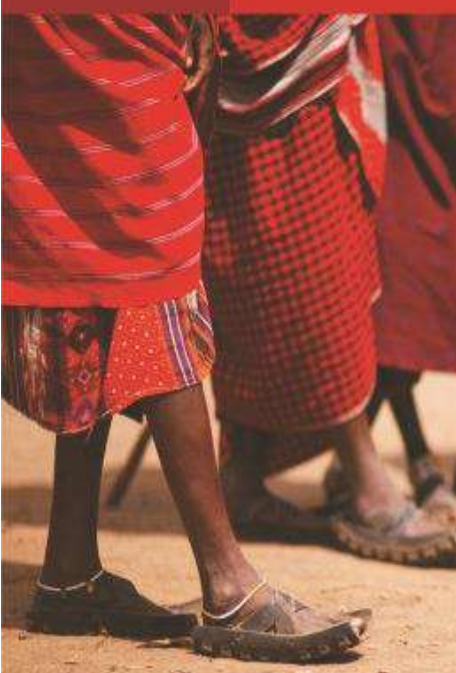




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Environmental Impact Assessment for the Proposed Temo Coal Rail Loop, Road Diversion and Pipeline Project, near Lephalale, Limpopo Province

Fauna and Flora Impact Assessment Report

Project Number:

NAM5335

Prepared for:

Temo Coal (Pty) Ltd

February 2019

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EXECUTIVE SUMMARY

Temo Coal Mining (Pty) Ltd (hereinafter Temo Coal), proposes to construct ancillary infrastructure associated with their approved coal mining operation, the Temo Coal Mine (“Temo Mine”), near Lephalale in the Limpopo Province (“the Project”). The proposed ancillary infrastructure includes a road diversion, rail loop and water pipeline.

Digby Wells Environmental was commissioned by Temo Coal to perform a fauna and flora survey to compile a report for the inclusion in an Environmental Impact Assessment (EIA) for Environmental Authorisation for Listed Activities as detailed in the EIA Regulations, under the National Environmental Management Act No. 7 of 1998 (NEMA). The purpose of this report is to: a) Verify the findings of previous fauna, flora and wetland studies conducted on the farm Duikerpan, 249LQ for the Temo Coal Project completed by Digby Wells in 2011 and 2016; and b) Conduct a fauna and flora assessment of the water pipeline route from the farm Duikerpan, 249LQ in the north west to the water treatment plant in Lephalale.

The methodology employed was aligned required scientific and regulatory requirements. Baseline and background information was researched and used to understand the area prior to fieldwork and to complete the screening (desktop) assessment. A site visit was undertaken in the study area in December 2018. The Braun-Blanquet sampling method was used during vegetation surveys for the rail loop and road diversion footprint and an adapted methodology of Random Botanical Sampling (RBS) technique was employed for the water pipeline; thus a total of 23 sample terrestrial plots/relevés were sampled for this study. The majority of the proposed project areas were traversed by foot during which fauna occurring on site were sampled by visual sightings and ecological indications such as scats, tracks and nesting sites such as burrows and dens. Small mammal trapping was applied by using non-fatal Sherman traps for the proposed rail loop and pipeline.

The study area falls within two regional vegetation types within the Savanna biome, namely: Limpopo Sweet Bushveld and Western Sandy Bushveld. Within the study area, eight broad vegetation habitats were delineated within which approximately 90 of the 144 expected flora species were identified. Five protected plant species were recorded being large trees. The study does not represent all potential SCC as the area.

The fauna survey recorded a total of 16 mammals, 106 Birds, six herpetofaunal species and 12 invertebrates. Of these, a total of eight mammal species, six bird species and one invertebrate species were recorded as Red Data and/or protected. The habitats delineated in the fauna and flora assessment are found to be important habitat for the above mentioned fauna. Of particular importance are the area of very high sensitivity being the wetlands and woodlands as these area provide unique and varied habitats.

The Impact Assessment highlighted the following impacts for the construction phase:

- Direct and permanent loss of approximately 400 ha of natural habitat on the farm Duikerpan for the rail loops project area and direct large loss of natural habitat along the pipeline line servitude.

- Loss of ecological services provided by areas of sensitivity including the woodland areas.
- Indirect impacts due to an industrial activity occurring within a largely natural landscape including increased road kills.

The Impact Assessment highlighted the following impacts for the operational phase:

- Indirect impacts due to an industrial activity occurring within a largely natural landscape including increased road kills.
- Direct and continual loss of the 400 ha of habitat in the pipeline servitude (Option 2) and continually compromised ecological services provided by areas of sensitivity including the pans and woodland areas.

In response to these impacts, mitigation measures are given to avoid, minimise, rehabilitate and offset. It is recommended that all Red Data and protected plant species, as well as the immediate habitat surrounding them, should be preserved and development should be restricted to areas outside of their immediate habitat. All pans and their catchments (or at least their 500 m buffer area) should be conserved and seen as a no-go area. In the case where this is not possible as all efforts to avoid these areas have been exhausted, permits may be applied for from the provincial authorities to either translocate these species (where possible) or remove them.

It can be concluded that the area provides suitable habitat for many species including Red Data and protected species, which are dependent on the present habitat for refuge and resources. Therefore the impact of the proposed project and associated transmission line will have an immediate and lasting effect on the ecology. From an ecological perspective, option 2 pipeline is seen as the preferred alternative. It is critical that Temo Coal orientate their intentions within the larger regional developmental plans and attempt to align with regional objectives to keep impacts to designated areas and protect sensitive habitats.

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LIST OF ACRONYMS AND ABBREVIATIONS

ADU	Animal Demography Unit
CARA	Conservation of Agricultural Resources Act, 1993 (Act 43 of 1983)
C-Plan	Conservation Plan
CR	Critically Endangered
DD	Data Deficient
DEA	Department of Environmental Affairs
DM	District Municipality
DMR	Department of Mineral Rights
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EBA	Endemic Bird Area
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
EN	Endangered

EW	Extinct in the Wild
EX	Extinct
Ha	Hectares
HL	Habitat linkage
HR	Habitat requirements
HS	Habitat status
IBA	Important Birding Area
IUCN	International Union for the Conservation of Nature
IPP	Independent Power Plant
km	Kilometres
km ²	Square kilometres
LC	Least Concern
LEMA	Limpopo Environmental Management Act, 2003 (Act 7 of 2003)
m	Metres
mm	Millimetres
MRA	Mining Right Application
NBSAP	National Biodiversity Strategy and Action Plan
NE	Not Evaluated
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NEMBA	National Environmental Biodiversity Act, 2004 (Act 10 of 2014)
NFEPA	National Freshwater Ecosystem Priority Areas
No.	Number
NPAES	National Protected Areas Expansion Strategy
NT	Near Threatened
PES	Present Ecological Status
PRECIS	Pretoria Computerised Information System
QDS	Quarter Degree Square
SABAP	South African Bird Atlas Project
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SSC	Species of Special Concern
VU	Vulnerable

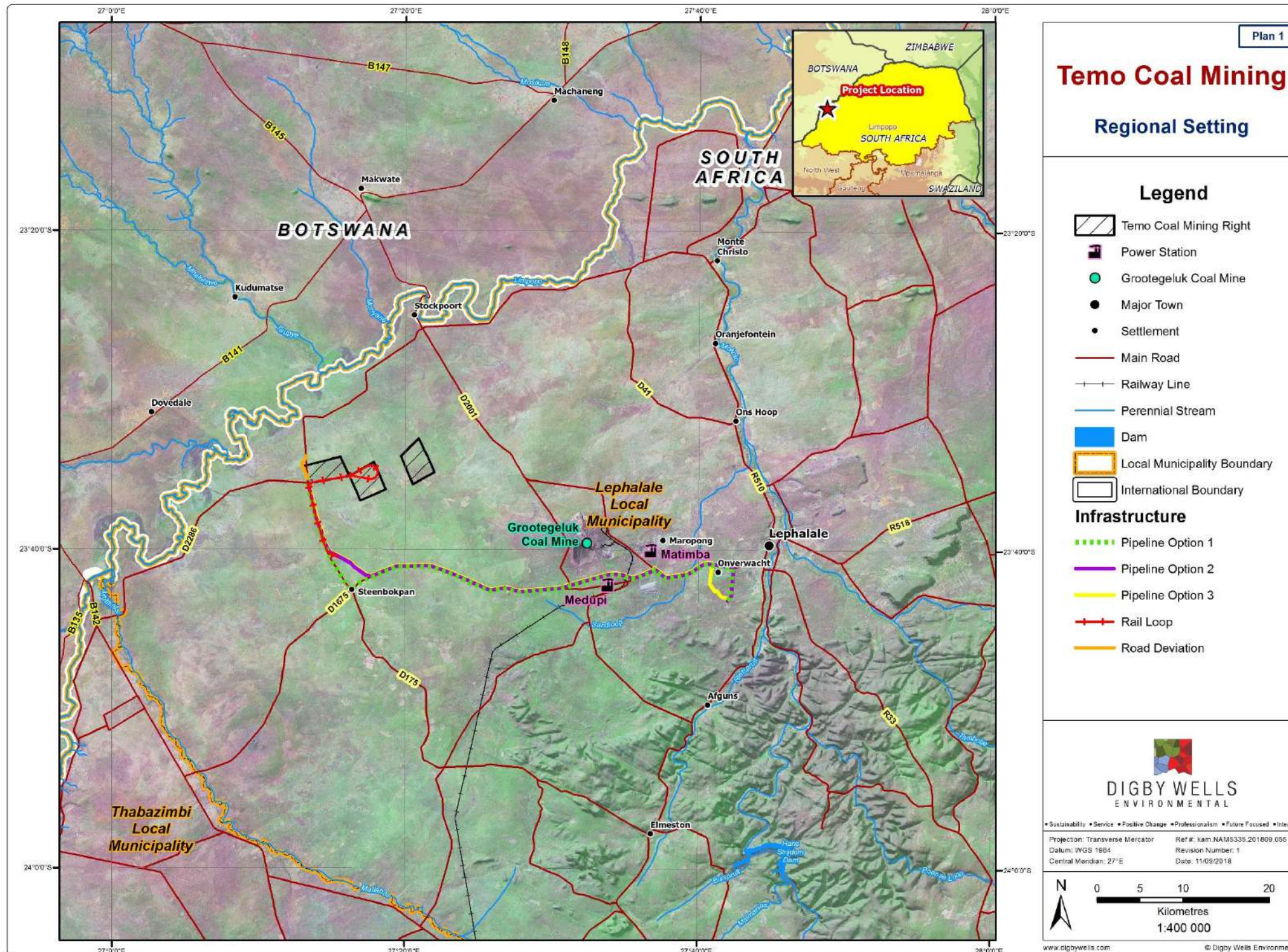
1 Introduction

Temo Coal Mining (Pty) Ltd (hereinafter Temo Coal), proposes to construct ancillary infrastructure associated with their approved coal mining operation, the Temo Coal Mine (“Temo Mine”), near Lephalale in the Limpopo Province (“the Project”). The proposed ancillary infrastructure includes a road diversion, rail loop and water pipeline (Plan 1).

Digby Wells Environmental (Digby Wells) was commissioned by Temo Coal to perform a fauna and flora field survey to compile a report for the inclusion in an Environmental Impact Assessment (EIA) for Environmental Authorisation for Listed Activities as detailed in the EIA Regulations, under the National Environmental Management Act No. 7 of 1998 (NEMA).

This report serves to discuss the findings of the ecological studies including an impact assessment for a proposed Rail Loop, Road Diversion and Pipeline in the Steenbokpan area of the Waterberg District in Limpopo Province, South Africa. These studies included the assessment of the flora and fauna.

Biodiversity is defined as “*the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems*” according to the National Environmental Management Biodiversity Act (NEMBA), 2004 (Act 10 of 2014). The NEMBA legislation upholds the country’s commitment to the protection of South Africa’s biological resources and it is imperative that development takes place in a sustainable way in order to achieve this. South Africa is an exceptionally diverse country, one of the most biologically diverse in the world, which is largely due to the species diversity and endemism of the vegetation.



Plan 1: Regional Setting



2 Project Description

Temo currently has an approved mining right (MR) which was authorised by the Department of Mineral Resources on 27 September 2013 (Reference Number: LP 30/5/1/2/2/199 MR). That Project was also authorised in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the Environmental Impact Assessment (EIA) Regulations thereunder, dated 18 June 2010 (which have since been repealed). The Environmental Authorisation was granted by the Limpopo Department of Economic Development, Environment and Tourism (LEDET) on 13 July 2015 (Reference Number: 12/1/9/2-W55).

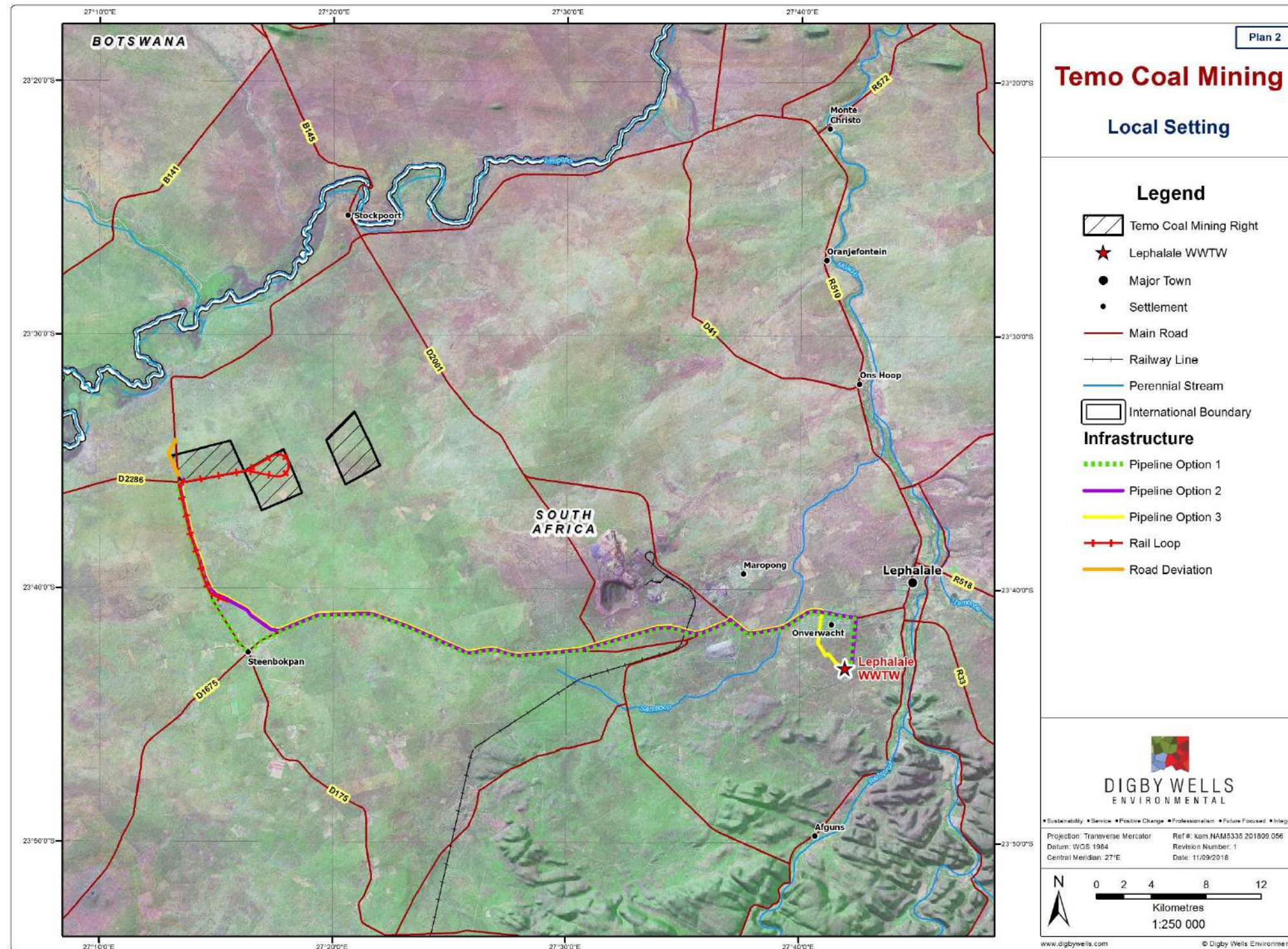
Temo Mine is located approximately 60km from Lephalale in the Limpopo Province (Plan 2). This project considers applying for Environmental Authorisation, in terms of NEMA, and a Water Use Licence (WUL) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) to construct a rail loop, road diversion and pipeline.

The farm portions on which the Temo Mine is situated comprise Verloren Valey 246 LQ, Duikerpan 249 LQ, Japie 714 LQ, Hans 713 LQ and Kleinberg 252 LQ. Temo proposes to mine coal using open pit methods and the open pit will be situated entirely within the Farm Verloren Valey 246 LQ.

In reference to this assessment, Temo proposes to divert the dirt road (D175) around the approved mining right area for mining to continue, to construct a rail loop for transportation of coal and construct a water pipeline to service the Temo mine. As detailed below:

- **Diversion of road D175:** The approved open pit area has a road, the D175, which transects the south-western corner of the future pit area and continues to exit the Mining Right boundary near the north-western corner. To facilitate continued mining and maximise the minable area at the Temo Mine, Temo proposes that the D175 be diverted around the mining area;
- **Proposed Rail Loop:** The purpose of the rail loop is to enable Temo Mine to transport coal to domestic markets as well as transport export-grade coal product to the Richards Bay Coal Terminal (RBCT). The rail loop will include a loading loop which will be within the approved Mining Right boundary of the Temo Mine; and
- **Proposed Bulk Water Pipeline:** Construction of a bulk water pipeline (for which three different pipeline routes are proposed) connecting the Temo mine.

