

# BIODIVERSITY STUDY FOR THE EXPANSION OF RAILWAY LINES AT PYRAMID SOUTH, PRETORIA, GAUTENG, SOUTH AFRICA

DEA REF. NO: 14/12/16/3/3/1/1839



**Biodiversity study report prepared for** : Kimopax Pty Ltd  
**On behalf of** : Transnet SOC Ltd  
**Study area** : Pyramid South, Pretoria, Gauteng  
**Extent of study area** : 30 hectares  
**Contact person** : Thabelo Matshisevhe

**Commissioned by** : Agri Flora Consultants (Pty) Ltd  
**Our reference** : 13-Eco-2017  
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Reference this study/report as:

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## **EXECUTIVE SUMMARY**

Agri Flora Consultants (Pty) Ltd has been appointed by the Kimopax (Pty) Ltd on behalf of Transnet SOC Ltd to conduct biodiversity study of fauna and flora, for expansion of railway lines at Pyramid South in Pretoria. The proposed site was located on farm Doornpoort 295 JR within City of Tshwane Metropolitan Municipality. Therefore, as part of the Environmental Impact Assessment (EIA) regulations of 2014 (GN R982, as amended), Agri Flora Consultants (Pty) Ltd conducted the study to identify Red Data Listed and threatened ecosystems associated, in order to identify impacts that are likely to be posed by the project activities. This included determining if translocation permits of species are required.

The ecological study was based on the desktop and relevant fieldwork methodology approach [i.e. (Braun-Blanquet and Line Transect for floral assessment), and (live nets traps, ground or pitfall traps for faunal assessment)], which were both carried out during September and October 2017. Data was collected on the field/lab notebook. Fauna and flora species were identified and classified, using identification keys (fauna-spoor, faeces and fur) from different field guidebooks and relevant data to the farms, obtained from POSA, SANBI, DWAF, IUCN and previous biodiversity studies conducted in the Gauteng Province.

There were two habitat units identified on the sites namely, wetland and terrestrial units. The terrestrial unit was extensively disturbed by fire during September 2017, and then shown sufficient recovery towards mid October 2017. Nevertheless, natural flora and fauna indicators were observed and recorded on the both habitat units. Alien invasive tree, shrub and herb species were most prominent in the habitat units. Following the Conservation of Agricultural Resource Act (CARA, Act 43 of 1983), these plant species are declared to be killed or removed, either through chemical or mechanical measures. Furthermore, a total of 11 plant species (inclusive of medicinal and indigenous) were observed and recorded in the both habitats units. Pertaining to the City of Tshwane C-Plan, Department of Water and Sanitation (DWS), National Environmental Management: Biodiversity Act 10 of 2004 (NEM: BA) and the International Union for Conservation of Nature and Natural Resources of the Red Listed Species, there was no Red Data Listed (RDL) or protected flora species in the both habitats units. These findings suggest that no permit for the translocation of species should be obtained prior to the commencement of the project activities.

The disturbance occurred in the terrestrial unit, inflicted low occurrence of suitable feeding vegetation. Nevertheless, breeding microsites were not observed, and this could be due to the small size of the patch (terrestrial unit) area which was highly exposed to edge effects. Animals, particularly larger ones, tend to avoid such patches as they put offspring to be highly vulnerable to predation. However, a total of 13 mammal, five (5) bird and nine (9) invertebrates species were recorded on the habitat units. Among these faunal species, five (5) species were detected to be Near Threatened (NT), and this was detected from the IUCN Red Listed Species and City of Tshwane C-Plan. The *Aonyx capensis* was highly linked to the spoor and faeces observed in the wetland unit, then *Lutra maculicollis* which are both NT. Moreover, *Parahyaena brunnea* (highly linked to faeces observed), *Crocota crocota* and *Leptailurus serval* were observed on terrestrial unit and classified as Near Threatened. In the arachnids, scorpion, invertebrates and reptiles groups, only nine (9) insects' species were live trapped and identified. None of these were detected to be of Red Data Listed.

The pre-impact assessment was based on these biodiversity study findings, as well with the relevant published relevant international, national and provincial planning, and other biodiversity conservation initiatives concerning the City of Tshwane, Gauteng Province biodiversity resource protection. The pre-impact assessment findings, have suggested that the project activities would pose **Low Significant Impact** on the floral and faunal species associated with the terrestrial unit, while it was further detected that it would also inflict **High Significant Impact** on the wetland unit. This further suggested that, the wetland habitat unit should be treated as a no go area. Based on the relevant ecological information available to date, as well as the results obtained from this study, it is our opinion that, there are no fatal flaws associated with the project activities to be conducted on the terrestrial unit. Agri Flora Consultants (Pty) Ltd shows no objection to the project going forward to the highlighted habitat unit if the mitigation measures set out in this report are adhered to by the proponent, with the commitment to undertake the development in a sustainable manner.

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## ACRONYMS

<b>RDL</b>	Red Data Listed
<b>NEM:BA</b>	National Environmental Management: Biodiversity Act
<b>CI</b>	Conservation Importance
<b>LO</b>	Likelihood of Occurrence
<b>C-Plan</b>	Conservation Plan
<b>SANBI</b>	South African National Biodiversity Institute
<b>CBA</b>	Critical Biodiversity Area
<b>NT</b>	Near Threatened
<b>CR</b>	Critically Rare
<b>VU</b>	Vulnerable
<b>EN</b>	Endangered
<b>EX</b>	Extinct
<b>CARA</b>	Conservation of Agricultural Resource Act
<b>SCC</b>	Species of Special Conservation
<b>IUCN</b>	International Union for Conservation of Nature and Natural Resources



## **TERMS AND DESCRIPTION**

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**Ecology:** The study of plant and animals interacting with their environment

**Biodiversity:** The study of variety of plants and animals in any given ecosystem

**Niche:** An immediate habitat type that is fully utilized for feeding and breeding by fauna

**Edge effects:** effects that are associated with activities around a fragmented patch

## PROJECT TEAM AND DECLARATIONS

This report has been prepared as per the requirements of the Environmental Impact Assessment Regulations and the National Environmental Management Act (Act 107 of 1998) as amended, inclusive of any subsequent amendments and relevant National and / or Provincial Policies related to biodiversity assessments.

**Mr. Tshililo Mphephu (*Botanist; Entomologist/Zoologist*); Director (1988-11-07)**

- \* Conducted field assessment and preparation of report

Expertise / Field of Study: MSc Entomology/ Zoology; BSc Honours Botany; BSc Botany and Zoology-Aquatic and terrestrial biodiversity components specialist

Signature:.... ..  ..... Date: .....07 November 2017.....

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**Assisted By: Ms Magoele Mmalesolo (*Aquatic Ecologist and Accounts Management*)**

- \* Edited report

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- \* Analysed invertebrates species

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*WE, AGRI FLORA CONSULTANTS DECLARE THAT THIS REPORT HAS BEEN PREPARED INDEPENDENTLY OF ANY INFLUENCE OR PREJUDICE AS MAY BE SPECIFIED BY THE NATIONAL DEPARTMENT OF ENVIRONMENTAL AFFAIRS.*

## **1. GENERAL INTRODUCTION**

### ***1.1 Purpose of the biodiversity study***

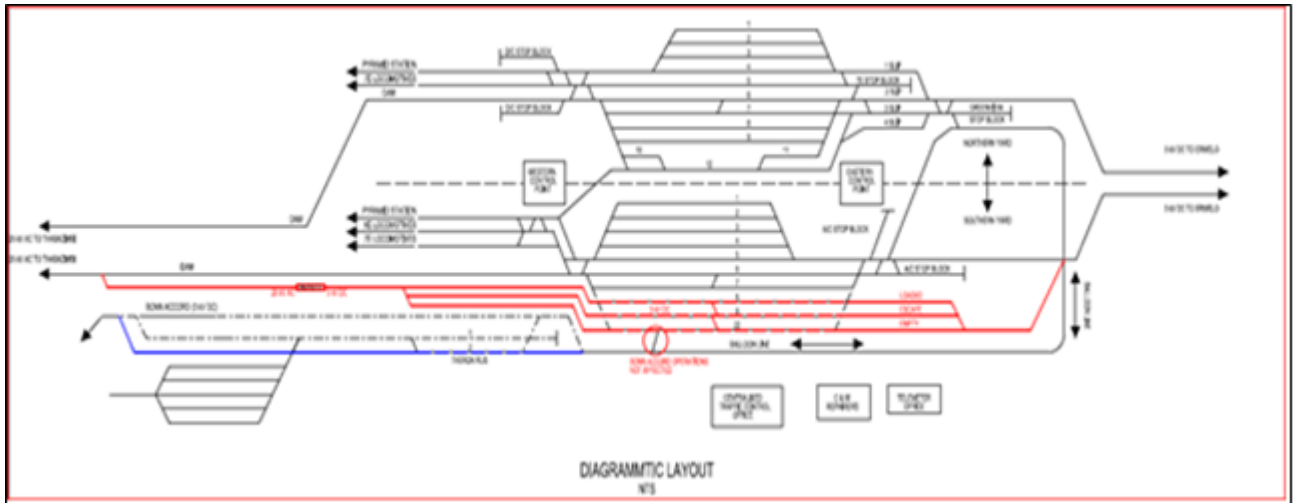
Agri Flora Consultants (Pty) Ltd was appointed by Kimopax (Pty) Ltd on behalf of Transnet SOC Ltd to evaluate the biodiversity components (i.e. flora and fauna) and their ecological conservation importance. This study was done for the expansion of railway lines in accordance with the National Environmental Management Act, 1998 (Act 107 of 1998) and the Environmental Impact Assessment (EIA) Regulations of April 2017, as amended, as well as all the relevant regulations promulgated in terms thereof for the proposed expansion of a railway lines at Pyramid South (see figure 1) within the City of Tshwane municipality in Pretoria, Gauteng Province. This study will form part of the Environmental Authorisation (EA) application submitted to the National Department of Environmental Affairs (DEA).

### ***1.2 Environmental impacts in the City of Tshwane Biodiversity***

The City of Tshwane is home to a high proportion of South Africa's mining activity, heavy industry, commercial enterprise and urban population. These activities and characteristics are all associated with land use change and the associated loss or degradation of natural habitats. The pressures placed on the environment and the remaining natural ecosystems are very high, and further loss of natural habitat and ecological processes is expected. Consequently, prior to any form of development, biodiversity components and their immediate systems should be assessed, to determine and minimize potential threats to biodiversity, to ensure continued ecological functioning in support of sustainable development.

### ***1.3 Objectives of the study***

Consequently, previous studies conducted on similar environmental conditions (i.e. soil form, topography, catchments and agricultural activities) were reviewed to document species of conservation concern (Red Data Listed and alien invasive species) likely to be associated with the subject area. Several important national and provincial conservation plans were also reviewed, with the results of those studies being included in this report. The site ground truthing or survey visit was then conducted during September and October 2017, to verify the information obtained from various and relevant conservation plans.



**Figure 1: Diagrammatic layout Pyramid South yard [Blue lines: Phase 1 (Bonn Accord Deviation), Red lines: Phase 2 (End-state)]**

#### ***1.4 Terms of reference***

The objectives of the study were to:

- (a) Describe the site vegetation and adjacent properties,
- (b) Map site vegetation and compile species list
- (c) Identify and list alien invasive species, protected species, endemic species and endangered species,
- (d) Assess or anticipate impacts of the project activities (construction of a railway line/ loop, construction of culverts and surface drains) on fauna and flora,
- (e) Construct sensitivity map reflecting species of conservation and ecological importance,
- (f) Recommendations and mitigation measures related to impacts likely to be posed on the species and ecological areas of conservational concern,
- (g) Suggest sustainable rehabilitation measures to ensure continuous functioning of ecological interactions,
- (h) And, construct a final summary of recommendations and conclusions based on the findings of this study.

#### ***1.5 Limitations***

In order to obtain a comprehensive understanding of the dynamics of both the floral and faunal components of both the terrestrial and aquatic systems, as well as the status of endemic, rare or threatened species in any given area, assessments should always consider temporal and spatial scales within the study. However, due to time and budget constraints, long-term studies

are rarely feasible, resulting in most EIA specialist assessments being once off surveys. Therefore, due to the scope of the work presented in this report, a detailed investigation of all, or part of, the proposed alignments was not possible. It should be emphasised that information, as presented in this document, only has reference to the study area(s) as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without a detailed investigation.

Furthermore, additional information may come to light during a later stage of the process or development particularly as the area during the surveys was very dry or burnt. Moreover, the subject area was burnt, and this has limited the number of species being observed, especially grazing mammals, bulbs, forbs or invertebrates' species etc.

### ***1.6 Site location***

Pyramid South is in the Onderstepoort, Bon Accord in Pretoria North, Gauteng Province and is situated along the old Warmbaths road (R101) in the Northern part of Rooiberg Asphalt Pyramid in Pretoria North. The proposed project is located on farm Doornpoort 295 JR within City of Tshwane Metropolitan Municipality.



