

TERRESTRIAL ECOLOGY ASSESSMENT FOR THE PROPOSED TAILINGS STORAGE FACILITY AT BAKUBUNG PLATINUM MINE

Final Report - February 2021



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Declaration of Independence by Specialist

I, Andrew Zinn, declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed Tailings Storage Facility at Bakubung Platinum Mine;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Do not have, nor will have, a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document.

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1. Introduction

Hawkhead Consulting (Hawkhead) was appointed by Knight Piésold (Pty) Ltd to conduct an updated terrestrial ecological assessment of the proposed footprint for the additional tailings storage facility (TSF), at Bakubung Platinum Mine, near Rustenburg in the North West Province, South Africa.

The terrestrial ecological assessment forms part of the larger Environmental Authorisation (EA) and Waste Management Licence (WML) amendment process, which is aimed at obtaining the necessary authorisations to develop the TSF. The proposed TSF project is part of a larger infrastructure development programme at the mine. This report provides a baseline ecological characterisation of the proposed TSF footprint and an assessment of ecological impacts associated with project activities.

1.1. Location and Delimits of the Study Area

Bakubung Platinum Mine is an operational mine located approximately 30 km north-west of Rustenburg, in the Bojanala Platinum District Municipality of the North West Province, South Africa. The mine consists of two sections, which are located on separate farms; Frischgewaagd 96 JQ and Mimosa 81 JQ. The site of the proposed additional TSF is on the Frischgewaagd section, which is located immediately south-east of the residential settlement of Ledig (Figure 1 and Figure 2).

The urban edge of Ledig and the R556 arterial road borders the Frischgewaagd section to the north and east, while the Elands River runs along the southern boundary of the section. Most of the surrounding land to the south and east of the Frischgewaagd section currently comprises open land, with varying levels of disturbance. A Concentrator Plant for the mine is planned for development on the land immediately east of the proposed TSF footprint (Figure 2).

Land to the north of the section is mostly modified, and consists of a mosaic of residential areas, small agricultural plots and open disturbed savanna.

The boundary of Pilanesberg Game Reserve lies approximately 2.6 km to the north of the mine, while the Sun City hotel development is located approximately 1.3 km to the north-east.

The proposed TSF footprint is approximately 32 ha in extent and located along the eastern boundary within the Frischgewaagd section (Figure 1). This terrestrial ecology assessment focused specifically on the proposed TSF footprint, which is hereafter referred to as the 'study area'.

1.2. Study Context and Terms of Reference

The outcome of sensitivity screening of the Frischgewaagd section indicates the property has a 'very high' sensitivity with respects to terrestrial biodiversity. This is predicated on two features rated as having 'very high' sensitivity: viz., Critical Biodiversity Area 2 and Focus areas for land-based protected areas expansion. The study area also has a 'medium sensitivity' with regard to plant species sensitivity, with *Cullen holubii* identified as a feature.

A Botanical Biodiversity Assessment and a Fauna Survey and Impact Assessment of the proposed footprints of the additional support infrastructure at Bakubung Platinum Mine were conducted by De Castro and Brits Ecological Consultants in 2016. The area of assessment for these studies included the farm Frischgewaagd 96 JQ, upon which the proposed additional TSF will be developed. Both studies comprised literature review and field survey components, the findings of which, are

presented in two reports that currently form the terrestrial ecology baseline for Bakubung Platinum Mine. Within the context of the existing ecological baseline dataset, which remains pertinent to the broader mine complex and the proposed TSF footprint, the terms of reference for this study included:

- Review and update of biodiversity information related to the study area and its immediate surrounds using existing literature and databases;
- A field visit of the proposed project footprint to confirm and update the findings of the existing flora and fauna baseline characterisations with respect to the study area; and
- An impact assessment for the proposed TSF project.

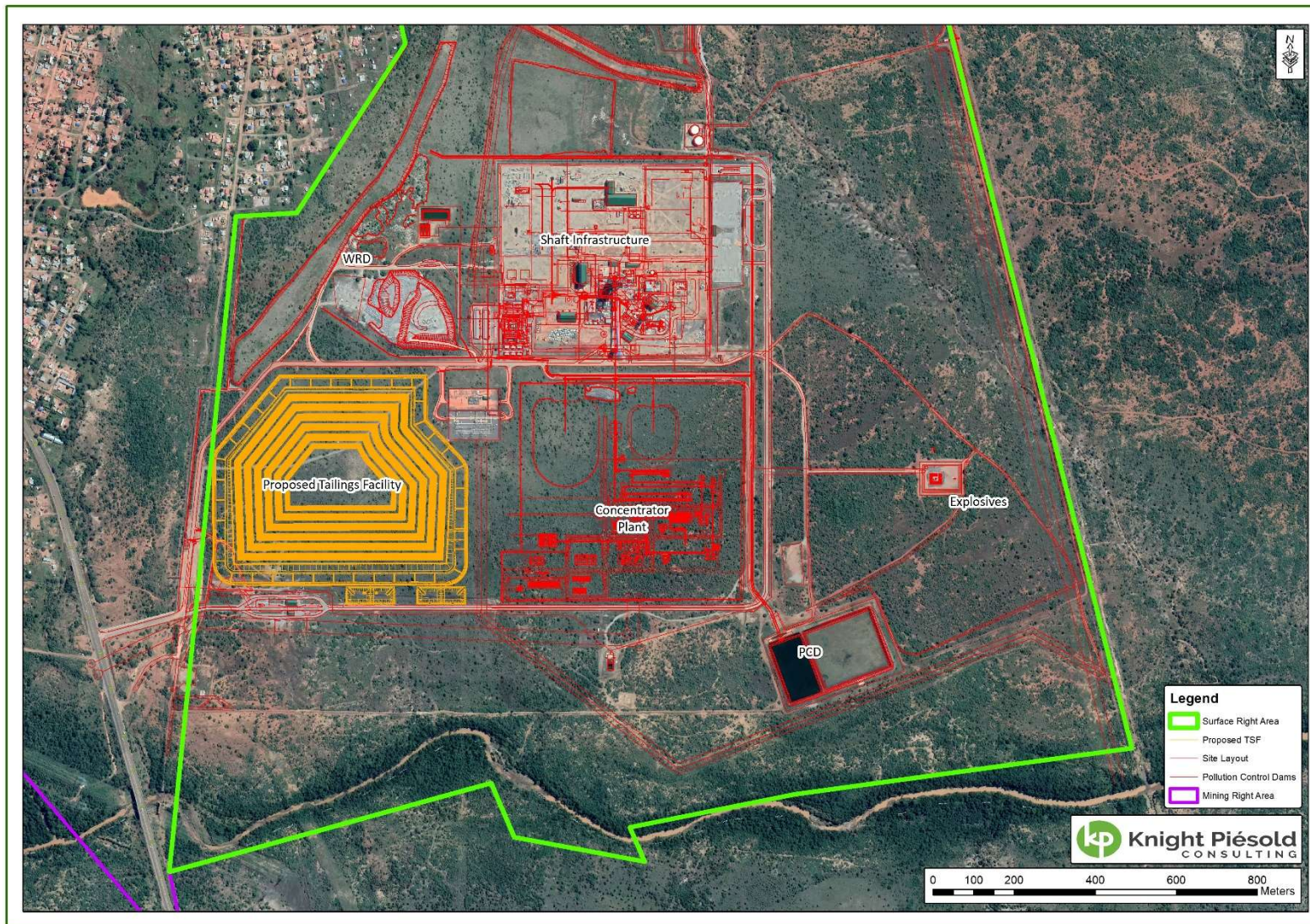


Figure 1: Frischgewaagd section of the Bakubung Platinum Mine, showing the layout of the proposed TSF in relation to other existing and planned mine infrastructure.

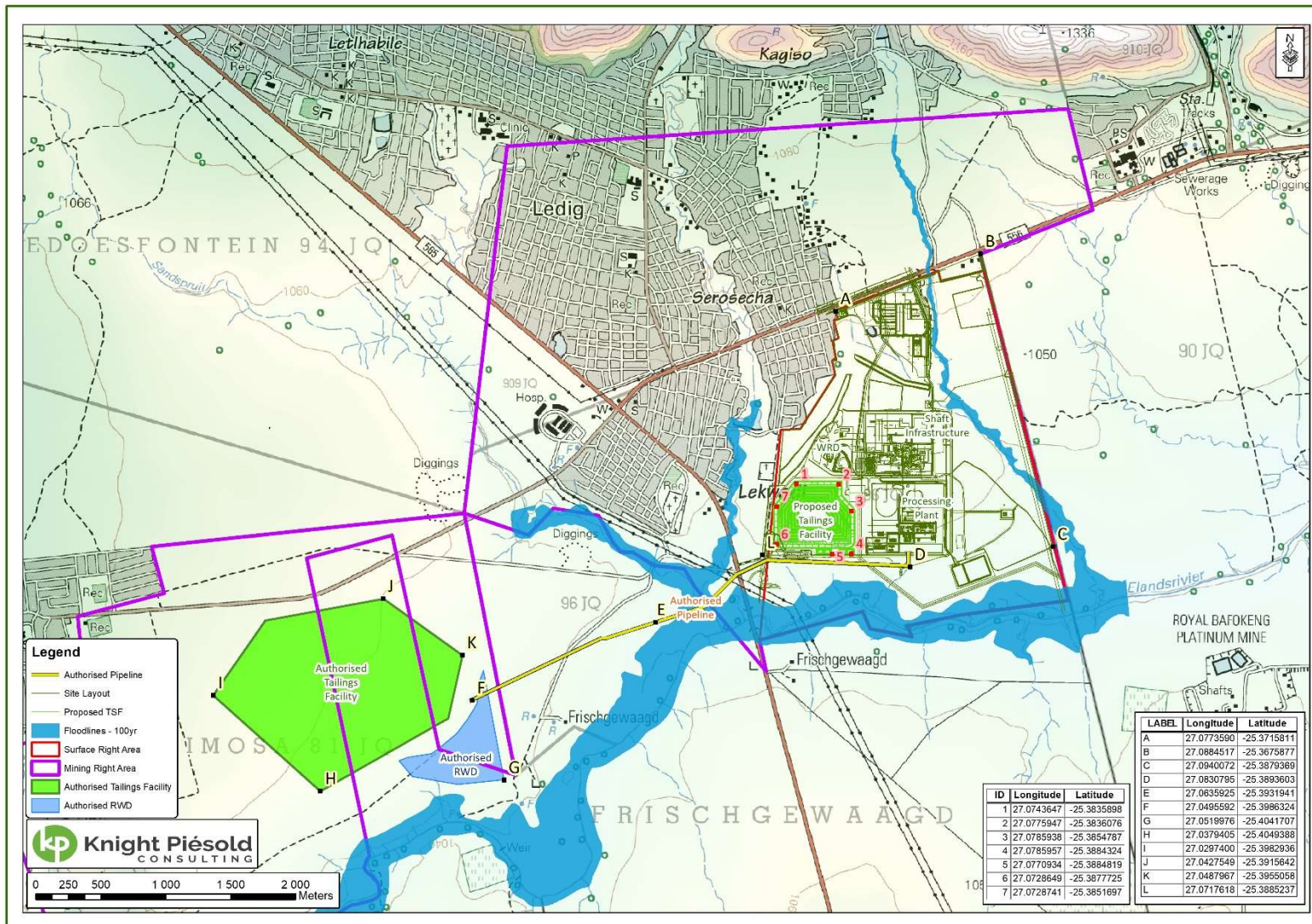


Figure 2: Regional location of Bakubung Platinum Mine and the study area. Existing and additional planned mine infrastructure are also shown.

2. Legislative Framework

The following national and provincial legislations were consulted during the study:

- National Environmental Management Act (NEMA) (Act No. 107 of 1998);
- National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004);
- Environment Conservation Act (ECA) (Act No. 73 of 1989);
- Conservation of Agricultural Resources Act (CARA) (Act No. 43 of 1983);
- National Forests Act (NFA) (Act No. 84 of 1998); and
- North West Biodiversity Management Act (Act no. 4 of 2016) (DRAFT).

3. Study Methodology

3.1. Literature Review

3.1.1. Vegetation Types and Flora Species

- A general habitat description relevant to the study area was obtained from Scholes and Walker (1993) and Mucina and Rutherford (2011);
- The formal conservation context of the region at a national and provincial level was established based on the National List of Threatened Ecosystems (NEMBA Threatened Ecosystems, 2011) and the North West Biodiversity Sector Plan (NW BSP, 2015); and
- De Castro & Brits (2016a) botanical assessment report describing the dominant vegetation communities and floristic diversity of Bakubung Platinum Mine was reviewed.

3.1.2. Fauna Characterisation

Mammals

- A list of expected mammal species was compiled by consulting Stuart and Stuart (2007) and MammalMAP (FitzPatrick Institute of African Ornithology, 2021). Considering the nearby location of Pilanesberg Game Reserve, mammals that are considered likely to be present only in protected areas were excluded from further consideration. These include many large ungulates and predators; and
- The De Castro and Brits (2016b) fauna survey and impact assessment report was also reviewed for a list of mammal species recorded and potentially occurring in the study area.

Birds

- A list of bird species expected for the study area was based on the South African Bird Atlas Project 2 (SABAP2) records for the pentads 2520_2705 and 2520_2700, which cover the study area;
- De Castro and Brits (2016b) was also reviewed for a list of bird species recorded and potentially occurring in the study area; and
- Marnewick et al., (2015) was consulted for a description of the Pilanesberg Important Bird Area (IBA).

Herpetofauna (Reptiles and Amphibians)

- Expected reptile and amphibian species lists were based on the distribution maps presented in Bates et al. (2014) for reptiles, and du Preez and Carruthers (2009) for amphibians;

- Additional data were also sourced from the ReptileMAP and FrogMAP (FitzPatrick Institute of African Ornithology, 2021); and
- De Castro and Brits (2016b) was also reviewed for a list of herpetofauna species recorded and potentially occurring in the study area.

3.2. Field Survey

The field survey comprised a one-day wet season field visit, conducted on the 5th February 2021. The aim of the survey was to collect supplementary data in the study area to verify and update the existing flora and fauna baseline descriptions developed by De Castro and Brits (2016a and b):

- Quadrats were used to assess vegetation in the study area. Quadrats were approximately 10 X 10 m in dimension and were located in representative vegetation communities;
- Vegetation communities were also traversed on foot and any unrecorded plant species were documented; and
- Passive surveys were used to sample fauna:
 - All opportunistic observations/encounters of mammals, birds and herpetofauna were documented; and
 - Mammal tracks, faeces, burrows and feedings signs were also identified and documented.

3.3. Assessment of Biodiversity Value

3.3.1. Vegetation Community Sensitivity Analysis

The assessment of the biodiversity value and sensitivity of vegetation communities is based on the analyses of De Castro and Brits (2016a and b), updated and supported with additional observations made in the field during the 2021 field visit.

3.3.2. Species of Conservation Concern

Species of conservation concern were based on the National Red Lists of threatened flora and fauna species, and the Protected status as per national and provincial legislation. These included:

- Red List of South African Plants Version (SANBI, 2020);
- Red List of Mammals of South Africa, Lesotho and Swaziland (EWT, 2016);
- Regional Red List for Birds of South Africa, Lesotho and Swaziland (BirdLife South Africa, 2015);
- Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates et al., 2014);
- IUCN Red List of Threatened Species for amphibians (IUCN, 2020-3);
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) - Threatened or Protected Species List (Notice 389 of 2013) (NEMBA ToPS List, 2007);
- National Forests Act (Act No. 84 of 1998) – List of Protected Tree Species (National Forests Act, 1998); and
- North West Biodiversity Management Act (Act No. 4 of 2016).

1.1.1. Habitat Suitability Assessments

Based on the lists of species of conservation concern potentially present, the ‘probability of occurrence’ of a species in the study area was determined by conducting habitat suitability assessments. The following parameters were used in the assessments:

- Habitat requirements: Most threatened and endemic species have very specific habitat requirements. The presence of these habitats in the study area was evaluated;
- Habitat status: The status or ecological condition of available habitat in the area was assessed. Often a high level of habitat degradation will negate the potential presence of sensitive species; and
- Habitat linkage: Dispersal and movement between natural areas for breeding and feeding are important population-level processes. Habitat connectivity within the study area and to surrounding natural habitat and corridors was evaluated to determine the likely persistence of species of concern in the study area.

Probability of occurrence is presented in categories, namely:

- High: the species is likely to occur on the site due to suitable habitat and resources being present on the site;
- Medium/moderate: The species may occur on the site, or move through the site (in the case of mobile species), due to potential habitat and/or resources;
- Low: the species will not likely occur on the site due to lack of suitable habitat and resources; and
- Any species of conservation concern observed/documentated in the study area is listed as 'recorded'.

1.1.1. Alien Invasive and Medicinal Flora Species

- Alien invasive plant species were categorised according to the National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004) - 2016 listing of declared alien invasive species; and
- Flora of medicinal value were based on purported uses presented in Van Wyk, et al., (2009).

4. Study Assumptions and Limitations

The following limitations are applicable to this study:

- The field work for this study comprised a one-day site visit conducted during the wet season to verify the existing flora and fauna characterisation developed by De Castro and Brits (2016a and b) and identify any significant changes that may have occurred.
- Sufficient wet-season rain had fallen prior to the field visit. This promoted optimal flora growing conditions, which facilitated the vegetation assessment. Pursuant to this, and considering the small size of the study area and the existing biodiversity datasets for the site, the field survey effort was considered sufficient to inform the impact assessment; and
- The absence or non-recording of a specific flora or fauna species, at a particular time, does not necessarily indicate that 1) the species does not occur there; 2) the species does not utilise resources in that area; or 3) the area does not play an ecological support role in the life-history of that species.

5. Baseline Ecological Characterisation of the Study Area

5.1. General Biophysical Environment

The study area is located in the savanna biome and according to the regional mapping of South Africa's vegetation types by Mucina and Rutherford (2011), it and most of the Frischgewaagd section consists of Zeerust Thornveld (SVcb 3) – shown in Figure 3. In their study of the Frischgewaagd section, De Castro and Brits (2016a) determined that this evaluation is inaccurate, and that although the section does show some physiognomic similarities to Zeerust Thornveld, it is more closely aligned to Marikana Thornveld (SVcb 6) in both dominant species and general composition. This is in part supported by a mapping exercise by the NWBSP (2015) who delineate most of the land to the south of the Frischgewaagd section and Eland's River as Marikana Thornveld, rather than Zeerust Thornveld – shown in Figure 4.

The attributes of the savanna biome and both Zeerust Thornveld and Marikana Thornveld, as per Mucina and Rutherford's (2011) descriptions, are summarised below:

5.1.1. Savanna Biome

The savanna biome is the largest biome in South Africa, covering approximately 35% of the country's land surface (Scholes and Walker, 1993). Savannas are characterised by a dominant grass layer, overtopped by a discontinuous, yet distinct woody plant component. Primary determinants of savanna composition, structure and functioning are; fire, a distinct seasonal climate, substrate type, and browsing and grazing by large herbivores (Scholes and Walker, 1993). Compositionally, Africa's savannas are distinguished as either fine-leafed savannas or broad-leafed savannas. The distribution of these forms is based primarily on soil fertility (Scholes and Walker, 1993); fine-leafed savannas occur on nutrient rich soils and are dominated by microphyllous woody species of the Fabaceae family (most commonly *Acacia*'s). These savannas have a productive and diverse herbaceous layer that is dominated by grasses, and can support large populations of mammalian herbivores (Scholes and Walker, 1993). Conversely, broad-leafed savannas usually occur on nutrient poor soils and are dominated by macrophyllous woody species from the Combretaceae family (common genera: *Combretum* & *Terminalia*). Compared to fine-leafed savannas, broad-leafed savannas are less productive and support a lower herbivore biomass (Scholes and Walker, 1993).

