Author: Barbara Kasl E-mail: bk.zoology@gmail.com

Tshedza 3 Investments (Pty) Ltd: Solar PV Project Phase 2 (40 MW): Gauteng Province

Terrestrial Fauna Desktop Assessment (Scoping Phase)

January 2022

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; and
- Has been actively involved in the environmental consultancy field for over 13 years.

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 the Animal Species and Terrestrial Biodiversity Protocols as required under the National Environmental Management Act (107/1998) (NEMA) as far as these are relevant to the specific subject and 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.

24-01-2022

Acronyms

ADU	Animal Demographic Unit
AI(S)	Alien Invasive (Species)
BGIS	Biodiversity Geographic Information System
CBA	Critical Biodiversity Areas
ESA	Ecological Support 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
NPAES	National Protected Area Expansion Strategy
PA	Protected Area
PES	Present Ecological State
QDGS	Quarter Degree Grid Square
RIVCON	River Condition
RL	Red-listed
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern (specifically listed in the SANBI's 2020 Species Guideline)
SEI	Site Ecological Importance
SWSA	Strategic Water Source Area
TOP(S)	Threatened or Protected (Species)
UNESCO	United Nations Educational, Scientific and Cultural Organization
VMUS	Virtual Museum

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1. Introduction & Site Characterisation

The proposed project is being developed to generate electricity for the ERGO Mining plant's power requirements. The Phase 1 (19.9MW) assessment has been completed through a Basic Assessment application process (Ref: GP158MREA) and included solar panel development on the Farm Witpoortje 117 IR with associated power lines and 100MWh containerised battery storage, south of Brakpan, The solar project will be expanded to incorporate Phase 2 (40MW) (Plan 1) resulting in a 59.9MW total production site. No development details for phase 2 have been provided at this time, other than general areas for panel development along the proposed power line route, which was assessed in Phase 1 (not further assessed in this report).

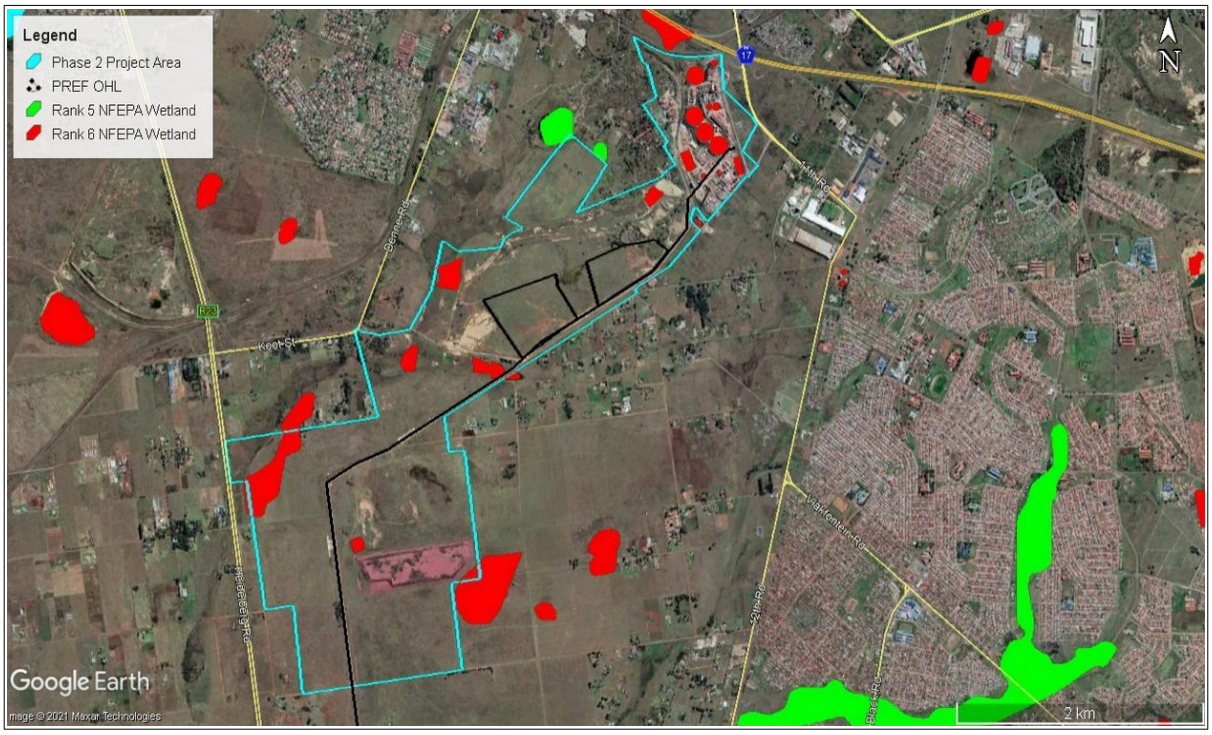
The site lies just south of the N17 and just east of the Heidelberg Road (R23), and lies within the Ekurhuleni Municipality, Gauteng Province. Table 1 provides a summary of the desktop assessment of the ecologically significant features relevant to the site.

A separate avifauna assessment is being undertaken, and the birds have been omitted from this report, which focusses on mammals and herpetofauna and also provides a high-level assessment of threatened or protected (TOP) invertebrates. This report includes a desktop assessment of additional areas being considered for Phase 2 in preparation for the scoping phase. Full Phase 2 assessment and report will be concluded during the next growing season (2021/2022). Phase 1 findings are only incorporated in this report where relevant and to provide additional or supporting information.

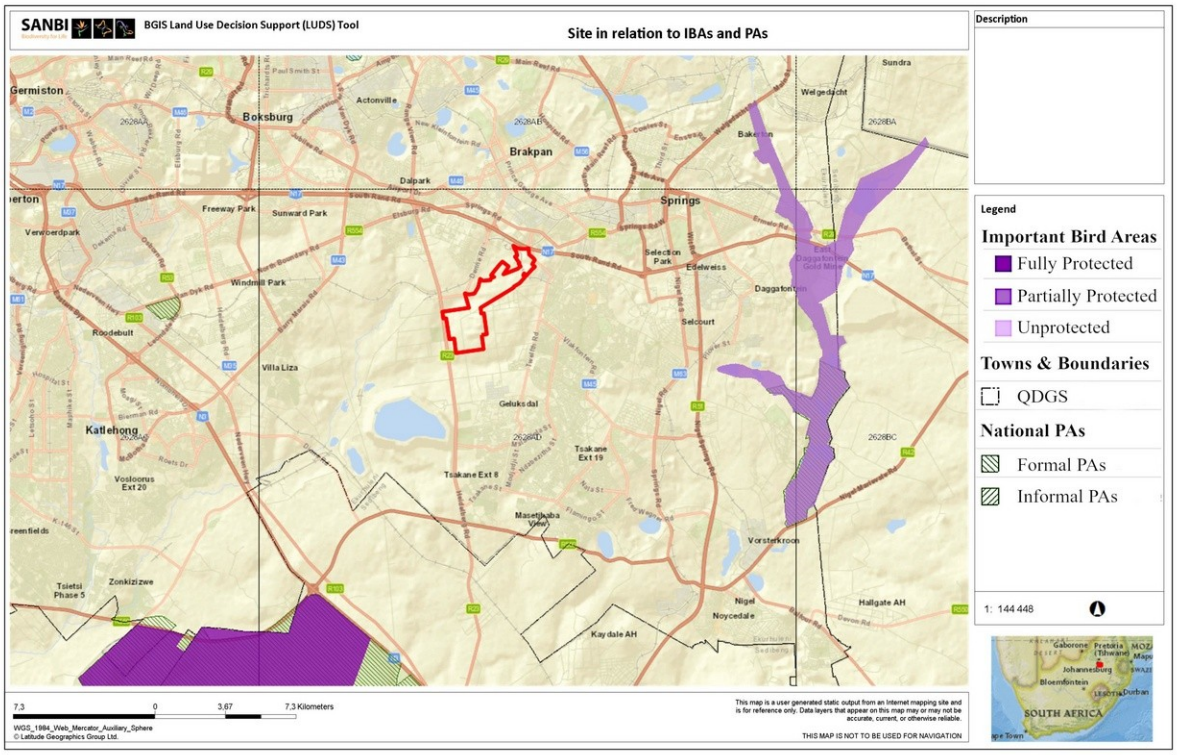
Table 1: Ecologically significant features (distances are "as the crow flies" approximations)

Ecological feature / area	Description of feature relevant to the site
International Conservation:	The Blesbokspruit RAMSAR Wetlands (incorporated in part in the Marievale Bird Sanctuary Provincial Nature Reserve) are approximately 12km east of site. No World Heritage sites occur within 50km of site.
Protected Areas (PAs) (Plan 2)	The formally protected Suikerbosrand Provincial Nature Reserve lies <10km south of site. Other nearby provincial nature reserves and bird sanctuaries are all more than 10km from site. No National Protected Area Expansion Strategies (NPAES) are targeted within 10km of site.
National Freshwater Priority Area (NFEPA) Features (Plan 3)	The site is not within a NFEPA Catchment. A non-perennial tributary flows just within the north and north-west property boundaries and flows south into the Rietspruit Tributary, which is a NFEPA river with an unacceptable ecological state (river condition has not been assessed). The tributary eventually confluences with the NFEPA Rietspruit (unacceptable ecological state and river condition) 5.3km further west. The wetlands associated with this non-perennial tributary and with the mine area and other nearby wetlands (Plan 1) are Rank 5 and 6 NFEPA wetlands, which provide little in terms of habitat for TOP species (cranes, TOP water birds and frogs). In terms of the desktop information, the aquatic habitats are impaired and unlikely to have significant value for sensitive riverine and wetland fauna species.
Strategic Water Source	The Eastern Karst Belt SWSA occurs just over 2km north-east of the project area.

