
**Terrestrial Fauna Biodiversity Impact Assessment in terms of
the Proposed Hekpoort Housing Development to support the
Environmental Authorisation and Water Use Licence Application
process, Gauteng Province**

January 2020



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Specialist Qualification & Declaration

Barbara Kasl (CV summary attached as Appendix A):

- Holds a PhD in Animal, Plant and Environmental Sciences from the University of the Witwatersrand;
- Is a registered SACNASP Professional Ecological and Environmental Scientist (Pr.Sci.Nat. Registration No.: 400257/09), with expertise in faunal ecology;
- Has been actively involved in the environmental consultancy field for over 12 years; and
- Is a member of the Entomological Society of South Africa.

I, Barbara Kasl, confirm that:

- I act as independent consultant and specialist in the field of ecology and environmental sciences;
- I have no vested interest in the project other than remuneration for work completed in terms of the Scope of Work;
- I have presented the information in this report in line with the requirements of Appendix 6 of General Notice Regulation 982: National Environmental Management Act (107/1998) (NEMA): Environmental Impact Assessment Regulations, 2014 (GNR982) as far as these are relevant to the specific Scope of Work;
- I have taken NEMA Principals into account as far as these are relevant to the Scope of Work; and
- Information presented is, to the best of my knowledge, accurate and correct within the restraints of stipulated limitations.



27-01-2020

Acronyms

ADU	Animal Demographic Unit
AI(S)	Alien Invasive (Species)
BGIS	Biodiversity Geographic Information System
CBA	Critical Biodiversity Areas
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EMF	Environmental Management Framework
EMP(r)	Environmental Management Plan (Report)
EO	Environmental Officer
ESA	Ecological Support Area
EWT	Endangered Wildlife Trust
FEPA	Freshwater Ecosystem Priority Area
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
NEMA	National Environment Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
PA	Protected Area
PES	Present Ecological State
QDGS	Quarter Degree Grid Square
RIVCON	River Condition
RL	Red-listed
SABAP	South African Bird Atlas Project
SANBI	South African National Biodiversity Institute
TOP(S)	Threatened or Protected (Species)
UNESCO	United Nations Educational, Scientific and Cultural Organization
VMUS	Virtual Museum
WUL	Water Use License

Executive Summary

The proposed Hekpoort site occupies an area of approximately 73.37Ha and comprises of Portion 79, Portion 91, Portion 96, Portion 321 and Portion 322 of the Farm Hekpoort 504 JQ. The site lies across the R560, just east of the R563/R560 intersection, in Hekpoort in the greater Magaliesberg area. The site lies within the Mogale City Local Municipality of the West Rand District in the Gauteng Province.

The site was surveyed on the 8 January 2020 on a partly cloudy to overcast and warm day and was considered adequate in terms of fauna surveying. The site supports small holdings and associated activities, largely agricultural, and natural areas are largely grasslands and riverine woodlands along the river. As requested by the EAP, the survey focussed on the riverine area in the northern extent of the property. Due to the fact that the area could only be accessed on foot, most of the site north of the R560 was surveyed.

The ecological findings (desktop and site survey) identified the following features:

- No National Protected Areas Expansion Strategy occur within 10km of site. No strategic water source areas occur on or near site. No forests occur on or near site. No NFEPA Wetlands occur on the property. No Gauteng Ridges occur on the property.
- The site is just inside the Magaliesberg Biosphere Transition Zone.
 - The development must adhere to the codes of conduct for the Biosphere as may be relevant to the transition zone.
- The Cradle of Human Kind is 1.3km south-east of site at its nearest border.
 - Any requirements that may be relevant to the development regarding the buffer zones of World Heritage sites or protected areas must be complied with.
- The site occurs within the Magaliesberg IBA.
 - In terms of the development footprint and identified threats for the IBA use of poisons must be restricted and properly managed, property should be developed in a manner to leave larger tracts of land open attached to ecological corridors and powerlines must be properly fitted with bird flappers.
 - BirdLife South Africa must be consulted as part of the public participation process and any additional requirements incorporated into the final EMPr.
- Nearby Protected Areas include:
 - The formally protected Magaliesberg Protected Natural Environment approximately 5.7km north of site. The development must align to the PA's environmental management plan concerning the PAs buffer zones.
- The site is within a National Freshwater Priority Area (NFEPA) Catchment (Fish support area).
 - The Magalies River flows along the far northern boundary and has a RIVCON (C) and a moderately modified PES (C). The river flows north-east towards the Hartebeespoort Dam..
 - Any contamination on land can find its way to aquatic systems through runoff fairly quickly and contamination to land must be prevented and water runoff managed on site.
 - Storm water runoff must also be managed in a manner so as to mimic natural flow rates into the river and maintain aquatic ecosystems.
- The area falls within Central Bushveld Bioregion of the Savanna Biome and the Moot Plains Bushveld vegetation type, which is not listed as a threatened ecosystem (NEM:BA, GN1002, 2011).

The following is summarised from the fauna species assessment:

- In terms of the TOP mammals, the QDGS does support a few TOP species, but the property is likely to support less on a permanent basis and this is likely to be concentrated in the north-western strip of the property where the riverine and wetland habitats are more in tact and the surrounding anthropogenic activities are limited. The remainder of the property is more impacted by anthropogenic activities associated with the existing developments around the roads and the existing townships. Therefore the remainder of the property is more likely to provide ecological connectivity and foraging areas to TOPS rather than permanent refuge. Although endemic species were recorded and are likely to occur on the property, none are restricted species and the area is not seen as a significant area in terms of mammal endemism.
- In terms of the TOP birds, the pentad has limited confirmed species and a few species are likely on the property, largely the riverine and associated wetland specialists. More may utilise the area for foraging. TOP bird biodiversity can be considered limited on the property. Although endemic species were recorded and are likely to occur on the property, none are restricted species and the area is not seen as a significant area in terms of avifauna endemism.
- No significant TOP herpetofauna populations are expected on the property. None of the endemic species are restricted and the areas is not considered significant in terms of herpetofauna endemism.
- Ecosystem services provided by confirmed and likely TOP, provincially protected and endemic species on the property broadly include:
 - Ecosystem-engineering provided by burrowing and digging species.
 - Prey base / potential carrion for predators and / or raptors.
 - Carrion and dung utilisation and associated waste removal.
 - Control of prey / competitive predator numbers.
 - Aid in existence and survival of other species.
 - Pollination and seed dispersal.

In terms of overall site sensitivity the northern boundary associated with the Magalies River and a terrestrial buffer incorporating a small grassland and wooded area has been designated as highly sensitive in terms of terrestrial fauna. The highly sensitive area incorporates:

- At least three main habitat types (aquatic, woodland and grassland) which increases habitat heterogeneity and therefore will provide habitat to a greater diversity of fauna.
- Is connected to an aquatic ecological corridor associated with the Magalies River and provides terrestrial buffer zone to this aquatic corridor.
- Is connected to a weaker terrestrial ecological corridor connecting two main mountain ridges in the north (main Magaliesberg) and south (secondary foothills).

The small area around the R560 supporting the farmstead is designated as low sensitivity in terms of terrestrial fauna.

The remainder of the property is designated as moderately sensitive. The remainder of the property has at one time or another been utilised for agricultural activities (cultivated crops and pastures) within the last 10 years and continues to be used for stock farming. The main function offered to fauna is foraging grounds and ecological corridors, however ecological connectivity has been pinched off to some extent due to development along the R560, and there is better scope for establishing a stronger north-south ecological corridor approximately 2.2km east of site.

The Hekpoort project proposes mixed-use development comprising of the 50% RDP and 50% Mixed Use (Social Housing and Business Ground Floor), Commercial and Agricultural developments. No specific plan was provided in terms of the proposed development. The development will be serviced by the Mogale City Local Municipality in terms of water, storm water, roads, sewage, electricity and any other required services. The activities considered included:

- Site preparation and construction:
 - Removing vegetation with soil stripping and stockpiling.
 - Excavation for foundations.
 - Cement mixing and construction of foundations and storm water drainage.
 - Construction of buildings.
 - Generation and handling of waste.
- Operation of the site:
 - Arrival and activity of residents / land users on site.
 - Generation of sewage and grey water.
 - Generation of domestic and hazardous (hydrocarbon and chemical) waste.

The following was considered in terms of impact assessment:

- Ecological drivers include climate change, AIS infestation and change in habitat.
 - With increased density of human residences, it is expected that Greenhouse Gas (GHG) emissions per hectare will increase and contribute to drivers of climate change. GHG legislation must be complied with.
 - For fauna to respond to climate change, ecological corridors and connectivity are critical. The highly sensitive area (Plan 5) is connected to the Magalies River ecological corridor and provides fauna the opportunity to retreat from site. Furthermore, the largely undeveloped nature of the greater area means that fauna have opportunity for dispersal from the site.
 - Climate change refugia and high diversity areas are also required to aid fauna to respond to climate change on a micro-scale. An example is the gradient up a hill / mountain, or the gradient from aquatic to terrestrial habitats, which over a relatively short distance provides a range of habitat types. Species can then respond to climatic changes by moving along these gradients. The site designated as highly sensitive (Plan 5) incorporates the broader habitat types within the immediate area, creating a mosaic of various habitats within the largely aquatic corridor associated with the Magalies River. Greater habitat diversity is more likely to support higher faunal diversity and therefore preservation of this area will provide the maximum opportunity for higher faunal biodiversity conservation. Conservation of this area, along with adequate terrestrial areas along the Magalies River and terrestrial ecological corridors connecting the southern and northern mountain ridges (see ecological connectivity below) will provide fauna opportunity to respond to climate change in future on both a macro- and micro-scale.
 - The area is already impacted by AIS, but with increased activity of people of site, the risk for AIS infestation or escalation of current species numbers could increase and prevention measures must be implemented.
- The main ecological process is primary production, where solar energy is converted to organic matter through photosynthesis and associated contribution of plants to the water cycle through evapotranspiration. This is a process that will be affected with removal of flora. Another important

process is that of natural fires. As the natural fire cycles in South Africa's grasslands and savannas have already been impacted by humans, this is not evaluated further.

- Species identified on site and species identified for the pentad and QDGS provide a range of ecological services and include the regulation of potential pest species (invertebrates, rodents, AIS birds), suppression or control of predator numbers, provision of prey and carrion, pioneering and initiating nutrient recycling, ecosystem engineering, prevention of bush encroachment, seed dispersal, pollination and vectors of disease / pests.
 - These faunal interactions and ecosystem services are reliant on overall ecological structure and removal of flora and other faunal habitat will cause fauna to retreat from the area and therefore result in the loss of ecological services within the disturbed footprint and buffer zones. The termites were the most significant ecosystem engineers observed on the property and they play a significant role in soil structure and characteristics, which will be lost with the development of the property.
- Ecological corridors and connectivity:
 - As discussed under Section 3.6, the connectivity offered by the site is already impacted to some extent due to development along the R560. Although limited, the site does provide a terrestrial ecological corridor connecting two mountain ridges in the north (main Magaliesberg) and south (secondary foothills). As the greater area is still fairly undeveloped, there are other terrestrial areas that can be established as open space to provide ecological connectivity and prevent isolation of the northern and southern ridge systems.
- Direct impacts to fauna and loss of fauna:
 - No TOP burrowing vertebrate species were identified for the area and habitat for TOP burrowing invertebrates was not identified on site and therefore it is unlikely that TOP burrowing species will be significantly impacted and impacts on burrowing species are not further assessed.
 - Very few TOPS were identified as likely to occur on the site. Their mobility and proximity of nearby natural areas makes them likely to leave the area and retreat to the surrounding areas once activities on site commence and no significant impacts are expected on TOP fauna. The impact is assessed as part of the overall potential loss of fauna.

All impacts to terrestrial fauna (other than loss of fauna habitat) can be mitigated to low significance as long as the proposed mitigation measures within this report are strictly applied on site. Destruction of habitat can be curbed to some extent by maintaining highly sensitive heterogeneous habitats and ecological corridors in tact. The following conditions are also important:

- No activities are to take place in areas designated as highly sensitive and minimal activity is to take place in the ecological corridor (Plan 5).
- Recommendations of other specialists, such as the air quality and surface water specialists, must be implemented in order to preserve the overall environment for fauna.
- Ensure all activities on site are in line with any requirements of the Biosphere Transition Zone, the relevant World Heritage and Protected Areas Management Plans (Cradle of Humankind and Magaliesberg Protected Natural Environment) and IBA Management Plans.
- Ensure a waste management plan has been compiled in line with the National Environmental Management: Waste Act (NEM:WA).
- Where predator or pest species need to be controlled, this will be done by environmentally sensitive means and no exposed poisons are to be used under any circumstances.

- Integrate all mitigation measures and monitoring requirements of this report and the vegetation report into the EMPr and operational procedures.

In terms of the terrestrial fauna, if the above conditions are met there should be no reason not to authorise the activity.

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1. Introduction & Site Characterisation in Terms of Terrestrial Fauna

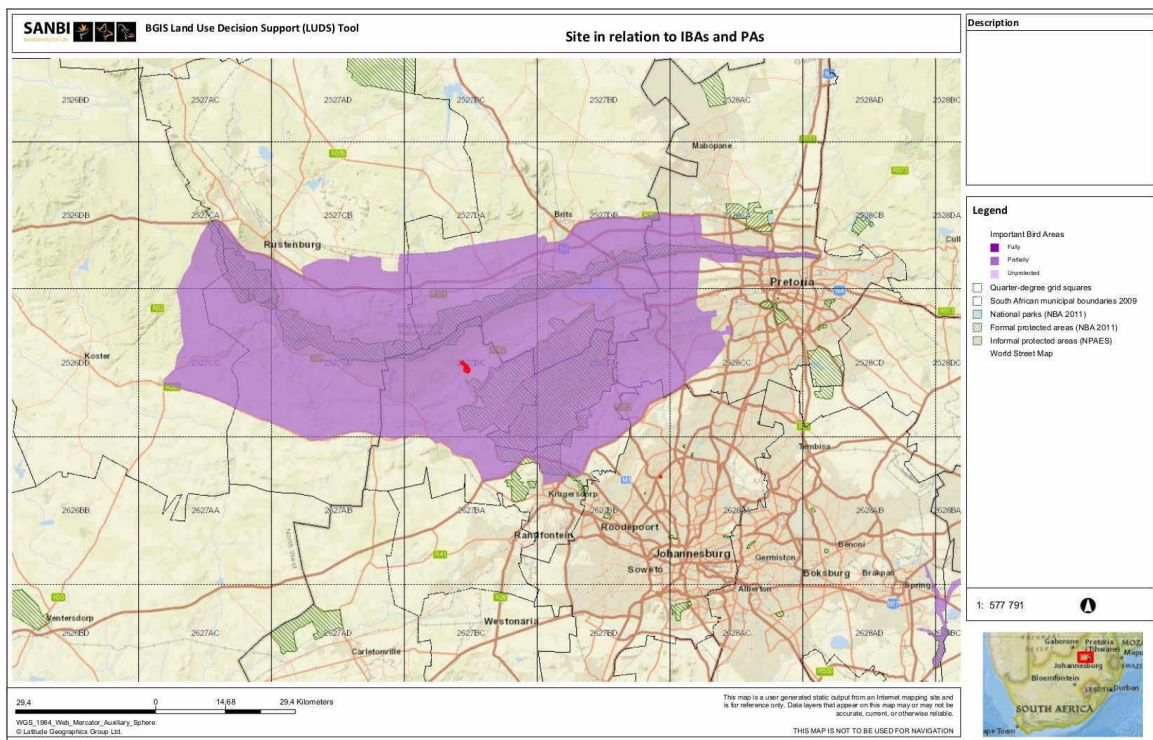
The proposed Hekpoort site occupies an area of approximately 73.37Ha and comprises of Portion 79, Portion 91, Portion 96, Portion 321 and Portion 322 of the Farm Hekpoort 504 JQ. The site lies across the R560, just east of the R563/R560 intersection, in Hekpoort in the greater Magaliesberg area. The site lies within the Mogale City Local Municipality of the West Rand District in the Gauteng Province.

The Hekpoort project proposes mixed-use development comprising of the 50% RDP and 50% Mixed Use (Social Housing and Business Ground Floor), Commercial and Agricultural developments. No specific plan was provided in terms of the proposed development. The development will be serviced by the Mogale City Local Municipality in terms of water, storm water, roads, sewage, electricity and any other required services. Table 1 provides a summary of the desktop assessment of the ecologically significant features relevant to the regional and local context of the site.

