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Orlando Dam Upgrade & Maintenance, Gauteng Province

Terrestrial Fauna Biodiversity Impact Statement in terms of:

NEMA EIA Regulations (GNR982, 2017) &

Protocol for the Assessment and Reporting of Environmental Impacts on Terrestrial Biodiversity (GN648, 2019)

January 2020

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.

B.Kasl

_____ 28-01-2020

Acronyms

ADU	Animal Demographic Unit
AI(S)	Alien Invasive (Species)
BGIS	Biodiversity Geographic Information System
CBA	Critical Biodiversity Areas
EA	Environmental Authorisation
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
SWSA	Strategic Water Source Area
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 site lies on the corner of Nicholas Street and the M68, Klipsruit, within the City of Johannesburg Metropolitan Municipality, Gauteng Province.

The intention is to conduct repair and maintenance activities on the Orlando Dam and existing surrounding bridges and culverts. From the desktop ecological assessment, the following is relevant:

- No sites of International Conservation, IBAs, NPAES or SWSAs occur within 10km of site.
- The nearest Protected Area is the formally protected Klipriviersberg Nature Reserve, approximately 8km south-east of the site.
- The site is not within a National Freshwater Priority Area (NFEPA) Catchment. No NFEPA rivers occur within the property boundary or within 1km of the site.
- The Orlando Dam is a Rank 6 NFEPA wetland and provides no significant habitat to ecologically significant fauna (frogs, cranes and water birds).
- The site falls within the Mesic Highveld Grassland Bioregion of the Grassland Biome, specifically the Klipriver Highveld Grassland vegetation unit, which is also a Critically Endangered Ecosystem (NEM:BA, GN1002, 2011).
- A Class 3 Ridge neighbours the southern border.
- The site overlaps Important Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). All on-site and surrounding CBAs are categorised as such due to floral characteristics and none are listed as important RL fauna habitat.

Considering the limited value of the site in terms of fauna characteristics (limited to potential sensitive habitats and ecological connectivity) and the fact that the proposed activities will not result in any long term changes to the overall setting of the site, this the report is compiled as a Compliance Statement (GN648, 2019), with more detailed discussion on habitat and ecological connectivity in line with Appendix 6 of NEMA EIA Regulations.

The survey was undertaken on the 21 January 2020. The weather was overcast and warm and deemed adequate in terms of fauna surveying. The TOP species assessment indicated the following:

- The only TOPS confirmed (based on scat) is the South African Hedgehog with no TOPS recorded for the QDGS and very limited species likely to occur on site. The site is therefore unlikely to support significant TOP mammal populations. Only one endemic species is likely in the area and is not restricted; the area is not considered significant in terms of mammal endemism.
- No TOPS or endemic species were observed on site, and only a few were recorded for the pentad or likely to occur on site. Therefore the immediate area is unlikely to support significant TOP bird populations. None of the endemic species are restricted and the area is not considered significant in terms of bird endemism.
- Four Category 3 invasive species (GN864, 2016) and one exotic species were recorded for the Pentad (SABAP2). Only the Common Mynah (Category 3) is confirmed for the site.
- No significant TOP herpetofauna populations are expected on site. The specific site is not considered significant in terms of maintaining endemic herpetofauna populations.
- No TOP invertebrates were observed on site, but due to the cryptic and nocturnal nature of many TOP Boboon Spiders and TOP Scorpions these cannot be excluded from the site. As these are

burrowing species, they may be less frequent in areas along the road and busy pedestrian pathways where noise and vibration from traffic may dissuade burrowers.

In term of the sensitivity of the site as it pertains to terrestrial fauna, site findings are in agreement with the Gauteng C-Plan where the site is part of a significant ecological corridor and the site should continue to be conserved as a significant ESA, with wetlands and rivers considered highly sensitive and the remaining adjacent terrestrial areas considered moderately sensitive in terms of fauna. In terms of the specific CBAs, these hold no specific additional value in terms of fauna and their value and sensitivity should be further confirmed in terms of the flora assessment.

Limited background information was supplied and it is assumed that the maintenance and repair activities will involve the following:

- Establishing a contractors camp and storage area.
- Repairing the dam wall and spillway and any erosion / seepage around the wall embankment.
- Repair and rehabilitation of erosion around the various culverts.
- Possible limited excavation and in-filling to conduct repair work at the dam wall and culverts as may be needed.

The impact statement summary did not identify any highly significant impacts to terrestrial fauna and only the following impacts were further in detail in this report:

- AIS infestation.
- Trapping, killing and hindering of fauna in general.
- Contamination of terrestrial and aquatic habitats.

Impacts to terrestrial fauna are minimal and can be mitigated to low significance as long as the following proposed conditions are met:

- The managing body of the Klipriviersberg Nature Reserve must be included within the public participation process and any requirements included within the final EMPr.
- Wetlands and rivers must be managed in terms of the wetland report and also in line with the requirements of the water use authorisation.
- 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 site lies on the corner of Nicholas Street and the M68, Klipsruit, within the City of Johannesburg Metropolitan Municipality, Gauteng Province.

The intention is to conduct repair and maintenance activities on the Orlando Dam and existing surrounding bridges and culverts. From Table 1 it is clear that the only significant features on site are the CBA2 (categorised in terms of flora characteristics), the potential for the site to support a threatened ecosystem (a floral characteristic) and the fact that the site is within 10km of a formal protected area, the Klipriviersberg Nature Reserve surrounded by residential development.

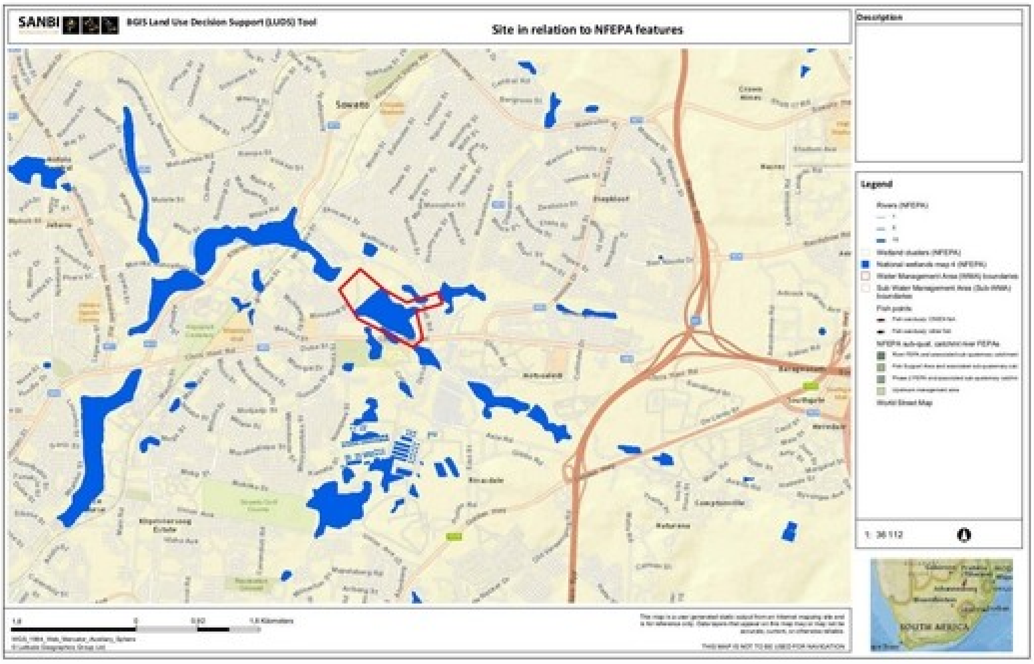
Considering the limited value of the site in terms of fauna characteristics (limited to potential sensitive habitats and ecological connectivity) and the fact that the proposed activities will not result in any long term changes to the overall setting of the site, this the report is compiled as a Compliance Statement (GN648, 2019), with more detailed discussion on habitat and ecological connectivity in line with Appendix 6 on the NEMA EIA Regulations.