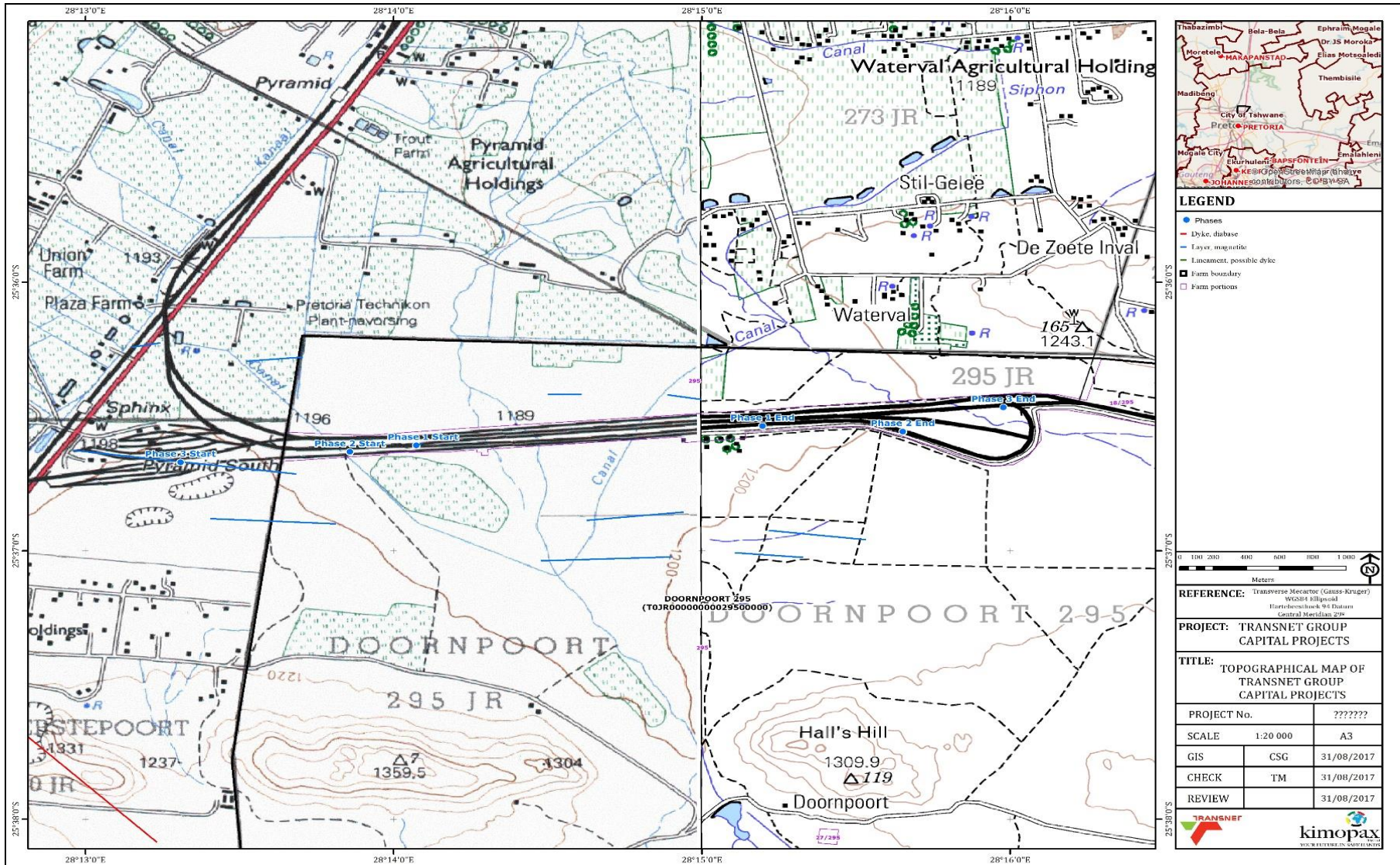


Figure 2. Map showing locality of the subject project

### ***1.7 Indemnity and terms of use of this report***

The findings and recommendations presented in this report are based on the authors' best scientific and professional knowledge, as well as available and relevant information. This report is further based on survey and assessment techniques, which were limited by time and budgetary constraints. The authors conducted this study, as Agri Flora Consultants, reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

## **2. MATERIALS AND METHODS**

### ***2.1 Floral assessment***

#### ***Field flora assessment***

The line-transect (walking through) and Braun-Blanquet cover-abundance (Mueller-Dombois & Ellenberg, 1974) approach were applied farm areas dominated by patches of trees and shrubs. The plant taxa were identified to species level, and habitat types and cover abundance were recorded. Scientific names follow POSA (Accessed, September/ October 2017). These methodologies have further allowed the documentation of the following biodiversity aspects:

(a) The identification of declared weeds and invader species as promulgated under: the NEM:BA August 2014 regulations (GG37885); and the amended regulations (Regulation 15) of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983).

(b) Vegetation community descriptions, mapping of broad habitat types / vegetation communities and Conservation Importance (CI) species analysis. For CI floral species, Likelihood of Occurrence (LO) rating was assigned to each species based on the availability of suitable habitat using the following scale: Present; Highly likely; Possible; Unlikely or No Habitat available.

(c) The Grass and forbs/herb's plants species were sampled by placing quadrats randomly within the site. In every 50 meters walked, a total size of 50 x 50 square meters' (m<sup>2</sup>) quadrants



were randomly placed on various points within a selected area. The Quadrants also covered the vegetation patches with large canopies and high diversity of the groundcover species. It has also covered faunal habitat diversity.

### ***Desktop floral assessment***

The vegetation type and ecosystem status assessment: source of information included:

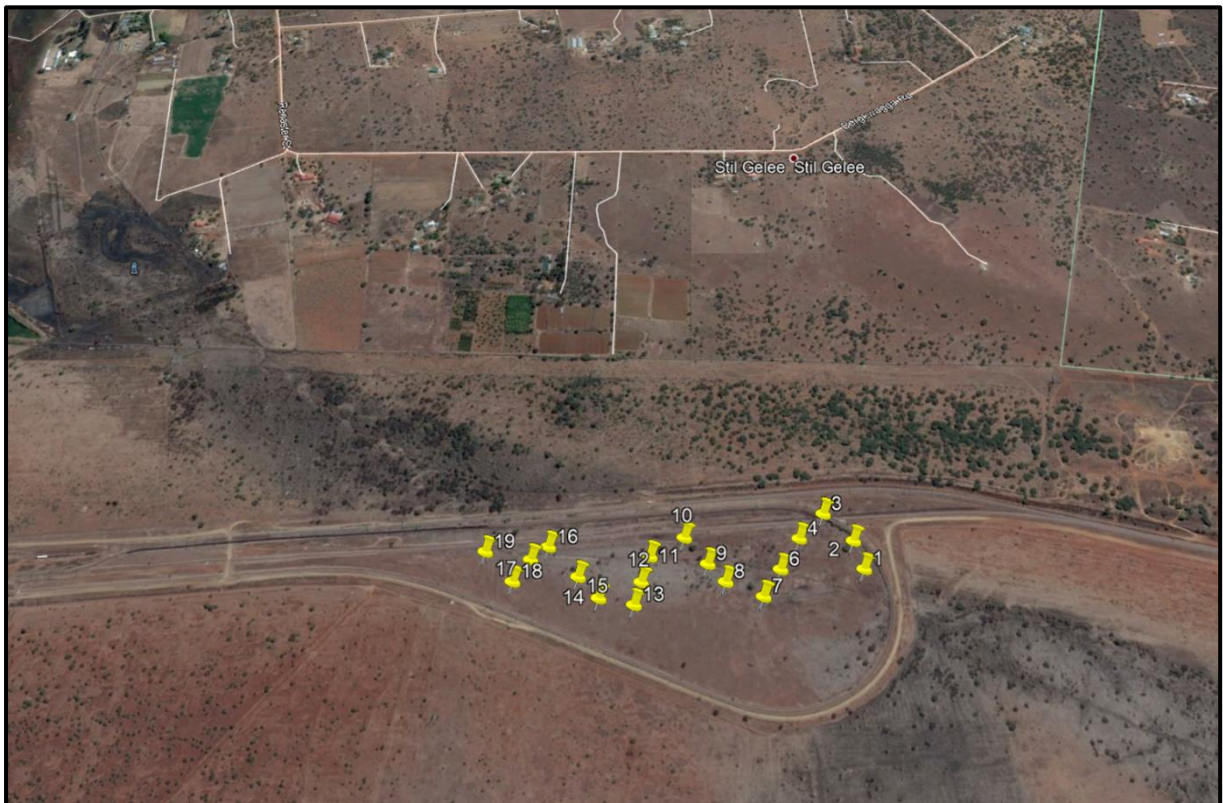
- (a) SANBI's1 Plants of South Africa (POSA)
- (b) Mucina & Rutherford's (2006) vegetation map of southern Africa.
- (c) The current Mpumalanga Province Conservation Plan (C-Plan).
- (d) Conservation Importance (CI) plant species records in the study region obtained through POSA
- (e) The IUCN Red List of Threatened Species

## 2.2 Fauna assessment

### Field assessment

#### *Visual observation, live trapping and environmentally friendly pit fall traps*

Faunal observations were made while driving, walking, and inspecting different habitats on site and in the area. Taxa were identified based on observed specimens, spoor, droppings, burrows and other evidence of occurrence. Rocks and logs were turned in search of reptiles, scorpions, frogs and invertebrates. A scouting hand sweep and live trapping nets were used to catch butterflies and other pollinating species.



**Figure 3. Illustration of line sampling tracts procedure conducted in the terrestrial habitat unit**



**Figure 4. Illustration of faunal (invertebrates and herpetofauna) sampling procedure**

### *Desktop faunal assessment*

#### *2.3 Biodiversity components associated with wetland assessment*

Vegetation and fauna species associated with the wetland unit were assessed according to the walking through sampling procedure. Long waiting observation was done to document movement or any other activities by aquatic faunal species. A total of five (5) quadrats of 1 m<sup>2</sup> by size, were placed on flowing water from the adjacent farm to determine fish and frog species associated. Sweep netting was also applied to document dragonflies' species.

## **3. RESULTS AND DISCUSSION**

### *3.1 Desktop flora and fauna assessment*

The City of Tshwane falls within the grasslands biome, and is home to a disproportionately high percentage of rare and threatened species and threatened ecosystems. There are at least 35 threatened plant species and 15 threatened animal species that occur in Tshwane (see Table 1), and 15 nationally listed threatened ecosystems (figure 5). Furthermore, 83% of wetland types and 58% of river types in the city are threatened. Just under two-thirds of Tshwane is in a natural or near-natural state (65%), with urban areas (14%), intensive agriculture (19%) and mining (2%) together covering 35% of the city. Critical biodiversity areas (CBAs) cover 26% of the city, with CBA 1 (natural or near-natural state) covering 25% and CBA 2 (highly modified landscapes that are important for threatened species) covering 1%. Ecological support areas (ESAs) cover a further 17% of the city, with ESA 1 (natural, near-natural or degraded

state) covering 11% and ESA 2 (highly modified landscapes that are important for ecological processes) covering 6%. Protected areas cover just over 3% of Tshwane (figure 7).

**Table 1. List of threatened species occurring in the City of Tshwane**

Plants	Mammals	Birds	Invertebrates
<b>NT-<i>Encephalartos dolomiticus</i>;</b> <i>Encephalartos dyerianus</i> ; <i>Erica baueri</i> subsp. <i>Baueri</i> ; <i>Leucadendron chamelaea</i> ; <i>Protea caespitosa</i> ; <i>Secale strictum</i> subsp. <i>Africanum</i>	<b>CR-<i>Neamblysomus julianae</i></b>	<b>VU-<i>Podica senegalensis</i>;</b> <i>Tyto capensis</i> ; <i>Anthropoides paradiseus</i> ; <i>Gorsachius leuconotus</i>	<b>VU-<i>Ichnestoma stobbiai</i></b>
<b>EN-9 species</b>	<b>NT-<i>Atelerix frontalis</i>;</b> <i>Lutra maculicollis</i> ; <i>Rhinolophus darling</i> ; <i>Rhinolophus clivosus</i> ; <i>Miniopterus schreibersii</i>	<b>NT-<i>Sagittarius serpentarius</i>;</b> <i>Mirafra cheniana</i> ; <i>Alcedo semitorquata</i>	
<b>VU-19 species</b>	<b>VU-<i>Rhinolophus blassi</i></b>		
<b>EX-<i>Macledium pretoriense</i></b>			

***Terrestrial habitats***

The study area was surrounded by agricultural plantation and game farms. The site falls in the grassland biome, despite the occurrence of some shrub and tree species scattered throughout the site. In addition, wetland units were also associated with the terrestrial habitat unit.