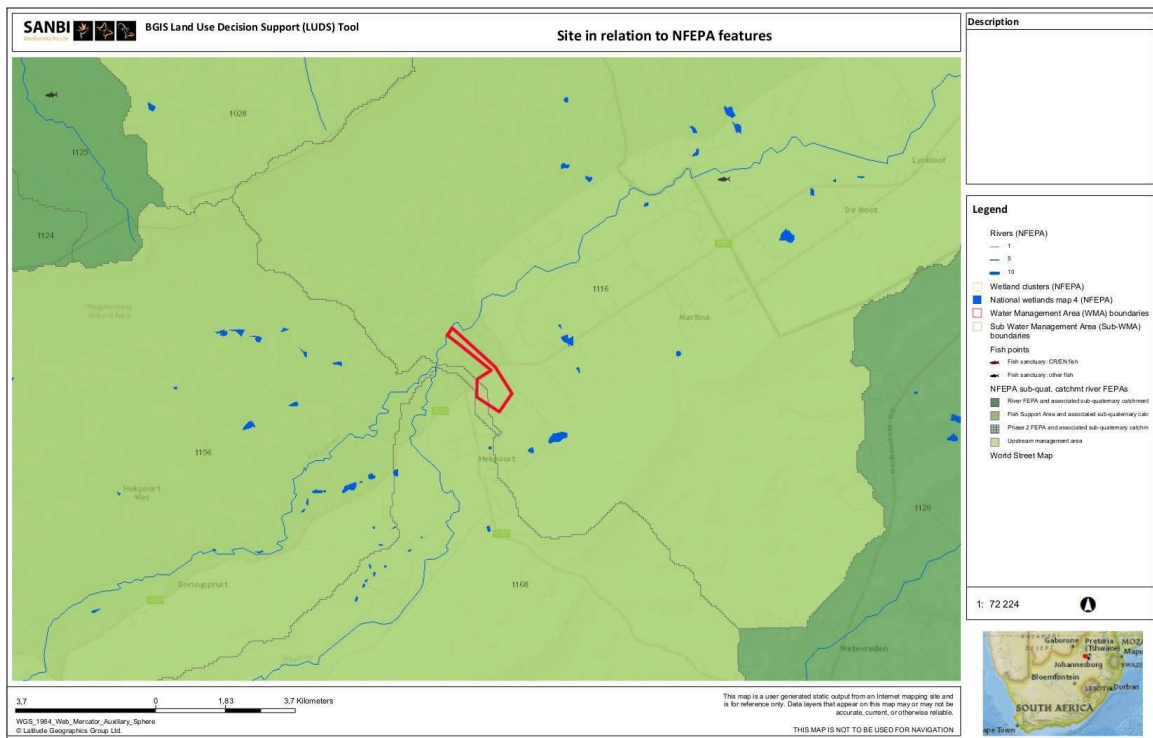
Table 1: Regional and local ecologically significant features relevant to the site (distances are “as the crow flies” approximations)

Ecological feature / area	Description of feature relevant to the site
International Conservation:	The site is within the Magaliesberg Biosphere Transition Zone just adjacent to the Magaliesberg Biosphere Buffer Zone. Activities in the Transition Zone must not harm Core or Buffer Zones of the biosphere. The Cradle of Human Kind is 1.3km south-east of site at its nearest border. No RAMSAR Wetlands occur within 10km of the site
Important Bird Areas (IBAs) (Plan 1)	The site occurs within the Magaliesberg IBA. Globally threatened trigger species include the Cape Vulture and Secretarybird. Regionally threatened species include the Lanner Falcon, Half-collared Kingfisher, African Grass Owl, African Finfoot and Verreauxs’ Eagle. Biome-restricted species include the White-bellied Sunbird, Kurrichane Thrush, White-throated Robin-Chat, Kalahari Scrub Robin and Barred Wren-warbler. Main threats in the IBA include: expansion of commercial, recreational and housing developments removing habitat for ungulates, use of poisons by small-stock farmers, and collisions with man-made structures such as power lines (Marnewick et al., 2015).
Protected Areas (PA) (Plan 1)	The site lies between two protected areas: <ul style="list-style-type: none"> The formally protected Cradle of Humankind World Heritage Site approximately 1.3km south-east of site at its nearest border. The formally protected Magaliesberg Protected Natural Environment approximately 5.7km north of site at its nearest border. No other protected areas or NPAES occur within 10km of site.
Water Catchments & NFEPA Features (Plan 2)	The site is within a National Freshwater Priority Area (NFEPA) Catchment, designated as a fish support area. The Magalies River flows along the far northern boundary and has a RIVCON (C) and a moderately modified PES (C). The river flows north-east towards the Hartebeespoort Dam. No NFEPA Wetlands occur on site, although it is highly likely that wetland areas may be associated with the Magalies River at the far northern boundary. A few scattered NFEPA Wetlands occur approximately 0.9-1.1km south and east of site. All are Rank 6 wetlands and are not considered significant in terms of TOP

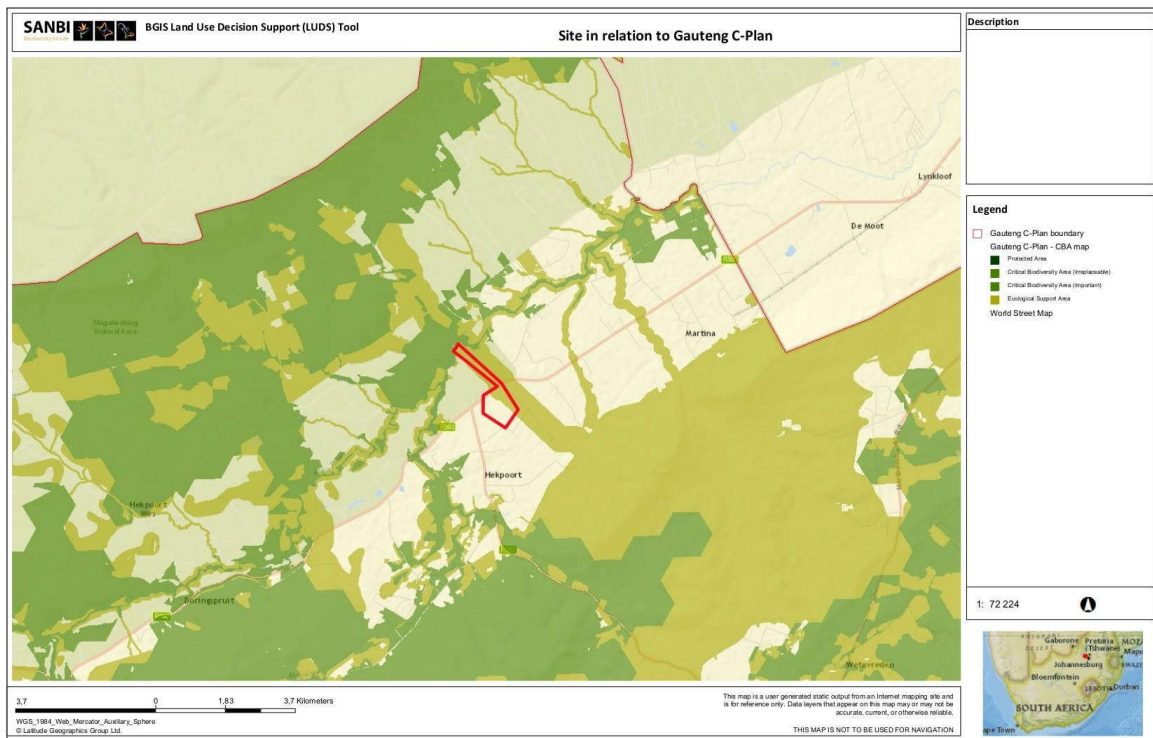
Ecological feature / area	Description of feature relevant to the site
	fauna habitat (frogs and birds).
Strategic Water Source Areas (SWSA)	The site lies between two SWSAs, the Kroondal / Marikana to the north-west and the Westrand Karst Belt to the south-east of site.
Biome and Ecosystem	The area falls within Central Bushveld Bioregion of the Savanna Biome and the Moot Plains Bushveld vegetation type, which is not listed as a threatened ecosystem (NEM:BA, GN1002, 2011).
Gauteng Ridges	The site itself does not overlap Gauteng Ridges but several Class 2 and one Class 1 Ridge surround the property. The nearest Class 2 Ridge lies 640m west of site.
Gauteng C-Plan (Plan 3)	The site incorporates an Ecological Support Area (ESA) which includes ESA buffer area and an ESA corridor. The south-eastern half of the property is not classified in the Gauteng C-Plan. The far northern extent of the property encompasses a small area of an Irreplaceable Critical Biodiversity Area (CBA) which provides habitat for RL mammals and birds. The CBA is also a larger node along a CBA corridor.
Gauteng EMF	The site lies largely within Zone 4: Normal Control Zone, with the northern extent extending into Zone 3: High Control Zone. It must be stressed that the EMF plan utilised had low resolution. The EMF guidelines must be complied with regarding activities within the various zones.
NEMA EIA Regulations Screening tool	No EIA Screening Report was provided at the time of generating this report.
Quarter Degree Grid Square (QDGS)	The site lies within QDGS 2527DC. All desktop data obtained from the citizen science sites have been sourced for this QDGS or relevant Pentad.



Plan 1: Regional setting in relation to Important Bird Areas and Protected Areas (SANBI, BGIS Map Viewers)



Plan 2: Regional setting in relation to National Freshwater Priority Areas (catchments, rivers and wetlands) (SANBI, BGIS Map Viewers)



Plan 3: Local setting in relation to the Gauteng C-Plan (SANBI, BGIS Map Viewers)

1.1 Scope of Work

As per NEMA EIA Regulations (GNR982, 2017) and the requirements of the EIA Screening Tool Protocol for the Assessment and Reporting of Environmental Impacts on Terrestrial Biodiversity (GN648, 2019), the following is relevant regarding the Scope of Work as far as it pertains to this report (considering budget and time restraints):

- Assess and comment on the significance of the terrestrial fauna habitat components and current general conservation status of the property in terms of SANBI BGIS data;
- Generally comment on the likelihood of TOPS and threatened Red-Listed fauna occurring on site.
- Discuss important ecological drivers, processes and services as may be relevant.
- Discuss site sensitivity based on site survey findings.
- Highlight potential risks on terrestrial fauna, with specific focus on ecologically significant species; and
- Provide management recommendations to mitigate negative impacts of the activities on terrestrial fauna assemblages.

1.2 Relevant Legislation

The following Acts govern the environment and development in relation to the environment within South Africa:

- The Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983);
- The Environmental Conservation Act, 1989 (Act No. 73 of 1989);
- The National Environment Management Act, 1998 (Act No. 107 of 1998);
- The National Environmental Management Biodiversity Act, 2004. (Act 10 of 2004);
- The National Environmental Management: Protected Areas Act (Act 57 Of 2003);
- The National Environmental Management: Waste Act [NEM:WA] (Act 59 of 2008);
- The National Environmental Management: Air Quality Act [NEM:AQA] (Act 39 of 2004);
- The National Forests Act, 2006 (Act 84 of 1998 as amended in 2006);
- The National Water Act, 1998 (Act No. 36 of 1998); and
- The Spatial Planning and Land Use Management Act (SPLUMA) (Act 16 of 2013).

NEM:BA and its regulations are of particular importance in terms of the fauna and flora ecosystems.

The principal regulations considered within this report are:

- The National Environmental Management: Biodiversity Act (10/2004): Threatened or Protected Species Regulations. General Notice 152 of the 23/02/2007;
- The National Environmental Management: Biodiversity Act (10/2004): Publication of lists of species that are threatened or protected, activities that are prohibited and exemption from restriction. General Notice 151 of the 23/02/2007;
- The National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Lists. General Notice 864 of 29 July 2016; and
- National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Regulations. General Notice Regulation 598 of 1 August 2014.

The Nature Conservation Ordinance 12 of 1983 as amended by Gauteng General Law Amendment Act 4 of 2005 provides for the regulation of nature conservation within the Gauteng Province. Although this report does not delve into the legislation, any relevant requirements must be complied with regarding the proposed development.

2. Methodology

The desktop assessment utilised predominantly SANBI BGIS data as detailed above, accompanied by Google Earth satellite imagery. This was supplemented by field surveys.

2.1 TOP Species Desktop Lists for the Development Area

This terrestrial fauna report focussed on TOPS. Although the term TOPS or TOP species was coined in terms of the threatened and protected species lists published under NEM:BA's General Notice 151 of 2007 (GN151, 2007), in this report TOPS also includes threatened (Vulnerable, Endangered, Critically Endangered) Red-listed species (supplemented by threatened IUCN threatened species) that are not specifically included in GN151 (2007).

Near Threatened species were not included in the TOPS assessment, except where these species were noted during field surveys. Where a TOPS or Endemic species is listed as Near Threatened for another category, this is indicated as such, but only threatened categories are considered in terms of the desktop assessment.

Threatened Red-Listed species' (Critically Endangered, Endangered and Vulnerable) distribution and general information as presented in this report were sourced for:

- Mammals [sourced from Child, *et al.* (2016) as presented in the mammal Red-list on SANBI.org.za, and the Endangered Wildlife Trust Red-listed mammal fact sheets on ewt.org.za/reddata].
- Birds (Taylor *et al.*, 2015).
- Reptiles (Bates, *et al.*, 2014), although an Atlas Project and not strictly a Red-listed species book, provides recent taxonomic names and more recent listings to the prior outdated Red-Data Book of 1988.
- Frogs [sourced from Minter, *et al.* (2004) as presented in the frog Red-lists on FrogMap.adu.org.za and supplemented by du Preez & Carruthers (2009)].
- Butterflies [Mecenero *et al.* (2013) as obtained from the South African Butterfly Conservation Association lists].
- Dragonflies (Samways & Simaika, 2016).
- Spiders (Dippenaar-Schoeman *et al.*, 2010).

IUCN Red-list species for South Africa (IUCNredlist.org) were consulted for mammals, birds, frogs, reptiles and invertebrates. Any additional threatened species on the IUCN lists were also added to the TOP species lists, and where IUCN categories varied this was presented.

In addition to TOP species, endemic species for mammals, birds (supplemented by Chittenden *et al.*, 2016), reptiles and frogs (supplemented by information on inaturalist.org) were also indicated where relevant. There may be some variation between sources on endemic species (just South Africa or South Africa, Lesotho and Swaziland). In terms of the terrestrial fauna report, this variation is not seen as critical.

Additional sources for fauna distribution and supplementary information were also obtained from various field guides (Stuart & Stuart, 2015; Monadjem *et al.*, 2010a; Monadjem *et al.*, 2010b; Sinclair *et al.*, 2011; Tolley & Burger, 2012; Picker *et al.*, 2012; Woodhall, 2005) as needed. The SANBI Biodiversity Advisor Animal Checklists were consulted for distribution data for invertebrates, specifically the ants, millipedes, Orthoptera, scarabs, scorpions and spiders.

2.2 Survey Area Desktop Species Lists

Terrestrial fauna (mammal, amphibian, reptile & available invertebrate species) lists for the QDGS were collected from the Virtual Museum of the Animal Demographic Unit (VMUS.ADU.org) for the last 10 year period. Pentad (5° x 5° grid square) summaries for birds were obtained from the South African Bird Atlas Project (SABAP2.org). Furthermore, iNaturalist (iNaturalist.org) was also consulted for presences of potential TOPS. These are discussed in the results where relevant.

All TOPS and exotic and / or Alien Invasive (AI) Species (AIS) recorded in the area as per the ADU, SABAP 2 and iNaturalist are discussed in the results where relevant.

2.3 Site Assessments and Site-Specific TOP Species List

Many TOPS are rare or shy and elusive species and may not be observed on site, even with extended periods of surveying. Thus focussed surveys for, and within, preferred habitats / micro-habitats of TOPS was undertaken. This provided info as to whether a TOP species is likely to reside on site for any length of time or likely to just visit or forage over the area or is unlikely to occur on site. The likelihood of a TOPS species occurring within the survey area is further detailed below.

The various sources mentioned above were consulted where needed to assist in identification of species encountered on site. In addition field guides for tracks and signs were used (Murray, 2011; Stuart & Stuart, 2013; Tarboton, 2014).

Although an invertebrate survey did not form part of the scope of work, any invertebrates (with focus on the TOPS families) inadvertently spotted were recorded where possible. The Field Guide to Insects of South Africa (Picker *et al.*, 2012), the Field guide to butterflies of South Africa (Woodhall, 2005) and iNaturalist assisted in species identification which was completed to genus level where possible.

Overall site survey methodology included the following:

- Completing a site assessment, which entailed the following:
 - Completing transects within broad fauna habitat types / significant desktop ecological areas within the sites and recording:
 - Signs of fauna species, including direct sightings, tracks, calls and/or other ecological indicators (scat, dung, nests, egg shells, burrows, feeding signs, skeletal remains, etc.). A sample of rocks and logs, where present, were overturned.
 - Periodic binocular surveys specifically for birds.
 - Any specific habitats or micro-habitats, such as substrate types, water resource types, rocky areas, wooded areas, man-made structures, cliffs, etc. were noted.

- Visual scans for specialist habitat / micro habitat types within the general neighbouring areas where visible / accessible.
- Generating species lists for the survey sites (observed on site, from citizen science sites).

For the TOPS and Endemic species presented in the results, a probability assessment to determine the likelihood of species occurring on site was completed. The probability assessment should be seen as a ranking system rather than an absolute and is designed to reduce subjectivity of results. Likelihood of occurrence was generally assessed as follows:

- **Confirmed:** either through past or current surveys or through sightings, ecological indicators and local knowledge where provided.
- **Highly Likely:** Distribution of the species occurs over the sites and the sites and immediate surrounds provide habitat, roosting and food requirements of the specific species. There is nothing to prevent the species from residing on site for a length of time (season or year).
- **Possible:** Distribution of the species occurs over the sites but the specific habitat, roosting and/or food requirements are absent or sparse on site, but are present in the greater area. Species are not likely to reside on site, but may forage over or traverse the site. Species population is at low density or erratic over site, but habitat and / or foraging areas are present on site and in the immediate surrounds.
- **Unlikely:** Distribution is on the edge of site and habitat, roosting and/or food requirements are absent or sparse in the sites and surrounds. Species population is at low density or erratic over site and habitat and foraging areas are sparse or absent.

2.4 Site Characterisation and Fauna Sensitivity Mapping

General comment is provided on the important features identified during the desktop survey and how applicable they are to the site. In addition any important ecological drivers, processes and services as it relates to terrestrial fauna is discussed in terms of the site.

The site survey findings and likelihood of TOPS species on site informed the fauna sensitivity mapping. Sensitivity mapping considered the following:

- **Areas of high sensitivity:**
 - All streams, rivers and wetlands are deemed highly sensitive environments and are regarded as highly sensitive areas in this report. Ridges, rocky outcrops and rocky hills are also considered highly sensitive environments in terms of fauna. Both habitat types provide unique habitat within the larger terrestrial setting and support Red-listed species. In addition they provide ecological corridors and maintain connectivity between areas that may otherwise become isolated.
 - Any habitats that are in a good condition and that are highly likely to support TOP species or have generally high faunal assemblages were also designated as highly sensitive in terms of fauna, where these are ecologically connected to at least other natural areas.
- **Areas of moderate sensitivity:**
 - Any areas that are in a good condition, but that may not necessarily support TOP species, were considered as moderately sensitive in terms of fauna.
 - Any areas that may be disturbed, but contained some semblance of natural vegetation or habitat / micro-habitat for general fauna were also considered as moderately sensitive

where these provided a buffer between a disturbed area and a highly sensitive area or where these are ecologically connected to at least other natural areas.

- Areas of low sensitivity:
 - Any areas that have been highly disturbed, over-run by AIS, are isolated areas within a developed / disturbed landscape and provide no meaningful use for fauna were designated as areas of low sensitivity in terms of fauna.

A sensitivity plan is presented in the results. This plan must be considered along with the floral and wetland sensitivity maps to obtain an overall biodiversity sensitivity plan.

2.5 Fauna Impact Assessment Report

This report forms the fauna impact assessment report. The impact assessment methodology used is based on NEMA guidelines and is presented under the impact assessment section. The following has been included:

- Impact assessment in terms of the activities / development on terrestrial fauna, including discussion on cumulative and residual impacts where relevant.
- Presentation of mitigation measures for identified impacts. The mitigation actions considered the following:
 - STOP: These are activities that cannot continue until the necessary additional authorisations / legal requirements are obtained / met or the necessary operating procedures are compiled. Also includes activities that are considered fatal flaws where stipulated as such. These **MUST** be implemented.
 - MODIFY: These are development / activity aspects that must be considered for alteration or modification in order to reduce the impact on fauna.
 - CONTROL: These are mitigation actions that must be implemented to reduce the overall impact significance on fauna.
 - REMEDY: These are mitigation measures that focus on remedying impacts that may inadvertently occur on site.
- Terrestrial fauna monitoring plan where this is relevant.
- Concluding remarks and pertinent recommendations.

2.6 Limitations

Specialist studies are conducted to certain levels of confidence, and in all instances known and accepted methodologies have been used and confidence levels are generally high. This means that in most cases the situation described in the report is accurate at high certainty levels, but there exists a low probability that some aspects have not been identified / captured during the studies. Such situations cannot be avoided simply due to the nature of field work.