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	UNESCO Biosphere: Magaliesberg Biosphere and World Heritage Site: Cradle of Humankind lie more than 35km north-north-west of the site. The nearest RAMSAR site is the Blesbokspruit Wetland system, more than 55km east of site.
Important Bird Areas (IBAs) (Plan 1)	The Magaliesberg IBA lies approximately 20km north-north-west of site.
Protected Areas (PA) (Plan 1)	The nearest Protected Area is the formally protected Klipriviersberg Nature Reserve approximately 8km south-east of the site. No other protected areas or NPAES occur within 10km of site.
Water Catchments & NFEPA Features (Plan 2)	The site is not within a National Freshwater Priority Area (NFEPA) Catchment. No NFEPA rivers occur within the property boundary or within 1km of the site. The Orlando Dam stream confluences with the Klip River approximately 7.5km south-south-west of site. The Klip River has an unacceptable PES (E/F) and RIVCON (E/F). The Orlando Dam is a Rank 6 NFEPA wetland with the other surrounding wetlands classed as Rank 5 wetlands. Rank 5 and 6 wetlands provide no significant habitat to ecologically significant fauna (frogs, cranes and water birds).
Strategic Water Source Areas (SWSA)	The nearest SWSA is the Far West Karst Region, approximately 11km west of site. The SWSA is upstream of the site.
Biome and Ecosystem	The site falls within the Mesic Highveld Grassland Bioregion of the Grassland Biome, specifically the Klipriver Highveld Grassland vegetation unit, which is also a Critically Endangered Ecosystem (NEM:BA, GN1002, 2011).
Gauteng Ridges	No ridges occur on site. A Class 3 Ridge neighbours the southern border.
Gauteng EMF (2014)	The site affects Zone 2: High control zone (within the urban development

Ecological feature / area	Description of feature relevant to the site
	zone) within a greater Zone 1: Urban development zone. It must be stressed that the resolution of the EMF is low.
Conservation Management Plans (Plan 3)	The site overlaps Important Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). All on-site and surrounding CBAs are categorised as such due to floral characteristics and none are listed as important RL fauna habitat.
EIA Screening Tool	No screening report was provided at the time of compiling this report. It is assumed that a "very high" sensitivity classification will be obtained for terrestrial biodiversity due possible threatened vegetation and the Important CBAs. No significant features, other than the ecological connectivity and corridor, of specific value to ecologically significant fauna have been identified from the desktop assessment above.
Quarter Degree Grid Square (QDGS)	The site lies within QDGS 2627BD. All desktop data obtained from the citizen science sites have been sourced for this QDGS.

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 (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:

- 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 site sensitivity based on desktop and site survey findings.
- Highlight potential risks on terrestrial fauna, with specific focus on ecologically significant species.
- 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 0f 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.

In addition to the above sources, 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 and 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 site 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.).
        - 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.

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 Fauna Sensitivity Assessment

A general discussion is provided on potential sensitive features relevant to terrestrial fauna. The sensitivity of the site must be considered along with the floral and wetland sensitivity 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 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 it is difficult to conclusively state if every species does or does not occur 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 survey was undertaken on the 21 January 2020. The weather was overcast and warm and deemed adequate in terms of fauna surveying. Plan 4 indicates the areas surveyed with the GPS tracks. Table 2 summarises the main features and main habitats and micro-habitats noted at each survey site.

The area is dominated by the Orlando Dam which is linked to a riverine CBA corridor east and west. Surrounding the Orlando Dam are largely CBAs associated with the wetland buffer zones and the greater riverine ecological corridor, with remaining areas designated as ESAs. The CBAs formed the focus for investigations.

The river was flowing at the time of the survey and showed definite signs of sewage contamination, which is likely to also have impacted the dam.

The main terrestrial vegetation is grassland, with patches of tree-lined areas, largely AI trees. The soils ranged from gravels to sandy-loams and clays are expected to dominate the wetlands and floodplains.

Surrounding areas are fairly densely developed and ecological connectivity is limited to the east and west along the river. Developments include formal and informal housing, industrial, community and tourism developments such as the canoe and adventure club associated with the decommissioned cooling towers.

Plan 4: GPS tracks and survey focus areas

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

Main Survey Sites	Overall Site Observations
Orlando Dam 	The dam forms a significant surface water feature in the area. The dam is surrounded by dense vegetation, ranging from dense shrubby growth to dense reed-beds. Therefore the site is likely to support aquatic species, including water birds and wetland specialists with a preference for dense aquatic growth around the water edge. The quality of water and surrounding anthropogenic activities would limit species to hardier fauna that can adapt to human activities and man-modified habitats.
Site 1 – Orlando Dam Wall 	View from the Orland Dam wall indicating the main CBA area lying north-west of the dam. The site is largely a floodplain grassland with small areas of preferential flow eroded into the floodplain. The area provides grassland habitat with dense low shrubs, largely exotic and AIS. Arboreal habitat on site is absent and limited to edges lying well outside the floodplain limits. The area will therefore support wetland and grassland specialist. But again, these are expected to only be hardier fauna that can adapt to human activities.
Site 2 – Orlando Dam Inlet Culvert 	The area south of the M68 where the river flows through the culvert was fenced off. The dam edges and the river provided dense reed-bed habitats utilised by several birds. The adjacent area is dominated by grassland well-utilised by pedestrians and several tracks are present through the site. Some trees, largely AIS, grew at various densities (single, isolated to grouped trees) along the outer edge of the dam near the water line. Although the area provided reasonable habitat heterogeneity, the limited size of natural areas coupled with the existing and ongoing anthropogenic impacts (including the busy roads) means that fauna in this area will be limited. Bird life was good within the reed-beds, although limited to common urban species.
Site 3  Site 4 	Site 3 and Site 4 are along the same tributary entering the Orlando Dam just south of the old cooling towers. The stream was in full flow, but the narrower stream only provided for smaller and more isolated reed-beds along its course. The stream edges were dominated by dense grassland vegetation, AI shrubs and trees, and reed-beds. The surrounding terrestrial vegetation was dominated by grassland with more scattered and isolated trees within the overall landscape. The stream showed signs of sewage contamination and has been impacted by anthropogenic activities, including subsistence crop plots, roads and infrastructure. The area will therefore support wetland and grassland specialist and also provides some arboreal habitats. Again, fauna are expected to only be hardier species that can adapt to impacted environments and human activities.

3.1 Mammals

Mammals recorded on site, the TOP, endemic and provincially protected mammals occurring in the region based on distribution maps and desktop mammals for the QDGS and iNaturalist are listed in Table 3.

3.1.1 Site species

No mammals were noted on site, but scat for two species were noted. Based on the characteristics of the scat and overall habitat characteristics it is suspected to belong to the following two species:

- Southern African Hedgehog (Atelerix frontalis) (GN151 Protected; RL Near Threatened; GP Protected Game). The species feeds predominantly on invertebrates and may play an important role in pest control. The most severe threats are 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).
- Common Duiker (*Sylvicapra grimmia*). The Common Duiker is an important prey base for several carnivores (Birss *et al.*, 2016).

3.1.2 Desktop species

The Plains Zebra (*Equus quagga*) was recorded in the greater area on iNaturalist. The ADU lists three additional species for the QDGS, all likely to occur on site. The following is relevant:

- Plains Zebra (*Equus quagga*) (RL and IUCN Near Threatened). By feeding on taller grass and lower quality grasses the Plains Zebra facilitates grazing of other herbivores that require shorter grazing grass. Zebra also chase and deter smaller predators, and are utilised by stock farmers for this reason. Main threats include habitat encroachment by cattle, illegal hunting and constrained movement increasing vulnerability to drought, and breeding issues due to isolation (Stears *et al.*, 2016).
- Savanna Hare (*Lepus victoriae*). The species is a prey base for carnivores and raptors. Although not listed as a TOPS, species is threatened by habitat loss and fragmentation as a result of urban sprawl, agricultural encroachment, commercial plantations and infrastructure development for tourism and also by hunting (Robinson *et al.*, 2016).
- Water (Marsh) Mongoose (*Atilax paludinosus*). The species is a prey base for carnivores and raptors. There are no major threats listed for the species, but its dependency on riverine vegetation for shelter in some areas, may make it vulnerable to loss of wetland habitat (Baker *et al.*, 2016).
- Cape Ground Squirrel (*Xerus inauris*). Species is an eco-engineer due to its burrowing activities. Other species also utilise their burrows. There are no major threats to this species (Waterman *et al.*, 2016).

Of the TOP and endemic species identified for the area, the following are likely to occur on site:

- Spotted-necked Otter (*Hydrictis maculicollis*) (GN151 Protected; RL Vulnerable). Species offers no significant eco-services. Main threats include crop and livestock agricultural practices leading to bank and shoreline erosion, denuding important vegetative cover used by otters, increased human presence and disturbance, increased use of mesh nets and poisoning in fishing, and change or depletion of their prey base. Human settlement expansion and disturbance increases habitat degradation from pollution and increases

incidences of persecution. Otters are killed for food or skins, or as a perceived threat to poultry and / or fish farms (Ponsonby *et al.*, 2016).