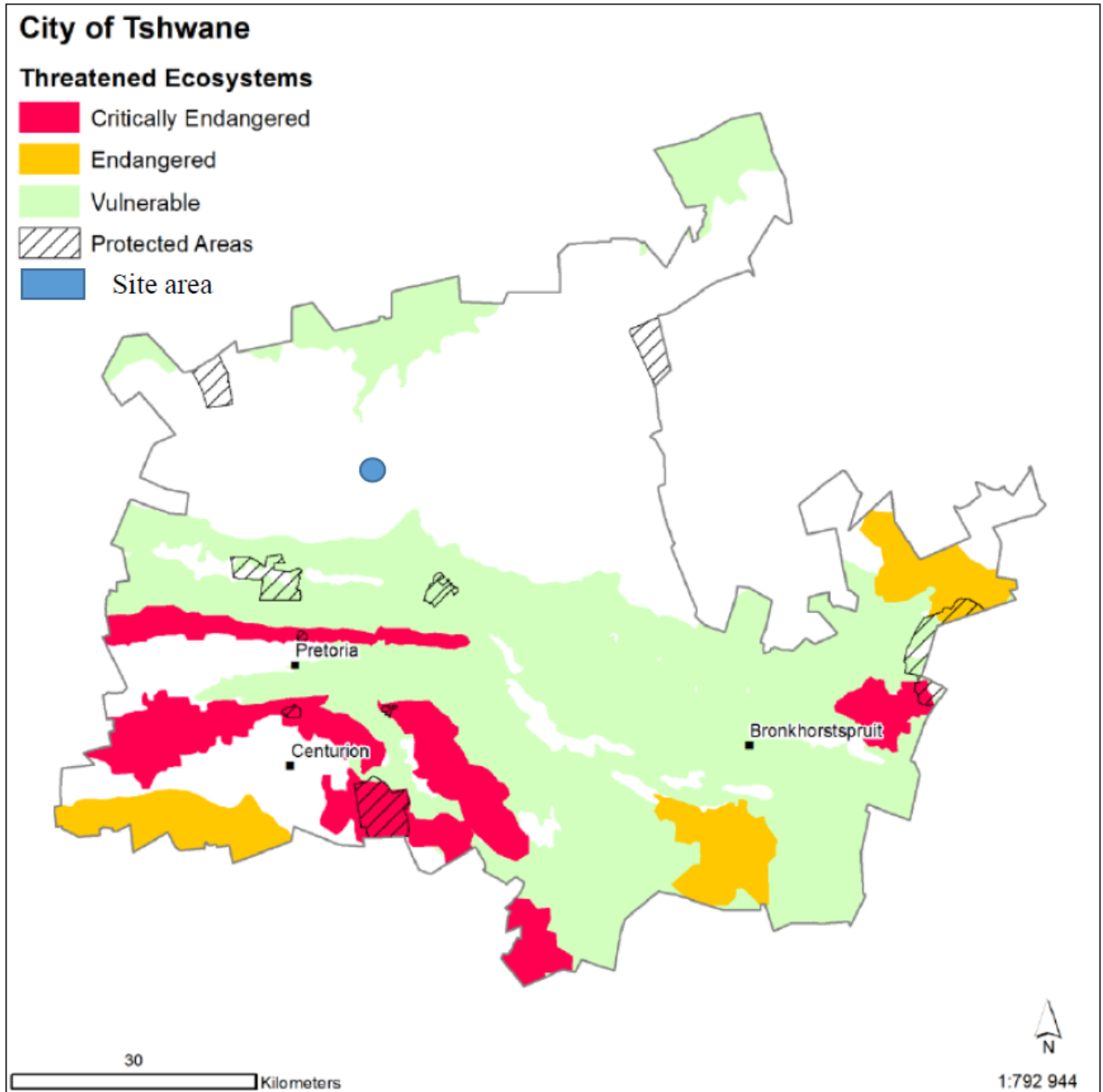


Figure 5. Map showing threatened ecosystems within the City of Tshwane. Site (●).

According to the Mucina and Rutherford (2006) Vegmap, four regional vegetation types are present along the rail line route (Figure 2). These include:

- Soweto Highveld Grassland (Gm 8)
- Eastern Temperate Freshwater Wetland (Azonal – Azf 3)
- Eastern Highveld Grassland (Gm 12)
- KaNgwane Montane Grassland (Gm 16)

The Biodiversity Act (No 10 of 2004) (Amendment December 2011), lists 225 threatened ecosystems based on vegetation type. All four vegetation types are listed by this Act as Vulnerable. Therefore, as a minimum, the Act stipulates that a minimum of a Basic Assessment must be conducted when an activity is proposed within these ecosystems and should any of these vegetation types in a natural state be lost the significance of the impact should be rated as **HIGH**.



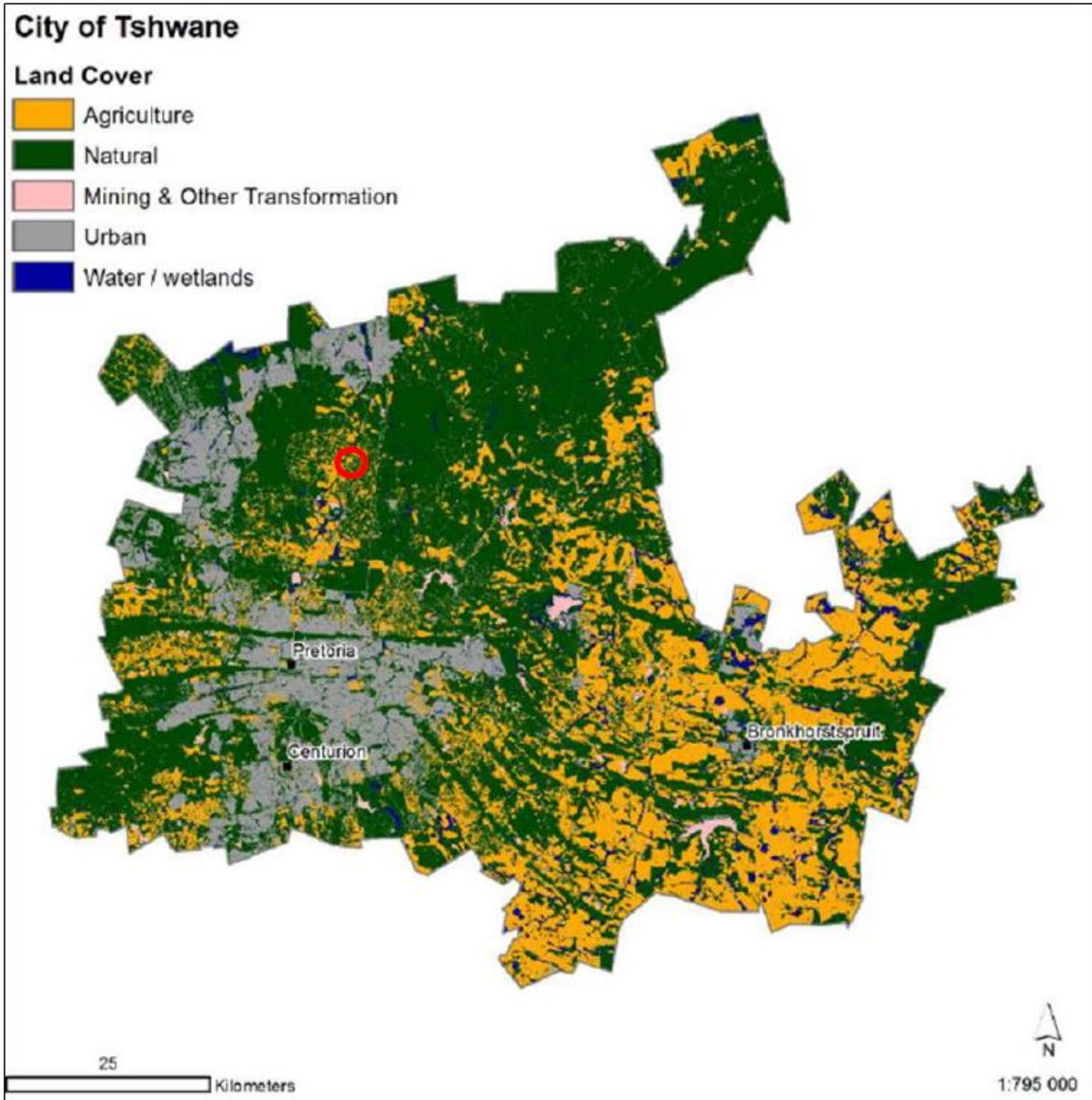


Figure 3. Map showing land cover within the City of Tshwane. Site = 



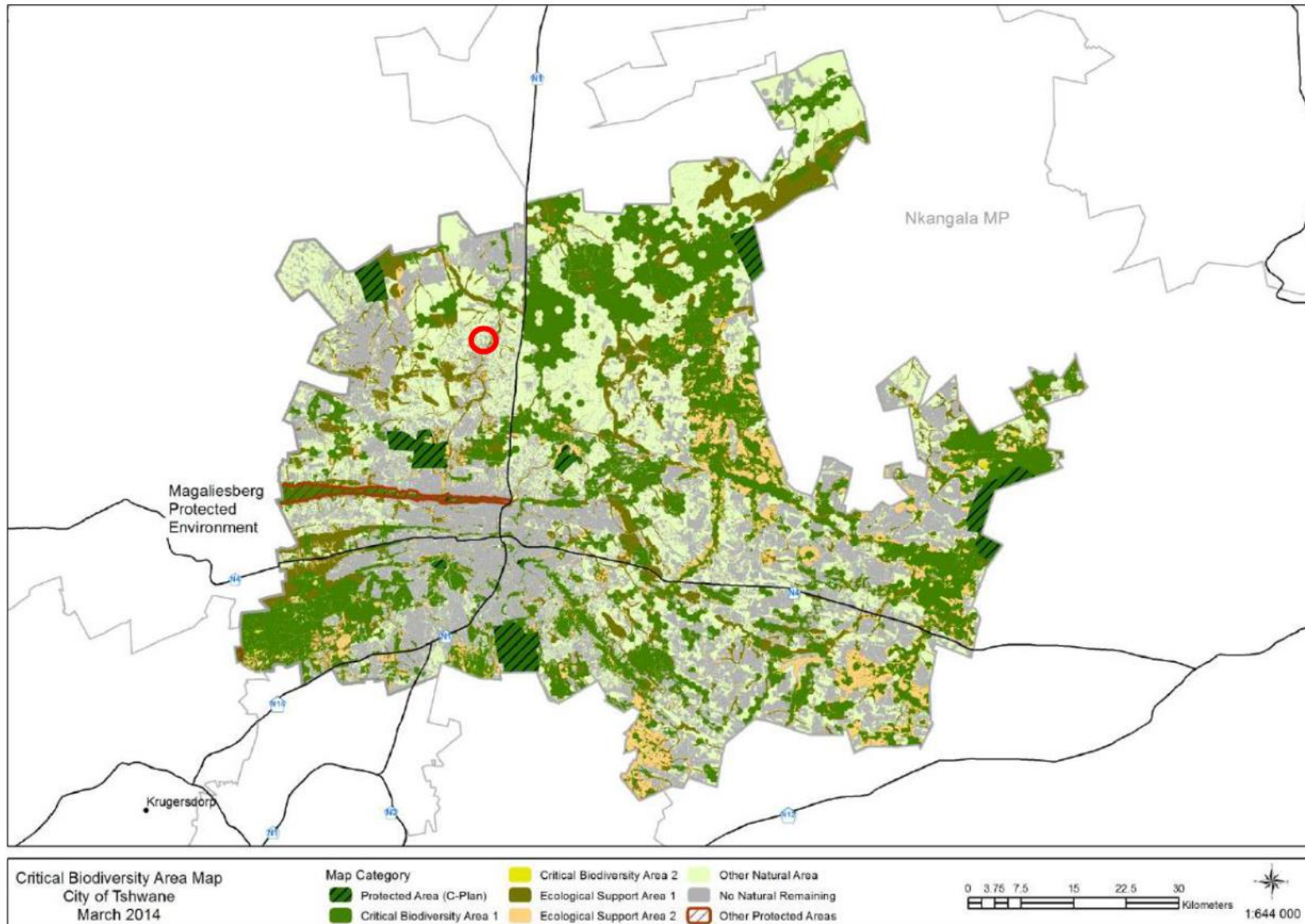


Figure 7. Map showing critical biodiversity areas within the City of Tshwane. = site area.

### ***Threatened ecosystems***

The list of threatened terrestrial ecosystems has been published by the Minister of Environmental Affairs in December 2011, following terms of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (hereafter referred to as the “National List of Threatened Ecosystems”), was based largely on South African vegetation types and the extent to which they have been irreversibly modified.

According to this list, Tshwane has a total of 15 threatened ecosystems, six (6) of which are considered critically endangered, four (4) are endangered and five (5) vulnerable (figure 5). Although much of this habitat has now been irreversibly modified, the historical extent of the threatened habitat types covers 59% of Tshwane

### ***3.2 Field flora assessment***

Floral assessment results presented in this report, have been obtained from the terrestrial and aquatic units associated with the subject area of the site. A total six (6) NT, nine (9) EN and 19 VU red listed plants species were also searched in the site areas (see table 1).