The abovementioned proposed developments requires an EIA Report and Environmental Management Programme, in terms of the new EIA Regulations, published in GN R982 dated 04 December 2014 (as amended December 2017).



Plan 2: Local Setting



3 Terms of Reference

Digby Wells was commissioned by Temo to perform a fauna and flora survey to compile a report for the inclusion into the (EIA) for Environmental Authorisation for Listed Activities as detailed in the EIA Regulations, under NEMA. The agreed Terms of Reference includes the following:

- Compile a list of the plant species that occur within the study area based on the results of the desktop and infield vegetation/flora assessment;
- Compile a list the animal species (mammals, reptiles, amphibians, birds and invertebrates (butterflies and spiders) that occur within the study area based on the results of the desktop and infield fauna assessments;
- Identify which of the species recorded are Species of Special Concern (SSC) based on the following lists:
 - International Union for the Conservation of Nature (IUCN) Red Data List (2016);
 - The South African National Biodiversity Institute (SANBI) Red Data List (2016);
 - SIBIS: SABIF (South African Biodiversity Information Facility) established by the Department of Science and Technology (DST); and
 - The Threatened Species Programme (TSP) listing in collaboration with the National Botanical Institute (NBI) was consulted to identify any SSC and/ or any Red Data Fauna and Flora Listed Species that may be present within the proposed project area of development; and
 - The National Environmental Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA): Threatened or Protected Species List (ToPS).
- Determine if any of the recorded species are alien invasive species or problem species in terms of NEMBA alien invasive species;
- Using the results of the vegetation infield assessment and conduct a vegetation classification to identified the different plant communities within the study area;
- Compile a vegetation distribution map of the identified plant communities recorded;
- Map important faunal habitats identified within the study area;
- Determine the biodiversity value of the study area using information gathered on both flora and fauna;
- Compile a Biodiversity sensitivity map based on the identified biodiversity value s; and
- Assess the identified impacts of the proposed project and recommend mitigation measures.



4 Details of Specialist

Rudi Greffrath is manager of Digby Well's Biodiversity department and has a National diploma and B-tech in Nature Conservation from Nelson Mandela Metropolitan University's George Campus and is a registration as a *Professional Natural Scientist* in the field of practice *Conservation Science*, registration number 400018/17. He has ten years' experience in the environmental consulting field specifically in the terrestrial ecology within the Highveld grasslands and Savanna regions of Southern and central Africa and the forest regions of central and West Africa. He specialises in fauna and flora surveys, biodiversity surveys, environmental management plans, environmental monitoring and rehabilitation for projects in accordance with the International Finance Corporation (IFC) and World Bank. Rudi has gained experience working throughout Africa specifically Sierra Leone, Ghana, Mali, Botswana, Namibia and Cote D'Ivoire.

Curricula Vitae of the specialist involved in this study can be found in Appendix E.

5 Aims and Objectives

The aim of the ecological study is to conduct an assessment on the natural environment including the terrestrial (flora) and the fauna associated with the proposed plan to construct and operate the Rail Loop, Road Diversion and Pipeline with associated infrastructure. The screening (desktop) assessment was completed for the project and the route alternatives to highlight any potential fatal flaws and significant impacts that may be realised by the full intent of the project. The study thereafter aimed to re-assess the vegetation habits and fauna associated with the project footprint and the preferred route of the transmission line in detail.

The following objectives were considered for this specialist study:

- To delineate the various vegetation/habitat types and describe their sensitivity, present within the study area;
- To determine if any flora and fauna species or assemblages will be directly impacted upon by the proposed mining activities and its associated infrastructure, this includes flora and fauna communities present, the ecological state of these communities, identification of possible Red Data Listed species (according to the International Union for the Conservation of Nature (IUCN)) as well as considering National and Provincial criteria, and;
- To determine mitigation measures for the identified impacts in order to reduce the severity of these impacts. In cases where impacts cannot be mitigated, areas may be regarded as 'no-go' owing to the presence of Species of Special Concern (SSC) or critical habitat.

The assessment aims to support the following regulations, regulatory procedures and guidelines:

- NEMA;

- NEMBA;
- National Environmental Waste Act, Act 59 of 2008;
- Standard for Bush Clearance, ESKSABG3 (Eskom);
- Conservation of Agricultural Resources Act (CARA), 1993 (Act 43 of 1983)

6 Methodology

6.1 Literature Review and Desktop Study

A desktop study was undertaken, aiming to identify:

- Potential species in the proposed development area/site area according to the (South African National Botanical Institute (SANBI), Pretoria Computerised Information System) PRECIS List's;
- South African Bird Atlasing Project (SABAP2);
- Potential Red Data Listed species and their current status according to Provincial legislation;
- Expected vegetation type and community structure, (Mucina and Rutherford 2006); and
- Current biodiversity and ecosystem status.

6.1.1 National

National legislation and frameworks consulted include:

- Regional vegetation according to Mucina and Rutherford (2006);
- National Protected Areas Expansion Strategy (NPAES);
- South African Protected Areas Database (DEA, 2015);
- South African Biodiversity Information Facility (SABIF) expected floral and faunal species lists per Quarter Degree Square (QDS);
- South African Bird Atlas Project (SABAP 2) (2011);
- National Freshwater Ecosystems Priority Areas (NFEPA) (Nel *et al.*, 2011);

6.1.2 Regional

Regional legislation and frameworks consulted include:

- Limpopo Conservation Plan version 2 (LCP v2) (Desmet *et al.*, 2013).

6.1.3 Municipal

Municipal legislation and frameworks consulted include:

- Waterberg District Municipality Bioregional Plan Draft 1 (Desmet *et al*, 2014).

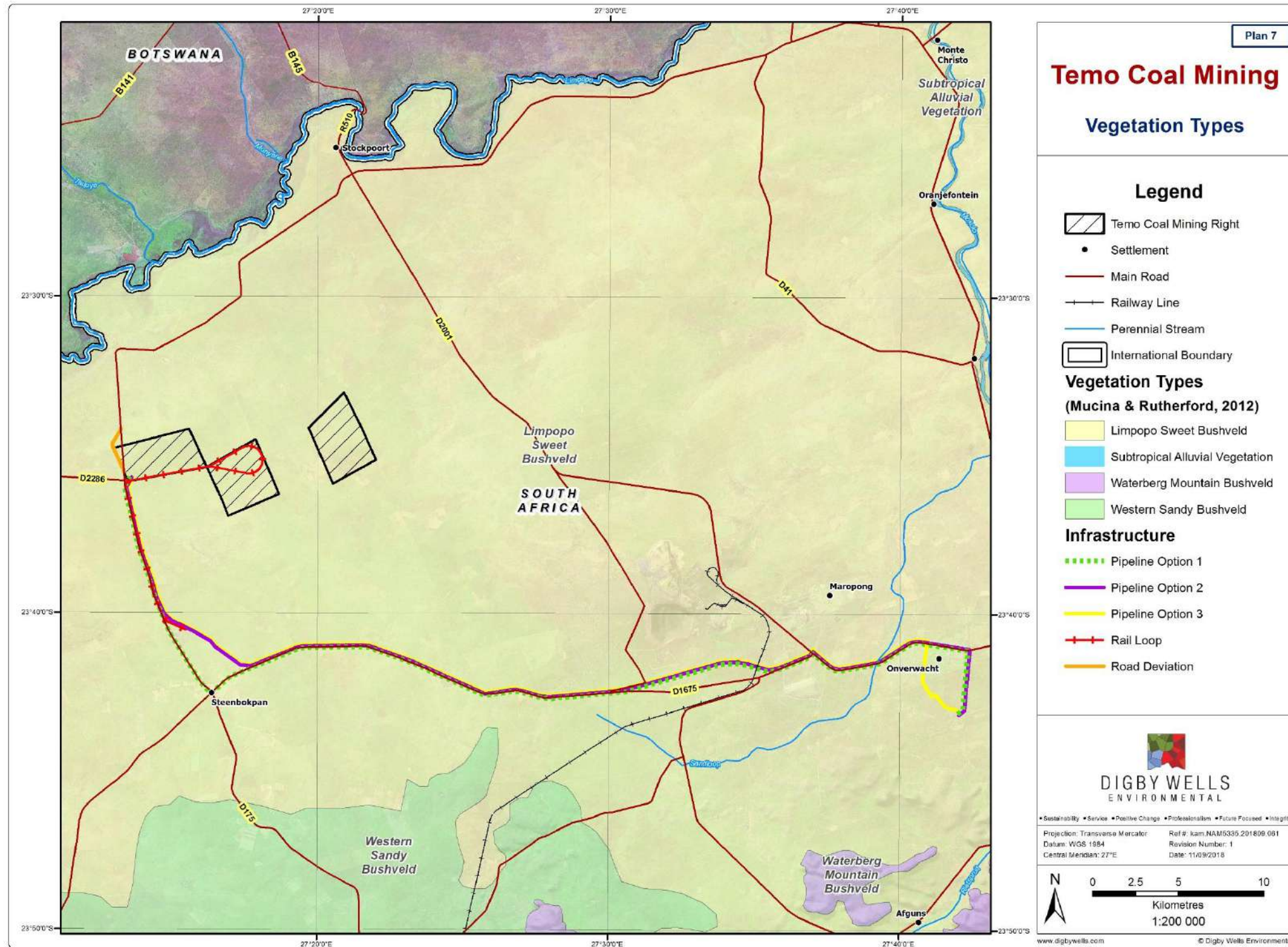
6.1.4 Local

Local legislation and frameworks consulted include:

- Previous EIA studies (Digby Wells, 2011, 2016).

6.1.5 Mucina and Rutherford Vegetation Map of South Africa, Swaziland and Lesotho

The vegetation of South Africa was extensively mapped in the 2006 publication by Mucina and Rutherford. This publication provides relatively detailed descriptions of the various vegetation habitats that are found in South Africa detailing expected species, conservation importance and more. The expected species lists supplied by Mucina and Rutherford (2006) for each vegetation type found in the study area were used to add to the list of expected species for the study area.

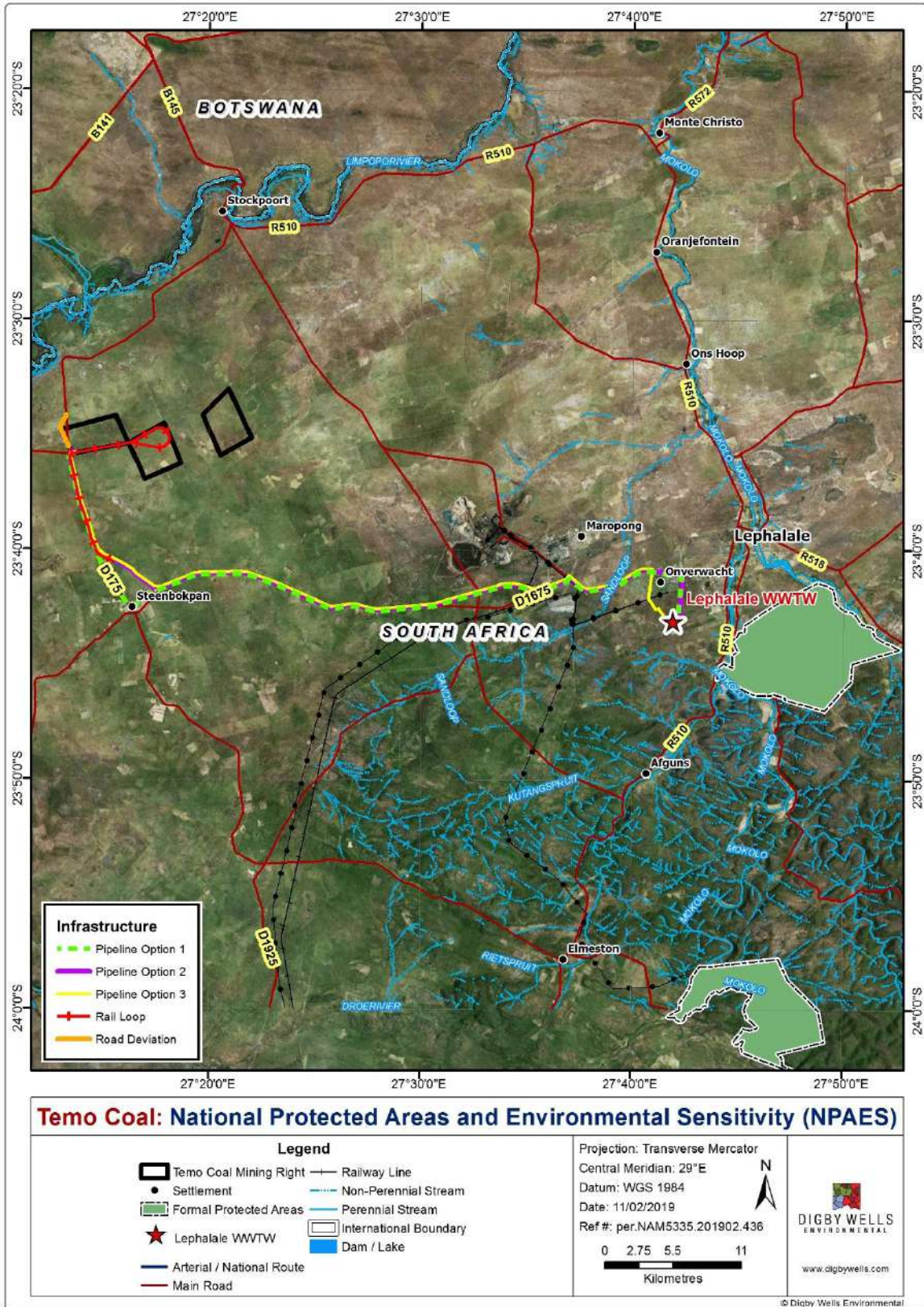


Plan 3: Regional Vegetation Types



6.1.6 National Protected Area Expansion Strategy

The National Protected Area Expansion Strategy (NPAES) has designated areas for future incorporation into existing protected areas (both National and Informal protected areas). These areas are large, mostly intact areas required to meet biodiversity targets, and suitable for protection. They may not necessarily be proclaimed as protected areas in the future and are a broad scale planning tool allowing for better development and conservation planning.



Plan 4: National Protected Areas and Environmental Sensitivity.

6.1.7 South African Biodiversity Information Facility

The SIBIS South African Biodiversity Information Facility (SABIF) online interactive species distribution lists were obtained from the SANBI which includes all the plants, mammals, reptiles, amphibians and terrestrial invertebrates species officially recorded by SANBI and associates for Quarter Degree Squares (QDS 2327 CA, CB, DA) which the study site is located in. This list is therefore not a comprehensive list representing only those species that may occur in these grids, but rather a guideline as to what is likely to occur here. The sites sampled are also only a very small portion of the whole grid and habitats suitable for certain species in these lists may not be present at the sites sampled. It is therefore not unusual for species in the list to be absent from the sampling sites.

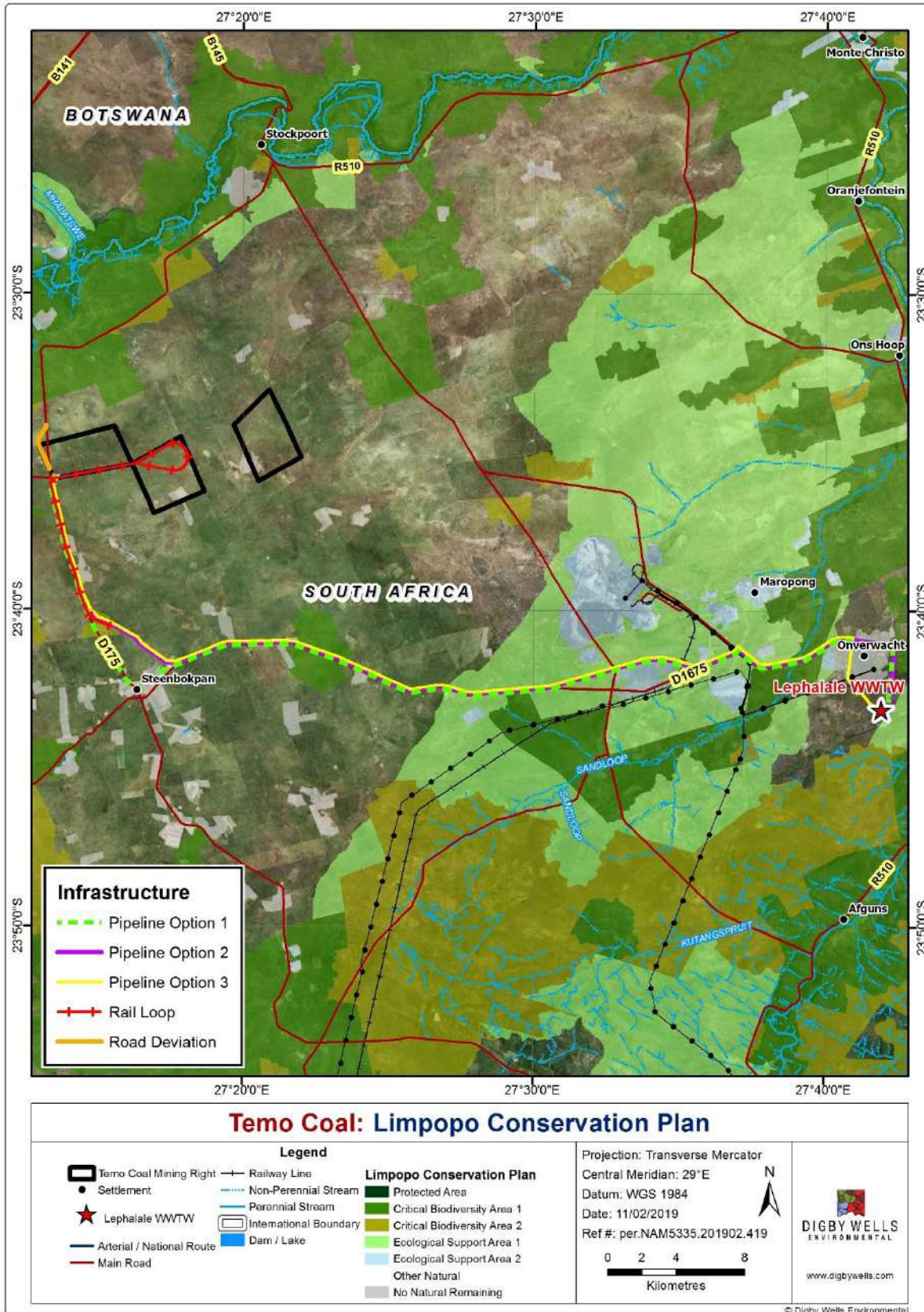
6.1.8 Limpopo Conservation Plan

The Limpopo Conservation Plan Version 2 (C-Plan v2) was published in September 2013 and delivered a detailed map of Critical Biodiversity Areas (CBAs) for the Limpopo Province. CBA's within the bioregion are the series of sites that are required to meet the region's biodiversity targets, and need to be maintained in the appropriate condition for their category. The purpose of a conservation plan is to inform land-use planning, environmental assessment and authorisations, and natural resource management, by a range of sectors whose policies and decisions impact on biodiversity. Accompanying the map of the CBA's are land-use guidelines that are compatible or not with the biodiversity management objective of the CBA category. The CBA's are summarised below.