In terms of the initial proposal, a budget for a Basic Assessment level assessment was submitted. No additional budget was available to complete the S&EIR level assessment. In order to provide for additional reporting time for the S&EIR level assessment, the site survey was reduced to one (1) day and limited to only the riparian area on the north-west boundary. Additional time on site was utilised for visual scans on the remaining property where accessible by car.

In situations where species sampling or sensitive site assessment is conducted (such as is completed for this fauna assessment), it must be understood that time limitation and conditions on site means that not all species can be identified / sites can be discovered during the surveys. Again, as accepted methodologies are used, this is not deemed to be a fatal flaw, but must be considered.

It must be stressed that the survey area is a much smaller area within the larger QDGS and Pentad areas utilised for desktop species, and species presented in these databases may not have been recorded at the specific site.

Rhinos and Elephants have not been evaluated within this report due to sensitivity of information. As these species are largely restricted to reserves and farms this is not seen as a significant omission.

There are inherent errors in mapping programmes which must be considered with all mapping information presented.

Impact assessment is a predictive tool to identify aspects of a development that need to be prevented, altered or controlled in a manner to reduce the impact to the receiving environment, or determine where remediation activities will need to be incorporated into the overall development / activity plan. This does not mean that the impact will occur at the predicted significance.

Citizen Science projects were used for bird (SABAP2) and animal (ADU) baseline data. When utilising data from Citizen Science projects, the following must be kept in mind:

- Public interest in sites may be fickle, and may wane and increase, which could have a direct effect on the number of records available and therefore the number of species recorded.
- Populated areas or popular tourist destinations may have more participants and therefore higher biodiversity data than less populated areas.
- Misidentification of species by the public cannot be excluded, but is not seen as a major problem as this is likely to be a consistent issue from year to year, and a degree of vetting does take place.
- It must also be considered that animals observed in captivity may be recorded by citizens. Such animals should not be considered part of the natural biodiversity but as the data provided by citizen science sites do not make such distinctions, it cannot be separated from the biodiversity data presented in this report.

SANBI's Biodiversity Advisor Animal Checklist website stipulates specifically that the Checklist author and the SANBI website must be cited in order to ensure that the intellectual input of scientists is acknowledged. The Checklist authors and dates of compilation could not be found for the lists consulted and thus only the web-site and name of the list is referenced. The site can be visited for the specific authors of the species discussed in this report.

Due to the low resolution of some distribution maps and the mobility of animals, distribution data utilised to present animal lists are not 100% accurate. Proper distribution data for the TOP invertebrates is scant and difficult to conclusively state if every species occurs in the area.

On this note, the invertebrate list provided is likely to contain many species that will not occur in the area, but due to the lack of specific distribution data, these have been retained as a cautionary approach.

3. Results

The site was surveyed on the 8 January 2020 on a partly cloudy to overcast and warm day and was considered adequate in terms of fauna surveying. The site supports small holdings and associated activities, largely agricultural, and natural areas are largely grasslands and riverine woodlands along the river. Plan 4 indicates the site boundary overlaid onto recent Google Earth imagery (July 2019) and the GPS tracks completed during the site assessment. As requested by the EAP, the survey focused on the riverine area in the northern extent of the property. Due to the fact that the area could only be accessed on foot, most of the site north of the R560 was surveyed fully. The bulk of the property south of the R560 was previously under crop agriculture and only a scan survey was completed to confirm fauna habitat.



Plan 4: Survey areas and GPS tracks

3.1 Site Characterisation as it relates to terrestrial fauna

Table 2 summarises main habitats and micro-habitats noted on site as may be relevant to terrestrial fauna. In general many areas of the property were historically disturbed and under agriculture (crops and pastures).

Table 2: Sites assessed and general characteristics as may be relevant to fauna

Main Habitats	Overall Site Observations
Survey Area – Strip of property north of the R560	
Southern extent	The area is largely impacted by existing farmstead infrastructure, driveways, gardens and subsistence crops. Generalist fauna species, well-adapted to anthropogenic activities and man-modified habitats are most likely to reside in this area.
Central extent 	The bulk of the central extent of the property was being utilised for stock farming (cattle and sheep). The area was dominated by red soil and grassland, with some sparsely wooded areas along the eastern boundary providing arboreal habitats ranging from dense shrubs to isolated trees. The northern half of the area is dominated by milkweed and was being cleared to extend the area for grazing. Many butterflies and other milkweed arthropods were prevalent in the area.
Northern extent 	The area is dominated by the river and riverine woodland which is composed of tall trees including indigenous, exotic and alien invasive species. The area provides dense arboreal habitats for a range of tree-dwelling species and an unidentified owl was startled from the area. The area also encompassed a small tract of grassland between the riverine woodland and a second stretch of trees. The entire width of the area provides a good ecological corridor encompassing grassland and woodland habitat into the existing aquatic riverine corridor. Where visible, the river appeared to contain water although it appeared to have limited flow.
Scan Area – Bulk area south of the R560	
	The bulk of the site is composed of grassland establishing on old agricultural lands. The site therefore provides habitat to grassland specialists and grazers. Arboreal habitats are largely absent from site and limited to a corridor along the R560 and neighbouring areas. The site is composed of red clay to loam soils and could provide adequate habitat for burrowing species. The borders and surrounds are affected by anthropogenic activities associated with agricultural, rural towns and farmsteads and traffic along the neighbouring roads. These activities may prevent shy and sensitive fauna from utilising the site for extensive periods.

3.2 Mammals

Mammals recorded on site, the TOP, endemic and provincially protected mammals occurring in the greater region based on distribution maps and desktop mammals for the QDGS are listed in Table 3. No species were recorded on iNaturalist for the area.

The ADU records for the QDGS are extensive, because the QDGS extends north and encompasses parts of the Magaliesberg Protected Area (Plan 1) and therefore includes a large cross section of undisturbed habitat types. Therefore the full ADU Mammal list is included in Appendix B. Only TOPS and endemic species are included in Table 3.

The ADU included for an unidentified *Mastomys* sp. Both species with distributions on site are included in Appendix B. Furthermore, in terms of the species recorded on the ADU, *Cryptomys hottentotus* and *Genetta tigrina* do not have distribution ranges over the region and have been represented as *Cryptomys pretoriae* and *Genetta genetta*.

3.2.1 Site species

Table 3 lists the species observed on site and those inferred to occur on site from tracks and signs. The only small mammals confirmed for the site include the Mole Rat, most likely the Pretoria Mole-rat (*Cryptomys pretoriae*), inferred from soil mounds, and the Black-backed Jackal (*Canis mesomelas*), inferred from old scat. The following is relevant:

- The endemic Pretoria Mole-rat (*Cryptomys pretoriae*) is considered an eco-engineer, increasing the organic content of soil and aerating soil with their burrow systems. Burrowing could also enhance water infiltration and holding capacity. In addition their burrows are used by other species as refuge from fire. No major threats are identified for the species but it is occasionally persecuted as agricultural, garden and golf-course pest (Bennet *et al.*, 2016).
- The Black-backed Jackal (*Canis mesomelas*) plays a role in predator–prey interactions, regulating prey and small carnivore numbers. They are also vectors of canine diseases. The species is threatened by direct and indirect persecution (Minnie *et al.*, 2016).

3.2.2 Desktop species

From the ADU desktop records, the following TOPS, provincially protected and endemic mammals have been recorded for the QDGS:

- Tsessebe (*Damaliscus lunatus lunatus*) (GN151 Endangered; RL Vulnerable; GP Schedule 2). Main threats to the species include deteriorating habitat quality, unnaturally high competition from other grazers due to high stocking rates, and increase in poaching in some areas. Poaching is an increasing problem in some protected areas, especially as human settlements and density increase along protected area edges (Nel *et al.*, 2016).
- Lion (*Panthera leo*) (GN151, RL and IUCN Vulnerable; GP Schedule 4). The Lion is an apex predator. There are no major threats to Lions in the assessment region. However, human-wildlife conflict and associated persecution may threaten local sub-populations. Other threats include accidental persecution and disease (bovine TB), particularly in inbred and genetically weak species (Miller *et al.*, 2016).
- Leopard (*Panthera pardus*) (GN151 and IUCN Vulnerable; GP Schedule 4). The Leopard is an apex predator and also controls meso-predator numbers. Main threats include direct and

indirect persecution, capture for cultural regalia and trophy hunting. Other significant and localised threats include the injudicious use of radio-collars for research and recreational purpose; sub-adults exhibit rapid growth and collars can asphyxiate individuals collared to young. Species is also susceptible to road collisions (Swanepoel *et al.*, 2016).

- Endemic Black Wildebeest (*Connochaetes gnou*) (GN151 Protected; GP Schedule 2). Species often occurs with other selective short grass grazers resulting in grassland degradation and establishment of homogeneous grazing lawns in higher rainfall areas and areas with poor basal cover in lower rainfall areas. Historical threats included hunting pressure, habitat loss, and periodic outbreak of disease. Species has recovered and numbers are increasing. Current threats are hybridisation with the Blue Wildebeest, habitat fragmentation and isolation of species leading to inbreeding (Vrahimis *et al.*, 2016).
- Brown Hyena (*Parahyaena brunnea*) (GN151 Protected; RL and IUCN Near Threatened; GP Schedule 2). Species is a scavenger and cleans up carrion. As a competitive meso-predator also controls other meso-predator numbers. Main threats to the species include hunting (shot, poisoned, trapped, snared and hunted with dogs) in an attempt to reduce livestock predation events (Yarnell *et al.*, 2016).
- Honey Badger (*Mellivora capensis*) (GN151 Protected). Species could potentially aid in control of rodents and arthropods. Main threats to the species arises from conflict and persecution by bee farmers (Begg *et al.*, 2016).
- Southern Mountain Reedbuck (*Redunca fulvorufula*) (RL and IUCN Endangered; GP Schedule 2). Species is an important prey base for several carnivores. Main threats included expansion of human settlements and associated increase in poaching, disturbance by cattle herders and their livestock, and increased predation levels from higher abundances of meso-predators. Droughts may also affect Southern Mountain Reedbuck as they move down from suitable habitat areas due to a lack of sufficient food resources and to obtain water resources, making them more vulnerable to predation (Taylor *et al.*, 2016a).
- Sable Antelope (*Hippotragus niger niger*) (RL Vulnerable; GP Schedule 2). Sub-population declines expected due to decline in suitable habitat within fenced areas where the animals are constrained from shifting with habitat shifts caused by climate change. Poor habitat management may cause fragmentation and isolation of species (Parrini *et al.*, 2016a).
- Endemic Blesbok (*Damaliscus pygargus phillipsi*) (RL Near Threatened). Main threats included selective breeding and hybridisation (Dalton *et al.*, 2016).
- Hippopotamus (*Hippopotamus amphibius*) (IUCN Vulnerable; GP Schedule 2). Hippos are ecosystem engineers, acting as carbon and nutrient vectors between savanna grassland and aquatic habitats. Main threat is habitat loss and land transformation, particularly with regards to the drainage of associated wetland regions and the expansion of agricultural development onto floodplains. Also threatened by poaching for meat and ivory (Eksteen *et al.*, 2016).
- Giraffe (*Giraffa camelopardalis*) (IUCN Vulnerable; GP Schedule 2). Main threat is habitat fragmentation and degradation, causing population isolation, inbreeding and weakening of the resilience of the population as a whole. Hybridisation of different subspecies may result in loss of the genetic integrity of the SA sub-species (Deacon and Parker, 2016).
- Aardwolf (*Proteles cristata*) (GP Schedule 2). Species provides no significant ecosystem services. There are currently no major threats to Aardwolves; occasional inadvertent victims of problem animal control operations. Loss of habitat, through urbanisation or expansion of industrial agriculture may have negative impacts and species may be vulnerable to future environmental changes caused by global warming, especially if specialist prey is impacted (de Vries *et al.*, 2016).

- Common Eland (*Tragelaphus oryx*) (GP Schedule 2). The Eland facilitates for more selective smaller sized ungulates through their grazing / browsing and also serve as prey for the larger predators. There are no listed threats for this species (Buijs *et al.*, 2016).
- Gemsbok (*Oryx gazella*) (GP Schedule 2). The Gemsbok is a valuable prey species to large predators. No major threats have been identified but minor threats include livestock farming (including habitat degradation from overgrazing and bush encroachment). Climate change leading to loss of resource may become a threat in future (Relton *et al.*, 2016a).
- Red Hartebeest (*Alcelaphus buselaphus caama*) (GP Schedule 2). Poaching is a localised threat to this species. Other ongoing threats include habitat loss, fragmentation and degradation, hybridisation with other Hartebeest, Blesbok, Bontebok and Tsetsebe. Climate change may affect western populations into the future (Venter *et al.*, 2016).
- Klipspringer (*Oreotragus oreotragus*) (GP Schedule 2). No major threats have been identified but minor threats include subsistence hunting, resource competition with domestic goats and climate change leading to loss of resource may become a threat in future (Birss *et al.*, 2016).
- Nyala (*Tragelaphus angasi*) (GP Schedule 2). Nyala can be useful as browsers to contain bush encroachment. No major threats have been identified but minor threats include reduced habitat due to human settlement and poaching for bushmeat (Relton *et al.*, 2016b).
- Waterbuck (*Kobus ellipsiprymnus*) (GP Schedule 2). The Waterbuck is a valuable prey species for large carnivores. Globally, Waterbuck have declined due to hunting. Locally. The species are well protected with local declines due to poaching and drought which changes habitat quality and forage availability; climate change may threaten species in the future (Parrini *et al.*, 2016b).
- Endemic Xeric Four-striped Grass Mouse (*Rhabdomys pumilio*). Ecologically, the species is important prey for diurnal raptors, snakes and small mammals as they are one of few diurnal rodents. They are also pollinators in fynbos habitats. Species faces no current major threats but may be susceptible to range declines or shifts due to climate change (Du Toit *et al.*, 2016).
- Possible endemic Tete Veld Rat (*Aethomys ineptus*). Species are considered seed dispersers and prey base for carnivores and raptors. Species faces no major threats (Linzey *et al.*, 2016).

Other ADU species will contribute to the following ecosystem services:

- Controlling or regulating potential pest species (rodents, AIS birds).
- Suppress or control predator numbers.
- Prey base for carnivores / raptors.
- Pioneer species – first to utilise disturbed habitats and commence with nutrient recycling.
- Contributes to prevention and control of bush encroachment.
- Ecosystem engineers.
- May contribute to controlling insect populations, and could play important role in agricultural pest control.
- Seed dispersers.
- Pollinators.
- Vectors of disease / pests.

Other TOP, provincially protected and endemic species likely on site include:

- Black-footed Cat (*Felis nigripes*) (GN151 Protected; RL and IUCN Vulnerable). With other small to medium sized carnivore species, it is likely to play a role in controlling rodent and other small mammal population numbers. Main threats include intra-guild predation,

diseases, habitat degradation that results in the loss of key resources (Springhare dens and prey base) and unsuitable farming practices. Occurrence is highly fragmented and patchy, which may have resulted in island sub-populations resulting in limited dispersal opportunities and restricting genetic exchange. Also lost through indirect persecution (Wilson *et al.*, 2016).

- Southern African Hedgehog (*Atelerix frontalis*) (GN151 Protected; RL Near Threatened; GP Schedule 2). Species plays a role in invertebrate pest control. Main threats include habitat loss, degradation and fragmentation from urban sprawl and agriculture. Also threatened by illegal harvesting from the wild for food, or for sale as pets and traditional medicine (Light *et al.*, 2016).
- Serval (*Leptailurus serval*) (GN151 Protected; RL Near Threatened). Servals may play a functional role in agricultural landscapes in controlling the numbers of pest species, specifically rodents and invertebrates. Main threats include loss and degradation of wetlands and associated grasslands. Wetlands generally harbour high rodent densities compared with other habitat types, and form the core areas of Serval home ranges; disruption to such habitats reduces prey-base (Ramesh *et al.*, 2016).
- Southern Reedbuck (*Redunca arundinum*) (GN151 Protected; GP Schedule 2). Species provides no significant ecosystem services. Main threats included habitat transformation and degradation associated with agricultural activities and spread of settlements. On agricultural land, they are subjected to possible persecution due to damage to pastures and crops. Also susceptible to hunting, snaring and poaching (du Plessis *et al.*, 2016).
- Cape Fox (*Vulpes chama*) (GN151 Protected). The Cape Fox is a significant predator of rodents. Along with other large burrowing species (Aardvark, Porcupine, Bat-eared Fox), the Cape Fox digs holes which create micro-sites where detritus and water accumulate and seed germination is significantly increased, promoting habitat structure. Main threats include hunting, poisoning (direct and also indirect through agricultural chemicals) and are also caught in traps for other species. Species is also affected by road mortalities (Kamler *et al.*, 2016).
- Percival's (Short-eared) Trident Bat (*Cloeotis percivali*) (RL Endangered). Species provides no significant ecosystem services, but as an insectivore will contribute cumulatively to control of insect numbers. Main threat includes mining (both legal and illegal). Species is highly sensitive to roost disturbance and regular roost disturbance may lead to abandonment or dissuade breeding (Balona *et al.*, 2016).
- Steenbok (*Raphicerus campestris*) (GP Schedule 2). Species may contribute to seed dispersal as the species is known to eat fruit and pods. The Steenbok is also an important prey species for carnivores. No major threats to the species, but minor threats include subsistence hunting, range restriction through erection of fences, and loss of habitat through poor ranch management (Palmer *et al.*, 2016).
- Southern Lesser Galago (*Galago moholi*) (GP Schedule 2). Species may contribute to pollination of gum / resin trees and possibly contribute to control of insect populations. No major threats to the species, but minor threats include habitat fragmentation which leads to isolated populations and inbreeding. Also potentially threatened by poaching for bushmeat, muti and pet trade (Masters *et al.*, 2016).
- Aardvark (*Orycteropus afer*) (GP Schedule 2). The Aardvark is a keystone species in grasslands where its burrows create a micro-habitat which facilitates the existence of many other vertebrates, including the threatened Blue Swallow. No known major threats to the species, but local declines are likely due to cumulative impacts of habitat loss from agricultural and human settlement expansion and associated subsistence hunting and persecution. Climate change may present an emerging threat (Taylor *et al.*, 2016b).

- Endemic Forest Shrew (*Myosorex varius*). Species is Important prey for the Barn Owl, Water Mongoose, African Striped Weasel and Striped Polecat. Main threats include loss or degradation of moist, productive areas such as wetlands and rank grasslands within suitable habitat. Climate change also seen as threat to the species (Taylor *et al.*, 2016c).

In terms of the TOP mammals, the QDGS does support a few TOP species, but the property is likely to support less on a permanent basis and this is likely to be concentrated in the north-western strip of the property where the riverine and wetland habitats are more in tact and the surrounding anthropogenic activities are limited. The remainder of the property is more impacted by anthropogenic activities associated with the existing developments around the roads and the existing townships. Therefore the remainder of the property is more likely to provide ecological connectivity and foraging areas to TOPS rather than permanent refuge. Although endemic species were recorded and are likely to occur on the property, none are restricted species and the area is not seen as a significant area in terms of mammal endemism.