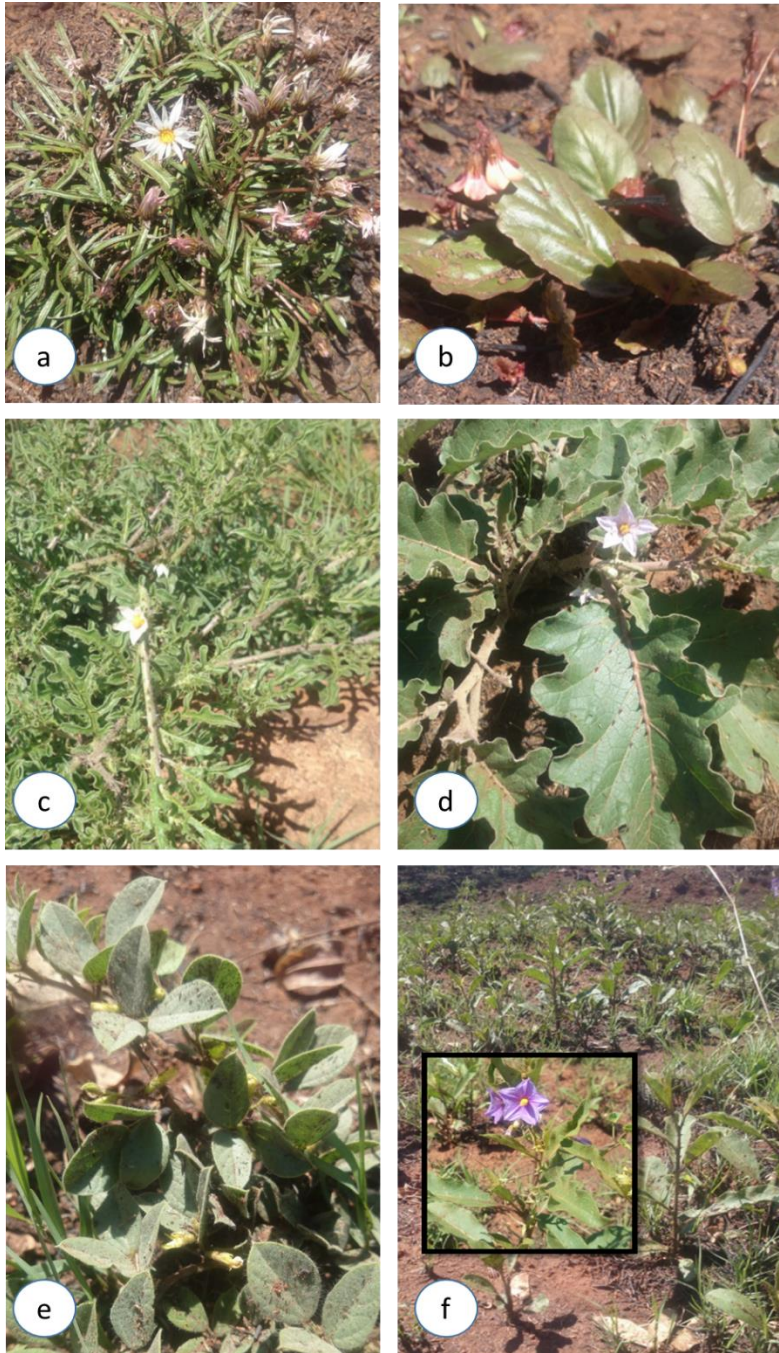


Figure 8. Example of herbaceous plants species recorded in the vicinity. a= *Senecio* sp., b= Vine species, c= *Solanum sisymbriifolium*, d= *Solanum* sp., e= Vine species, f= *Solanum elaeagnifolium*

#### (a) Alien invasive plants species

A total of five (5) alien invasive plants was encountered scattered throughout the subject site area (listed in table 2). However, the density of alien invasive species was prominent on forbs than tree plants species. In addition, assessment was conducted on recovering site after being burnt down, therefore, other alien invasive plants species could have been missed out, particularly herbaceous and tubers plants species. Therefore, following Conservation of Agricultural Resource Act (CARA, 1983) and section 28 of the National Environmental

Management of Biodiversity Act (NEM:BA, 1998), all these plants species should be controlled, either through chemical, mechanical or biological control measures.

#### **(b) Medicinal and indigenous plants species**

According to SANBI (2006), medicinal plants species are viewed as problematic from a conservation perspective, and can also be seen as a positive conservation opportunity, as these plants have increased value in terms of healthcare, income or cultural identity. These factors can be used as a motivator for conservation of these species and their habitats. Plant part substitution can be an important strategy for the conservation of medicinal plants, and traders should be encouraged to consider this strategy (Moeng & Potgieter, 2011). It is also well known that mining and agricultural activities encourage destruction of these plants species as well with their habitats.

As part of this assessment, a total of one (1) plants species, *Aloe* sp. (Asphodelaceae) was distinguished as a popular medicinal plant species (see figure 9c).

#### **(c) Forb and grass plants species**

A total of 14 forb plants species (including invasive, indigenous, medicinal) and one (1) grass species (table 2). These plants species were recorded in the both terrestrial and aquatic units. Since the herbaceous plants may be annuals, biennials or perennials, some could have been missed out during assessment, due to the fire disturbance triggered in the site.



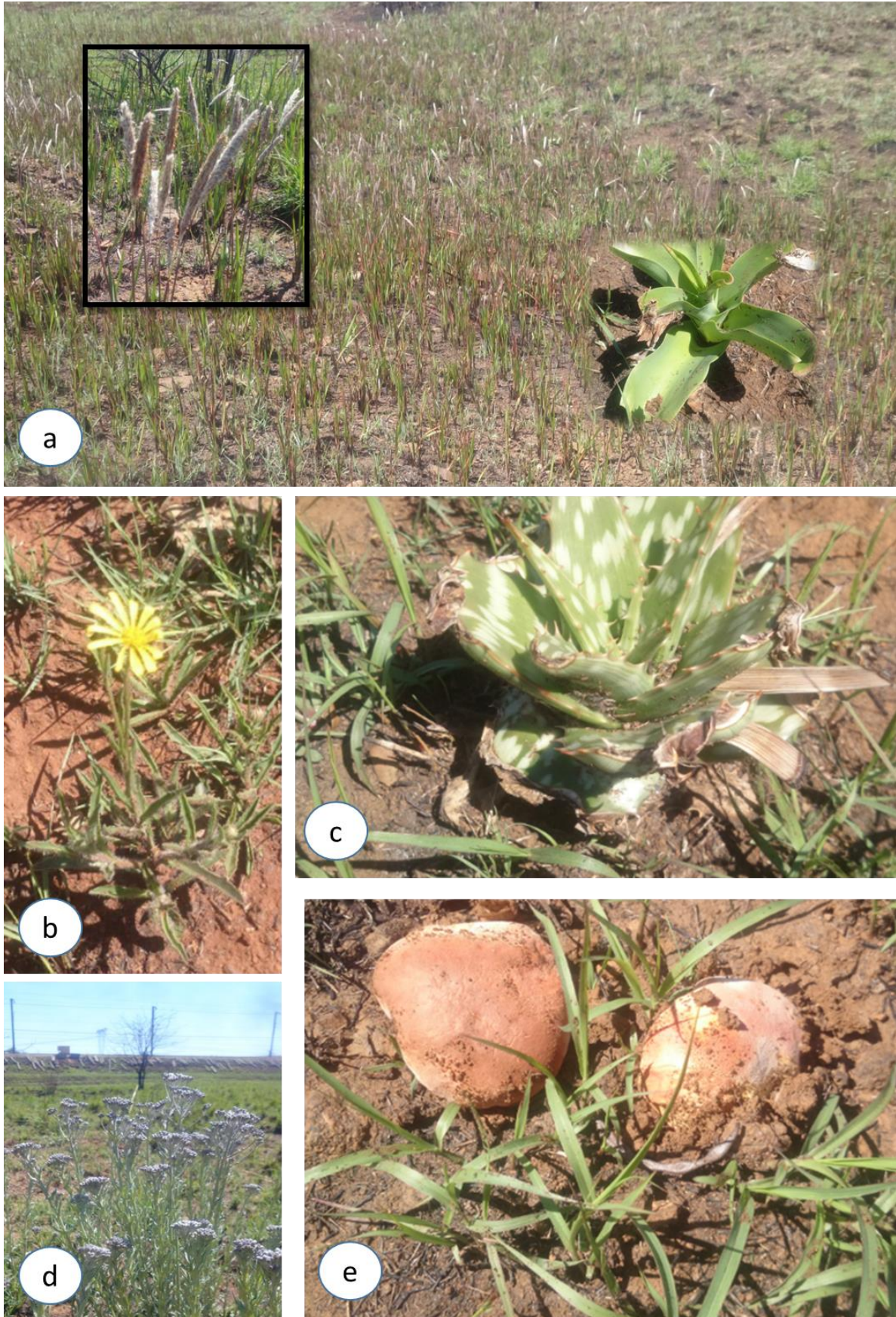


Figure 9. Examples of herbaceous plants species recorded in the vicinity. a= Poacea sp., b= *Senecio* sp., c= *Aloe* sp., d= *Senecio* sp., e= Mushroom species.





**Figure 10. Examples of plants species associated with the wetland in the site. a= *Argemone mexicana*, b= *Cyperus textilis*, c= *Combretum* sp., d= *Typha* sp.**

**(d) Flora species of special conservation concern**

Following the Gauteng, City of Tshwane C-Plan, the IUCN Red List of Threatened Species and NEM:BA assessments, some of these plants species described in the sections 3.2 b and c, are declared to be of Least Concern (LC), while some are CARA listed (see section 3.2 c). The results obtained in the both terrestrial and aquatic units suggest that, there was no plant Species of Conservation Concern (SCC) that requires translocation prior commencement of the project activities. Furthermore, the PRECIS SANBI database reflected no SCC plants associated with the subject site area.



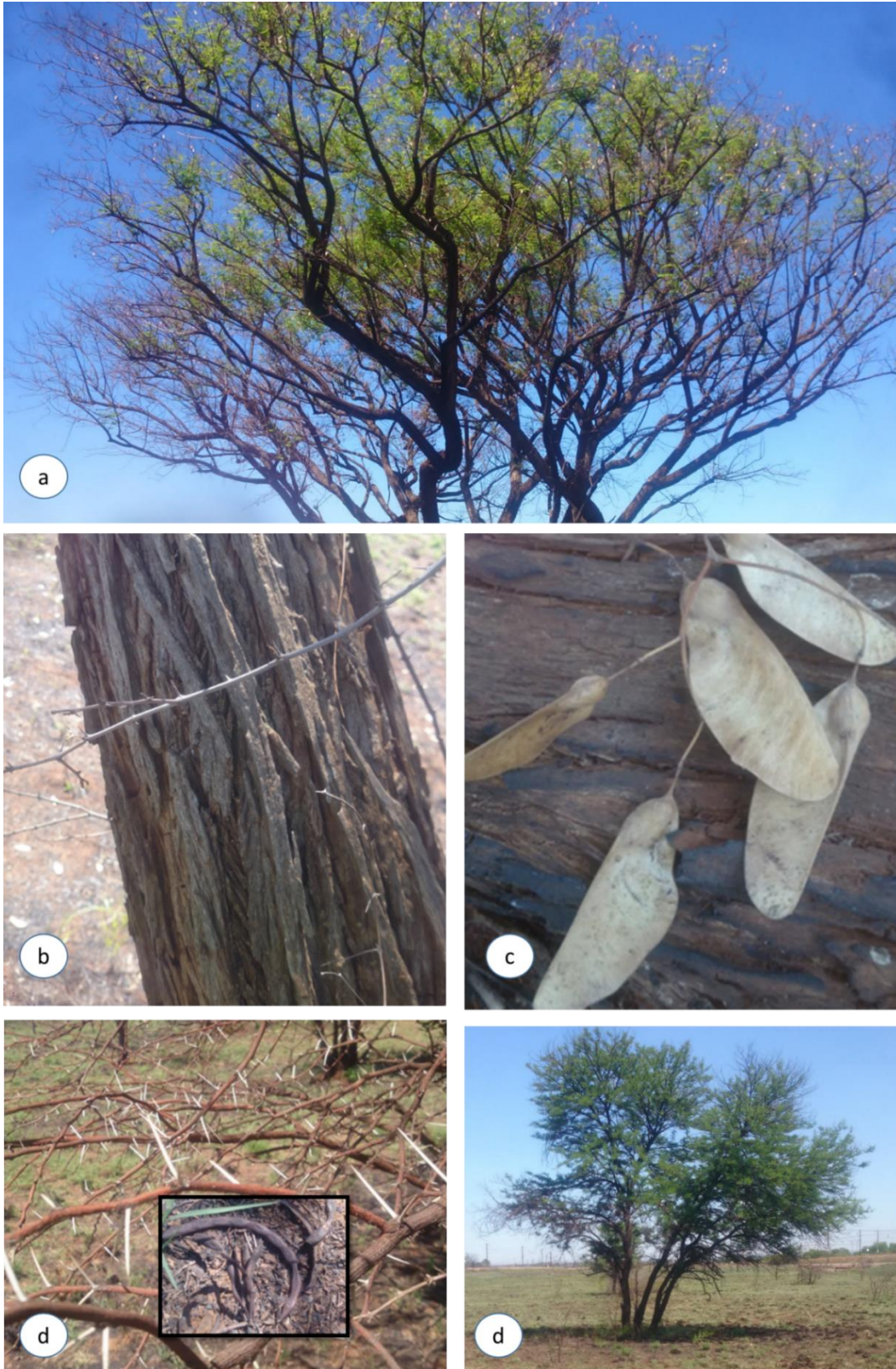


Figure 11. Tree species recorded in the vicinity. a= *Tipuana tipu*; b= stem bark of *T. tiputa*; c=fruit of *T. tiputa*; d= diagnostic features of *A. karroo*; e=*Acacia karroo*.