- Protected Areas: Formal Protected Areas and protected Areas pending declaration under National Environmental Management; Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPA).
- Critical Biodiversity Area 1: Irreplaceable sites. Areas required to meet biodiversity pattern and/or ecological process targets. No alternative sites are available to meet targets.
- Critical Biodiversity Area 2: Best Design Selected sites. Areas selected to meet biodiversity pattern and/or ecological process targets. Alternative sites may be available to meet targets.
- Ecological Support Areas 1: Natural, near natural and degraded areas supporting CBAs by maintaining ecological processes.
- Ecological Support Areas 2: Areas with no natural habitat that is important for supporting ecological processes.
- Other Natural Areas: Natural and intact but not required to meet targets, or identified as CBA or ESA.
- No natural habitat remaining: Areas with no significant direct biodiversity value. Not natural or degraded natural areas that are not required as ESA, including intensive agriculture, urban, industry, and human infrastructure.



Based on the C-Plan, the Waterberg District Municipality (WDM) Bioregional Plan (BRP) draft version was published in December 2014; making it the most recent municipal biodiversity and conservation document. Bioregional plans are one of a range of tools provided for in NEMBA that can be used to facilitate the management and conservation of biodiversity priority areas outside the protected area network. The final version is currently under review by the South African National Biodiversity Institute (SANBI) and thereafter the DEA. The C-Plan and BRP for the area is looked at for the project at hand and the relevant findings are discussed in relation to the overall biodiversity of the area.



Plan 5: Limpopo C-Plan

6.2 Field Investigations and Seasonal Influence

6.2.1 Flora Assessment

A single of site visit was undertaken in the study area in December 2018 within the summer rainfall season. At the time of the study, significant drought conditions were prevalent in this part of South Africa, which led to relatively dry conditions at the time of the sampling. For this reason certain plant species was difficult to identify and less hardy species could not have been present.

6.2.1.1 Rail Loop Footprint

The rail loop footprint is located on the northern half of the farm Duikerpan 249 LQ, which has been previously studied in 2011 for the Temo Coal project (Digby Wells, 2011), and in 2016 for the for the Temo IPP project (Digby Wells, 2016).

This flora assessment was completed in early December 2018 and aimed to ground-truth the 2016 results, update the findings and describe the vegetation habitats present. A total of two vegetation sampling plots (25 m²) were completed within the study area of the rail loop in order to ground truth the previous findings. The Braun-Blanquet sampling method was used during vegetation surveys, which allows for the following to be compiled:

- Vegetation classification regarding plant communities within the area and sub communities and variations of these;
- Species list for each plant community, including diagnostic and dominant species;
- Red Data and/or protected plant species;
- Invasive species (if present) for each plant community;
- Exotic species (if present) for each plant community;
- Protected and/or endemic species for each plant community; and
- Culturally significant plant species within each community.

6.2.1.2 Bulk Water Supply Line Options

The study aimed to gain an understanding of the broad vegetation habitats that characterise the linear study area. A total of 23 vegetation sampling plots (approximately 25 m²) were completed during the field assessment (refer to Figure 10-1). An adapted methodology of Random Botanical Sampling (RBS) technique was employed (Hawthorne, 2012).

This provides a methodology to rapidly assess the vegetation and floral biodiversity of the project area, which aims to provide information about the following:

- List of species occurring in the area;
- The species distributions including common and rare species;
- Main trends about the vegetation and environmental variables; and

- Vegetation bio-quality and conservation priority.

6.2.2 Fauna Assessment

A desktop analysis combined with a wet-season survey was undertaken to ascertain the species that occur in the study area against historical and previously surveyed results. Fauna occurring on site include assemblages within terrestrial and wetland (pan) ecosystems: mammals, birds, reptiles, amphibians and invertebrates. Each of these assemblages occurs within unique habitats, the ecological state of these habitats directly relates to the number of species found within them. The main habitats occurring in the project area are bushveld (all woodland vegetation units form the bushveld described here) plains and pans with little altitudinal variation. As the area is used primarily for game hunting, there are large numbers of mammals, both naturally occurring and introduced. The majority of these make use of the bushveld habitat for grazing, browsing and hunting. Small mammals are also quite common in the area.

6.2.2.1 Mammals

The mammal survey was conducted in conjunction with the flora survey. The visual sightings and ecological indications were used to identify the mammal inhabitants of the study area; this includes scats, tracks and nesting sites such as burrows and dens. Scats found were collected (if required), photographed on scale and along with any tracks found were identified. For identification purposes a field guide Smithers Mammals of Southern Africa (2000) was used.

The following was recorded:

- All mammals encountered, noted or captured during the survey;
- Mammal species listed by landowners;
- A list of the most prominent mammal species; and
- A list of rare and endangered species encountered during the survey.

Small mammal trapping was completed by using non-fatal Sherman traps for the proposed rail loop and road diversion areas. Sherman traps are collapsible traps (23 cm x 9 cm x 7.5 cm) which were baited and laid along transects in the representative vegetation of the study areas. Areas where clear small mammal activity could be seen such as the presence of burrows were also used as sites for trapping and baited. The traps were checked in the morning due to the fact that the small mammals are predominantly active at night.

Trapping was undertaken for one night at the predetermined sites. Species of conservation concern and listed by the IUCN or by the LEMA as protected and endemic within the study area, took priority and the Red Data status was identified and recorded.

Relating to the proposed bulk water supply route, a visual mammal survey was conducted during the day as access was restricted.

6.2.2.2 Birds

Concurrently with the mammal survey, the principal ornithological field survey techniques of drive, transect counts and point counts was used for the project area in the summer of December 2018. Drive counts and point counts were completed in all dominant veld types delineated. Transect counts were undertaken in sites representative of different avifauna habitat, such as bushveld, open areas and pans. A transect line was selected at each site to reflect its general habitat conditions. Transect count procedures involve slow attentive walks along transects during which any bird seen or heard is identified and recorded.

Drive counts were performed while inside a vehicle, thereby covering large areas, where point counts were performed in selected areas on site, where an observer was stationary for the duration of the count, recording all birds encountered.

The following were recorded:

- All birds encountered or noted during the survey;
- A list of the birds encountered; and
- A list of rare and endangered species encountered.

Because the primary purpose of this work was to establish the presence of species, no distance or time limit was set, and hence any species seen or heard anywhere within the general vicinity of the proposed project site was recorded. Visual identification was used to confirm calls of the less common species. Bird species were confirmed using the Sasol Field Guide (Sinclair *et al*, 2009).

Assessment of the conservation status of species recorded focused on the various categories of Globally Threatened Species (IUCN 2018) and birds listed by NEMBA. The area around Steenbokpan is known for its birds of prey. Large terrestrial birds such as the Korhaans and Bustard species are common in the bushveld habitat throughout the area. South African Bird Atlas Project 1&2 (SABAP) was used to compile a list of possible species that might occur in the project area which falls within the QDS 2327CA, CB and 2327DA (Appendix B).

6.2.2.3 Reptiles and Frogs

Herpetofauna include reptile and amphibian species. Direct /opportunistic observations were completed along trails or paths within the project area. Any herpetofauna species seen or heard along such paths or trails within the project area were identified and recorded. Another method used will be to examine refuges using visual scanning of terrains to record smaller herpetofaunal species which often conceal themselves under rocks and in fallen logs, rotten tree stumps, in leaf litter, rodent burrows, ponds, old termite mounds, etc. Du Preez, *et al*. (2009) and Alexander, *et al*, (2007) will be used to confirm identification where necessary. Assessment of the conservation status of species recorded focused on the various categories of Globally Threatened Species (IUCN 2015) and listed by NEMBA.

6.2.3 Invertebrates (Spiders, Scorpions, Beetles and Butterflies)

During the summer (wet) season, butterflies were identified when observed and transects were walked along the road diversion and pipeline route extending into the surrounding vegetation where necessary to identify any scorpion or baboon spider nests. The focus of this assessment was on protected species as this would narrow the field considerably. Assessment of the conservation status of species recorded focused on the various categories of Globally Threatened Species (IUCN 2018) and inverts listed by the NEMBA.

7.3.1.1 Red Data Faunal Assessment

The following parameters will be used to assess the Probability of Occurrence of each Red Data species:

- Habitat requirements (HR) – Most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics in the study area was evaluated.
- Habitat status (HS) – The status or ecological condition of available habitat in the area is assessed. Often a high level of habitat degradation prevalent in a specific habitat will negate the potential presence of Red Data species (this is especially evident in wetland habitats).
- Habitat linkage (HL) – Movement between areas for breeding and feeding forms an essential part of the existence of many species. Connectivity of the study area to surrounding habitat and the adequacy of these linkages are evaluated for the ecological functioning of Red Data species habitat within the study area.

Probability of occurrence is presented in four categories, namely:

- Low (will not occur);
- Medium (could possibly occur);
- High (most likely could occur); or
- Recorded (does occur on site).

The IUCN Red Data categories are defined as follow and it is used for the status identification of mammals, birds, reptiles and amphibians globally:

- Critically Endangered (CR): A taxon is Critically Endangered when it is considered to be facing an extremely high risk of extinction in the wild (IUCN, 2017).
- Endangered (EN): A taxon is Endangered when it is considered to be facing a very high risk of extinction in the wild (IUCN, 2017).
- Vulnerable (VU): A taxon is Vulnerable when the best available evidence indicates it to be facing a high risk of extinction in the wild (IUCN, 2017).
- Near Threatened (NT): A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or

Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future (IUCN, 2017).

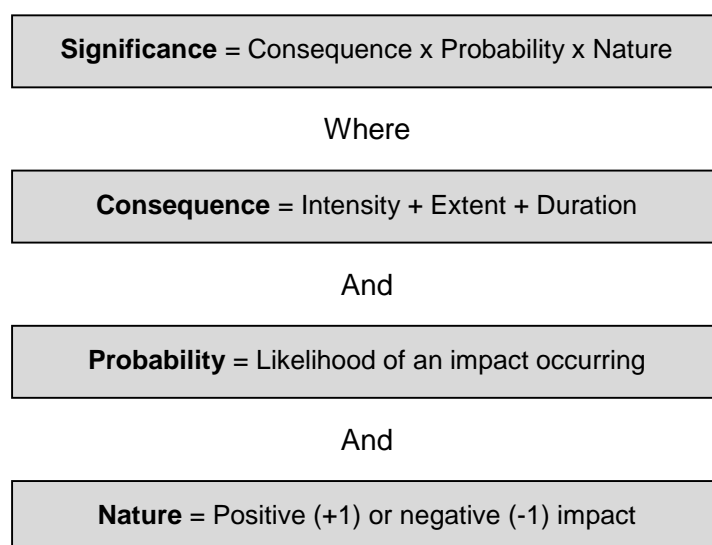
7 Impact Assessment Methodology

The impacts are assessed based on the impact's magnitude as well as the receiver's sensitivity, culminating in an impact significance which identifies the most important impacts that require management.

Based on international guidelines and South African legislation, the following criteria are taken into account when examining potentially significant impacts:

- Nature of impacts (direct/indirect, positive/negative);
- Duration (short/medium/long-term, permanent(irreversible) / temporary (reversible), frequent/seldom);
- Extent (geographical area, size of affected population/habitat/species);
- Intensity (minimal, severe, replaceable/irreplaceable);
- Probability (high/medium/low probability); and
- Possibility to mitigate, avoid or offset significant adverse impacts.

Details of the impact assessment methodology used to determine the significance of bio-physical impacts are provided below. The significance rating process follows the established impact/risk assessment formula:



Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts

The matrix calculates the rating out of 147, whereby Intensity, Extent, Duration and Probability are each rated out of seven. The weight assigned to the various parameters is



then multiplied by +1 for positive and -1 for negative impacts. Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this Report. The significance of an impact is then determined and categorised into one of eight categories. It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Table 7-1: Impact Assessment Parameter Ratings

Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
7	Irreplaceable loss or damage to biological or physical resources or highly sensitive environments. Irreplaceable damage to highly sensitive cultural/social resources.	Noticeable, on-going natural and/or social benefits which have improved the overall conditions of the baseline.	<u>International</u> The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or moderate to highly sensitive environments. Irreplaceable damage to cultural/social resources of moderate to highly sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	<u>National</u> Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain/Highly probable: It is most likely that the impact will occur. <80% probability.

Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
5	Serious loss and/or damage to physical or biological resources or highly sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	<u>Province/ Region</u> Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or moderately sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures/items of cultural significance.	Average to intense natural and/or social benefits to some elements of the baseline.	<u>Municipal Area</u> Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.



Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
3	Moderate loss and/or damage to biological or physical resources of low to moderately sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	<u>Local</u> Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	Minor loss and/or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	<u>Limited</u> Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare/improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
1	Minimal to no loss and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	<u>Very limited/Isolated</u> Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely/None: Expected never to happen. <1% probability.

Table 7-2: Probability/Consequence Matrix

		Significance																																					
Probability	7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
	6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
	5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
	4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
	3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
	2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
	1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		Consequence																																					

8 Assumptions and Limitations

The report is based on the following assumptions and limitations:

- The project was assessed according to the project activities listed herein (that were made available to Digby Wells by the client;
- Whilst every effort is made to identify all plant species on site undertaken in the summer season, not all species will be seeding, fruiting and/or flowering at the times of sampling and some therefore species may not have been identified to species level due to the lack of identifying features;
- Previous Digby Wells Specialist reports were utilized for area data, and is assumed to be complete and correct;
- Owing to time constraints, the exact locations of every individual Red Data flora and fauna species could not be recorded. Many protected tree species occurred on site and groups of these were recorded with a GPS when encountered during the random vegetation sampling;

9 Fauna Desktop Results

9.1 Mammals

The results of the desktop study into the mammals that have been recorded in the project area indicate that 207 mammals occur in the Limpopo Province (ADU 2019) (Appendix B), of which 20 are Red Data (IUCN 2019) mammal species and 23 are NEMBA listed mammal species (Table 9-1).

Digby Wells (2011, 2016), identified 177 mammals (SANBI: SIBS, 2011, 2016), 20 Red Data mammal species and 22 NEMBA listed species. According to ADU (2019) 8 mammal species have been recorded in the project area (Bold), 4 Red Data (IUCN 2019) and 4 NEMBA listed species and 8 species that are endemic to the region. (Table 9-1), Digby Wells, (2011) recorded 25 mammal species occurring in the project area.

Table 9-1: Red Data and Protected large Mammal Species (ADU, 2019, DWE 2016) possibly occurring within the project area.