5.1.2. Zeerust Thornveld (SVcb 3)

Zeerust Thornveld occurs along the plains from the Lobatsi River in the west, via Zeerust to the large flats located between the Magaliesberg and the Pilanesberg Game Reserve (Mucina & Rutherford, 2011). Vegetation is characterised by open to dense, short deciduous woodland that is dominated by *Acacia* species. The herbaceous layer is generally well-established and comprises mostly grasses (Mucina & Rutherford, 2011).

Mucina & Rutherford (2011) list the following flora species as being important or characteristic taxa in the Zeerust Thornveld vegetation type:

Trees: *Peltophorum africanum*, *Searsia lancea*, *Senegalia burkei*, *Senegalia mellifera* subsp. *detinens*, *Vachellia erioloba*, *Vachellia nilotica*, *Vachellia tortilis* subsp. *heteracantha* and *Terminalia sericea*.

Shrubs: *Myroxylon aethiopicum* subsp. *burkeanum*, *Diospyros lycioides* subsp. *lycioides*, *Ehretia rigida*, *Euclea undulata*, *Grewia flava*, *Agathisanthemum*, *Chaetacanthus costatus*, *Clerodendrum ternatum*, *Indigofera filipes*, *Searsia grandidens*, *Sida chrysantha* and *Stylosanthes fruticosa*.

Graminoids: *Eragrostis lehmanniana*, *Panicum maximum*, *Aristida congesta* and *Cymbopogon pospischilii*.

Herbs and Geophytic Herbs: *Blepharis integrifolia*, *Chamaecrista absus*, *C. mimosoides*, *Cleome maculata*, *Dicoma anomala*, *Kyphocarpa angustifolia*, *Limeum viscosum* and *Lophiocarpus tenuissimus*.

5.1.3. Marikana Thornveld (SVcb 6)

Marikana Thornveld extends on the broad plains from Rustenburg in the west, through Marikana and Brits, towards Pretoria in the east (Mucina & Rutherford, 2011). It is characterised by open *Acacia karroo* woodland, which occurs in valleys and on undulating plains and hills. Fire protected habitats, such as drainage lines, rocky outcrops and termitaria are typical dominated by denser, shrub-dominated vegetation (Mucina & Rutherford, 2011).

Mucina & Rutherford (2011) list the following species as being important or characteristic taxa in the Marikana Thornveld vegetation type:

Trees: *Senegalia burkei*, *Senegalia caffra*, *Vachellia karroo*, *Vachellia nilotica*, *Vachellia tortilis*, *Celtis africana*, *Combretum molle*, *Dombeya rotundifolia*, *Pappea capensis*, *Peltophorum africanum*, *Searsia lancea*, *Terminalia sericea* and *Ziziphus mucronata*.

Shrubs: *Asparagus cooperi*, *Euclea crispa*, *Diospyros lycioides*, *Ehretia rigida*, *Euclea undulata*, *Grewia flava*, *Indigofera zeyheri*, *Olea europaea* subsp. *africana* and *Searsia pyroides*.

Graminoids: *Eragrostis lehmanniana*, *Aristida scabrivalvis*, *Fingerhuthia africana*, *Heteropogon contortus*, *Hyperthelia dissoluta*, *Melinis nerviglumis*, *Setaria sphacelata*, *Themeda triandra* and *Pogonarthria squarrosa*.

Herbs and Geophytic Herbs: *Hermannia depressa*, *Ipomoea obscura*, *I. oblongata*, *Dianthus mooiensis* subsp. *mooiensis*, *Vernonia oligocephala*, *Barleria macrostegia*, *Ledebouria revoluta*, *Ornithogalum tenuifolium* and *Sansevieria aethiopica*.

5.2. Conservation Context

Across its range large areas of Marikana Thornveld have been transformed by cultivation, urbanisation, alien species encroachment and mining (Mucina & Rutherford, 2011). This vegetation type is therefore categorised as a Vulnerable Ecosystem, according to the National List of Threatened Ecosystems (NEMBA Threatened Ecosystems, 2011). Zeerust Thornveld is not considered a threatened vegetation type.

5.2.1. North West Biodiversity Sector Plan (2015)

According to the North West Biodiversity Sector Plan (NW BSP, 2015), which aims to map critical biodiversity areas (CBA's) and ecological support areas (ESA's) at a provincial level, the study area as well as the Frischgewaagd section and much of the surrounding landscape (excluding transformed

areas mostly associated with Ledig and other mines), are designated Critical Biodiversity Area Category 2 (CBA 2) - Figure 5.

The NWBSP (2015) states that Critical Biodiversity Areas are portions of land that need to be maintained in a natural or semi-natural state in order to ensure the continued existence and functioning of species and ecosystems, and the delivery of ecosystem services. In summary, according to the NWBSP (2015), areas designated as CBA 2 usually comprise land with a combination of the following traits:

- Ecosystems and species fully or largely intact and undisturbed;
- Areas of intermediate irreplaceability (i.e., some flexibility with regard to meeting biodiversity targets); and
- Biodiversity features that are approaching but have not surpassed their limits of acceptable change.

De Castro and Brits (2016a) indicate that the criteria resulting in the CBA 2 designation for the study area by North West Department of Rural, Environment and Agricultural Development is that the land is regarded as 'Natural Corridor Linkage' and 'Natural Protected Area Buffer' (within 5 km of the Pilanesberg Game Reserve). However, based on their work in the area De Castro and Brits (2016a) contend that the NWBSP (2015) mapping is partly inaccurate, as large areas that have been mapped as CBA 2 are in fact, transformed by mining and cultivation, and are thus characterised by either no vegetation (permanently transformed) or secondary vegetation (De Castro and Brits, 2016a).

5.2.2. Protected Areas

Pilanesberg Game Reserve¹ (Pilanesberg) is a formally protected conservation area, situated approximately 2.6 km to the north of the study area. The reserve is managed by the North West Parks and Tourism Board and is approximately 49 580 ha in extent.

Pilanesberg encompasses an eroded volcano that is more than one billion years old. The reserve is characterised by varied habitats, including woodland, grassland, riparian areas and numerous rocky areas and hillslopes. A diverse and abundant wildlife assemblage is present, including numerous large mammals (Big Five) and many raptors.

Pilanesberg Game Reserve is a recognised Important Bird Area (IBA). The main IBA triggers for the reserve include the breeding presence of the globally threatened Kori Bustard and Secretary Bird, as well as the European Roller (Marnewick, et al., 2015). Regionally threatened species present in the reserve include Verreaux's Eagle (also breeding in the reserve), Lanner Falcon, African Finfoot, African Grass Owl, Yellow-billed Stork, Yellow-throated Sandgrouse and the Marabou Stork (Marnewick, et al., 2015).

In addition, and aligned to its importance as a conservation area, Pilanesberg Game Reserve is also a popular and important eco-tourism destination, with numerous recreational camps, lodges and hotel facilities.

¹ Sometimes referred to as Pilanesberg National Park. Pilanesberg is a provincial park and not managed by the South African National Parks.

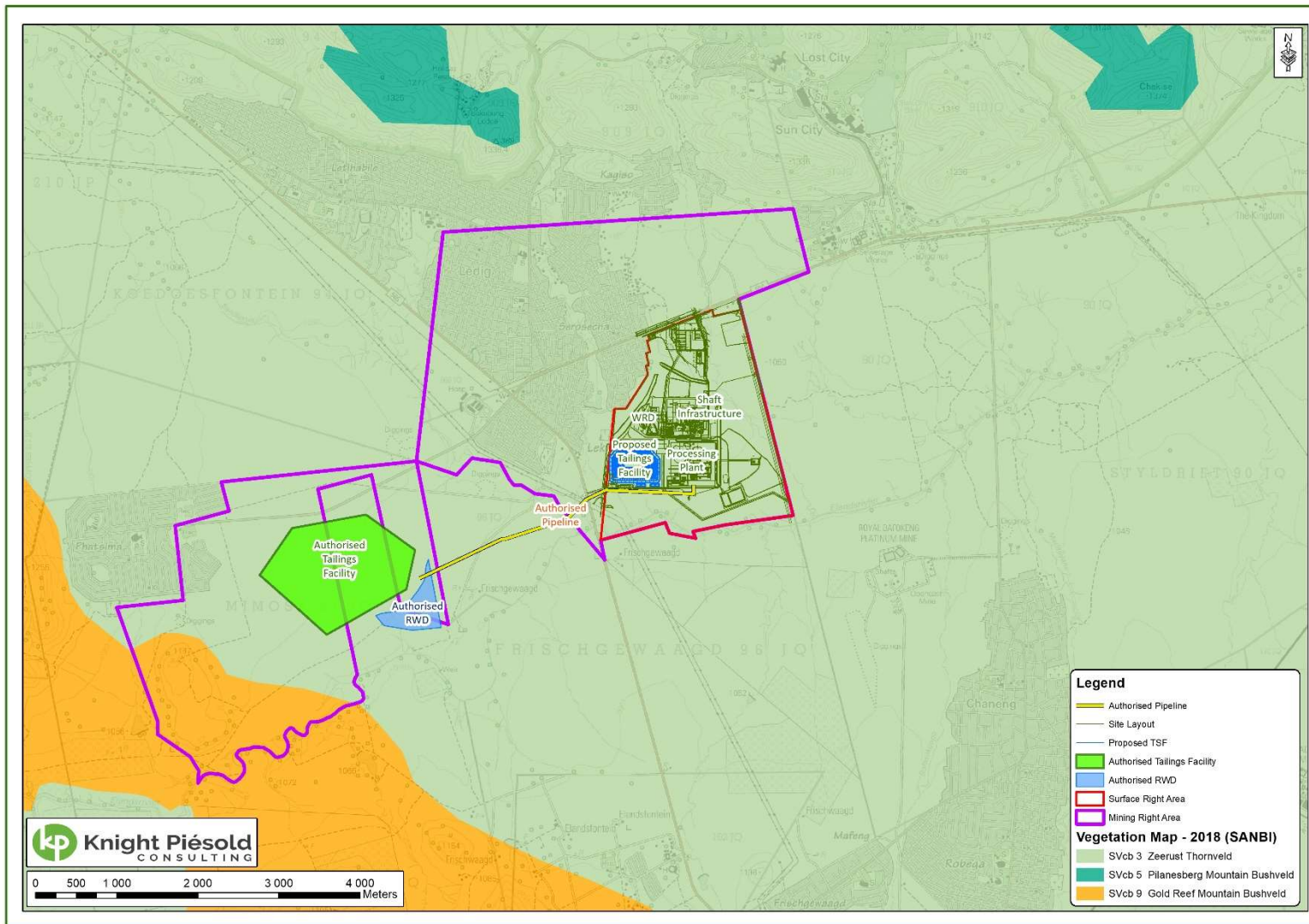


Figure 3: Study area in relation to the national delineations of Mucina and Rutherford's (2011) vegetation types. Proposed TSF location shown in dark blue.

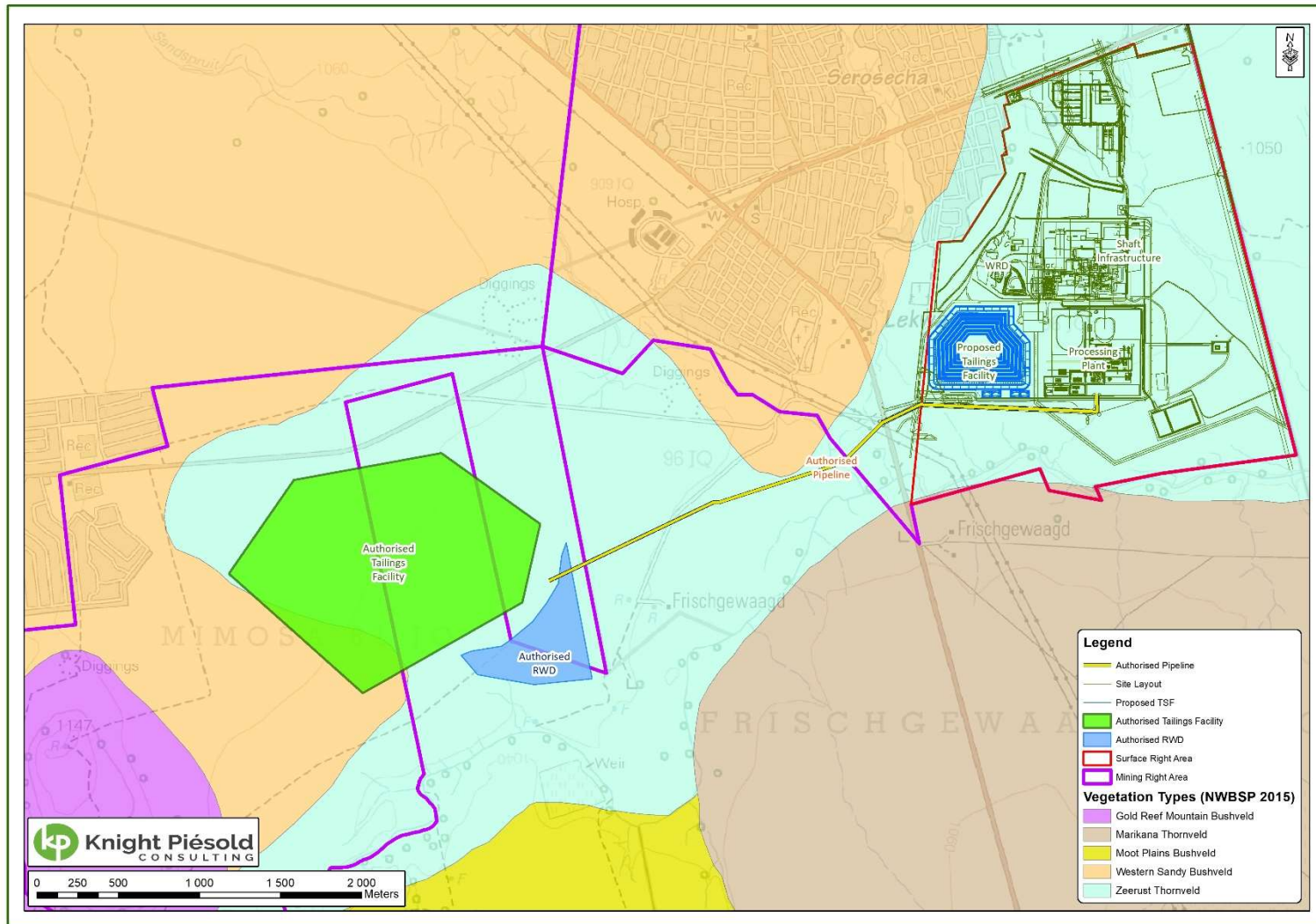


Figure 4: Study area in relation to the refined vegetation type map produced by the NWBSP (2015). Proposed TSF location shown in dark blue.

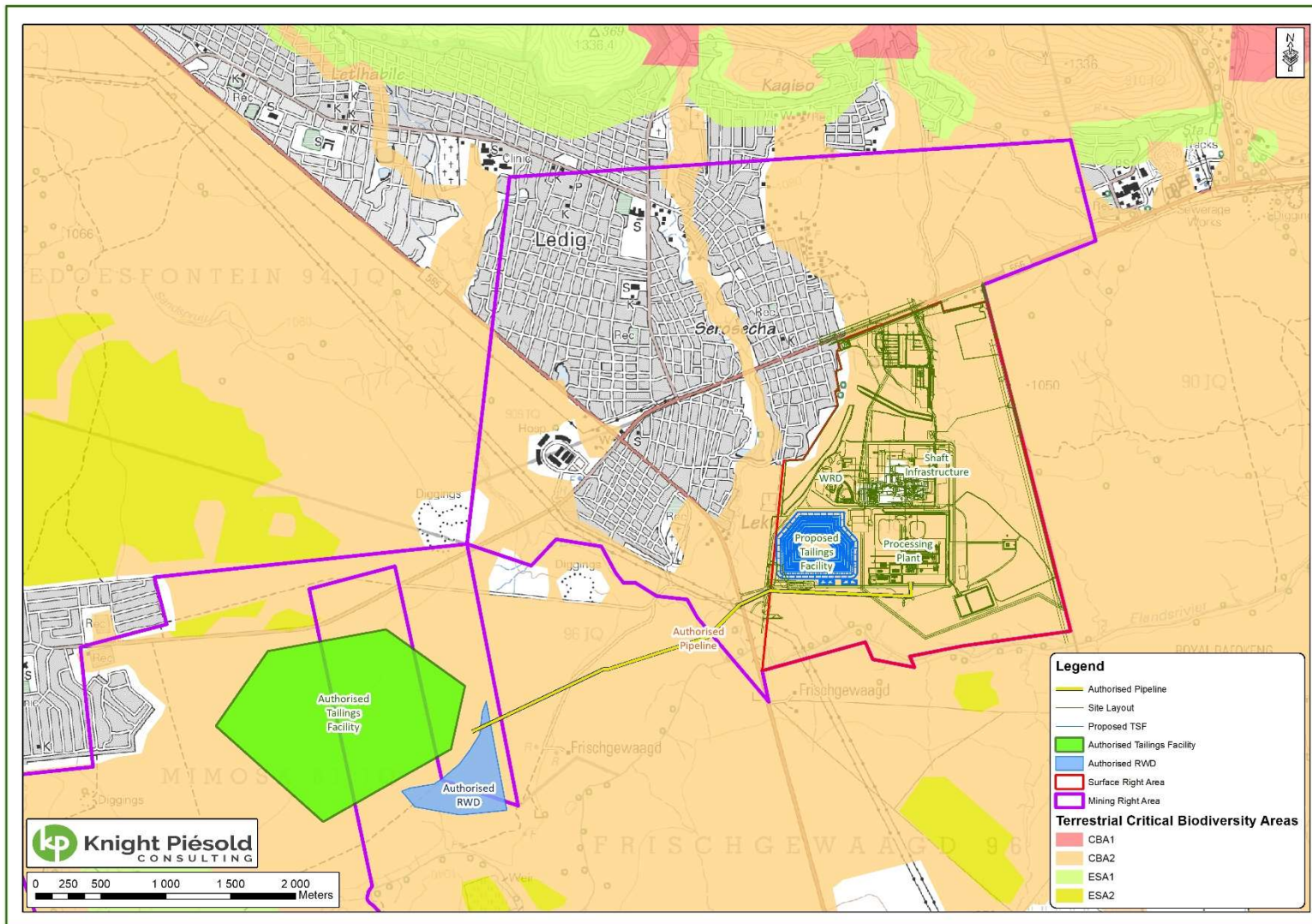


Figure 5: Study area in relation to the North West Biodiversity Sector Plan (NWBSP) (2015). Proposed TSF location shown in dark blue.

5.3. General Characteristics and Landscape Context

The study area is located within the main operational area of the Frischgewaagd section of Bakubung Platinum Mine. The site is bordered to the west by the current mine entrance road (gravel) and a razor-wire fence that is approximately 2 m in height (Figure 6). This razor-wire fence encloses the entire Frischgewaagd section, although portions of it have apparently been illegally dismantled by local community members.

The new mine entrance gate and entrance road (tarred) border the study area to the south (at the time of the field visit, neither were fully operational) (Figure 7), while a large rock dump is located immediately north of the site (Figure 8). A small electrical substation (Figure 9) and the main mine complex are positioned to the north-east of the study area. Although most of the land immediately east of the study area is currently undeveloped, construction activities for the Concentrator Plant on this portion of the Frischgewaagd section are in progress.