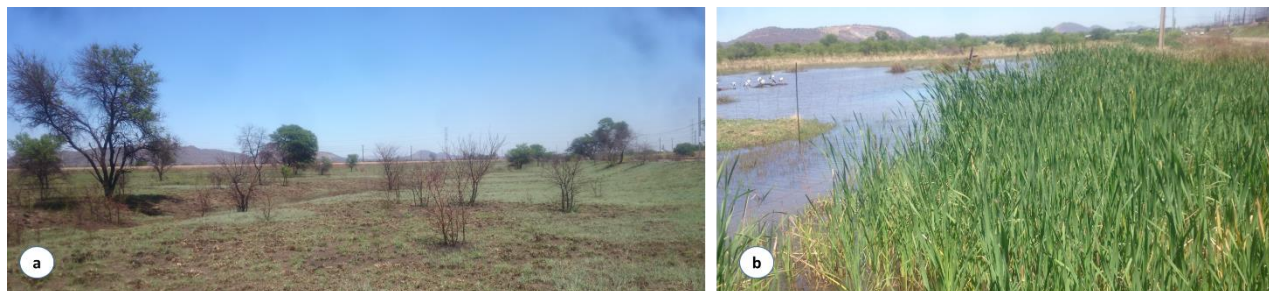
**Table 2. List of different types of plants species recorded in wetland and terrestrial units**

Family	Species	Conservation status <sup>R, N</sup> ; IUCN	CARA Listed	National Protection Forestry Listed
Fabaceae	<i>Acacia karoo</i>	LC	No	No
Fabaceae	<i>Tipuana tipu</i>	Not assessed	Yes, 1b	No
Papaveraceae	<i>Argemone Mexicana</i> **	Not assessed	Yes, 1b	No
Solanaceae	<i>Solanum elaeagnifolium</i> **	Not assessed	Yes, 1b	No
Solanaceae	<i>Solanum sisymbriifolium</i> **	Not assessed	Yes, 1b	No
Solanaceae	<i>Solanum sp. (x3)</i> **	Not assessed	Yes, 1b	No
Asteraceae	<i>Senecio telekii</i>	LC	No	No
Asteraceae	<i>Senecio aureus</i>	LC	No	No
Russulaceae	Mushroom plant species	LC	No	No
Cyperaceae	<i>Cyperus textilis</i>	LC	No	No
Typhaceae	<i>Typha sp.</i>	LC	No	No
Combretaceae	<i>Combretum sp.*</i>	LC	No	No
Asphodelaceae	<i>Aloe sp.#</i>	LC	No	No
?	Vine plant species (x2)	LC	No	No

**N= national protected; R= regionally protected; CARA=conservation of agricultural resource act; 0=no; 1=yes; \*=endemic/indigenous;#=medicinal; alien invasive=\*\*; the IUCN Red List of Threatened Species [Least Concern (LC), Vulnerable (VU), Near Threatened (NT), Critically Endangered (CR), Critical (C), Endangered (E); Rare (R)].**

### 3.3 Field fauna assessment

A total of two faunal habitat types were distinguished as terrestrial and wetland units (see figure 12 a & b) existing in the subject site areas. The observed wetland has been regarded as permanent water body, with accurate indicators such as plant and soil types (see figures 12 b; 10 b, c & d). There was no form of rocky outcrops observed, and this has limited breeding sites for many rock dwelling, terrestrial fauna species. Although the both wetland and terrestrial units shown natural fauna and flora occurrence, these units were small and highly exposed to edge effects. Ecologically, terrestrial mammals and some other herpertofauna species may only utilize the unit for occasional feeding only.



**Figure 12. Faunal habitat units. a= terrestrial habitat unit, b= wetland habitat unit.**

### (a) Mammal species

A total of 13 mammal species (table 3) were identified within the site, through direct visual observation, spoors, tracks, bones and faeces (see figures 13 a-f; 14 d & e). There was no form of burrows observed on the terrestrial unit, and notably, hiding and resting grass patches were distinguished on the wetland unit. This observation has suggested that, breeding was being avoided on the terrestrial unit, as it is highly exposed to predation.

Based on the mammal indicators subjected to extensive analysis (by means of using mammal guide of Southern Africa and analysis of the contents of faeces) identity of the responsible mammal species were established (see table 3). Subjection of these mammal species to International Union for the Conservation of Nature (IUCN) Red List of Threatened Species and SANBI databases, as well with the City of Tshwane C-Plan, has shown five (5) Near Threatened and 10 Least Concern of the recorded species are utilizing the terrestrial and wetlands units (see figures 13 a-f; 14 d & e). These results further suggest that, relevant authorization or permit would be required prior commencement of the project activities, as the units were being utilized for feeding and breeding by SCC/ Red Data Listed species.

**Table 3. List of mammal species recorded in the wetland and terrestrial units**

Family	Species	Conservation status <sup>R</sup>	IUCN Red List of Threatened Species	Occurrence level
Felidae	<i>Caracal caracal</i> *	LC	LC	1*
Felidae	<i>Leptailurus serval</i> **	NT	LC	1*
Hyaenidae	<i>Crocuta crocuta</i>	NT	LC	1*
Hyaenidae	<i>Parahyaena brunnea</i> ****	NT	NT	1*
Mustelidae	<i>Aonyx capensis</i> ****	LC	NT	2****
Mustelidae	<i>Lutra maculicollis</i> **	NT	NT	1*
Bovidae	<i>Aepyceros melampus melampus</i>	LC	LC	1
Bovidae	<i>Tragelaphus scriptus</i>	LC	LC	1*
Bovidae	<i>Redunca arundinum</i>	LC	LC	1*
Bovidae	<i>Raphicerus campestris</i>	LC	LC	2***
	<i>Sylvicpra grimmia</i>	LC	LC	1***
Suidae	<i>Phacochoerus africanus</i>	LC	LC	2
Hystriidae	<i>Hystrix africaeaustralis</i>	LC	LC	1
Leporidae	<i>Lepus saxatilis</i>	LC	LC	2

N= national protected; R= regionally protected; CARA=conservation of agricultural resource act; 0=no; 1=yes; E=endemic/indigenous; the IUCN Red List of Threatened Species [Least Concern (LC), Vulnerable (VU), Near Threatened (NT), Critically Endangered (CR), Critical (C), Endangered (E); Rare (R)]. Mammal indicators matching rating: \* = less likely; \*\*= partially likely; \*\*\*= likely; \*\*\*\*= highly likely



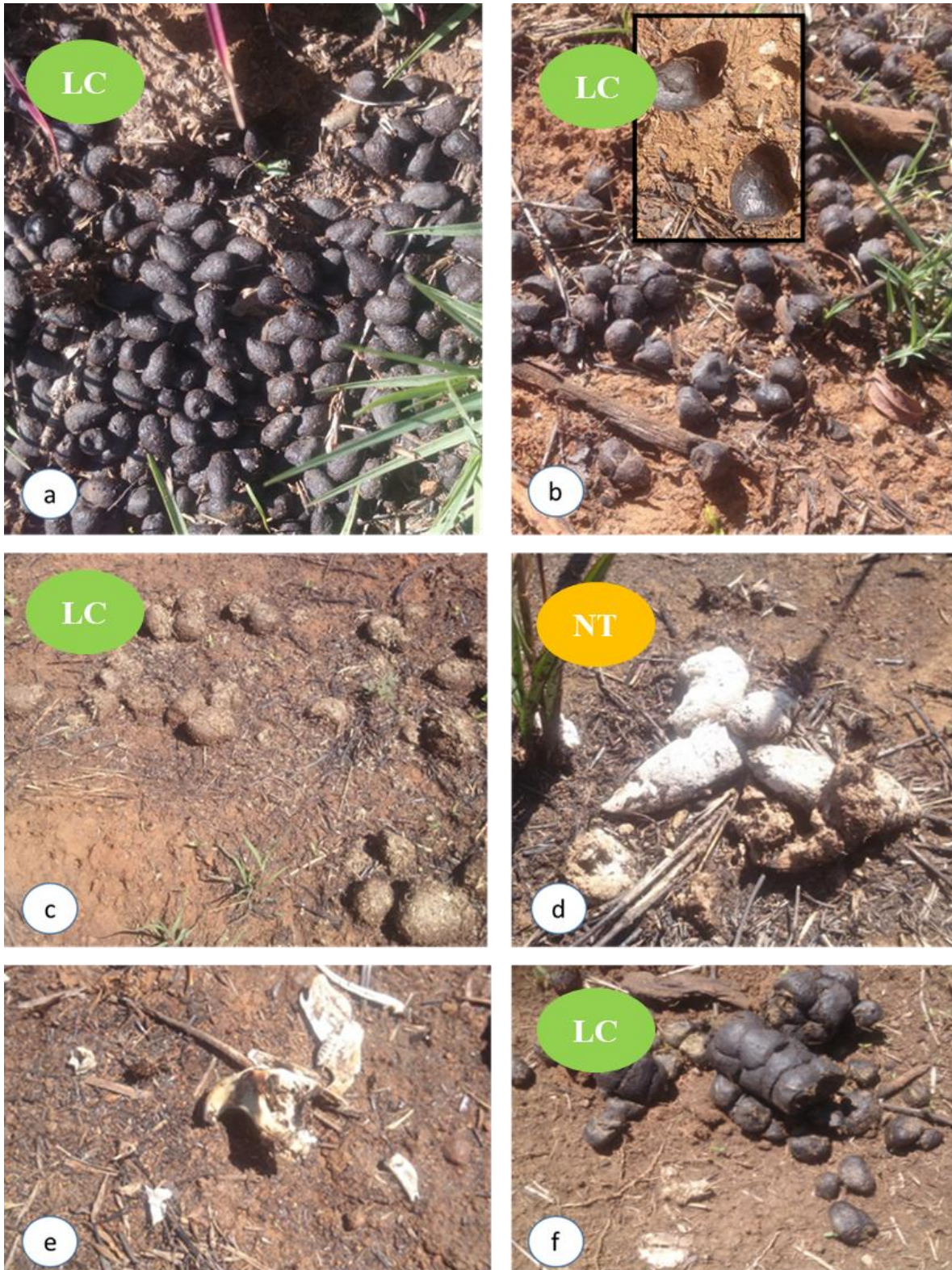


Figure 13. Indicators of mammal species recorded in the vicinity. a= *Raphicerus campestris*; b=; c= *Phacochoerus africanus*; d=likely to be *Parahyaena brunnea*, *Leptailurus serval*, *Crocuta crocuta* & *Caracal caracal*; e= Mice species; f= Antelope faeces?



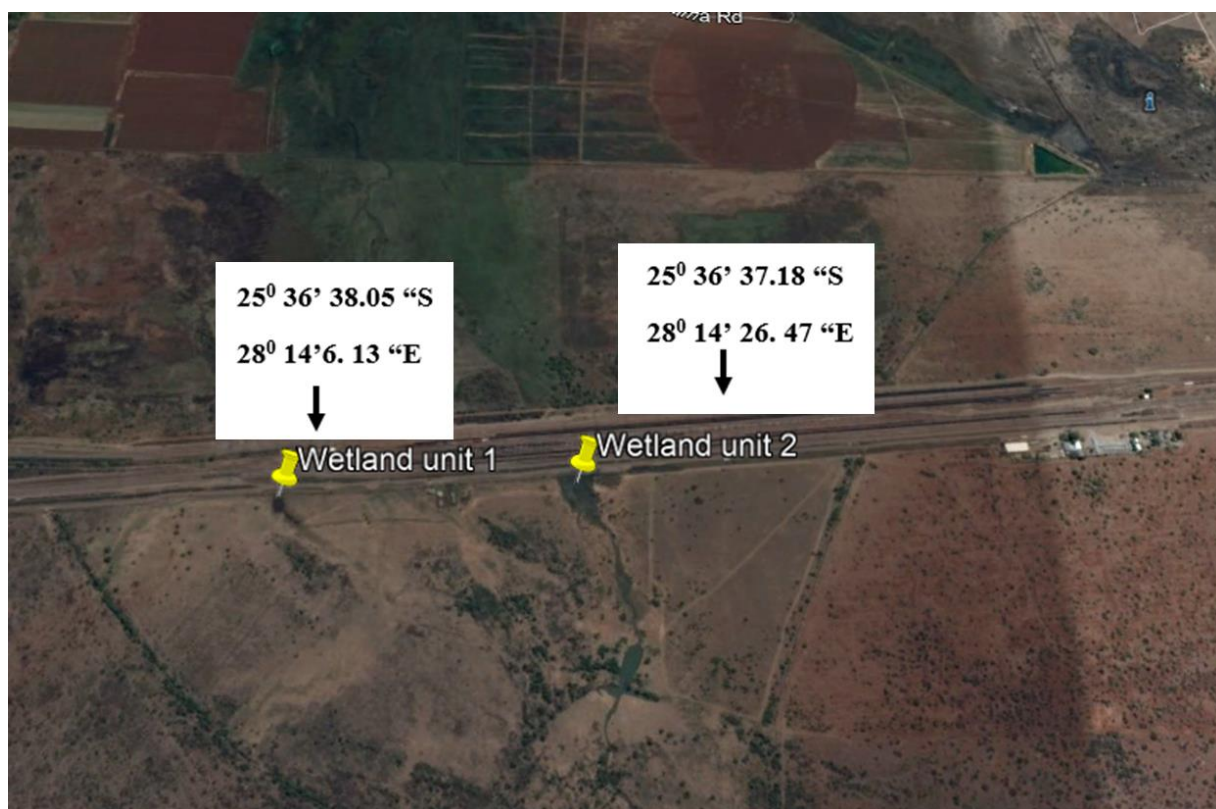
**(b) Avifauna**

The site has provided a limited avifaunal habitat types namely, wetland and open veld (terrestrial) units of small size patches. Based on visual observations, both units hosted different species. Species occurrence levels were higher on wetland than terrestrial units. A total of five (5) birds species (table 4) were established in the both units (see figure 15 a & c). Following the IUCN Red List of Threatened Species, NEMBA (Act 4 of 2004) and City of Tshwane C-Plan, these birds' species are highly diverse in the country, South Africa, and are regarded as of Least Concern species.

**Table 4. List of avifaunal species recorded in the wetland and terrestrial units**

Family	Species	Conservation status <sup>R, N</sup>	IUCN Red Listed Species	CARA Listed
Charadriidae	<i>Vanellus coronatus</i>	LC	LC	No
Motacillidae	<i>Anthus cinnamomeus</i>	LC	LC	No
Numididae	<i>Helmeted guineafowl</i>	LC	LC	No
Ploceidae	<i>Ploceus velatus</i>	LC	LC	No
Threskiornithidae	<i>Threskiornis aethiopicus</i>	LC	LC	No

N= national protected; R= regionally protected; CARA=conservation of agricultural resource act; 0=no; 1=yes; E=endemic/indigenous; the IUCN Red List of Threatened Species [Least Concern (LC), Vulnerable (VU), Near Threatened (NT), Critically Endangered (CR), Critical (C), Endangered (E); Rare (R)].