Common Name	Scientific Name	IUCN	NEMBA	Probability
Aardvark	<i>Orycteropus afer</i>	Least Concern	Protected	High
African Bush Elephant	<i>Loxodonta africana</i>	Vulnerable	Protected	Low
African Clawless Otter	<i>Aonyx capensis</i>	Near Threatened		Low



Common Name	Scientific Name	IUCN	NEMBA	Probability
African wild dog	<i>Lycaon pictus</i>	Endangered	Endangered	Low
Bat-eared Fox	<i>Otocyon megalotis</i>	Least Concern	Protected	Medium
Black Rhino	<i>Diceros bicornis</i>	Critically Endangered	Endangered	Low
Black-footed Cat	<i>Felis nigripes</i>	Vulnerable	Protected	High
Blue Monkey	<i>Cercopithecus mitis</i>	Least Concern		Low
Bontebok	<i>Damaliscus pygargus</i>	Not Assessed	Protected	Medium
Brown Hyena	<i>Hyaena brunnea</i>	Near Threatened	Protected	High
Cape Fox	<i>Vulpes chama</i>	Least Concern	Protected	Medium
Cape Mountain Zebra	<i>Equus zebra zebra</i>	Not Assessed	Protected	Low
Cheetah	<i>Acinonyx jubatus</i>	Vulnerable	Vulnerable	High
Common Eland	<i>Tragelaphus oryx</i>	Least Concern		Low
Common Warthog	<i>Phacochoerus africanus</i>	Least Concern		High
Commerson's Leaf-nosed Bat	<i>Hipposideros commersoni</i>	Near Threatened		Medium
South African Giraffe	<i>Giraffa camelopardalis giraffa</i>	Not Assessed		Low
Gunning's Golden Mole	<i>Neamblysomus gunningi</i>	Endangered		Medium



Common Name	Scientific Name	IUCN	NEMBA	Probability
Hartmann's Zebra	<i>Equus zebra hartmannae</i>	Not Assessed	Vulnerable	Medium
Isalo Serotine	<i>Neoromicia malagasyensis</i>	Endangered		Medium
Juliana's Golden Mole	<i>Neamblysomus julianae</i>	Endangered		Medium
Leopard	<i>Panthera pardus</i>	Near Threatened	Protected	High
Lesser Long-fingered Bat	<i>Miniopterus fraterculus</i>	Near Threatened		Medium
Lion	<i>Panthera leo</i>	Vulnerable	Vulnerable	Low
Mauritian Tomb Bat	<i>Taphozous mauritanus</i>	Least Concern		Medium
Red Hartebeest	<i>Alcelaphus buselaphus caama</i>	Not Assessed		Medium
Roan Antelope	<i>Hippotragus equinus</i>	Least Concern	Endangered	Low
Sable Antelope	<i>Hippotragus niger</i>	Least Concern	Vulnerable	High
Serval	<i>Leptailurus serval</i>	Least Concern	Protected	Low
Sharpe's Grysbok	<i>Raphicerus sharpei</i>	Least Concern	Protected	Low
Side-striped Jackal	<i>Canis mesomelas</i>	Near Threatened		Medium
Southern African Hedgehog	<i>Atelerix frontalis</i>	Near Threatened		Medium



Common Name	Scientific Name	IUCN	NEMBA	Probability
Spotted Hyena	<i>Crocuta crocuta</i>	Least Concern	Protected	Low
Temminck's Ground Pangolin	<i>Smutsia temminckii</i>	Vulnerable	Vulnerable	Medium
Temminck's Myotis	<i>Myotis tricolor</i>	Least Concern		Medium
Tete Veld Aethomys	<i>Aethomys namaquensis</i>	Least Concern		Medium
Thick-tailed Greater Galago	<i>Otolemur crassicaudatus</i>	Least Concern		Low
Thomas's Mouse	<i>Mus sorella</i>	Not listed		Low
Tsessebe	<i>Damaliscus lunatus</i>	Least Concern	Protected	Low
White Rhino	<i>Ceratotherium simum</i>	Near Threatened	Protected	High
<i>Graphiurus murinus</i>	<i>Woodland Dormouse</i>	Least Concern	Protected	Medium
Yellow Golden Mole	<i>Calcochloris obtusirostris</i>	Vulnerable		Medium

9.2 Avifauna

Birds have been viewed as good ecological indicators, since their presence or absence tends to represent conditions relating to the proper functioning of an ecosystem. Bird communities and ecological condition are linked to land cover. As the habitat of an area changes, so does the diversity and density of bird species. The diversity of these habitats should give rise to many different species. According to the South African Bird Atlas Project (SABAP 2), almost 300 species of birds have been identified in the area (relevant QDSG); the majority of these birds are comprised of Bushveld species. All birds that could be present within the project area are listed in Appendix C with those recorded from the study area (143) marked. Of these species, 12 have been assigned a Red Data status (either South African or IUCN), 25 are either endemic or near-endemic to South Africa, these species of special concern that have been recorded from the study area are listed in the Table 9-2 below.



The project area would be considered to be unique from an avifaunal perspective in that it falls within the transition area of the dry western region meeting the more tropical eastern habitats. This gives rise to a number of interesting avifaunal aspects. Furthermore, the Limpopo River system contains many species from east and central Africa that have reached their southern limit and therefore the project site and related farms offer a suite of interesting range restricted birds. These include, but not limited to; Meves's Starling (*Lamprotornis mevesii*), Senegal Coucal (*Centropus senegalensis*), Three-banded Courser (*Rhinoptilus cinctus*), and Thrush Nightingale (*Luscinia luscinia*). These species have been observed closer to the riparian thickets adjacent to the Limpopo River and other than the Three-banded Courser (*Rhinoptilus cinctus*) are unlikely to be found within the immediate project area.

Table 9-2: Red Data and Protected Bird Species and their probability of being recorded on the Project Site

Common Name	Scientific Name	IUCN	NEMBA	Probability
Red-billed Oxpecker	<i>Buphagus erythrorhynchus</i>	LC	Vulnerable	High
Greater Painted-snipe	<i>Rostratula benghalensis</i>	LC	Vulnerable	Low
Marabou Stork	<i>Leptoptilos crumeniferus</i>	NT	Least Concern	High
Yellow-billed Stork	<i>Mycteria ibis</i>	NT	Vulnerable	Medium
Kori Bustard	<i>Ardeotis kori</i>	VU	Protected	High
Bateleur	<i>Terathopius ecaudatus</i>	VU	Endangered	High
Lesser Kestrel	<i>Falco naumanni</i>	LC	Vulnerable	High
Tawny Eagle	<i>Aquila rapax</i>	VU	Endangered	High
Martial Eagle	<i>Polemaetus bellicosus</i>	VU	Endangered	High
Cape Vulture	<i>Gyps coprotheres</i>	EN	Endangered	High
Lappet-faced Vulture	<i>Torgos tracheliotus</i>	EN	Endangered	Medium
White-backed Vulture	<i>Gyps africanus</i>	EN	Endangered	High

9.3 Herpetofauna

The desktop assessment revealed that there are 199 reptile and 49 amphibian (frogs) species occurring in the Limpopo Province, with 53 reptiles and 3 frogs endemic to the



Province (Appendix D), of these 17 reptiles and 2 frog species have Red Data status, 13 reptile (snake, lizard, tortoise species) and 12 frog species have been recorded within the project area (ADU, 2019) (Table 9-3). Digby Wells, (2011) recorded 5 reptile species and no frog species during the 2011 survey.

Table 9-3: Red Data and Protected Herpetofauna, their conservation status and probability of occurrence in the Project Area

Common Name	Scientific Name	IUCN	NEMBA	Probability
Blouberg Flat Lizard	<i>Platysaurus intermedius inopinus</i>	Endangered (SARCA 2014)		Medium
Breyer's Long-tailed Seps	<i>Tetradactylus breyeri</i>	Vulnerable (SARCA 2014)		Medium
Coppery Grass Lizard	<i>Chamaesaura aenea</i>	Near Threatened (SARCA 2014)		Medium
FitzSimons' Flat Lizard	<i>Platysaurus orientalis fitzsimonsi</i>	Near Threatened (SARCA 2014)		Medium
Giant Bull Frog	<i>Pyxicephalus adspersus</i>	Near Threatened		Medium
Granite Dwarf Gecko	<i>Lygodactylus graniticolus</i>	Near Threatened (SARCA 2014)		Medium
Large-scaled Grass Lizard	<i>Chamaesaura macrolepis</i>	Near Threatened (SARCA 2014)		Medium
Methuen's Dwarf Gecko	<i>Lygodactylus methueni</i>	Vulnerable (SARCA 2014)		Medium
Muller's Velvet Gecko	<i>Homopholis mulleri</i>	Vulnerable (SARCA 2014)		Medium
Nile Crocodile	<i>Crocodylus niloticus</i>	Vulnerable (SARCA 2014)	Vulnerable	Low



Common Name	Scientific Name	IUCN	NEMBA	Probability
Northern Crag Lizard	<i>Pseudocordylus transvaalensis</i>	Near Threatened (SARCA 2014)		Low
Orange-throated Flat Lizard	<i>Platysaurus monotropis</i>	Endangered (SARCA 2014)		Medium
Southern African Python	<i>Python natalensis</i>	Least Concern (SARCA 2014)	Protected	High
Soutpansberg Dwarf Gecko	<i>Lygodactylus soutpansbergensis</i>	Near Threatened (SARCA 2014)		Low
Soutpansberg Rock Lizard	<i>Vhembelacerta rupicola</i>	Near Threatened (SARCA 2014)		Low
Soutpansberg Worm Lizard	<i>Chirindia langi occidentalis</i>	Vulnerable (SARCA 2014)		Low
Transvaal Rain Frog	<i>Breviceps sylvestrus</i>	Vulnerable		High
White-bellied Dwarf Burrowing Skink	<i>Scelotes limpopoensis albiventris</i>	Near Threatened (SARCA 2014)		Low
Woodbush Flat Gecko	<i>Afroedura multiporus</i>	Vulnerable (SARCA 2014)		Medium
Woodbush Legless Skink	<i>Acontias rieppeli</i>	Endangered (SARCA 2014)		Medium

9.4 Invertebrates

According to the Schedules published in Government Notice (GN) 38600 the National Environmental Biodiversity Act (NEMBA), 2004, (Act 10 of 2004) dated the 31st March 2015, certain invertebrate species in South Africa are listed as either Critically Endangered, Endangered, Vulnerable and Protected species, relevant species are as follows: (Table 9-4).



Table 9-4: Red Data (IUCN) and NEMBA Protected Invertebrate Species and the probability of occurring in the Project Site

Common Name	Scientific Name	IUCN	NEMBA	Probability
Paulsens Horned Babon Spider	<i>Ceratogyrus paulseni</i>	Not Assessed	Critically Endangered	U/K
Barnards Cape Stag Beetle	<i>Colophon barnardi</i>	Endangered	Critically Endangered	Low
Berrisfords Cape Stag Beetle	<i>Colophon berrisfordii</i>	Not Assessed	Critically Endangered	Low
Endrody Younga's Cape Stag Beetle	<i>Colophon endroedyi</i>	Not Assessed	Critically Endangered	Low
Kawai's Cape Stag Beetle	<i>Colophon kawaii</i>	Not Assessed	Critically Endangered	Low
Swartberg Cape Stag Beetle	<i>Colophon montisatris</i>	Critically Endangered	Critically Endangered	Low
Owen's Cape Stag Beetle	<i>Colophon oweni</i>	Not Assessed	Critically Endangered	Low
Thunberg's Cape Stag Beetle	<i>Colophon thunbergi</i>	Endangered	Critically Endangered	Low
Westwood's Cape Stag Beetle	<i>Colophon westwoodi</i>	Vulnerable	Critically Endangered	Low
Steinkopf Burrowing Scorpion	<i>Opisthophthalmus ater</i>	Not Assessed	Critically Endangered	Medium
Dark-legged Burrowing Scorpion	<i>Opisthophthalmus fuscipes</i>	Not Assessed	Critically Endangered	Medium
Cameron's Cape Stag Beetle	<i>Colophon cameroni</i>	Vulnerable	Endangered	Low
Eastman's Cape Stag Beetle	<i>Colophon eastmani</i>	Endangered	Endangered	Low



Common Name	Scientific Name	IUCN	NEMBA	Probability
Haughton's Cape Stag Beetle	<i>Colophon haughtoni</i>	Endangered	Endangered	Low
Izard's Cape Stag Beetle	<i>Colophon izardi</i>	Near Threatened	Endangered	Low
Nel's Cape Stag Beetle	<i>Colophon neli</i>	Vulnerable	Endangered	Low
Primos's Cape Stag Beetle	<i>Colophon primosi</i>	Critically Endangered	Endangered	Low
Whites Cape Stag Beetle	<i>Colophon whitei</i>	Endangered	Endangered	Low
Blue-footed Baboon Spider	<i>Idiothele mira</i>	Not Assessed	Endangered	Low
Regal Small Stag Beetle	<i>Oonotus rex</i>	Not Assessed	Endangered	Low
Chaper's Burrowing Scorpion	<i>Opisthophthalmus chaperi</i>	Not Assessed	Endangered	Low
Cape Mountain Burrowing Scorpion	<i>Opisthophthalmus intermedius</i>	Not Assessed	Endangered	Low
Strandveld Burrowing Scorpion	<i>Opisthophthalmus latro</i>	Not Assessed	Endangered	Medium
Inland Small Stag Beetle	<i>Oonotus interioris</i>	Not Assessed	Vulnerable	Medium



126 spider species have been in the Limpopo Province, there are no species listed as Red Data or protected (ADU, 2016). A total of 31 Scorpion species are reported to occur in the Limpopo Province, there are no Red data listings (ADU 2016), however 2 protected species (NEMBA) have a medium probability of occurring in the project site. (Table 9-5)

Butterflies are a good indication of the habitats available in a specific area (Woodhall 2005). Although many species are eurytopes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised. Butterflies are useful indicators as they are relatively easy to locate and catch, and to identify. It is for this reason that Lepidoptera were used as the primary focus for the invertebrate survey. There are 1098 species of butterflies listed as occurring in the Limpopo Province of which there are 15 Red Data species and 14 species are endemic to the Limpopo Province (ADU 2016) (Table 9-5)

Table 9-5: Red Data and Protected Butterflies, their conservation status and probability of occurrence in the Project Area

Common name	Genus	IUCN	Probability
Wolkberg zulu	<i>Alaena margaritacea</i>	Critically Endangered (SABCA 2013)	High
Juanita's hairtail	<i>Anthene crawshayi</i>	Critically Endangered (SABCA 2013)	High
Erikson's copper	<i>Eriksonia edgei</i>	Critically Endangered (SABCA 2013)	High
Blue-spangled charaxes	<i>Charaxes guderiana</i>	Critically Endangered (SABCA 2013)	Medium
Scarce widow	<i>Dingana fraterna</i>	Critically Endangered (SABCA 2013)	High
Natal brown	<i>Coenyropsis natalii</i> <i>poetulodes</i>	Data Deficient (SABCA 2013)	High



Common name	Genus	IUCN	Probability
Swanepoel's brown	<i>Pseudonympha swanepoeli</i>	Data Deficient (SABCA 2013)	High
Cloud copper	<i>Aloeides nubilus</i>	Endangered (SABCA 2013)	High
Rossouw's copper	<i>Aloeides rossouwi</i>	Endangered (SABCA 2013)	High
Stevenson's copper	<i>Aloeides stevensoni</i>	Endangered (SABCA 2013)	High
Irving's blue	<i>Lepidochrysops irvingi</i>	Endangered (SABCA 2013)	High
Lotana blue	<i>Lepidochrysops lotana</i>	Endangered (SABCA 2013)	High
Clara's widow	<i>Dingana clara</i>	Endangered (SABCA 2013)	High
Induna acraea	<i>Telchinia induna salmontana</i>	Endangered (SABCA 2013)	High
Violescent blue	<i>Orachrysops violescens</i>	Vulnerable (SABCA 2013)	High



9.5 Regional Vegetation Findings

The project area falls within two regional vegetation types, namely: the Limpopo Sweet Bushveld and the Western Sandy Bushveld, as described by Mucina and Rutherford (2012), which is part of the savanna biome. Plan 3 shows the distribution of the two vegetation types and each are briefly described below.

Owing to the recent taxonomic revision of *Acacias*, all African *Acacia*'s have been renamed to either *Senegalia* or *Vachellia*. The International Code of Botanical Nomenclature, the official botanical names authority, made a decision in July 2005 to reserve the name *Acacia* for Australian species only. Both Africa and Australia had been sharing the genus name for two distinctly different groups of species and a final call had become a necessity. The *Acacia* name change has been a matter of dispute for over a decade but it is important to note that the change is now official. The reasons for voting *Acacia* as an Australian type were numerous, primarily owing to the fact that over 1000 *Acacia*'s (many that are endemic) are to be found in Australia, making up the largest genus in the country. In addition, the *Acacia* has significant cultural and traditional value as a symbol in the Australian coat of arms. South Africa appealed this revision but this was rejected and the name change has been published.

9.5.1 Limpopo Sweet Bushveld

This vegetation type occurs within Limpopo Province at an altitude of 700-1000 metres. The vegetation extends across the border, into Botswana and consists of plains, which are traversed by several tributaries of the Limpopo River and is made up of short, open woodland (Mucina and Rutherford, 2012). Areas which have been disturbed are dominated by thickets of Blue Thorn (*Senegalia (Acacia) erubescens*), Black Thorn (*Senegalia (Acacia) mellifera*) and Sickie Bush (*Dichrostachys cinerea*) (Mucina and Rutherford, 2006). This vegetation type is classified as Least Threatened and approximately 5% of the vegetation type has been transformed according to Mucina and Rutherford (2006). Owing to the pressures of coal mining in the area however, a considerably larger proportion of the Limpopo Sweet Bushveld has been transformed since this figure was reported. Table 9-6 lists common characteristic plant species for this vegetation unit and Plan 3 shows the distribution of the Limpopo Sweet Bushveld.

Table 9-6: Common and characteristic plant species of the Limpopo Sweet Bushveld

Life Form	Species
Small Trees	<i>Vachellia (Acacia) robusta</i> (d); <i>Senegalia (Acacia) burkei</i> (d); <i>Senegalia (Acacia) erubescens</i> (d); <i>Senegalia (Acacia) cinerea</i> (d); <i>Vachellia (Acacia) nilotica</i> (d); <i>Senegalia (Acacia) senegal</i> (d); <i>Albizia anthelmintica</i> (d), <i>Boscia albitrunca</i> (d); <i>Combretum apiculatum</i> (d) and <i>Terminalia sericea</i> .
Tall Shrubs	<i>Catophractes alexandri</i> (d); <i>Dichrostachys cinerea</i> (d); <i>Phaeoptilum spinosum</i> (d); <i>Rhigozum obovatum</i> (d); <i>Cadaba aphylla</i> ; <i>Combretum hereroense</i> ;



	<i>Commiphora pyracanthioides</i> ; <i>Ehretia rigida</i> subsp. <i>rigida</i> ; <i>Euclea undulata</i> ; <i>Grewia flava</i> ; <i>Gymnosporia senegalensis</i> .
Low Shrubs	<i>Vachellia (Acacia) tenuispina</i> (d); <i>Commiphora africana</i> ; <i>Felicia muricata</i> ; <i>Gossypium herbaceum</i> subsp. <i>africanum</i> ; <i>Leucospaera bainesii</i> .
Grasses and Sedges	<i>Digitaria eriantha</i> (d); <i>Enneapogon cenchroides</i> (d); <i>Eragrostis lehmanniana</i> (d); <i>Panicum coloratum</i> (d); <i>Schmidtia pappophoroides</i> (d); <i>Aristida congesta</i> ; <i>Cymbopogon nardus</i> ; <i>Eragrostis pallens</i> : <i>E. rigidior</i> ; <i>E. trichophora</i> ; <i>Ishaemum afrum</i> ; <i>Panicum maximum</i> ; <i>Setaria verticillata</i> ; <i>Stipagrostis uniplumis</i> ; <i>Urochloa mossambicensis</i> .
Herbs	<i>Acanthosicyos naudinianus</i> ; <i>Commelina benghalensis</i> ; <i>Harpagophytum procumbens</i> subsp. <i>transvaalensis</i> ; <i>Hemizygia elliottii</i> ; <i>Hermbsstaedtia odorata</i> ; <i>Indigofera daleoides</i> .
Succulent Herbs	<i>Kleinia fulgens</i> ; <i>Plectranthus neochilus</i> .