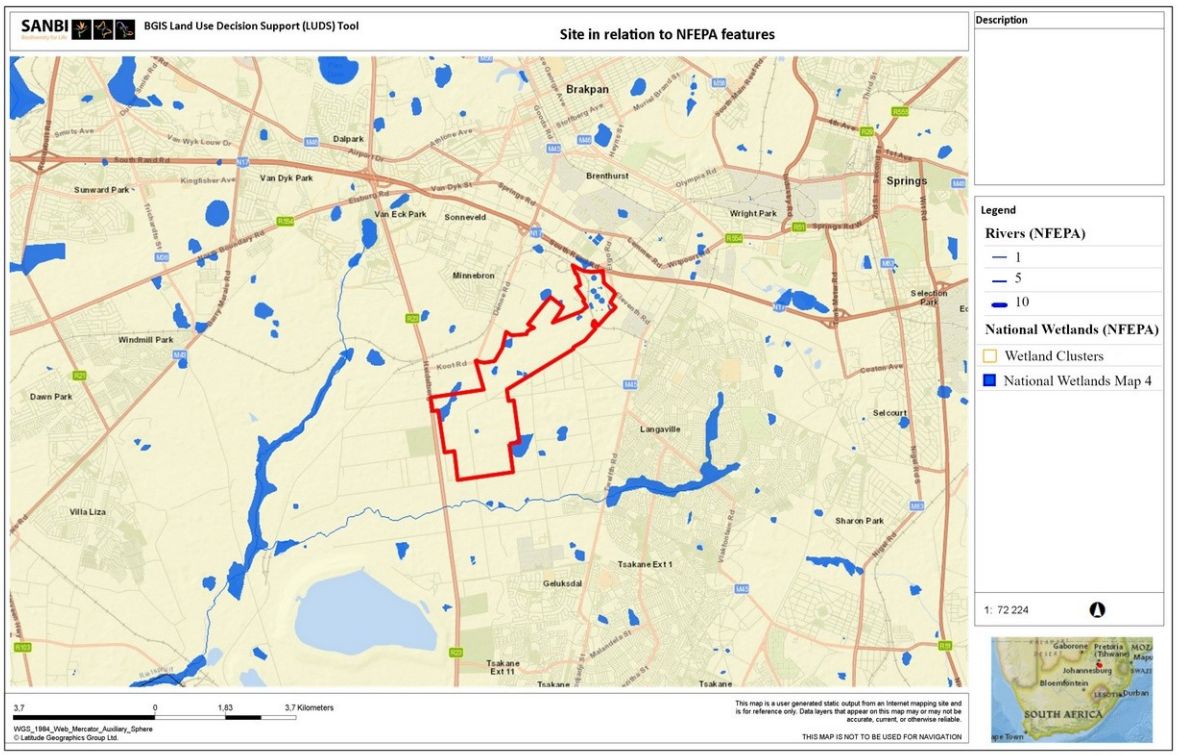
Ecological feature / area	Description of feature relevant to the site
Areas (SWSAs)	
Biome and Ecosystem	The area falls within the Grassland Biome. The following is relevant: • The bulk of the project area is within the Klipriver Highveld Grassland, listed as a Critically Endangered ecosystem (NEM:BA, GN1002, 2011). • The northern-eastern part extends into Tsakane Clay Grassland, listed as an Endangered ecosystem (NEM:BA, GN1002, 2011). • The very north-eastern extent of the area extends into Soweto Highveld Grassland, which is listed as a Vulnerable ecosystem (NEM:BA, GN1002, 2011). Given the history of the site, and the historical impacts and ongoing activities in and around the area, it is not expected that the area will support representative units of these ecosystems (to be confirmed by the flora specialist), however any good grassland habitats would support grassland fauna species.
Gauteng Ridges	No Class 1 or 2 ridges occur on or near site. Small Class 4 (lowest ridge classification) ridges occur within 4-11km of site. On-site ridges are related to mine dumps and are not natural features.
Conservation Plan (Plan 4)	Much of the project area is currently / was historically occupied by mining-related infrastructure and lies within undesignated areas. CBAs and ESAs are associated with the non-perennial tributary and form an ecological corridor in the area. The far southern extent of the project area also extends into ESA and CBA); the bulk of this ESA is a cleared tailings dump.
QDGS	The site lies within QDGS 2628AD. All desktop data obtained from the citizen science sites have been sourced for this QDGS.



Plan 1: Phase 2 project area for consideration for panel development, including Phase 1 panel development area (black) and nearby NFEPA wetlands overlaid onto Google Earth Image (April 2021)



Plan 2: Project area in relation to Important Bird Areas and Protected Areas (SANBI, BGIS Map Viewers)



Plan 3: Project area in relation to National Freshwater Priority Areas (SANBI, BGIS Map Viewers)

Plan 4: Project area in relation to the Gauteng biodiversity conservation plan (SANBI, BGIS Map Viewers)

1.1 Scope of Work

The site and surrounds rank as high sensitivity (EIA Toolkit) for terrestrial biodiversity from a desktop perspective, but given the history of the site (old tailings facilities, historical mine areas, historical and current cultivation areas), it is expected that the on-site biodiversity value to terrestrial fauna is low, other than the potential tributaries and associated ecological corridors on site. A full biodiversity impact assessment, in line with the new environmental theme's protocols, has been completed with focus on the ecological corridors and natural habitat units.

The site and surrounds rank as medium and low sensitivity (EIA Toolkit) for animal species, with one butterfly (*Aloeides dentatis dentatis*) and two mammals (*Ourebia ourebi ourebi* and *Hydrictis maculicollis*) listed as potential species of conservation concern (SCC). Due to the current status of the site in terms of historical land use and impacts (to be confirmed during Phase 2 site assessment), it is expected that these animals are unlikely to permanently occur in the project area, or at least be restricted to the less disturbed habitats where these are ecologically connected and the bulk of the site will have low value for significant animals species; a compliance statement will be completed for animal species, but with a more detailed discussion of the three listed SCCs.

As per NEMA EIA Regulations (GNR982, 2017) and the requirements of the EIA Screening Tool Protocols for the Assessment and Reporting of Environmental Themes (GN320 & GN1150 of 2020), the following is relevant regarding the scope of work considering the site rankings and state:

- 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 (Table 1).
- Comment on the likelihood of threatened or protected (TOP) and potential SCC fauna occurring on site (completed to desktop level for Phase 2 Project area).
- Discuss important ecological drivers, processes and services as may be relevant.
- Address site sensitivity based on site survey findings in relation to regional ecological setting (to be finalised once Phase 2 site assessment is completed).
- Complete an impact statement for TOP fauna species and complete an impact assessment for biodiversity features of relevance to terrestrial fauna (completed to desktop level for Phase 2 Project area).
- Provide management recommendations to mitigate negative impacts of the activities on terrestrial fauna (to be finalised once Phase 2 site assessment is completed).

Summary of Phase 1 findings are included where relevant and desktop findings are provided for the Phase 2 project area.

1.2 Relevant Legislation

Several Acts govern the environment and development in relation to the environment within South Africa. In terms of this study the following are relevant:

- The National Environment Management Act, 1998 (Act No. 107 of 1998) (NEMA); and
- The National Environmental Management Biodiversity Act, 2004. (Act 10 of 2004) (NEM:BA)

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 1003 of 18 September 2020; and
- National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Regulations. General Notice Regulation 1020 of 18 September 2020.

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

2.1 Desktop Ecological Status

The desktop assessment utilised predominantly SANBI BGIS data as detailed in Table 1, accompanied by Google Earth satellite imagery.

2.2 TOP Species Desktop Lists

A TOP species assessment was undertaken, which incorporates the potential SCCs. The term TOP species (TOPS) 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 and IUCN (IUCNredlist.org) species (Near Threatened species are not detailed to retain focus on threatened taxa, but status is indicated where species is listed as threatened under another listing). 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; supplemented by Stuart and Stuart (2013), Stuart and Stuart (2015), Murray (2011), Monadjem *et al*. (2010a) and Monadjem *et al*. (2010b)].
- 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. Reptile information was supplemented by Tolley and Burger (2012)]
- Frogs [sourced from Minter, *et al.* (2004) as presented in the frog Red-lists on FrogMap.adu.org.za and supplemented by du Preez and Carruthers (2009)].
- Invertebrates [also supplemented by Picker *et al. (*2012), Woodhall (2005) and SANBI Biodiversity Advisor Animal Checklists for ants, millipedes, Orthoptera and scarabs]:
    - 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).
    - Scorpions (Leeming, 2019).

Endemic species for mammals, reptiles and frogs (supplemented by information on inaturalist.org) were also indicated where relevant. Variation between sources on endemic species (just South Africa or South Africa, Lesotho and Swaziland) is not seen as critical in terms of this report.

In order to determine recent fauna diversity data, various citizen science sites were consulted:

- Mammal, amphibian, reptile and available invertebrate species lists for the QDGS over the last 10 year period from the Virtual Museum of the Animal Demographic Unit (VMUS.ADU.org).
- Furthermore, iNaturalist (iNaturalist.org) was also consulted for presences of potential TOP species.

Exotic and / or Alien Invasive (AI) Species (AIS) recorded in the area as per the citizen science sites are also discussed where relevant.

2.3 Site Assessment

Much of the area was historically disturbed (mostly through mining and related activities, but also crop agriculture), as evidenced in historical Google Earth imagery. Most of the grasslands assessed during Phase 1 can be considered historically disturbed and recovering to varying degrees and only a few patches were regarded as undisturbed habitat units. It is expected that the Phase 2 development area will show similar habitats, but greater areas of moist grasslands will be expected with the inclusion of the non-perennial tributary.

Additional meanders will be completed for the proposed Phase 2 project area during the site assessments which will be scheduled during spring / summer. Meanders will only be completed for the final preferred site and alternative site selected based on the Scoping Phase outcomes.

During meanders the areas will be assessed for micro-habitats, signs (tracks, scat, etc.) of fauna and actual fauna species sightings. In addition, a particular effort will be made to note butterflies on site.