**Figure 14. Wetland unit with Near Threatened Otters species**

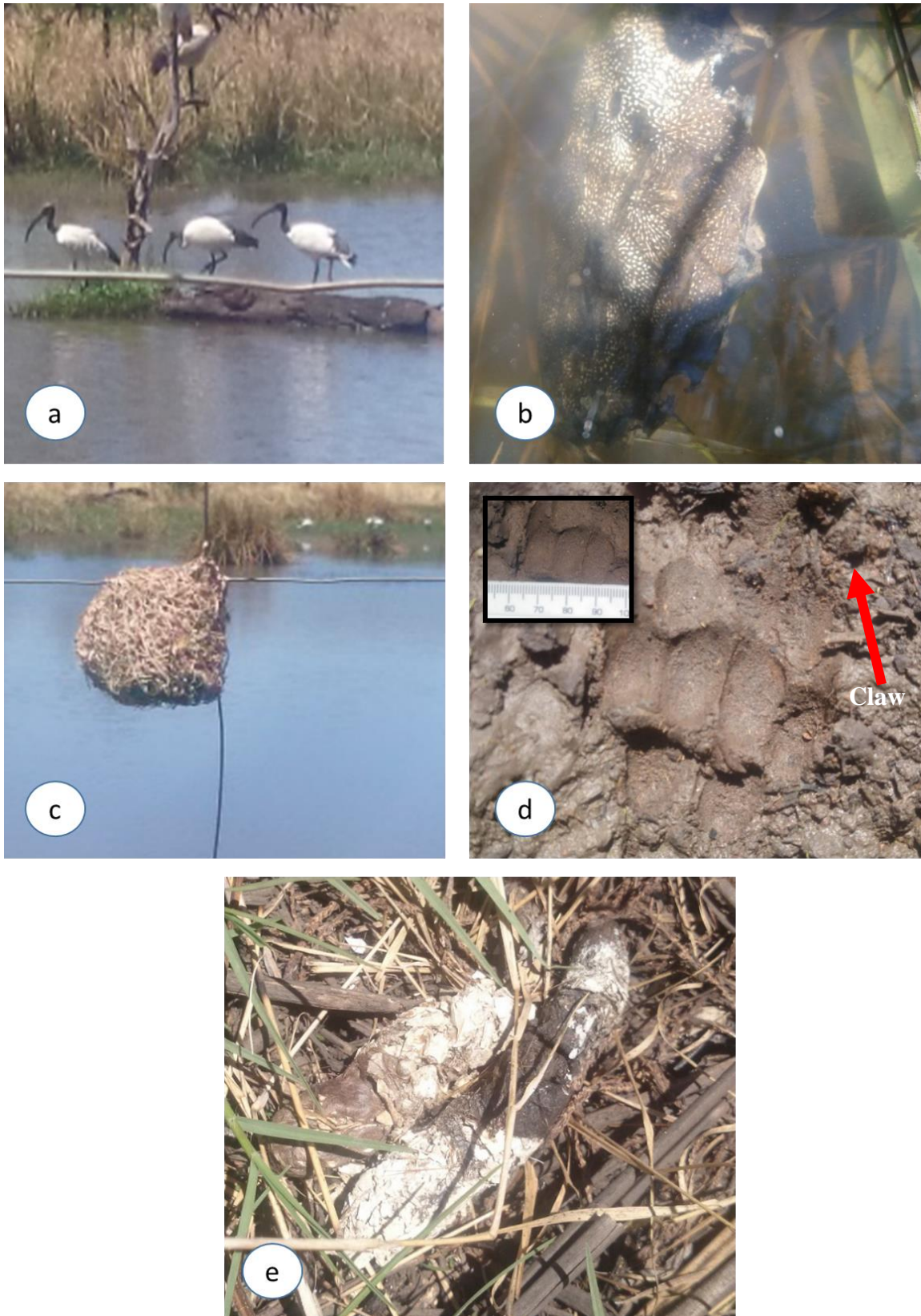


Figure 15. Faunal species recorded on the wetland within the site. a= *Threskiornis aethiopicus*, b= *Ictaluridae* sp. prey species of *L. maculicollis*, c= *Ploceus velatus* nest, d= *Lutra maculicollis* spoor (35mm wide), e= *L. maculicollis* faeces

***(c) Invertebrates, arachnids and scorpion, amphibian and reptile species***

***(i) Invertebrates***

Although this group of fauna species is highly neglected, it is the driver of all natural systems on land. Based on species diversity assessments done, the City of Tshwane C-Plan (2016) has listed a Vulnerable (VU) invertebrate species, *Ichnestoma stobbiai* (Coleoptera: Cetoniidae) which is a ground and low lying fruit feeding beetle. However, ground traps and sweep netting assessment measure conducted in this study, have shown no existence indicators of *I. stobbiai* species. This could be due to the limited occurrence of plants species that produce potential fruits for feeding.

In addition, a total nine (9) invertebrate's species (table 5) was sampled and recorded in the terrestrial and wetland units (see figure 16). Therefore, according to the IUCN Red List of Threatened Species, NEMBA (Act 4 of 2004) and City of Tshwane C-Plan, these invertebrates' species are highly diverse in the country and elsewhere, and were regarded as of Least Concern species for conservation purposes.

***(ii) Arachnids, scorpion and reptile species***

These groups of faunal species are highly secretive and shy. They restrict their feeding and movement activities during the day, to decrease chances of being vulnerable to predation. However, there was no suitable habitats on terrestrial unit to be of a potential niche. This has led to no species detected and recorded. Although none of these species were not observed in the wetland unit, some could still be occurring.

***(iii) Amphibian species***

The suitable and potential wetland unit was observed and recorded. Unfortunately, there was no amphibian species observed within this unit. Although some could be existing.





Figure 16. Invertebrate's species recorded in the terrestrial and wetland units.



**Table 5. List of invertebrate's and herpetofauna species recorded in the terrestrial and wetland units**

<b>Order</b>	<b>Family</b>	<b>Species</b>	<b>Conservation status<sup>R</sup></b>	<b>IUCN Red Data Listed</b>
Odonata	Aeshnidae	<i>Anax imperator</i>	LC	LC
Odonata	Libellulidae	<i>Trithemis arteriosa</i>	LC	LC
Orthoptera	Acrididae	<i>Zenocerus elegans</i>	LC	LC
Orthoptera	Acrididae	<i>Acanthacris ruficonis</i>	LC	LC
Orthoptera	Acrididae	<i>Oedaleus sp.</i>	LC	LC
Hemiptera	Lygaeidae	<i>Spilostethus pandurus</i>	LC	LC
Hemiptera	Pentatomidae	<i>Nezara viridala</i>	LC	LC
Coleoptera	Coccinellidae	<i>Cheilomenes lunata</i>	LC	LC
Lepidoptera	Pterophoridae	<i>Trichoptilis wahlbergi</i>	LC	LC

N= national protected; R= regionally protected; The IUCN Red List of Threatened Species [E=endemic/indigenous; the IUCN Red List of Threatened Species [Least Concern (LC), Vulnerable (VU), Near Threatened (NT), Critically Endangered (CR), Critical (C), Endangered (E); Rare (R)].

## **4. PRE-IMPACT ASSESSMENT**

### ***4.1 Flora***

#### ***(a) Flora diversity***

The floral diversity was low within the subject site areas. Most areas were covered by grass species, which were not categorized and identified to species level as they were recovering from fire disturbance. The impact likely to be posed on the flora diversity would be of no significance, with or without implementation of mitigation measures.

#### ***(b) Flora habitat diversity***

##### ***Terrestrial unit***

The terrestrial habitat unit has shown occurrence of flora species that are of no SCC and are highly diverse in the country. This implies that, with or without mitigation measures, destruction or modification of this habitat type in the site, will result in no significant impact. However, portions of this habitat type that are not forming part of the development, should be kept as natural as they are.

##### ***Wetland unit***

Wetland verification and its status assessment was not part of this study, however it is highly recommended that it should be done prior any development of the project activities. There was not plant species of SCC associated with this habitat unit. No impact could results on flora species associated with the habitat unit, as the species occurring there are highly diverse in the country and elsewhere.

#### ***(c) Flora of special conservation concern***

The was no flora of SCC associated with the both terrestrial and wetland units. However, few species are listed by CARA, and this implies that such species could be removed through mechanical or chemical measures. However, mechanical removal of these species is highly recommended to be followed, as the site is small, with less diversity of alien invasive species. Pictures of the alien invasive species are provided in this report to serve as a field guide. It is also further recommended that, these species should be cleared before commencement of the project activities in the both wetland and terrestrial habitats units.

## 4.2 Fauna

### (a) Faunal diversity

The site was surrounded by the railway lines and a farm, which hosted various game animals. The abundance and diversity of the faunal species was high in the both wetland and terrestrial unit. However, the terrestrial unit was highly utilised for feed, while the wetland unit was used for feeding and breeding. Fauna diversity in the both units included threatened species that are ranked as Near Threatened to extinction. This further suggest that, necessary authorizations or permits are required prior commencement of the project activities.

### (b) Faunal habitat diversity

#### Terrestrial

This unit has shown occurrence of mammal faeces that are highly likely to be associated with *Parahyaena brunnea* and *Crocuta crocuta*, which are both ranked as Near Threatened, based on ICUN Red Listed and City of Tshwane C-plan. Furthermore, the faeces appeared to be less likely of *Leptailurus serval* and *Caracal caracal*, which are of Least Concern. Based on these findings, a relevant permit to develop environmental activities on habitat that is supporting NT species is required. Although mammals are mobile, loss of their feeding habitat could also have some behavioural impacts on their populations.

#### Wetland

This habitat unit has shown occurrence of the faeces and spoor that are less and highly likely to be of the *Lutra maculicollis* and *Aonyx capensis*, respectively, which are both assigned to Near Threatened status in the both City of Tshwane C-Plan and IUCN Red Listed Species. This implies that, the wetland unit cannot be disturbed or modified as it is supporting Near Threatened mammal species to extinction. The *L. maculicollis* and *A. capensis* are the only two otter's species in South Africa with limited distribution. Therefore, based on this circumstance, the wetland unit becomes a 'no go area' as there is no mitigation that could inhibit destruction of this niche to the NT species.

#### **Justification: for *Aonyx capensis*** (adapted from IUCN Red Listed Species)

Although this species has a large distribution they are restricted to areas of permanent fresh water, offering good shoreline cover and an abundant prey base. Thus while the distribution range is large the spatial size of their occupied habitats is much smaller and unknown, particularly due to the widespread habitat destruction and pollution problems reported for much of the African continent. The increasing human/otter conflict for increasingly scarce resources

such as water, land, and fish is contributing high impact on otters populations in Africa. Both this decrease in suitable habitat and increase in human/otter conflict are currently occurring and will certainly increase over the next three generations (13 years).

This reassessment is based on a perceived (in regions where studies have been conducted) (Ray *et al.* 2005, Somers and Nel 2013) and assumed (in regions where no studies have been done) population decline over the last 18 years and beyond. In much of their range, populations of African Clawless Otters are faced with habitat loss or degradation, polluted waters, and/or degraded water ecosystems due to the introduction of invasive alien species such as Water Hyacinth (*Eichhornia crassipes*) and marginal agricultural practices. This habitat disturbance is exacerbated by poor sanitation infrastructure and growing industrial waste pollution. Additionally regional human populations are poor and increasingly placing pressure on all resources including water, vegetation, the otter prey base, as well as reducing suitable resting and denning sites vital to survival of the species.

For all of these reasons and the lack of effective conservation measures currently in place, the African Clawless Otter population is projected to decline by at least 20% in the next three generations (13 years based on Pacifici *et al.* 2013). The species is therefore uplisted from Least Concern to Near Threatened as it almost qualifies as threatened under criterion A2cde+3cde.

**Justification: for *Lutra maculicollis* (adapted from IUCN Red Listed Species)**

Although this species has a large distribution they are restricted to areas of permanent fresh water, offering good shoreline cover and an abundant prey base. Thus while the distribution range is large, the spatial size of their occupied habitats is much smaller and unknown, particularly due to the widespread habitat destruction and pollution problems reported for much of the African continent. The impact of global climate change throughout Africa (Magadza 1994, Dixon *et al.* 2003, Hendrix and Glaser 2007) also has the potential of decreasing suitable habitat for otters and increasing human/otter conflict for increasingly scarce resources such as water, land, and fish. Both this decrease in suitable habitat and increase in human/otter conflict are currently occurring and will certainly increase over the next three generations.

This reassessment is based on a perceived (in regions where studies have been conducted) (Akpona *et al.* 2011, Reed-Smith in prep.) and assumed (in regions where no studies have been done) population decline over the last 16 years and beyond. In much of their range, populations

of Spotted-necked Otters are faced with habitat loss or degradation, polluted waters, and/or degraded water ecosystems due to the introduction of exotic species such as Water Hyacinth (*Eichhornia crassipes*) and Nile Perch (*Lates niloticus*) and marginal agricultural practices. This habitat disturbance is exacerbated by poor sanitation infrastructure and growing industrial waste pollution. Additionally, regional human populations are poor and increasingly placing pressure on all resources including water, vegetation, the otter prey base, as well as reducing suitable resting and denning sites vital to survival of the species.

