis</i>	+	<i>Tephrosia capensis</i>	+
	+	<i>Pentanisia pruneloides</i>	+
Succulents:	+	<i>Evolvulus alsinoides</i>	+
<i>Euphorbia shinzii</i>		<i>Pearsonia sessilifolia</i>	+
<i>Crassula swaziensis</i>		<i>Lantana rugosa</i>	+
<i>Kalanchoe thyrsiiflora</i>	+	<i>Selaginella krausiana</i>	+
<i>Orbea lutea</i>	+	<i>Dipcade viride</i>	+
<i>Anacampseros subnuda</i> subsp. <i>subnuda</i>	r	<i>Heliotropium</i> sp.	+
	+	<i>^RCleome conrathii</i>	r
	r	<i>Eriospermum</i> sp.	+

Conclusions

The grassland and woodland of this area is unique as dolomitic communities have unique species composition.

Development taking place should concentrate on the southern end (towards JHB) of the study area and mid-slopes below the rocky crest, grassland where the species diversity is lower than the woodland. Units can also be placed on the northwest side of the study area adjacent to the game fence. The Red List species, *Cleome conrathii*, is present in the woodland area and a buffer zone of 100m should be maintained for its continued existence and having this species thus protected would be advantageous. This specific development with certain sites set aside for natural habitat is ideal for the protection of this species.

ROCKY CREST,
GRASSLAND WITH FEW SH



ANNEXURE H: SERVICES REPORT

OUTLINE SCHEME REPORT

REDCLIFF PRIVATE RESERVE ON PORTION 6 OF THE FARM ROODEKRANS 492 JQ – PROPOSED FREEHOLD DEVELOPMENT

1. DEVELOPER

The developer of the proposed subdivision is:

REDCLIFF PRIVATE RESERVE (PTY) Ltd

P.O. BOX 1332

WITKOPPEN

2068

CONTACT: MR. KON LEECH

TEL. (011) 469 1553

FAX. (011) 086 659 3233

CONSULTANTS

DE REUCK & ASSOCIATES

P.O. BOX 98

NORTHRIDING

2162

CONTACT: MR. R.D. DE REUCK

TEL. (011) 794 2299

FAX (011) 794 2288

2. LOCATION

The proposed development is situated on Portion 6 of the farm Roodekrans 492JQ in the Centurion Magisterial District, some 12.6 km north east of Dainfern, and east of the Lanseria Airport. Access to the development is off the M34 or R511, on 6 km of gravel road. The development is bounded by existing farms.

3. SCOPE OF THE DEVELOPMENT

The development consists of 120 residential stands, at a density of 0.5 units per hectare. The total development is in the order of 225 hectares.

The scope of the works is as follows:

Internal Gravel Roads		22 500m ² .
External Access road upgrading		36 000m ²
Water reticulation	Rising main	200m
	Domestic	3 600m
	Storage	1 MI reservoir
Sewer reticulation	Internal	4 000m
	Treatment works	GES-RAS system
Stormwater Management	Internal	215m

4. **TOWN PLANNING**

Delacon CC is responsible for all town-planning issues.

DELACON CC
P.O. BOX 7522
CENTURION
0046

CONTACT:DR SUSAN BOUILLON
TEL.(012) 663 7733
FAX 086 656 2954

5. **GEOTECHNICAL INVESTIGATION**

Africa Exposed Consulting Engineering Geologists, carried out a geotechnical investigation in February 2006, and the ground conditions are influenced by residual dolomite and residual syenite, and will require a sink hole risk evaluation be completed in terms of the NHBRC and Council for Geoscience to establish the suitability for township establishment. The services of Dr. D. Buttrick are also to be called upon to assist with the risk assessment.

There is a gentle to moderate slope to the west of 3 to 4% across the main portion of the development, while the southern spur of the development slopes to the north at 4%. A natural drainage path divides the two portions of the development, which drains northwards, is encountered on southern portion of the site.