2.4 Likelihood of TOP Species

For the desktop TOP species, 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 surveys, citizen science sites and local knowledge where provided.
- 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 over site.
- 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 and erratic over site or no recent records in the area.

2.5 Sensitivity Assessment

A preliminary desktop sensitivity assessment is completed, which focusses largely on the findings of Table 1; CBAs and ESAs will form the main back-bone of the desktop sensitivity map as these areas incorporate most of the features of potential relevance to terrestrial fauna. The knowledge gained from Phase 1 assessment, coupled with Google Earth historical imagery will also be used to extrapolate and motivate any potential deviations from the Gauteng conservation plan units.

2.6 Fauna Impact Assessment

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.

The impact assessment methodology used is based on NEMA requirements (Appendix 3 of the EIA Regulations) and is presented under the impact assessment section. The following has been included:

- Impact assessment in terms of the activities / development on terrestrial fauna biodiversity and species, 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.

2.7 Limitations

This report is a desktop study of the Phase 2 project area, in part also extrapolated from surveys completed within the smaller Phase 1 project area. Site assessments are still required for the full Phase 2 project area.

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

Large herbivores and antelope are excluded from more detailed discussion as many of these species are actively fenced in and managed as stock within selected areas. 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.

Citizen Science projects were used for animal (ADU and iNaturalist) 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 historical activities that have taken place within the area means that there is very little likelihood of grassland representing TOP ecosystems (to be confirmed by the flora specialists) occurring in the area. Therefore, from Table 1, the only significant desktop features relevant to terrestrial fauna included the streams, CBAs and ESAs, largely associated with the streams and adjacent areas.

The fauna survey carried out for Phase 1 assessment confirmed that the bulk of the Phase 1 project area was developed, supported infrastructure or was completely denuded or supported disturbed grasslands (historically impacted by mining or crop farming). Some fauna species still utilise such areas, but tend to be species that are highly tolerant of human activity and generalists species with wide habitat tolerances or very common species widely distributed in crop-lands of the Highveld. Most of the AI species (birds and rats) would also occupy such areas as most are closely linked to human settlements and areas of activity. More sensitive habitats within the Phase 1 project area were limited and associated with the riverine areas and undisturbed grasslands and often correlated with the CBAs and ESAs, other than the highly disturbed grassland in an historical tailings dump in the southern extent of the Phase 2 project area.

It is expected that Phase 2 will have similar habitat units, although the project area incorporates the non-perennial tributary (along the northern and north-western boundaries of the area) and is, therefore, likely to support more sensitive habitat units. As the entire area will not be developed, there is potential to exclude any sensitive habitat units from the final development footprint.

The complete desktop fauna lists as extracted from the various citizen science sites are included in Appendix B. The TOP and endemic species extracted from this list are further discussed below. Each faunal vertebrate group discusses, as relevant, the TOP species, endemic and restricted species and the AIS, focussing on species that are highly likely to occur on site for extended periods and therefore most likely to be exposed to the development and potential impacts. Invertebrates are discussed more generally but TOP species lists are included.

3.1 Mammals

In terms of the Animal Demographic Unit (ADU) list (Appendix B), the following is relevant:

- Unidentified species on the ADU list have not been included.
- Species names are indicated as per the latest mammal Red-Lists (Child *et al.*, 2016).
- *Rhabdomys pumilio* does not have a distribution within Gauteng and *Rhabdomys dilectus* is included in Appendix B instead.
- *Mastomys natalensis* and *Mastomys coucha* represent the ADU *Mastomys* species in Appendix B.

3.1.1 Site Species (from Phase 1 assessments only)

The Yellow Mongoose (*Cynictis penicillata*), Common Duiker (*Sylvicapra grimmia*) and Pretoria Mole-rat (*Cryptomys pretoriae)* are considered as confirmed species for the Phase 1 project area. All are tolerant of man-modified habitats and common in rural settings.

3.1.2 Historical & Likely TOP, SCC & Endemic Species

The previously recorded TOP and endemic mammals for the area and those with distributions across the area are indicated in Table 3. All previously recorded TOP species are antelope which are not likely to occur on site unless deliberately stocked on site and are not further discussed.

As stated above, the Phase 2 project area is likely to incorporate more sensitive and undisturbed habitats. The Oribi (*Ourebia ourebia*), a potential SCC for the area, which utilises the more natural, undisturbed grasslands as part of their territory (Shrader *et al.,* 2016), is likely to occur in the Phase 2 project area. The likelihood of the Spotted-necked Otter (*Hydrictis maculicollis*), another potential SCC for the area, which has a preference for large rivers, permanent pools, lakes, dams and well-watered swamps and is likely to be deterred by poor quality water (Ponsoby *et al.,* 2016) and has been considered only as a possible species for the general area.

The following TOP and endemic species are listed as likely to occur in the Phase 2 project area and surrounds, based on desktop findings:

- Oribi (*Ourebia ourebia*) (GN151 Endangered; RL Endangered; SCC, Provincially Protected). Main threats include habitat destruction, illegal hunting, poor farm management practices,

poor law enforcement, including the lack of coordinated / cooperative management and lack of awareness of the status, threats and legal repercussions of killing Oribi which prevents effective implementation of interventions (Shrader *et al*., 2016).

- Southern African Hedgehog (*Atelerix frontalis*) (GN151 Protected; Provincially Protected). Plays a role in invertebrate pest control as an insectivore. Main threats include habitat loss, degradation and fragmentation from urban sprawl and agriculture. Also threatened by illegal harvesting from the wild for food, or for sale as pets and for traditional medicine (Light *et al*., 2016).
- Serval (*Leptailurus serval*) (GN151 Protected). Servals may play a functional role in agricultural landscapes in controlling the numbers of pest species, specifically rodents and invertebrates. Main threats include loss and degradation of wetlands and associated grasslands. Wetlands generally harbour high rodent densities compared with other habitat types, and form the core areas of Serval home ranges; disruption to such habitats reduces prey-base (Ramesh *et al*., 2016).
- Southern Reedbuck (*Redunca arundinum*) (GN151 Protected; Provincially Protected). Impacted in the past by habitat transformation and degradation associated with agricultural activities and 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).
- Steenbok (*Raphicerus campestris*) (Provincially Protected). 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 this 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).
- Forest Shrew (*Myosorex varius*) (Endemic). The Forest Shrew is an important prey for the Barn Owl, Water Mongoose, African Striped Weasel and Striped Polecat. The main threat to Forest Shrew is the loss or degradation of moist, productive areas such as wetlands and rank grasslands within suitable habitat. Climate change is also seen as a threat (Taylor *et al*., 2016).

3.1.3 Alien & Exotic Species

No exotic or AI species were recorded for the QDGS. Cats were noted in the area and dogs were heard around site during Phase 1 assessments. The area is also an agricultural area and utilised for stock grazing. Cattle and chickens are confirmed and it is also suspected that sheep occur in the area based on scat and tracks observed during Phase 1 site assessments.

3.1.4 Ecosystem Services

The various ecosystem services provided by the fauna species previously recorded and likely to occur in the area are fairly typical and include:

- Prey-base for predators / raptors.
- Control of potential vermin, pests and AI species, including potential vectors for disease.
- Seed dispersal.
- Ecosystem engineers:
    - Bulk grazers facilitate the presence of more selective, smaller grazers by inducing productive grasslands for these species.

- Burrowers (for refuge, habitat or simply digging for tubers / roots). Diggings and burrows affect flow of resources, trapping materials that change soil chemical, physical nature and moisture, creating a mosaic of varied and regenerating habitat patches.

Table 2: TOP and Endemic Mammals (Bold species are SCC – SANBI, 2020)

Common name	Scientific name	Endemism	SA GN151	SA Red-list	IUCN	GP Protected Schedule
Site species						
Mongoose, Yellow	*Cynictis penicillata*					
Duiker, Common (scat & tracks)	*Sylvicapra grimmia*					
Mole-rat, Pretoria (mounds)	*Cryptomys pretoriae*	Endemic				
TOP and Endemic Species recorded in the QDGS						
Wildebeest, Black	*Connochaetes gnou*	Endemic	Protected			2: Protected Game
Blesbok	*Damaliscus pygargus phillipsi*	Endemic		NT		
Eland, Common	*Tragelaphus oryx*					2: Protected Game
Hartebeest, Red	*Alcelaphus buselaphus caama*					2: Protected Game
Likely TOP and Endemic species						
Oribi	***Ourebia ourebi***		**Endangered**	**Endangered**		**2: Protected Game**
Hedgehog, Southern African	*Atelerix frontalis*		Protected	NT		2: Protected Game
Serval	*Leptailurus serval*		Protected	NT		
Reedbuck, Southern	*Redunca arundinum*		Protected			2: Protected Game
Steenbok	*Raphicerus campestris*					2: Protected Game
Shrew, Forest	*Myosorex varius*	Endemic				
Possible TOP and Endemic Species						
Otter, Spotted-necked	***Hydrictis maculicollis***		**Protected**	**Vulnerable**	**NT**	
Hyaena, Brown	*Parahyaena brunnea*		Protected	NT	NT	2: Protected Game
Reedbuck, Southern Mountain	***Redunca fulvorufula***			**Endangered**	**Endangered**	**2: Protected Game**
Mouse (Rat), White-tailed	***Mystromys albicaudatus***			**Vulnerable**	**Endangered**	
Rhebok, Grey	*Pelea capreolus*	Endemic		NT	NT	2: Protected Game
Unlikely TOP and Endemic Species						
Leopard	*Panthera pardus*		Vulnerable	Vulnerable	Vulnerable	4: Protected Wild Animals
Cat, Black-footed	***Felis nigripes***		**Protected**	**Vulnerable**	**Vulnerable**	
Honey Badger (Ratel)	*Mellivora capensis*		Protected			
Fox, Cape	*Vulpes chama*		Protected			

Common name	Scientific name	Endemism	SA GN151	SA Red-list	IUCN	GP Protected Schedule
Aardwolf	*Proteles cristata*					2: Protected Game
Klipspringer	*Oreotragus oreotragus*					2: Protected Game
Aardvark	*Orycteropus afer*					2: Protected Game
Rat, Tete Veld	*Aethomys ineptus*	Possible endemic				
AIS / Exotic Species recorded in the area						
Cat, Domestic	*Felis catus*	Exotic				
Dog, Domestic	*Canis familiarus*	Bred				

NT: Near Threatened

3.2 Herpetofauna

In terms of the ADU list (Appendix B) the following is relevant:

- Omitted species are excluded from this report.
- The species names used in this report are as per Bates *et al.* (2014) and du Preez and Carruthers (2009).
- The ADU list includes *Leptotyphlops* sp. *Leptotyphlops scutifrons* has a corresponding distribution and is included in Appendix B.