The topography of the study area is flat to slightly undulating, with a gradual slope southward, toward the Elands River. A drainage channel has been excavated along the southern boundary of the study area. This transports stormwater from the site, via stormwater culverts under the new entrance road, into natural drainage lines that drain into the Elands River. Portions of the study area have been disturbed; an area of disturbed vegetation associated with a suspected old topsoil deposit dominates the north-east of the study, while a network of formal and informal pedestrian foot-pathways and vehicle tracks traverse across the study area (Figure 10).



Figure 6: Gravel access road and razor-wire boundary fence



Figure 7: New tarred entrance road to the south of the study area.



Figure 8: Existing rock/spoil dump and gravel entrance road north of the study area.



Figure 9: Electrical substation to the north-east of the study area.



Figure 10: Well-maintained pedestrian path through the centre of the study area.

5.4. Vegetation Characteristics of the Study Area

In their vegetation assessment of the Frischgewaagd section, De Castro and Brits (2016a) identified eight vegetation and land-cover types. Of these, two are relevant to the study area, namely Secondary Vegetation and Marikana Thornveld. A general description of these communities based on 2021 field observations and De Castro and Brits (2016a) are presented below, while a vegetation map is shown in Figure 11.

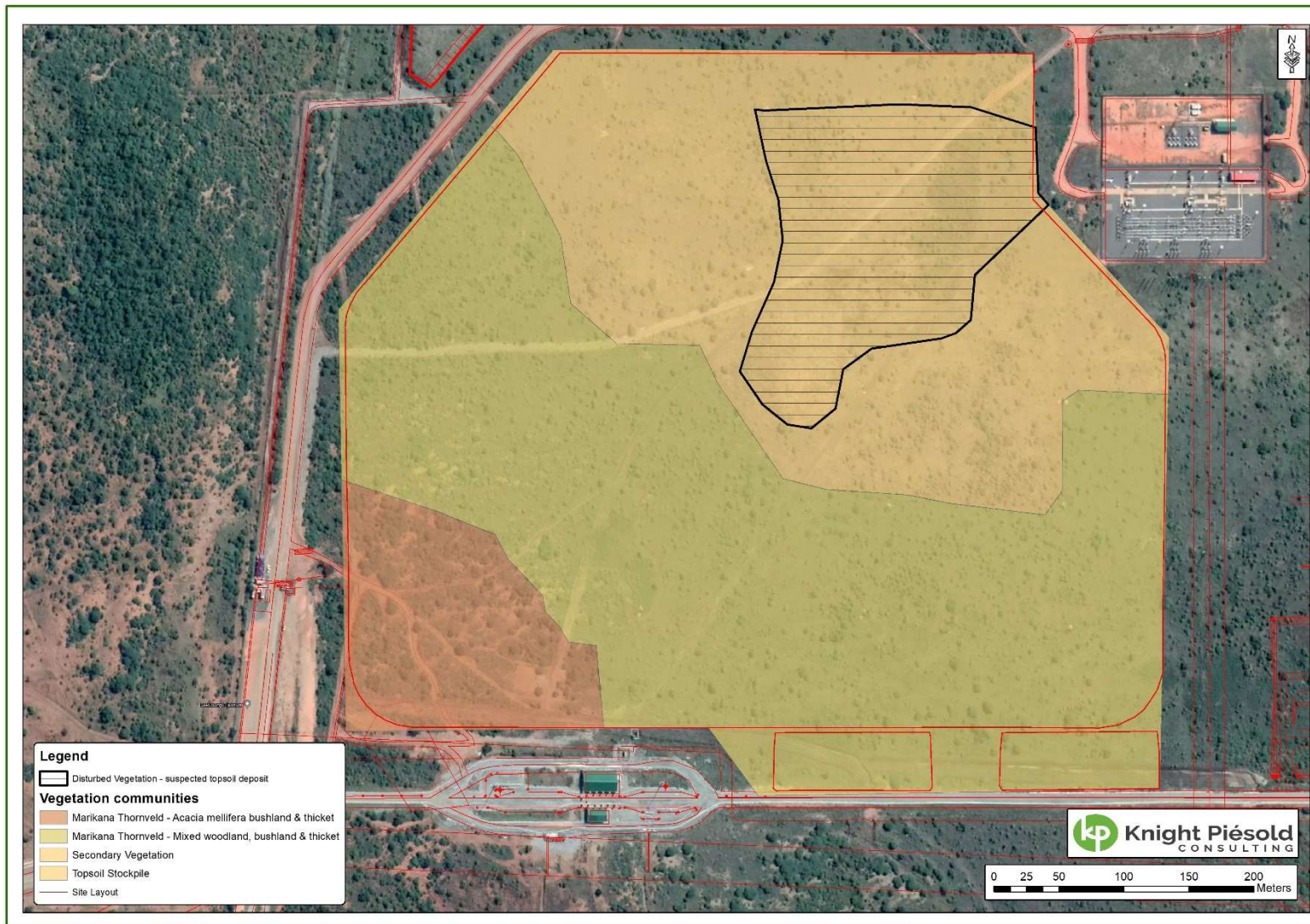


Figure 11: Vegetation community map of the study area.

5.4.1. Secondary Vegetation

Most of the northern portion of the study area comprises secondary vegetation, which is in a fairly advanced stage of secondary succession. De Castro and Brits (2016a) indicate that much of the Frischgewaagd section that comprises this community would likely have been cultivated, heavily grazed and browsed by livestock, and frequently burnt in the past.

In the study area, vegetation structure generally comprises low and fairly open savanna (Figure 12). Common woody species recorded include *Asparagus larycinus* and *Vachellia tortilis*. Common herbaceous species include the grasses *Aristida bipartita*, *Bothriochloa insculpta*, *Eragrostis lehmanniana* and *Sorghum versicolor*, as well as several weedy forbs such as *Acalypha indica*, *Bidens bipinnata** and *Zinnia peruviana**.

A prominent feature in this vegetation community is a suspected old topsoil deposit, which is located in the north-east corner of the study area. In comparison to the surrounding land, this area is elevated (about 0.5 to 1 m in height) and undulating. It appears to have revegetated naturally (Figure 13) and is dominated by alien weedy species. The annual alien herb *Zinnia peruviana* was the most visibly prominent taxa at the time of the field visit and has colonised large portions of the topsoil deposit. Other commonly recorded herbaceous species include *Acalypha indica*, *Bidens bipinnata** (*denotes alien species), *Bidens pilosa**, *Gomphocarpus fruticosus*, *Schkuhria bipinnata** and *Tagetes minuta**. Recorded grasses include *Andropogon shirensis*, *Aristida bipartita* and *Dichanthium annulatum*. Scattered woody species were noted and included *Gymnosporia polyacantha*, *Searsia lancea* and *Vachellia tortilis*.

Despite its disturbed condition, no declared alien invasive species were observed on the revegetated topsoil deposit or in the remaining areas of this vegetation community during the field visit. Similarly, no flora species of conservation concern were observed.

Areas of secondary vegetation have low species richness and do not contain suitable habitat for species of conservation concern (De Castro and Brits, 2016a). These areas (excluding the suspected topsoil deposit, which is highly disturbed) do however, provide suitable supporting habitat for fauna and will likely improve in condition over time if left undisturbed. This community is thus considered to have moderate botanical biodiversity conservation value and sensitivity, in line with the findings of De Castro and Brits (2016a) (Figure 14). The suspected topsoil deposit is a highly modified site, that is dominated by alien weed species. Accordingly, this feature is considered to have low botanical biodiversity conservation value and sensitivity (Figure 14).



Figure 12: Secondary vegetation



Figure 13: Ruderal vegetation characterising the suspected topsoil deposit

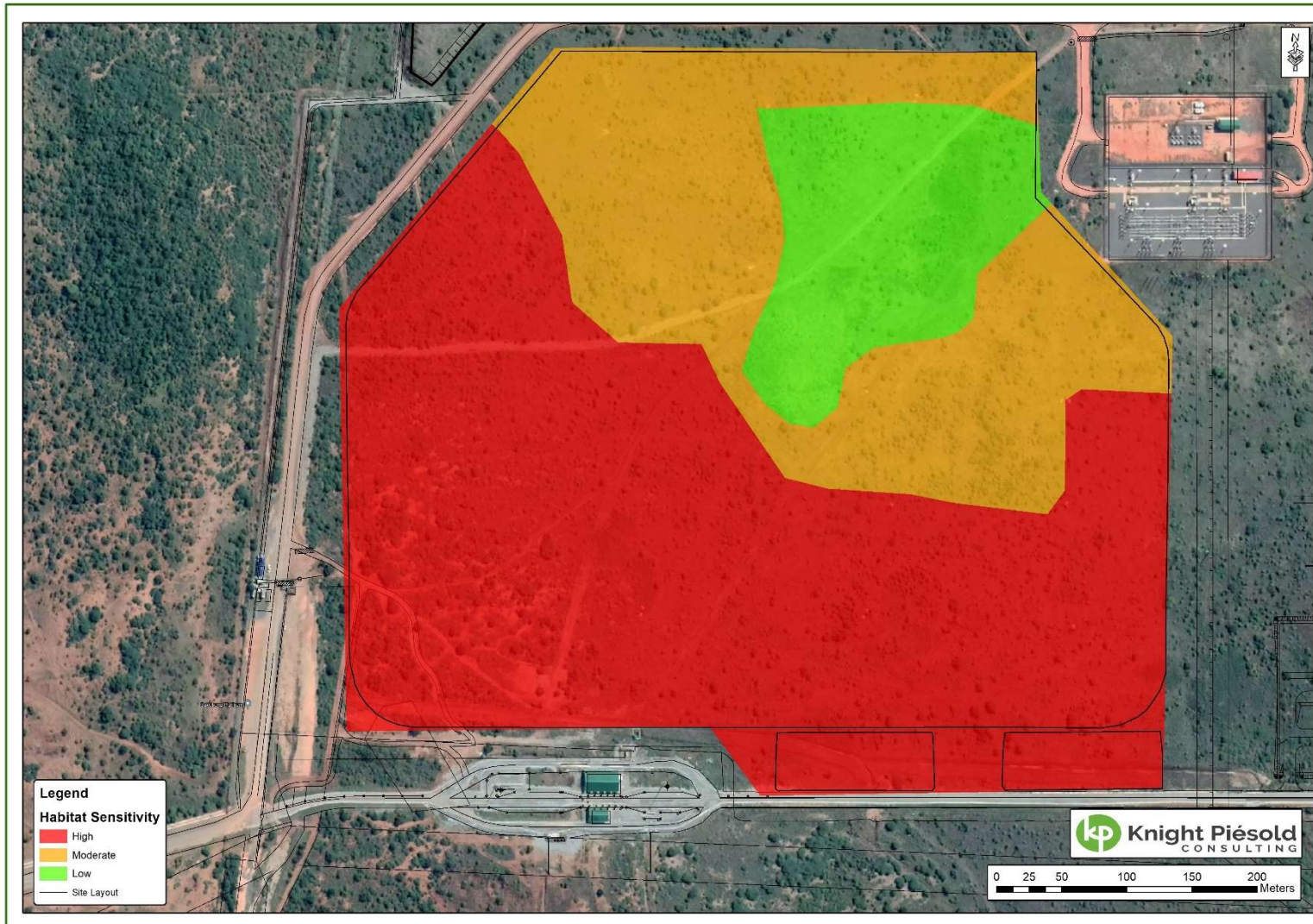


Figure 14: Sensitivity map of the proposed study area.

5.4.2. Marikana Thornveld

This community characterises the southern portion of the study area. De Castro and Brits (2016a) indicate that historically, Marikana Thornveld would have covered the majority of the Frischgewaagd section. High levels of livestock grazing and browsing, coupled with fire, are likely to have reduced large tree density and increased shrub density (De Castro and Brits, 2016a).

General structure is short, open to closed woodland, with a well-developed grass layer (Figure 15 and Figure 16). De Castro and Brits (2016a) parsed this community into two sub-units or forms; Mixed Bushland, Woodland and Thicket, and *Acacia mellifera*² Bushland and Thicket.

Mixed Bushland, Woodland and Thicket covers much of the central and south-east of the study area. Dominant woody taxa include the *Dichrostachys cinerea*, *Diospyros lycioides* and *Ziziphus zeyheriana*, which typically grow as small shrubs - *Diospyros lycioides* is a dominant species in localised thickets in this community. Other common larger woody taxa include *Grewia flava*, *Searsia lancea*, *Senegalia caffra*, *Vachellia karroo*, *Vachellia tortilis* and *Ziziphus mucronata*. Frequently recorded grasses include *Aristida bipartita*, *Cymbopogon pospischilii*, *Ischaemum afrum*, *Panicum coloratum*, *Themeda triandra* and *Trachypogon spicatus*.

The *Acacia mellifera* Bushland and Thicket community subunit is located over a small area in the south-west corner of the study area. In contrast to adjacent Mixed Bushland, Woodland and Thicket, this subunit in the study area is characterised by a more prominent 'large' tree component and a fairly patchy herbaceous layer that has been disturbed by various vehicle tracks. Woody species composition comprises a mixture of broad- and fine-leafed species, including the common *Grewia flava*, *Vachellia mellifera* and *Searsia lancea*, as well as *Vachellia tortilis* and *Ziziphus mucronata*. Other less common woody taxa include *inter alia*, *Carissa bispinosa*, *Ehretia rigida*, *Euclea undulata* and *Senegalia erubescens*. Commonly recorded grasses include *Aristida canescens*, *Cymbopogon pospischilii*, *Panicum chloratum*, *Themeda triandra* and *Trachypogon spicatus*.

Common forb species include *Antizoma angustifolia*, *Commelina africana*, *C. erecta*, *Crabbea angustifolia* and *Syncolostemon pretoriae*. The succulent *Aloe dayana* is also abundant throughout this vegetation community. No species of conservation concern were recorded in the study area during the 2021 field visit. Similarly, despite localised disturbances, no declared alien invasive species were recorded.

Following their study of the Frischgewaagd section, De Castro and Brits (2016a) noted that Marikana Thornveld is floristically species rich. They recorded one protected tree (*Boscia albitrunca*) in this vegetation community (not in the current study area) and suggest that one threatened species (*Drimia sanguinea*) has a moderate probability of occurrence – refer to Section 5.4.3. This community is thus considered to have high botanical biodiversity conservation value and sensitivity (De Castro and Brits, 2016a) (Figure 14).

² *Acacia mellifera* is now known as *Senegalia mellifera*.



Figure 15: Mixed Bushland, Woodland and Thicket



Figure 16: *Acacia mellifera* Bushland and Thicket

5.4.3. Floristic Diversity

A total of 338 flora species have been recorded across the entire Frischgewaagd section (De Castro and Brits, 2016a). This comprises 286 indigenous species and 52 naturalised alien species (De Castro and Brits, 2016a). During the 2021 one-day site visit, 81 flora species were identified. For a list of flora species identified in the study area during the field visit, refer to Appendix 1.

5.4.3.1. Alien Invasive Species

Of the naturalised alien species recorded on Frischgewaagd section by De Castro and Brits (2016a), nineteen are declared alien invasive taxa according to NEMBA Alien Invasive Species Lists (2016) – listed in Table 1. Most of the alien species were recorded by De Castro and Brits (2016a) in areas of secondary vegetation or modified areas.

During the 2021 field visit no declared alien invasive were recorded in the study area. Several non-declared alien weed species are common in areas of secondary vegetation and disturbed sites. These include, most commonly *Zinnia peruviana*, as well as *Bidens bipinnata*, *Bidens pilosa*, *Hibiscus trionum* and *Tagetes minuta*.

Table 1: Declared alien invasive species recorded in the Frischgewaagd section by De Castro and Brits (2016a).

Scientific Name	Common Name	NEMBA Category
<i>Araujia sericifera</i>	Moth Catcher	1b
<i>Argemone ochroleuca</i>	White-flowered Mexican Poppy	1b
<i>Datura ferox</i>	Large Thorn Apple	1b
<i>Datura stramonium</i>	Thorn Apple	1b
<i>Eucalyptus camaldulensis</i>	Saligna- Gum	1b or 2
<i>Flaveria bidentis</i>	Smelter's Bush	1b
<i>Ipomoea purpurea</i>	Morning Glory	1b
<i>Melia azedarach</i>	Seringa	1b
<i>Morus alba</i>	White Mulberry	3
<i>Nicotiana glauca</i>	Wild Tobacco	1b
<i>Opuntia ficus-indica</i>	Sweet prickly Pear	1b
<i>Pennisetum clandestinum</i>	Kikuyu	1b
<i>Populus x canescens</i>	Grey Poplar	1b
<i>Ricinus communis</i>	Castor Oil Plant	2

<i>Sesbania punicea</i>	Red Sesbania	1b
<i>Solanum elaeagnifolium</i>	Silver-leaf Bitter Apple	1b
<i>Sorghum halepense</i>	Johnson Grass	2
<i>Verbena bonariensis</i>	Wild Verbena	1b
<i>Xanthium strumarium</i>	Large Cocklebur	1b

5.4.3.2. Flora Species of Medicinal Value

Flora species recorded in the study area during the 2021 field visit that have a purported medicinal value are listed in Table 2.

Table 2: Flora species of medicinal value

Scientific Name	Purported Use
<i>Asparagus species</i>	Used for the treatment of tuberculosis, kidney ailments and rheumatism
<i>Vachellia karroo</i>	Used for the treatment of diarrhoea and dysentery.
<i>Dichrostachys cinerea</i>	Used to treat pain, back- and tooth ache, amongst other afflictions.
<i>Elephantorrhiza elephantina</i>	Used for the treatment of diarrhoea, dysentery and general stomach disorders.
<i>Euclea undulata</i>	Used to treat heart disease.
<i>Gomphocarpus fruticosus</i>	Used as snuff for headaches and tuberculosis.
<i>Ziziphus mucronata</i>	Bark infusion is used as an expectorant, while roots are used in the treatment of diarrhoea and dysentery.
Source: Medicinal uses as per Van Wyk, et al., (2009).	

5.4.3.3. Flora Species of Conservation Concern

Flora species that are considered to be of conservation concern include protected taxa, as listed in terms of the National Forests Act (Act No. 84 of 1998) or the National Environmental Management Biodiversity Act (Act No. 10 of 2004) (NEMBA ToPS List, 2007), as well as species considered threatened on the Red List of South African Plants.

Protected Flora

Two tree species recorded by De Castro and Brits (2016a) during their field work are listed as protected in terms of the National Forests Act (Act No. 84 of 1998) (Table 3). Although *Sclerocarya birrea* subsp. *africana* was not recorded on the Frischgewaagd section, De Castro and Brits (2016a) indicate that is likely to be present. *Boscia albitrunca* has been recorded on the Frischgewaagd section (De Castro and Brits, 2016a). Neither *Sclerocarya birrea* subsp. *africana* nor *Boscia albitrunca*, nor any other protected trees, were recorded in the study area during the 2021 field visit.

Table 3: Protected trees potentially occurring in the study area

Scientific Name	Family
<i>Boscia albitrunca</i>	Capparaceae
<i>Sclerocarya birrea</i> subsp. <i>africana</i>	Anacardiaceae

Threatened Flora

Based on historical records, De Castro and Brits (2016a) listed 11 threatened flora species as potentially occurring at Bakubung Platinum Mine. Of these, the conservation statuses of five species have subsequently been downgraded; *Boophone disticha*, *Gunnera perpensa*, *Ilex mitis*, *Rapanea melanophloeos* and *Hypoxis hemerocallidea* were all previously assessed as 'Declining' on the National Red List, but have been downgraded to 'Least Concern' (SANBI, 2020).