6. EXISTING SERVICES

Existing services are not available on the township boundaries, and the Local Authority of the City of Tshwane Metropolitan Municipality (Centurion) is unable to supply either potable water, or treat sludge produced by the development.

7. DESIGN OF ENGINEERING SERVICES

The design of Civil Engineering Services, are based on the “Guidelines for Engineering Services and Amenities” (Red Book) and design norms prescribed by the City of Tshwane Metropolitan Municipality (Centurion). All specifications as laid down in the SABS 1200 standard specification for Civil Engineering construction. The standard of services allowed for are as follows:

7.1 WATER RETICULATION

- Two existing boreholes are available on site, and their rate of delivery is still to be confirmed. In discussion with the Geotechnical Engineer, it is proposed to drill a further borehole in the southeast corner of the development, where the anticipated groundwater level would be within 5 to 10m of the ground surface. It is proposed to link these boreholes to a rising main and pump to a storage area on the south of the development, which is the highest point of the development. It is proposed to erect a 1Ml reservoir, with a chemical dosing plant and a booster pump. Subject to the tests of the borehole water, the dosing plant will be designed accordingly.
- The proposed internal water reticulation will consist of uPVC Class 12 110mm diameter combined domestic and fire main pipe with spigot and socket couplings and thrust blocks.
- All fire hydrants will be positioned to meet the requirements of the Rational Fire Design and the Emergency Services, and will be the Woodlands High Efficiency type.
- The total estimated average demand would be in the order of 225,7kl/day, at an average demand of 1 850 litres/dwelling/day.

The development consists of 120 stands x 1 850 litres/stand/day x 4 = 888Kl., and a 1Ml reservoir would then allow for four to five days storage.

7.2 SEWER RETICULATION

- It is proposed to install an onsite sewerage management system in the form of an installed infiltrator chamber system developed by P D & M Services in association with GES Environmental of Pretoria, and known as the GES-RAS System. We attach a copy of the GES-RAS Plant Performance VS DWAF Standards, for your records. The Department of Water Affairs and Forestry have approve this system installed on other locations, and the quality of the discharge after treatment can be discharged directly into a storage reservoir for use as irrigation water, and be circulated between the feature dams to be constructed between the development. The infiltrator chamber is installed underground and has the added advantage that there is no odour and is low maintenance unit. P D & M Services are the registered manufactures of this system and will supply addition information if required. It must be noted that a license for this system for this development will have to be by DWAF.
- The proposed internal sewer reticulation will consist of 160mm diameter Maincor Class 400 pipes.
- All manholes will be 1050mm diameter precast rings, with concrete covers and frames and have sealed joints, at a maximum of 80m spacing.
- The design flow for the development is as follows:

Maximum development potential	120 units
Discharge per stand	1250 litres/stand/day
Peak factor	2.30
Extraneous flow	15%
Total wet weather design flow	403.36kl/day

7.3 ROADS

All roads are considered as internal roads, and only serve the development. The proposed foundation layers are as follows:

Subbase	150mm G6 imported material stabilized and compacted to 95% Mod AASHTO
Roadbed	150mm rip and recompact insitu material to 93% Mod AASHTO

The access road to the M34 will be upgrade from a gravel road, and constructed to the specifications of providing a dust free low maintenance roadway, by incorporating Ecobond stabilizer. Plans will be submitted to the City of Tshwane Metropolitan Municipality (Centurian) Roads Department for approval and wayleave, before construction commences.

7.4 STORMWATER

The total area of the development is 26.6 ha draining north and westwards to the natural watercourse. The watercourse to which the development will be discharging, is non-perennial in nature and only contain water after periods of rainfall.

Stormwater generated by the development will be managed as overland flow and roads will be protected in the form of armoflex where concentrated flows are encountered. Stone pitch channels will be constructed between the stands where flow has to be channelized for protection to proposed dwellings.

8. LANDSCAPING

It is proposed to retain the natural veld grasses and trees, and only allow manicured lawns for a limited area around the dwelling units.