The Gauteng Province lists several non-serpentine reptiles as Schedule 2: Protected Game and the list is too extensive to incorporate in this report. The Giant Bullfrog (*Pyxicephalus adspersus*) is the only amphibian listed (listed as Schedule 2: Protected Game). The proposed development does not intend any specific scheduled activities (hunting, catching, transporting, amongst others) involving herpetofauna, but the legislation must be consulted and complied with should any species need to be handled under any circumstances.

3.2.1 Site Species (from Phase 1 assessments only)

Only one species of frog was confirmed for site and was also previously recorded in the larger QDGS:

- Giant Bullfrog (*Pyxicephalus adspersus*) (GN151 Protected; Provincially Protected). Species is threatened by loss and degradation of its wetland and neighbouring terrestrial habitat.

A juvenile Giant Bullfrog was observed during Phase 1 assessments, on the move near the Rietspruit Tributary further south of the Phase 2 project area. The Giant Bullfrog has been reported to be declining and is listed nationally as Near Threatened and effort must be made to conserve the species by way of maintaining the natural habitats and ecological corridors remaining in the area.

3.2.2 Historical & Likely TOP, SCC & Endemic Species

No other TOP species (other than the Giant Bullfrog) or SCC are expected in the area (Table 4). The following endemic herpetofauna have been previously recorded in the greater area and could occur in the project area:

- Eastern Ground Agama (*Agama aculeata distanti*) (Endemic).
- Common Crag Lizard (*Pseudocordylus melanotus melanotus*) (Endemic).
- Transvaal Thick-toed Gecko (*Pachydactylus affinis*) (Endemic).
- Aurora House Snake (*Lamprophis aurora*) (Endemic).
- Thin-tailed Legless Skink (*Acontias gracilicauda*) (Endemic).
- Raucous Toad (*Amietophrynus rangeri*) (Endemic).

Other endemic species that are likely to occur on site include:

- Delalande's Sandveld Lizard (*Nucras lalandii*) (Endemic).
- Spotted Harlequin Snake (*Homoroselaps lacteus*) (Endemic).
- Olive Ground Snake (*Lycodonomorphus inornatus*) (Endemic).
- Rattling Frog (*Semnodactylus wealii*) (Endemic).

Rocky habitats were very limited within the Phase 1 project area and are not likely to significantly increase within the Phase 2 area. This obviously reduces the likelihood of the rocky species that are listed above from occurring on site, but as habitat requirements are met, the species are retained as likely species for the project area.

3.2.3 Alien & Exotic Species

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

3.2.4 Ecosystem Services

Many of the herpetofauna species feed on arthropods and will cumulatively contribute to control of invertebrate numbers, including aquatic invertebrates that may be vectors for disease. Many reptiles and frogs are also food sources to many birds and mammals, as well as other reptile species.

3.3 Invertebrates

A summary of TOP and provincially protected invertebrates with distribution ranges over and near the survey area are included in Table 5, with ADU desktop species (no iNaturalist species) indicated in bold. It must be stressed that the distribution of many species are unknown and it is very possible that species in Table 5 do not occur in the area and possibly the province (these are indicated as such). They have been included as a cautionary measure. Furthermore, in many instances, entire Family or Genera are listed and listing all these species would be too extensive.

Of the TOP ADU species confirmed for the QDGS (indicated in bold in Table 5), the Baboon Spider, *Harpactira hamiltoni (Araneae: Theraphosidae)*, is a nocturnal burrowing species unlikely to be confirmed during diurnal surveys, but cannot be excluded from the more natural habitats.

One SCC butterfly has distribution near the area and has been recorded for the QDGS (October 2015) and includes:

- *Aloeides dentatis dentatis* (Lepidoptera: Nymphalidae) (RL Endangered; IUCN Vulnerable; Schedule 7: Invertebrata). Host plants include *Hermannia depressa*, confirmed and scattered throughout the grasslands along the power line route, and *Lotononis eriantha* (not confirmed on site).
    - The species is mapped in the Gauteng conservation plan and is known from three localities in Gauteng Province, all within protected areas (i.e. Ruimsig Entomological Reserve, Klipriviersberg Nature Reserve, Suikerbosrand Nature Reserve). The species is therefore unlikely on site (Gauteng C-Plan technical report).
    - Butterflies were specifically noted on site during the Phase 1 survey, but no *Aloeides dentatis dentatis* or similar, potentially confusing, species were noted on site, despite surveys being within a peak flight period of the species.

The following butterflies were confirmed for the site during Phase 1 assessments:

- *Junonia orithya madagascariensis* (Lepidoptera: Nymphalidae) (Eyed Pansy).
- *Junonia hierta cebrene* (Lepidoptera: Nymphalidae) (Yellow Pansy).
- *Danaus chrysippus* (Lepidoptera: Nymphalidae) (African Monarch).

- *Pontia helice helice* (Lepidoptera: Pieridae) (Meadow White).
- *Eurema brigitta brigitta* (Lepidoptera: Pieridae) (Broad-bordered Grass Yellow).
- *Catopsilia florella* (Lepidoptera: Pieridae) (African / Common Vagrant).
- *Tarucus sybaris* (Lepidoptera: Lycaenidae) (Dotted Blue).

The bush cricket, (Orthoptera: Tettigoniidae) is the only other SCC listed in Table 4, but there is no information provided on the SANBI Species database on the species distribution range or habitat preferences so as to determine the likelihood of the species on site. According to the IUCN distribution data, the project area is just south and outside the species main distribution range, which reduces the likelihood of this species occurring in the area.

Table 3: TOP and Endemic Herpetofauna (No SCCs as per SANBI, 2020)

Common name	Scientific name	Endemism	SA GN151	SA Red-list	IUCN
Site species					
Bullfrog, Giant	*Pyxicephalus adspersus*		Protected	NT	
TOP and Endemic Species recorded in the greater area					
Agama, Eastern Ground	*Agama aculeata distanti*	Endemic			
Lizard, Common Crag	*Pseudocordylus melanotus melanotus*	Endemic (PR)			
Gecko, Transvaal Thick-toed	*Pachydactylus affinis*	Endemic (PR)			
Snake, Aurora House	*Lamprophis aurora*	Endemic			
Skink, Thin-tailed Legless	*Acontias gracilicauda*	Endemic			
Bullfrog, Giant	*Pyxicephalus adspersus*		Protected	NT	
Toad, Raucous	*Amietophrynus rangeri*	Endemic			
Likely TOP and Endemic species					
Lizard, Delalande's Sandveld	*Nucras lalandii*	Endemic			
Snake, Spotted Harlequin	*Homoroselaps lacteus*	Endemic			
Snake, Olive Ground	*Lycodonomorphus inornatus*	Endemic			
Frog, Rattling	*Semnodactylus wealii*	Endemic			
Possible TOP and Endemic Species					
Lizard, Coppery Grass	*Chamaesaura aenea*	Endemic		NT	
Slug-eater, Common	*Duberria lutrix lutrix*	Endemic			
Snake, Striped Harlequin	*Homoroselaps dorsalis*	Endemic		NT	
Unlikely TOP and Endemic Species					
Lizard, Cape Grass	*Chamaesaura anguina anguina*	Endemic			
AIS / Exotic Species recorded in the area					
No AIS or exotic species recorded on ADU or iNaturalist					

NT: Near Threatened
PR: Partially Restricted

Table 4: Invertebrates of interest (Bold species are SCC – SANBI, 2020; Shaded species are ADU / iNaturalist species)

Order	Family	Scientific name	SA GN151	SA Red-list	IUCN	GP Protected Schedule
Araneae	Theraphosidae	*Harpactira hamiltoni*	Protected			7: Invertebrata
Araneae	Theraphosidae	*Pterinochilus lugardi*	Protected			7: Invertebrata
Scorpiones	Scorpionidae	*Opistophthalmus pugnax*	Protected			
Coleoptera	Carabidae	*Dromica sp.*	Protected			
Coleoptera	Carabidae	*Graphipterus assimilis**	Protected			
Coleoptera	Carabidae	*Manticora sp.*	Protected			
Coleoptera	Carabidae	*Megacephala asperata**	Protected			
Coleoptera	Carabidae	*Megacephala regalis**	Protected			
Coleoptera	Carabidae	*Prothyma guttipennis**	Protected			
Coleoptera	Lucanidae	*Nigidius auriculatus**	Protected			
Coleoptera	Lucanidae	*Prosopocoilus petitclerci**	Protected			
Coleoptera	Scarabaeidae	*Ichnestoma sp.*	Protected			
Lepidoptera	**Lycaenidae**	***Aloeides dentatis dentatis***		**Endangered**	**Vulnerable**	**7: Invertebrata**
Lepidoptera	Nymphalidae	*Charaxes jahlusa rex*				7: Invertebrata
Lepidoptera	Nymphalidae	*Charaxes jasius saturnus*				7: Invertebrata
Orthoptera	**Tettigoniidae**	***Clonia uvarovi****			**Vulnerable**	