- Serval (Leptailurus serval) (GN151 Protected; RL Near Threatened). Servals may play a functional role in agricultural landscapes in controlling the number 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 Protected Game). 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).
- Honey Badger (*Mellivora capensis*) (GN151 Protected). Species may potentially contribute to the control of rodents and arthropods. Main threats include conflict and persecution by bee farmers (Begg *et al*., 2016).
- Steenbok (*Raphicerus campestris*) (GP Protected Game). 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).
- Endemic Pretoria Mole-rat (*Cryptomys pretoriae*). Species is considered an eco-engineer increasing the organic content of soil, aerating soil and may enhance infiltration and water holding capacity of soil. Also, the Mole-rat creates refuge in its burrows for other species to escape fire. Species is not threatened but is occasionally persecuted as agricultural, garden and golf-course pest (Bennett *et al*., 2016).

The only TOPS confirmed (based on scat) is the South African Hedgehog with no TOPS recorded for the QDGS and very limited TOP species likely to occur on site. The site is therefore unlikely to support significant TOP mammal populations. Only one endemic species is likely in the area. None of the endemic species listed in Table 3 are restricted and the area is not considered significant in terms of mammal endemism.

No exotic or AIS were identified from ADU lists or iNaturalist and none were observed on site. Due to the proximity of the site to residential areas, exotic and AI rodents and escaped pets are likely to occur in the area.

Table 3: TOP and Endemic Mammals

Common name	Taxon name	Endemism	SA GN151 Status	SA Red-list Status	Gauteng Schedule	IUCN Threatened Status
Species confirmed on site						
Hedgehog, Southern African	*Atelerix frontalis*		Protected	NT	2: Protected Game	
Duiker, Common	*Sylvicapra grimmia*					
Species confirmed for the QDGS (ADU / iNaturalist)						
Zebra, Plains	*Equus quagga*			NT		NT
Hare, Savanna	*Lepus victoriae*					
Mongoose, Water (Marsh)	*Atilax paludinosus*					
Squirrel, Cape Ground	*Xerus inauris*					
TOP and Endemic species Likely to occur on site						
Otter, Spotted-necked	*Hydrictis maculicollis*		Protected	Vulnerable		NT
Serval	*Leptailurus serval*		Protected	NT		
Reedbuck, Southern	*Redunca arundinum*		Protected		2: Protected Game	
Honey Badger (Ratel)	*Mellivora capensis*		Protected			
Steenbok	*Raphicerus campestris*				2: Protected Game	
Mole-rat, Pretoria	*Cryptomys pretoriae*	Endemic				
Possible TOP and Endemic species: Faunal habitat requirements limited in the area; Species may traverse or periodically forage in areas; Low / erratic density in area						
Oribi	*Ourebia ourebia*		Endangered	Endangered	2: Protected Game	
Hyaena, Brown	*Parahyaena brunnea*		Protected	NT	2: Protected Game	NT
Reedbuck, Southern Mountain	*Redunca fulvorufula*			Endangered	2: Protected Game	Endangered
Bat, Percival's Trident	*Cloeotis percivali*			Endangered		
Blesbok	*Damaliscus pygargus phillipsi*	Endemic		NT		
Aardvark	*Orycteropus afer*				2: Protected Game	
Eland, Common	*Tragelaphus (Taurotragus) oryx*				2: Protected Game	
Galago, Southern Lesser	*Galago moholi*				2: Protected Game	
Hartebeest, Red	*Alcelaphus buselaphus caama*				2: Protected Game	
Shrew, Forest	*Myosorex varius*	Endemic				
Rat, Tete Veld	*Aethomys ineptus*	Possible endemic				
Unlikely TOP and Endemic species: Edge of the species' distribution range; Preferred habitat is not available in the surrounds; Species restricted or at low / erratic density						
Leopard	*Panthera pardus*		Vulnerable	Vulnerable	4: Protected Wild Animals	Vulnerable
Wildebeest, Black	*Connochaetes gnou*	Endemic	Protected		2: Protected Game	
Fox, Cape	*Vulpes chama*		Protected			

Common name	Taxon name	Endemism	SA GN151 Status	SA Red-list Status	Gauteng Schedule	IUCN Threatened Status
Cat, Black-footed	*Felis nigripes*		Protected	Vulnerable		Vulnerable
Antelope, Sable	*Hippotragus niger niger*			Vulnerable	2: Protected Game	
Mouse (Rat), White-tailed	*Mystromys albicaudatus*			Vulnerable		Endangered
Shrew, Maquassie Musk	*Crocidura maquassiensis*			Vulnerable		
Rhebok, Grey	*Pelea capreolus*	Endemic		NT	2: Protected Game	NT
Giraffe	*Giraffa camelopardalis*				2: Protected Game	Vulnerable
Aardwolf	*Proteles cristata*				2: Protected Game	
Klipspringer	*Oreotragus oreotragus*				2: Protected Game	
Waterbuck	*Kobus ellipsiprymnus*				2: Protected Game	
Alien and Exotic Species recorded for the QDGS / on site						
None recorded						

NT: Near Threatened

3.2 Birds

Birds recorded on site and the TOP and endemic birds occurring in the greater region based on distribution maps and SABAP2 data (no birds recorded for the area on iNaturalist) are listed in Table 4. The full SABAP2 bird list is provided in Appendix B. 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 due to activities on site.

3.2.1 Site species

The species list is not indicative of the species on site and many more calls could be heard. Species were well concealed in the dense shrubs, grasses and reeds along the dam edges. No TOPS or endemic species were observed but several species are listed as Schedule 2: Protected Game species. Most species recorded feed on insects or invertebrates and will cumulatively contribute to invertebrate pest control. A few species are also seed, fruit and nectar eaters and will play a role in seed dispersal and pollination.

3.2.2 Desktop species

The following TOP and Endemic Species were recorded for the pentad (SABAP2):

- African Marsh Harrier (*Circus ranivorus*) (GN151 Protected; RL Endangered). Species provides little in terms of ecological services but together with other species may contribute to control of pest invertebrates, rodents and AI avifauna. Main threats include deterioration and loss of wetlands, primarily draining and damming of wetlands. Also threatened by poor land management practices and direct disturbance by humans during the breeding season (Taylor *et al.*, 2015).
- Secretarybird (*Sagittarius serpentarius*) (RL Vulnerable; IUCN Vulnerable). Species feeds on invertebrates and any small animal that can be over-powered. Species provides little in terms of ecological services. 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).
- Verreaux's Eagle (*Aquila verreauxii*) (RL Vulnerable). Species is more likely to reside in the neighbouring cliffs and ridges, but will forage and traverse neighbouring areas and may forage on site. 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).
- Lanner Falcon (*Falco biarmicus*) (RL Vulnerable). Species feeds mostly on birds, but also small mammals, reptiles and insects. Species provides little in terms of ecological services but together with other species may contribute to control of pest invertebrates, rodents and AI avifauna. Threats include loss and degradation of grassland habitat through agriculture and afforestation, which reduces its prey numbers. Also threatened by

poisoning, collisions with power-lines, persecution by fowl farmers and pigeon enthusiasts (Taylor *et al.*, 2015).

- White-bellied Korhaan (*Eupodotis senegalensis*) (RL Vulnerable). Species feeds mostly on insects, small reptiles and vegetative matter. Species provides little in terms of ecological services but together with other species may contribute to control of pest invertebrates. 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).
- Maccoa Duck (*Oxyura maccoa*) (RL Near Threatened; IUCN Vulnerable). Species feeds mostly on invertebrates, including snails and some plant matter. Species provides little in terms of ecological services but together with other species may contribute to control of aquatic invertebrates / vectors. Threats include draining of wetlands, pollution through bio-accumulation and AIS infestation. Water quality changes that alter their food source could also impact population numbers (Taylor *et al.*, 2015).
- Endemic Sentinel Rock-thrush (*Monticola explorator*) (IUCN Near Threatened). Species feeds on insects, fruit and seeds and will act as seed disperser and may contribute to control of invertebrate numbers with other insectivores (Taylor *et al.*, 2015).
- Endemic South African Cliff Swallow (*Hirundo spilodera*). Species feeds on aerial insects and termites. Species may contribute to control of invertebrate numbers with other insectivores (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. Species may also contribute to control of invertebrate numbers with other insectivores (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. Species may also contribute to control of invertebrate numbers with other insectivores (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. Species may also contribute to control of invertebrate numbers with other insectivores (Taylor *et al.*, 2015).