No exotic or AIS were recorded for the QDGS on the ADU data.

Table 3: TOP and Endemic Mammals

Common name	Taxon name	Endemism	SA GN151 Status	SA Red-list Status	GP Nature Conservation Ordinance Schedule	IUCN Status
Species confirmed on site (species sighted indicated in bold – remainder inferred from tracks and signs)						
Mole-rat, Pretoria	<i>Cryptomys pretoriae</i>	Endemic				
Jackal, Black-backed	<i>Canis mesomelas</i>					
TOP Species confirmed for the QDGS (ADU)						
Tsessebe	<i>Damaliscus lunatus lunatus</i>		Endangered	Vulnerable	2: Protected Game	
Leopard	<i>Panthera pardus</i>		Vulnerable	Vulnerable	4: Protected Wild Animals	Vulnerable
Lion	<i>Panthera leo</i>		Vulnerable		4: Protected Wild Animals	Vulnerable
Wildebeest, Black	<i>Connochaetes gnou</i>	Endemic	Protected		2: Protected Game	
Hyaena, Brown	<i>Parahyaena brunnea</i>		Protected	NT	2: Protected Game	NT
Honey Badger (Ratel)	<i>Mellivora capensis</i>		Protected			
Reedbuck, Southern Mountain	<i>Redunca fulvorufula</i>			Endangered	2: Protected Game	Endangered
Antelope, Sable	<i>Hippotragus niger niger</i>			Vulnerable	2: Protected Game	
Blesbok	<i>Damaliscus pygargus phillipsi</i>	Endemic		NT		
Hippopotamus	<i>Hippopotamus amphibius</i>				2: Protected Game	Vulnerable
Giraffe	<i>Giraffa camelopardalis</i>				2: Protected Game	Vulnerable
Aardwolf	<i>Proteles cristata</i>				2: Protected Game	
Eland, Common	<i>Tragelaphus (Taurotragus) oryx</i>				2: Protected Game	
Gemsbok (Southern Oryx)	<i>Oryx gazella</i>				2: Protected Game	
Hartebeest, Red	<i>Alcelaphus buselaphus caama</i>				2: Protected Game	
Klipspringer	<i>Oreotragus oreotragus</i>				2: Protected Game	
Nyala	<i>Tragelaphus angasi</i>				2: Protected Game	
Waterbuck	<i>Kobus ellipsiprymnus</i>				2: Protected Game	
Mole-rat, Pretoria	<i>Cryptomys pretoriae</i>	Endemic				
Mouse, Xeric Four-striped Grass	<i>Rhabdomys pumilio</i>	Endemic				
Rat, Tete Veld	<i>Aethomys ineptus</i>	Possible endemic				
TOP species Likely to occur in the natural landscape associated with the site						

Common name	Taxon name	Endemism	SA GN151 Status	SA Red-list Status	GP Nature Conservation Ordinance Schedule	IUCN Status
Cat, Small Spotted (Black-footed)	<i>Felis nigripes</i>		Protected	Vulnerable		Vulnerable
Hedgehog, Southern African	<i>Atelerix frontalis</i>		Protected	NT	2: Protected Game	
Serval	<i>Leptailurus serval</i>		Protected	NT		
Reedbuck, Southern	<i>Redunca arundinum</i>		Protected		2: Protected Game	
Fox, Cape	<i>Vulpes chama</i>		Protected			
Bat, Percival's (Short-eared) Trident	<i>Cloeotis percivali</i>			Endangered		
Steenbok	<i>Raphicerus campestris</i>				2: Protected Game	
Aardvark	<i>Orycteropus afer</i>				2: Protected Game	
Galago, Southern Lesser	<i>Galago moholi</i>				2: Protected Game	
Shrew, Forest	<i>Myosorex varius</i>	Endemic				
Possible TOPS: Habitat requirements limited in the area; Species may traverse or periodically forage in area; Low / erratic density in area						
Otter, Spotted-necked	<i>Hydriclis maculicollis</i>		Protected	Vulnerable		NT
Rat, Robert's Marsh	<i>Dasymys robertsii</i>			Vulnerable		
Rhebok, Grey	<i>Pelea capreolus</i>	Endemic		NT	2: Protected Game	NT
Unlikely TOPS: Edge of the species' distribution range; Preferred habitat is not available within the surrounding natural landscape; No recent records						
Mouse (Rat), White-tailed	<i>Mystromys albicaudatus</i>			Vulnerable		Endangered
Buffalo, African Savanna	<i>Syncerus caffer</i>				4: Protected Wild Animals	
AIS / Exotic Species recorded in the area						
None						

NT: Near Threatened

3.3 Birds

Birds recorded on site and the TOP and endemic birds occurring in the greater region based on distribution maps and SABAP2 data are listed in Table 4. The full SABAP2 bird list is provided in Appendix C. No species were recorded on iNaturalist for the area.

Gauteng lists several indigenous birds as Schedule 2: Protected game species and the list is too extensive to represent here. The proposed development does not intend any specific scheduled activities involving birds, but the legislation must be consulted and complied with should any bird species need to be handled under any circumstances.

3.3.1 Site species

The birds observed on site are indicated in Table 4, and most of the species are Schedule 2: Protected Game under the Gauteng Nature Conservation Ordinance. It must be stressed that the list underestimates the birds on site judging by the variety of calls on site. Many birds were well-concealed in the foliage of trees and tall grasses and shrubs and could not be adequately identified. Of the birds observed on site, the following TOP species was noted:

- Cape Vulture (*Gyps coprotheres*) (GN151, RL and IUC Endangered). Species is more likely to reside in the cliffs associated with the Magaliesberg, but will forage and traverse neighbouring areas. Species feeds on large carrion and is important in terms of clearing carrion and recycling nutrients. Main threats include contamination of food supply, negative interactions with humans and human infrastructure (electrocutions, collisions with overhead lines and fences, wind-farms, sheer/concrete-walled reservoirs) and demand for traditional health industry. Species is also threatened by reduction in large carrion food and disruption at breeding sites (Taylor *et al.*, 2015).

Ecological services that may be provided by other birds observed on site include:

- Insectivorous species will cumulatively play a role in regulating invertebrate numbers and could also prevent outbreaks and swarms.
 - Dark-capped Bulbul (*Pycnonotus tricolor*), Wing-snapping Cisticola (*Cisticola ayresii*), Cape Turtle Dove (*Streptopelia capicola*), Red-winged Francolin (*Scleroptila levaillantii*), Hadedda Ibis (*Bostrychia hagedash*), Crowned Lapwing (*Vanellus coronatus*), Common House Martin (*Delichon urbicum*), Southern Masked-weaver (*Ploceus velatus*), African Pipit (*Anthus cinnamomeus*), Red-backed Shrike (*Lanius collurio*), Lesser Striped Swallow (*Hirundo abyssinica*) and White-winged Widowbird (*Euplectes albonotatus*).
- Fruit and seed eaters will play a role in dispersal of seeds.
 - Dark-capped Bulbul (*Pycnonotus tricolor*), Cape Turtle Dove (*Streptopelia capicola*), Southern Masked-weaver (*Ploceus velatus*), Lesser Striped Swallow (*Hirundo abyssinica*) and White-winged Widowbird (*Euplectes albonotatus*).
- Flower and nectar feeders will play a role in pollination.
 - Dark-capped Bulbul (*Pycnonotus tricolor*), Southern Masked-weaver (*Ploceus velatus*) and White-winged Widowbird (*Euplectes albonotatus*).

3.3.2 Desktop species

The SABAP2 pentad extends north and encompasses parts of the Magaliesberg Protected Area and therefore includes a large cross section of undisturbed habitat types. Not all the species listed on the SABAP2 list will therefore occur on the specific site and immediate surrounds.

The SABAP2 desktop records include the following TOP and endemic birds for the Pentad:

- Black Stork (*Ciconia nigra*) (GN151 and RL Vulnerable). Species is more likely to be associated with the foraging in the riverine area on the property boundary. Species feeds on fish, other small vertebrates, insects and snails and will contribute to control of invertebrate populations, particularly aquatic invertebrates and possibly AIS fish. Main threats include degradation of wetlands, damming of small rivers, collisions with overhead-lines and persecution by fish farmers (Taylor *et al.*, 2015).
- Yellow-billed Stork (*Mycteria ibis*) (RL Endangered). Species is more likely to be associated with the riverine area on the property boundary. Species feeds on fish, frogs, insects, worms and crustaceans and may contribute to control of aquatic invertebrate populations and possibly AIS fish. Main threats include loss of wetland habitats, including wetland systems of pans, marshes and floodplains, and loss of suitable trees for roosting / nesting (Taylor *et al.*, 2015).
- Verreaux's Eagle (*Aquila verreauxii*) (RL Vulnerable). Species is more likely to reside in the cliffs associated with the Magaliesberg, but will forage and traverse neighbouring areas. Species feeds predominantly on Hyraxes, but also mammals, birds and reptiles and will play a role in controlling Hyrax populations and possibly to a limited extent small mammal populations. Threats to the species include persecution by stock farmers, decrease in Hyrax populations through hunting and urbanisation, drowning in reservoirs, collisions with power-lines and wind-farms (Taylor *et al.*, 2015).
- African Finfoot (*Podica senegalensis*) (RL Vulnerable). Species is more likely to be associated with riverine areas, which occurs only on the north-west property boundary. Species feeds on frogs and invertebrates and may contribute to control of aquatic invertebrate populations. Threats to the species include reduction of water flow in its habitat due to afforestation, damming, water extraction, degradation and clearing of riverine vegetation and increased silt and salt load into rivers through erosion. Species is also threatened by pesticide poisoning through its prey, increased human settlement, cultivation along rivers and drought. Species is also used in traditional health trade (Taylor *et al.*, 2015).
- White-backed Night Heron (*Gorsachius leuconotus*) (RL Vulnerable). Species is more likely to be associated with riverine areas, which occurs only on the north-west property boundary. Species feeds on crustaceans, insects, small frogs and fish and may contribute to control of aquatic invertebrate populations and AIS fish. Threats to the species include degradation and clearance of sensitive riverbank habitats and activities that alter water flow, sediment loads and chemistry, such as impoundments. Unnatural rises in water levels may destroy nests (Taylor *et al.*, 2015).
- Endemic African Pied Starling (*Spreo bicolor*). Species feeds on insects, fruit and aloe nectar and will act as pollinator for aloes and also as a seed disperser. May also cumulatively contribute to control of insect populations (Taylor *et al.*, 2015).
- Endemic Cape Weaver (*Ploceus capensis*). Species feeds on insects, fruit, nectar and pollen and will act as pollinator and also as a seed disperser. May also cumulatively contribute to control of insect populations (Taylor *et al.*, 2015).
- Endemic Cape White-eye (*Zosterops virens*). Species feeds on insects, fruit and nectar and will act as pollinator and also as a seed disperser. May also cumulatively contribute to control of insect populations (Taylor *et al.*, 2015).

Other SABAP2 desktop species provide the following ecological services:

- Insectivores. Although individually a species may not significantly control invertebrates, cumulatively a variety of invertebrate feeders will play a role in regulating invertebrate numbers and could also prevent outbreaks and swarms and could control invertebrate disease vectors.
- Control of small animals, including birds and potential pests. Species hunting such prey will play a role in regulating small mammal populations and could also play a role in regulating AIS avifauna and fish.
- Fruit and seed eaters play a role in dispersal of seeds.
- Nectar feeders and flower feeders will contribute to pollination.

The following TOP and endemic birds are also highly likely to occur on site:

- Blue Crane (*Anthropoides paradiseus*) (GN151 Endangered; RL Near Threatened; IUCN Vulnerable). The species feeds on bulbs, seeds, roots, maize seedlings, invertebrates and various small mammals. Therefore the species will contribute to seed dispersal and together with other insectivorous species will play a role in regulating invertebrate numbers. Main threats include loss of grassland to afforestation, development, mining and agriculture. Also susceptible to collisions with overhead lines (Taylor *et al.*, 2015).
- African Grass Owl (*Falco naumanni*) (GN151 and RL Vulnerable). Although wetland habitats appear to be limited to the north-west boundary, rank grasslands do occur on the property near the river and do provide limited Grass Owl habitat. The species feeds primarily on large vlei rats and other rodents and also birds and insects. Principally, the species will aid in control of rodent populations. Main threats include loss and degradation of grassland and wetland habitat through afforestation, mining, urban development, and agriculture. Also impacted by disruption to nesting sites and eggs (Taylor *et al.*, 2015).
- Lesser Kestrel (*Falco naumanni*) (GN151 Vulnerable). The species is an insectivore and together with other insectivorous species will play a role in regulating insect numbers. Mainly faces threats in Europe and Asia, but also threatened by control of insects through pesticides, felling of tall trees and collisions with vehicles (Taylor *et al.*, 2015).
- Secretarybird (*Sagittarius serpentarius*) (RL and IUCN Vulnerable). The species is an insectivore and also eats small vertebrates and together with other species of similar diets will play a role in regulating insect and small mammal numbers. Main threats include loss and degradation of grassland habitat through poor grazing and fire management, bush encroachment, urban development and agriculture. Also threatened by trade, hunting and nest raiding, collisions with power-lines, drowning in sheer-walled reservoirs and wind-farms. (Taylor *et al.*, 2015).
- White-bellied Korhaan (*Eupodotis senegalensis*) (RL Vulnerable). Main threats include loss and degradation of grassland habitat due to agriculture, afforestation, AIS infestation, urban development and unsuitable burning practices. Also threatened by subsistence hunting and poaching (Taylor *et al.*, 2015).
- European Turtle Dove (*Streptopelia turtur*) (IUCN Vulnerable). As a seed eater the species will play a role in seed dispersal. No threats identified for this vagrant species in South Africa.
- Endemic South African Cliff Swallow (*Hirundo spilodera*). As an insectivore, species will cumulatively contribute to control of insect populations.
- Endemic Greater Double-collared Sunbird (*Cinnyris afer*). Species feeds on nectar and also insects and spiders. Species is a pollinator.

In terms of the TOP birds, the pentad has limited confirmed species and a few species are likely on the property, largely the riverine and associated wetland specialists. More may utilise the area for

foraging. TOP bird biodiversity can be considered limited on the property. Although endemic species were recorded and are likely to occur on the property, none are restricted species and the area is not seen as a significant area in terms of avifauna endemism.

One Category 2 and three Category 3 invasive species (GN864, 2016) were recorded for the Pentad (SABAP2). Also two exotic species were recorded for the pentad. None were noted on site. These are common species, occurring throughout South Africa and associated with human settlements and are highly likely to occur in the development footprint.

Table 4: TOP and Endemic Birds

Common name	Taxon name	Endemism	SA GN151 Status	SA Red-list Status	IUCN Status
Species confirmed on site (species sighted indicated in bold – remainder inferred from tracks and signs)					
Vulture, Cape	<i>Gyps coprotheres</i>		Endangered	Endangered	Endangered
Bulbul, Dark-capped	<i>Pycnonotus tricolor</i>				
Cisticola, Wing-snapping	<i>Cisticola ayresii</i>				
Crow, Pied	<i>Corvus albus</i>				
Dove, Cape Turtle (Ring-necked)	<i>Streptopelia capicola</i>				
Fish-eagle, African	<i>Haliaeetus vocifer</i>				
Francolin, Red-winged	<i>Scleroptila levaillantii</i>				
Ibis, Hadedda	<i>Bostrychia hagedash</i>				
Lapwing, Crowned	<i>Vanellus coronatus</i>				
Martin, Common House	<i>Delichon urbicum</i>				
Masked-weaver, Southern	<i>Ploceus velatus</i>				
Pipit, African	<i>Anthus cinnamomeus</i>				
Shrike, Red-backed	<i>Lanius collurio</i>				
Swallow, Lesser Striped	<i>Hirundo (Cecropis) abyssinica</i>				
Widowbird, White-winged	<i>Euplectes albonotatus</i>				
Species confirmed for the QDGS (SABAP2)					
Stork, Black	<i>Ciconia nigra</i>		Vulnerable	Vulnerable	
Stork, Yellow-billed	<i>Mycteria ibis</i>			Endangered	
Eagle, Verreaux's	<i>Aquila verreauxii</i>			Vulnerable	
Finfoot, African	<i>Podica senegalensis</i>			Vulnerable	
Heron, White-backed Night	<i>Gorsachius leuconotus</i>			Vulnerable	
Starling, African Pied	<i>Spreo (Lamprotornis) bicolor</i>	Endemic			
Weaver, Cape	<i>Ploceus capensis</i>	Endemic			
White-eye, Cape	<i>Zosterops virens</i>	Endemic			
TOP species Likely to occur in the natural landscape associated with the site					

Common name	Taxon name	Endemism	SA GN151 Status	SA Red-list Status	IUCN Status
Crane, Blue	<i>Anthropoides paradiseus</i>	Endemic	Endangered	NT	Vulnerable
Owl, African Grass	<i>Tyto capensis</i>		Vulnerable	Vulnerable	
Kestrel, Lesser	<i>Falco naumanni</i>		Vulnerable		
Secretarybird	<i>Sagittarius serpentarius</i>			Vulnerable	Vulnerable
Korhaan, White-bellied	<i>Eupodotis senegalensis</i>			Vulnerable	
Dove, European Turtle	<i>Streptopelia turtur</i>				Vulnerable
Swallow, South African Cliff	<i>Hirundo (Petrochelidon) spilodera</i>	Breeding Endemic			
Sunbird, Greater Double-collared	<i>Cinnyris afer</i>	Endemic			
Possible TOPS: Habitat requirements limited in the area; Species may traverse or periodically forage in area; Low / erratic density in area					
Pelican, Pink-backed	<i>Pelecanus rufescens</i>		Endangered	Vulnerable	
Harrier, African Marsh	<i>Circus ranivorus</i>		Protected	Endangered	
Eagle, Martial	<i>Polmaetus bellicosus</i>		Vulnerable	Endangered	Vulnerable
Eagle, Tawny	<i>Aquila rapax</i>		Vulnerable	Endangered	Vulnerable
Falcon, Peregrine	<i>Falco peregrinus</i>		Vulnerable		
Vulture, White-backed	<i>Gyps africanus</i>			Critically Endangered	Critically Endangered
Falcon, Lanner	<i>Falco biarmicus</i>			Vulnerable	
Pelican, Great White	<i>Pelecanus onocrotalus</i>			Vulnerable	
Tern, Caspian	<i>Sterna (Hydroprogne) caspia</i>			Vulnerable	
Duck, Maccoa	<i>Oxyura maccoa</i>			NT	Vulnerable
Eagle, Steppe	<i>Aquila nipalensis</i>				Endangered
Thrush, Cape Rock	<i>Monticola rupestris</i>	Endemic			
Lark, Eastern Long-billed	<i>Certhilauda semitorquata</i>	Endemic			
Unlikely TOPS: Edge of the species' distribution range; Preferred habitat is not available within the surrounding natural landscape; No recent records					
Harrier, Black	<i>Circus maurus</i>			Endangered	Endangered
AIS / Exotic Species recorded in the area					
Duck, Mallard	<i>Anas platyrhynchos</i>	Category 2#			
Mynah, Common	<i>Acridotheres tristis</i>	Category 3#			
Dove / Pigeon, Rock	<i>Columa livia</i>	Category 3#			

Common name	Taxon name	Endemism	SA GN151 Status	SA Red-list Status	IUCN Status
Sparrow, House	<i>Passer domesticus</i>	Category 3#			
Goose, Greylag (Domestic)	<i>Anser anser</i>	Exotic			
Peacock, Common	<i>Pavo cristatus</i>	Exotic			

NT: Near Threatened

GN864 of 2016, South African AIS List

3.4 Herpetofauna

Herpetofauna recorded on site and the TOP and endemic herpetofauna occurring in the greater region based on distribution maps and ADU data are listed in Table 5. No species were recorded for the area on iNaturalist.