9. CONSTRUCTION COST ESTIMATE

Our estimate of the construction costs for the civil services on the above development is as follows:

Preliminary & General		R1 250 000-00
Water Reticulation		R1 150 000-00
Water reservoir		R 750 000-00
Sewer Reticulation		R1 650 000-00
Sewer treatment works		R 750 000-00
Stormwater management	Internal	R 250 000-00
Roads	Internal	R2 250 000-00
	External	R5 400 000-00
Contingencies (5%)		<u>R 675 000-00</u>
SUB TOTAL		R14 125 000-00

VAT (14%)	<u>R 1 977 500-00</u>
TOTAL	<u>R16 102 500-00</u>

The proposed development consists of 120 stands and a servicing cost of R131 987-70 (incl. VAT) per stand.

10. **CONCLUSION**

The contentious points to be addressed are:

- Approval of design norms as proposed in the report.

.....

R.D. DE REUCK PrTech(Eng)

ANNEXURE I: TRAFFIC IMPACT ASSESSMENT

ANNEXURE J: ENVIRONMENTAL MANAGEMENT PLAN

1. SCOPE

The aim of this Environmental Management Programme (EMP) is to ensure that proper controls are in place to address the environmental impacts during the construction of roads and infrastructure and to set out the methods by which the environmental controls are to be implemented by the contractor. The duration over which the contractor's controls shall be in place cover the construction period of the project as well as the limited time after contract completion defined by the General Conditions of Contract, and the project specifications. The provisions of the EMP are binding on the contractor during the life of the contract.

2. OBJECTIVES OF THE EMP

The EMP also serves to highlight specific requirements that will be monitored during the project and the document should therefore be seen as a guideline to assist in minimising the potential environmental impact of activities. The EMP has the following goals:

- Identification of construction activities that could impact on the environment;
- Detailing the mitigation measures and specifications with which the contractor shall comply in order to minimise the extent of environmental impacts during construction by providing procedures for their implementation;
- Defines corrective actions that shall be taken in the event of non-compliance and;
- Prevent long-term environmental degradation.

3. LEGAL REQUIREMENTS

The legal requirements are twofold: The first concerns the adhering of the measures contained in the EMP by the developer and the procedures for environmental auditing as required by the relative Acts. The second is the inclusion of measures that will bind the contractor to the measures of the EMP.

3.1 ADMINISTRATION OF ENVIRONMENTAL OBLIGATIONS

Appointment of an Environmental Consultant: The Environmental Consultant must monitor compliance with the approved EMP and undertake regular environmental audits for submission to GDACE.

4. ENVIRONMENTAL MANAGEMENT OF CONSTRUCTION ACTIVITIES

Table 5 Environmental Management Plan

IMPACT	DISCUSSION
	PLANNING PHASE
Statutory authorization / permissions	LOCAL AUTHORITY: ➤ The site development plan must be approved; ➤ Service agreements must be put in place; ➤ Construction drawings must be completed and submitted to the Local Authority for approval. GDACE ➤ Scoping Report must be approved. RECORD KEEPING ➤ The Environmental Consultant / Engineer will continuously monitor the Contractor's adherence to the approved impact prevention procedures and shall issue to the Contractor a notice of non-compliance whenever transgressions are observed. The Environmental Consultant should document the nature and magnitude of the non-conformance in a designated register, the action taken to discontinue the non-conformance, the action taken to mitigate its effects and the results of the actions; ➤ Copies of any record of decision or EMPs shall be kept on site and made available for inspection by visiting officials from the employer or relevant environmental departments.
	CONSTRUCTION PHASE
Environmental auditing	➤ The Developer must take responsibility for the compliance of the EMP during the operational phase. If he does not have the necessary expertise in house, he must appoint such a consultant to undertake the task on his behalf. ➤ The monitoring must ensure that all existing environmental legislation is adhered to.
Site establishment of contractors camps	Site establishment comprise a variety of activities such as erection of security fencing, material storage areas, workshops, temporary ablution facilities, etc. ➤ The Contractor shall establish his construction camps, offices, workshops, staff accommodation and testing facilities on the site in a manner that does not adversely affect the environment. However, before construction can begin, the Contractor shall submit to the Environmental Consultant, for his approval, plans of the exact location, extent and construction details of these facilities. The plans shall detail the locality as well as the layout of the waste treatment facilities for litter, kitchen refuse, sewage and workshop-derived effluents. ➤ The Contractor shall provide adequate facilities for his staff so that they are not encouraged to supplement their comforts on site by accessing what can be taken from the natural surroundings. The contractor shall ensure that energy sources are available at all times for construction and supervision personnel for heating and cooking purposes; ➤ The contractor's camp must make provision for an impervious area with controlled access where pollutants such as fuel, grease, paint, solvents, etc. can be stored. ➤ The positioning and development of the contractor's facilities must be done in such a way that the potential for soil erosion is minimized;