For all of the above reasons and the lack of effective conservations measures currently, a continued decline in the overall Spotted-necked Otter population of at least 20% is projected for the next three generations (23 years; Pacifici *et al.* 2013). Therefore the species is listed as Near Threatened as it almost qualifies as threatened under criterion A3cde; this is a precautionary listing.

***(c) Fauna of special conservation concern***

According to the faunal diversity and assemblage's data collected, there was four (4) Red Data Listed (RDL) species identified within wetland and terrestrial units in the site. However, more RDL species could still be existing, and might have been missed out, because the site experienced extensive fire disturbances prior. Therefore, the likelihood of the proposed development resulting in loss of these species is considered to be of **Medium Significance** for terrestrial unit, and High significant for wetland unit, as it is localised.

This implies that, there is no mitigation measure that could be provided for Red Listed mammal species associated with the wetland. However, impacts that are likely to be posed on the Red Listed, terrestrial mammal species could be of **Low Significance**, if the mitigation measures suggested in this report are adhered to.

### 4.3 Pre-impact analysis systems

**Table 1. Impact assessment aspects and scaling**

Nature of impact	Aspects of impact	Impact rating	Description of impact
Extant (E)	Site	1	Effect confined to the development area
	Local	2	Effect limited to within 3-5 km of the development area
	Regional	3	Effect extends beyond the borders of the development area to influence the area as whole
Duration (D)	Short	1	Effect lasts for a period of up to 5 years
	Medium	2	Effect continues for a period of between 5 and 10 years
	Long	3	Effect continues for a period in excess of 10 years
	Permanent	4	Effect lasts permanently
Intensity (I)	Low	½ /0.5	Will have no or little effect on the flora and fauna
	Medium	1	Will have some effect but parts of the vegetation will remain intact
	High	2	Will destroy the vegetation or habitat for fauna completely
Probability (P)	Low	1	Less than 33% chance of occurrence
	Medium	2	Between 33% and 66% chance of occurrence
	High	3	Greater than 66% chance of occurrence
Status (S)	Positive	2	Impact will be beneficial to the environment
	Negative	1	Impact will not be beneficial to the environment
	Neutral	0	No positive or negative impact

**Key: 0=No effect/impact**

#### Defining the significant of the impact

It is crucial to identify the significance level of the impact that is likely to be inflicted by the activities on the natural environment.

#### Significance of impact rating

Impact occurrence scale		
	Impact rating	Impact description
	0-3	Significantly low
	4-7	Significantly moderate
	8-12	Significantly high

Significance of the impact= I+ D+ E+ P



**Table 2. Summary of the anticipated impacts likely to be posed on flora by the project activities**

<b>PRE-IMPACT ASSESSMENT OF FLORA HABITAT DIVERSITY</b>								
Activity	Nature impact (project activities)	Extent	Duration	Intensity	Significance	Status	Probability	Mitigation and management measure
<b>Construction phase</b>	-Excavation -Destruction of faunal habitat units	1, Site specific	1	0.5	<b>3.5, Significantly Low (SL)</b>	1	1	Two flora habitat units were established and plants species recorded on them highly diverse in the country and elsewhere. No impact was anticipated. Alien invasive plants should be cleared as suggested prior commencement of the project activities., particularly construction phase which involves removal of top soil.
<b>Development phase</b>	-Transformation of habitat units, introduction of railway line structures	1	1	0.5	<b>3.5, SL</b>	1	1	Development phase would pose low significant impact on habitat diversity. Therefore, with or without mitigation, the impact would be low.
<b>Completion phase: permanent structure established</b>	-No impact associated	1	1	0.5	<b>3.5, SL</b>	1	1	Permanent structure (railway line) to be established would pose no impact. Nevertheless, alien invasive species could emerge in large number and should therefore be controlled as suggested.
<b>PRE-IMPACT ASSESSMENT OF FLORA DIVERSITY</b>								
Activity	Nature of impact (project activities)	Extent	Duration	Intensity	Significance	Status	Probability	Mitigation and management measure
<b>Construction phase</b>	-Removal of faunal species diversity -Excavation	1, Site specific	1	0.5	<b>3.5, Significantly Low (SL)</b>	1	1	Low flora diversity was recorded in the two habitats units established. Species recorded were determined to be highly diverse in the country, and no impact is likely to be posed on them. With or without a mitigation measure, no impact is likely to be posed on flora diversity.
<b>Development phase</b>	-Habitat transformation , introduction of railway line structures	1	1	0.5	<b>3.5, SL</b>	1	1	Low flora diversity was recorded in the two habitats units established. Species recorded were determined to be highly diverse in the country, and no impact is likely to be posed on them.

<b>Completion phase: permanent structure established</b>	-No impact associated	1	1	0.5	<b>3.5, SL</b>	1	1	Permanent structure (railway line) to be established would pose no impact. Nevertheless, alien invasive species could emerge in large number and should therefore be controlled as suggested
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**PRE-IMPACT ASSESSMENT OF FLORA OF CONSERVATION CONCERN**

Activity	Nature of impact	Extent	Duration	Intensity	Significance	Status	Probability	Mitigation and management measure
<b>Construction phase, removal of topsoil and vegetation</b>	-Removal of habitat units	1	1	0.5	<b>3.5, Significantly Low</b>	1	1	The was no protected or listed flora species detected in the wetland and terrestrial units. Therefore, with or without a mitigation measure, no impact would results on vegetation types on the both units.
<b>Development phase: establishment of railway line structures</b>	-Habitat transformation	1	1	0.5	<b>3.5, SL</b>	1	1	No impact will result, as the is no SCC species in the habitat units. With or without mitigation measures, the impact from permanently established railway line structures, would have no impact on the SCC species.
<b>Completion phase: permanent structure established (railway line)</b>	-No impact associated	1	1	0.5	<b>3.5, SL</b>	1	1	No impact will result, as the is no SCC species in the habitat units. With or without mitigation measures, the impact from permanently established railway line structures, would have no impact on the SCC species.

- \* **Construction phase= Involves removal of top, top and under vegetation layer**
- \* **Development phase=Involves establishment of man-made structures on intensively disturbed natural environment**
- \* **Completion phase= Involves permanent changes, from natural to modified or unnatural state on environment.**

**Table 3. Summary of the anticipated impacts likely to be posed on fauna by the project activities**

<b>PRE-IMPACT ASSESSMENT OF FAUNAL HABITAT OF CONSERVATION CONCERN</b>								
Activity	Nature impact	Extent	Duration	Intensity	Significance	Status	Probability	Mitigation and management measure
<b>Construction phase</b>	-Excavation -Destruction of faunal habitat units	1, Site specific	4	2	<b>10, Significantly High (SH)</b>	1	3	Faunal habitat units were low. However, both wetland and terrestrial supported Near Threatened fauna species. <b>High significant impact</b> is linked to wetland unit as it is localised, and <b>Low significant impact</b> for terrestrial unit as it is broad and diverse. Development activities on wetland unit are not recommended, alternative way should be established. With or without a mitigation measure, any development activity on wetland will largely impact NT species, therefore it has been established to be of no go area.
<b>Development phase</b>	-Transformation of habitat units	1	4	2	<b>10, SH</b>	1	3	Development phase (establishment of railway line structures) would pose High significant impact on wetland unit, as it is a localized habitat unit for SCC fauna.
<b>Completion phase: permanent structure established</b>	-No impact associated	1	4	2	<b>10, SH</b>	1	3	Permanent structure (established railway line structures) would cause a significant threat to the red listed mammal's species on wetland. However, on terrestrial, redlisted mammals will switch to other nearby areas for feeding and breeding. Such animals should not be killed if they appear during the course of project development. Therefore, wetland area is of a no go area.
<b>PRE-IMPACT ASSESSMENT OF FAUNAL DIVERSITY OF CONSERVATION CONCERN</b>								
Activity	Nature of impact	Extent	Duration	Intensity	Significance	Status	Probability	Mitigation and management measure
<b>Construction phase</b>	-Removal of faunal species diversity	1, Site specific	4	2	<b>10, SH</b>	1	3	Low fauna diversity was recorded in the two habitats units. However, sensitive fauna species were established in both units. High impact will result on wetland than terrestrial fauna species. No mitigation measure for NT species in the wetland unit However, on terrestrial unit, if highlighted species

								are found on the unit during all the phases of the development, they should not be killed or provoked. In case of encountering immobile life stages of these species, the relevant conservationists of Gauteng should be contacted for safely relocation.
<b>Development phase</b>	-Habitat transformation	1	4	2	<b>10, SH</b>	1	3	No mitigation measure for NT species in the wetland unit, it was concluded to be a no go area.
<b>Completion phase: permanent structure established</b>	-No impact associated	1	4	2	<b>10, SH</b>	1	3	Permanent structure (established railway lines) would pose serious threats to the wetland unit fauna species as it is localised. No development should be done on the wetland unit. Terrestrial fauna species are likely not be impacted as they are able to switch to another patches for feeding and breeding.

**PRE-IMPACT ASSESSMENT OF FAUNAL OF CONSERVATION CONCERN**

Activity	Nature of impact	Extent	Duration	Intensity	Significance	Status	Probability	Mitigation and management measure
<b>Construction phase</b>	-Removal of habitat units	1	4	2	<b>10, SH</b>	1	3	The are two listed fauna species detected in the wetland unit. No mitigation for any form of development on this unit. One red listed species was recorded on terrestrial unit, and such species would possibly switch to another patches for survival, it is therefore unlikely to be impacted. However, on terrestrial unit, if highlighted species are found on the unit during all the phases of the development, they should not be killed or provoked. In case of encountering immobile life stages of these species, the relevant conservationists of Gauteng should be contacted for safely relocation.
<b>Development phase</b>	-Habitat transformation	1	4	2	<b>10, SH</b>	1	3	The are two listed fauna species detected in the wetland unit. No mitigation for any form of development on this unit. One red listed species was recorded on terrestrial unit, and such species would possibly switch to another patches for survival, it is therefore unlikely to be impacted. However, a permit to destruct its territory is required.
<b>Completion phase: permanent structure established</b>	-No impact associated	1	4	2	<b>10, SH</b>	1	3	The are two listed fauna species detected in the wetland unit. No mitigation for any form of development on this unit. One red listed species was recorded on terrestrial unit, and such species would possibly switch to

								another patches for survival, it is therefore unlikely to be impacted. However, a permit to destruct its territory is required.
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- \* **Construction phase= Involves removal of top, top and under vegetation layer**
- \* **Development phase=Involves establishment of man-made structures on intensively disturbed natural environment**
- \* **Completion phase= Involves permanent changes, from natural to modified or unnatural state on environment.**

## 5. GENERAL DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

This section discusses the mitigation and management measures, as well as suitable recommendations suggested in the previous sections.

### 5.1 General discussion and recommendations

The development should not overlap with the areas that are not proposed for, as they have not been ecologically assessed during this study.

**(a) Floral species:** based on the ecological study conducted on the site, there was no Red Data Listed species. Despite the absence of RDL, seven (7) alien invasive species namely, *Tipuana tipu*, *Argemone mexicana*, *Solanum elaeagnifolium*, *Solanum sisymbriifolium* and other 3 three unidentified *Solanum* species were associated with the both wetland and terrestrial units, and they are listed by CARA. There is no impact that is likely to be posed on any of these species. However, as stated by CARA, these plants species should be removed through manual, chemical and biocontrol measures. Any form of habitat clearing that could be done prior removal of these plants species, could results in higher infestations within the site and neighbouring areas, and removal of the resulting infestations could be highly expensive. Therefore, as stated in the previous sections, there is no translocation or removal permit required for the flora associated with the both units.

**(b) Faunal species:** based on the ecological study conducted on the occurrence and movement of faunal specie on the site, there were highly likely five (5) mammal Red Data Listed species. The two and three of these species are associated with the wetland and terrestrial units, respectively. However, some of the fauna species types could still be existing and missed out during field assessment.

The wetland unit appeared as a potential breeding habitat for most of the fauna types, but only one Near Threatened otter species, *Aonyx capensis* was highly liked to the spoors and faeces detected on this unit, than other otter species, *Lutra maculicollis*, which is also an NT species. The terrestrial unit detected to have faeces that was highly likely to be of the *Leptailurus serval*, *Caracal caracal* and *Parahyaena brunnea* species. The pre-impact assessment has suggest that, the wetland unit should be ranked as a ‘no go area’, since the otter species have limited distribution as wetlands are also diminishing from our country. Thus, conservation of these species is highly recommended, than clearing or disturbing their wetland environment. It



should be noted that, The NT otter species are currently feeding and breeding successfully in the wetland unit. This suggest that, the system is ecologically functioning accordingly. Any form of disturbance on this unit, could lead to the deviation of this system.

The no go area, simply mean that no form of development or effects from other sites should reach the unit area. Following this suggestion or recommendation as stated, will absolutely contribute to the conservation of these NT otters species.

(c) **Habitat units:** The ecological study have shown the occurrence of two types of habitat units, namely wetland and terrestrial units within the site. Pertaining to the biodiversity profile compiled by the City of Tshwane C-Plan, the subject site area falls in the grassland biome, despite the occurrence of some trees and shrubs that were scattered throughout the area. Moreover, the site does not fall in to any of the threatened ecosystem (Figure 5), however does form part of the Critical Biodiversity Area 1 and other natural areas assessed (City of Tshwane C-Plan 2014) (figure 7). This implies that, the site is associated with the areas of conservation concern. Although, the terrestrial unit has no flora of special concern, development should be strictly be conducted on the proposed areas only, leaving adjacent areas as natural as they are.