Gauteng lists most indigenous reptiles (excluding most snakes) as Schedule 2: Protected game species and the list is too extensive to represent here. The proposed development does not intend any specific scheduled activities involving reptiles, but the legislation must be consulted and complied with should any species need to be handled under any circumstances.

In terms of frogs, only the Giant Bullfrog (*Pyxicephalus adspersus*) is listed as a Schedule 2: Protected game species.

3.4.1 Site species

Despite cautious approaches toward appropriate habitat and active searching under logs, no herpetofauna was observed on site.

3.4.2 Desktop species

The QDGS extends north and encompasses parts of the Magaliesberg Protected Area (Plan 1) and therefore includes a large cross section of undisturbed habitat types. Not all the species listed on the ADU list will therefore occur on the specific site.

TOP and Endemic herpetofauna recorded for the QDGS include:

- Southern African Python (*Python natalensis*) (GN151 Protected). Threats include habitat transformation and hunting for the pet trade.
- Lobatse Hinged-back Tortoise (*Kinixys lobatsiana*) (IUCN Vulnerable). Species is considered widespread and under no threat in South Africa. The IUCN lists residential and commercial development, non-timber crop agriculture, mining and quarrying, hunting and trapping and alien species diseases as potential threats.
- Endemic Common Crag Lizard (*Pseudocordylus melanotus melanotus*).
- Endemic Transvaal Thick-toed Gecko (*Pachydactylus affinis*).
- Endemic Western Natal Green Snake (*Philothamnus natalensis occidentalis*).
- Giant Bullfrog (*Pyxicephalus adspersus*) (GN151 Protected, RL Near Threatened). Main threats include habitat loss and degradation.
- Endemic Raucous Toad (*Amietophrynus rangeri*).

The following TOP and endemic species are likely to occur on site:

- Endemic Coppery Grass Lizard (*Chamaesaura aenea*) (RL Near Threatened). Threatened by habitat loss due to the transformation of the Grassland Biome by various agricultural and infrastructural developments.
- Endemic Striped Harlequin Snake (*Homoroselaps dorsalis*) (RL Near Threatened). Threatened by habitat loss, degradation and fragmentation of habitat, primarily due to afforestation and

poor fire management practices and also urban, mining, industrial and agricultural developments.

- Endemic Eastern Ground Agama (*Agama aculeata distantii*).
- Endemic Spotted Dwarf Gecko (*Lygodactylus ocellatus ocellatus*).
- Endemic Delalande's Sandveld Lizard (*Nucras lalandii*).
- Endemic Aurora House Snake (*Lamprophis aurora*).
- Endemic Spotted Harlequin Snake (*Homoroselaps lacteus*).

Almost all the herpetofauna species above feed on arthropods and will cumulatively contribute to control of invertebrate numbers. Many reptiles are also food source to many birds and mammals, as well as other reptile species.

No significant TOP herpetofauna populations are expected on the property. None of the endemic species are restricted and the areas is not considered significant in terms of herpetofauna endemism.

No AIS or exotic species were identified from ADU lists or iNaturalist.

3.5 Invertebrates

A summary of TOP and provincially protected invertebrates with distribution ranges over and near the survey area are included in Table 6, with ADU desktop species indicated in bold. It must be stressed that the distribution of many species listed are unknown and it is very possible that these species do not occur in the area and possibly the province (these are indicated as such). They have been included as a cautionary measure. In terms of this, no likelihood of occurrence has been completed for invertebrates. Furthermore, in many instances, entire Genera are listed. In this case only the Genus is indicated.

Although a specific invertebrate assessment was not completed, note was taken of species observed on site. The area could be considered rich in invertebrate life as the site supports several insectivores. Various Hemiptera, Diptera, Hymenoptera, Isoptera, Orthoptera, Lepidoptera, Diplopoda and Araneae were noted on site. Specifically the following was noted:

- Lepidoptera: African Monarch (*Danaus chrysippus aegyptius*), Forest White (*Belenois zochalia zochalia*) and Grass Yellow (*Eurema* sp.).
- Diptera: Bee Fly (*Exoprosopa* sp.).
- Isoptera: Harvester Termite (*Hodotermes mossambicus*).
- Coleoptera: Milkweed Leaf Beetle (*Platycorynus dejeani*), Net-winged beetles (*Lycus* sp.) and dung beetles (*Garreta* sp. and unknown sp.).

Although none were observed, the cryptic and often nocturnal nature of Baboon Spiders and TOP scorpions means these species cannot be excluded from site, although good habitat was not noted on site for these species.

Table 5: TOP and Endemic Herpetofauna

Common name	Taxon name	Endemism	SA GN151 Status	SA Red-list Status	IUCN Status
Species confirmed on site (species sighted indicated in bold – remainder inferred from tracks and signs)					
None					
Species confirmed for the QDGS (ADU)					
Python, Southern African	<i>Python natalensis</i>		Protected		
Tortoise, Lobatse Hinged-back	<i>Kinixys lobatsiana</i>				Vulnerable
Gecko, Transvaal Thick-toed	<i>Pachydactylus affinis</i>	Endemic			
Lizard, Common Crag	<i>Pseudocordylus melanotus melanotus</i>	Endemic			
Snake, Western Natal Green	<i>Philothamnus natalensis occidentalis</i>	Endemic			
Agama, Southern Rock	<i>Agama atra</i>				
Agama, Southern Tree	<i>Acanthocercus atricollis atricollis</i>				
Gecko, Cape (Common) Dwarf Day	<i>Lygodactylus capensis capensis</i>				
Skink, Speckled Rock	<i>Trachylepis punctatissima</i>				
Skink, Sundevall's Writhing	<i>Mochlus sundevallii sundevallii</i>				
Skink, Variable	<i>Trachylepis varia</i>				
Snake, Common (Brown) Water	<i>Lycodonomorphus rufulus</i>				
Snake, Short-snouted Grass	<i>Psammophis brevirostris</i>				
Snake, Striped Grass (Striped Skaapsteker)	<i>Psammophylax tritaeniatus</i>				
Bullfrog, Giant	<i>Pyxicephalus adspersus</i>		Protected	NT	
Platanna, Common	<i>Xenopus laevis</i>				
Toad, Raucous	<i>Amietophrynus rangeri (Sclerophrys capensis)</i>	Endemic			
River Frog, Delalande's	<i>Amieta(delalandii) queckettii</i>				
River Frog, Poynton's	<i>Amietia poyntoni</i>				
Sand Frog, Natal	<i>Tomopterna natalensis</i>				
Sand Frog, Tremolo	<i>Tomopterna cryptotis</i>				
Toad, Guttural	<i>Amietophrynus (Sclerophrys) gutturalis</i>				
Toad, Red	<i>Schismaderma carens</i>				
TOP species Likely to occur in the natural landscape associated with the site					

Common name	Taxon name	Endemism	SA GN151 Status	SA Red-list Status	IUCN Status
Lizard, Coppery Grass (Transvaal Grass)	<i>Chamaesaura aenea</i>	Endemic		NT	
Snake, Striped Harlequin	<i>Homoroselaps dorsalis</i>	Endemic		NT	
Agama, Eastern Ground	<i>Agama aculeata distanti</i>	Endemic			
Lizard, Delalande's Sandveld	<i>Nucras lalandii</i>	Endemic			
Snake, Aurora House	<i>Lamprophis aurora</i>	Endemic			
Snake, Spotted Harlequin	<i>Homoroselaps lacteus</i>	Endemic			
Possible TOPS: Habitat requirements limited in the area; Species may traverse or periodically forage in area; Low / erratic density in area					
Skink, Thin-tailed Legless	<i>Acontias gracilicauda</i>	Endemic			
Slug-eater, Common	<i>Duberria lutrix lutrix</i>	Endemic			
Snake, Olive Ground	<i>Lycodonomorphus inornatus</i>	Endemic			
Frog, Rattling	<i>Semnodactylus wealii</i>	Endemic			
Unlikely TOPS: Edge of the species' distribution range; Preferred habitat is not available within the surrounding natural landscape; No recent records					
Gecko, Spotted Dwarf	<i>Lygodactylus ocellatus ocellatus</i>	Endemic			
AIS / Exotic Species recorded in the area					
No AIS or exotic species recorded on ADU or iNaturalist					

NT: Near Threatened

Table 6: Invertebrates of interest (Desktop species in Bold, Confirmed species Underlined)

Class	Order	Scientific name (IUCN Nomenclature)	SA GN151 Status	SA Red-list Status	GP Nature Conservation Ordinance Schedule	IUCN Threatened Status
Arachnida	Araneae	Harpactira atra	Protected		7: Invertebrata	
Arachnida	Araneae	Harpactira hamiltoni	Protected		7: Invertebrata	
Arachnida	Araneae	Pterinochilus lugardi	Protected		7: Invertebrata	
Arachnida	Scorpiones	Hadogenes gracilis	Protected			
Arachnida	Scorpiones	Hadogenes gunningi	Protected			
Arachnida	Scorpiones	Opisththalmus pugnaxx	Protected			
Insecta	Coleoptera	Dromica sp.	Protected			
Insecta	Coleoptera	Graphipterus assimilis*	Protected			
Insecta	Coleoptera	Ichnestoma sp.	Protected			
Insecta	Coleoptera	Manticora sp.	Protected			
Insecta	Coleoptera	Megacephala asperata*	Protected			
Insecta	Coleoptera	Megacephala regalis*	Protected			
Insecta	Coleoptera	Nigidius auriculatus*	Protected			
Insecta	Coleoptera	Pachysoma glentoni*				Vulnerable
Insecta	Coleoptera	Prosopocoilus petitclerci*	Protected			
Insecta	Coleoptera	Prothyma guttipennis*	Protected			
Insecta	Coleoptera	Sarophorus punctatus*				Endangered
Insecta	Lepidoptera	Aloeides dentatis dentatis		Endangered	7: Invertebrata	Vulnerable
Insecta	Lepidoptera	Charaxes achaemenes achaemenes			7: Invertebrata	
Insecta	Lepidoptera	Charaxes candiope candiope			7: Invertebrata	
Insecta	Lepidoptera	Charaxes jahlnusa rex			7: Invertebrata	
Insecta	Lepidoptera	Charaxes jasius saturnus			7: Invertebrata	
Insecta	Lepidoptera	Charaxes phaeus phaeus			7: Invertebrata	
Insecta	Lepidoptera	Charaxes vansoni vansoni			7: Invertebrata	
Insecta	Orthoptera	Clonia uvarovi				Vulnerable

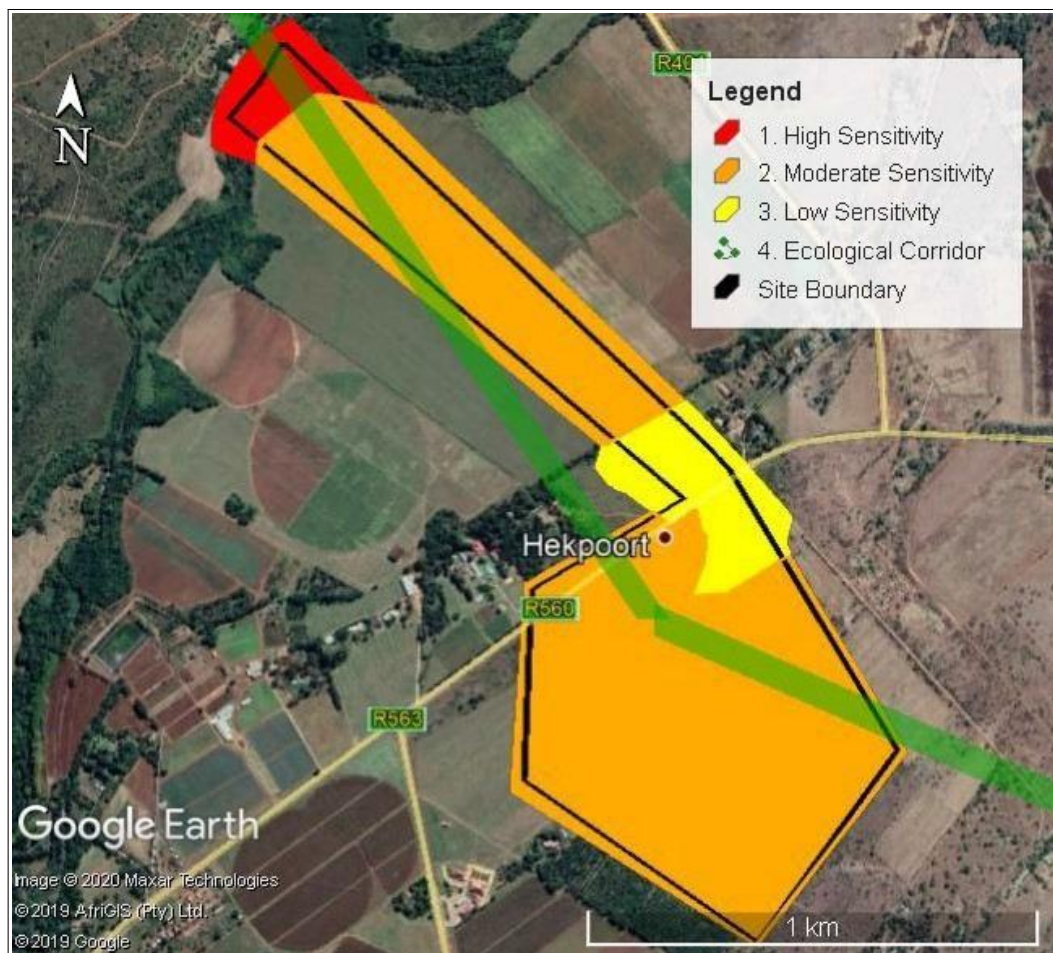
* Provincial and specific distribution unknown

3.6 Site sensitivity in terms of terrestrial fauna

This section must be read together with the floral sensitivity plan to ensure a comprehensive terrestrial biodiversity sensitivity plan.

The northern boundary associated with the Magalies River and a terrestrial buffer incorporating a small grassland and wooded area has been designated as highly sensitive in terms of terrestrial fauna (Plan 5). The highly sensitive area incorporates:

- At least three main habitat types (aquatic, woodland and grassland) which increases habitat heterogeneity and therefore will provide habitat to a greater diversity of fauna.
- Is connected to an aquatic ecological corridor associated with the Magalies River and provides terrestrial buffer zone to this aquatic corridor.
- Is connected to a weaker terrestrial ecological corridor connecting two main mountain ridges in the north (main Magaliesberg) and south (secondary foothills).



Plan 5: Fauna Sensitivity plan and main ecological connectivity

The small area around the R560 supporting the farmstead is designated as low sensitivity in terms of terrestrial fauna.

The remainder of the property is designated as moderately sensitive. The remainder of the property has at one time or another been utilised for agricultural activities (cultivated crops and pastures) within the last 10 years and continues to be used for stock farming. The main function offered to fauna is foraging grounds and ecological corridors, however ecological connectivity has been pinched off to some extent due to development along the R560, and there is better scope for establishing a stronger north-south ecological corridor approximately 2.2km east of site.

4. Fauna Impact Assessment

No details were provided regarding the site plans or activity details, other than the site boundaries and that the area is targeted for mixed-use residential (housing, light commercial and social facilities). No decommissioning or closure is applicable to the activity. The following activities are assumed for the impact assessment:

- Site preparation and construction:
 - Removing vegetation with soil stripping and stockpiling.
 - Excavation for foundations.
 - Cement mixing and construction of foundations and storm water drainage.
 - Construction of buildings.
 - Generation and handling of waste.
- Operation of the site:
 - Arrival and activity of residents / land users on site.
 - Generation of sewage and grey water.
 - Generation of domestic and hazardous (hydrocarbon and chemical) waste.

All the relevant impacts are detailed in the tables below. The following was considered in terms of impacts and considers ecological aspects relevant to GN648, 2019:

- Ecological drivers include climate change, AIS infestation and change in habitat.
 - With increased density of human residences, it is expected that Greenhouse Gas (GHG) emissions per hectare will increase and contribute to drivers of climate change. GHG legislation must be complied with.
 - For fauna to respond to climate change, ecological corridors and connectivity are critical. The highly sensitive area (Plan 5) is connected to the Magalies River ecological corridor and provides fauna the opportunity to retreat from site. Furthermore, the largely undeveloped nature of the greater area means that fauna have opportunity for dispersal from the site.
 - Climate change refugia and high diversity areas are also required to aid fauna to respond to climate change on a micro-scale. An example is the gradient up a hill / mountain, or the gradient from aquatic to terrestrial habitats, which over a relatively short distance provides a range of habitat types. Species can then respond to climatic changes by moving along these gradients. The site designated as highly sensitive (Plan 5) incorporates the broader habitat types within the immediate area, creating a mosaic of various habitats within the largely aquatic corridor associated with the Magalies River. Greater habitat diversity is more likely to support higher faunal diversity and therefore preservation of this area will provide the maximum opportunity for higher faunal biodiversity conservation. Conservation of this area, along with adequate terrestrial areas along the Magalies River and terrestrial ecological corridors connecting the southern and northern mountain ridges (see ecological connectivity below) will provide fauna opportunity to respond to climate change in future on both a macro- and micro-scale.
 - The area is already impacted by AIS, but with increased activity of people of site, the risk for AIS infestation or escalation of current species numbers could increase and prevention measures must be implemented.