Key: 'd' denotes dominant plant species

9.5.2 Western Sandy Bushveld

The Western Sandy Bushveld occurs in Limpopo and the North-West Provinces on flats and undulating plains from Assen, northwards past Thabazimbi and remain west of the Waterberg Mountains towards Steenbokpan in the north. This vegetation type varies from tall, open woodland to low woodland, with broad-leaved as well as microphyllous tree species. Dominant species include *Senegalia (Acacia) erubescens* on flat areas, *Combretum apiculatum* on shallow soils of gravelly upland sites and *Terminalia sericea* on deep sands.

Only 6% of habitat is statutorily conserved and 4% is transformed (mainly by cultivation) according to the 2006 data. Table 9-7 lists the common and characteristic species and the distribution of the Western Sandy Bushveld is represented in Plan 3.


Table 9-7: Common and characteristic plant species of the Western Sandy Bushveld

Life Form	Species
Small Trees	<i>Senegalia (Acacia) erubescens (d)</i> ; <i>Senegalia (Acacia) mellifera (d)</i> ; <i>Vachellia (Acacia) nilotica (d)</i> ; <i>Vachellia (Acacia) tortilis subsp. heterocantha (d)</i> ; <i>Combretum apiculatum (d)</i> ; <i>C. imberbe (d)</i> ; <i>Terminalia sericea (d)</i> ; <i>Combretum zeyheri</i> ; <i>Lannea discolor</i> ; <i>Ochna pulchra</i> ; <i>Peltophorum africanum</i> .
Tall Trees	<i>Vachellia (Acacia) erioloba</i> , <i>Senegalia (Acacia). nigrescens</i> , <i>Sclerocarya birrea</i> ,
Tall Shrubs	<i>Combretum hereroense (d)</i> ; <i>Euclea undulata (d)</i> ; <i>Coptosperma supra-axillare</i> ; <i>Dichrostachys cinerea</i> ; <i>Grewia bicolor</i> ; <i>G. flava</i> ; <i>G. monticola</i> .
Low Shrubs	<i>Clerodendrum ternatum</i> ; <i>Indigofera filipes</i> ; <i>Justicia flava</i> .
Grasses and Sedges	<i>Antheophora pubescens (d)</i> ; <i>Digitaria eriantha subsp. eriatha (d)</i> ; <i>Eragrostis pallens (d)</i> ; <i>E. rigidior (d)</i> ; <i>Schmidtia pappophoroides (d)</i> ; <i>Aristida congesta</i> ; <i>A. diffusa</i> ; <i>A. stipitata subsp. graciflora</i> ; <i>Eragrostis superba</i> ; <i>Panicum maximum</i> ; <i>Perotis patens</i>
Herbs	<i>Blepharis integrifolia</i> ; <i>Chamaecrista absus</i> ; <i>Evolvulus alsinoides</i> ; <i>Geigeria burkei</i> ; <i>Kyphocarpa angustifolia</i> ; <i>Limeum fenestratum</i> ; <i>L. Viscosum</i> ; <i>Lophiocarphus tenuissimus</i> ; <i>Monsonia angustifolia</i> .

Key: 'd' denotes dominant plant species

10 Results from Infield Assessment

10.1 Flora Assessment

The results from the infield assessment were found to be in line with previous studies completed, namely the study conducted by Resgen Resources with respect to the Boikarabelo Railway Line Development. The expected species (from Desktop Assessment) were encountered within the less impacted natural areas. The delineated vegetation types discussed in this section are based on data gathered by Digby Wells's specialists previously.

The vegetation of the study area is part of the Limpopo Sweet Bushveld and Western Sandy Bushveld, which is a component of the Savanna biome and therefore is comprised of a grassy ground layer and an upper layer of woody species.

10.1.1 Delineated Vegetation Habitats

A total of 34 sample plots/relevés were completed for this study. Bushveld vegetation does not typically show large variation and therefore communities were similar with an abundance of some cosmopolitan species such as *Boscia* spp. and *Grewia* spp. However, dominance of some species varied throughout the project area and this led to the confirmation of 10 broad



terrestrial vegetation habitats, wetland habitats associated with the ephemeral pans and transformed areas associated with large agricultural fields based on previous assessments completed by Digby Wells specialists (Digby Wells 2016).

Local and small scale changes will occur within these habitats but these are not captured at this level. These changes can be associated with different management techniques of the multiple land owners, local changes in soil, geological features, variations in faunal activity and more. The vegetation habitats are briefly summarised in Table 10-1 and Figure 10-1 on the following pages. Brief descriptions of the habitats are given in the sub-headings that follow.

Table 10-1: Vegetation Habitats

Vegetation Habitat		Main trees and shrubs present	Main grasses present
1	Commiphora bushveld	<i>Commiphora angolensis</i> ; <i>C. pyracanthoides</i> ; <i>Combretum apiculatum</i> ; <i>Peltophorum africanum</i> ; <i>Vachellia erioloba</i> ; <i>Elephantorirza elephantine</i> ;	<i>Aristida rhinochloa</i> ; <i>Panicum maximum</i>
2	Combretum-dominated thornveld	<i>Combretum apiculatum</i> ; <i>Dichrostachys cinera</i> ; <i>Grewia bicolor</i> , <i>G. flava</i> ; <i>G. flavescens</i> ; <i>Boscia foetida</i> subsp <i>rehamniana</i> ; <i>Boscia albitrunca</i>	<i>Aristida rhinochloa</i> ; <i>A. diffusa</i> ; <i>A. stipitataa</i>
3	Combretum/Marula thornveld	<i>Combretum apiculatum</i> ; <i>Sclerocarya birrea</i> ; <i>Senegalia erioloba</i> ; <i>S. nigrescens</i> <i>Dichrostachys cinera</i> ; <i>Terminalia sericea</i> ; <i>Boscia foetida</i> subsp <i>rehamniana</i> ; <i>Grewia bicolor</i> , <i>G. flava</i> ; <i>G. flavescens</i>	<i>Aristida spp</i> ; <i>Panicum maximum</i> ; <i>Urochloa mosambicensis</i> ; <i>Tragus berteronianus</i> ; <i>Schmidtia pappophoroides</i> ; <i>Tricholaena monachne</i>
4	Terminalia/Marula bushveld	<i>Terminalia sericea</i> ; <i>Sclerocarya birrea</i> ; <i>Combretum apiculatum</i> ; <i>Peltophorum africanum</i> ; <i>Bauhinia petersiana</i> ; <i>Combretum molle</i> ; <i>Combretum hereroreense</i> ; <i>Senegalia erioloba</i> ; <i>Grewia bicolor</i> , <i>G. flava</i> ; <i>G. flavescens</i> ;	<i>Aristida congesta</i> subsp <i>congesta</i> ; <i>A. stipitata</i> ; <i>Digitaria eriantha</i> ; <i>Urochloa masambicensis</i> ; <i>Scmidtia pappophoroides</i> ; <i>Stipagrostis uniplumis</i> ; <i>Panicum maximum</i> ; <i>P. coloratum</i> ; <i>Eragrostis rigidior</i> ; <i>E. pallens</i> ; <i>E. lehmanniana</i>



Vegetation Habitat		Main trees and shrubs present	Main grasses present
5	Terminalia/Pterocarpus bushveld	<i>Terminalia sericea</i> ; <i>Pterocarpus rotundifolius</i> ; <i>Combretum apiculatum</i> ; <i>Commiphora pyracanthoides</i> ; <i>C. angolensis</i> ; <i>Sclerocarya birrea</i> ; <i>Boscia foetida</i> subsp <i>rehmanniana</i> ; <i>Boscia albitrunca</i> ; <i>Senegalia nigrescens</i> ; <i>Dichrostachys cinera</i> ; <i>Grewia bicolor</i> , <i>G. flava</i> ; <i>G. flavescens</i> ; <i>Senegalia burkei</i> ; <i>Peltophorum africanum</i>	<i>Urochloa masambicensis</i> ; <i>Panicum coloratum</i> ; <i>P. maximum</i> ; <i>Schmidtia pappophoroides</i>
6	Combretum/Senegalia thornveld	<i>Combretum apiculatum</i> ; <i>C. hererorensis</i> ; ; <i>C. zeyheri</i> ; <i>Terminalia sericea</i> ; <i>Senegalia erubescens</i> ; <i>S. nigrescens</i> ; <i>Vachellia gerrardia</i> ; <i>V. robusta</i> ; <i>V. nilotica</i> <i>V. karoo</i> ; <i>Ziziphus mucronata</i> ; <i>Peltophorum africanum</i> ; <i>Burkea africana</i> ; <i>Grewia bicolor</i> , <i>G. flava</i> ; <i>G. flavescens</i> ; <i>Senegalia burkei</i> ; <i>Boscia foetida</i> subsp <i>rehmanniana</i>	<i>Panicum maximum</i> ; <i>Aristida stipitata</i> ; <i>Eragrostis sp's</i> <i>Urochloa mosambicensis</i> , <i>Melinis repens</i> and <i>Chloris virgata</i> . <i>Crinum bulbispermum</i> and various <i>Cyperus</i> species
7	Transformed Areas	<i>Dichrostachys cinera</i> ; <i>Senegalia melilfera</i> ; <i>S. toritillis</i>	<i>Aristida stipitata</i> ; <i>Eragrostis sp's</i> ; <i>Stipagrostis uniplumis</i>
8	Ephemeral Pans	<i>Senegalia melilfera</i> ; <i>S. toritillis</i> ; <i>Ziziphus mucronata</i> ; <i>Combretum imberbe</i>	<i>Dactyloctenium aegyptium</i> ; <i>Ammocharis coranica</i> ; <i>Urochloa mosambicensis</i>

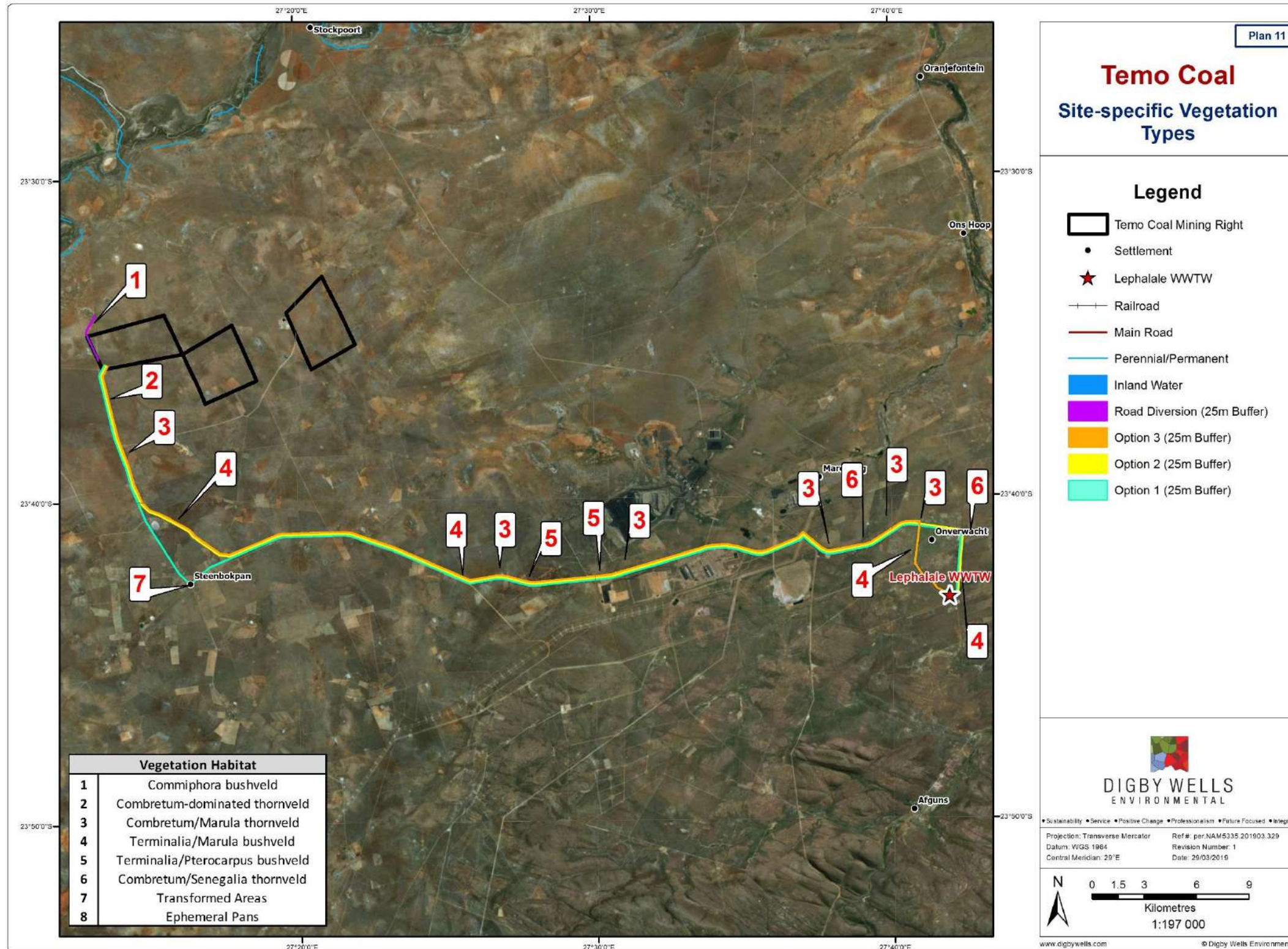


Figure 10-1: Delineated Vegetation Types



10.1.1.1 Habitat 1: Commiphora Bushveld

This habitat was dominated by *Commiphora* species including *C. pyracanthoides* and *C. angolensis* with additional upper storey species such as *Combretum apiculatum*; *Senegalia erioloba* (Camel Thorn) and *Peltophorum africanum*. Scrambling bushes such as *Bauhinia petersiana*; *Grewia bicolor*, *G. flava*, *G. flavescens*, *Gymnosporia tenuispina* and *Elephantorrhiza elephantina* were common throughout. The grass layer was poor in this area with on average 35% bare ground present. *Aristida* spp were present, which are predominantly hardy grasses that are typical of overgrazed veld, with *Panicum* spp present in the protected shady areas and on occasion *Digitaria eriantha* (Digit Grass) was found. The soils of this area are moderately deep to very deep sandy soils (ESS, 2016). The predominant land use was cattle farming and overutilization was observed. The habitat is utilised by naturally occurring ungulate species as well.



Figure 10-2: Habitat 1 Commiphora Bushveld: a) general habitat; b) *Commiphora angolensis* (Sand corkwood)

10.1.1.2 Habitat 2: Combretum thornveld

This habitat is dominated by *Combretum apiculatum* with additional upper storey species such as *Senegalia tortilis* and *Dichrostachys cinerea*. *Terminalia sericea*, *Boscia* spp and *Commiphora pyracanthoides* also occur here but are relatively small and non-dominant. Scrambling bushes such as *Grewia flava*, *G. flavescens* and *Gymnosporia tenuispina* were common throughout. The grass layer was very poor in this area with *Aristida* spp being present, which are predominantly hardy grasses that are typical of overgrazed veld, and *Panicum* spp were present in the protected shady areas under trees and shrubs. Understory forbs and succulents included: *Cotyledon* sp., *Commelina benghalensis*, *Sanseveria hyacinthoides*. Species diversity was generally low with an absence of unique species. The

soils of this habitat were moderately deep soils that are predominantly composed of fine sandy material. This varies towards the pan habitat where the soils show wetness and calcrete is exposed at the surface. This vegetation type is impacted by the adjacent agricultural fields as well as the cattle grazing that are practiced on the farm by the land owner. Ground cover was often below 50%, which contributes to the susceptibility of the soil to erosion.



Figure 10-3: Habitat 2 Combretum thornveld: a) general habitat; b) *Senegalia tortilis* (Umbrella thorn)

10.1.1.3 Habitat 3: Combretum / Marula thornveld

This habitat differed from habitat one and two in that the presence and co-dominance of *Sclerocarya birrea* (Marula) with *Combretum apiculatum* was noted. Additional upper storey species included *Senegalia erioloba*, *S. nigrescens*, *Dichrostachys cinera*, *Terminalia sericea*, *Peltophorum africanum* and *Boscia* spp. Scrambling bushes such as *Bauhinia petersiana*; *Commiphora pyracanthoides*; *Grewia* spp., *Gymnosporia tenuispina* and *Elephantorrhiza elephantina* were common throughout. The grass layer of this habitat was of greater variety of species and better overall cover in comparison to the habitats one and two of the neighbouring farms. Grasses included *Panicum* spp., *Aristida* spp., *Urochloa mosambicensis*, *Tragus berteronianus*, *Schmidtia pappophoroides*, and *Tricholaena monachne*. This is a relatively small habitat type that was found on moderately deep soils that are predominantly composed of fine sandy material. The predominant land use of this area was cattle farming; however the impact from trampling and grazing appears to be less than that observed on the habitats one and two.