IMPACT	DISCUSSION
	➤ Public health aspects of site establishments and camps must be considered and all health regulation adhered to; ➤ Non-polluting toilets such as “Enviroloo” must be provided. Septic tanks and french drains are not to be allowed. The contractor shall be entirely responsible for enforcing the use of provided toilets and for maintaining them in a clean, orderly and sanitary condition to the satisfaction of the Environmental Consultant. Latrines shall be positioned within walking distance from wherever employees are employed on the works. ➤ Water for human consumption should be available at the site offices and at other convenient locations on site.
Material handling on site during construction	HAZARDOUS MATERIAL ➤ Petrochemicals, oils and identified hazardous substances shall only be stored under controlled conditions. All hazardous materials i.e. bitumen binders will be stored in a secured, appointed area that is fenced and has restricted entry. Storage of bituminous products shall only take place using suitable containers to the approval of the Environmental Consultant; ➤ The Contractor shall provide proof to the Environmental Consultant that authorisation to store such substances have been obtained by the relevant authority. In addition, hazard signs indicating the nature of the stored materials shall be displayed on the storage facility or containment structure. Before containment or storage facilities can be erected, the Contractor shall furnish the Environmental Consultant with details of the preventative measures he proposes to install in order to mitigate against pollution of the surrounding environment from leaks or spillage. The preferred method shall be a concrete floor that is bunded. The proposals shall also indicate the emergency procedures in the event of misuse or spillage that will negatively affect an individual or the environment. ➤ The Contractor is responsible for ensuring that any materials delivery drivers are informed of all procedures and restrictions (e.g. roads to use, “no go” areas, speed limits, dust control, etc) required to comply with the EMP before they arrive at site and off-load materials; ➤ All the necessary handling and safety equipment required for the safe use of petrochemicals and oils shall be provided by the Contractor to, and used or worn by the staff whose duty it is to manage and maintain the Contractor’s and his subcontractor’s and supplier’s plant, machinery and equipment; ➤ No materials must be left on site once work is completed; neither may they be dumped at any other place. FUEL AND GAS STORAGE ➤ Fuel should be stored in a secure area in a steel tank supplied and maintained by the fuel suppliers. Leakage of fuel should be avoided. An adequate bund wall, 110% of volume, should be provided for fuel and diesel areas to accommodate any spillage or overflow from these substances. The area inside the bund wall should be lined with an impervious lining to prevent infiltration of the fuel into the soil. ➤ Gas welding cylinders and LPG cylinders should be stored in a secure, well-ventilated area.
Preparation of working areas	TOPSOIL ➤ The topsoil must be removed from those areas where construction will take place on such as the footprint of buildings and asphalt, brick and concrete paved areas, and stored on site for later use; ➤ The Contractor shall ensure that no, or minimal topsoil is lost due to erosion – either by wind or water. Areas to be topsoiled and grassed shall be done systematically to allow for quick cover and reduction in the chance of heavy topsoil losses due to