The remaining six species are all still threatened according to the National Red List (2020), with statuses ranging from Critically Endangered (*Aloe peglerae*) to Rare (*Frithia pulchra*). The six species are presented in Table 4, along with a probability of occurrence predicated on the De Castro and Brits (2016a) evaluation for the Frischgewaagd section. An additional species, *Cullen holubii* (Vulnerable), is highlighted as medium sensitivity feature by the environmental screening tool. This species favours sandy savanna areas and is known only from populations near Zeerust (west of the study area) and between Bela Bela and Pretoria (SANBI, 2020). Its probability of occurrence in the study area is therefore considered negligible. No threatened species were recorded in the study area during the 2021 field visit.

Table 4: Red List flora species potentially occurring in the study area

Scientific Name	Family	Red List Status	Habitat Preferences*	Probability of Occurrence	Rationale
<i>Adromischus umbraticola</i> <i>subsp. umbraticola</i>	Crassulaceae	Near Threatened	South-facing rock crevices on ridges	Negligible	No suitable habitat
<i>Aloe peglerae</i>	Asphodelaceae	Critically Endangered	Shallow quartzitic soils on rocky north-facing slopes and ridges	Negligible	No suitable habitat
<i>Cullen holubii</i>	Fabaceae	Vulnerable	Savanna on sandy flats	Negligible	No suitable habitat and not known from area.
<i>Drimia sanguinea</i>	Hyacinthaceae	Near Threatened	Open savanna and woodland	Moderate	Suitable habitat present
<i>Frithia pulchra</i>	Aizoaceae	Rare	Shallow quartzitic soils on sandstones in savanna areas.	Low	Limited suitable habitat
<i>Prunus africana</i>	Rosaceae	Vulnerable	Favours evergreen and mistbelt forest	Negligible	No suitable habitat
<i>Stenostelma umbelluliferum</i>	Apocynaceae	Near Threatened	Favours black turf in open savanna, close to drainage lines.	Moderate	Suitable habitat is present
*Habitat preferences as per SANBI (2020)					

5.5. Fauna Characteristics of the Study Area

This section provides a description of fauna recorded or potentially occurring in the study area, based on field observations, previous studies and reference literature/datasets. Emphasis is placed on species of conservation concern.

5.5.1. Mammals

Based on historic distribution maps in Stuart and Stuart (2007) and MammalMap records (FitzPatrick Institute of African Ornithology, 2021), up to 93 mammal species potentially occur in the region in which the study area is located (Appendix B). Anthropogenic disturbances, such as mining, urbanisation and agriculture, have caused large-scale transformation and disturbance of habitats in the broader landscape, and this has negatively affected the abundance and diversity of mammals. Due to active conservation efforts, however, the Pilanesberg Game Reserve is likely to have retained a full mammal assemblage, which includes a number of large megafauna and species of conservation concern.

Ten mammal species were recorded by De Castro and Brits (2016b) during their work at Bakubung Platinum Mine (Table 5). Apart from the Serval, the recorded species are all common taxa, with widespread distributions in savanna and grassland habitats. The most commonly observed species were Scrub Hare and Common Duiker (De Castro and Brits, 2016b).

During the 2021 field visit, evidence of three mammal species was observed in the study area: Scrub Hare faecal droppings were recorded in an area of Secondary Vegetation; and although partially obscured by rain, the tracks of a small antelope (either Steenbok or Common Duiker) and possibly a Warthog, were also noted. These are all common taxa in savanna areas.

Table 5: Mammals recorded at Bakubung Platinum Mine

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status (2016)	Recorded in the Study Area during 2021 field visit
Family Bovidae					
Steenbok	<i>Raphicerus campestris</i>	-	-	-	X
Common Duiker	<i>Sylvicapra grimmia</i>	-	-	-	X
Family Canidae					
Black-backed Jackal	<i>Canis mesomelas</i>	-	-	-	
Family Felidae					
Caracal	<i>Caracal caracal</i>	-	-	-	
Serval	<i>Leptailurus serval</i>	Near Threatened	Protected	Specially Protected	
Family Herpestidae					
Slender Mongoose	<i>Galerella sanguinea</i>	-	-	-	
Water Mongoose	<i>Atilax paludinosus</i>	-	-	-	

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status (2016)	Recorded in the Study Area during 2021 field visit
Family Hystricidae					
Porcupine	<i>Hystrix africaeaustralis</i>	-	-	-	
Family Leporidae					
Scrub Hare	<i>Lepus saxatilis</i>	-	-	-	X
Family Pedetidae					
Springhare	<i>Pedetes capensis</i>	-	-	-	
Family Suidae					
Common Warthog	<i>Phacochoerus africanus</i>	-	-	-	X
Source: Master list as per De Castro and Brits (2016b). Updated with 2021 field data.					

During their study, De Castro and Brits (2016b) recorded evidence of Serval (*Leptailurus serval*) along the TSF pipeline, between Frischgewaagd and Mimosa Sections. The Red List status of the Serval is Near Threatened. It is also listed as Protected in terms of the NEMBA ToPS (2007) and Specially Protected in terms of the North West Biodiversity Management Act (Act No. 4 of 2016).

De Castro and Brits (2016b) highlighted 23 additional mammal species of conservation concern that could potentially occur in the region. At the time, most of these were considered species of conservation concern based on their 'Data Deficient' Red List status. Subsequently however, 13 of these taxa have been reevaluated and classified as Least Concern on the most recent mammal Red List (*sensu*. EWT, 2016). Currently, only 11 species are still considered threatened on the Red List and/or listed as nationally protected (Table 6). Several other taxa that potentially occur in the study area are also listed as specially protected at a provincial level (see Appendix B).

Table 6: Mammal species of conservation concern potentially occurring in the study area

Family	Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Habitat Preferences*	Probability of Occurrence	Rationale
Canidae	Cape Fox	<i>Vulpes chama</i>	Least Concern	Protected	-	Range of habitats, including savanna	Low	High levels of disturbance
Erinaceidae	Southern African Hedgehog	<i>Atelerix frontalis</i>	Near Threatened	Protected	-	Range of habitats, including savanna	Moderate	Suitable habitat present
Felidae	Serval	<i>Leptailurus serval</i>	Near Threatened	Protected	Specially Protected	Range of habitats, including savanna and savanna	Moderate	Recorded by De Castro and Brits (2016b) along the TSF pipeline, between Frischgewaagd and Mimosa Sections. Possibly transitory through the study area.
	Black-footed Cat	<i>Felix nigripes</i>	Vulnerable	Protected	Specially Protected	Savanna and grassland habitats	Low	High levels of disturbance
Hyaenidae	Brown Hyaena	<i>Hyaena brunnea</i>	Near Threatened	Protected	-	Savanna and desert habitats	Low	High levels of disturbance
Manidae	Pangolin	<i>Smutsia temminckii</i>	Vulnerable	Vulnerable	-	Savanna habitats	Low	Very rare species, facing high levels of disturbance
Muridae	Vlei Rat	<i>Otomys auratus</i>	Near Threatened	-	-	Wetland habitats, but also grassland and savanna	Moderate	Suitable habitat present
Mustelidae	Cape Clawless Otter	<i>Aonyx capensis</i>	Near Threatened	Protected	Specially Protected	Riparian habitats	Low	No suitable habitat present
	Spotted-necked Otter	<i>Hydrictis maculicollis</i>	Vulnerable	Protected	-	Riparian habitats, but favours open water bodies.	Low	No suitable habitat present
	African Weasel	<i>Poecilogale albinucha</i>	Near Threatened	-	Specially Protected	Savanna and grassland habitats	Moderate	Suitable habitat present
Soricidae	Swamp Musk Shrew	<i>Crocidura mariquensis</i>	Near Threatened	-	-	Moist grassland and wetland habitats	Low	Limited suitable habitat

*Habitat preferences as per Skinner and Smithers (1990)

5.5.2. Birds

Based on records presented by the South African Bird Atlas Project 2 (SABAP2), the broader landscape has a high bird species richness, with 343 species collectively recorded in the pentads 2520_2705 and 2520_2700 (Appendix C). These high counts are largely attributable to the presence of Pilanesberg Game Reserve, which has an unusually observer coverage, compared to adjacent non-protected areas.

In total, 88 bird species were recorded during bird surveys at Bakubung Platinum Mine by De Castro and Brits (2016b). These authors parsed the recorded species into four main bird assemblages, predicated on habitat type, viz; Thicket, Shrubland, Grassland and Secondary/Modified.

The most frequently observed bird species in thicket were Crested Francolin, Kalahari Scrub-robin, Chestnut-vented Titbabbler, Southern Bou Bou and the White-bellied Sunbird (De Castro and Brits, 2016b). The shrubland assemblage recorded the greatest species richness of the four assemblages (n=58), with the most frequently recorded taxa consisting of Rattling Cisticola, Sabota Lark, Black-chested Prinia and Red-faced Mousebird (De Castro and Brits, 2016b). In grassland habitats, Rufous-naped Lark was the most recorded taxa, followed by African Quailfinch and Cattle Egret (De Castro and Brits, 2016b). Lastly, records in the Secondary/Modified assemblage were dominated by Common Myna, Cattle Egret, Pied Crow and House Sparrow (De Castro and Brits, 2016b).

Thirty-two bird species were recorded as incidental observations during the 2021 field visit. Of these, 31 are common and widespread species in savanna and grassland habitats. One species is of conservation concern; a single White-backed Vulture (*Gyps africanus*) - Critically Endangered, was observed flying high above the Frischgewaagd Section. This species typically roosts in large *Acacia* trees, and favours large natural areas where it can locate and scavenge on carcasses. The observed individual is likely to roost in the Pilanesberg Game Reserve and was observed on an aerial search for carcasses across the broader landscape surrounding the reserve. Considering its location and the degree of local anthropogenic activities and disturbances, the study area is not considered to be important life-cycle habitat for this species.

During their field work, De Castro and Brits (2016b) did not observe any bird species listed nationally as either threatened or protected. However, based on distribution ranges alone, up to 26 bird species of conservation concern potentially occur in the region (Table 7). This notwithstanding, considering the characteristics of the site and its environs, most of these have either a low or moderate probability of being present.

Table 7: Bird species of conservation concern potentially occurring in the study area

Family	Scientific Name	Common Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Habitat Preferences*	Probability of Occurrence	Rationale
Accipitridae	<i>Polemaetus bellicosus</i>	Martial Eagle	Endangered	Vulnerable	Specially Protected	Range of habitats, including savanna	Low	Limited suitable habitat present and high levels of disturbance
	<i>Aquila verreauxii</i>	Verreaux's Eagle	Vulnerable	-	Specially Protected	Mountainous habitats	Low	No suitable habitat present.
	<i>Aquila rapax</i>	Tawny Eagle	Endangered	Vulnerable	Specially Protected	Savanna habitats	Low	Limited suitable habitat present and high levels of disturbance
	<i>Gyps africanus</i>	White-backed Vulture	Critically Endangered	Endangered	Specially Protected	Savanna habitats	Recorded gliding high above the Frischgewaagd Section	Limited suitable habitat present or foraging opportunities on-site and high levels of anthropogenic disturbance make it highly unlikely this species resides on-site.
	<i>Gyps coprotheres</i>	Cape Vulture	Endangered	Endangered	Specially Protected	Savanna and grassland habitats	Low	Limited suitable habitat present and high levels of disturbance
	<i>Terathopius ecaudatus</i>	Bateleur	Endangered	Vulnerable	Specially Protected	Savanna habitats	Low	Limited suitable habitat present and high levels of disturbance
	<i>Torgos tracheliotus</i>	Lappet-faced Vulture	Endangered	Endangered	Specially Protected	Range of habitats, including savanna	Low	Limited suitable habitat present and

Family	Scientific Name	Common Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Habitat Preferences*	Probability of Occurrence	Rationale
								high levels of disturbance
	<i>Circus macrourus</i>	Pallid Harrier	Near Threatened	-	Specially Protected	Savanna and grassland habitats	Low	Limited suitable habitat present.
	<i>Circus ranivorus</i>	African Marsh Harrier	Endangered	Protected	Specially Protected	Grassland and wetland habitats	Low	Limited suitable habitat present.
Alcedinidae	<i>Alcedo semitorquata</i>	Half-collared Kingfisher	Near Threatened	-	Specially Protected	Riparian woodland and forest	Low	Limited suitable habitat present.
Ciconiidae	<i>Ciconia abdimii</i>	Abdim's Stork	Near Threatened	-	Specially Protected	Range of habitats, including savanna	Low	Limited suitable habitat present.
	<i>Ciconia nigra</i>	Black Stork	Vulnerable	Vulnerable	Specially Protected	Riparian habitats	Low	Limited suitable habitat present.
	<i>Leptoptilos crumeniferus</i>	Marabou Stork	Near Threatened	-	Specially Protected	Range of habitats, including savanna	Moderate	Suitable habitat is present.
	<i>Mycteria ibis</i>	Yellow-billed Stork	Endangered	-	Specially Protected	Wetland habitats	Low	No suitable habitat present.
Coraciidae	<i>Coracias garrulus</i>	European Roller	Near Threatened	-	Specially Protected	Savanna habitats	Moderate	Suitable habitat is present
Falconidae	<i>Falco biarmicus</i>	Lanner Falcon	Vulnerable	-	Specially Protected	Range of habitats, including savanna	Moderate	Suitable habitat is present
Glareolidae	<i>Glareola nordmanni</i>	Black-winged Pratincole	Near Threatened	-	Specially Protected	Grassland and wetland habitats	Low	Limited suitable habitat present.
Gruidae	<i>Anthropoides paradiseus</i>	Blue Crane	Near Threatened	Endangered	-	Grassland and wetland habitats	Low	Limited suitable habitat present.
Otididae	<i>Ardeotis kori</i>	Kori Bustard	Near Threatened	Vulnerable	-	Grassland and savanna habitats	Low	Limited suitable habitat present and high levels of disturbance

Family	Scientific Name	Common Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Habitat Preferences*	Probability of Occurrence	Rationale
Pelecanidae	<i>Pelecanus rufescens</i>	Pink-backed Pelican	Vulnerable	Endangered	Specially Protected	Wetland habitats	Low	No suitable habitat present.
Phoenicopteriformes	<i>Phoenicopus minor</i>	Lesser Flamingo	Near Threatened	-	Specially Protected	Wetland habitats	Low	No suitable habitat present.
	<i>Phoenicopus ruber</i>	Greater Flamingo	Near Threatened	-	Specially Protected	Wetland habitats	Low	No suitable habitat present.
Pteroclididae	<i>Pterocles gutturalis</i>	Yellow-throated Sandgrouse	Near Threatened	-	Specially Protected	Savanna habitats	Moderate	Suitable habitat is present
Rostratulidae	<i>Rostratula benghalensis</i>	Greater-painted Snipe		-	Specially Protected	Wetland habitats	Low	No suitable habitat present.
Sagittariidae	<i>Sagittarius serpentarius</i>	Secretarybird	Vulnerable	-	Specially Protected	Grassland and savanna habitats	Low	Limited suitable habitat present and high levels of disturbance
Tytonidae	<i>Tyto capensis</i>	African Grass Owl	Vulnerable	Vulnerable	-	Grassland and wetland habitats	Low	No suitable habitat present.
*Habitat preferences as per Roberts VII Multimedia								

5.5.3. Herpetofauna (Reptiles and Amphibians)

Based historic distribution ranges presented in literature, 23 amphibian (Du Preez and Carruthers, 2009) and 73 reptile species (Bates et al., 2014) potentially occurring in the study area (refer to Appendix D). Of these, four reptile and four amphibian species were recorded at Bakubung Platinum Mine by De Castro and Brits (2016b) – these are listed in Table 8. No reptiles or amphibians were recorded during the 2021 field visit.

The African Bullfrog (*Pyxicephalus edulis*), which De Castro and Brits (2016b) reported from a previous study, is listed as Protected and Specially Protected according to the NEMBA ToPS (2007) and North West Biodiversity Management Act (Act No. 4 of 2016), respectively. The remaining seven herpetofauna taxa are common and widespread species in grassland and savanna habitats.

Two other herpetofauna of conservation concern potentially occur in the study area:

- The Southern African Python (*Python natalensis*) is not listed as threatened, but it is listed as Protected in terms of the NEMBA ToPS (2007) list. This species is found in a wide variety of habitats, but typically prefers riverine and rocky areas in savanna habitats (Bates et al., 2014). The probability of this species occurring in the study area is considered moderate, as there is potential suitable habitat present; and
- The Giant Bullfrog (*Pyxicephalus adspersus*) is also not listed as threatened, but it is listed as Protected (NEMBA ToPS, 2007). Giant Bullfrog favour seasonal shallow, grassy pans and vleis in open, flat areas of grassland and savanna (du Preez and Carruthers, 2009). The probability of this species occurring in the study area is considered low, as there is little suitable habitat present.

Table 8: Herpetofauna recorded at Bakubung Platinum Mine by De Castro and Brits (2016b).

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status
Reptiles				
Family Elapidae				
Mozambique Spitting Cobra	<i>Naja mossambica</i>	Least Concern	-	-
Family Scincidae				
Striped Skink	<i>Trachylepis striata</i>	Least Concern	-	-
Variable Skink	<i>Trachylepis varia</i>	Least Concern	-	-
Family Viperidae				
Puffadder	<i>Bitis arietans</i>	Least Concern	-	-
Amphibians				
Family Bufonidae				
Guttural Toad	<i>Amietophrynus gutturalis</i>	Least Concern	-	-
Raucous Toad	<i>Amietophrynus rangeri</i>	Least Concern	-	-
Family Pyxicephalidae				

African Bullfrog	<i>Pyxicephalus edulis</i>	Least Concern	Protected	Specially Protected
Common River Frog	<i>Amieta angolensis</i>	Least Concern	-	-

5.6. Key Ecological Processes and Attributes

5.6.1. Landscape Linkages and Corridors

As a formal protected area, characterised by diverse habitats and an intact fauna assemblage, Pilanesberg Game Reserve is vitally important in biodiversity conservation in the North West Province. Areas of undeveloped natural and semi-natural habitat that surround the reserve play a vital role supporting and buffering the ecological processes within the reserve. Amongst other traits, habitat patches in the surrounding landscape are likely act as movement and dispersal corridors or 'stepping stones' for certain fauna and flora.

The landscape immediately surrounding the study area and the Frischgewaagd section comprises a mosaic of completely modified/transformed land (urban and mining) and areas of natural and semi-natural habitat. Numerous linear developments, such as large arterial roads, informal gravel roads/tracks, security and farm fences, and large electrical power lines, further fragment the landscape.

Land to the north and west of the study area (i.e., between the study area and the Pilanesberg Game Reserve) comprises the Ledig residential area. Little natural habitat is present, and where it does occur, it is typically disturbed by anthropogenic activities. Undeveloped patches in Ledig that were noted include two narrow drainage lines (shown in Figure 2, also see Figure 17). These extend southward through Ledig, and bypass the study area to the west and east of the Frischgewaagd section, before joining the Elands River. Although disturbed, they are likely to act as potential corridors between Pilanesberg Game Reserve, the Elands River and undeveloped areas to the south of the Frischgewaagd section. They may therefore be of ecological importance at a landscape-scale. Neither however, is likely to be impeded by the proposed development of the TSF in the study area or other planned infrastructure at Frischgewaagd.