The following TOP and Endemic Species are likely to occur on site:

- Lesser Kestrel (*Falco naumanni*) (GN151 Vulnerable). As an insectivore, the species may contribute to control of invertebrate populations. 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).
- Yellow-billed Stork (*Mycteria ibis*) (RL Endangered). Species feeds on fish, frogs, insects, worms and crustaceans. Ecosystem services are limited but may contribute to aquatic pest control and possibly control of AI fish. Threats include loss of wetland habitats, including wetland systems of pans, marshes and floodplains. Loss of suitable trees for roosting/nesting also threatens species (Taylor *et al.*, 2015).
- Endemic Eastern Long-billed Lark (*Certhilauda semitorquata*). Species feeds on insects and seeds and may provide limited seed dispersal. Species may also contribute to control of invertebrate numbers with other insectivores (Taylor *et al.*, 2015).
- Endemic Greater Double-collared Sunbird (*Cinnyris afer*). Species feeds on nectar and also insects and spiders. Species is a pollinator. Species may also contribute to control of invertebrate numbers with other insectivores(Taylor *et al.*, 2015).

No TOPS or endemic species were observed on site, and only a few were recorded for the pentad or likely to occur on site. Therefore the immediate area is unlikely to support significant TOP bird

populations. None of the endemic species listed in Table 4 are restricted and the area is not considered significant in terms of bird endemism.

Four Category 3 invasive species (GN864, 2016) and one exotic species were recorded for the Pentad (SABAP2). Only the Common Mynah is confirmed for the site. These AIS are common, occurring throughout South Africa and associated with human settlements and are highly likely to occur in the urban area and the property.

Table 4: TOP and Endemic Birds

Common name	Taxon name	Endemism	SA GN151 Status	SA Red-list Status	IUCN Threatened Status
Species confirmed on site					
Barbet, Black-collared	*Lybius torquatus*				
Batis, Chinspot	*Batis molitor*				
Bishop, Southern Red	*Euplectes orix*				
Chat, Familiar	*Cercomela (Oenanthe) familiaris*				
Dove, Cape Turtle (Ring-necked)	*Streptopelia capicola*				
Dove, Laughing	*Spilopelia senegalensis*				
Ibis, Hadeda	*Bostrychia hagedash*				
Lapwing, Blacksmith	*Vanellus armatus*				
Martin, Common House	*Delichon urbicum*				
Masked-weaver, Southern	*Ploceus velatus*				
Myna, Common	*Acridotheres tristis*	Category 3 #			
Pipit, African	*Anthus cinnamomeus*				
Sparrow-lark, Chestnut-backed	*Eremopterix leucotis*				
Swallow, Lesser Striped	*Hirundo (Cecropis) abyssinica*				
Thrush, Karoo	*Turdus smithi*				
Whydah, Pin-tailed	*Vidua macroura*				
TOP, Endemic and Near Threatened species confirmed for the Pentad (SABAP2) (full SABAP2 species list in Appendix B)					
Harrier, African Marsh	*Circus ranivorus*		Protected	Endangered	
Secretarybird	*Sagittarius serpentarius*			Vulnerable	Vulnerable
Eagle, Verreaux's	*Aquila verreauxii*			Vulnerable	
Falcon, Lanner	*Falco biarmicus*			Vulnerable	
Korhaan, White-bellied	*Eupodotis senegalensis*			Vulnerable	
Duck, Maccoa	*Oxyura maccoa*			NT	Vulnerable
Rock-thrush, Sentinel	*Monticola explorator*	Endemic			NT
Swallow, South African Cliff	*Hirundo (Petrochelidon) spilodera*	Breeding Endemic			
Starling, African Pied	*Spreo (Lamprotornis) bicolor*	Endemic			
Weaver, Cape	*Ploceus capensis*	Endemic			
White-eye, Cape	*Zosterops virens*	Endemic			
TOP and Endemic species Likely to occur in the natural landscape associated with the site					
Kestrel, Lesser	*Falco naumanni*		Vulnerable		
Stork, Yellow-billed	*Mycteria ibis*			Endangered	

Common name	Taxon name	Endemism	SA GN151 Status	SA Red-list Status	IUCN Threatened Status
Lark, Eastern Long-billed	*Certhilauda semitorquata*	Endemic			
Sunbird, Greater Double-collared	*Cinnyris afer*	Endemic			
Possible TOP and Endemic species: Faunal habitat requirements limited in the area; Species may traverse or periodically forage in areas; Low / erratic density in area					
Pelican, Pink-backed	*Pelecanus rufescens*		Endangered	Vulnerable	
Eagle, Martial	*Polmaetus bellicosus*		Vulnerable	Endangered	Vulnerable
Owl, African Grass	*Tyto capensis*		Vulnerable	Vulnerable	
Harrier, Black	*Circus maurus*			Endangered	Endangered
Finfoot, African	*Podica senegalensis*			Vulnerable	
Pelican, Great White	*Pelecanus onocrotalus*			Vulnerable	
Tern, Caspian	*Sterna (Hydroprogne) caspia*			Vulnerable	
Rock-thrush, Cape	*Monticola rupestris*	Endemic			
Unlikely TOP and Endemic species: Edge of the species' distribution range; Preferred habitat is not available in the surrounds; Species restricted or at low / erratic density					
Vulture, Cape	*Gyps coprotheres*		Endangered	Endangered	Endangered
Crane, Blue	*Anthropoides paradiseus*	Endemic	Endangered	NT	Vulnerable
Stork, Black	*Ciconia nigra*		Vulnerable	Vulnerable	
Korhaan, Blue	*Eupodotis caerulescens*	Endemic	Vulnerable		NT
Falcon, Peregrine	*Falco peregrinus*		Vulnerable		
Heron, White-backed Night	*Gorsachius leuconotus*			Vulnerable	
Dove, European Turtle	*Streptopelia turtur*				Vulnerable
Alien and Exotic Species recorded for the QDGS / on site					
Dove / Pigeon, Rock	*Columa livia*	Category 3 (Restricted Category 2) #			
Myna, Common	*Acridotheres tristis*	Category 3 #			
Sparrow, House	*Passer domesticus*	Category 3 #			
Starling, Common	*Sturnus vulgaris*	Category 3 #			
Peacock, Common	*Pavo cristatus*	Exotic			

NT: Near Threatened
 # GN864 of 2016, South African AIS List

3.3 Herpetofauna

TOP and endemic herpetofauna occurring in the greater region based on distribution maps and ADU data (no herpetofauna recorded for the area on iNaturalist) are listed in Table 5.

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 the proposed activities.

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

3.3.1 Site species

No frogs or reptiles were noted on site.

3.3.2 Desktop species

Only a single endemic species was recorded for the QDGS:

- Endemic Transvaal Thick-toed Gecko (*Pachydactylus affinis*).

TOP and endemic herpetofauna likely to occur on site include:

- Endemic Striped Harlequin Snake (*Homoroselaps dorsalis*) (RL Near Threatened). Species is threatened by loss, degradation and fragmentation of habitat.
- Endemic Eastern Ground Agama (*Agama aculeata distanti*).
- Endemic Thin-tailed Legless Skink (*Acontias gracilicauda*).
- Endemic Aurora House Snake (*Lamprophis aurora*).
- Endemic Olive Ground Snake (*Lycodonomorphus inornatus*).
- Giant Bullfrog (*Pyxicephalus adspersus*) (GN151 Protected; RL Near Threatened). Species is threatened by loss and degradation of its wetland and neighbouring terrestrial habitat.
- Endemic Rattling Frog (*Semnodactylus wealii).*
- Endemic Raucous Toad (*Amietophrynus rangeri).*

Many reptiles and frogs are insectivores and contribute to control of invertebrate populations with other insectivorous species. They are also prey-base for many animals.

No significant TOP herpetofauna populations are expected on site. The specific site is not considered significant in terms of maintaining endemic herpetofauna populations.

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

3.4 Invertebrates

A summary of TOP invertebrates and provincially protected invertebrates with distribution ranges over and near the survey area are included in Table 6 with ADU species indicated in bold (no TOP species were recorded in the area on iNaturalist). It must be stressed that the distribution of many species listed in GN151 (2007) 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.

Although a specific invertebrate assessment was not completed, the site supported various invertebrate species which is not surprising considering the diversity of insectivorous birds recorded on site. Abundant invertebrates included flies (Diptera), grasshoppers and locusts (Orthoptera), Hymenoptera (including honeybees and ants), various spiders (Araneae) and butterflies (Lepidoptera). Two butterflies were confirmed and include the Meadow White (*Pontia helice helice*) and African Monarch (*Danaus chrysippus aegyptius*).