IMPACT	DISCUSSION
	unusual weather patterns. The Contractor's programme shall clearly show the proposed rate of progress of the application of topsoil and grassing. The Contractor shall be held responsible for the replacement, at his own cost, for any unnecessary loss of topsoil due to his failure to work according to the progress plan approved by the Environmental Consultant. The Contractor's responsibility shall also extend to the clearing of drainage or water systems within and beyond the boundaries of the Project that may have been affected by such negligence; DRAINAGE ➤ The quality, quantity and flow direction of any surface water runoff shall be established prior to disturbing any area for construction purposes. Cognisance shall be taken of these aspects and incorporated into the planning of all Construction Activities. Before a site is developed or expanded, it shall be established how this development or expansion will affect the drainage pattern. No water source shall be polluted in any way due to proposed changes; ➤ Streams and their catchments shall be protected from erosion, direct or indirect spillage of pollutants such as refuse, garbage, cement, concrete, sewage, chemicals, fuels, oils, aggregate, tailings, wash water, organic materials and bituminous products; STOCKPILES ➤ The contractor shall plan his activities so that materials excavated from borrow pits and cuttings, as far as possible can be transported direct to and placed at the point where it is to be used. However, should temporary stockpiling become necessary, the areas for the stockpiling of excavated and imported material shall be indicated and demarcated on the site plan submitted in writing to the Environmental Consultant for his approval, together with the Contractor's proposed measures for prevention, containment and rehabilitation against environmental damage; ➤ The areas chosen shall have no naturally occurring indigenous trees and shrubs present that may be damaged during operations. Care shall be taken to preserve all vegetation in the immediate area of these temporary stockpiles. During the life of the stockpiles the Contractor shall at all times ensure that they are: positioned and sloped to create the least visual impact; constructed and maintained so as to avoid erosion of the material and contamination of surrounding environment; and kept free from all alien / undesirable vegetation. After the stockpiled material has been removed, the site shall be re-instated to its original condition. No foreign material generated / deposited during construction shall remain on site. Areas affected by stockpiling shall be landscaped; top soiled, grassed and maintained at the contractor's cost until clearance from the Consultant is received.
Waste Management during construction	ACCIDENTAL SPILLS ➤ Streams should be protected from direct or indirect spillage of pollutants such as refuse, garbage, cement, concrete, sewage, chemicals, fuels, oils, aggregate, tailings, wash water, organic materials and bituminous products. In the event of a spillage, the Contractor would be liable to arrange for competent instances to clear the affected area. ➤ All chemical spills must be contained and cleaned up by the supplier or by professional pollution control companies. ➤ Use appropriate structures and methods to confine spillages such as the construction of berms and pans, or through the application of surface treatments that neutralise the toxic effects prior to the entry into a watercourse; ➤ Should water downstream of the spill be polluted, and fauna and flora show signs of deterioration or death, specialist hydrological or ecological advice will be sought for appropriate treatment and remedial procedures to be followed. The requirement for such input shall be agreed with the Environmental Consultant. The costs of containment and rehabilitation shall be for the Contractor's account,