The absence of flora of conservation concern on the site, declares that this site does not necessarily have characters to be listed under Critical Biodiversity Area 1. The site is also too narrow and highly exposed to the edge effects of other railway lines and gravel road. Furthermore, fauna of conservation concern could be visiting the site occasionally for feeding. Based on these findings or observation, it is not necessary to request a permit to develop expansion of the railway lines in this terrestrial unit.

**Table 4: Summary of Species of Special Concern detected in the site and actions that should be done prior development**

Family	Species name	Conservation status	Recommendations (Management measure)
<b>Flora</b>			
Papaveraceae	<i>Argemone mexicana</i>	Removal declared-CARA	Manual/chemical control
Solanaceae	<i>Solanum elaeagnifolium</i>	Removal declared-CARA	Manual/chemical control
Solanaceae	<i>Solanum sisymbriifolium</i>	Removal declared-CARA	Manual/chemical control
Fabaceae	<i>Tipuana tipu</i>	Removal declared-CARA	Manual removal
Solanaceae	<i>Solanum</i> sp (x3)	Removal declared-CARA	Manual/chemical control
<b>Fauna</b>			
Felidae	<i>Leptailurus serval</i>	Protected-IUCN	Translocation permit is required if sp. found
Felidae	<i>Caracal caracal</i>	Protected-IUCN	Translocation permit is required if sp. found
Hyaenidae	<i>Parahyaena brunnea</i>	Protected-IUCN	Translocation permit is required if sp. found
Mustelidae	<i>Aonyx capensis</i>	Protected-IUCN	Translocation permit is required if sp. found
Mustelidae	<i>Lutra maculicollis</i>	Protected-IUCN	Translocation permit is required if sp. found

\* **CARA listed species=no permit is required to remove such species. However, CARA prohibit all the activities that further spread such weeds. Only herbicides that are registered with DAFF or any authorized entity should be applied on the weeds, and by any person in possession of relevant certificates/training.**

\* **IUCN-Red Data Listed Species=As for fauna permits, this would be required if immobile life stages of red listed species are encountered during the project activities. Otherwise, matured fauna species will migrate and abandon the site during early stages of project activities.**

\* **Sp.= species**

## 5.2 Conclusions

This study was mainly conducted to document sensitive or Red Data Listed species and to ensure sustainable development of the proposed activity, to assess particularly if the area is not listed on “no go area”. From Ecological perspective, the wetland unit is regarded as of “**no go area**”, due to the Red Listed mammal species that are utilizing this unit for feeding and breeding. However, if the proponent implement the mitigation and management measures set out in this report, **no significant impact** will results from developmental activities on the terrestrial unit. Based on the information available to date, with the brief Ecological study conducted on site, it is Agri Flora Consultants (Pty) Ltd’s opinion that, there are no fatal flaws associated with project activities to be conducted on terrestrial unit. In addition, if the mitigations set out in this report are adhered to, and the proponent shows commitment to the sustainable development, with constructive monitoring and controlling strategies of the alien invasive species establishment during and after the project activities, Agri Flora Consultants have no objections to the project going forward.

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## APPENDICES

### Appendix 1. Selected list of national red listed plants species likely to occur in the Gauteng Province

Family	Species	Common name	Conservation status, S. A. NEM: BA
Asclepiadaceae	<i>Brachystelma canum</i>	-	CR
Asclepiadaceae	<i>Brachystelma gracillimum</i>	-	CR
Compositae	<i>Senecio holubii</i>	-	DDT
Apocynaceae	<i>Ceropegia insignis</i>	-	EN
Euphorbiaceae	<i>Euphorbia knobelii</i>	-	EN
Euphorbiaceae	<i>Euphorbia perangusta</i>	-	EN
Anacampserotaceae	<i>Anacampseros dicapitata</i>	-	VU
Aloaceae	<i>Aloe peglerae</i>	Magaliesberg aloe	VU
Asclepiadaceae	<i>Brachystelma dimorphum</i>	-	VU
Asclepiadaceae	<i>Brachystelma incanum</i>	-	VU
Acanthaceae	<i>Barleria media</i>	-	VU
Apocynaceae	<i>Ceropegia stentiae</i>	-	VU
Fabaceae	<i>Indigofera commixta</i>	-	VU
Lobeliaceae	<i>Lobelia cuneifolia var. ananda</i>	-	VU
Rosaceae	<i>Prunus africana</i>	Stink wood	VU
Anacardiaceae	<i>Searsia maricoana</i>	-	VU

**Red status levels assessment: EX= extinct; EW= extinct in the wild; RE= regional extinct; CR PE= critically endangered, possibly extinct; CR= critically endangered; EN= endangered; VU= vulnerable; NT= near threatened; CR= critically rare; R= rare; D= declining; DDD= data deficient; DDT= data deficient; LC= least concern. ?= unknown.**



## Appendix 2. Selected list of national red listed mammals species likely to occur in the Gauteng Province

Family	Species	Common name	Conservation status, S. A. NEM: BA
Rhinocerotidae	<i>Diceros bicornis minor</i>	Black rhinoceros	CR
Hipposideridae	<i>Clootis percivali</i>	short-eared trident bat	CR
Canidae	<i>Lycaon pictus</i>	African wild dog	EN
Bovidae	<i>Ourebia ourebi</i>	Oribi	EN
Bovidae	<i>Damaliscus lunatus</i>	Tsessebe	EN
Nesomyidae	<i>Mystromys albicaudatus</i>	White-tailed mouse	EN
Felidae	<i>Acinonyx jubatus</i>	Cheetah	VU
Manidae	<i>Smutsia temminckii</i>	Ground pangolin	VU
Bovidae	<i>Hippotragus equinus</i>	Roan antelope	VU
Bovidae	<i>Hippotragus niger</i>	Sable	VU
Muridae	<i>Dasymys incomptus</i>	African marsh rat	NT
Hyaenidae	<i>Hyaena brunnea</i>	Brown hyaena	NT
Rhinolophidae	<i>Rhinolophus darlingi</i>	Darling's horseshoe bat	NT
Rhinolophidae	<i>Rhinolophus denti</i>	Dent's horseshoe bat	NT
Rhinolophidae	<i>Rhinolophus clivosus</i>	Geoffroy's horseshoe bat	NT
Mustelidae	<i>Mellivora capensis</i>	Honey badger	NT
Vespertilionidae	<i>Pipistrellus rusticus</i>	Rusty pipistrelle	NT
Miniopteridae	<i>Miniopterus schreibersii</i>	Schreibers' long-fingered bat	NT
Felidae	<i>Leptailurus serval</i>	Serval	NT
Erinaceidae	<i>Atelerix frontalis</i>	Southern African hedgehog	NT
Hyaenidae	<i>Crocuta crocuta</i>	Spotted hyaena	NT
Mustelidae	<i>Lutra maculicollis</i>	Spottednecked otter	NT
Pteropodidae	<i>Eidolon helvum</i>	Straw-coloured fruit bat	NT
Vespertilionidae	<i>Myotis tricolor</i>	Temminck's hairy bat	NT
Elephantidae	<i>Loxodonta africana</i>	African savanna elephant	NT
Felidae	<i>Felis nigripes</i>	Black-footed cat	NT
Felidae	<i>Felis nigripes</i>	Black-footed cat	NT
Felidae	<i>Panthera pardus</i>	Leopard	NT
Felidae	<i>Panthera leo</i>	Lion	NT
Rhinocerotidae	<i>Ceratotherium simum</i>	white rhinoceros	NT
Muridae	<i>Thallomys nigricauda</i>	Black-tailed tree rat	NT
Mustelidae	<i>Poecilogale albinucha</i>	African striped weasel	NT
Felidae	<i>Felis silvestris</i>	African wild cat	NT
Bovidae	<i>Redunca arundinum</i>	Southern reedbuck	NT
Bovidae	<i>Pelea capreolus</i>	grey rhebok	NT

**Red status levels assessment:** EX= extinct; EW= extinct in the wild; RE= regional extinct; CR PE= critically endangered, possibly extinct; CR= critically endangered; EN= endangered; VU= vulnerable; NT= near threatened; CR= critically rare; R= rare; D= declining; DDD= data deficient; DDT= data deficient; LC= least concern. ?= unknown.

### Appendix 3. Selected list of national red listed avifaunal (birds) likely to occur in the Gauteng Province

Family	Species	Common name	Conservation status
Ciconiidae	<i>Ephippiorhynchus senegalensis</i>	Saddle-billed stork	EN
Heliornithidae	<i>Podica senegalensis</i>	African finfoot	VU
Tytonidae	<i>Tyto capensis</i>	African grass-owl	VU
Accipitridae	<i>Circus ranivorus</i>	African marsh-harrier	VU
Accipitridae	<i>Terathopius ecaudatus</i>	bateleur	VU
Gruidae	<i>Anthropoides paradiseus</i>	blue crane	VU
Accipitridae	<i>Gyps coprotheres</i>	Cape vulture	VU
Otididae	<i>Ardeotis kori</i>	Kori bustard	VU
Otididae	<i>Neotis denhami</i>	Denhams bustard	VU
Accipitridae	<i>Aegyptius tracheliotos</i>	Lappetfaced vulture	VU
Falconidae	<i>Falco naumanni</i>	lesser kestrel	VU
Accipitridae	<i>Polemaetus bellicosus</i>	Martial eagle	VU
Pelecanidae	<i>Pelecanus rufescens</i>	pink-backed pelican	VU
Accipitridae	<i>Aquila rapax</i>	tawny eagle	VU
Ardeidae	<i>Gorsachius leuconotus</i>	white-backed night-heron	VU
Accipitridae	<i>Gyps africanus</i>	white-backed vulture	VU
Otididae	<i>Eupodotis cafra</i>	white-bellied korhaan	VU
Ciconiidae	<i>Anastomus lamelligerus</i>	African openbill	NT
Accipitridae	<i>Hieraaetus ayresii</i>	Ayre's hawk-eagle	NT
Accipitridae	<i>Circus maurus</i>	Black harrier	NT
Ciconiidae	<i>Ciconia nigra</i>	black stork	NT
Glareolidae	<i>Glareola nordmanni</i>	black-winged pratincole	NT
Sternidae	<i>Sterna caspia</i>	caspian tern	NT
Charadriidae	<i>Charadrius pallidus</i>	chestnut-banded plover	NT
Falconidae	<i>Falco biarmicus</i>	lanner falcon	NT
Phoenicopteridae	<i>Phoeniconaias minor</i>	Lesser flamingo	NT
Ciconiidae	<i>Leptoptilos crumeniferus</i>	Marabou stork	NT
Alaudidae	<i>Mirafra cheniana</i>	Melodious lark	NT
Accipitridae	<i>Circus macrourus</i>	pallid harrier	NT
Falconidae	<i>Falco peregrinus</i>	peregrine falcon	NT
Sagittariidae	<i>Sagittarius serpentarius</i>	Secretarybird	NT
Alaudidae	<i>Certhilauda chuana</i>	short-clawed lark	NT
Ciconiidae	<i>Mycteria ibis</i>	yellow-billed stork	NT
Pteroclididae	<i>Pterocles gutturalis</i>	yellow-throated sandgrouse	NT

**Red status levels assessment:** EX= extinct; EW= extinct in the wild; RE= regional extinct; CR PE= critically endangered, possibly extinct; CR= critically endangered; EN= endangered; VU= vulnerable; NT= near threatened; CR= critically rare; R= rare; D= declining; DDD= data deficient; DDT= data deficient; LC= least concern. ?= unknown.

**Appendix 4. Selected list of national red listed herpetofauna and invertebrate's species likely to occur in the Gauteng Province**

Family	Species	Common name	Conservation status
Crocodylidae	<i>Crocodilus niloticus</i>	Nile crocodile	VU
Cordylidae	<i>Chamaesaura aenea</i>	coppery grass lizard	NT
Pythonidae	<i>Python natalensis</i>	southern African python	NT
Pyxicephalidae	<i>Pyxicephalus adspersus</i>	giant bullfrog	NT
Corinnidae	<i>Austrachelas merwei</i>	Corrinid sac spiders	LC
Cyatholipidae	<i>Cyatholipus isolatus</i>	-	LC
Gnaphosidae	<i>Setaphis sexmaculata</i>	Ground spiders	LC
Idiopidae	<i>Galeosoma coronatum</i>	Armoured trapdoor spiders	LC
Idiopidae	<i>Galeosoma crinitum</i>	-	LC
Idiopidae	<i>Galeosoma scutatum</i>	-	LC
Idiopidae	<i>Idiops pullus</i>	-	LC
Salticidae	<i>Aelurillus cristatopalpus</i>	Jumping spiders	LC
Salticidae	<i>Afromarengo bimaculata</i>	-	LC
Salticidae	<i>Evarcha flagellaris</i>	-	LC
Salticidae	<i>Langona manicata</i>	-	LC
Salticidae	<i>Pseudicius gracilis</i>	-	LC
Salticidae	<i>Rhene konradi</i>	-	LC
Segestriidae	<i>Ariadna similis</i>	Tube-dwelling spiders	LC
Sparassidae	<i>Eusparassus borakalalo</i>	Huntsman spiders	LC
Tetragnathidae	<i>Diphya simony</i>	Long-jawed orb weavers	LC
Zodariidae	<i>Diores femoralis</i>	Zodariid ground spiders	LC

**Red status levels assessment: EX= extinct; EW= extinct in the wild; RE= regional extinct; CR PE= critically endangered, possibly extinct; CR= critically endangered; EN= endangered; VU= vulnerable; NT= near threatened; CR= critically rare; R= rare; D= declining; DDD= data deficient; DDT= data deficient; LC= least concern. ?= unknown.**