*** Provincial and / or specific distribution unknown**

4. Terrestrial Biodiversity and Fauna Site Sensitivity

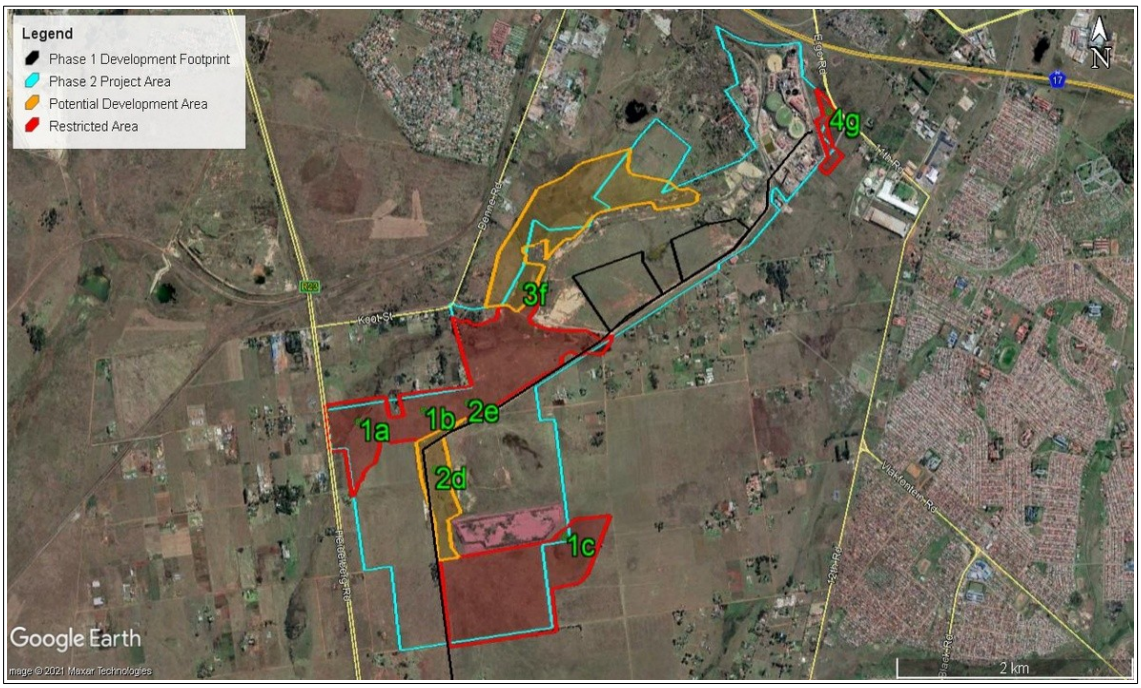
This section has been completed to a desktop level and must be read together with the floral sensitivity plan to ensure a comprehensive terrestrial biodiversity sensitivity plan. The desktop site sensitivity considered predominantly the Gauteng Conservation Plan units, streams, NFEPA wetlands and prior knowledge and has included Restricted Areas which should be avoided and Potential Development Areas which can be considered for development if additional areas are required. This is all completed as a desktop study with the knowledge gained from the Phase 1 area assessment and still needs to be ground-truthed.

The following is relevant regarding the areas in the sensitivity plan indicated in Plan 5:

- The Withok Estates small holdings include the properties in the far western and southern extent:
  - The northern part of the western small holdings are designated as restricted as the site contains largely CBAs, some ESAs and a NFEPA wetland (Plan 5 area 1a) and incorporates largely undisturbed habitats (some areas with historical disturbance included to maintain the ecological connectivity) and provides a good terrestrial ecological corridor to the non-perennial tributary and associated aquatic ecological corridor (Plan 5 area 1b). Some of the designated wetland was historically farmed, but the remainder of the area appears relatively undisturbed, limited to secondary impacts.
  - The western small holdings have a CBA and ESA along the eastern boundary and have been incorporated in the discussion for Portion 9 of the Farm Withok 131 IR below (area 2d).
  - The southern small holdings are designated as restricted and incorporate a CBA connected to the Rietspruit Tributary in the south and also incorporating an NFEPA wetland (Plan 5 area 1c). The juvenile Giant Bullfrog was observed on the move along the road adjacent to this area during the Phase 1 assessment.
  - The remaining areas are not designated in terms of desktop ecological features and areas and have been historically farmed and are considered as priority areas for development pending site assessments. They may still function as buffer areas and the panel development should be prioritised and densified in areas away from the Restricted Areas where possible.
- Portion 9 of the Farm Withok 131 IR, the southern-most property:
  - The area along the western boundary (along with the south-eastern small holding) incorporates a section of CBA, a narrow stretch of ESA and an old mine dam designated as an NFEPA wetland (Plan 5 area 2d). These ecological units occur along a gravel road and are within the impacted area of an old tailings dump. In terms of terrestrial fauna, this area would provide limited value in terms of habitat and connectivity but does create a corridor between the CBA in the south and the restricted areas to the north and has been designated a Potential Development Area if the additional area is required and pending site findings.
  - The northern protuberance of the property is undesignated (Plan 5 area 2e) in terms of ecological desktop features but has been incorporated as a Restricted Area as this area connects the Restricted Area and CBAs of the small holdings in the west to the CBA grasslands to the east. The area also appears to be largely undisturbed grassland, therefore provides habitat and ecological connectivity.

- The bulk of the site, designated as an ESA, is an old tailings dump with recovering grassland and an existing rock dump and in terms of terrestrial fauna has little value as habitat or connectivity and is considered as a priority area for development pending site assessments.

- Portion 283 of the Farm Witpoortjie 117 IR, north of Portion 9 of the Farm Withok 131 IR:
  - The bulk of the property is designated as a Restricted Area incorporating all the CBAs and NFEPA wetlands, most of the ESAs on the property and also undesignated areas that contain undisturbed habitats. The property contains the confluence of two tributaries, the main tributary flowing west and connecting to the Restricted Area of the small holdings.
  - The bulk of this property should therefore be avoided other than undesignated areas.
  - A section of ESA (Plan 5 area 3f) in the north-east of the property has been incorporated into a Potential Development Area. The area forms part of the smaller tributary which has been highly impacted (historically and currently) by the surrounding land uses and activities. The area is unlikely to be utilised by sensitive or significant fauna species, but does still provide an ecological corridor within a largely disturbed area. This secondary tributary is therefore designated as a Potential Development Area that should be considered if additional area is required, but where activities will be completed in a manner that will not significantly impair the ecological connectivity (activity is to be considered along edges rather than across the ecological corridor).
- Remaining Extent of Portion 183 of the Farm Witpoortjie 117, the main property incorporating the Phase 1 panel development area:
  - The bulk of the site includes historical and existing mine infrastructure areas and is considered as a priority area for development pending site assessments.
  - A small area in the far east (Plan 5 area 4g), which contains small, undisturbed patches of habitat and provides ecological connectivity southwards, is considered a Restricted Area and should be avoided.
  - Some CBAs and ESAs are associated with the secondary tributary that encroaches along the northern boundary of this property, and incorporate edges of the tailings facility that occupies the bulk of the property. This secondary tributary is designated as a Potential Development Area, much of which falls outside the proposed project area (it is part of the same tributary discussed for Portion 283 of the Farm Witpoortjie 117 IR) and that should be considered if additional area is required, but where activities will be competed in a manner that will not significantly impair the ecological connectivity.
- Portion 272 of the Farm Witpoortjie 117 IR, north of the Remaining Extent of Portion 183 of the Farm Witpoortjie 117:
  - The bulk of the site is under ESA and CBAs along the boundaries. The northern part of the property was historically cultivated and disturbed and considered as priority for development.
  - The southern half of the property has been included as a Potential Development Area (forming part of the secondary tributary discussed for Portion 283 of the Farm Witpoortjie 117 IR).



Plan 5: Desktop site sensitivity in terms of terrestrial fauna

5. Fauna Impact Assessment

In terms of the fauna biodiversity and animal species, the following impacts could be significant during the construction and operational phases (requires ground-truthing) and are assessed further in this desktop report:

- Destruction of significant fauna habitat, specifically potential TOP species habitat.
- Destruction of ecological corridors and impaired ecological connectivity.
- Hindering or interfering with TOP fauna species.
- Contaminated or silt-loaded runoff to on-site and nearby aquatic ecosystems.

Impact assessment criteria considered include:

The duration of the impact		
Score	Duration	Description
1	Temporary	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	National	Extends to almost entire province or larger region

5	International	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		
Low (score of 1 to 29)		Impact will not significantly change fauna biodiversity and requires no significant mitigation measures.
Moderate (score of 30 to 60)		Impact will change fauna biodiversity and requires some mitigation measures.
High (Score of 61 to 100)		Impact will significantly change fauna biodiversity and significant mitigation measures and management is required. Potential fatal flaw.