IMPACT	DISCUSSION
	including the costs of specialist input. BUILDING RUBBLE ➤ Temporary disposal areas must be carefully chosen, designed and fenced so that there is no risk of polluting surface or ground water, being flooded or posing any health risk; ➤ Excavated material must be flattened (not compacted) or removed from site. No heaps of spoil material must be left on site once the Contractor vacates the site; ➤ Littering on site and the surrounding areas is prohibited. ➤ Clearly marked litterbins must be provided on site. The contractor's representative must monitor the presence of litter on the work sites as well as the construction campsite. All bins must be closed to prevent refuse from being blown out by wind. All bins must be cleaned of litter on a daily basis. Large skips must be stored in a fenced area. ➤ All waste removed from site must be disposed at a municipal/permitted waste disposal site. ➤ All plastic material must be removed from areas where it can enter any stream. HAZARDOUS WASTE ➤ Hazardous wastes, waste oils, chemicals, etc, may not be disposed or stored on site and should be disposed off at a facility that is licensed to handle such materials. ➤ Hazardous waste such as bitumen, tar, oils etc. should be disposed of in a Department of Water Affairs and Forestry approved landfill site. Special care should be taken to avoid spillage of tar products such as tar prime or pre-coating fluid to avoid water-soluble phenols from entering the ground or contaminating water; ➤ Under no circumstances shall the spoiling of bituminous products on the site, over embankments, in borrow pits or any burying, be allowed. Unused or rejected bituminous products shall be taken to the supplier's production plant. OIL & LUBRICANT WASTE ➤ Used oil, lubricants and cleaning materials from the maintenance of vehicles and machinery, should be retained in a safe holding tank and removed from site by a specialist oil recycling company for disposal at approved waste disposal sites for toxic/hazardous materials. ➤ All used filter materials should be stored in a secure bin for disposal off site. Any contaminated soil should be removed and replaced. Soils contaminated by oils and lubricants should be collected and disposed of at a facility designated by the local authority. HOUSEHOLD WASTE ➤ Arrangements for waste collection and removal must be made with the Local Authority.
IMPACT ON LAND	
Soil contamination by oil, fuel, concrete, etc.	➤ Provide and protect the storage area by providing impervious surfaces and bunded areas; ➤ Educate labourers on the use of chemicals and pollutants; ➤ Provide dedicated impervious areas where pollution is likely to occur such as where the mixing of concrete will be done, where servicing of vehicles and equipment takes place and where chemicals and materials are stored; ➤ Undertake regular inspections of vehicles and service areas.

IMPACT	DISCUSSION
Alteration & compaction of original soil	➤ All areas compacted through construction activities and which has to be landscaped must be suitably rehabilitated. This should include the ripping of all compacted areas and the adding of organic material prior to planting.
IMPACT ON WATER	
Contamination of streams and groundwater	➤ All areas where pollution may occur such as the materials storage areas must have an impervious surface. ➤ It must be protected from flooding thus preventing clean from mixing with polluted water.
Erosion control	➤ Due to the shallow slope, water will tend to run to the lowest points on the site as sheet flow. Stormwater must not be allowed to remain concentrated in a channel once it has been diverted around structures or where it is taken from parking areas. In such cases the discharge areas must be planted to permanent creeping grasses and the water forced to disperse over an area as wide as possible thus re-instating the natural erosion regime, i.e. sheet flow. ➤ Areas denuded of vegetation must be limited to the shortest period possible;
IMPACT ON AIR	
Air pollution due to dust, smoke and odours.	➤ The contractor must take precautions to limit the generation of dust. The minimum requirement is regular watering and early surfacing of permanent roads in order to limit vehicle-entrained dust and to expose the smallest area possible to the elements at any time.
Noise pollution and vibrations caused by construction machinery and vehicles.	The objective is to reduce noise pollution and vibrations caused by construction actions, material loading and haulage. ➤ Noise control measures must be implemented. All noise levels must be controlled at the source. If the noise levels at the boundaries of the site exceed 7 dB above ambient levels, the local health authorities must be informed. All employees must be given the necessary ear protection gear. ➤ Wherever blasting activity is required on the site the contractor shall rigorously adhere to the relevant statutes and regulations that control the use of explosives. In addition, the contractor shall, prior to any drilling of holes in preparation for blasting, supply the engineer with a locality plan of the blast site on which shall be shown the zones of influence of the ground and air shock-waves and expected limits of fly-rock. The plan shall show each dwelling, structure and service within the zones of influence and record all details of the dwellings/structures/services including existing positions, lengths and widths of cracks, as well as the condition of doors, windows, roofing, wells, boreholes etc. ➤ The contractor must adhere to engine maintenance schedules to reduce noise; ➤ The contractor shall not use sound amplification equipment on site unless in emergency situations; ➤ The contractor must provide a schedule of working hours with the expressed objective of avoiding noise generation during the evening and weekend periods. ➤ The contractor must ensure that all on-site vehicles comply with the SABS 0181 standards.
IMPACT ON BIOLOGICAL SYSTEMS	
Management of wetlands	There are no wetlands on the property.
Landscape	➤ Contractors shall comply with any specifications in the Environmental Management Plan regarding specific use and/or protection of specific plant and