Table 5: TOP and Endemic Herpetofauna

Common name	Taxon name	Endemism	SA GN151 Status	SA Red-list Status	IUCN Threatened Status
Species confirmed for the QDGS (ADU / iNaturalist)					
Gecko, Transvaal Thick-toed	*Pachydactylus affinis*	Endemic			
Agama, Southern Rock	*Agama atra*				
Centipede-eater, Black-headed	*Aparallactus capensis*				
Egg-eater, Common	*Dasypeltis scabra*				
Gecko, Cape	*Pachydactylus capensis*				
Rinkhals	*Hemachatus haemachatus*				
Skink, Cape	*Trachylepis capensis*				
Snake, Brown House	*Boaedon capensis*				
Toad, Guttural	*Amietophrynus (Sclerophrys) gutturalis*				
River Frog, Poynton's	*Amietia poyntoni*				
TOP and Endemic species Likely to occur in the natural landscape associated with the site					
Snake, Striped Harlequin	*Homoroselaps dorsalis*	Endemic		NT	
Agama, Eastern Ground	*Agama aculeata distanti*	Endemic			
Skink, Thin-tailed Legless	*Acontias gracilicauda*	Endemic			
Snake, Aurora House	*Lamprophis aurora*	Endemic			
Snake, Olive Ground	*Lycodonomorphus inornatus*	Endemic			
Bullfrog, Giant	*Pyxicephalus adspersus*		Protected	NT	
Frog, Rattling	*Semnodactylus wealii*	Endemic			
Toad, Raucous	*Amietophrynus rangeri (Sclerophrys capensis)*	Endemic			
Possible TOP and Endemic species: Faunal habitat requirements limited in the area; Species may traverse or periodically forage in areas; Low / erratic density in area					
Lizard, Coppery Grass (Transvaal Grass)	*Chamaesaura aenea*	Endemic		NT	
Tortoise, Lobatse Hinged-back	*Kinixys lobatsiana*				Vulnerable
Lizard, Common Crag	*Pseudocordylus melanotus melanotus*	Endemic			
Lizard, Delalande's Sandveld	*Nucras lalandii*	Endemic			
Slug-eater, Common	*Duberria lutrix lutrix*	Endemic			
Snake, Spotted Harlequin	*Homoroselaps lacteus*	Endemic			
Unlikely TOP and Endemic species: Edge of the species' distribution range; Preferred habitat is not available in the surrounds; Species restricted or at low / erratic density					
-					
Alien and Exotic Species recorded for the QDGS / on site					
No AIS or exotic species recorded on ADU or iNaturalist					

NT: Near Threatened

Table 6: TOP Invertebrates (ADU species indicated in bold)

Class	Order	Scientific name (IUCN Nomenclature)	Common name	SA GN151 Status	SA Red-list Status	Gauteng Schedule	IUCN Threatened Status
Arachnida	Aranae	*Harpactira atra*	Common Baboon Spiders	Protected		7: Invertebrates	
Arachnida	**Aranae**	***Harpactira hamiltoni***	**Common Baboon Spiders**	**Protected**		**7: Invertebrates**	
Arachnida	Aranae	*Pterinochilus lugardi*	Golden Baboon Spiders	Protected		7: Invertebrates	
Arachnida	Scorpiones	*Hadogenes gracilis*	Flat Rock Scorpions	Protected			
Arachnida	Scorpiones	*Hadogenes gunningi*		Protected			
Arachnida	Scorpiones	*Hadogenes longimanus*		Protected			
Arachnida	Scorpiones	*Opisthacanthus capensis*	Creeping Scorpions	Protected			
Arachnida	Scorpiones	*Opistophthalmus glabrifrons*	Burrowing Scorpions	Protected			
Insecta	Coleoptera	*Dromica sp.*	Tiger Beetles	Protected			
Insecta	Coleoptera	*Graphipterus assimilis**	Velvet Ground Beetle	Protected			
Insecta	Coleoptera	*Manticora sp.*	Monster Tiger Beetles	Protected			
Insecta	Coleoptera	*Megacephala asperata**	Tiger Beetles	Protected			
Insecta	Coleoptera	*Megacephala regalis**	Tiger Beetles	Protected			
Insecta	Coleoptera	*Prothyma guttipennis**	Tiger Beetles	Protected			
Insecta	Coleoptera	*Nigidius auriculatus**	Stag Beetles	Protected			
Insecta	Coleoptera	*Prosopocoilus petitclerci**	Stag Beetles	Protected			
Insecta	Coleoptera	*Ichnestoma sp.*	Fruit Chafer Beetles	Protected			
Insecta	Lepidoptera	*Aloeides dentatis dentatis*	Roodepoort Copper		Endangered	7: Invertebrates	Vulnerable
Insecta	Lepidoptera	*Chrysoritis aureus*	Heidelberg Opal		Endangered	7: Invertebrates	
Insecta	**Lepidoptera**	***Lepidochrysops praeterita***	**Highveld Blue**		**Endangered**		
Insecta	**Lepidoptera**	***Orachrysops mijburghi***	**Mijburgh's Blue**		**Endangered**		
Insecta	Lepidoptera	*Charaxes jahlusa*	Pearl-spotted Emperor			7: Invertebrates	
Insecta	Lepidoptera	*Charaxes jasius saturnus*	Foxy Emperor			7: Invertebrates	
Insecta	Orthoptera	*Clonia uvarovi*	Uvarov's Clonia				Vulnerable

*** Provincial and specific distribution unknown**

3.5 Habitat Sensitivity in Terms of Fauna

The site has limited value in terms of terrestrial fauna, however as an aquatic corridor it provides wetland and associated terrestrial habitat and a significant regional ecological corridor within a fairly densely developed urban area. The wetlands and rivers are considered highly sensitive and the remaining adjacent terrestrial areas considered moderately sensitive in terms of fauna.

Therefore, site findings are in agreement with the Gauteng C-Plan where the site is part of a significant ecological corridor and the site should continue to be conserved as a significant ESA.

In terms of the specific C-Plan CBAs, these hold no specific additional value in terms of fauna and their value and sensitivity should be further confirmed in terms of the flora assessment.

4. Fauna Impact Statement

In terms of the impact assessment the following is assumed:

- The 100m / 1:100 year flood-line of the streams, rivers, dams and wetlands will be respected as per legislation (NWA) or the necessary authorisation obtained.

Limited background information was supplied and it is assumed that the maintenance and repair activities will involve the following:

- Establishing a contractors camp and storage area.
- Repairing the dam wall and spillway and any erosion / seepage around the wall embankment.
- Repair and rehabilitation of erosion around the various culverts.
- Possible limited excavation and in-filling to conduct repair work at the dam wall and culverts as may be needed.

In terms of terrestrial fauna, the impacts are expected to be minimal due to the nature of the activity, the limited area of disturbance and the fact that very few TOPS are likely in the area. Operational phase impacts have not been assessed as it is expected to be limited to inspection and minor repair and maintenance, which in the long term would prevent environmental impact.

The following impacts were considered, with significant impacts further assessed below:

- Ecological drivers include climate change, AIS infestation and change in habitat.
  - The main driver that may be affected by the proposed development is that of AIS infestation, however the area is already heavily impacted by AIS and additional contribution is not seen as significant. Regardless, the risk for AIS infestation or AIS population growth must be mitigated.
  - The only significant habitat is that associated with the wetlands and rivers which must be managed in terms of the wetland report and also in line with the requirements of the water use authorisation.
- The main ecological process is the primary production through photosynthesis and associated contribution to the water cycle through evapotranspiration. This is not expected to be impacted. 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.
- Ecological services that have been identified are largely centred around the control of invertebrate populations by insectivorous species on site. Other services identified include the provision of prey to carnivores and raptors, control of small animals (rodents, AI birds or fish), eco-engineering (mostly burrowing), pollination and seed dispersal.
  - Due to the limited fauna observed on site and the fact that ongoing anthropogenic impacts exist on site, the proposed activity will not further impact or impair on ecological services provided by fauna, as long as staff and contractors on site are instructed not to kill any fauna on site.
- Features identified through the desktop assessment:
  - The nearest Protected Area is the formally protected Klipriviersberg Nature Reserve approximately 8km south-east of the site. The managing body of the reserve must be

included within the public participation process and any requirements included within the final EMPr.