- The main ecological process is primary production, where solar energy is converted to organic matter through photosynthesis and associated contribution of plants to the water cycle through evapotranspiration. This is a process that will be affected with removal of flora. Another important process is that of natural fires. As the natural fire cycles in South Africa's grasslands and savannas have already been impacted by humans, this is not evaluated further.
- Species identified on site and species identified for the pentad and QDGS provide a range of ecological services and include the regulation of potential pest species (invertebrates, rodents, AIS birds), suppression or control of predator numbers, provision of prey and carrion, pioneering and initiating nutrient recycling, ecosystem engineering, prevention of bush encroachment, seed dispersal, pollination and vectors of disease / pests.
 - These faunal interactions and ecosystem services are reliant on overall ecological structure and removal of flora and other faunal habitat will cause fauna to retreat from the area and therefore result in the loss of ecological services within the disturbed footprint and buffer zones. The termites were the most significant ecosystem engineers observed on the property and they play a significant role in soil structure and characteristics, which will be lost with the development of the property.
- Ecological corridors and connectivity:
 - As discussed under Section 3.6, the connectivity offered by the site is already impacted to some extent due to development along the R560. Although limited, the site does provide a terrestrial ecological corridor connecting two mountain ridges in the north (main Magaliesberg) and south (secondary foothills). As the greater area is still fairly undeveloped, there are other terrestrial areas that can be established as open space to provide ecological connectivity and prevent isolation of the northern and southern ridge systems.
- Features identified through the desktop assessment:
 - The site is within the Magaliesberg Biosphere Transition Zone just adjacent to the Magaliesberg Biosphere Buffer Zone. Activities in the Transition Zone must not harm Core or Buffer Zones of the biosphere. The managing body of the Biosphere must be included in the public participation process and any requirements incorporated into the final EMPr.
 - The Cradle of Human Kind World Heritage Site (also a protected area) is 1.3km south-east of site at its nearest border. The managing body must be included in the public participation process and any requirements incorporated into the final EMPr. In addition any requirements or restriction in terms of activities within the buffer zones of protected areas must be applied and incorporated into the final EMPr.
 - The site occurs within the Magaliesberg IBA. Main threats in the IBA include: expansion of commercial, recreational and housing developments removing habitat for ungulates, use of poisons by small-stock farmers, and collisions with man-made structures such as power lines. Therefore, the proposed activity is a potential threatening activity for the IBA. BirdLife SA must be included in the public participation process and any requirements incorporated into the final EMPr.
 - The formally protected Magaliesberg Protected Natural Environment approximately 5.7km north of site at its nearest border. The managing body must be included in the public participation process and any requirements incorporated into the final EMPr. In addition any requirements or restriction in terms of activities within the buffer zones of protected areas must be applied and incorporated into the final EMPr.
 - The site is within a National Freshwater Priority Area (NFEPA) Catchment, designated as a fish support area. In terms of this, water quality, wetlands and aquatic ecosystems must

not be impacted. Specialist recommendations for these disciplines must be incorporated into the final EMP.

- The site incorporates an Ecological Support Area (ESA). The south-eastern half of the property is not classified in the Gauteng C-Plan. The far northern extent of the property encompasses a small area of an Irreplaceable Critical Biodiversity Area (CBA) which provides habitat for RL mammals and birds. The highly sensitive area incorporates the CBA as well as additional terrestrial habitat which, if conserved, will improve habitat heterogeneity.
- Direct impacts to fauna and loss of fauna:
 - No TOP burrowing vertebrate species were identified for the area and habitat for TOP burrowing invertebrates was not identified on site and therefore it is unlikely that TOP burrowing species will be significantly impacted and impacts on burrowing species are not further assessed.
 - Very few TOPS were identified as likely to occur on the site. Their mobility and proximity of nearby natural areas makes them likely to leave the area and retreat to the surrounding areas once activities on site commence and no significant impacts are expected on TOP fauna. The impact assessed as part of the overall potential loss of fauna.

In terms of the above, the following impacts are further assessed below:

- Habitat destruction and loss of fauna habitat.
- Destruction of ecological connectivity and impeding fauna migration.
- Destruction of fauna with focus on ecologically significant fauna.
- Disturbance to fauna through noise, vibration, dust and emigration of fauna from site.
- AIS infestation.
- Waste generation, handling and disposal.

Impact assessment criteria considered include:

The duration of the impact		
Score	Duration	Description
1	Short term	0 – 1 years
2	Short to medium term	2 – 5 years
3	Medium term	5 – 15 years
4	Medium to long term	15+ years
5	Permanent	Permanent
The extent of the impact		
Score	Extent	Description
1	Site specific	Within the site boundary
2	Local	Affects immediate surrounding areas
3	Regional	Extends substantially beyond the site boundary
4	Provincial	Extends to almost entire province or larger region
5	National	Affects country or possibly world
The magnitude (severe or beneficial) of the impact		
Score	Severe/beneficial effect	Description
0	None	No effect – No disturbance/benefit

2	Slight	Little effect – negligible disturbance/benefit
4	Slight to moderate	Effects observable – environmental impacts reversible with time
6	Moderate	Effects observable – impacts reversible with rehabilitation
8	Moderate to high	Extensive effects – irreversible alteration to the environment
10	High	Extensive permanent effects with irreversible alteration
The probability of the impact		
Score	Rating	Description
1	Very Improbable	Probably won't occur
2	Improbable	Low likelihood of occurring
3	Probable	Distinct possibility of occurring
4	Highly Probable	Very likely to occur
5	Definite	Will occur, regardless of any intervention
The Significance = (Magnitude + Spatial Scale + Duration) x Probability		

Significance of the impact, Degree of Irreversibility, Degree of loss of Resource are rated as follows:

Significance Rating	
Low (score of 1 to 29)	Impact will not significantly change fauna biodiversity and requires no significant mitigation measures.
Moderate (score of 30 to 60)	Impact will change fauna biodiversity and requires some mitigation measures.
High (Score of 61 to 100)	Impact will significantly change fauna biodiversity and significant mitigation measures and management is required. Potential fatal flaw.
Degree of irreversibility of the impact	
Low	Completely reversible: Reverses with minimal rehabilitation & negligible residual affects
Moderate	Reversible: Requires mitigation and rehabilitation to ensure reversibility
High	Irreversible: Cannot be rehabilitated completely/rehabilitation not viable
Degree of loss resource	
Low	Fauna biodiversity will recover with no / limited rehabilitation / intervention over a specific time.
Moderate	Resource will recover with rehabilitation / intervention over specific time.
High	Resource cannot be recovered, or will require extensive rehabilitation / intervention.

1) Nature: Destruction of fauna habitat.		
The loss of flora will result in loss of fauna habitat, refuges and foraging areas.		
	Without Mitigation	With Mitigation
Construction Phase		
Probability	Definite (5)	Probable (3)
Duration	Permanent (5)	Permanent (5)
Extent	Local (2)	Site specific (1)
Magnitude	Moderate-high (8)	Slight-moderate (4)
Significance	High (75)	Moderate (30)
Status	-ve	-ve
Operational Phase		
Probability	Probable (3)	Improbable (2)
Duration	Short (1)	Short (1)
Extent	Site specific (1)	Site specific (1)
Magnitude	Slight to moderate (4)	Slight (2)
Significance	Low (18)	Low (8)
Status	-ve	-ve
Is Impact Reversible?	High	
Irreplaceable loss of resource?	High	
Can impact be mitigated?	Yes	
<p>Mitigation:</p> <p>STOP: No activities are to commence within the wetlands and buffers (100m buffer) until the necessary authorisations are obtained under the National Water Act (NWA) and NEMA.</p> <p>No activities are to take place in areas designated as highly sensitive as per Plan 5 and at least a 100m buffer of moderately sensitive areas around the highly sensitive areas should be retained for storm water management and buffer for edge effects.</p> <p>MODIFY: Areas designated as low sensitivity must be targeted for high density development and areas of moderate sensitivity should be targeted for low density development integrated with continuous indigenous green corridors or drainage lines. Where moderately sensitive areas form part of existing ecological corridors and buffer areas between highly and moderately sensitive areas, these areas should be targeted for agricultural landscape or as indigenous gardens / green drainage lines. The ecological connectivity between moderately sensitive areas targeted for inclusion into development areas and surrounding natural areas must be maintained through palisade fencing or tunnels in walls that will allow for at least serval-sized animals to move through.</p> <p>Plan and implement a proper engineered storm-water management plan from the onset to prevent excessive runoff and associated erosion and sedimentation in downstream habitats.</p> <p>CONTROL: Peg out and demarcate areas for development and no-go areas before commencing with any activities. No activity whatsoever should occur in no-go areas.</p> <p>Maintain areas of physical disturbance as small as possible to limit the area of disturbance.</p> <p>Plan for material stockpiles (topsoil and subsoil and excavated rock) within the areas designated as low sensitivity. Utilise the soil in private gardens or for landscaping / berms or level out over areas of low sensitivity. Do not leave the mounds in place after construction.</p> <p>REMEDY: Where areas not targeted for development are inadvertently impacted and / or damaged, clear any material dumped and rehabilitate the site as soon as possible.</p>		
<p>Cumulative Impact: Generally, the cumulative loss of habitat will reduce species richness and biodiversity. Therefore the Gauteng Guidelines regarding CBAs and ESAs must be respected in terms of achieving biodiversity targets for the province. The success of meeting biodiversity targets can be improved by improving habitat heterogeneity and conserving well-connected habitat mosaics as represented in the highly sensitive area (Plan 5).</p> <p>Specifically, one of the main impacts within the Magaliesberg IBA is loss of land to ungulates, which</p>		

1) Nature: Destruction of fauna habitat.
reduces food sources for the Cape Vultures. Interest groups and conservation bodies already place animal carcasses out to feed the vultures to ensure their continued survival. Although the specific site did not support species that would qualify as appropriate carrion, the cumulative loss of any land in the IBA will compound the threat faced by the Cape Vultures.
<p>Residual Impacts:</p> <p>The isolation of fauna populations and potential for local extinction in general and specifically for species like the Cape Vulture is a realistic residual impact into the future if land management practices for the IBA and Biosphere initiatives are not respected. Many species are threatened due to isolation of populations which results in in-breeding, genetic deterioration and associated illness and possible local extinctions and the impact is seen as highly significant.</p>

2) Nature: Destruction of ecological corridors and ecological connectivity.		
Loss of ecological connectivity (complete severing or reducing the width so as to make it useless for target species) prevents fauna mobility and response to climate change on a macro-scale (along large recognised regional corridors associated with rivers and recognised mountain ranges or ridges), but also on a micro-scale (along mountain slopes or river cross sections where relatively small distances can support a variety of micro-habitats and habitats for fauna) if adequate buffer habitats are not incorporated into these corridors. It also results in isolation of fauna which can lead to local extinctions.		
	Without Mitigation	With Mitigation
Construction Phase		
Probability	Highly Probable (4)	Probable (3)
Duration	Permanent (5)	Short (1)
Extent	Local (2)	Site specific (1)
Magnitude	Moderate-high (8)	Slight-moderate (4)
Significance	Moderate (60)	Low (18)
Status	-ve	-ve
Operational Phase		
Probability	Probable (3)	Improbable (2)
Duration	Short (1)	Short (1)
Extent	Site specific (1)	Site specific (1)
Magnitude	Slight to moderate (4)	Slight (2)
Significance	Low (18)	Low (8)
Status	-ve	-ve
Is Impact Reversible?	Moderate	
Irreplaceable loss of resource?	Moderate	
Can impact be mitigated?	Yes	
Mitigation:		
<p>STOP: No activities are to take place in areas designated as highly sensitive as per Plan 5 and at least a 100m buffer of moderately sensitive areas around the highly sensitive areas. This will preserve the CBA and expand the ecological corridor associated with the Magalies River to include more diverse terrestrial habitats.</p> <p>MODIFY: The north-south connectivity offered by the site is already impacted to some extent due to development along the R560. Maintain this connectivity by planning low-impacting activities in this area (Plan 5) such as agricultural areas, connected indigenous gardens and / or green drainage lines. Connectivity along this corridor and surrounding CBAs and ESAs should be maintained by utilising palisade fencing or tunnels in walls that will allow for at least serval-sized animals to move through.</p> <p>CONTROL: Maintain areas of physical disturbance as small as possible to limit the area of disturbance. Ensure policies are in place to prevent body corporates / residents hard-scaping gardens within moderately sensitive areas.</p> <p>REMEDY: Where areas not targeted for development are inadvertently impacted and / or damaged, clear any material dumped and rehabilitate the site as soon as possible.</p>		
Cumulative Impact: Continued development along the R560 could result in isolation between the northern and southern Magaliesberg ridges and also isolation of the Magalies River. It is critical to ensure that future development plans for the area include for north-south ecological corridors that encompass the cross section of the Magaliesberg and foothills which will also incorporate the rivers, tributaries and associated valleys and wetlands.		
Residual Impacts:		
The isolation of fauna populations and potential for local extinction in general is a realistic residual impact into the future. Many species are threatened due to isolation of populations which results in in-breeding, genetic deterioration and associated illness and possible local extinctions and the impact is seen as highly significant.		

3) Nature: Hindrance, trapping, killing of fauna		
Staff and contractors on site must undergo environmental awareness training which must include strict instruction on the prevention of deliberate trapping, killing, hindering of fauna in the area. This is applicable to all groups of fauna, from invertebrates to mammals.		
	Without Mitigation	With Mitigation
Construction Phase		
Probability	Probable (3)	Improbable (2)
Duration	Short-medium (2)	Short-medium (2)
Extent	Local (2)	Local (2)
Magnitude	Moderate (6)	Slight-moderate (4)
Significance	Moderate (30)	Low (16)
Status	-ve	-ve
Operational Phase		
Probability	Improbable (2)	Improbable (2)
Duration	Medium-long (4)	Medium-long (4)
Extent	Local (2)	Local (2)
Magnitude	Slight to moderate (4)	Slight (2)
Significance	Low (20)	Low (16)
Status	-ve	-ve
Is Impact Reversible?	Low	
Irreplaceable loss of resource?	Moderate	
Can impact be mitigated?	Yes	
<p>Mitigation:</p> <p>STOP: No poisons against fauna are to be brought on site; where this is not possible any substance that could be toxic to fauna will be stored and handled in a manner that will prevent exposure of the substance to the environment.</p> <p>No deliberate killing or trapping of indigenous fauna is allowed on site, unless trapping is done by a specialist to remove the specimen from the area. Any requirements of the Gauteng Nature Conservation Ordinance complied with regarding handling of such species.</p> <p>Overhead lines through highly sensitive areas and across the ecological corridors must be avoided or limited to no more than one (1) crossing for the entire development area.</p> <p>MODIFY: Commence with primary excavation and earth-moving activities outside the breeding season of birds. This will have the added benefit of being during the dry season and reduce the risk of erosion and downstream sedimentation associated with runoff.</p> <p>All overhead lines crossing highly and moderately sensitive areas will be fitted with bird flappers for the entire length of the crossing and an additional 50m on either side.</p> <p>Ensure that unhindered access for fauna is maintained along the ecological corridors (see Plan 5).</p> <p>Establish indigenous gardens and consider establishing bird and bat boxes in and around residential areas to attract local species to the site. This will have the added benefit of providing local ecological services, such as pest (insect, AIS and rodents) control and potential competition to AIS species.</p> <p>CONTROL: Environmental awareness training must include the prohibition of any harm or hindrance to any indigenous fauna species and the consequences of such actions.</p> <p>Policies must be in place to ensure residents do not kill indigenous fauna.</p> <p>Policies with residents should include control of potentially toxic substances to fauna which will be stored and handled in a manner that prevents exposure of the toxin to the environment.</p> <p>Consideration should be given to include for strict control of domestic cats in residential policies.</p> <p>REMEDY: Contracts with contractors must specify actions that will be taken against contractors who do not conduct activities in line with the EMP.</p> <p>Monitor TOPS observed to enter the site. Should monitoring indicate that aspects of the development are posing a risk to these species, then management must be adapted to protect these species. Any</p>		

3) Nature: Hindrance, trapping, killing of fauna
requirements of the Gauteng Nature Conservation Ordinance complied with regarding handling of such species. Ensure safe speed limits and working conditions on the site.
Cumulative Impact: Local extinctions that could be caused by cumulative destruction of TOPS will alter the faunal community structure (for example the prey-base may bloom, or competitive predator numbers could decline). Predicting the extent and significance of such changes is not possible, but could have severe consequences on ecological balances and overall biodiversity.
Residual Impact: Destruction of any TOPS (or prey-base of TOPS) could cause a cascade affect on populations and, in extreme circumstances, local extinctions. Predicting the extent and significance of such changes is not possible.

4) Nature: Disturbance to fauna through noise, vibration, dust and emigration of fauna from site.		
The existing nature of the surrounds means that parts of the site are experiencing much of these impacts on a daily basis and the additional contribution by the proposed development will be minimal in these areas, concentrated during construction phase. Even in the more secluded northern extent near the river, the noise of farming equipment and vehicles could be heard, although these areas will experience the impacts more acutely.		
	Without Mitigation	With Mitigation
Construction Phase		
Probability	Highly Probable (4)	Probable (3)
Duration	Short (1)	Short (1)
Extent	Local (2)	Local (2)
Magnitude	Moderate (6)	Slight-moderate (4)
Significance	Moderate (36)	21 (Low)
Status	-ve	-ve
Operational Phase		
Probability	Improbable (2)	Improbable (2)
Duration	Short (1)	Short (1)
Extent	Local (2)	Local (2)
Magnitude	Slight to moderate (4)	Slight (2)
Significance	Low (14)	Low (10)
Status	-ve	-ve
Is Impact Reversible?	Moderate	
Irreplaceable loss of resource?	Low	
Can impact be mitigated?	Yes	
<p>Mitigation: STOP: No activities are to take place in areas designated as highly sensitive as per Plan 5 and at least a 100m buffer of moderately sensitive areas around the highly sensitive areas. MODIFY: Commence with primary excavation and earth-moving activities during the dry season when bird populations are likely to be lower (migrants will be absent and birds unlikely to have chicks or fledglings). Utilise quieter equipment where feasible. Any fencing erected in areas of moderate sensitivity must provide for animal migration (see Impact 1 and Impact 2). CONTROL: Ensure dust suppression, through water sprinkling, is applied at time of high dust generation. Noisy point-sources should be enclosed and equipment / machinery fitted with silencers. All equipment / machinery will be serviced and maintained within operating specifications to prevent excessive noise. Ensure policies are in place to ensure residents do not generate excessive noise on site and maintain rural / urban noise level limits.</p>		
<p>Cumulative Impact: No significant cumulative impacts are foreseen. Currently fauna have suitable surrounding habitats and access to these habitats to escape to. Continued future developments could significantly affect fauna dispersal if habitat and corridors are not maintained as per Impacts 1 and 2 above.</p>		
<p>Residual Impacts: Should activity disrupt fauna in the highly sensitive areas, these species will need to disperse to other nearby suitable habitats, which could cause over-population of these sites and competition for resources at these sites. This will ultimately reduce species richness of the greater region. Quantification is outside the scope of the study, but application of the mitigation measures (conducting work at a time when fauna numbers are regionally lower, protecting existing sensitive areas heterogeneous habitat patches and ecological connectivity, and minimising noise near sensitive areas) will, to an extent, curb the impact and improve recovery of fauna biodiversity and richness after construction activities are completed.</p>		

5) Nature: Attraction of pests and exotic / alien species		
The nature of the site means that several urbanised exotic and alien invasive species are already present in the greater area. Activities, such as leaving food and food waste out, could attract additional species or individuals to site which must at all costs be avoided.		
	Without Mitigation	With Mitigation
Construction Phase		
Probability	Probable (3)	Probable (3)
Duration	Short-medium (2)	Short (1)
Extent	Local (2)	Local (2)
Magnitude	Moderate (6)	Slight (2)
Significance	Moderate (30)	Low (15)
Status	-ve	-ve
Operational Phase		
Probability	Probable (3)	Probable (3)
Duration	Medium (3)	Medium (3)
Extent	Local (2)	Local (2)
Magnitude	Slight-moderate (4)	Slight (2)
Significance	Low (27)	Low (21)
Status	-ve	-ve
Is Impact Reversible?	Moderate	
Irreplaceable loss of resource?	Low	
Can impact be mitigated?	Yes	
<p>Mitigation: MODIFY: Maintaining and improving local indigenous populations could assist in reducing alien species numbers on site through competition. Therefore maintain indigenous gardens on site. Consider establishing bird/bat boxes to attract local species back to the site. CONTROL: Compile and implement an alien invasive management plan in line with the municipal management plan, which must include measures to prevent attracting additional alien avifauna and mammals to site. This should include not feeding wild life and ensuring that all food and food waste, including domestic waste, is placed in sealed containers and not exposed on site. Ensure that the outside areas are kept clean and tidy and provide adequate waste removal services to prevent the attraction of rats and other alien scavenging species to the site. Ensure policies are in place to prevent residents from planting AI species. REMEDY: Clear all domestic and food waste from site on a daily basis.</p>		
Cumulative Impact: If not properly managed, alien invasive species will out-compete indigenous flora and reduce overall indigenous biodiversity in the area.		
Residual Impact: Not attempting to control or preventing the worsening of alien invasive infestation will cause a decline in indigenous species. Altered population dynamics such as displacement of natural indigenous species by alien invasive species, can cause significant impact on overall fauna community structure, impacting further on ecological interactions, ecological services and natural food-chains.		