Activity:	Clearing the area for foundations (construction phase); edge impacts to neighbouring natural areas (operational phase).				
Impact:	**1) Nature: Destruction of significant fauna habitat, specifically potential TOP species habitat** Restricted Areas, containing the undisturbed habitat units, are most likely to provide natural habitat units and also most likely to support good indigenous faunal assemblages and ecologically significant fauna species.				
Significance rating Construction:	Duration	Extent	Magnitude	Probability	Significance
Pre-Mitigation	Permanent (5)	Local (2)	Moderate to high (8)	Definite (5)	High (75)
Post-Mitigation	Short-medium (2)	Local (2)	Slight-moderate (4)	Probable (3)	Low (24)
Significance rating Operation:	Duration	Extent	Magnitude	Probability	Significance
Pre-Mitigation	Permanent (5)	Local (2)	Moderate (6)	Highly Likely (4)	Moderate (52)
Post-Mitigation	Short-medium (2)	Local (2)	Slight (2)	Improbable (2)	Low (12)
Is the Impact Reversible?	Reversible: Important areas can potentially be avoided.				
Mitigation Measures:	**STOP**: No activities are to commence within the streams, wetlands and buffers until authorisations are obtained under the National Water Act, 1998 (Act36 of 1998) (NWA) and NEMA. No contractors camps, storage yards, parking areas or other activities are allowed to occur within Restricted Areas (Plan 5). These must be planned in disturbed and undesignated areas where needed. Avoid Restricted Areas (Plan 5) where feasible. Where such areas are included, site assessments will need to be completed and it must be understood that proposed developments / activities may be restricted by the authorities. Do not remove any vegetation from areas not targeted fro physical development. **MODIFY**: Prioritise undesignated areas (Plan 5) for permanent and temporary development / activity and preferentially use Potential Development Areas (Plan 5) for permanent development if additional area is required. Minimise activity in any Potential Development Areas (Plan 5) (condense activity in specific areas where feasible and retain other areas in existing state). Consider including buffer areas within the development boundary. For example a fire-break / indigenous garden inside the boundary where this abuts a Restricted Area or Potential Development Area would reduce edge impacts to these neighbouring areas. Plan and implement a proper storm-water management plan from the onset to prevent excessive runoff and associated erosion and sedimentation in downstream habitats. **CONTROL**: Peg out and demarcate areas for development and no-go areas before commencing with any activities. No activity whatsoever should occur in no-go areas, especially within Restricted Areas. **REMEDY**: Where areas not targeted for development are inadvertently impacted and / or damaged, clear any material dumped and rehabilitate the site as soon as possible.				
Cumulative impacts:	The cumulative loss of habitat will reduce species richness and biodiversity. In highly disturbed areas the impact is not seen as significant as long as undisturbed areas remain in their current state, and connectivity between these sites is maintained.				
Residual impacts:	The loss of undisturbed habitats / fragmentation of undisturbed habitats could result in a significant decrease (possible local				

	extinction) of potential TOP species in the area.
Climate Change:	Climate change status for Gauteng is not expected to change significantly due to the proposed development, although local carbon emissions may be reduced in the long term due to the proposed development. No additional regional or national climate change impacts expected on terrestrial fauna.

Activity:	Clearing the area for foundations across ecological corridors (construction phase only).				
Impact:	**2) Nature: Destruction of ecological corridors and impaired ecological connectivity** Activities in or near highly sensitive areas and moderately sensitive areas within ecological corridors (Plan 5) must be managed to ensure the ecological connectivity is preserved to prevent habitat fragmentation and isolation of faunal communities.				
Significance rating Construction:	Duration	Extent	Magnitude	Probability	Significance
Pre-Mitigation	Permanent (5)	Local (2)	Moderate-high (8)	Highly Probable (4)	Moderate (60)
Post-Mitigation	Short (1)	Site specific (1)	Slight (2)	Improbable (2)	Low (8)
Is the Impact Reversible?	Reversible: Ecological corridors can potentially be avoided.				
Mitigation Measures:	**STOP**: No activities are to commence within the streams, wetlands and buffers until authorisations are obtained under the National Water Act (NWA) and NEMA. Avoid Restricted Areas (Plan 5) where feasible. No contractors camps, storage yards, parking areas or other activities are allowed to occur within Restricted Areas (Plan 5). **MODIFY:** Do not plan for activities across the ecological corridors of Potential Development Areas (Plan 5), rather plan for activities so that the core corridor areas remain intact. No fencing should be established in Restricted Areas or Potential Development Areas (Plan 5). Where fencing is required, these must enclose very discrete footprints and not sever connectivity within and between sensitive areas. Fencing must be palisade or similar fencing and not wire mesh or barbed wire (materials which could ensnare animals) and not solid walls which hinder fauna movement. **CONTROL:** Ensure that unhindered access for fauna is maintained along the ecological corridors associated with the Restricted Areas or Potential Development Areas (Plan 5). **REMEDY**: Where areas not targeted for development are inadvertently impacted and / or damaged, clear any material dumped and rehabilitate the site as soon as possible.				
Cumulative impacts:	Development within the existing corridors will cumulatively deteriorate the ecological corridors, connectivity and dispersal routes for fauna and could result in isolation of faunal populations.				
Residual impacts:	Many species are threatened due to isolation of populations which results in in-breeding, genetic deterioration and associated illness and severing corridors could lead to local extinctions of potential TOP species in the area.				
Climate Change:	No additional regional or national climate change impacts expected on terrestrial fauna. It must be stressed that ecological corridors are critical for terrestrial fauna to mobilise in response to climate change and therefore preservation of ecological corridors will improve fauna survival in the face of climate change.				

Activity:	Activity of contractors, staff, maintenance personnel and visitors to site (construction and operation)				
Impact:	**3) Nature: Hindrance, trapping, killing of fauna, focussing on potential TOP species in the project area** TOP species may wonder into the project area periodically.				
Significance rating Construction:	Duration	Extent	Magnitude	Probability	Significance
Pre-Mitigation	Short-medium (2)	Local (2)	Moderate (6)	Highly Probable (4)	Moderate (40)
Post-Mitigation	Short-medium (2)	Local (2)	Slight-moderate (4)	Improbable (2)	Low (16)
Significance rating Operation:	Duration	Extent	Magnitude	Probability	Significance
Pre-Mitigation	Medium-long (4)	Local (2)	Slight to moderate (4)	Improbable (2)	Low (20)
Post-Mitigation	Medium-long (4)	Local (2)	Slight (2)	Improbable (2)	Low (16)
Is the Impact Reversible?	Moderately Reversible: Requires mitigation through education and awareness training and monitoring.				
Mitigation Measures:	**STOP**: As far as possible, no poisons against fauna are to be brought on site; any substance that could be toxic to fauna will be stored and handled in a manner that will prevent exposure of the substance to the environment. Select biodegradable pesticides and do not use insecticides that bioaccumulate in the environment or can be transported off-site by fauna (such as many rat poisons). No deliberate killing or trapping of indigenous fauna is allowed on site. **MODIFY:** The gravel road crossing tributaries in and around the area should not be utilised by any construction vehicles during the rainy season if the bullfrogs are observed to be active in the area. Conduct all excavations near tributaries (Potential Development Areas in Plan 5) during the dry season (outside the November to January rainy period). **CONTROL**: Any poisons used against fauna (insecticides for example) will be used as per manufacturer's specification and within discrete areas and will never be applied during rainy or windy conditions. Environmental awareness training must include the prohibition of any harm or hindrance to any indigenous fauna species and the consequences of such actions. Ensure safe speed limits and safe working conditions in the project area. **REMEDY**: Contracts with contractors must specify actions that will be taken against contractors who do not conduct activities in line with the EMPr. Should any fauna be trapped within the development area, activities will cease and specialists brought in to safely remove the animals from site in line with the Gauteng Nature Conservation Ordinance. Monitor TOPS observed to enter the site, specifically the tributaries and undisturbed grasslands for Giant Bullfrog activity (November to January) and also Oribi (year-round). Should monitoring indicate that aspects of the development are posing a risk to these species, then cease activity and adapt management as necessary to protect these species (consult specialists is needed). Any requirements of the Gauteng Nature Conservation Ordinance must be complied with regarding handling of such species.				
Cumulative impacts:	Local extinctions that could be caused by cumulative destruction of TOPS will alter the faunal community structure (for example the prey-base may bloom, or competitive predator numbers could decline). Predicting the extent and significance of such changes is not possible, although is not expected to be severe in terms of this area.				

Activity:	Activity of contractors, staff, maintenance personnel and visitors to site (construction and operation)
Residual impacts:	Destruction of any TOPS (or prey-base of TOPS) could cause a cascade affect on populations and, in extreme circumstances, local extinctions.
Climate Change:	No climate-change related impacts.

Activity:	Uncontrolled runoff from site (mainly construction and to a lesser extent operations)				
Impact:	**4) Nature: Contamination of fauna environment** The proximity of the project area to various water bodies and tributaries means that any contamination in the project area will find its way into the streams and aquatic environments during a rainfall event.				
Significance rating Construction:	Duration	Extent	Magnitude	Probability	Significance
Pre-Mitigation	Medium (3)	Local (2)	Moderate (6)	Definite (5)	Moderate (55)
Post-Mitigation	Short-medium (2)	Site specific (1)	Slight-moderate (4)	Probable (3)	Low (21)
Significance rating Operation:	Duration	Extent	Magnitude	Probability	Significance
Pre-Mitigation	Medium-long (4)	Local (2)	Slight to moderate (4)	Improbable (2)	Low (20)
Post-Mitigation	Medium-long (4)	Site specific (1)	Slight to moderate (4)	Improbable (2)	Low (18)
Is the Impact Reversible?	Moderately Reversible: Requires mitigation and rehabilitation to ensure reversibility				
Mitigation Measures:	**STOP**: Discontinue use of all faulty machinery / equipment on site until properly repaired. No activities are to commence within the streams, wetlands and buffers until the necessary authorisations are obtained under the National Water Act (NWA). Ensure a waste management plan has been compiled in line with the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEM:WA) before any activities commence on site. **MODIFY**: Due to proximity of petrol stations, hydrocarbon storage on site should be limited to daily needs only. Plan and implement a proper storm-water management plan, with erosion control measures, from the onset, to prevent contamination and sedimentation to downstream environments as per the hydrology and pedology specialists' recommendations. Facilities will be provided for storage of all hazardous substances and waste to prevent the exposure of these substances to the environment. The aim is to PREVENT exposure of fauna to any potential toxin. **CONTROL**: 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. All substances including waste must be properly stored and handled according to prescribed manner / standards and must not be exposed to the environment and sheltered from environmental elements. Any cars, machinery or equipment parked on site will either be parked on a concrete slab or have pans placed under them to collect all drips and potential leaks. Manage all waste in line with the waste management plan. Cement bags will be stored under a tarpaulin and on an impervious sheet. Cement mixing will take place within a designated area				

Activity:	Uncontrolled runoff from site (mainly construction and to a lesser extent operations)
	only. **REMEDY**: All hydrocarbons spills on bare ground will be cleared immediately. Inspect and clear all litter and waste from the site and surrounds. All dry and wet cement spills on bare ground will be cleared immediately.
Cumulative impacts:	Any additional development will add to the potential of contamination to the area and down-slope areas. Large spills or continuous cumulative leaks and waste dumping that are not cleaned up will enter the environment through run-off or leachate and contaminate the environment.
Residual impacts:	If toxic substances and waste are not properly managed or spills not cleared immediately, the environment will suffer extended residual impacts, particularly if toxins seep into the soils or are washed to downstream environments. No impacts with proper on-site management.
Climate Change:	Although there will be an initial increase in diesel-powered vehicles and machinery contributing to elevated carbon emissions, this will be temporary, and overall long-term carbon emissions may be reduced in the area due to the proposed development.