- The site falls within the Mesic Highveld Grassland Bioregion of the Grassland Biome, specifically the Klipriver Highveld Grassland vegetation unit, which is also a Critically Endangered Ecosystem (NEM:BA, GN1002, 2011). The flora report must be consulted in terms of the presence of the vegetation unit, or other sensitive flora habitats.
- The site overlaps Important Critical Biodiversity Areas (CBAs) and Ecological Support Areas ESAs). All CBAs are categorised for their potential floral characteristics and none are listed as important RL fauna habitat. The site finding confirm that CBAs had little value in terms of terrestrial fauna specifically, but do contribute to the ecological corridor.

- Ecological corridors and connectivity:
  - As stated above the site is connected to CBAs and ESAs, and although not specifically listed in terms of RL fauna habitat, the features do provide a significant ecological corridor within a region that is largely developed. Therefore, the site is important in terms of ecological connectivity. The proposed activities will however not impair the ecological corridor and no significant impacts are expected.
- Direct impacts to fauna and loss of fauna:
  - No burrowing vertebrate species were identified for the area and it is unlikely that TOP burrowing species will be affected, other than possible TOP Baboon Spiders and TOP scorpions.
  - The site is unlikely to support significant TOPS populations and is not an area of faunal endemism.
  - No significant TOP water birds were recorded on site or on the SABAP2 data. Therefore TOP water birds are unlikely to utilise the site for any significant period of time and are likely to leave the area should additional disturbance take place. Regardless, disturbance to fauna breeding sites and dens must be prevented in terms of conserving existing faunal biodiversity on site.
  - The development must have policies in place to prevent staff and contractors from hunting, trapping, killing and hindering any fauna on and around site.
  - As the site is traversed by well-utilised roads and pedestrian pathways, and adjacent to bustling formal and informal developments additional impacts associated with noise and dust from the proposed development are not expected to significantly impact on fauna.

In light of the impact statement above, the following impacts are further assessed and must be mitigated:

- AIS infestation.
- Trapping, killing and hindering of fauna in general.
- Contamination of terrestrial and aquatic habitats.

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 1-29)	Impact will not significantly change fauna biodiversity and requires no significant mitigation measures.
Moderate (score of 30-60)	Impact will change fauna biodiversity and requires some mitigation measures.
High (Score of 61-100)	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: 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 area. Activities, such as leaving food and food waste out, could attract additional species or individuals to site which must be avoided, although this is likely to be insignificant due to the short duration of the activity.		
	Without Mitigation	With Mitigation
Construction Phase		
Probability	Improbable (2)	Very improbable (1)
Duration	Short to medium (2)	Short to medium (2)
Extent	Local (2)	Local (2)
Magnitude	Moderate (6)	Moderate to slight (4)
Significance	**20 (Low)**	**8 (Low)**
Status	-ve	-ve
Is Impact Reversible?	Low: Species numbers should revert to current state naturally	
Irreplaceable loss of resource?	Low	
Can impact be mitigated?	Yes	
Mitigation: **CONTROL**: Implement AIS management plan in line with the municipal management plan. Prevent attracting additional alien fauna: do not feed wildlife and ensure that all food and food 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 for disposal of waste to prevent the attraction of scavenging pest species to the site. **REMEDY**: Inspect and clear waste from site on a daily basis. Utilise local indigenous plants during rehabilitation where needed and do not disturb indigenous fauna in any way.		
Cumulative Impact: Altered population dynamics of natural indigenous species, such as displacement by alien invasive species, could cause significant impact on overall faunal community structure and indigenous biodiversity. The probability is seen as low in terms of the propose development.		
Residual Impact: If not properly managed, alien invasive species will out-compete indigenous flora and reduce overall indigenous biodiversity in the area. The probability is seen as low in terms of the propose development.		

2) Nature: Hindrance, trapping, killing of fauna Prevent deliberate trapping, killing and hindering of fauna (mammals through to invertebrates) in the area.		
	Without Mitigation	With Mitigation
Construction Phase		
Probability	Probable (3)	Improbable (2)
Duration	Permanent (5)	Permanent (5)
Extent	Site specific (1)	Site specific (1)
Magnitude	Slight to moderate (4)	Slight (2)
Significance	**30 (Moderate)**	**16 (Low)**
Status	-ve	-ve
Is Impact Reversible?	Low: Reversible	
Irreplaceable loss of resource?	Low	
Can impact be mitigated?	Yes	
Mitigation: **STOP**: No work to be conducted until water use authorisation is obtained. **MODIFY**: If possible schedule work during the dry season when fauna richness is likely to be lower (migrants have left the area, fauna less likely to be breeding). **CONTROL**: Peg out areas for activities / storage and maintain areas as small as possible to prevent disturbance to areas not targeted for development. All contractors on site must undergo environmental awareness training which must include the prohibition of any harm or hindrance to any indigenous fauna species. Ensure safe speed limits in the development area. Ensure all drivers on site and staff and contractors are informed of the importance of TOP species that are highly likely to or could possibly occur in the area through environmental awareness training. **REMEDY**: Contracts with contractors must specify actions that will be taken against contractors who do not conduct activities in line with the EMP.r Should any fauna be trapped within the development area, activities will cease and specialists brought in to safely remove the animals from site.		
Cumulative Impacts: Any inadvertent destruction of TOPS (or prey-base of TOPS) could cause a cascade affect on populations and in extreme circumstances local extinctions which would cause further significant declines in species.		
Residual Impact: Local extinctions caused by destruction of TOPS will alter the faunal community structure (for example the prey-base my bloom, or competitive predator numbers could increase). Predicting the extent and significance of such changes is not possible, but could have devastating consequences on ecological balances and overall biodiversity.		

3) Nature: Pollution of faunal environments and habitats through leaks and spills of hazardous substances (hydrocarbons and chemicals), littering and dumping of waste, cement spills, sewage leaks including downstream impacts through run-off.

Any pollution to the environment could leach and contaminate soils and groundwater, and will contaminate the nearby downstream environments through storm-water run-off. This will impact wetlands, aquatic ecology, ecological corridors and water quality in downstream environments.

	Without Mitigation	With Mitigation
Construction Phase		
Probability	Highly Probable (4)	Improbable (2)
Duration	Medium (3)	Medium (3)
Extent	Local (2)	Site specific (1)
Magnitude	Moderate (6)	Slight (2)
Significance	**44 (moderate)**	**12 (Low)**
Status	-ve	-ve
Is Impact Reversible?	Moderate: Clean-up is required if impact occurs	
Irreplaceable loss of resource?	Low	
Can impact be mitigated?	Yes	

Mitigation:
STOP: Discontinue use of all faulty machinery / equipment on site until properly repaired.
Ensure that facilities are provided, where relevant, to ensure that ALL substances on site are stored, handled and disposed of as prescribed by law and national or prescribed standards before substances are brought to site.
MODIFY: Facilities will be provided for storage of all hazardous substances and waste to prevent the exposure of these substances to the environment.
CONTROL: Provide for adequate portable toilets and keep these clean and hygienic and outside the flood lines. Portable toilets will properly managed and emptied regularly to prevent overflow and leaks.
Waste will be stored, handled and disposed of according to NEM:WA.
All equipment / machinery will be serviced and maintained within operating specifications to prevent the risks of leaks. 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. Due to proximity of petrol stations, hydrocarbon storage on site should be limited. All oily rags and oil-contaminated containers will be placed in the hazardous used-hydrocarbon drums for disposal to a hazardous waste facility.
Cement bags and construction material will be stored under a tarpaulin and on an impervious sheet.
Cement mixing will take place within a designated area outside the flood-line.
REMEDY: Inspect and clear all litter and waste from the site and surrounds.
All hydrocarbons spills on bare ground will be cleared immediately.
All dry and wet cement spills on bare ground will be cleared immediately.
All material not utilised and all waste will be removed from site on completion of activities.

Cumulative Impact: Any additional activity 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 and contaminate the environment and poison the fauna.

Residual Impact: If toxic substances and waste are not properly handled, the environment will suffer extended residual impacts, particularly if toxins seep into the soils or are washed to downstream environments.

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 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 four Category 3 alien invasive avifauna species were identified for the QDGS, with the Common Myna confirmed. 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 8 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. This includes the final layout of no-go areas.	Environmental officer (EO)	Once-off
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
Activity areas must be checked daily and all litter and waste food collected and disposed of to the relevant waste bin, all hydrocarbon and cement spills and leaks cleared.	EO appointed person.	Daily
Apply monitoring and auditing requirements stipulated in NWA & NEMA authorisations as relevant.	Environmental officer (EO)	Every 6 months

6. Conclusion and Recommendations

As detailed above, impacts to terrestrial fauna are minor and can be mitigated to low significance as long as the following proposed conditions are met:

- The managing body of the Klipriviersberg Nature Reserve must be included within the public participation process and any requirements included within the final EMPr.
- Wetlands and rivers must be managed in terms of the wetland report and also in line with the requirements of the water use authorisation.
- 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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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.