Figure 10-4: Habitat 3 Combretum / Marula thornveld: general habitat showing *Combretum apiculatum* (Red bushwillow) and a large *Sclerocarya birrea* (Marula); b) *Commiphora pyracanthoides* (Common corkwood); c) *Dichrostachys cinera* (Sickle bush)

10.1.1.4 Habitat 4: Terminalia / Marula Veld

This habitat type covers a large part of the central parts of the study area and is comprised of the co-dominance of *Terminalia sericea*, *Combretum apiculatum* and *Sclerocarya birrea*. Additional upper storey species included: *Peltophorum africanum*, *Combretum molle*, *Combretum hererorensense* and *Senegalia erioloba* with shrubs including *Bauhinia petersiana*, *Grewia bicolor*, *G. flava*, *G. flavescens*, *Gymnosporia tenuispina* and *G. senagalensis*. The grass component of this area was varied and included *Aristida congesta subsp congesta*, *A. stipitata*, *Digitaria eriantha*, *Urochloa masambicensis*, *Scmitdia pappophoroides*; *Stipagrostis uniplumis*; *Panicum maximum*, *P. coloratum*; *Eragrostis rigidior*, *E. pallens*, and *E. lehmaniana*. The land uses within this habitat type varied from cattle farming with some agricultural fields to tourism uses with game farming and hunting lodges. This therefore leads to the health condition of the bushveld to vary with the different management measures. The area is dominated by very deep sandy loam soils with some variation to moderately deep fine soils and some soils with a wetness base (below 70cm) (ESS, 2016)



Figure 10-5: Habitat 4 Terminalia / Marula Veld: a) *Combretum apiculatum* (Red bushwillow); *Terminalia sericea* (Silver cluster-leaf); c) *Sclerocarya birrea* (Marula)

10.1.1.5 Habitat 5: Terminalia / Pterocarpus Bushveld

This habitat type covers a moderately large part of the central to southern part of the study area and is comprised of the co-dominance of *Terminalia sericea*, *Pterocarpus rotundifolius* and *Combretum apiculatum*. Additional upper storey species included *Commiphora pyracanthoides*, *C. angolensis*, *Sclerocarya birrea*, *Boscia foetida* subsp *rehmanniana*, *Senegalia nigrescens*, *Senegalia burkei* and *Peltophorum africanum*. Typical shrub species are present here including *Grewia bicolor*, *G. flava*, *G. flavescens*, *Gymnosporia tenuispina* and *G. senegalensis*. The grasses observed in this area were predominantly comprised of *Urochloa masambisensis*, *Panicum coloratum*, *P. maximum* and *Schmidia pappophoroides*. The soils varied between moderately deep and shallow according to the changes in the topography, as these slope variations are more pronounced in this part of the study area. The land use associated with this vegetation type was a combination of some cattle farming and agricultural practices with most other areas practicing natural game stocking and game farming. Some of the areas were not able to be assessed in the field due to limited access and desktop extrapolation was done.



Figure 10-6: Habitat 6 Terminalia / Pterocarpus bushveld: a) habitat showing *Sclerocarya birrea* (Marula); b) *Pterocarpus rotundifolius* (Round-leaved teak)

10.1.1.6 Habitat 6: *Combretum* / *Acacia* thornveld

This habitat type covers a moderately large part of the central to southern part of the study area and is comprised of the co-dominance of *Combretum* spp with *Acacia* spp. The Sandloop River, is where this vegetation type interspersed with the project infrastructure, and is characterised by a sandy areas, interspersed with sandstone bedrock with various depressions.

This and other trees include: *Combretum apiculatum*, *C. hererorensis*, *C. zeyheri*, *Terminalia sericea*, *Senegalia erubescens*, *S. nigrescens*, *S. burkei*, *Vachellia gerrardia*, *V. robusta*, *V. karoo*, *Ziziphus mucronata*, *Peltophorum africanum*, *Burkea africana*, *Commiphora pyracanthoides* and *Boscia foetida* subsp. *rehmanniana*. The grasses were dominated by the hardy species typical of the area including *Panicum* spp., *Aristida* spp. and *Eragrostis* spp, *Urochloa mosambicensis*, *Melinis repens* and *Chloris virgata*. *Grewia flava* and *Acacia nilotica* lined the edges of the system. *Crinum bulbispermum* and various *Cyperus* species were also found within the Sand River portion of the habitat type. This habitat type is dominated by game farming as a land use offering hunting safaris. The soils varied between moderately deep and shallow according to the changes in the topography, as these slope variations are more pronounced in this part of the study area, similar to habitat 5. Some of the areas were not able to be assessed in the field due to access issues and thus desktop extrapolation was done.



Figure 10-7: Habitat 8 Combretum / Acacia thornveld: a) *Combretum hererorens* (Russet Bushwillow); b) *Vachellia karoo* (Sweet thorn); c) *Senegalia burkei* (Black monkey thorn); d) *Senegalia erubescens* (Blue thorn)

10.1.1.7 Habitat 7: Transformed areas

These areas are characterised by current or abandoned agricultural fields or grazing lands in which the natural habitat has been considerably altered. These areas are found throughout the study area and in most cases have a variety of grasses with the most common tree being *Dichrostachys cinerea*, which colonises impacted areas and can become an indigenous invader.



Figure 10-8: Habitat 9 Transformed areas

10.1.1.8 Habitat 8: Ephemeral Pans

Endorheic ephemeral pans are found along the powerline route and these provide a unique habitat for both flora and fauna. This habitat provides important ecological functions as well as a high diversity of faunal species, particularly birds. Ephemeral pans generally provide good habitat for frog species which are able of breeding in temporary environments of seasonal inundation (Du Preez and Caruthers 2009), such as the African Bullfrog (*Pyxicephalus adspersus*). *Senegalia mellifera* and *Vachellia tortilis* dominated the edges of pans, in addition to occasional occurrences of *Ziziphus mucronata*, which is a wetland indicator species. Refer to the next section for detailed wetland assessment findings.



Figure 10-9: Habitat 10 Ephemeral pans: a & b) *Senegalia mellifera* (Monkey Thorn); c) *Dactyloctenium aegyptium* (Common Crowfoot); d) *Ammocharis coranica* (Karoo Lily); e) *Senegalia toritilis* (Umbrella Thorn); f) *Urochloa mosambicensis* (Bushveld)

Signal Grass); g) *Ziziphus mucronata* (Buffalo Thorn); and h) *Combretum imberbe* (Leadwood)

10.1.2 General Observations

Bushveld vegetation does not typically show large variation and therefore communities were similar with an abundance of some cosmopolitan species. Common and characteristic shrubs, grasses and forbs observed throughout the whole study area are represented in Figure 10-10 to Figure 10-12.



Figure 10-10: Common bushes observed: a) *Grewia flava*; b) *Grewia flavescens*; c) *Grewia bicolor*; d) *Bauhinia petersiana*; e) *Gymnosporia tenuispina*; f) *Elephantorrhiza elephantina*





Figure 10-11: Grasses observed: a) *Aristida congesta* var. *congesta*; b) *Aristida stipitata*; c) *Panicum* sp.; d) *Stipagrostis uniplumis*; e) *Panicum coloratum*; f) *Schmidtia pappophoroides*; g) *Cenchrus ciliaris*; h) *Paspalum dilatatum*.; i) *Cyperus* spp.; j) *Urochloa mosambisencis*; k) *Tragus berteronianus*; l) *Eragrostis lehmanniana*; m) *Cyperus obtusiflorus*



Figure 10-12: Forb species observed on site: a) *Tephrosia multijuga*; b) *Commelina africana*; c) *Indigofera* sp; d) *Cleome maculate*; e) *Commelina bengalensis*; f) *Adenium oleifolium*; g) *Heliotropium nelsonii*; h) *Sarcostemma viminalis*; i) *Ledebouria revoluta*; j) *Ledebouria* spp.; k) *Tylosema esculentum*

10.1.3 Species of Special Concern

Table 10-2 lists the plant SSC recorded during the field visit. Protected plant species are listed under the LEMA Protected plants Schedule 11 or the National Protected Trees list and/or the national protected trees list under the National Forests Act (No. 84 of 1998). *Vachellia (Acacia) erioloba* (Camel Thorn) is listed as Declining.

Table 10-2: Plant Species of Special Concern recorded on site

Species Name	Common Name	Threat Status	Habitat Observed	National Tree Number
<i>Vachellia (Acacia) erioloba</i>	Camel Thorn	Declining; Nationally protected	1,4,8	168
<i>Boscia albitrunca</i>	Shepherd's Tree	LC; Nationally protected	2,10	122
<i>Combretum imberbe</i>	Leadwood	LC; Nationally protected	10	539
<i>Spirostachys africana</i>	Tamboti	LC; Provincially protected	1	341
<i>Sclerocarya birrea</i>	Marula	LC; Nationally protected	3,4,8	360



Figure 10-13: Protected tree species recorded on site; a) *Combretum imberbe* (Leadwood); b) *Sclerocarya birrea* (Marula); c) *Vachellia erioloba* (Camel Thorn); d) *Boscia albitrunca* (Shepherds Tree); e) *Spirostachys africana* (Tambotie)

10.1.3.1 Alien and Invasive Plant Species

Alien plants are considered to be non-native plants that invade formerly pristine environments (Bromilow, 2010). Invasions by alien plants cause a change in the composition and functioning of ecosystems and delivery of ecosystem services (Wilgen and de Lange, 2011). If alien plant invasions are not controlled, they exhibit the ability to transform heterogeneous landscapes to homogenous, often dominated by single species or scattered mono-specific clumps, thereby replacing natural vegetation. Further to this, alien bushclumps can alter hydraulic properties, such as infestations of *Pinus* in the Fynbos biome, rendering a water deficit for native plants in the area (Foxcroft 2002). In 2002, the estimated area of alien plant cover in South Africa was 10 million ha, which resulted in an annual water use of 3.3 billion m³ in excess of natural vegetation (Wilgen and de Lange 2011). Although this is a preliminary estimate, based on desktop studies, it is a good indication of the water losses that incur due to alien plant invasion.

Alien plant species in South Africa have been classified according to NEMBA as published in August 2014 (GN R599 in GG 37886 of 1 August 2014) into the following categories:

- Category 1a: Species requiring compulsory control;

- Category 1b: Invasive species controlled by an invasive species management programme;
- Category 2: Invasive species controlled by area, and;
- Category 3: Invasive species controlled by activity.

Five alien plant species were recorded along the transmission line route, as listed in Table 10-3.

Table 10-3: Alien Plant Species recorded on Site

Species Name	Common Name	CARA; Category	NEMBA	Habitat Observed
<i>Datura stramonium</i>	Downy Thorn Apple	1; 1b		Recorded in predominately Habitat 9 (Transformed area) and scattered in all others
<i>Solanum lichtensteinii</i>	Lichtenstein's Solanum	No category		
<i>Solanum mauritanium</i>	Bugweed	1; 1b		
<i>Solanum incanum</i>	Bitter Apple	No category		
<i>Tribulus terrestris</i>	Devil's Weed	No category		



Figure 10-14: Examples of alien plant species recorded on site: a) *Tribulus terrestris*; b) *Solanum incanum*; c) *Datura stramonium* and d) *Solanum mauritanium*

10.1.4 Medicinal Plants

Ethnobotany is a branch of botany that places focus on the use of plants for medicines and other practical purposes. The use of native plants for ethnobotanical uses can be detrimental to populations that are overexploited. For instance, Senegalia (*Acacia erioloba*), identified in the present study, has been assigned a 'Declining' status owing to mounting concerns for the large areas cleared for this species for the purpose of firewood and construction materials (von Staden and Raimondo 2008).

South Africa has a rich diversity of medicinal plants that not only have a global significance, but also have a cultural and historical role (van Wyk *et al.* 2009). There is a rapidly growing concern for conservation of medicinal plants that are dwindling in number due to illegal harvesting (Institute of Natural Resources 2003). This is particularly apparent in rural areas where medicinal plants are overexploited by traditional doctors. Medicinal plants identified for the area Table 10-4.

Table 10-4: Common Medicinal plants identified within the study area (van Wyk, 2009)

<i>Terminalia sericea</i>
Decoctions and infusions used as eye lotions and to treat pneumonia. Also used traditionally as a Tswana remedy for stomach disorders and diarrhoea.
<i>Vachellia (Acacia) karoo</i>
Decoctions of bark and leaves used as an emollient and astringent for colds, conjunctivitis and haemorrhage.
<i>Combretum spp.</i>
Numerous <i>Combretum</i> species recorded on site are used for the treatment of coughs, venereal diseases, stomach ailments and diarrhoea.
<i>Ziziphus mucronata</i>
Warm bark infusions used as expectorants for cough and chest problems. Decoctions of roots and leaves are applied topically to boils, sores and glandular swellings to promote healing and relief.
<i>Elephantorrhiza elephantina</i>
This provides food and medicine for local people and can also be used for tanning.

10.2 Fauna Surveys

The faunal survey presented below is based on the results from the Digby Wells 2015/16 fauna, flora and wetland report, and is included here to depict the faunal environment that prevails in the general area of the rail loop water pipeline and road diversion.

7.3.2 Mammals

10.2.1.1 Large Mammals

The initial mammal survey was conducted from the 1st to the 3rd of December 2015 within the proposed project area, and from the 15th to the 20th December and again on the 18th to the 21st January 2016. From the screening assessment it was expected that the majority of the large mammal species and avifaunal species would be identified as they are known to occur in the area.

The presence of the Honey Badger (*Mellivora capensis*), Porcupine (*Hystrix africaeaustralis*) and Black Backed Jackal (*Canis mesomelas*) confirmed on Duikerpan 249. Game cameras

also revealed a number of the more common antelope species such as Steenbok (*Raphicerus campestris*) and Impala (*Aepyceros melampus*) being present.

The Honey Badger (*Mellivora capensis*) was located on the farm Duikerpan 249 and was captured on a night camera trap. Despite its extensive range, this carnivore is absent from large areas of its former habitat in the North West, Gauteng, Mpumalanga, southern Kwazulu Natal and areas of the Northern and Eastern Cape provinces. Its threat status globally is 'Least Concern', however, in South Africa it is Vulnerable.

Honey Badgers have large space requirements and for this reason, breeding populations are not adequately conserved in small reserves. They are often hunted for meat and traditional medicine by the local communities. The general population trend is decreasing and night count estimates report densities of 0.03 adults per km² in the SANParks (Begg *et al.* 2008).

Brown Hyena (*Hyaena brunnea*) spoor and scats (Figure 10-15) was observed throughout the project area. They are confined to the limits of the southern African subregion with exception of a marginal extension into the arid parts of south-western Angola (Weasel *et al.* 2008). Brown Hyena are associated with the Nama-Karoo, Succulent Karoo and Savanna Biomes and occur in regions of low MAR in semi-desert scrub (Skinner and Chimimba 2005). Canopy cover is an essential component of their habitat and they have often been reported to seek shelter under *Boscia albitrunca* trees (present in the project area) or holes underground.

Brown Hyena are solitary foragers but some can live in small groups, they are 'Near Threatened' according to the IUCN. The territory of a single clan can be as large as 400 km². Their diet includes small mammals, birds, reptiles and insects as well as eggs and occasionally fruit. According to estimates from the IUCN, the total population size varies from 5000 to 8000 individuals (Wiesel *et al.* 2008). Major threats include human persecution in the form of poisoning, trapping and shooting as well as minor threats from traditional medicine hunters.



Figure 10-15: Evidence of mammal presence: a) Scat of a Brown Hyena (*Hyaena brunnea*); b) tracks of a Gemsbok (*Oryx gazella*); c) potential Aardvark (*Orycteropus afer*) excavations

Fourteen (14) large mammal species were recorded as listed in Table 10-5 in the project area which traverses two regional vegetation types: Limpopo Sweet Bushveld and the Western Sandy Bushveld. The region as had below average rainfall at the time of the survey. The majority of species were observed against the fence line of the property



boundaries or close to manmade watering holes due to the effect the drought is having on the area.

Table 10-5: Large Mammals Recorded During the Field Survey

Common name	Scientific name	IUCN (Global)	IUCN (Regional)	NEMBA	Type of Record
Aardvark	<i>Orycteropus afer</i>	Least Concern	Least Concern	Protected	Excavation
Black-backed Jackal	<i>Canis mesomelas</i>	Least Concern	Least Concern	Least Concern	Camera Trap
Brown Hyena	<i>Hyaena brunnea</i>	Near Threat	Near Threat	Protected	Scat observation
Common Duiker	<i>Sylvicapra grimmia</i>	Least Concern	Least Concern	Least Concern	Observation
Honey Badger	<i>Mellivora capensis</i>	Least Concern	Least Concern	Least Concern	Camera Trap
Gemsbok	<i>Oryx gazella</i>	Least Concern	Least Concern	Least Concern	Observation
Impala	<i>Aepyceros malampus</i>	Least Concern	Least Concern	Least Concern	Observation
Kudu	<i>Tragelaphus strepsiceros</i>	Least Concern	Least Concern	Least Concern	Observation
Porcupine	<i>Hystrix africaeaustralis</i>	Least Concern	Least Concern	Least Concern	Camera Trap
Scrub Hare	<i>Lepus saxatillis</i>	Least Concern	Least Concern	Least Concern	Camera Trap
Steenbok	<i>Raphicerus campestris</i>	Least Concern	Least Concern	Least Concern	Observation
Warthog	<i>Phacochoerus aethiopicus</i>	Least Concern	Least Concern	Least Concern	Observation/Camera trap

10.2.1.2 Small Mammals

Two Sherman trap lines were laid out in two veld variations (within Habitat type 1 being *Commiphora* bushveld); the first variation is more dominated by the *Combretum apiculatum*-*subsp apiculatum* (Red Bush Willow) and the second had a larger frequency of *Vachellia erioloba* (Camelthorn) (Figure 10-16). Five Sherman traps were laid down in each trap line in suitable places for two consecutive nights, where after the traps were checked each morning and rebaited.