IMPACT	DISCUSSION
development	animal species; ➤ Alien invasive plants must be removed manually or mechanically, preferably before seed forming; ➤ Herbicides, pesticides and other poisonous substances may only be used on site compliant to health legislation and only once the environmental consultant or another competent person has approved it. ➤ Site landscaping must be sympathetic to the environment; ➤ Only non-invasive indigenous plants should be used.
IMPACT ON SOCIO-ECONOMIC ENVIRONMENT	
Areas of specific importance	Any area, as determined and identified within the project document or during the construction phase as sensitive or of special interest within the site shall be treated according to the express instructions contained in these specifications or the approved EMP. GRAVES & ARCHAEOLOGICAL SITES ➤ If a grave or an artefact is uncovered, other than those identified in the existing graveyard, during construction, work in the immediate vicinity shall be stopped immediately. The contractor shall take reasonable precautions to prevent any person from removing or damaging any such article and shall immediately upon discovery thereof inform the Environmental Consultant of such discovery. The National Monuments Council is to be contacted who will appoint an archaeological consultant. Work may only resume once clearance is given in writing by the archaeologist;
Change in the aesthetic quality of environment	➤ All spoil areas, temporary storage areas and foreign structures must be designed to, as far as is possible, blend in with the surrounding landscape; ➤ If possible, the contractors yards and storage areas must be screened from public eye; ➤ Littering by the contractor and his labourers must be dissuaded;
Security and safety of the workers and the public because of loitering.	➤ Clear signs must be displayed on site explaining that there are no vacant jobs to prevent prospective job seekers to loiter and congregate at the site during the construction period. ➤ Regular monitoring of the surrounding properties should take place to ensure that no squatting takes place. Occurrences should be reported to the Police for immediate action.
Danger to health and safety of workers and school children moving on site and on surrounding roads.	➤ The Contractor must maintain a safe working environment at all times; ➤ The contractor must ensure that relevant telephone numbers of emergency services are available on site at all times; ➤ The contractor must ensure that there are no unauthorized persons on site. Authorized persons include employees of the contractor, subcontractors, suppliers and the consultants; ➤ Fencing and security gates must be provided to control access to work areas; ➤ Erect suitable signage to warn public and personnel of any dangerous activity or structure. ➤ The contractor shall take all reasonable measures to ensure that the public is not endangered as a result of the construction activities; ➤ A health-monitoring programme must be established for workers.

IMPACT	DISCUSSION
Informal traders	➤ Plan for informal traders on the construction site to avoid potential problems on site ➤ Access to the site must be controlled. ➤ Signs prohibiting other hawkers from operating illegally on / adjacent to the site must be erected. This is important if construction area is near a busy road, for example.
	OPERATIONAL PHASE
Environmental auditing	➤ The Developer must take responsibility for the compliance of the EMP during the operational phase. If he does not have the necessary expertise in house, he must appoint such a consultant to undertake the task on his behalf; ➤ The monitoring must ensure that all existing environmental legislation is adhered to.

5. ENVIRONMENTAL AUDITING STRATEGY

The aim is to develop a cost-effective approach to monitoring the contractors' environmental performance. Certain parameters (e.g., noise, water quality, and dust) can be monitored through measurement; others can only be monitored through observation (e.g., erosion). However, in all cases anticipation of environmental problems through assessment of the environmental impact of the contractors' working methods, followed by forward planning to prevent problems or at least limit their effects, is seen as the key to successful environmental management.

6. CONCLUSIONS

This EMP sets out guidelines for the monitoring and protection of the environment during the planning, construction and operational phase of the project. It has identified those activities that give rise to environmental problems, proposed mitigation measures and, through the EMP, set out a strategy for compliance.

ANNEXURE K: GEOTECHNICAL INVESTIGATION