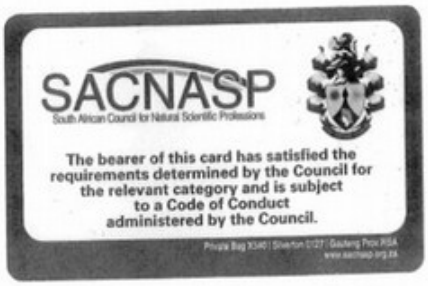
1993-1998: Part-Time Jobs

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



SACNASP

South African Council for Natural Scientific Professions

The bearer of this card has satisfied the requirements determined by the Council for the relevant category and is subject to a Code of Conduct administered by the Council.

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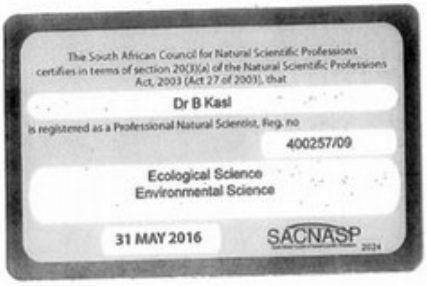


The South African Council for Natural Scientific Professions certifies in terms of section 20(3)(a) of the Natural Scientific Professions Act, 2003 (Act 27 of 2003), that

Dr B Kasl

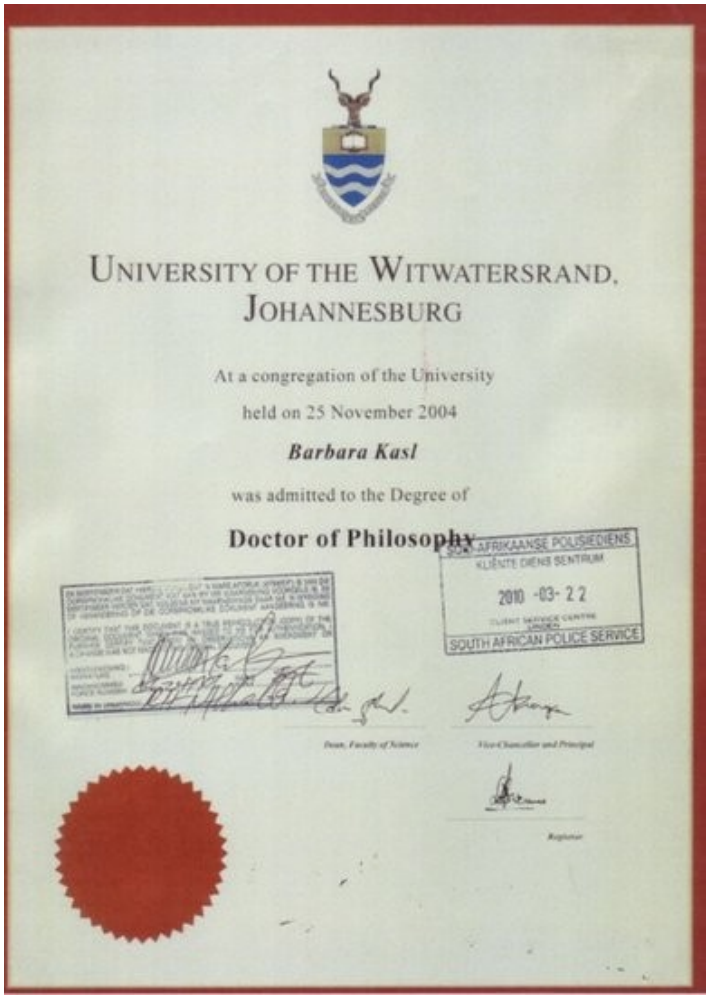
is registered as a Professional Natural Scientist, Reg. no

400257/09

Ecological Science
Environmental Science

31 MAY 2016

SACNASP 2024



UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

At a congregation of the University

held on 25 November 2004

Barbara Kasl

was admitted to the Degree of

Doctor of Philosophy

SUID-AFRIKAANSE POLISIEDIENS
KLIËNTE DIENS SENTRUM
2010 -03- 22
SOUTH AFRICAN POLICE SERVICE

Dean, Faculty of Science

Vice-Chancellor and Principal

Registrar

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

Common Name	Scientific name
Apalis, Bar-throated	*Apalis thoracica*
Avocet, Pied	*Recurvirostra avosetta*
Barbet, Acacia Pied	*Tricholaema leucomelas*
Barbet, Black-collared	*Lybius torquatus*
Barbet, Crested	*Trachyphonus vaillantii*
Bee-eater, European	*Merops apiaster*
Bee-eater, White-fronted	*Merops bullockoides*
Bishop, Southern Red	*Euplectes orix*
Bishop, Yellow	*Euplectes capensis*
Bishop, Yellow-crowned	*Euplectes afer*
Bittern, Little	*Ixobrychus minutus*
Bokmakierie, Bokmakierie	*Telophorus zeylonus*
Boubou, Southern	*Laniarius ferrugineus*
Bulbul, African Red-eyed	*Pycnonotus nigricans*
Bulbul, Dark-capped	*Pycnonotus tricolor*
Bunting, Cape	*Emberiza capensis*
Bunting, Cinnamon-breasted	*Emberiza tahapisi*
Buzzard, Steppe	*Buteo vulpinus*
Canary, Black-throated	*Crithagra atrogularis*
Canary, Yellow	*Crithagra flaviventris*
Canary, Yellow-fronted	*Crithagra mozambicus*
Chat, Anteating	*Myrmecocichla formicivora*
Cisticola, Cloud	*Cisticola textrix*
Cisticola, Desert	*Cisticola aridulus*
Cisticola, Lazy	*Cisticola aberrans*
Cisticola, Levaillant's	*Cisticola tinniens*
Cisticola, Wailing	*Cisticola lais*
Cisticola, Wing-snapping	*Cisticola ayresii*
Cisticola, Zitting	*Cisticola juncidis*
Cliff-chat, Mocking	*Thamnolaea cinnamomeiventris*
Cliff-swallow, South African	*Hirundo spilodera*
Coot, Red-knobbed	*Fulica cristata*
Cormorant, Reed	*Phalacrocorax africanus*
Cormorant, White-breasted	*Phalacrocorax carbo*
Coucal, Burchell's	*Centropus burchellii*
Courser, Temminck's	*Cursorius temminckii*
Crake, African	*Crecopsis egregia*
Crake, Black	*Amaurornis flavirostris*
Crake, Corn	*Crex crex*
Crombec, Long-billed	*Sylvietta rufescens*
Crow, Pied	*Corvus albus*
Cuckoo, Diderick	*Chrysococcyx caprius*
Cuckoo, Red-chested	*Cuculus solitarius*
Darter, African	*Anhinga rufa*
Dove, Laughing	*Streptopelia senegalensis*
Dove, Namaqua	*Oena capensis*
Dove, Red-eyed	*Streptopelia semitorquata*

Common Name	Scientific name
Dove, Rock	*Columba livia*
Duck, African Black	*Anas sparsa*
Duck, Fulvous	*Dendrocygna bicolor*
Duck, Maccoa	*Oxyura maccoa*
Duck, White-faced	*Dendrocygna viduata*
Duck, Yellow-billed	*Anas undulata*
Eagle, Verreaux's	*Aquila verreauxii*
Eagle-owl, Spotted	*Bubo africanus*
Egret, Cattle	*Bubulcus ibis*
Egret, Little	*Egretta garzetta*
Egret, Yellow-billed	*Egretta intermedia*
Falcon, Amur	*Falco amurensis*
Falcon, Lanner	*Falco biarmicus*
Finch, Red-headed	*Amadina erythrocephala*
Firefinch, Jameson's	*Lagonosticta rhodopareia*
Fiscal, Common (Southern)	*Lanius collaris*
Flamingo, Greater	*Phoenicopterus ruber*
Flufftail, Red-chested	*Sarothrura rufa*
Flycatcher, Fairy	*Stenostira scita*
Flycatcher, Fiscal	*Sigelus silens*
Flycatcher, Spotted	*Muscicapa striata*
Francolin, Orange River	*Scleroptila levaillantoides*
Francolin, Red-winged	*Scleroptila levaillantii*
Go-away-bird, Grey	*Corythaixoides concolor*
Goose, Egyptian	*Alopochen aegyptiacus*
Goose, Spur-winged	*Plectropterus gambensis*
Grassbird, Cape	*Sphenoeacus afer*
Grebe, Great Crested	*Podiceps cristatus*
Grebe, Little	*Tachybaptus ruficollis*
Greenshank, Common	*Tringa nebularia*
Guineafowl, Helmeted	*Numida meleagris*
Gull, Grey-headed	*Larus cirrocephalus*
Hamerkop, Hamerkop	*Scopus umbretta*
Harrier, Pallid	*Circus macrourus*
Heron, Black	*Egretta ardesiaca*
Heron, Black-headed	*Ardea melanocephala*
Heron, Goliath	*Ardea goliath*
Heron, Green-backed	*Butorides striata*
Heron, Grey	*Ardea cinerea*
Heron, Purple	*Ardea purpurea*
Heron, Squacco	*Ardeola ralloides*
Hobby, Eurasian	*Falco subbuteo*
Honeybird, Brown-backed	*Prodotiscus regulus*
Hoopoe, African	*Upupa africana*
House-martin, Common	*Delichon urbicum*
Ibis, African Sacred	*Threskiornis aethiopicus*
Ibis, Glossy	*Plegadis falcinellus*