6) Nature: Contamination of fauna environment through use and storage of hazardous substances, littering and dumping of waste or sewage leaks		
The proximity of the site to the Magalies River and existing storm water drainage lines means that any contamination on the property will find it way into the river during a rainfall event. Therefore all contaminating substances, including waste and sewage, must be handled properly on site.		
	Without Mitigation	With Mitigation
Construction Phase		
Probability	Highly probable (4)	Improbable (2)
Duration	Medium (3)	Short-medium (2)
Extent	Local (2)	Local (2)
Magnitude	Moderate-high (8)	Slight-moderate (4)
Significance	Moderate (52)	Low (16)
Status	-ve	-ve
Operational Phase		
Probability	Improbable (2)	Improbable (2)
Duration	Medium-long (4)	Medium-long (4)
Extent	Local (2)	Local (2)
Magnitude	Slight to moderate (4)	Slight to moderate (4)
Significance	Low (20)	Low (20)
Status	-ve	-ve
Is Impact Reversible?	Moderate	
Irreplaceable loss of resource?	High	
Can impact be mitigated?	Yes	
<p>Mitigation:</p> <p>STOP: Discontinue use of all faulty machinery / equipment on site until properly repaired. Ensure a waste management plan has been compiled in line with the National Environmental Management: Waste Act (NEM:WA) highlighting handling and storage of various wastes on site, in line with prescribed standards before any activities commence on site.</p> <p>MODIFY: Due to proximity of petrol stations, hydrocarbon storage on site during construction should be limited to daily needs only. Repairs to vehicles will be conducted off-site and where this is not possible the underlying ground will be covered with impermeable sheet and pans. Plan and implement a proper storm-water management plan from the onset, which must incorporate a hydrocarbon collection system for the workshop and parking area. Provide for adequate portable toilets for the number of staff on site.</p> <p>CONTROL: All equipment / machinery will be serviced and maintained within operating specifications to prevent the risks of leaks. Hydrocarbons (new and used) must be properly stored and handled according to prescribed manner and must in no way be exposed to the environmental elements. Any cars, machinery or equipment parked on site will either be parked on a concrete slab or have pans placed under them to collect all drips and potential leaks. Keep portable toilets clean and hygienic and keep all facilities outside the tributary buffer zone. Portable toilets will properly managed and emptied regularly to prevent overflow and leaks. All waste (domestic, hydrocarbon, hazardous) must be managed in line with the prescribed waste management plan. Waste will be stored according to the Norms and Standards for Storage of Waste.</p> <p>REMEDY: All hydrocarbons spills on bare ground will be cleared immediately. Inspect and clear all litter and waste from the site and surrounds. Toilets and general plumbing will be regularly checked for leaks which will be attended to immediately. Repair and clean any sewage leaks immediately.</p>		
<p>Cumulative Impact: Any additional development will add to the potential of contamination to the area and down-slope areas. Large spills or continuous cumulative leaks and waste dumping that are not cleaned up will enter the environment through run-off or leachate and contaminate the environment</p>		

<p>6) Nature: Contamination of fauna environment through use and storage of hazardous substances, littering and dumping of waste or sewage leaks</p>
<p>and poison the fauna.</p>
<p>Residual Impact: If toxic substances and waste are not properly handled or spills not cleared immediately, the environment will suffer extended residual impacts, particularly if toxins seep into the soils or are washed to downstream environments. No residual impacts foreseen if hydrocarbon and waste management is strictly implemented on site.</p>

5. Fauna Management & Monitoring Plan

The objectives of the management plan are as follows:

- To prevent the unnecessary destruction of natural habitat and animal life within the development area and to maintain ecological connectivity to neighbouring sites and, where possible, to regional ecological corridors.
- Not to unnecessarily or deliberately alienate or hinder the movement of fauna in the area or to harm any animal life found on the property.
- To maintain or improve existing fauna biodiversity and prevent the skewing of fauna communities as far as possible.

A monitoring plan must be implemented in order to ensure mitigation measures are effective. With monitoring an adaptive management approach must be applied. The benefits of monitoring and adaptive management include:

- Saving costs by discontinuation of non-effective measures.
- Higher success in environmental impact management through application of more effective management measures targeting actual identified impacts.

The specific mitigation measures are highlighted in the various tables above.

An Environmental Officer (EO) must be appointed to ensure construction activities are in line with EMPr requirements, including the mitigation and management measures stipulated within this report. Inspection, records of issues and corrective measures and sign-off will form part of the EO's responsibilities.

5.1 Invasive Species

The Alien and Invasive Species Regulations published under GNR598 (2014) list aliens under various categories, including:

- Category 1a Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of NEM:BA as species which must be eradicated.
- Category 1b Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of NEM:BA as species which must be controlled.
- Category 2 Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of NEM:BA as species which require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit, as the case may be. If no permit for these species then are to be treated as Category 1 species.
- Category 3 Listed Invasive Species are species that are listed by notice in terms of section 70(1)(a) of NEM:BA, as species which are subject to exemptions (regarding possession of such species) in terms of section 71(3) and prohibitions (importing, transporting, handling, breeding, releasing) in terms of section 71A of Act, as specified in the Notice.

In terms of the findings of this study, only one Category 2 and three Category 3 invasive species (GN864, 2016) were recorded for the Pentad. These specific bird species have extensive distributions

in South Africa and all are closely related to human settlements and no proper control programmes have been implemented in South Africa for these species (Picker & Griffiths, 2011).

5.2 Fauna Monitoring Plan

The monitoring plan in Table 7 is considered ecologically responsible practice and should be implemented as a minimum:

Table 7: Monitoring plan

Monitoring Action	Responsible person	Frequency
Ensure all proposed mitigation measures detailing proposed activity modifications have been fully considered and incorporated into the final design plan and operational procedures and sign off on final plans and procedures.	Environmental officer (EO)	Once-off
Inspect and sign-off on placement of demarcation pegs marking out activity areas and no-go areas.	Environmental officer (EO)	Before brought to site and then every 3 months.
Monitor activities to ensure they are within the designated areas.	Environmental officer (EO)	Weekly
Inspect natural areas around development areas and ensure these are in a natural state with no dumping, excavations, obstructions to fauna mobility.	Environmental officer (EO)	Weekly
Generally monitor TOPS observed to enter the site. Should monitoring indicate that aspects of the development are posing a risk to these species, then management must be adapted to protect these species.	EO to appoint on-site person	As needed and species are noted
Apply monitoring and auditing requirements stipulated in NWA & NEMA authorisations as relevant.	Environmental officer (EO)	Every 6 months

6. Conclusion and Recommendations

All impacts to terrestrial fauna (other than loss of fauna habitat) can be mitigated to low significance as long as the proposed mitigation measures within this report are strictly applied on site. Destruction of habitat can be curbed to some extent by maintaining highly sensitive heterogeneous habitats and ecological corridors in tact. The following conditions are also important:

- No activities are to take place in areas designated as highly sensitive and minimal activity is to take place in the ecological corridor (Plan 5).
- Recommendations of other specialists, such as the air quality and surface water specialists, must be implemented in order to preserve the overall environment for fauna.
- Ensure all activities on site are in line with any requirements of the Biosphere Transition Zone, the relevant World Heritage and Protected Areas Management Plans (Cradle of Humankind and Magaliesberg Protected Natural Environment) and IBA Management Plans.

- Ensure a waste management plan has been compiled in line with the National Environmental Management: Waste Act (NEM:WA).
- Where predator or pest species need to be controlled, this will be done by environmentally sensitive means and no exposed poisons are to be used under any circumstances.
- Integrate all mitigation measures and monitoring requirements of this report and the vegetation report into the EMPr and operational procedures.

In terms of the terrestrial fauna, if the above conditions are met there should be no reason not to authorise the activity.

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- whc.unesco.org: for information on SA World Heritage Sites

Appendix A: CV, Qualification, SACNASP registration

Curriculum Vitae

BARBARA KASL

Personal Information

- Full Name: Barbara Kasl
- Qualifications: PhD (Animal, Plant and Environmental Sciences)
- Phone: +27 71 988 6773
- E-mail: bk.zoology@gmail.com

Education – ±10 years

Tertiary Institute: University of the Witwatersrand

- 2002-2004: PhD (Animal, Plant and Environmental Sciences)
- 1999-2001: MSc (upgraded to PhD)
- 1998: B.Sc. Hon. (Zoology and Botany)
- 1995-1998: BSc (Zoology and Botany)

MSc AND PhD - South African Sugar Experiment Station (SAHRA) – On site research for MSc and PhD degree to determine habitat management strategies to control sugarcane borer (*Eldana saccharina*) in South African sugarcane (Mnt. Edgecombe, R. S. A.).

- Systematic and orderly work habits, which extended into the field, greenhouse and laboratory experiments, and associated data capturing.
- Gained competency on statistical programmes (Statistica, Origin and Excel).
- Data assessment, presentation and discussion of findings through written reports, presentations and posters.
- Good computer literacy and fully competent in MS Office.

Professional Experience – ±12 years

02/2017 - Current: Self-employed as fauna specialist & environmental consultant

- Fauna impact assessments and management and monitoring plans for various developments requiring NEMA authorisation.
- Terrestrial alien invasive fauna management plans.
- Working closely with ecologists on a variety of projects requiring specialists terrestrial fauna input.
- Gauteng & North West Provincial Biodiversity Outlook Reports – Terrestrial Fauna input.
- Generic environmental management plans for the Working for Ecosystems and Landcare projects (ongoing).

- Consulting on projects requiring Environmental Authorisation, including Mineral Authorisations.
- Review of various environmental documentation.

01/2008 – 02/2017: CABANGA CONCEPTS: Environmental Scientist / Principal Consultant

Requested to join the company as an environmental consultant specialising in all environmental authorisation processes and related documents. I am one of three principal members/shareholders of Cabanga Concepts.

- One of two **principal report reviewers** of external reports supplied by subcontractors [soil assessments, ecological (terrestrial and aquatic) assessments groundwater and surface water assessments, heritage and cultural resource assessments to name a few] and internal reports compiled by staff.
- Overall **project manager** regarding mineral rights application processes as well as environmental authorisation processes in South Africa, including **management of a team** of external (sub-consultants) and internal specialists. Including **overview of budget** and spending of the budget during the life of the project.
- **Compilation of proposals and associated budgets** for various environmental requirements made by new and existing clients.
- Principal EMP report compiler and reviewer for a **World Bank mining project** in Rwanda, including review of external specialist reports. Familiar with **IFC, Equator Principals**.
- Compilation of **environmental applications and documents** required under the various environmental acts (environmental act, waste act, air quality act and water act) in South Africa. This includes scoping reports, impact assessment reports, environmental management plans, environmental monitoring reports, environmental pre-feasibility reports and bankable feasibility studies, integrated water and waste management plans, audit reports, due diligence assessments, reports on monitoring findings (water quality, dust levels, ambient noise).
- Compilation of various **audit reports** including EMP Audits, Legal Compliance Audits, Due Diligences, Integrated Water and Waste Management Plan Audits, Licence and Permitting Audits.
- Compilation of draft sensitivity plans for internal GIS specialists to refine.
- Compiled a detailed and comprehensive **alien invasive management plan** for principal invasive plant species in the Highveld region of South Africa.
- Keep up-to-date with **environmental legislation** and relevant application processes.
- Keep up-to-date on various **standards, norms** and management requirements released through official organisations and institutes.

09/2004 – 11/2007: DIGBY WELLS & ASSOCIATES (Now DIGBY WELLS ENVIRONMENTAL): Unit Manager / Acting Department Head: Biophysical Department

- Initially hired as entomologist and fauna specialist.
- Responsible in **completion of full fauna assessments** and eventually **compilation of overall ecological reports**.
- Received training in full **environmental authorisation processes** including compilation of EIA and EMP reports.
- Various **sub-Saharan environmental projects** included Etoile Mine in DRC, Randgold Mine in Mali, Valencia uranium green-field mine in Namibia, Mmamabula coal mine and power plant in Botswana.
- **Unit Manager** for the Ecology Unit including management of a flora and wetland specialist.

- **Acting Department Head** and management of the Biophysical Department which included the Ecology Unit and Atmospheric Environment Unit.

2001-2003: Various University and Temp Research Jobs in Entomology

2001: Private Tutor - Private tutoring for first year student.

1993-1998: Part-Time Jobs

Professional Memberships and Affiliations

- **2011 – current:** Registered Professional Environmental And Ecological Scientist
- **2015 – 2017:** EAPSA Certified Environmental Assessment Practitioner
- **1999, 2001 & 2008 – current:** Entomological Society of South Africa
- **2008-2011:** International Association for Impact Assessment
- **1998:** Zoological Society of Southern Africa

Courses Attended

April 2017: Alien invasive species identification and management course in KZN organised through Kay Montgomery.

October 2010: NEM: Air Quality Act course through IMBEWU Sustainability Legal Specialists (Pty) Ltd

August 2009: NEMA and NEMWA course through ECOLAW

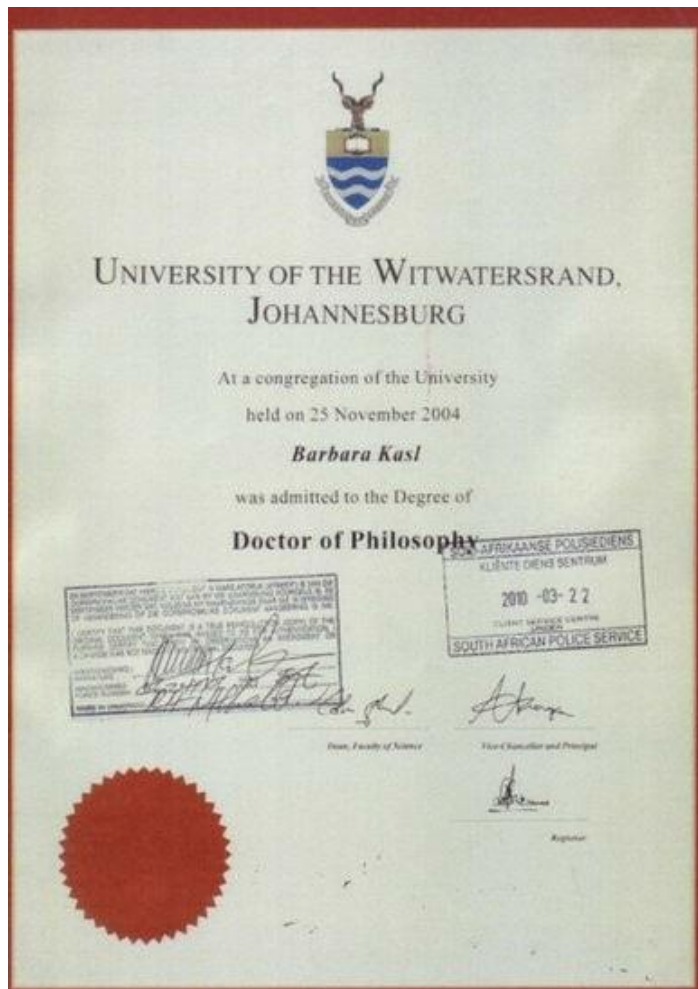
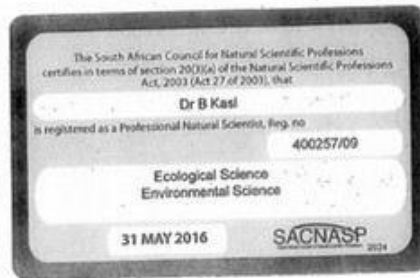
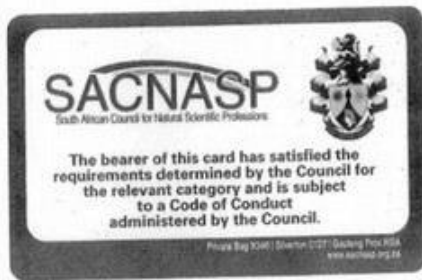
November 2007: Environmental Impact Assessment Training

February/March 2007: Project Management for Non-Project Managers Course through Astro Tech

September 2006: Unilever Introduction to Managing Environmental Water Quality - Practical, Theoretical and Policy; through Institute for Water Research – RHODES University.