The Elands River is located to the south of the study area (Figure 18). At this point, the river is characterised by a fairly broad river channel, flanked by riparian woodland. Most of the land to the south of the river comprises undeveloped, albeit fragmented savanna habitat. The Elands River will act as an important movement and dispersal corridor in the landscape. The proposed development of the study area is however, unlikely to affect the functionality of the Elands River as an ecological corridor. To maintain landscape connectivity, it is important that the land adjacent to the river in the Frischgewaagd section (i.e., between the new entrance road and the river) is designated a no-go area and strictly managed as a natural habitat corridor.



Figure 17: Drainage line in the Ledig residential settlement, located north-west of the Frischgewaagd section. The drainage line is flanked by homesteads. The mountains in the background are part of the Pilanesberg Game Reserve.



Figure 18: The Elands River to the south of the study area.

5.6.2. Key Ecological Processes and Drivers of Change

The following notes describe the key processes and drivers of change that are likely to be present in the landscape and their possible influence on the character of the terrestrial ecology of the study area.

Fire

Fire is a key determinant of savanna ecosystem dynamics as it is a dominant driver of spatial and temporal heterogeneity across the landscape (Du Toit et al., 2003). Through the large-scale and periodic removal of plant material, fire influences tree-grass ratios and plant species mixes (fire tolerant vs fire intolerant species) and therefore plays a key role determining vegetation structure, composition and function (Du Toit et al., 2003).

Based on the abundance of moribund grass material observed during the 2021 field visit, fire appears to be an irregular occurrence in the study area, and is probably actively excluded by mine management. Moreover, it is expected that the numerous vehicle roads/tracks, pedestrian paths and concrete stormwater drains that are present in the landscape surrounding the study area are likely to function as effective firebreaks, limiting the encroachment of fire from neighbouring properties onto the study area. The exclusion of fire or reduction in its frequency is likely to lead to an increase shade and moribund tolerant grass species and a general increase in the abundance of woody species.

Grazing by Ungulates

Overgrazing is a common cause of dryland degradation, leading to one or several recognised syndromes (Scholes, 2009). It occurs when grazing herbivores (both wildlife and domestic) are kept at excessive stocking rates and/or are able to concentrate their grazing to a limited foraging area without suitable rest periods. A common syndrome that can be linked to overgrazing, at least in part, is a change in plant species composition, that manifests as a combination of bush encroachment, a reduction in palatable grasses, and a reduction in grass productivity (Scholes, 2009).

It is likely that historic grazing has affected the composition of vegetation in the study area, as well as across most of the surrounding landscape. However, it is understood that currently grazing livestock, such as cattle and goats, are actively excluded from the Frischgewaagd section. Herbivory

is therefore unlikely to be a key ecosystem driver in the study area. This coupled with the absence of fire, is likely to favour flora species that are tolerant of underutilised savanna.

6. Impact Assessment

The methodology used for the impact assessment was the standard Knight Piésold impact assessment methodology. The methodology is described in more detail in Section 6.1, with the results of the impact assessment presented in Section 6.2.

6.1. Impact Assessment Methodology

6.1.1. Defining the Nature of the Impact

An impact is essentially any change to a resource or receptor brought about by the presence of the proposed project component or by the execution of a proposed project related activity. The terminology used to define the nature of an impact is detailed in Table 9.

Table 9: Impact Nature

Term	Definition
Positive (+)	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Negative (-)	An impact that is considered to represent an adverse change from the baseline or introduces a new undesirable factor.
Direct impact (D)	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (e.g., between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
Indirect impact (I)	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g., in-migration for employment placing a demand on resources).
Cumulative impact (C)	Impacts that act together with other impacts (including those from concurrent or planned future third-party activities) to affect the same resources and/or receptors as the Project.

6.1.2. Assessing Impact Significance

The Knight Piésold's impact significance rating system is based on the following equation:

$$\text{Significance of Environmental / Social Impact} = \text{Consequence} \times \text{Probability}$$

The consequence of an impact can be derived from the following factors:

- **Severity / Magnitude** – the degree of change brought about in the environment
- **Reversibility** - the ability of the receptor to recover after an impact has occurred
- **Duration** - how long the impact may be prevalent
- **Spatial Extent** - the physical area which could be affected by an impact.

The severity, reversibility, duration, and spatial extent are ranked using the criteria indicated in Table 10 and then the overall consequence is determined by adding up the individual scores and multiplying it by the overall probability (the likelihood of such an impact occurring). Once a score has been determined, this is checked against the significance descriptions indicated in Table 11.

Table 10: Ranking Criteria

Severity / magnitude (M)	Reversibility (R)	Duration (D)	Spatial extent (S)	Probability (P)
<p>5 – Very high – The impact causes the characteristics of the receiving environment/ social receptor to be altered by a factor of 80 – 100 %</p>	<p>5 – Irreversible – <u>Environmental</u> - where natural functions or ecological processes are altered to the extent that it will permanently cease. <u>Social</u>- Those affected will not be able to adapt to changes and continue to maintain-pre impact livelihoods.</p>	<p>5 – Permanent - Impacts that cause a permanent change in the affected receptor or resource (e.g., removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.</p>	<p>5 – International - Impacts that affect internationally important resources such as areas protected by international conventions, international waters etc.</p>	<p>5 – Definite - The impact will occur.</p>
<p>4 – High – The impact alters the characteristics of the receiving environment/ social receptor by a factor of 60 – 80 %</p>		<p>4 – Long term - impacts that will continue for the life of the Project, but ceases when the Project stops operating.</p>	<p>4 – National - Impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences.</p>	<p>4 – High probability – 80% likelihood that the impact will occur</p>
<p>3 – Moderate – The impact alters the characteristics of the receiving environment/ social</p>	<p>3 – Recoverable <u>Environmental</u> - where the affected environment is altered but natural functions and ecological processes may</p>	<p>3 – Medium term - Impacts are predicted to be of medium duration (5 – 15 years)</p>	<p>3 – Regional - Impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by</p>	<p>3 – Medium probability – 60% likelihood that the impact will occur u</p>

receptor by a factor of 40 – 60 %	continue or recover with human input. <i>Social</i> - Able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support or intervention.		administrative boundaries, habitat type/ecosystem.	
2 – Low – The impact alters the characteristics of the receiving environment/ social receptor by a factor of 20 – 40 %		2 – Short term - Impacts are predicted to be of short duration (0 – 5 years)	2 – Local - Impacts that affect an area in a radius of 2 km around the site.	2 – Low probability - 40% likelihood that the impact will occur
1 – Minor – The impact causes very little change to the characteristics of the receiving environment/ social receptor and the alteration is less than 20 %	1 – Reversible <i>Environmental</i> - The impact affects the environment in such a way that natural functions and ecological processes are able to regenerate naturally. <i>Social</i> - People/ communities are able to adapt with relative ease and maintain pre-impact livelihoods.	1 – Temporary - Impacts are predicted to intermittent/ occasional over a short period.	1 – Site only - Impacts that are limited to the site boundaries.	1 – Improbable - 20% likelihood that the impact will occur

Table 11: Significance Definitions

Score According to Impact Assessment Matrix	Significance Definitions	Colour Scale Ratings	
		Negative Ratings	Positive Ratings
Between 0 and 29 significance points indicate Low Significance	An impact of low significance is one where an effect will be experienced, but the impact magnitude is sufficiently small and well within accepted standards, and/or the receptor is of low sensitivity/value.	Low	Low
Between 30 and 59 significance points indicate Moderate Significance	An impact of moderate significance is one within accepted limits and standards. The impact on the receptor will be noticeable and the normal functioning is altered, but the baseline condition prevail, albeit in a modified state. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is As Low As Reasonably Practicable (ALARP). This does not necessarily mean that “moderate” impacts have to be reduced to “low” impacts, but that moderate impacts are being managed effectively and efficiently to not exceed accepted standards.	Moderate	Moderate
60 to 100 significance points indicate High Significance	An impact of high significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An impact with high significance will completely modify the baseline conditions. A goal of the ESIA process is to get to a position where the Project does not have any high negative residual impacts, certainly not ones that would endure into the long term or extend over a large area. However, for some aspects there may be high residual impacts after all practicable mitigation options have been exhausted (i.e., ALARP has been applied). It is then the function of regulators and stakeholders to weigh such negative factors against the positive factors, such as employment, in coming to a decision on the Project.	High	High

6.1.3. Mitigation and Residual Impacts

It is expected that for the identified significant impacts, the project team will work with the client in identifying suitable and practical mitigation measures that are implementable. Mitigation that can be incorporated into the Project design in order to avoid or reduce the negative impacts or enhance the positive impacts will be developed. A description of these mitigation measures will also be included within the Environmental Authorisation (EA) and Waste Management Licence (WML) amendment Report.

Residual impacts are those impacts which remain once the mitigation measures have been designed and applied. Once the mitigation is applied, each impact is re-evaluated (assuming that the mitigation measure is effectively applied) and any remaining impact is rated once again using the process outlined above. The result is a significance rating for the residual impact.

6.2. Identification and Assessment of Impacts

Several potential negative impacts on terrestrial ecology have been identified for the proposed project. These are:

- Habitat loss and modification;
- Habitat fragmentation;
- Establishment and spread of alien invasive species;
- Soil erosion and sedimentation of drainage features;
- Mortality and disturbance of fauna; and
- Loss and disturbance of species of conservation importance.

Based on the terrestrial ecology of the study area and surrounding landscape, the character and significance of each identified impact was assessed. The results of the assessment are described in Sections 6.2.1 to 6.2.6, with the rating calculations presented in Table 12.

6.2.1. Habitat Loss and Modification

Impact: Habitat loss and modification

Impact Character

Habitat loss refers to the removal of natural habitat. In terrestrial ecosystems this occurs through the vegetation clearing and earth works during construction. The immediate impact is the destruction of flora and fauna occurring in the development footprint.

Habitat modification occurs when natural habitat is degraded or disturbed to the extent that it is compositionally and structurally dissimilar to reference habitat conditions. In severe cases of habitat modification, the mix of functional species-types is altered and ecosystem functioning is impaired as a result.

Both habitat loss and modification can lead to the impairment of ecosystem function at broader landscape scales, if remaining habitat is insufficient in size and heterogeneity to sustain ecological processes (also refer to habitat fragmentation).

Impact in Relation to Project

Direct habitat loss is the foremost **negative** impact of the proposed project, with approximately 31.52 ha of vegetation, comprising 12.40 ha of Secondary Vegetation and 19.12 ha of Marikana Thornveld likely to be completely cleared during the construction phase of the project. This impact is rated separately for the two main vegetation communities:

Marikana Thornveld

Prior to mitigation, this impact will have a **very high** magnitude and a **permanent** duration score. The spatial extent of the impact will be **local** and the probability of occurrence is **definite**. The reversibility of the impact is **irreversible**. Prior to mitigation, habitat loss and modification of Marikana Thornveld is rated an impact of **high** significance (score 85).

Due to the nature of the proposed TSF development, habitat loss is difficult to avoid or significantly mitigate. Steps however, can be taken to reduce the overall significance during all phases, but particularly during closure. With successful stabilisation and rehabilitation, impact magnitude can be reduced to **high**. Impact probability and duration will remain **definite** and **permanent**, respectively, while its spatial extent can be maintained at the **site only**. After mitigation, the impact score of habitat loss and modification of Marikana Thornveld is reduced (score 75), but remains an impact of **high** significance.

Secondary Vegetation

Prior to mitigation, this impact will have a **high** magnitude and a **permanent** duration score. The spatial extent of the impact will be **local** and the probability of occurrence is **definite**. With active intervention during the closure phase, the reversibility of the impact is partly **recoverable**. Prior to mitigation, habitat loss and modification of Secondary Vegetation is rated an impact of high significance.

With successful rehabilitation, impact magnitude can be reduced to **moderate**, with reversibility rated as **recoverable**. Impact probability and duration will be **high** and **long-term**, respectively, while its spatial extent can be maintained at **site only**. After mitigation, habitat loss and modification of Secondary Vegetation is rated an impact of **moderate** significance.

6.2.2. Habitat Fragmentation

Impact: Habitat fragmentation

Impact Character

Habitat fragmentation occurs when habitat loss and modification cause the breakup of available natural habitat into smaller, discontinuous and often isolated habitat patches. The ecological properties of remaining habitats patches are altered as a consequence, which negatively affects various important landscape-scale ecological processes, such propagule (seed) dispersal and fauna movement.

Impact in Relation to Project

The study area is an area of natural and semi-natural habitat. It is however, located in an operational mine characterised by large areas of transformation. The mine is enclosed by a razor-fence and numerous roads, tracks, pedestrian paths and stormwater features fragment the land surrounding the study area.

This impact is rated of **high** magnitude that is **irreversible** before mitigation. It will be a **permanent** impact, with a **local** spatial extent and a **high probability**. Prior to mitigation, habitat fragmentation is rated an impact of **high** significance.

With successful rehabilitation during the closure phase, the creation of secondary and supporting (corridor) habitats may restore some landscape connectivity that was lost due to fragmentation. This impact is therefore **recoverable** and rated of **moderate** magnitude after mitigation. Impact probability will be **high** and duration **long-term**, but spatial extent is likely to remain **local**. After mitigation, habitat fragmentation is rated an impact of **moderate** significance.

6.2.3. Establishment and Spread of Alien Invasive Species

Impact: Establishment and spread of alien invasive species

Impact Character

Disturbances caused by vegetation clearing and earth works can create conditions conducive to the establishment and spread of alien invasive vegetation. Alien plant infestations can spread exponentially, suppressing or replacing indigenous vegetation. This may result in a breakdown of ecosystem functioning and a loss of biodiversity.

Impact in Relation to Project

Although no declared alien invasive flora species were recorded in the study area, several species have been previously recorded in the landscape surrounding the study area. Large-scale disturbances from vegetation clearing and earth works are likely to facilitate the local establishment and spread of alien invasive species.

Before mitigation, impact magnitude is **high**, while duration is **long term** and it has a **high probability**. The spatial extent of alien invasive species spread is **local**, but it is **reversible**. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of **moderate** significance.

With the implementation of active control across all stages of the proposed project, coupled with active revegetation during closure, this impact can be reduced to a **minor** magnitude, with a **temporary** duration. Spatial extent will be maintained at the **site only** and probability at **low**. After mitigation this impact is rated to be of **low** significance.

6.2.4. Soil Erosion and Sedimentation of Drainage Features

Impact: Soil erosion and sedimentation of drainage features

Impact Character

Disturbance to existing vegetation coupled with earth works during construction, could lead to increase in soil erosion. Eroded material could mobilise and lead to increases in sediment load in adjacent drainage features.

Impact in Relation to Project

Before mitigation, this **reversible** impact is rated as having a **moderate** magnitude and **medium-term** duration. It is likely to have a **local** spatial extent and a **medium** probability of occurring. This results in an impact significance of **low** prior to mitigation.

After **mitigation**, this impact can be reduced to a **minor** magnitude, with a **temporary** duration. Spatial extent will be maintained at the **site only** and probability at **low**. After mitigation, possible soil erosion and sedimentation is rated an impact of **low** significance.

6.2.5. Mortality and Disturbance of Fauna

Impact: Killing or injuring of fauna

Impact Character

Large or mobile fauna will move off to avoid disturbances caused by construction activities. However, smaller and less mobile species may be trapped, injured and killed during vegetation clearing and earth works. Susceptible fauna includes amongst others, burrowing mammals (e.g., moles, rodents), nesting birds, reptiles and amphibians.

Other common causes of fauna death or injury include:

- Vehicle collisions along access roads;
- Hunting and snaring of larger fauna; and
- Trapping of fauna in fences, excavations and trenches.

Impact in Relation to Project

Vegetation clearing and earth works during construction are likely to lead to the death/injury of small and/or less mobile fauna, such as rodents, nesting birds and small reptiles.

Before mitigation, impact magnitude is **moderate**, while duration is **short term** and it has a **medium probability**. The spatial extent of alien invasive species spread is restricted to the **site only**, but it is **irreversible**. Prior to mitigation, the mortality and disturbance of fauna is rated an impact of **moderate** significance.

After mitigation, which includes active supervision during the construction phase, this impact becomes recoverable and can be reduced to a **low** magnitude, with a **temporary** duration. Spatial extent will be maintained at the **site only** and probability at **low**. After mitigation the killing or injuring of fauna is rated to be of **low** significance.

6.2.6. Loss and Disturbance of Species of Conservation Concern.

Impact: Loss and disturbance of species of conservation concern

Impact Character

Various project activities and their associated ecological impacts can lead to the loss or disturbance of species of conservation concern. Typical examples include, *inter alia*:

- Vegetation clearing and earth works can result in the direct destruction of both flora and fauna species of conservation concern; and
- Habitat loss, modification and fragmentation may render remaining habitat patches less acceptable to sensitive species, which may result in a reduction in species populations.

Impact in Relation to Project

No species of conservation concern have been recorded in the study area. There is however, a moderate probability that certain species may be present and/or occasionally move through the area in the case of fauna.

Before mitigation, impact magnitude is **high**, while duration is **medium term** and it has a **medium probability**. The spatial extent of the impact is **local**, but it is partly **reversible**. Prior to mitigation, this impact is rated of **moderate** significance.

With the implementation of proposed mitigation measures, this impact can be reduced to a **low** magnitude, with a **short-term** duration. Spatial extent will be maintained at the **site only** and probability at **low**. After mitigation this impact is rated to be of **low** significance.

Table 12: Rating of impacts on terrestrial flora and fauna

Project activity or issue	Potential impact	Nature of impact		Significance before mitigation						SP	Significance after mitigation as per EMP						SP
		+ / -	D//C	M	R	D	S	P	TOTAL		M	R	D	S	P	TOTAL	
Terrestrial Flora and Fauna																	
Vegetation clearing and earth works	Habitat loss and modification - Marikana Thornveld.	-	D	5	5	5	2	5	85	H	4	5	5	1	5	75	H
Vegetation clearing and earth works	Habitat loss and modification - Secondary Vegetation.	-	D	4	3	5	2	5	70	H	3	3	4	1	4	44	M
Vegetation clearing and earth works	Habitat fragmentation.	-	C	4	5	5	2	4	64	H	3	3	4	2	4	48	M
Vegetation clearing and earth works	Establishment and spread of alien invasive species.	-	I	4	1	4	2	4	44	M	1	1	1	1	2	8	L
Vegetation clearing and earth works	Soil erosion and sedimentation of drainage features.	-	I	3	1	3	2	3	27	L	1	1	1	1	2	8	L
Vegetation clearing and earth works, vehicle collisions, trapping in fences, excavations and trenches.	Mortality and disturbance of fauna.	-	D	3	5	2	1	3	33	M	1	3	1	1	2	12	L
All project related activities	Loss and disturbance of species of conservation concern.		D	4	5	3	2	3	42	M	2	3	2	1	2	16	L

6.3. Notes on Cumulative Impacts

Hansen and DeFries (2007) note that because the spatial domains of many ecological processes operate at broad-scales, land use changes in a portion of an ecosystem can cause a rescaling of the ecosystem as a whole, and result in changes in overall function. Development projects that cause habitat transformation and degradation may thus have negative ecological impacts that extend beyond the immediate project boundary.

Considering its size and location within an existing mining operation, the development of the TSF at Bakubung Platinum Mine is unlikely, in and of itself, to result in a significant attenuation of ecological processes at the landscape scale. It is noted however, that the broader landscape is spatially complex and characterised by large areas that have been transformed or disturbed. Remaining areas of undeveloped natural and semi-natural habitat in the landscape are therefore important in supporting and buffering the ecological process within nearby Pilanesberg Game Reserve.

The cumulative impact of the progressive loss and disturbance of natural habitat in the landscape surrounding Pilanesberg from urbanisation, mining and agriculture, is likely to negatively impact on the ability of the broader landscape to maintain the ecological supporting and buffering role that is important to the ecosystem dynamics of the reserve. This in turn, may negatively impact the integrity and ecological processes within the reserve.