Common Name	Scientific name
Ibis, Hadeda	*Bostrychia hagedash*
Indigobird, Purple	*Vidua purpurascens*
Jacana, African	*Actophilornis africanus*
Kingfisher, Brown-hooded	*Halcyon albiventris*
Kingfisher, Giant	*Megaceryle maximus*
Kingfisher, Malachite	*Alcedo cristata*
Kingfisher, Pied	*Ceryle rudis*
Kite, Black-shouldered	*Elanus caeruleus*
Kite, Yellow-billed	*Milvus aegyptius*
Korhaan, Northern Black	*Afrotis afraoides*
Korhaan, White-bellied	*Eupodotis senegalensis*
Lapwing, African Wattled	*Vanellus senegallus*
Lapwing, Blacksmith	*Vanellus armatus*
Lapwing, Crowned	*Vanellus coronatus*
Lark, Melodious	*Mirafra cheniana*
Lark, Red-capped	*Calandrella cinerea*
Lark, Rufous-naped	*Mirafra africana*
Lark, Sabota	*Calendulauda sabota*
Lark, Spike-heeled	*Chersomanes albofasciata*
Longclaw, Cape	*Macronyx capensis*
Mannikin, Bronze	*Spermestes cucullatus*
Marsh-harrier, African	*Circus ranivorus*
Martin, Banded	*Riparia cincta*
Martin, Brown-throated	*Riparia paludicola*
Martin, Rock	*Hirundo fuligula*
Martin, Sand	*Riparia riparia*
Masked-weaver, Southern	*Ploceus velatus*
Moorhen, Common	*Gallinula chloropus*
Mousebird, Red-faced	*Urocolius indicus*
Mousebird, Speckled	*Colius striatus*
Mousebird, White-backed	*Colius colius*
Myna, Common	*Acridotheres tristis*
Neddicky, Neddicky	*Cisticola fulvicapilla*
Night-Heron, Black-crowned	*Nycticorax nycticorax*
Olive-pigeon, African	*Columba arquatrix*
Owl, Barn	*Tyto alba*
Owl, Marsh	*Asio capensis*
Palm-swift, African	*Cypsiurus parvus*
Paradise-flycatcher, African	*Terpsiphone viridis*
Peacock, Common	*Pavo cristatus*
Pigeon, Speckled	*Columba guinea*
Pipit, African	*Anthus cinnamomeus*
Pipit, Long-billed (Split, see Nicholson's and Long-billed)	*Anthus similis*
Pipit, Plain-backed	*Anthus leucophrys*
Plover, Kittlitz's	*Charadrius pecuarius*
Plover, Three-banded	*Charadrius tricollaris*

Common Name	Scientific name
Pochard, Red-crested	*Netta rufina*
Pochard, Southern	*Netta erythrophthalma*
Prinia, Black-chested	*Prinia flavicans*
Prinia, Tawny-flanked	*Prinia subflava*
Quail, Common	*Coturnix coturnix*
Quailfinch, African	*Ortygospiza atricollis*
Quelea, Red-billed	*Quelea quelea*
Rail, African	*Rallus caerulescens*
Reed-warbler, African	*Acrocephalus baeticatus*
Reed-warbler, Great	*Acrocephalus arundinaceus*
Robin-chat, Cape	*Cossypha caffra*
Rock-thrush, Sentinel	*Monticola explorator*
Roller, European	*Coracias garrulus*
Ruff, Ruff	*Philomachus pugnax*
Rush-warbler, Little	*Bradypterus baboecala*
Sandpiper, Common	*Actitis hypoleucos*
Sandpiper, Marsh	*Tringa stagnatilis*
Sandpiper, Wood	*Tringa glareola*
Scrub-robin, Kalahari	*Cercotrichas paena*
Secretarybird, Secretarybird	*Sagittarius serpentarius*
Seedeater, Streaky-headed	*Crithagra gularis*
Shelduck, South African	*Tadorna cana*
Shoveler, Cape	*Anas smithii*
Shrike, Red-backed	*Lanius collurio*
Snipe, African	*Gallinago nigripennis*
Sparrow, Cape	*Passer melanurus*
Sparrow, House	*Passer domesticus*
Sparrow, Southern Grey-headed	*Passer diffusus*
Sparrow-weaver, White-browed	*Plocepasser mahali*
Sparrowhawk, Black	*Accipiter melanoleucus*
Sparrowhawk, Ovambo	*Accipiter ovampensis*
Spurfowl, Swainson's	*Pternistis swainsonii*
Starling, Cape Glossy	*Lamprotornis nitens*
Starling, Common	*Sturnus vulgaris*
Starling, Pied	*Spreo bicolor*
Starling, Red-winged	*Onychognathus morio*
Starling, Wattled	*Creatophora cinerea*
Stilt, Black-winged	*Himantopus himantopus*
Stint, Little	*Calidris minuta*
Stonechat, African	*Saxicola torquatus*
Stork, Abdim's	*Ciconia abdimii*
Stork, White	*Ciconia ciconia*
Sunbird, Amethyst	*Chalcomitra amethystina*
Sunbird, White-bellied	*Cinnyris talatala*
Swallow, Barn	*Hirundo rustica*
Swallow, Greater Striped	*Hirundo cucullata*
Swallow, Pearl-breasted	*Hirundo dimidiata*

Common Name	**Scientific name**
Swallow, Red-breasted	*Hirundo semirufa*
Swallow, White-throated	*Hirundo albigularis*
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*
Swamphen, African Purple	*Porphyrio madagascariensis*
Swift, African Black	*Apus barbatus*
Swift, Common	*Apus apus*
Swift, Horus	*Apus horus*
Swift, Little	*Apus affinis*
Swift, White-rumped	*Apus caffer*
Tchagra, Brown-crowned	*Tchagra australis*
Teal, Hottentot	*Anas hottentota*
Teal, Red-billed	*Anas erythrorhyncha*
Tern, Whiskered	*Chlidonias hybrida*
Tern, White-winged	*Chlidonias leucopterus*
Thick-knee, Spotted	*Burhinus capensis*
Thrush, Karoo	*Turdus smithi*
Tit, Ashy	*Parus cinerascens*
Tit-babbler, Chestnut-vented	*Parisoma subcaeruleum*
Turtle-dove, Cape	*Streptopelia capicola*
Wagtail, Cape	*Motacilla capensis*
Warbler, Garden	*Sylvia borin*
Warbler, Icterine	*Hippolais icterina*
Warbler, Marsh	*Acrocephalus palustris*
Warbler, Willow	*Phylloscopus trochilus*
Waxbill, Common	*Estrilda astrild*
Waxbill, Orange-breasted	*Amandava subflava*
Weaver, Cape	*Ploceus capensis*
Weaver, Thick-billed	*Amblyospiza albifrons*
Wheatear, Capped	*Oenanthe pileata*
Wheatear, Mountain	*Oenanthe monticola*
White-eye, Cape	*Zosterops virens*
Whydah, Pin-tailed	*Vidua macroura*
Widowbird, Fan-tailed	*Euplectes axillaris*
Widowbird, Long-tailed	*Euplectes progne*
Widowbird, Red-collared	*Euplectes ardens*
Widowbird, White-winged	*Euplectes albonotatus*
Wood-hoopoe, Green	*Phoeniculus purpureus*
Woodpecker, Cardinal	*Dendropicos fuscescens*
Wryneck, Red-throated	*Jynx ruficollis*