6. 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 existing fauna biodiversity and prevent the skewing of fauna communities as far as possible.

A monitoring plan and an adaptive management approach must be implemented in order to ensure effective mitigation measures are applied at all times. The specific mitigation measures are highlighted in the impact assessment tables above and the monitoring plan is indicated in Table 8.

In addition to the mitigation measures in the various impact tables above, the following general measures must also be applied during the construction and operation of the development:

- AI species status is not likely to be impaired or altered, but activities on site must be managed to prevent attracting such species to site or cause population explosions of existing AI species on site.
    - Maintaining and improving local indigenous populations could assist in reducing alien species numbers on site through competition and predation. Therefore, maintain indigenous landscapes in and around the project area where any landscaping is conducted (possibly in and around the panel development area).
    - Compile and implement an alien invasive management plan in line with the municipal management plan, which must include measures to prevent attracting additional alien animals to site. This should include not feeding wildlife and ensuring that all food and food waste, including domestic waste, is placed in sealed containers and not exposed on site. Ensure that the outside areas are kept clean and tidy and provide adequate waste removal services to prevent the attraction of rats and other alien scavenging species to the site.
- General activities that generate noise, dust and vibration will be nuisance impacts to fauna. The status of the site means these impacts are already taking place, but these should not be exacerbated as far as possible.
    - Where the possibility exists to purchase similar equipment at similar cost, purchase the quieter equipment.
    - Ensure dust suppression, through water sprinkling, is applied at time of high dust generation.
    - Noisy point-sources should be enclosed and equipment / machinery fitted with silencers and serviced and maintained within operating specifications to prevent excessive noise.
- Ensure all operational and maintenance activities proceed in an environmentally responsible manner as per the recommendations in this report and the environmental management plan.

An Environmental Officer (EO) must be appointed to ensure construction activities are in line with environmental management programme and authorisation requirements, including the mitigation

and management measures stipulated within this report. Inspection, records of issues, corrective measures and sign-off will form part of the EO's responsibilities.

Table 5: Monitoring plan to be undertaken by EO

Monitoring Action	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.	Once-off
Inspect and sign-off on placement of demarcation pegs marking out no-go areas and specific activity areas.	Once-off
Monitor TOPS observed to enter the site. Cease any activity that could be harmful or adapt activity to prevent harm. Requirements of the Gauteng Nature Conservation Ordinance must be complied with regarding handling of such species.	Tributaries and undisturbed grasslands around activity areas should be checked at least monthly and after every rainfall event in the mornings from November to January.
Apply monitoring and auditing requirements stipulated in NWA & NEMA authorisations as relevant.	Every 6 months

6.1 Invasive Species

The Alien and Invasive Species Regulations published under GNR1020 (2020) 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 they 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, no AIS species have been confirmed at site.

7. Conclusion and Recommendations

The only significant desktop features included the surface water features, CBAs and ESAs, largely associated with the streams and adjacent areas. Most of these areas have been incorporated into the Restricted Areas (Plan 5), along with undesignated undisturbed areas; areas that appear to have not been historically cultivated or impacted by mine infrastructure and may have experienced only superficial impacts. A few desktop ecological features have been included within the allowable development area (Plan 5) as they have little value in terms of habitat provision or ecological connectivity for terrestrial fauna.

As the Phase 2 areas incorporate more sensitive and less disturbed habitat units, the area is more likely to support TOP species / SCCs, although these are still expected to be fairly limited on site due to general anthropogenic activity in and around the general area. Most are expected to traverse or forage in the area; the Restricted Areas (Plan 5) are most likely to host these species on a more permanent basis. Being mobile they can move away from the development once it commences, and return after activities are completed, as long as the Restricted Areas are maintained. Significant direct impacts to fauna species are therefore not anticipated, but must be actively managed.

In terms of terrestrial fauna and the proposed Phase 2 development, the ground-truthing and site assessments must be completed and this report updated with the site findings once the preferred and alternative development sites are finalised. The following is still required in order to complete Phase 2:

- Obtain the final development footprints and alternative sites.
- Obtain the final environmental screening report for these areas and determine the terrestrial biodiversity and animal species sensitivity ranking and any additional listed SCCs.
- Complete the necessary site assessment of these areas during a time of year when the SCCs are more likely to be active and detected.
- Compete the Site Ecological Importance assessment based on SCCs confirmed or lkely to occur on site if relevant.
- Update this desktop report to reflect the site assessment findings and protocol requirements for the terrestrial fauna biodiversity and animal species reports.

8. References & Bibliography

8.1 Literature

Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M, Marais, J., and Alexander, G.J. & De Villiers, M.S. (Eds) (2014). **Atlas and red list of the reptiles of South Africa, Lesotho and Swaziland**. Suricata 1. South African National Biodiversity Institute, Pretoria.

Bennett N (2016). **A conservation assessment of Cryptomys spp**. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. **The Red List of Mammals of South Africa, Swaziland and Lesotho.** South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Child, M. F.; Raimondo, D.; Do Linh San, E.; Roxburgh, L.; Davies-Mostert, H. (2016). **The Red List of Mammals of South Africa, Swaziland and Lesotho**. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Dippenaar-Schoeman A.S.; Haddad C.R. ; Foord S.; Lyle R.; Lotz L.; Helberg L.; Mathebula S.; van den Berg A; Marais P.; van den Berg A.M. ; Van Niekerk E. & Jocqué R. (2010): **First Atlas of the Spiders of South Africa (Arachnida: Aranae).** South African National Survey of Arachnida Technical Report 2010: version 1.

du Plessis J, Peel M, Child MF. (2016). **A conservation assessment of Redunca arundinum.** In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. **The Red List of Mammals of South Africa, Swaziland and Lesotho.** South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

du Preez, L,; Carruthers, V. 2009. **A Complete Guide to the Frogs of Southern Africa**. Struik Nature: Cape Town. ISBN 978 1 77007 446 0.

Leeming, J. (2019). Scorpions of Southern Africa. Struik Nature: Cape Town. ISBN 978 1 77584 652 9.

Light J, Pillay N, Avenant NL, Child MF 2016. **A conservation assessment of *Atelerix frontalis*.** In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. **The Red List of Mammals of South Africa, Swaziland and Lesotho.** South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Mecenero, S., Ball, J. B., Edge, D. A., Hamer, M. L., Henning, G. A., Kruger, M., Williams, M. C. (2013). **Conservation assessment of butterflies of South Africa, Lesotho and Swaziland: Red List and Atlas.** Saftronics (Pty) Ltd., Johannesburg and Animal Demography Unit, Cape Town.

Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. and Kloepfer, D. (Eds). (2004). **Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland.** Si/Mab Series #9. Smithsonian Institution, Washington, DC.

Monadjem, A.; Taylor, P.J.; Cotterill, F.P.D.; Schoeman, M.C. 2010a. **Bats of Southern and Central Africa: A biogeographic and Taxonomic Synthesis**. Wits University Press: Johannesburg. ISBN 978 1 86814 508 9.

Monadjem, A.; Taylor, P.J.; Denys, C.; Cotterill, F.P.D. 2010b. **Rodents of Sub-Saharan Africa: A biogeographic and Taxonomic Synthesis**. de Gruyter: Berlin. ISBN 978 3 11 038923 4.

Murray, K. (2011). **Scatalogue**. Struik Nature: Cape Town. ISBN 978 1 77007 955 7

Palmer G, Birss C, du Toit JT. (2016). **A conservation assessment of Raphicerus campestris.** In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. **The Red List of Mammals of South Africa, Swaziland and Lesotho.** South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Ponsonby DW, Rowe-Rowe D, Power RJ, Somers MJ. (2016). **A conservation assessment of Hydrictis maculicollis.** In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. **The Red List of Mammals of South Africa, Swaziland and Lesotho.** South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Picker, M.; Griffiths, C. 2011. **Alien & Invasive Animals: A South African Perspective**. Struik Nature: Cape Town. ISBN 978 1 77007 823 9.

Picker, M.; Griffiths, C.; Weaving, A. 2012. **Field Guide to Insects of South Africa**. Struik Nature: Cape Town. ISBN 978 1 92057 225 9.

Ramesh T, Downs CT, Power RJ, Laurence S, Matthews W, Child MF. (2016). **A conservation assessment of Leptailurus serval.** In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. **The Red List of Mammals of South Africa, Swaziland and Lesotho.** South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Samways, M.J. & Simaika, J.P. 2016. **Manual of Freshwater Assessment for South Africa: Dragonfly Biotic Index.** Suricata 2. South African National Biodiversity Institute, Pretoria.

SANBI (South African National Biodiversity Institute). 2020. **Draft Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa.** South African National Biodiversity Institute, Pretoria. Version 1.0.

Shrader AM, Little I, Coverdale B, Patel T. (2016). **A conservation assessment of Ourebia ourebi ourebi**. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. **The Red List of Mammals of South Africa, Swaziland and Lesotho.** South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Stuart, C.; Stuart, M. 2013. **A field Guide to the Tracks & Signs of Southern, Central & East African Wildlife**. Struik Nature: Cape Town. ISBN 9781770073609.

Stuart, C.; Stuart, M. 2015. **Stuarts' Field Guide to Mammals of Southern Africa including Angola, Zambia & Malawi**. 5th Edition. Struik Nature: Cape Town. ISBN 978 1 77584 111 1.