7. Recommended Ecological Mitigation Measures

Proposed mitigation measures for reducing the significance of potential ecological impacts are detailed in Table 13. It is recommended that these are included in the proposed project's environmental management programme (EMP).

Table 13: Recommended ecological mitigation measures

Potential Impact	Mitigation Measures
Habitat loss and modification	<p><i>Minimisation</i></p> <ul style="list-style-type: none"> • Vegetation clearing should be restricted to the proposed TSF footprints only, with no clearing permitted outside of this area; • The footprint to be cleared should be clearly demarcated prior to construction to prevent unnecessary clearing outside of this area; <p><i>Rehabilitation</i></p> <ul style="list-style-type: none"> • Removed topsoil should be stockpiled and used to rehabilitate the TSF; • A suitable rehabilitation programme should be developed and implemented for all areas that were disturbed during construction, as well as the TSF. The programme should include: <ul style="list-style-type: none"> ○ Concurrent rehabilitation, if possible; ○ Stabilisation and active revegetation of all disturbed areas using locally-occurring indigenous grass and tree species that are known to be common in Marikana Thornveld.

Habitat fragmentation	<p><i>Minimisation</i></p> <ul style="list-style-type: none"> • The open undeveloped natural habitat located to the south of the study area (i.e., between the new entrance road and Elands River) should be managed as a no-go natural corridor. No development or any form of disturbance should be permitted in this area; and • See additional proposed mitigation measures for ‘Habitat loss and modification.’
Establishment and spread of alien invasive species	<p><i>Minimisation</i></p> <p>An alien invasive species control programme specific to the TSF must be developed and/or incorporated in the mine’s broader alien invasive species control programme. It should be implemented during all phases of the proposed project. It is recommended that the programme include:</p> <ul style="list-style-type: none"> • A combined approach using both chemical and mechanical control methods; • Periodic follow-up treatments, informed by regular monitoring; and • Monitoring should take place in all disturbed areas, as well as adjacent undisturbed areas. <p><i>Rehabilitation</i></p> <ul style="list-style-type: none"> • Rehabilitate all sites that were disturbed during the construction phase, as per the rehabilitation programme; and • Rehabilitate all disturbed footprints during the closure and rehabilitation phases, as per the rehabilitation programme.
Mortality and disturbance of fauna	<p><i>Avoidance and Minimisation</i></p> <p><u>Death / injury during vegetation clearing and earth works</u></p> <ul style="list-style-type: none"> • An ECO should be on-site during vegetation clearing to monitor and manage any wildlife-human interactions. The ECO should be trained in <i>inter alia</i>, snake handling and species identification; • As appropriate, fences should be erected to prevent fauna gaining access to construction and operational areas where they may be killed or injured. <p><u>Vehicle-wildlife collisions</u></p> <ul style="list-style-type: none"> • A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions. <p><u>Hunting, snaring and poisoning</u></p> <ul style="list-style-type: none"> • The handling, poisoning and killing of on-site fauna by mine workers and contractors must be strictly prohibited; and • Employees and contractors should be made aware of the presence of, and rules regarding fauna through suitable induction training and on-site signage.
Soil erosion and sedimentation of drainage features	<p><i>Avoidance and Minimisation</i></p> <ul style="list-style-type: none"> • Prior to construction, erosion prevention measures should be installed at all site where erosion is likely to occur. Measures should include:

	<ul style="list-style-type: none"> ○ Low berms on approach and departure slopes to prevent flow concentration; ○ Sediment barriers along the lower edge of bare soil areas, ● Sediment traps should be installed across drainage lines and storm water channels to the south of the proposed TSF footprint where increased sedimentation is likely to become an issue. Sediment traps should be regularly maintained to ensure functionality. <p><i>Rehabilitation</i></p> <ul style="list-style-type: none"> ● Any areas cleared of vegetation during construction should be stabilised and revegetated using indigenous grass species.
Loss and disturbance of species of conservation concern	<p><i>Avoidance and Minimisation</i></p> <p><u>Fauna</u></p> <ul style="list-style-type: none"> ● See recommended mitigation measures for ‘Mortality and disturbance of fauna’. <p><u>Flora</u></p> <ul style="list-style-type: none"> ● A grid survey of the proposed TSF footprint should be conducted prior to vegetation clearing to ensure that there are no flora species of conservation concern present; ● If flora species of conservation concern are encountered: <ul style="list-style-type: none"> ○ A suitable <i>ex situ</i> conservation plan should be developed under consultation with the relevant authority. This is likely to include the relocation of plants (under permit) to an adjacent area of natural vegetation that is unlikely to be disturbed in the future; and/or ○ Clearing permits should be obtained from the relevant authority to cleared protected trees.

8. Summary and Conclusions

The proposed TSF footprint is approximately 32 ha in extent and located within the Frischgewaagd section of Bakubung Platinum Mine. The Pilanesberg Game Reserve is located about 2.6 km north of the study area and is a regionally important conservation area. The residential settlement of Ledig is located between the study area and the reserve.

Based on Mucina and Rutherford’s (2011) delineation of South Africa’s regional vegetation types, the study area falls within Zeerust Thornveld. However, De Castro and Brits (2016a) indicate that vegetation across the Frischgewaagd section more closely approximates Marikana Thornveld, which is regarded as a Vulnerable Ecosystem. According to the North West Province’s Biodiversity Sector Plan (NW BSP, 2015), the study area and most of the surrounding landscape are designated Critical Biodiversity Area Category 2 (CBA 2). The stated rationale for this designation includes ‘Natural Corridor Linkage’ and ‘Natural Protected Area Buffer’ (NW BSP, 2015). This references the proximity of Pilanesberg in the landscape and the role that surrounding undeveloped land has in providing ‘ecological support’ to the reserve. It is noted that the study area is located entirely within the

mining rights area of the operational Bakubung Platinum Mine. It is surrounded by existing and planned mine infrastructure and facilities.

Two main vegetation communities were recognised in the study area; Secondary Vegetation and Marikana Thornveld. Secondary Vegetation dominates the northern portion of the study area. This area was subject to disturbances, probably related to agricultural and livestock grazing, in the past, and is mostly characterised by vegetation in an advanced stage of secondary succession. A notable feature in this community in the north-east corner of the study area is a suspected old topsoil deposit. This feature is highly disturbed and dominated by ruderal weedy species, many of which are alien. Excluding this feature, adjacent areas of secondary vegetation are considered to have moderate botanical biodiversity conservation value and sensitivity (De Castro and Brits, 2016a).

The remainder of the study area comprises Marikana Thornveld, with De Castro and Brits (2016a) recognising two forms; Mixed Bushland, Woodland and Thicket; and, *Acacia mellifera* Bushland and Thicket. This community comprises short, open to closed woodland, with a well-developed grass layer. Although portions are disturbed, it is considered to have a high botanical biodiversity conservation value and sensitivity (De Castro and Brits, 2016a). The study area does provide habitat for a variety of fauna taxa, including several common and widespread mammals, birds and herpetofauna species. It is not however, considered to contain critically important life-cycle habitats for fauna.

Of the identified negative impacts, habitat loss and modification resulting from vegetation clearing and earth works during construction is the primary impact of concern. The entire TSF footprint will be cleared, leading to a loss of Marikana Thornveld, as well as Secondary Vegetation. The loss of the former is considered to be an impact of high significance. Additional impacts that will need to be managed during all phases of the proposed project include the spread of alien invasive species, the erosion and sedimentation of drainage features and the killing or injuring of fauna. Although several flora and fauna species of conservation concern potentially occur in the surrounding landscape, none were recorded in the study area. The impact of the proposed TSF development on species of conservation concern is thus considered of low significance with correct management.

Several management measures have been identified to mitigate the significance of all the identified ecological impacts. It is important that these are actively implemented during the appropriate project phase.

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Appendix A: Flora species identified in the study area during the 2021 field visit

Family	Species Name	Marikana Thornveld	Secondary Vegetation
Acanthaceae	<i>Crabbea angustifolia</i>	X	
Acanthaceae	<i>Crabbea hirsuta</i>	X	
Acanthaceae	<i>Ruellia patula</i>	X	
Amaranthaceae	<i>Kyphocarpa angustifolia</i>	X	
Amaryllidaceae	<i>Crinum cf. lugardiae</i>	X	
Anacardiaceae	<i>Searsia lancea</i>	X	X
Anacardiaceae	<i>Searsia pyroides</i> var. <i>pyroides</i>	X	
Apocynaceae	<i>Carissa bispinosa</i>	X	
Apocynaceae	<i>Gomphocarpus fruticosa</i> *		X
Asparagaceae	<i>Asparagus laricinus</i>	X	X
Asparagaceae	<i>Asparagus suaveolens</i>	X	
Asphodelaceae	<i>Aloe davyana</i>	X	
Asphodelaceae	<i>Aloe transvaalensis</i>	X	
Asteraceae	<i>Bidens bipinnata</i> *	X	X
Asteraceae	<i>Bidens pilosa</i> *		X
Asteraceae	<i>Nidorella anomala</i>	X	X
Asteraceae	<i>Nidorella resedifolia</i>		X
Asteraceae	<i>Schkuhria bipinnata</i> *		X
Asteraceae	<i>Tarchonanthus camphoratus</i>	X	
Asteraceae	<i>Tagetes minuta</i> *	X	X
Asteraceae	<i>Zinnia peruviana</i> *	X	X
Boraginaceae	<i>Ehretia rigida</i>	X	
Commelinaceae	<i>Commelina africana</i>	X	
Commelinaceae	<i>Commelina erecta</i>	X	
Convolvulaceae	<i>Ipomoea oblongata</i>	X	
Cyperaceae	<i>Cyperus congestus</i>	X	
Ebenaceae	<i>Diospyros lycioides</i>	X	X
Ebenaceae	<i>Euclea crispa</i>	X	
Ebenaceae	<i>Euclea undulata</i>	X	
Euphorbiaceae	<i>Acalypha indica</i>	X	X
Fabaceae	<i>Dichrostachys cinerea</i>	X	
Fabaceae	<i>Elephantorrhiza elephantina</i>	X	
Fabaceae	<i>Indigofera holubii</i>	X	X
Fabaceae	<i>Rhynchosia nitens</i>	X	X
Fabaceae	<i>Senegalia caffra</i> (=Acacia <i>caffra</i>)	X	
Fabaceae	<i>Senegalia erubescens</i> (=Acacia <i>erubescens</i>)	X	
Fabaceae	<i>Senegalia mellifera</i> (=Acacia <i>mellifera</i>)	X	
Fabaceae	<i>Sesbania bispinosa</i>		X
Fabaceae	<i>Tephrosia capensis</i>	X	
Fabaceae	<i>Vachellia karroo</i> (=Acacia <i>karroo</i>)	X	
Fabaceae	<i>Vachellia tortilis</i> (=Acacia <i>tortilis</i>)	X	X
Hyacinthaceae	<i>Ledebouria marginata</i>	X	

Iridaceae	<i>Gladiolus woodii</i>	X	
Lamiaceae	<i>Syncolostemon pretoriae</i>	X	
Malvaceae	<i>Hibiscus trionum</i>	X	
Menispermaceae	<i>Antizoma angustifolia</i>	X	
Nyctaginaceae	<i>Commicarpus pentandrus</i>	X	
Oleaceae	<i>Olea capensis</i>	X	
Orobanchaceae	<i>Striga asiatica</i>	X	
Orobanchaceae	<i>Striga sp.</i>		
Poaceae	<i>Andropogon shirensis</i>	X	X
Poaceae	<i>Aristida bipartita</i>	X	X
Poaceae	<i>Aristida canescens</i>	X	
Poaceae	<i>Bothriochloa insculpta</i>	X	X
Poaceae	<i>Brachiaria eruciformis</i>	X	
Poaceae	<i>Brachiaria nigropedata</i>	X	
Poaceae	<i>Cymbopogon pospischilii</i> (=C. plurinodis)	X	
Poaceae	<i>Dichanthium annulatum</i>	X	X
Poaceae	<i>Digitaria eriantha</i>	X	
Poaceae	<i>Eragrostis lehmanniana</i>		X
Poaceae	<i>Fingerhuthia africana</i>	X	
Poaceae	<i>Ischaemum afrum</i>	X	X
Poaceae	<i>Melinis repens</i>	X	
Poaceae	<i>Panicum coloratum</i>	X	
Poaceae	<i>Pogonarthria squarrosa</i>	X	
Poaceae	<i>Setaria incrassata</i>		
Poaceae	<i>Setaria sphacelata</i>	X	
Poaceae	<i>Sorghum versicolor</i>	X	
Poaceae	<i>Sporobolus cf. ioclados</i>	X	
Poaceae	<i>Themeda triandra</i>	X	
Poaceae	<i>Trachypogon spicatus</i>	X	
Poaceae	<i>Urochloa mossambicensis</i>	X	
Polygalaceae	<i>Polygala hottentotta</i>		
Rhamnaceae	<i>Ziziphus mucronata</i>	X	
Rhamnaceae	<i>Ziziphus zeyheriana</i>	X	
Tiliaceae	<i>Corchorus asplenifolius</i>	X	
Tiliaceae	<i>Grewia flava</i>	X	
Tiliaceae	<i>Gymnosporia polyacantha</i>		X
Verbenaceae	<i>Lantana rugosa</i>	X	
Unidentified flora	Dicot 1	X	
Unidentified flora	Dicot 2	X	

Appendix B: Mammal species occurring and potentially occurring in the study area, based on literature.

Family	Scientific Name	Common Name	Red List – Regional Status (2016)	NEMBA ToPS List (2013)	Provincial Protected Status
Bathyergidae	<i>Cryptomys hottentotus</i>	Common Mole-rat	Least Concern		
Bovidae	<i>Oreotragus oreotragus</i>	Klipspringer	Least Concern		Specially Protected
Bovidae	<i>Raphicerus campestris</i>	Steenbok	Least Concern		
Bovidae	<i>Sylvicapra grimmia</i>	Common Duiker	Least Concern		
Bovidae	<i>Tragelaphus strepsiceros</i>	Greater Kudu	Least Concern		
Bovidae	<i>Tragelaphus sylvaticus</i>	Southern Bushbuck	Least Concern		Specially Protected
Canidae	<i>Canis mesomelas</i>	Black-backed Jackal	Least Concern		
Canidae	<i>Vulpes chama</i>	Cape Fox	Least Concern	Protected	
Cercopithecidae	<i>Chlorocebus pygerythrus</i>	Vervet Monkey	Least Concern		
Cercopithecidae	<i>Papio ursinus</i>	Chacma Baboon	Least Concern		
Emballonuridae	<i>Taphozous mauritanus</i>	Mauritian Tomb Bat	Least Concern		Specially Protected
Erinaceidae	<i>Atelerix frontalis</i>	South African Hedgehog	Near Threatened	Protected	
Felidae	<i>Caracal caracal</i>	Caracal	Least Concern		Specially Protected
Felidae	<i>Felis nigripes</i>	Black-footed Cat	Vulnerable	Protected	Specially Protected
Felidae	<i>Felis silvestris</i>	African Wildcat	Least Concern		Specially Protected
Felidae	<i>Leptailurus serval</i>	Serval	Near Threatened	Protected	
Galagidae	<i>Galago moholi</i>	Southern Lesser Galago	Least Concern		Specially Protected
Gliridae	<i>Graphiurus murinus</i>	Woodland Dormouse	Least Concern		Specially Protected
Gliridae	<i>Graphiurus platyops</i>	Rock Dormouse	Least Concern		Specially Protected
Herpestidae	<i>Atilax paludinosus</i>	Water Mongoose	Least Concern		
Herpestidae	<i>Cynictis penicillata</i>	Yellow Mongoose	Least Concern		
Herpestidae	<i>Helogale parvula</i>	Dwarf Mongoose	Least Concern		Specially Protected
Herpestidae	<i>Herpestes sanguineus</i>	Slender Mongoose	Least Concern		
Herpestidae	<i>Ichneumia albicauda</i>	White-tailed Mongoose	Least Concern		
Herpestidae	<i>Mungos mungo</i>	Banded Mongoose	Least Concern		
Hipposideridae	<i>Hipposideros caffer</i>	Sundevall's Leaf-nosed Bat	Least Concern		Specially Protected
Hyaenidae	<i>Parahyaena brunnea</i>	Brown Hyaena	Near Threatened	Protected	
Hyaenidae	<i>Proteles cristata</i>	Aardwolf	Least Concern		Specially Protected
Hystricidae	<i>Hystrix africae australis</i>	Cape Porcupine	Least Concern		
Leporidae	<i>Lepus saxatilis</i>	Scrub Hare	Least Concern		
Leporidae	<i>Lepus victoriae</i>	African Savanna Hare	Least Concern		
Leporidae	<i>Pronolagus randensis</i>	Jameson's Red Rock Rabbit	Least Concern		
Macroscelididae	<i>Elephantulus brachyrhynchus</i>	Short-snouted Sengi	Least Concern		Specially Protected

Family	Scientific Name	Common Name	Red List – Regional Status (2016)	NEMBA ToPS List (2013)	Provincial Protected Status
Macroscelididae	<i>Elephantulus myurus</i>	Eastern Rock Sengi	Least Concern		Specially Protected
Manidae	<i>Smutsia temminckii</i>	Temminck's Ground Pangolin	Vulnerable	Vulnerable	
Molossidae	<i>Chaerephon ansorgei</i>	Ansorge's Free-tailed Bat	Least Concern		Specially Protected
Molossidae	<i>Chaerephon pumilus</i>	Little Free-tailed Bat	Least Concern		Specially Protected
Molossidae	<i>Sauromys petrophilus</i>	Flat-headed Free-tailed Bat	Least Concern		Specially Protected
Molossidae	<i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	Least Concern		Specially Protected
Muridae	<i>Acomys spinosissimus</i>	Spiny Mouse	Least Concern		
Muridae	<i>Aethomys chrysophilus</i>	Red Veld Rat	Least Concern		
Muridae	<i>Aethomys ineptus</i>	Tete Veld Rat	Least Concern		
Muridae	<i>Desmodillus auricularis</i>	Short-tailed Gerbil	Least Concern		
Muridae	<i>Gerbilliscus brantsii</i>	Highveld Gerbil	Least Concern		
Muridae	<i>Gerbilliscus leucogaster</i>	Bushveld Gerbil	Least Concern		
Muridae	<i>Lemniscomys rosalia</i>	Single-striped Mouse	Least Concern		
Muridae	<i>Mastomys coucha</i>	Multimammate Mouse	Least Concern		
Muridae	<i>Mastomys natalensis</i>	Natal Multimammate Mouse	Least Concern		
Muridae	<i>Micaelamys namaquensis</i>	Namaqua Rock Mouse	Least Concern		
Muridae	<i>Mus indutus</i>	Desert Pygmy Mouse	Least Concern		
Muridae	<i>Mus minutoides</i>	Pygmy Mouse	Least Concern		
Muridae	<i>Otomys auratus</i>	Vlei Rat (grassland type)	Near Threatened		
Muridae	<i>Rhabdomys pumilio</i>	Xeric Four-striped Mouse	Least Concern		
Muridae	<i>Thallomys nigricauda</i>	Black-tailed Tree Rat	Least Concern		Specially Protected
Muridae	<i>Thallomys paedulus</i>	Tree Rat	Least Concern		
Mustelidae	<i>Aonyx capensis</i>	Cape Clawless Otter	Near Threatened	Protected	Specially Protected
Mustelidae	<i>Hydrictis maculicollis</i>	Spotted-necked Otter	Vulnerable	Protected	
Mustelidae	<i>Ictonyx striatus</i>	Striped Polecat	Least Concern		
Mustelidae	<i>Mellivora capensis</i>	Honey Badger	Least Concern	Protected	
Mustelidae	<i>Poecilogale albinucha</i>	African Striped Weasel	Near Threatened		Specially Protected
Nesomyidae	<i>Dendromus melanotis</i>	Grey Climbing Mouse	Least Concern		
Nesomyidae	<i>Saccostomus campestris</i>	Pouched Mouse	Least Concern		
Nesomyidae	<i>Steatomys krebsii</i>	Krebs's Fat Mouse	Least Concern		Specially Protected
Nesomyidae	<i>Steatomys pratensis</i>	Fat Mouse	Least Concern		
Nycteridae	<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	Least Concern		Specially Protected
Orycteropodidae	<i>Orycteropus afer</i>	Aardvark	Least Concern		Specially Protected