Activity of rodent species was observed including recent activity around nesting sites and burrows. Although not confirmed in any of the Sherman traps the occurrence of the common species such as Red Veld Rat (*Aethomys chrysophilus*), Bushveld Gerbil (*Tetara leucogaster*), and Single Striped Mouse (*Lemniscomys rosalia*) was evident.



Figure 10-16: Examples of Sherman trap locations: a) *Combretum apiculatum* (Red Bush Willow) veld variation; b) *Vachellia erioloba* (Camelthorn) veld variation; c) trap location with the rodent burrow to the left

Small rodents were observed and heard but only two were identified (Table 10-6). A Rock Elephant Shrew (*Elephantulus myurus*) was observed on the farm Slangkop 256 on one of the night surveys that was conducted. It generally occupies habitats that are dominated by large rocks and boulders that are not particularly suitable for any intense human activities with the possible exception of grazing, especially by sheep, goats or cattle. There is no indication that this species or the preferred habitats it uses face any major threats. Therefore, the species is listed as Least Concern.

Dwarf Mongoose (*Helogale parvula*) was observed. This species is widely distributed throughout Sub-Saharan Africa (IUCN 2017). It is usually found to elevations of around 2000 masl. It prefers woodlands, thickets and wooded savannas, particularly where there are termitaria, rock outcroppings or crevices, or hollow logs and trees that they use as dens. Although susceptible to large scale industry such as mining, there are no major threats to this species. Due to the relatively high densities of this species in its preferred habitat it has been given a “least concern” status according to IUCN 2015.

Table 10-6: Small Mammals Recorded during the Field Surveys



Common name	Scientific name	IUCN (Global)	IUCN (Regional)	NEMBA	Source
Dwarf Mongoose	<i>Helogale parvula</i>	Least Concern	Least Concern	Least Concern	Observed
Rock Elephant Shrew	<i>Elephantulus myurus</i>	Least Concern	Least Concern	Least Concern	Observed

10.2.1.3 Red Data and Protected Mammals

There were 64 species identified in the screening assessment to have the likelihood of occurring in the Limpopo Province and in the project area. Some of the species would be expected and the habitat present is ideally suited to them. 7 of the 43 expected red data and protected species were recorded (Table 10-7).

Table 10-7: Evidence of Red Data or Protected Species occurring in the Project Area

Common name	Scientific name	IUCN (Global)	IUCN (Regional)	NEMBA	Probability
Brown Hyena	<i>Hyaena brunnea</i>	Near Threatened	Near Threatened	Protected	Sign and Tracks Recorded
Aardvark	<i>Orycteropus afer</i>	Least Concern	Least Concern	Protected	Sign Recorded
Cape Buffalo	<i>Syncerus caffer</i>	Least Concern	Vulnerable	Protected	Observed on Mooipan

During the survey discussions were held with representatives of the landowners, who provided further information regarding the occurrence of mammals on Duikerpan. The following red data species were cited by the representatives to occur on the property (Table 10-8).

Table 10-8: List of the Red Data and Protected species provide by the Land owner Representatives

Common name	Scientific name	IUCN (Global)	IUCN (Regional)	NEMBA	Probability
Brown Hyena	<i>Hyaena brunnea</i>	Near Threatened	Near Threatened	Protected	High
Bat Eared Fox	<i>Otocyon megalotis</i>	Least Concern	Least Concern	Protected	High
Cheetah	<i>Acinonyx jubatus</i>	Vulnerable	Vulnerable	Vulnerable	High



Leopard	<i>Panthera pardus</i>	Near Threatened	Near Threatened	Protected	High
Sable Antelope*	<i>Hippotragus niger niger</i>	Least Concern	Least Concern	Vulnerable	High

* Introduced

10.2.2 Avifauna

The avifaunal survey was conducted over three days on the farm Duikerpan 249 from the 1st to the 3rd December 2015 and the areas immediately surrounding the property as well as a further five days traversing the remainder of the project areas, from the 18th to the 22nd January 2016, 106 bird species observed. The vegetation habitat types have been delineated within the flora assessment and the table below (Table 10-9) represents selected avifaunal species that were observed within each habitat type. The avifaunal species observed are listed in Table 10-10.

Due to the transition zone it was interesting to observe certain closely related species alongside one another within or adjacent or the same vegetation habitat type. These include (eastern species first) Southern Boubou (*Laniarius ferrugineus*), Tropical Boubou (*Laniarius aethiopicus*) and Crimson-breasted Shrike (*Laniarius atrococcineus*), Arrow-marked Babbler (*Turdoides jardineii*) and Southern Pied Babbler (*Turdoides bicolor*), Tawny-flanked Prinia (*Prinia subflava*) and Black-chested Prinia (*Prinia flavicans*), Pin-tailed Whydah (*Vidua macroura*) and Shaft-tailed Whydah (*Vidua regia*), Dark-capped Bulbul (*Pycnonotus barbatus*) and Red-eyed Bulbul (*Pycnonotus nigricans*), Grey Penduline Tit (*Anthoscopus caroli*), and Cape Penduline Tit (*Anthoscopus minutus*) and White-browed Scrub Robin (*Cercotrichas leucophrys*), and Kalahari Scrub Robin (*Erythropygia paena*).

Generally the bird species remained uniform however variations were observed in areas where habitat change was obvious such as around the pan systems or close to the agricultural areas which included red data species such as Kori Bustard (*Ardeotis kori*), Lesser Kestrel (*Falco naumanni*) and in the wetter areas including pans the Yellow-billed stork (*Mycteria ibis*). Given the nature of the project being inclusive of transmission lines, there is a moderate threat to the large terrestrial bird species and the birds of prey that can be impacted on during flight and poor visibility.

Table 10-9: Selected Bird Species per Vegetation Habitat type

Vegetation Habitat		Selected species
1	<i>Commiphora</i> Bushveld	<i>Barred Wren-Warbler, Black-chested Snake-Eagle, Chestnut-vented Tit-Babbler, Kalahari Scrub Robin, Shaft-tailed Whydah, Little Sparrowhawk</i>
2	<i>Combretum</i> Thornveld	<i>Barred Wren-Warbler, Kori Bustard, Burnt-necked Eremomela, Chestnut-vented Tit-Babbler, European Roller, Crimson-breasted Shrike, Pale Chanting Goshawk</i>



Vegetation Habitat		Selected species
3	<i>Combretum/Marula</i> Thornveld	<i>Burnt-necked Eremomela, Chestnut-vented Tit-Babbler, European Roller, Southern-black Tit, Chinspot Batis</i>
4	<i>Terminalia/Marula</i> Bushveld	<i>Cape Vulture (flight), Kori Bustard, Fawn-coloured Lark, European Roller, Village Indigobird, Pale Chanting Goshawk, Wahlberg's Eagle, Red-crested Korhaan</i>
5	<i>Terminalia/Pterocarpus</i> Bushveld	<i>Burnt-necked Eremomela, Chestnut-vented Tit-Babbler, Fawn-coloured Lark, European Roller, White-backed Vulture (flight), Common Whitethroat</i>
6	<i>Combretum/Senegalia</i> thornveld	<i>Barred Wren-Warbler, Brubru, Chinspot Batis, White-fronted Bee-eater</i>
7	Transformed Areas	<i>Barn Owl, Kori Bustard, European Roller, Quail Finch, Rufous-naped Lark, Pale Chanting Goshawk, European Bee-eater, Chestnut-backed Sparrowlark</i>
8	Ephemeral Pans	<i>Tawny-flanked Prinia, Common Sandpiper, Greenshank, Three-banded Plover, Brown-hooded Kingfisher, Swallow-tailed Bee-eater, Comb Duck</i>

Table 10-10: List of Avifauna found during the Field Surveys

Common Name	Scientific Name	IUCN	NEMBA
Acacia Pied Barbet	<i>Tricholaema leucomelas</i>	Least Concern	Least Concern
African Pipit	<i>Anthus cinnamomeus</i>	Least Concern	Least Concern
African Grey Hornbill	<i>Tockus nasutus</i>	Least Concern	Least Concern
African Hoopoe	<i>Upupa epops</i>	Least Concern	Least Concern
African Red-eyed Bulbul	<i>Pycnonotus nigricans</i>	Least Concern	Least Concern
Arrow-marked Babbler	<i>Turdoides jardineii</i>	Least Concern	Least Concern
Barn Swallow	<i>Hirundo rustica</i>	Least Concern	Least Concern
Barn Owl	<i>Tyto alba</i>	Least Concern	Least Concern
Barred Wren-Warbler	<i>Calamonastes fasciolatus</i>	Least Concern	Least Concern
Black-chested Snake-Eagle	<i>Circaetus pectoralis</i>	Least Concern	Least Concern
Black-chested Prinia	<i>Prinia flavicans</i>	Least Concern	Least Concern
Black-headed Oriole	<i>Oriolus larvatus</i>	Least Concern	Least Concern
Black-shouldered Kite	<i>Elanus caeruleus</i>	Least Concern	Least Concern
Grey-backed Cameroptera	<i>Cameroptera brachyura</i>	Least Concern	Least Concern



Common Name	Scientific Name	IUCN	NEMBA
Bateleur	<i>Terathopius ecaudatus</i>	Vulnerable	Endangered
Blue Waxbill	<i>Uraeginthus angolensis</i>	Least Concern	Least Concern
Brown-crowned Tchagra	<i>Tchagra australis</i>	Least Concern	Least Concern
Brown-hooded Kingfisher	<i>Halcyon albiventris</i>	Least Concern	Least Concern
Brubru	<i>Nilaus afer</i>	Least Concern	Least Concern
Burchell's Sandgrouse	<i>Pterocles burchelli</i>	Least Concern	Least Concern
Burnt-necked Eremomela	<i>Eremomela usticollis</i>	Least Concern	Least Concern
Cape Glossy Starling	<i>Lamprotornis nitens</i>	Least Concern	Least Concern
Cape Turtle Dove	<i>Streptopelia capicola</i>	Least Concern	Least Concern
Cape Vulture	<i>Gyps coprotheres</i>	Endangered	Endangered
Cardinal Woodpecker	<i>Dendropicops fuscescens</i>	Least Concern	Least Concern
Carmine Bee-eater	<i>Merops nubicooides</i>	Least Concern	Least Concern
Chestnut-backed Sparrowlark	<i>Eremopterix leucotis</i>	Least Concern	Least Concern
Chestnut-vented Tit-Babbler	<i>Sylvia subcaerulea</i>	Least Concern	Least Concern
Chinspot Batis	<i>Batis molitor</i>	Least Concern	Least Concern
Crested Barbet	<i>Trachyphonus vaillantii</i>	Least Concern	Least Concern
Crested Francolin	<i>Dendroperdix sephaena</i>	Least Concern	Least Concern
Crimson-breasted Shrike	<i>Laniarius atrococcineus</i>	Least Concern	Least Concern
Crowned Lapwing	<i>Vanellus coronatus</i>	Least Concern	Least Concern
Dark-capped Bulbul	<i>Pycnonotus tricolor</i>	Least Concern	Least Concern
Diederik Cuckoo	<i>Chrysococcyx caprius</i>	Least Concern	Least Concern
Egyptian Goose	<i>Alopochen aegyptiaca</i>	Least Concern	Least Concern
Emerald-spotted Wood-Dove	<i>Turtur chalcospilos</i>	Least Concern	Least Concern
Eurasian Golden-Oriole	<i>Oriolus oriolus</i>	Least Concern	Least Concern
European Bee-eater	<i>Merops apiaster</i>	Least Concern	Least Concern
European Roller	<i>Coracias garrulus</i>	Least Concern	Vulnerable
Fawn-coloured Lark	<i>Calendulauda africanoides</i>	Least Concern	Least Concern
Fork-tailed Drongo	<i>Dicrurus adsimilis</i>	Least Concern	Least Concern
Golden-breasted Bunting	<i>Emberiza flaviventris</i>	Least Concern	Least Concern
Golden-tailed Woodpecker	<i>Campethera abingoni</i>	Least Concern	Least Concern



Common Name	Scientific Name	IUCN	NEMBA
Green Wood-hoopoe	<i>Phoeniculus purpureus</i>	Least Concern	Least Concern
Green-winged Pytilia	<i>Pytilia melba</i>	Least Concern	Least Concern
Grey Go-away-bird	<i>Corythaixoides concolor</i>	Least Concern	Least Concern
Greyheaded Sparrow	<i>Passer griseus</i>	Least Concern	Least Concern
Ground Scraper Thrush	<i>Psophocichla litsitsirupa</i>	Least Concern	Least Concern
Helmeted Guineafowl	<i>Numida meleagris</i>	Least Concern	Least Concern
House Sparrow	<i>Passer domesticus</i>	Least Concern	Least Concern
Kalahari Scrub-Robin	<i>Cercotrichas paena</i>	Least Concern	Least Concern
Klaas's Cuckoo	<i>Chrysococcyx klaas</i>	Least Concern	Least Concern
Kori Bustard	<i>Ardeotis kori</i>	Vulnerable	Protected
Laughing Dove	<i>Spilopelia senegalensis</i>	Least Concern	Least Concern
Levaillant's Cuckoo	<i>Clamator levaillantii</i>	Least Concern	Least Concern
Lilac-breasted Roller	<i>Coracias caudatus</i>	Least Concern	Least Concern
Little Bee-eater	<i>Merops pusillus</i>	Least Concern	Least Concern
Little Swift	<i>Apus affinis</i>	Least Concern	Least Concern
Long-billed Crombec	<i>Sylvietta rufescens</i>	Least Concern	Least Concern
Magpie Shrike	<i>Corvinella melanoleuca</i>	Least Concern	Least Concern
Marico Flycatcher	<i>Bradornis mariquensis</i>	Least Concern	Least Concern
Marico Sunbird	<i>Cinnyris mariquensis</i>	Least Concern	Least Concern
Martial Eagle	<i>Polemaetus bellicosus</i>	Vulnerable	Vulnerable
Namaqua Dove	<i>Oena capensis</i>	Least Concern	Least Concern
Pale-chanting Goshawk	<i>Melierax canourus</i>	Least Concern	Least Concern
Pearl-spotted Owlet	<i>Glaucidium perlatum</i>	Least Concern	Least Concern
Purple Roller	<i>Coracias naevius</i>	Least Concern	Least Concern
Rattling Cisticola	<i>Cisticola chiniana</i>	Least Concern	Least Concern
Red-backed Shrike	<i>Lanius collurio</i>	Least Concern	Least Concern
Redbilled Hornbill	<i>Tockus erythrorhynchus</i>	Least Concern	Least Concern
Red-billed Quelea	<i>Quelea quelea</i>	Least Concern	Least Concern
Red-breasted Swallow	<i>Cecropis semirufa</i>	Least Concern	Least Concern
Red-crested Korhaan	<i>Lophotis ruficrista</i>	Least Concern	Least Concern



Common Name	Scientific Name	IUCN	NEMBA
Red-eyed Dove	<i>Streptopelia semitorquata</i>	Least Concern	Least Concern
Red-billed Oxpecker	<i>Buphagus erythrorhynchus</i>	Least Concern	Least Concern
Red-faced Mousebird	<i>Urocolius indicus</i>	Least Concern	Least Concern
Rufous-naped Lark	<i>Mirafra africana</i>	Least Concern	Least Concern
Sabota Lark	<i>Mirafra sabota</i>	Least Concern	Least Concern
Shaft-tailed Whydah	<i>Vidua regia</i>	Least Concern	Least Concern
Shikra (Little Banded Goshawk)	<i>Accipiter badius</i>	Least Concern	Least Concern
Southern Black Tit	<i>Parus niger</i>	Least Concern	Least Concern
Southern Carmine Bee-eater	<i>Merops nubicoides</i>	Least Concern	Least Concern
Southern Masked-Weaver	<i>Ploceus velatus</i>	Least Concern	Least Concern
Southern Pale Chanting Goshawk	<i>Melierax canorus</i>	Least Concern	Least Concern
Southern Pied-Babbler	<i>Turdoides bicolor</i>	Least Concern	Least Concern
Southern White-crowned Shrike	<i>Eurocephalus anguitimens</i>	Least Concern	Least Concern
Southern Yellow-billed Hornbill	<i>Tockus leucomelas</i>	Least Concern	Least Concern
Speckled Mousebird	<i>Colius striatus</i>	Least Concern	Least Concern
Spotted Flycatcher	<i>Muscicapa striata</i>	Least Concern	Least Concern
Steppe Buzzard	<i>Buteo buteo vulpinus</i>	Least Concern	Least Concern
Swainson's Spurfowl	<i>Pternistis swainsonii</i>	Least Concern	Least Concern
Swallow-tailed Bee-eater	<i>Pternistis swainsonii</i>	Least Concern	Least Concern
Tawny Eagle	<i>Aquila rapax</i>	Vulnerable	Endangered
Tawny-flanked Prinia	<i>Prinia subflava</i>	Least Concern	Least Concern
Village Weaver	<i>Ploceus cucullatus</i>	Least Concern	Least Concern
Violet-backed Starling	<i>Cinnyricinclus leucogaster</i>	Least Concern	Least Concern
Violet-eared Waxbill	<i>Uraeginthus granatinus</i>	Least Concern	Least Concern
Wahlberg's Eagle	<i>Hieraaetus wahlbergi</i>	Least Concern	Least Concern
Wattled Starling	<i>Creatophora cinerea</i>	Least Concern	Least Concern
White Winged Widow	<i>Euplectes albonotatus</i>	Least Concern	Least Concern
White-backed Vulture	<i>Gyps africanus</i>	Endangered	Endangered
White-bellied Sunbird	<i>Cinnyris talatala</i>	Least Concern	Least Concern
White-browed Scrub-Robin	<i>Cercotrichas leucophrys</i>	Least Concern	Least Concern



Common Name	Scientific Name	IUCN	NEMBA
White-browed Sparrow-Weaver	<i>Plocepasser mahali</i>	Least Concern	Least Concern
White-fronted Bee-eater	<i>Merops nubicoides</i>	Least Concern	Least Concern

10.2.2.1 Red Data and Protected Birds

Six Red Data species were found to occur in the vicinity of the project area (Table 10-11). The majority were birds of prey and observed in flight. Many of these species were observed throughout the project area with only the Kori Bustard (*Ardeotis kori*) was located in both disturbed agricultural fields and the sensitive bushveld habitats. Some are shown in Figure 10-17.