September 2005: Non-credited course in River health and SASS5 rapid methodology of water quality assessment through NEPID Consultants

May 2005: Snake Identification and Snakebite Treatment Course



Appendix B: ADU Mammal list for relevant QDGS

Family	Common name	Scientific name
Carnivora	Aardwolf	<i>Proteles cristata</i>
Carnivora	Genet, Common Large-spotted	<i>Genetta maculata</i>
Carnivora	Genet, Small-spotted	<i>Genetta genetta</i>
Carnivora	Honey Badger (Ratel)	<i>Mellivora capensis</i>
Carnivora	Hyaena, Brown	<i>Parahyaena brunnea</i>
Carnivora	Jackal, Black-backed	<i>Canis mesomelas</i>
Carnivora	Leopard	<i>Panthera pardus</i>
Carnivora	Lion	<i>Panthera leo</i>
Carnivora	Mongoose, Slender	<i>Herpestes sanguineus</i>
Carnivora	Mongoose, Water (Marsh)	<i>Atilax paludinosus</i>
Cetartiodactyla	Antelope, Sable	<i>Hippotragus niger niger</i>
Cetartiodactyla	Blesbok	<i>Damaliscus pygargus phillipsi</i>
Cetartiodactyla	Bushbuck, Southern	<i>Tragelaphus sylvaticus (scriptus)</i>
Cetartiodactyla	Eland, Common	<i>Tragelaphus (Taurotragus) oryx</i>
Cetartiodactyla	Gemsbok (Southern Oryx)	<i>Oryx gazella</i>
Cetartiodactyla	Giraffe	<i>Giraffa camelopardalis</i>
Cetartiodactyla	Hartebeest, Red	<i>Alcelaphus buselaphus caama</i>
Cetartiodactyla	Hippopotamus	<i>Hippopotamus amphibius</i>
Cetartiodactyla	Impala	<i>Aepyceros melampus</i>
Cetartiodactyla	Klipspringer	<i>Oreotragus oreotragus</i>
Cetartiodactyla	Kudu, Greater	<i>Tragelaphus strepsiceros</i>
Cetartiodactyla	Nyala	<i>Tragelaphus angasi</i>
Cetartiodactyla	Reedbuck, Southern Mountain	<i>Redunca fulvorufula</i>
Cetartiodactyla	Warthog, Common	<i>Phacochoerus africanus</i>
Cetartiodactyla	Waterbuck	<i>Kobus ellipsiprymnus</i>
Cetartiodactyla	Wildebeest, Black	<i>Connochaetes gnou</i>
Cetartiodactyla	Wildebeest, Blue	<i>Connochaetes taurinus</i>
Chiroptera	Bat, Blasius's Horseshoe	<i>Rhinolophus blasii</i>
Chiroptera	Bat, Bushveld Horseshoe	<i>Rhinolophus simulator</i>
Chiroptera	Bat, Darling's Horseshoe	<i>Rhinolophus darlingi</i>
Chiroptera	Bat, Geoffroy's Horseshoe	<i>Rhinolophus clivus</i>
Hyracoidae	Hyrax, Rock (Dassie)	<i>Procavia capensis</i>
Lagomorpha	Hare, Scrub	<i>Lepus saxatilis</i>
Lagomorpha	Rabbit, Jameson's Red Rock	<i>Pronolagus randensis</i>
Macroscelidae	Sengi, Eastern Rock	<i>Elephantulus myurus</i>
Macroscelidae	Sengi, Short-snouted	<i>Elephantulus brachyrhynchus</i>
Perissodactyla	Zebra, Plains	<i>Equus quagga</i>
Primata	Baboon, Chacma	<i>Papio ursinus</i>
Primata	Monkey, Vervet	<i>Chlorocebus pygerythrus</i>
Rodentia	Mole-rat, Pretoria	<i>Cryptomys pretoriae</i>
Rodentia	Mouse, Namaqua Rock	<i>Micaelamys namaquensis</i>
Rodentia	Mouse, Natal Multimammate	<i>Mastomys natalensis</i>
Rodentia	Mouse, Single-striped Grass	<i>Lemniscomys rosalia</i>
Rodentia	Mouse, Southern Multimammate	<i>Mastomys coucha</i>
Rodentia	Mouse, Xeric Four-striped Grass	<i>Rhabdomys pumilio</i>
Rodentia	Porcupine, Cape	<i>Hystrix africae australis</i>
Rodentia	Rat, Tete Veld	<i>Aethomys ineptus</i>
Rodentia	Squirrel, Tree	<i>Paraxerus cepapi</i>

Appendix C: SABAP2 Bird list for relevant PENTAD(s)

Common Name	Scientific name
Apalis, Bar-throated	<i>Apalis thoracica</i>
Babbler, Arrow-marked	<i>Turdoides jardineii</i>
Barbet, Acacia Pied	<i>Tricholaema leucomelas</i>
Barbet, Black-collared	<i>Lybius torquatus</i>
Barbet, Crested	<i>Trachyphonus vaillantii</i>
Batis, Chinspot	<i>Batis molitor</i>
Bee-eater, European	<i>Merops apiaster</i>
Bee-eater, Little	<i>Merops pusillus</i>
Bee-eater, White-fronted	<i>Merops bullockoides</i>
Bishop, Southern Red	<i>Euplectes orix</i>
Bishop, Yellow-crowned	<i>Euplectes afer</i>
Bittern, Little	<i>Ixobrychus minutus</i>
Bokmakierie, Bokmakierie	<i>Telophorus zeylonus</i>
Boubou, Southern	<i>Laniarius ferrugineus</i>
Brubru, Brubru	<i>Nilaus afer</i>
Buffalo-weaver, Red-billed	<i>Bubalornis niger</i>
Bulbul, Dark-capped	<i>Pycnonotus tricolor</i>
Bunting, Cinnamon-breasted	<i>Emberiza tahapisi</i>
Bunting, Golden-breasted	<i>Emberiza flaviventris</i>
Bush-shrike, Grey-headed	<i>Malaconotus blanchoti</i>
Bush-shrike, Orange-breasted	<i>Telophorus sulfureopectus</i>
Buzzard, Steppe	<i>Buteo vulpinus</i>
Camaroptera, Grey-backed	<i>Camaroptera brevicaudata</i>
Canary, Black-throated	<i>Crithagra atrogularis</i>
Canary, Yellow	<i>Crithagra flaviventris</i>
Canary, Yellow-fronted	<i>Crithagra mozambicus</i>
Chat, Familiar	<i>Cercomela familiaris</i>
Cisticola, Cloud	<i>Cisticola textrix</i>
Cisticola, Desert	<i>Cisticola aridulus</i>
Cisticola, Lazy	<i>Cisticola aberrans</i>
Cisticola, Levallant's	<i>Cisticola tinniens</i>
Cisticola, Rattling	<i>Cisticola chiniana</i>
Cisticola, Wing-snapping	<i>Cisticola ayresii</i>
Cisticola, Zitting	<i>Cisticola juncidis</i>
Cliff-chat, Mocking	<i>Thamnolaea cinnamomeiventris</i>
Coot, Red-knobbed	<i>Fulica cristata</i>
Cormorant, Reed	<i>Phalacrocorax africanus</i>
Cormorant, White-breasted	<i>Phalacrocorax carbo</i>
Coucal, Burchell's	<i>Centropus burchellii</i>
Crake, Black	<i>Amaurornis flavirostris</i>
Crombec, Long-billed	<i>Sylvietta rufescens</i>
Crow, Pied	<i>Corvus albus</i>
Cuckoo, Black	<i>Cuculus clamosus</i>
Cuckoo, Diderick	<i>Chrysococcyx caprius</i>
Cuckoo, Jacobin	<i>Clamator jacobinus</i>
Cuckoo, Klaas's	<i>Chrysococcyx klaas</i>
Cuckoo, Levallant's	<i>Clamator levallantii</i>

Common Name	Scientific name
Cuckoo, Red-chested	<i>Cuculus solitarius</i>
Dove, Laughing	<i>Streptopelia senegalensis</i>
Dove, Namaqua	<i>Oena capensis</i>
Dove, Red-eyed	<i>Streptopelia semitorquata</i>
Dove, Rock	<i>Columba livia</i>
Drongo, Fork-tailed	<i>Dicrurus adsimilis</i>
Duck, African Black	<i>Anas sparsa</i>
Duck, Mallard	<i>Anas platyrhynchos</i>
Duck, White-faced	<i>Dendrocygna viduata</i>
Duck, Yellow-billed	<i>Anas undulata</i>
Eagle, Long-crested	<i>Lophaelix occipitalis</i>
Eagle, Verreaux's	<i>Aquila verreauxii</i>
Eagle, Wahlberg's	<i>Aquila wahlbergi</i>
Eagle-owl, Spotted	<i>Bubo africanus</i>
Egret, Cattle	<i>Bubulcus ibis</i>
Egret, Great	<i>Egretta alba</i>
Egret, Little	<i>Egretta garzetta</i>
Falcon, Amur	<i>Falco amurensis</i>
Finch, Cut-throat	<i>Amadina fasciata</i>
Finch, Scaly-feathered	<i>Sporopipes squamifrons</i>
Finfoot, African	<i>Podica senegalensis</i>
Firefinch, African	<i>Lagonosticta rubricata</i>
Firefinch, Jameson's	<i>Lagonosticta rhodopareia</i>
Firefinch, Red-billed	<i>Lagonosticta senegalensis</i>
Fiscal, Common (Southern)	<i>Lanius collaris</i>
Fish-eagle, African	<i>Haliaeetus vocifer</i>
Flycatcher, Fiscal	<i>Sigelus silens</i>
Flycatcher, Marico	<i>Bradornis mariquensis</i>
Flycatcher, Southern Black	<i>Melaenornis pammelaina</i>
Flycatcher, Spotted	<i>Muscicapa striata</i>
Francolin, Coqui	<i>Peliperdix coqui</i>
Francolin, Crested	<i>Dendroperdix sephaena</i>
Go-away-bird, Grey	<i>Corythaixoides concolor</i>
Goose, Domestic	<i>Anser anser</i>
Goose, Egyptian	<i>Alopochen aegyptiacus</i>
Goose, Spur-winged	<i>Plectropterus gambensis</i>
Goshawk, Gabar	<i>Melierax gabar</i>
Grassbird, Cape	<i>Sphenoeacus afer</i>
Grebe, Little	<i>Tachybaptus ruficollis</i>
Green-pigeon, African	<i>Treron calvus</i>
Guineafowl, Helmeted	<i>Numida meleagris</i>
Hamerkop, Hamerkop	<i>Scopus umbretta</i>
Harrier-Hawk, African	<i>Polyboroides typus</i>
Heron, Black-headed	<i>Ardea melanocephala</i>
Heron, Green-backed	<i>Butorides striata</i>
Heron, Grey	<i>Ardea cinerea</i>
Heron, Purple	<i>Ardea purpurea</i>

Common Name	Scientific name
Honeyguide, Greater	<i>Indicator indicator</i>
Honeyguide, Lesser	<i>Indicator minor</i>
Hoopoe, African	<i>Upupa africana</i>
Hornbill, African Grey	<i>Tockus nasutus</i>
House-martin, Common	<i>Delichon urbicum</i>
Ibis, African Sacred	<i>Threskiornis aethiopicus</i>
Ibis, Glossy	<i>Plegadis falcinellus</i>
Ibis, Hadedda	<i>Bostrychia hagedash</i>
Indigobird, Purple	<i>Vidua purpurascens</i>
Indigobird, Village	<i>Vidua chalybeata</i>
Kestrel, Rock	<i>Falco rupicolus</i>
Kingfisher, Brown-hooded	<i>Halcyon albiventris</i>
Kingfisher, Giant	<i>Megaceryle maximus</i>
Kingfisher, Half-collared	<i>Alcedo semitorquata</i>
Kingfisher, Malachite	<i>Alcedo cristata</i>
Kingfisher, Pied	<i>Ceryle rudis</i>
Kingfisher, Woodland	<i>Halcyon senegalensis</i>
Kite, Black-shouldered	<i>Elanus caeruleus</i>
Kite, Yellow-billed	<i>Milvus aegyptius</i>
Korhaan, Northern Black	<i>Afrotis afraoides</i>
Lapwing, African Wattled	<i>Vanellus senegallus</i>
Lapwing, Blacksmith	<i>Vanellus armatus</i>
Lapwing, Crowned	<i>Vanellus coronatus</i>
Lark, Fawn-coloured	<i>Calendulauda africanoides</i>
Lark, Flappet	<i>Miraфра rufocinnamomea</i>
Lark, Rufous-naped	<i>Miraфра africana</i>
Lark, Sabota	<i>Calendulauda sabota</i>
Longclaw, Cape	<i>Macronyx capensis</i>
Mannikin, Bronze	<i>Spermestes cucullatus</i>
Martin, Brown-throated	<i>Riparia paludicola</i>
Martin, Rock	<i>Hirundo fuligula</i>
Martin, Sand	<i>Riparia riparia</i>
Masked-weaver, Lesser	<i>Ploceus intermedius</i>
Masked-weaver, Southern	<i>Ploceus velatus</i>
Moorhen, Common	<i>Gallinula chloropus</i>
Mousebird, Red-faced	<i>Urocolius indicus</i>
Mousebird, Speckled	<i>Colius striatus</i>
Myna, Common	<i>Acridotheres tristis</i>
Neddicky, Neddicky	<i>Cisticola fulvicapilla</i>
Night-Heron, Black-crowned	<i>Nycticorax nycticorax</i>
Night-Heron, White-backed	<i>Gorsachius leuconotus</i>
Nightjar, Fiery-necked	<i>Caprimulgus pectoralis</i>
Olive-pigeon, African	<i>Columba arquatrix</i>
Oriole, Black-headed	<i>Oriolus larvatus</i>
Ostrich, Common	<i>Struthio camelus</i>
Owl, Barn	<i>Tyto alba</i>
Owl, Marsh	<i>Asio capensis</i>

Common Name	Scientific name
Palm-swift, African	<i>Cypsiurus parvus</i>
Paradise-flycatcher, African	<i>Terpsiphone viridis</i>
Paradise-whydah, Long-tailed	<i>Vidua paradisaea</i>
Peacock, Common	<i>Pavo cristatus</i>
Pigeon, Speckled	<i>Columba guinea</i>
Pipit, African	<i>Anthus cinnamomeus</i>
Pipit, Plain-backed	<i>Anthus leucophrys</i>
Prinia, Black-chested	<i>Prinia flavicans</i>
Prinia, Tawny-flanked	<i>Prinia subflava</i>
Puffback, Black-backed	<i>Dryoscopus cubla</i>
Pytilia, Green-winged	<i>Pytilia melba</i>
Quailfinch, African	<i>Ortygospiza atricollis</i>
Quelea, Red-billed	<i>Quelea quelea</i>
Robin-chat, Cape	<i>Cossypha caffra</i>
Robin-chat, White-throated	<i>Cossypha humeralis</i>
Roller, European	<i>Coracias garrulus</i>
Roller, Lilac-breasted	<i>Coracias caudatus</i>
Scrub-robin, White-browed	<i>Cercotrichas leucophrys</i>
Seedeater, Streaky-headed	<i>Crithagra gularis</i>
Shikra, Shikra	<i>Accipiter badius</i>
Shrike, Crimson-breasted	<i>Laniarius atrococcineus</i>
Shrike, Red-backed	<i>Lanius collurio</i>
Snake-eagle, Black-chested	<i>Circaetus pectoralis</i>
Sparrow, Cape	<i>Passer melanurus</i>
Sparrow, House	<i>Passer domesticus</i>
Sparrow, Southern Grey-headed	<i>Passer diffusus</i>
Sparrow-weaver, White-browed	<i>Plocepasser mahali</i>
Sparrowhawk, Black	<i>Accipiter melanoleucus</i>
Sparrowhawk, Ovambo	<i>Accipiter ovampensis</i>
Spoonbill, African	<i>Platalea alba</i>
Spurfowl, Natal	<i>Pternistis natalensis</i>
Spurfowl, Swainson's	<i>Pternistis swainsonii</i>
Starling, Cape Glossy	<i>Lamprotornis nitens</i>
Starling, Pied	<i>Spreo bicolor</i>
Starling, Red-winged	<i>Onychognathus morio</i>
Starling, Violet-backed	<i>Cinnyricinclus leucogaster</i>
Starling, Wattled	<i>Creatophora cinerea</i>
Stonechat, African	<i>Saxicola torquatus</i>
Stork, Abdim's	<i>Ciconia abdimii</i>
Stork, Black	<i>Ciconia nigra</i>
Stork, White	<i>Ciconia ciconia</i>
Stork, Yellow-billed	<i>Mycteria ibis</i>
Sunbird, Amethyst	<i>Chalcomitra amethystina</i>
Sunbird, Malachite	<i>Nectarinia famosa</i>
Sunbird, Marico	<i>Cinnyris mariquensis</i>
Sunbird, White-bellied	<i>Cinnyris talatala</i>
Swallow, Barn	<i>Hirundo rustica</i>

Common Name	Scientific name
Swallow, Greater Striped	<i>Hirundo cucullata</i>
Swallow, Lesser Striped	<i>Hirundo abyssinica</i>
Swallow, Pearl-breasted	<i>Hirundo dimidiata</i>
Swallow, Red-breasted	<i>Hirundo semirufa</i>
Swallow, White-throated	<i>Hirundo albigularis</i>
Swamp-warbler, Lesser	<i>Acrocephalus gracilirostris</i>
Swift, African Black	<i>Apus barbatus</i>
Swift, Little	<i>Apus affinis</i>
Swift, White-rumped	<i>Apus caffer</i>
Tchagra, Black-crowned	<i>Tchagra senegalus</i>
Tchagra, Brown-crowned	<i>Tchagra australis</i>
Teal, Red-billed	<i>Anas erythrorhyncha</i>
Thick-knee, Spotted	<i>Burhinus capensis</i>
Thrush, Groundscraper	<i>Psophocichla litsipsirupa</i>
Thrush, Karoo	<i>Turdus smithi</i>
Thrush, Kurrichane	<i>Turdus libonyanus</i>
Tinkerbird, Yellow-fronted	<i>Pogoniulus chrysoconus</i>
Tit, Ashy	<i>Parus cinerascens</i>
Tit, Southern Black	<i>Parus niger</i>
Tit-babbler, Chestnut-vented	<i>Parisoma subcaeruleum</i>
Turtle-dove, Cape	<i>Streptopelia capicola</i>
Vulture, Cape	<i>Gyps coprotheres</i>
Wagtail, Cape	<i>Motacilla capensis</i>
Warbler, Marsh	<i>Acrocephalus palustris</i>
Warbler, Willow	<i>Phylloscopus trochilus</i>
Waxbill, Blue	<i>Uraeginthus angolensis</i>
Waxbill, Common	<i>Estrilda astrild</i>
Waxbill, Orange-breasted	<i>Amandava subflava</i>
Weaver, Cape	<i>Ploceus capensis</i>
Weaver, Thick-billed	<i>Amblyospiza albifrons</i>
Weaver, Village	<i>Ploceus cucullatus</i>
White-eye, Cape	<i>Zosterops virens</i>
Whydah, Pin-tailed	<i>Vidua macroura</i>
Widowbird, Long-tailed	<i>Euplectes progne</i>
Widowbird, Red-collared	<i>Euplectes ardens</i>
Widowbird, White-winged	<i>Euplectes albonotatus</i>
Wood-dove, Emerald-spotted	<i>Turtur chalcospilos</i>
Wood-hoopoe, Green	<i>Phoeniculus purpureus</i>
Woodpecker, Cardinal	<i>Dendropicus fuscescens</i>
Woodpecker, Golden-tailed	<i>Campethera abingoni</i>