Family	Scientific Name	Common Name	Red List – Regional Status (2016)	NEMBA ToPS List (2013)	Provincial Protected Status
Pedetidae	<i>Pedetes capensis</i>	Springhare	Least Concern		
Procaviidae	<i>Procavia capensis</i>	Rock Hyrax	Least Concern		
Pteropodidae	<i>Eidolon helvum</i>	African Straw-colored Fruit Bat	Least Concern		Specially Protected
Rhinolophidae	<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	Least Concern		Specially Protected
Rhinolophidae	<i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	Least Concern		Specially Protected
Rhinolophidae	<i>Rhinolophus simulator</i>	Bushveld Horseshoe Bat	Least Concern		Specially Protected
Sciuridae	<i>Paraxerus cepapi</i>	Tree Squirrel	Least Concern		
Sciuridae	<i>Xerus inauris</i>	South African Ground Squirrel	Least Concern		
Soricidae	<i>Crocidura cyanea</i>	Reddish-grey Musk Shrew	Least Concern		
Soricidae	<i>Crocidura fuscomurina</i>	Tiny Musk Shrew	Least Concern		
Soricidae	<i>Crocidura hirta</i>	Lesser Red Musk Shrew	Least Concern		
Soricidae	<i>Crocidura mariquensis</i>	Swamp Musk Shrew	Near Threatened		
Soricidae	<i>Crocidura silacea</i>	Lesser Grey-brown Musk Shrew	Least Concern		
Suidae	<i>Phacochoerus africanus</i>	Common Warthog	Least Concern		
Thryonomyidae	<i>Thryonomys swinderianus</i>	Greater Cane Rat	Least Concern		
Vespertilionidae	<i>Myotis tricolor</i>	Temminck's Hairy Bat	Least Concern		
Vespertilionidae	<i>Myotis welwitschii</i>	Welwitsch's Hairy Bat	Least Concern		
Vespertilionidae	<i>Neoromicia capensis</i>	Cape Serotine Bat	Least Concern		
Vespertilionidae	<i>Neoromicia zuluensis</i>	Aloe Bat	Least Concern		
Vespertilionidae	<i>Pipistrellus hesperidus</i>	African Pipistrelle	Least Concern		
Vespertilionidae	<i>Pipistrellus rusticus</i>	Rusty Bat	Least Concern		
Vespertilionidae	<i>Scotophilus dinganii</i>	Yellow House Bat	Least Concern		
Vespertilionidae	<i>Scotophilus viridis</i>	Lesser Yellow House Bat	Least Concern		
Viverridae	<i>Civettictis civetta</i>	African Civet	Least Concern		Specially Protected
Viverridae	<i>Genetta genetta</i>	Small-spotted Genet	Least Concern		
Viverridae	<i>Genetta maculata</i>	Rusty-spotted Genet	Least Concern		

Source: Based on the distribution maps in Stuart and Stuart (2007) and MammalMap records (FitzPatrick Institute of African Ornithology, 2021).

Appendix C: Bird species occurring and potentially occurring in the study area, based on SABAP 2 records and 2021 field trip.

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Recorded in the study area during the 2021 field visit
Abdim's Stork	<i>Ciconia abdimii</i>	Near Threatened		Specially Protected	
Acacia Pied Barbet	<i>Tricholaema leucomelas</i>				
African Black Duck	<i>Anas sparsa</i>				
African Black Swift	<i>Apus barbatus</i>				
African Crake	<i>Creccopsis egregia</i>				
African Cuckoo	<i>Cuculus gularis</i>				
African Darter	<i>Anhinga rufa</i>				
African Firefinch	<i>Lagonosticta rubricata</i>				
African Fish-eagle	<i>Haliaeetus vocifer</i>				
African Grass Owl	<i>Tyto capensis</i>	Vulnerable	Vulnerable		
African Green-pigeon	<i>Treron calvus</i>				
African Grey Hornbill	<i>Tockus nasutus</i>				
African Harrier-Hawk	<i>Polyboroides typus</i>				
African Hawk-eagle	<i>Aquila spilogaster</i>				
African Hoopoe	<i>Upupa africana</i>				
African Jacana	<i>Actophilornis africanus</i>				
African Marsh Harrier	<i>Circus ranivorus</i>	Endangered	Protected	Specially Protected	
African Olive-pigeon	<i>Columba arquatrix</i>				
African Palm-swift	<i>Cypsiurus parvus</i>				
African Paradise-flycatcher	<i>Terpsiphone viridis</i>				
African Pied Wagtail	<i>Motacilla aguimp</i>				
African Pipit	<i>Anthus cinnamomeus</i>				
African Purple Swamphen	<i>Porphyrio madagascariensis</i>				
African Pygmy-Kingfisher	<i>Ispidina picta</i>				
African Quailfinch	<i>Ortygospiza atricollis</i>				
African Red-eyed Bulbul	<i>Pycnonotus nigricans</i>				
African Reed-warbler	<i>Acrocephalus baeticatus</i>				
African Sacred Ibis	<i>Threskiornis aethiopicus</i>				
African Snipe	<i>Gallinago nigripennis</i>				
African Spoonbill	<i>Platalea alba</i>				
African Stonechat	<i>Saxicola torquatus</i>				
African Wattled Lapwing	<i>Vanellus senegallus</i>				
Alpine Swift	<i>Tachymarptis melba</i>				
Amethyst Sunbird	<i>Chalcomitra amethystina</i>				
Amur Falcon	<i>Falco amurensis</i>				
Arrow-marked Babbler	<i>Turdoides jardineii</i>				
Ashy Tit	<i>Parus cinerascens</i>				

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Recorded in the study area during the 2021 field visit
Barn Owl	<i>Tyto alba</i>				
Barn Swallow	<i>Hirundo rustica</i>				X
Barred Wren-warbler	<i>Calamonastes fasciolatus</i>				
Bar-throated Apalis	<i>Apalis thoracica</i>				
Bateleur	<i>Terathopius ecaudatus</i>	Endangered	Vulnerable	Specially Protected	
Bearded Woodpecker	<i>Dendropicos namaquus</i>				
Black Crake	<i>Amaurornis flavirostris</i>				
Black Cuckoo	<i>Cuculus clamosus</i>				
Black Cuckoo-shrike	<i>Campephaga flava</i>				
Black Heron	<i>Egretta ardesiaca</i>				
Black Kite	<i>Milvus migrans</i>				
Black Sparrowhawk	<i>Accipiter melanoleucus</i>				
Black Stork	<i>Ciconia nigra</i>	Vulnerable	Vulnerable	Specially Protected	
Black-backed Puffback	<i>Dryoscopus cubla</i>				
Black-chested Prinia	<i>Prinia flavicans</i>				
Black-chested Snake-eagle	<i>Circaetus pectoralis</i>				
Black-collared Barbet	<i>Lybius torquatus</i>				
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>				X
Black-crowned Tchagra	<i>Tchagra senegalus</i>				
Black-faced Waxbill	<i>Estrilda erythronotos</i>				
Black-headed Heron	<i>Ardea melanocephala</i>				
Black-headed Oriole	<i>Oriolus larvatus</i>				
Black-shouldered Kite	<i>Elanus caeruleus</i>				
Blacksmith Lapwing	<i>Vanellus armatus</i>				X
Black-throated Canary	<i>Crithagra atrogularis</i>				
Black-winged Pratincole	<i>Glareola nordmanni</i>	Near Threatened		Specially Protected	
Black-winged Stilt	<i>Himantopus himantopus</i>				
Blue Crane	<i>Anthropoides paradiseus</i>	Near Threatened	Endangered		
Blue Waxbill	<i>Uraeginthus angolensis</i>				X
Bokmakierie	<i>Telophorus zeylonus</i>				
Booted Eagle	<i>Aquila pennatus</i>				
Bronze Mannikin	<i>Spermestes cucullatus</i>				
Brown Snake-eagle	<i>Circaetus cinereus</i>				
Brown-backed Honeybird	<i>Prodotiscus regulus</i>				
Brown-crowned Tchagra	<i>Tchagra australis</i>				
Brown-hooded Kingfisher	<i>Halcyon albiventris</i>				

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Recorded in the study area during the 2021 field visit
Brown-throated Martin	<i>Riparia paludicola</i>				
Brubru	<i>Nilaus afer</i>				
Buff-spotted Flufftail	<i>Sarothrura elegans</i>				
Buffy Pipit	<i>Anthus vaalensis</i>				
Burchell's Coucal	<i>Centropus burchellii</i>				
Burchell's Starling	<i>Lamprotornis australis</i>				
Burnt-necked Eremomela	<i>Eremomela usticollis</i>				
Bushveld Pipit	<i>Anthus caffer</i>				
Cape Bunting	<i>Emberiza capensis</i>				
Cape Glossy Starling	<i>Lamprotornis nitens</i>				
Cape Longclaw	<i>Macronyx capensis</i>				
Cape Robin-chat	<i>Cossypha caffra</i>				
Cape Rock-thrush	<i>Monticola rupestris</i>				
Cape Sparrow	<i>Passer melanurus</i>				
Cape Turtle-dove	<i>Streptopelia capicola</i>				X
Cape Vulture	<i>Gyps coprotheres</i>	Endangered	Endangered	Specially Protected	
Cape Wagtail	<i>Motacilla capensis</i>				X
Cape White-eye	<i>Zosterops virens</i>				
Capped Wheatear	<i>Oenanthe pileata</i>				
Cardinal Woodpecker	<i>Dendropicos fuscescens</i>				
Cattle Egret	<i>Bubulcus ibis</i>				
Chestnut-backed Sparrowlark	<i>Eremopterix leucotis</i>				
Chestnut-vented Tit-babbler	<i>Parisoma subcaeruleum</i>				X
Chin-spot Batis	<i>Batis molitor</i>				
Cinnamon-breasted Bunting	<i>Emberiza tahapisi</i>				
Cloud Cisticola	<i>Cisticola textrix</i>				
Common (Southern) Fiscal	<i>Lanius collaris</i>				
Common Greenshank	<i>Tringa nebularia</i>				
Common House-martin	<i>Delichon urbicum</i>				
Common Moorhen	<i>Gallinula chloropus</i>				
Common Myna	<i>Acridotheres tristis</i>				X
Common Ostrich	<i>Struthio camelus</i>				
Common Peacock	<i>Pavo cristatus</i>				
Common Quail	<i>Coturnix coturnix</i>				
Common Sandpiper	<i>Actitis hypoleucos</i>				
Common Scimitarbill	<i>Rhinopomastus cyanomelas</i>				
Common Swift	<i>Apus apus</i>				

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Recorded in the study area during the 2021 field visit
Common Waxbill	<i>Estrilda astrild</i>				
Common Whitethroat	<i>Sylvia communis</i>				
Coqui Francolin	<i>Peliperdix coqui</i>				
Crested Barbet	<i>Trachyphonus vaillantii</i>				
Crested Francolin	<i>Dendroperdix sephaena</i>				
Crimson-breasted Shrike	<i>Laniarius atrococcineus</i>				
Crowned Lapwing	<i>Vanellus coronatus</i>				
Cut-throat Finch	<i>Amadina fasciata</i>				
Dark-capped Bulbul	<i>Pycnonotus tricolor</i>				X
Desert Cisticola	<i>Cisticola aridulus</i>				
Diderick Cuckoo	<i>Chrysococcyx caprius</i>				X
Domestic Duck	<i>Anas platyrhynchos</i>				
Double-banded Sandgrouse	<i>Pterocles bicinctus</i>				
Dusky Indigobird	<i>Vidua funerea</i>				X
Egyptian Goose	<i>Alopochen aegyptiacus</i>				
Emerald-spotted Wood-dove	<i>Turtur chalcospilos</i>				
European Bee-eater	<i>Merops apiaster</i>				X
European Roller	<i>Coracias garrulus</i>	Near Threatened		Specially Protected	
Fairy Flycatcher	<i>Stenostira scita</i>				
Familiar Chat	<i>Cercomela familiaris</i>				
Fiery-necked Nightjar	<i>Caprimulgus pectoralis</i>				
Fiscal Flycatcher	<i>Sigelus silens</i>				
Flappet Lark	<i>Mirafraga rufocinnamomea</i>				
Fork-tailed Drongo	<i>Dicrurus adsimilis</i>				
Freckled Nightjar	<i>Caprimulgus tristigma</i>				
Fulvous Duck	<i>Dendrocygna bicolor</i>				
Gabar Goshawk	<i>Melierax gabar</i>				
Giant Kingfisher	<i>Megaceryle maximus</i>				
Glossy Ibis	<i>Plegadis falcinellus</i>				
Golden-breasted Bunting	<i>Emberiza flaviventris</i>				X
Golden-tailed Woodpecker	<i>Campethera abingoni</i>				
Goliath Heron	<i>Ardea goliath</i>				
Great Egret	<i>Egretta alba</i>				
Great Reed-warbler	<i>Acrocephalus arundinaceus</i>				
Great Sparrow	<i>Passer motitensis</i>				
Great Spotted Cuckoo	<i>Clamator glandarius</i>				
Greater Flamingo	<i>Phoenicopterus ruber</i>	Near Threatened		Specially Protected	

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Recorded in the study area during the 2021 field visit
Greater Honeyguide	<i>Indicator indicator</i>				
Greater Kestrel	<i>Falco rupicoloides</i>				
Greater Striped Swallow	<i>Hirundo cucullata</i>				
Greater-painted Snipe	<i>Rostratula benghalensis</i>			Specially Protected	
Green Wood-hoopoe	<i>Phoeniculus purpureus</i>				
Green-backed Heron	<i>Butorides striata</i>				
Green-winged Pytilia	<i>Pytilia melba</i>				
Grey Go-away-bird	<i>Corythaixoides concolor</i>				X
Grey Heron	<i>Ardea cinerea</i>				
Grey Tit-flycatcher	<i>Myioparus plumbeus</i>				
Grey-backed Camaroptera	<i>Camaroptera brevicaudata</i>				
Grey-headed Bush-shrike	<i>Malaconotus blanchoti</i>				
Grey-headed Kingfisher	<i>Halcyon leucocephala</i>				
Groundscraper Thrush	<i>Psophocichla litsipsirupa</i>				
Hadedda Ibis	<i>Bostrychia hagedash</i>				
Half-collared Kingfisher	<i>Alcedo semitorquata</i>	Near Threatened		Specially Protected	
Hamerkop	<i>Scopus umbretta</i>				
Helmeted Guineafowl	<i>Numida meleagris</i>				X
Horus Swift	<i>Apus horus</i>				
House Sparrow	<i>Passer domesticus</i>				
Jackal Buzzard	<i>Buteo rufofuscus</i>				
Jacobin Cuckoo	<i>Clamator jacobinus</i>				
Jameson's Firefinch	<i>Lagonosticta rhodopareia</i>				
Kalahari Scrub-robin	<i>Cercotrichas paena</i>				
Karoo Thrush	<i>Turdus smithi</i>				
Klaas's Cuckoo	<i>Chrysococcyx klaas</i>				
Knob-billed Duck	<i>Sarkidiornis melanotos</i>				
Kori Bustard	<i>Ardeotis kori</i>	Near Threatened	Vulnerable		
Kurrichane Buttonquail	<i>Turnix sylvaticus</i>				
Kurrichane Thrush	<i>Turdus libonyanus</i>				
Lanner Falcon	<i>Falco biarmicus</i>	Vulnerable		Specially Protected	
Lappet-faced Vulture	<i>Torgos tracheliotus</i>	Endangered	Endangered	Specially Protected	
Lark-like Bunting	<i>Emberiza impetuani</i>				
Laughing Dove	<i>Streptopelia senegalensis</i>				X
Lazy Cisticola	<i>Cisticola aberrans</i>				

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Recorded in the study area during the 2021 field visit
Lesser Flamingo	<i>Phoenicopus minor</i>	Near Threatened		Specially Protected	
Lesser Grey Shrike	<i>Lanius minor</i>				
Lesser Honeyguide	<i>Indicator minor</i>				
Lesser Kestrel	<i>Falco naumanni</i>				
Lesser Masked-weaver	<i>Ploceus intermedius</i>				
Lesser Striped Swallow	<i>Hirundo abyssinica</i>				
Lesser Swamp-warbler	<i>Acrocephalus gracilirostris</i>				
Levaillant's Cisticola	<i>Cisticola tinniens</i>				
Levaillant's Cuckoo	<i>Clamator levaillantii</i>				
Lilac-breasted Roller	<i>Coracias caudatus</i>				
Little Bee-eater	<i>Merops pusillus</i>				
Little Bittern	<i>Ixobrychus minutus</i>				
Little Egret	<i>Egretta garzetta</i>				
Little Grebe	<i>Tachybaptus ruficollis</i>				
Little Rush-warbler	<i>Bradypterus baboecala</i>				
Little Sparrowhawk	<i>Accipiter minullus</i>				
Little Swift	<i>Apus affinis</i>				
Long-billed Crombec	<i>Sylvietta rufescens</i>				
Long-tailed Paradise-whydah	<i>Vidua paradisaea</i>				
Long-tailed Widowbird	<i>Euplectes progne</i>				
Magpie Shrike	<i>Urolestes melanoleucus</i>				X
Malachite Kingfisher	<i>Alcedo cristata</i>				
Marabou Stork	<i>Leptoptilos crumeniferus</i>	Near Threatened		Specially Protected	
Marico Flycatcher	<i>Bradornis mariquensis</i>				
Marico Sunbird	<i>Cinnyris mariquensis</i>				
Marsh Owl	<i>Asio capensis</i>				
Marsh Warbler	<i>Acrocephalus palustris</i>				
Martial Eagle	<i>Polemaetus bellicosus</i>	Endangered	Vulnerable	Specially Protected	
Melodious Lark	<i>Mirafraga cheniana</i>				
Meyer's Parrot	<i>Poicephalus meyeri</i>				
Mocking Cliff-chat	<i>Thamnolaea cinnamomeiventris</i>				
Monotonous Lark	<i>Mirafraga passerina</i>				
Mountain Wheatear	<i>Oenanthe monticola</i>				
Namaqua Dove	<i>Oena capensis</i>				
Natal Spurfowl	<i>Pternistis natalensis</i>				
Neddicky	<i>Cisticola fulvicapilla</i>				
Nicholson's Pipit	<i>Anthus nicholsoni</i>				