Taylor PJ, Willows-Munro S, Baxter R, Monadjem A, Child MF. (2016). **A conservation assessment of Myosorex varius.** In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. **The Red List of Mammals of South Africa, Swaziland and Lesotho.** South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Tolley, K.; Burger, M. 2012. **Chameleons of Southern Africa**. Struik Nature: Cape Town. ISBN 978 1 92057 286 0.

Woodhall, S. (2005). **Field guide to butterflies of South Africa**. Cape Town: Struik Nature. ISBN 978 1 92054 481 2.

8.2 Internet Sources

- Checklist of South African Scarabaeinae. Animal checklist website (http://biodiversityadvisor.sanbi.org/research-and-modelling/checklists-and-encyclopaedia-of-life/south-african-animal-checklist/), accessed 5 November 2019.
- Checklist of South African Diplopoda. Animal checklist website (http://biodiversityadvisor.sanbi.org/research-and-modelling/checklists-and-encyclopaedia-of-life/south-african-animal-checklist/), accessed 30 April 2019.
- Checklist of South African Hymenoptera, Ants. Animal checklist website (http://biodiversityadvisor.sanbi.org/research-and-modelling/checklists-and-encyclopaedia-of-life/south-african-animal-checklist/), accessed 30 April 2019.
- Checklist of South African Orthoptera. Animal checklist website (http://biodiversityadvisor.sanbi.org/research-and-modelling/checklists-and-encyclopaedia-of-life/south-african-animal-checklist/), accessed 30 April 2019.
- ewt.org.za/reddata: Endangered Wildlife Trust for information pertaining to Red-listed mammals.
- inaturalist.org: For supplementary information on species distribution (accessed 2021-02-16).
- iucnredlist.org: For the IUCN Red List status of species.
- SANBI.org.za: For geographic information related to protected and sensitive ecosystems and environments, such as National Freshwater Priority Areas (NFEPA), Fish Sanctuaries and important catchments under NFEPA, Biodiversity and Conservation Plans.
- saramsar.com: For information on SA RAMSAR sites
- vmus.adu.org.za/: Animal Demography Unit, Virtual Museum:
  - FitzPatrick Institute of African Ornithology (2021). FrogMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=FrogMAP on 2021-01-07
  - FitzPatrick Institute of African Ornithology (2021). LepiMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=LepiMAP on 2021-01-07
  - FitzPatrick Institute of African Ornithology (2021). MammalMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=MammalMAP on 2021-01-07
  - FitzPatrick Institute of African Ornithology (2021). OdonataMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=OdonataMAP on 2021-01-07
  - FitzPatrick Institute of African Ornithology (2021). ReptileMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=ReptileMAP on 2021-01-07
  - FitzPatrick Institute of African Ornithology (2021). ScorpionMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=ScorpionMAP on 2021-01-07

    - FitzPatrick Institute of African Ornithology (2021). SpiderMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=SpiderMAP on 2021-01-07
- whc.unesco.org: for information on SA World Heritage Sites

Appendix A: CV, Qualification, SACNASP registration

Curriculum Vitae

BARBARA KASL

Personal Information

- Full Name: Barbara Kasl
- Qualifications: PhD (Animal, Plant and Environmental Sciences)
- 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.

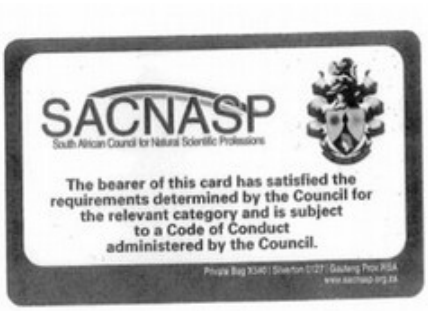
1993-1998: Part-Time Jobs

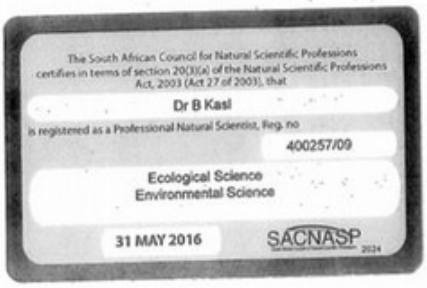
Professional Memberships and Affiliations

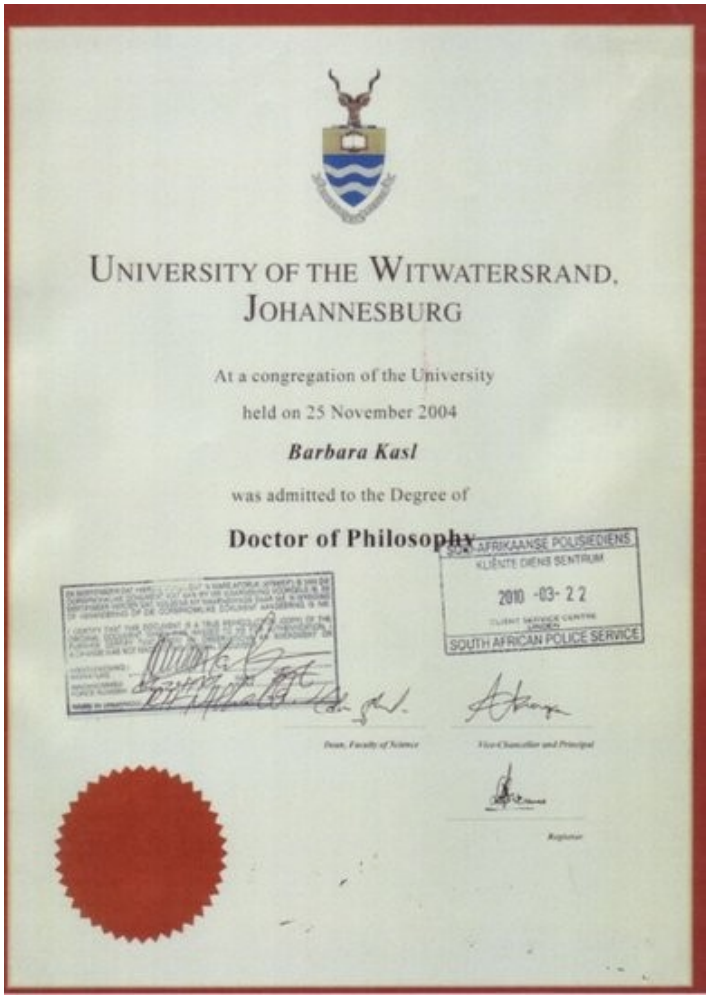
- **2011 – current:** Registered Professional Environmental And Ecological Scientist
- **2015 – 2017**: EAPSA Certified Environmental Assessment Practitioner
- **1999, 2001 & 2008 – current:** Entomological Society of South Africa
- **2008-2011:** International Association for Impact Assessment
- **1998:**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







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

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

Dean, Faculty of Science

Vice-Chancellor and Principal

Registrar

Appendix B: Desktop fauna records (mainly from ADU and iNaturalist)

Family	Common name	Taxon name
MAMMALS		
Carnivora	Otter, Cape Clawless	*Aonyx capensis*
Cetartiodactyla	Blesbok	*Damaliscus pygargus phillipsi*
Cetartiodactyla	Duiker, Common	*Sylvicapra grimmia*
Cetartiodactyla	Eland, Common	*Tragelaphus oryx*
Cetartiodactyla	Hartebeest, Red	*Alcelaphus buselaphus caama*
Cetartiodactyla	Springbok	*Antidorcas marsupialis*
Cetartiodactyla	Wildebeest, Black	*Connochaetes gnou*
Chiroptera	Bat, Mauritian Tomb	*Taphozous mauritianus*
Eulipotyphla	Shrew, Swamp Musk	*Crocidura mariquensis*
Perissodactyla	Zebra, Plains	*Equus quagga*
Rodentia	Gerbil, Bushveld	*Gerbilliscus leucogaster*
Rodentia	Mouse, Mesic Four-striped Grass	*Rhabdomys dilectus*
Rodentia	Mouse, Namaqua Rock	*Micaelamys namaquensis*
Rodentia	Mouse, Natal Multimammate	*Mastomys natalensis*
Rodentia	Mouse, Southern Multimammate	*Mastomys coucha*
Rodentia	Rat, Vlei	*Otomys auratus*
REPTILES		
Agamidae	Agama, Eastern Ground	*Agama aculeata distanti*
Agamidae	Agama, Southern Rock	*Agama atra*
Colubridae	Egg-eater, Common	*Dasypeltis scabra*
Cordylidae	Lizard, Common Girdled	*Cordylus vittifer*
Cordylidae	Lizard, Common Crag	*Pseudocordylus melanotus melanotus*
Gekkonidae	Gecko, Cape	*Pachydactylus capensis*
Gekkonidae	Gecko, Transvaal Thick-toed	*Pachydactylus affinis*
Lamprophiidae	Centipede-eater, Black-headed	*Aparallactus capensis*
Lamprophiidae	Snake, Aurora House	*Lamprophis aurora*
Lamprophiidae	Snake, Brown House	*Boaedon capensis*
Lamprophiidae	Snake, Common (Brown) Water	*Lycodonomorphus rufulus*
Leptotyphlopidae	Snake, Peters' Thread	*Leptotyphlops scutifrons*
Scincidae	Skink, Speckled Rock	*Trachylepis punctatissima*
Scincidae	Skink, Thin-tailed Legless	*Acontias gracilicauda*
Testudinidae	Tortoise, Leopard / Mountain	*Stigmochelys pardalis*
FROGS		
Pyxicephalidae	Bullfrog, Giant	*Pyxicephalus adspersus*
Pyxicephalidae	Caco, Boettger's	*Cacosternum boettgeri*
Hyperoliidae	Kassina, Bubbling	*Kassina senegalensis*
Pipidae	Platanna, Common	*Xenopus laevis*
Bufonidae	Toad, Raucous	*Amietophrynus rangeri*
Bufonidae	Toad, Red	*Schismaderma carens*