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Recorded in the study area during the 2021 field visit
Northern Black Korhaan	<i>Afrotis afraoides</i>				
Orange-breasted Bush-shrike	<i>Telophorus sulfureopectus</i>				
Pale Flycatcher	<i>Bradornis pallidus</i>				
Pallid Harrier	<i>Circus macrourus</i>	Near Threatened		Specially Protected	
Pearl-breasted Swallow	<i>Hirundo dimidiata</i>				
Pearl-spotted Owlet	<i>Glaucidium perlatum</i>				
Peregrine Falcon	<i>Falco peregrinus</i>				
Pied Crow	<i>Corvus albus</i>				X
Pied Kingfisher	<i>Ceryle rudis</i>				
Pied Starling	<i>Spreo bicolor</i>				
Pink-backed Pelican	<i>Pelecanus rufescens</i>	Vulnerable	Endangered	Specially Protected	
Pink-billed Lark	<i>Spizocorys conirostris</i>				
Pin-tailed Whydah	<i>Vidua macroura</i>				X
Plain-backed Pipit	<i>Anthus leucophrys</i>				
Purple Heron	<i>Ardea purpurea</i>				
Purple Indigobird	<i>Vidua purpurascens</i>				
Purple Roller	<i>Coracias naevius</i>				
Rattling Cisticola	<i>Cisticola chiniana</i>				X
Red-backed Shrike	<i>Lanius collurio</i>				
Red-billed Firefinch	<i>Lagonosticta senegala</i>				X
Red-billed Oxpecker	<i>Buphagus erythrorhynchus</i>				
Red-billed Quelea	<i>Quelea quelea</i>				
Red-billed Teal	<i>Anas erythrorhyncha</i>				
Red-breasted Swallow	<i>Hirundo semirufa</i>				
Red-capped Lark	<i>Calandrella cinerea</i>				
Red-chested Cuckoo	<i>Cuculus solitarius</i>				
Red-collared Widowbird	<i>Euplectes ardens</i>				
Red-crested Korhaan	<i>Lophotis ruficrista</i>				
Red-eyed Dove	<i>Streptopelia semitorquata</i>				X
Red-faced Mousebird	<i>Urocolius indicus</i>				
Red-headed Finch	<i>Amadina erythrocephala</i>				
Red-headed Weaver	<i>Anaplectes rubriceps</i>				
Red-knobbed Coot	<i>Fulica cristata</i>				
Red-throated Wryneck	<i>Jynx ruficollis</i>				
Red-winged Starling	<i>Onychognathus morio</i>				
Reed Cormorant	<i>Phalacrocorax africanus</i>				
Rock Dove	<i>Columba livia</i>				

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Recorded in the study area during the 2021 field visit
Rock Martin	<i>Hirundo fuligula</i>				
Rose-ringed Parakeet	<i>Psittacula krameri</i>				
Ruff	<i>Philomachus pugnax</i>				
Rufous-cheeked Nightjar	<i>Caprimulgus rufigena</i>				
Rufous-naped Lark	<i>Mirafraga africana</i>				X
Sabota Lark	<i>Calendulauda sabota</i>				
Scaly-feathered Finch	<i>Sporopipes squamifrons</i>				X
Secretarybird	<i>Sagittarius serpentarius</i>	Vulnerable		Specially Protected	
Shaft-tailed Whydah	<i>Vidua regia</i>				
Shikra	<i>Accipiter badius</i>				
Short-toed Rock-thrush	<i>Monticola brevipes</i>				
South African Cliff-swallow	<i>Hirundo spilodera</i>				
South African Shelduck	<i>Tadorna cana</i>				
Southern Black Flycatcher	<i>Melaenornis pammelaina</i>				
Southern Black Tit	<i>Parus niger</i>				
Southern Boubou	<i>Laniarius ferrugineus</i>				
Southern Grey-headed Sparrow	<i>Passer diffusus</i>				
Southern Masked-weaver	<i>Ploceus velatus</i>				X
Southern Pale Chanting Goshawk	<i>Melierax canorus</i>				
Southern Pied Babbler	<i>Turdoides bicolor</i>				
Southern Pochard	<i>Netta erythrophthalma</i>				
Southern Red Bishop	<i>Euplectes orix</i>				X
Southern Red-billed Hornbill	<i>Tockus rufirostris</i>				
Southern Yellow-billed Hornbill	<i>Tockus leucomelas</i>				
Speckled Mousebird	<i>Colius striatus</i>				X
Speckled Pigeon	<i>Columba guinea</i>				
Spike-heeled Lark	<i>Chersomanes albofasciata</i>				
Spotted Eagle-owl	<i>Bubo africanus</i>				
Spotted Flycatcher	<i>Muscicapa striata</i>				
Spotted Thick-knee	<i>Burhinus capensis</i>				
Spur-winged Goose	<i>Plectropterus gambensis</i>				
Squacco Heron	<i>Ardeola ralloides</i>				
Steppe Buzzard	<i>Buteo vulpinus</i>				
Streaky-headed Seedeater	<i>Crithagra gularis</i>				
Striped Kingfisher	<i>Halcyon chelicuti</i>				

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Recorded in the study area during the 2021 field visit
Striped Pipit	<i>Anthus lineiventris</i>				
Swainson's Spurfowl	<i>Pternistis swainsonii</i>				X
Tawny Eagle	<i>Aquila rapax</i>	Vulnerable		Specially Protected	
Tawny-flanked Prinia	<i>Prinia subflava</i>				X
Temminck's Courser	<i>Cursorius temminckii</i>				
Thick-billed Weaver	<i>Amblyospiza albifrons</i>				
Three-banded Plover	<i>Charadrius tricollaris</i>				
Tinkling Cisticola	<i>Cisticola rufilatus</i>				
Verreaux's Eagle	<i>Aquila verreauxii</i>	Vulnerable		Specially Protected	
Verreaux's Eagle-owl	<i>Bubo lacteus</i>				
Village Indigobird	<i>Vidua chalybeata</i>				
Village Weaver	<i>Ploceus cucullatus</i>				
Violet-backed Starling	<i>Cinnyricinclus leucogaster</i>				
Violet-eared Waxbill	<i>Granatina granatina</i>				
Wahlberg's Eagle	<i>Aquila wahlbergi</i>				
Wattled Starling	<i>Creatophora cinerea</i>				
Whiskered Tern	<i>Chlidonias hybrida</i>				
White Stork	<i>Ciconia ciconia</i>				
White-backed Mousebird	<i>Colius colius</i>				
White-backed Vulture	<i>Gyps africanus</i>	Critically Endangered	Endangered	Specially Protected	X
White-bellied Sunbird	<i>Cinnyris talatala</i>				
White-breasted Cormorant	<i>Phalacrocorax carbo</i>				
White-browed Robin-chat	<i>Cossypha heuglini</i>				
White-browed Scrub-robin	<i>Cercotrichas leucophrys</i>				
White-browed Sparrow-weaver	<i>Plocepasser mahali</i>				
White-crested Helmet-shrike	<i>Prionops plumatus</i>				
White-faced Duck	<i>Dendrocygna viduata</i>				
White-fronted Bee-eater	<i>Merops bullockoides</i>				
White-rumped Swift	<i>Apus caffer</i>				
White-throated Robin-chat	<i>Cossypha humeralis</i>				
White-throated Swallow	<i>Hirundo albicularis</i>				
White-winged Tern	<i>Chlidonias leucopterus</i>				
White-winged Widowbird	<i>Euplectes albonotatus</i>				X
Willow Warbler	<i>Phylloscopus trochilus</i>				

Common Name	Scientific Name	Red List Status	NEMBA ToPS Status	Provincial Protected Status	Recorded in the study area during the 2021 field visit
Wing-snapping Cisticola	<i>Cisticola ayresii</i>				
Wood Sandpiper	<i>Tringa glareola</i>				
Woodland Kingfisher	<i>Halcyon senegalensis</i>				
Yellow Canary	<i>Crithagra flaviventris</i>				X
Yellow-bellied Eremomela	<i>Eremomela icteropygialis</i>				
Yellow-bellied Greenbul	<i>Chlorocichla flaviventris</i>				
Yellow-billed Duck	<i>Anas undulata</i>				
Yellow-billed Egret	<i>Egretta intermedia</i>				
Yellow-billed Kite	<i>Milvus aegyptius</i>				
Yellow-billed Stork	<i>Mycteria ibis</i>	Endangered		Specially Protected	
Yellow-crowned Bishop	<i>Euplectes afer</i>				
Yellow-fronted Canary	<i>Crithagra mozambicus</i>				
Yellow-fronted Tinkerbird	<i>Pogoniulus chrysoconus</i>				
Yellow-throated Petronia	<i>Petronia superciliaris</i>				
Yellow-throated Sandgrouse	<i>Pterocles gutturalis</i>	Near Threatened		Specially Protected	
Zitting Cisticola	<i>Cisticola juncidis</i>				
Source: Master list from SABAP2					

Appendix D: Reptiles and amphibian species occurring and potentially occurring in the study area, based on literature.

Reptiles

Family	Scientific Name	Common Name	Red List Status (2014)	NEMBA TOPS List (2007)	Provincial Protected Status	Endemic Status
Agamidae	<i>Acanthocercus atricollis atricollis</i>	Southern Tree Agama	Least Concern			
Agamidae	<i>Agama aculeata distanti</i>	Eastern Ground Agama	Least Concern			Endemic
Agamidae	<i>Agama atra</i>	Southern Rock Agama	Least Concern			Near Endemic
Chamaeleonidae	<i>Chamaeleo dilepis</i>	Flap-neck Chameleon	Least Concern		Specially Protected	
Colubridae	<i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	Least Concern			
Colubridae	<i>Dasypeltis scabra</i>	Rhombic Egg-eater	Least Concern			
Colubridae	<i>Dispholidus typus</i>	Boomslang	Least Concern			
Colubridae	<i>Philothamnus hoplogaster</i>	Green Water Snake	Least Concern			
Colubridae	<i>Philothamnus natalensis occidentalis</i>	Western Natal Green Snake	Least Concern			Endemic
Colubridae	<i>Philothamnus semivariatus</i>	Spotted Bush Snake	Least Concern			
Colubridae	<i>Telescopus semiannulatus semiannulatus</i>	Eastern Tiger Snake	Least Concern			
Colubridae	<i>Thelotornis capensis capensis</i>	Southern Twig Snake	Least Concern			
Cordylidae	<i>Cordylus jonesii</i>	Jone's Girdled Lizard	Least Concern		Specially Protected	
Cordylidae	<i>Cordylus vittifer</i>	Common Girdled Lizard	Least Concern		Specially Protected	Near Endemic
Cordylidae	<i>Pseudocordylus melanotus melanotus</i>	Common Crag Lizard	Least Concern			Endemic
Elapidae	<i>Dendroaspis polylepis</i>	Black Mamba	Least Concern			
Elapidae	<i>Hemachatus heamachatus</i>	Rinkhals	Least Concern			Near Endemic
Elapidae	<i>Naja annulifera</i>	Snouted Cobra	Least Concern			
Elapidae	<i>Naja mossambica</i>	Mozambique Spitting Cobra	Least Concern			
Gekkonidae	<i>Chondrodactylus turneri</i>	Turner's Gecko	Least Concern			

Family	Scientific Name	Common Name	Red List Status (2014)	NEMBA TOPS List (2007)	Provincial Protected Status	Endemic Status
Gekkonidae	<i>Hemidactylus mabouia</i>	Common Tropical House Gecko	Least Concern			
Gekkonidae	<i>Lygodactylus capensis capensis</i>	Common Dwarf Gecko	Least Concern			
Gekkonidae	<i>Lygodactylus nigropunctatus</i>	Black-spotted Dwarf Gecko	Least Concern			Endemic
Gekkonidae	<i>Lygodactylus ocellatus ocellatus</i>	Spotted Dwarf Gecko	Least Concern			Endemic
Gekkonidae	<i>Pachydactylus affinis</i>	Transvaal Gecko	Least Concern		Specially Protected	Endemic
Gekkonidae	<i>Pachydactylus capensis</i>	Cape Gecko	Least Concern		Specially Protected	
Gerrhosauridae	<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	Least Concern			
Lacertidae	<i>Ichnotropis capensis</i>	Ornate Rough-scaled Lizard	Least Concern			
Lacertidae	<i>Meroles squamulosus</i>	Savanna Lizard	Least Concern			
Lacertidae	<i>Nucras holubi</i>	Holub's Sandveld	Least Concern			
Lacertidae	<i>Nucras intertexta</i>	Spotted Sandveld Lizard	Least Concern			
Lacertidae	<i>Nucras lalandii</i>	Delalande's Sandveld Lizard	Least Concern			Endemic
Lacertidae	<i>Nucras ornata</i>	Ornate Sandveld Lizard	Least Concern			
Lacertidae	<i>Pedioplanis lineocellata lineocellata</i>	Spotted Sand Snake	Least Concern			
Lamprophiidae	<i>Amblyodipsas Polylepis polylepis</i>	Common Purple-glossed Snake	Least Concern			
Lamprophiidae	<i>Aparallactus capensis</i>	Cape centipede-eater	Least Concern			
Lamprophiidae	<i>Atractaspis bibronii</i>	Bibron's Stiletto Snake	Least Concern			
Lamprophiidae	<i>Boaedon capensis</i>	Common House Snake	Least Concern			
Lamprophiidae	<i>Duberria lutrix lutrix</i>	South African Slug Eater	Least Concern			Endemic
Lamprophiidae	<i>Lamprophis aurora</i>	Aurora Snake	Least Concern			Endemic
Lamprophiidae	<i>Lycodonomorphus rufulus</i>	Brown Water Snake	Least Concern			
Lamprophiidae	<i>Lycophidion capense</i>	Cape Wolf Snake	Least Concern			
Lamprophiidae	<i>Prosymna bivittata</i>	Two-striped Shovel-snout	Least Concern			

Family	Scientific Name	Common Name	Red List Status (2014)	NEMBA TOPS List (2007)	Provincial Protected Status	Endemic Status
Lamprophiidae	<i>Prosymna sundevallii</i>	Sundevall's Shovel-snout	Least Concern			Near Endemic
Lamprophiidae	<i>Psammophis angolensis</i>	Dwarf Sand Snake	Least Concern			
Lamprophiidae	<i>Psammophis brevirostris</i>	Short-snouted Grass Snake	Least Concern			
Lamprophiidae	<i>Psammophis crucifer</i>	Montane Grass Snake	Least Concern			Near Endemic
Lamprophiidae	<i>Psammophis subtaeniatus</i>	Western Yellow-bellied Sand Snake	Least Concern			
Lamprophiidae	<i>Psammophylax tritaeniatus</i>	Striped Grass Snake	Least Concern			
Lamprophiidae	<i>Pseudaspis cana</i>	Mole Snake	Least Concern			
Pelomedusidae	<i>Pelomedusa galeata</i>	Marsh Terrapin	Least Concern			
Pelomedusidae	<i>Pelosios sinatus</i>	Serrated Hinged Terrapin	Least Concern			
Pythonidae	<i>Python natalensis</i>	South African Python	Least Concern	Protected		
Scincidae	<i>Acontias occidentalis</i>	Savanna Legless Skink	Least Concern			
Scincidae	<i>Afroablepharus wahlbergii</i>	Wahlberg's Snake-eyed Skink	Least Concern			
Scincidae	<i>Mochlus sundevallii sundevallii</i>	Sundevall's Writhing Skink	Least Concern			
Scincidae	<i>Trachylepis capensis capensis</i>	Cape Skink	Least Concern			
Scincidae	<i>Trachylepis punctatissima</i>	Montane Rock Skink	Least Concern			
Scincidae	<i>Trachylepis varia</i>	Variable Skink	Least Concern			
Testudinidae	<i>Kinixys lobatsiana</i>	Lobatse Hinged-back Tortoise	Least Concern			Near Endemic
Testudinidae	<i>Kinixys spekii</i>	Speke's Hinged-back Tortoise	Least Concern			
Testudinidae	<i>Psammobates oculifer</i>	Serrated tent Tortoise	Least Concern		Specially Protected	
Testudinidae	<i>Stigmochelys pardalis</i>	Leopard Tortoise	Least Concern			
Typhlopidae	<i>Afrotyphlops bibronii</i>	Bibron's Blind Snake	Least Concern			Near Endemic
Typhlopidae	<i>Rhinotyphlops lalandei</i>	Delalande's Beaked Blind Snake	Least Concern			
Leptotyphlopidae	<i>Leptotyphlops distanti</i>	Distant's Thread Snake	Least Concern			Near Endemic
Leptotyphlopidae	<i>Leptotyphlops incognitus</i>	Incognito Thread Snake	Least Concern			
Leptotyphlopidae	<i>Leptotyphlops scutifrons</i>	Peter's Thread Snake	Least Concern			

Family	Scientific Name	Common Name	Red List Status (2014)	NEMBA TOPS List (2007)	Provincial Protected Status	Endemic Status
Varanidae	<i>Varanus albigularis albigularis</i>	Rock Monitor	Least Concern			
Varanidae	<i>Varanus niloticus</i>	Water Monitor	Least Concern			
Viperidae	<i>Bitis arietans arietans</i>	Puff Adder	Least Concern			
Viperidae	<i>Bitis caudalis</i>	Horned Adder	Least Concern		Specially Protected	
Viperidae	<i>Causus rhombeatus</i>	Rhombic Night Adder	Least Concern			

Source: Based on the distribution maps in Bates et al., (2014) and ReptileMAP Records (FitzPatrick Institute of African Ornithology, 2021).

Amphibians

Family	Scientific Name	Common Name	IUCN – Red List Status	NEMBA TOPS List (2007)	North West Biodiversity Management Act (Act No. 4 of 2016)
Brevipectidae	<i>Breviceps adspersus</i>	Bushveld Rain Frog	Least Concern		
Bufonidae	<i>Amietophrynus gutturalis</i>	Guttural Toad	Least Concern		
	<i>Amietophrynus rangeri</i>	Raucous Toad	Least Concern		
	<i>Amietophrynus garmani</i>	Eastern olive Toad	Least Concern		
	<i>Amietophrynus poweri</i>	Western Olive Toad	Least Concern		
	<i>Potntonophrynus fenoulheti</i>	Northern Pygmy Toad	Least Concern		
	<i>Schismaderma carens</i>	Red Toad	Least Concern		
Hyperoliidae	<i>Kassina senegalensis</i>	Bubbling Kassina	Least Concern		
Microhylidae	<i>Phrynomantis bifasciatus</i>	Banded Rubber Frog	Least Concern		
Phrynobatrachidae	<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog	Least Concern		
Pipidae	<i>Xenopus laevis</i>	Common Platanna	Least Concern		
Ptychadenidae	<i>Ptychadena anchietae</i>	Plan Grass Frog	Least Concern		

	<i>Ptychadena mossambica</i>	Broad-banded Grass Frog	Least Concern		
Pyxicephalidae	<i>Amietia angolensis</i>	Common River Frog	Least Concern		
	<i>Cacosternum boettgeri</i>	Common Caco	Least Concern		
	<i>Pyxicephalus adspersus</i>	Giant Bullfrog	Least Concern	Protected	Specially Protected
	<i>Pyxicephalus edulis</i>	African Bullfrog	Least Concern		Specially Protected
	<i>Strongylopus fasciatus</i>	Striped Stream Frog	Least Concern		
	<i>Tomopterna cryptotis</i>	Tremolo Sand Frog	Least Concern		
	<i>Tomopterna krugerensis</i>	Knocking Sand Frog	Least Concern		
	<i>Tomopterna natalensis</i>	Natal Sand Frog	Least Concern		
	<i>Tomopterna tandyi</i>	Tandy's Sand Frog	Least Concern		
Rhacophoridae	<i>Chiromanis xerampelina</i>	Southern Foam Nest Frog	Least Concern		

Source: Based on the distribution maps in Du Preez and Carruthers (2009) and FrogMAP Records (FitzPatrick Institute of African Ornithology, 2021).