Table 10-11: Red Data and Protected Birds observed in the Project Area

Common name	Scientific name	IUCN status	Endemicity	Recorded
Kori Bustard	<i>Ardeotis kori</i>	VU		x
Bateleur	<i>Terathopius ecaudatus</i>	VU		x
Tawny Eagle	<i>Aquila rapax</i>	VU		x
Martial Eagle	<i>Polemaetus bellicosus</i>	VU		x
Cape Vulture	<i>Gyps coprotheres</i>	EN	Near Endemic	x
White Backed Vulture	<i>Gyps africanus</i>	EN		x



Figure 10-17: Avifaunal species observed that use existing powerlines as vantage points: a) Black-breasted Snake Eagle (*Circaetus pectoralis*); b) Carmine Bee-eater (*Merops nubicoides*); c) Shaft-tailed Whydah (*Vidua regia*); d) White-backed Vulture (*Gyps africanus*); e) Pale-chanting Goshawk (*Melierax canorus*)

10.2.3 Herpetofauna

Although the screening assessment indicates the number of herpetofauna in the Limpopo Province is relatively high, there records of occurrences in comparison is low, this may due to various factors namely, insufficient data collection or restriction in terms of rainfall, habitat and food availability.

At the time of the survey drought conditions prevailed and below average rainfall had occurred in the study area. Therefore it was expected that low numbers of herpetofauna assemblages would be encountered. Very little snake activity was observed and some landowners did indicate an increase in snake activity close to their residences. This is indicative of general food shortages due to the climatic conditions. Six herpetofaunal species were observed while walking in the project area (Table 10-12 and Figure 10-18).

Table 10-12: Herpetofaunal Species found on the Project Area

Common name	Scientific name	IUCN (Global)	IUCN (Regional)	NEMBA	Probability
Blue Headed Tree Agama	<i>Acanthocercus articolis</i>	Least Concern	Least Concern	Least Concern	Observed
Spotted Sand Lizard	<i>Nucras intertexta</i>	Least Concern	Least Concern	Least Concern	Observed
Bushveld Lizard	<i>Heliobolus lugubris</i>	Least Concern	Least Concern	Least Concern	Observed
Leopard Tortoise	<i>Stigmochelys pardalis</i>	Least Concern	Least Concern	Least Concern	Observed
Black Mamba	<i>Dendroaspis polylepis</i>	Least concern	Least concern	Least concern	Reported by farmers
African Rock Python	<i>Python sebae</i>	Near threatened	Near threatened	Threatened	Reported by farmers

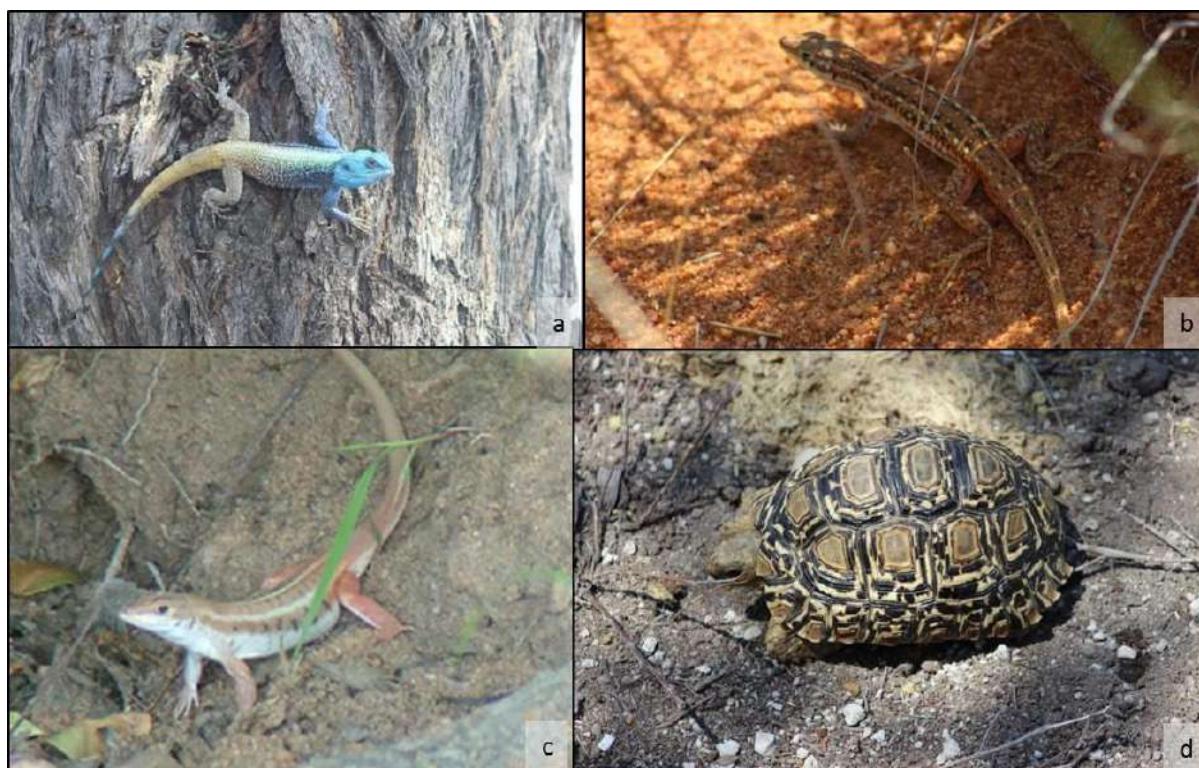


Figure 10-18: Examples of herpetofauna observed: a) Tree Agama (*Acanthocercus articolis*); b) Spotted Sand Lizard (*Nucras intertexta*); c) and Bushveld Lizard (*Heliobolus lugubris*); d) Leopard Tortoises (*Stigmochelys pardalis*)

No frog species were encountered during the survey. Although the lack of rainfall was evident and the pan systems were extremely dry, the habitat is perfect for the African

Bullfrog (*Pyxicephalus adspersus*) which has been observed in the area before by Digby Wells.

10.2.3.1 Herpetofauna of Special Concern

No Red Data or protected species were found during the survey however the local farm staff had recently removed a number of African Rock Pythons (*Python sebae*) (Figure 10-19). This species is listed as “vulnerable” and is by far the largest snake species in Southern Africa, reaching a maximum length of 5m and a mass of 60kg. It has a triangular head that is distinctive from the rest of the body (Alexander and Marais, 2005). The African Rock Python can be found in a variety of micro habitats including trees, rocky outcrops and pan and marsh areas all of which occur on within the project area. Although no sign of a Python was observed, the remoteness and surrounding habitat is conducive for the survival of this species. The local farmers specifically on the farms Duikerpan 249 and Twistspan 265 have recently had a number of pythons attempting to raid their chickens and domestic animals. This could also be attributed to the drought conditions.

It is rated as Vulnerable in the latest Red Data Book for South Africa and Swaziland mainly because it is exploited for human consumption. It is unlikely that this species will retain this threat classification using the latest IUCN criteria since it appears to be relatively common in protected areas and widespread. Outside the protected areas, the species seems to be on the decline.



Figure 10-19: South African Python (*Python sebae*) – Photo by Johan Marais, 1992

10.2.3.2 Baboon Spiders

Three baboon spider nests were identified previously. One was successfully identified and one Horned Baboon Spider (*Ceratogyrus darling*) as shown in Figure 10-20 below. Horned

baboon spiders (*Ceratogyrus darlingi*) are endemic to southern Africa and have a distinctive horn projecting from the top of their carapace. The shape of the horn varies between species. It is a nationally protected species and as the two nests that were observed falls just south of Duikerpan 249, and a relocation programme will be required to manage these species, if impacts are experienced.



Figure 10-20: Horned Baboon Spider (*Ceratogyrus darlingi*) and its nest

10.2.3.3 Butterflies and Beetles

Twelve invertebrate species (Table 10-13) were observed while surveying the project area. Nine butterfly species and three beetle species (Figure 10-21)

Table 10-13: Invertebrate Species observed within the project area

Common name	Scientific name	IUCN (Global)	NEMBA
Smokey Orange Tip Butterfly	<i>Colotis euipe</i>	Least Concern	Least Concern
African Monarch Butterfly	<i>Danaus chrysippus</i>	Least Concern	Least Concern
Zebra White Butterfly	<i>Pinacopteryx eriphia</i>	Least Concern	Least Concern
Common Zebra Blue	<i>Leptotes pirithous</i>	Least Concern	Least Concern
Wandering Donkey Acrea	<i>Acrea neobule</i>	Least Concern	Least Concern
Spotted Joker	<i>Byblia ilithyia</i>	Least Concern	Least Concern
Bushvel Charaxes	<i>Charaxes achaemenes</i>	Least Concern	Least Concern
Common Diadem	<i>Hypolimnas misippus</i>	Least Concern	Least Concern
Blue Pansy	<i>Junonia hierta</i>	Least Concern	Least Concern
Flattened Giant Dung Beetle	<i>Pachylomerus femoralis</i>	Least Concern	Least Concern
Small Green Dung Beetle	<i>Gymnopleurus humanus</i>	Least Concern	Least Concern
Plum Dung Beetle	<i>Anachalcos convexus</i>	Not Assessed	Not Assessed



Figure 10-21: Examples of dung beetles recorded on site: a) Flattened Giant Dung Beetle (*Pachylomerus femoralis*); b) Small Green Dung Beetle (*Gymnopleurus humanus*); c) Plum Dung Beetle (*Anachalcos convexus*)

10.2.3.4 Red Data and Protected Invertebrates

One protected invertebrate was observed on Vlakfontein 264 previously, according to the Schedules published in GN 29657/ R151 in NEMBA dated the 23rd February 2014, the Horned Baboon Spider (*Ceratogyrus darlingi*).

11 Ecological Impact Assessment

The objective of this section is to rate the significance of the potential impacts pre-mitigation and post-mitigation. The impacts below are a result of both the environment in which the activity takes place, as well as the activity itself.

This Ecological Impact Assessment is for the construction of infrastructure ancillary to the Temo Mine, which is the road diversion, Rail Loop and water Pipeline. This ancillary infrastructure is required for the operations of the Temo Mine however it was not included or assessed in the original environmental authorisation of the Temo Mine.

Table 11-1: Project Activities

Construction Phase Activities
Recruitment and employment of workers/appointment of contractors for construction and other services
Procurement of goods
Construction of access road(s)
Site clearing (removal of vegetation)
Topsoil and subsoil removal and stockpiling
Temporary storage of construction materials and hazardous material
Increased vehicular activity on road D175
Construction of the road diversion, rail loop and pipeline
Water storage for construction activities
Generation and removal of domestic and hazardous waste
Operation Phase Activities
Ongoing monitoring of social and environmental aspects
Continuous implementation of the management plans
Maintenance and repair of rail loop and pipeline
Vehicular activity on access roads and D175 main road
Operation of the rail loop and pipeline
Decommissioning Phase Activities (Rail loop and Pipeline)
Retrenchment of staff
Demolition of rail loop and associated infrastructure
Rehabilitation of area
Generation and disposal of demolition waste

Rehabilitation of access road
Post-closure Phase (Rail loop and Pipeline)
Post-closure monitoring and rehabilitation will determine the level of success of the rehabilitation, as well as to identify any additional measures that have to be undertaken to ensure that the area associated with the rail loop and pipeline route is restored to an adequate state. Monitoring will include surface water, soil fertility and erosion, natural vegetation and alien invasive species and potential dust generation.

11.1.1 Construction Phase

11.1.1.1 Impact Description

The construction of the road diversion, rail loop and pipeline and associated infrastructure will lead to the loss of approximately 328 ha of natural vegetation in total. It is envisaged that the project area will endure a permanent loss of vegetation and habitat in areas where the road diversion, pipeline and rail loop will be constructed. The major impacts anticipated due to the proposed interaction are listed in Table 11-2 below.

Table 11-2: Interactions and Impacts of the construction phase

Interaction	Impact
Site clearing for infrastructure placement including the increased traffic to complete the activity and habitat fragmentation.	<p>Direct and permanent loss of approximately 15 ha of natural habitat for the road diversion and 40 ha for the rail loop project areas and direct large loss of natural habitat of approximately 313 ha in the pipeline servitude (Option 2).</p> <p>Loss of ecological services provided by areas of high sensitivity including the woodland areas.</p> <p>Indirect impacts due to an industrial activity occurring within a largely natural landscape including increased road kills.</p>

11.1.1.2 Management Objectives

These objectives aim to prevent/minimise the loss of or further damage to natural ecosystems and their buffer areas, and limit the destruction of natural areas to project footprint areas. This is important as the naturally occurring habitat and ecosystems play a major role in supporting a range of ecological processes and biodiversity in the region; particularly as this currently is a tourism area.

11.1.1.3 Management Actions and Targets

The Ecological Management Plan detailed in Section 15 must be used as a guide to inform management actions. However, specific important management actions are briefly discussed below:

- A detailed sweep of the impacted areas and servitudes must be completed where:
 - All protected trees are located and counted for the permitting process;
 - All other floral SSC observed are located and documented;
 - All nesting faunal species (including baboon spiders) are located, counted and documented.
- Investigate the potential to establish or contribute to an ecological offset area;
- Ensure alien invasive plant species do not colonize open areas.



11.1.1.4 Impact Ratings

Table 11-3: Potential impacts of the Construction phase on the Ecological Environment

Activity and Interaction: Clearing of vegetation and increased traffic during construction			
Dimension	Rating	Motivation	Significance
Impact 1 Description: Loss of Vegetation and habitat types			
<p>Direct and permanent loss of approximately 55 ha of natural habitat on the farm Duikerpan for the Rail loop and road diversion project area and Direct large loss of natural habitat of approximately 313 ha in the pipeline servitude (Option 2).</p> <p>Topsoil stripping will eliminate fauna habitat and food resources. Haul roads and transport of material will affect the natural occurring/protected species of the site. Increased human presence will affect natural cycles. Construction noise will disturb faunal natural environment and the construction of powerlines (associated with rail loop) are dangerous to the large terrestrial bird communities including the critically endangered vulture species, birds of prey and large terrestrial species such as storks and bustards found in the area.</p>			
Prior to mitigation/ management			
Duration	Beyond Project Life (6)	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible.	Moderate negative (-98)
Extent	Municipal (4)	Loss of habitat will occur locally but will impact mobile faunal species of a greater area.	
Intensity	Moderate loss (4)	Serious loss and/or damage to physical or biological resources or moderately sensitive environments.	
Probability	Definite (7)	These impacts will occur if the project goes ahead.	
Nature	Negative (-1)		
Mitigation/ Management actions			


Activity and Interaction: Clearing of vegetation and increased traffic during construction

Dimension	Rating	Motivation	Significance
Limited mitigation measures exist for loss of habitat; however the following are recommended: <ul style="list-style-type: none"> ▪ Use previously disturbed areas where possible and where possible retain as much natural vegetation within the foot print of the developments and particularly within the pipeline and rail way servitude. ▪ Relocate red data or protected species prior to site clearing commencing. ▪ A 100 m buffer is recommended for the pan, wetland and woodland habitats. ▪ Ensure that the area is fenced off to limit the ingress of animal and plant species into the construction areas, including alien invasive species. ▪ Ensure that environmental awareness training is held prior and during construction operations are held. ▪ No poaching or lighting of fires or feeding of fauna. ▪ To further mitigate the permanent loss of natural habitat, ecological offsetting must be done. 			
Post- mitigation			
Duration	Beyond project life (6)	The impact will remain for some time after the life of the project and is potentially irreversible even with management	Moderate negative (-84)
Extent	Local (3)	Local extending only as far as the development site area.	
Intensity	Serious loss (3)	Moderate loss and/or damage to biological or physical resources.	
Probability	Definite (7)	These impacts will occur if the project goes ahead.	
Nature	Negative(-1)		



Activity and Interaction: Clearing of vegetation and increased traffic during construction			
Dimension	Rating	Motivation	Significance
Impact 2 Description:			
Loss of ecological services provided by areas of high sensitivity including the pan vegetation and woodland areas			
Pipe Line Servitude and rail loop clearing will directly remove woodland habitat and their buffer areas. Construction and clearing of this vegetation will disturb these natural environments and compromise the ecological services they provide, which are of great significance in the context of the area.			
<i>Prior to mitigation/ management</i>			
Duration	Beyond project life (6)	The impact will remain for some time after the life of the project and is potentially irreversible even with management	Moderate negative (-98)
Extent	Municipal (4)	Loss of ecological services will occur locally but will impact mobile faunal species of a greater area utilising these habitats.	
Intensity	Serious damage to sensitive environments (4)	Serious damage to sensitive biophysical resources limiting ecosystem function.	
Probability	Definite (7)	There are sound scientific reasons to expect that this impact will occur if the project goes ahead.	
Nature	Negative(-1)		
<i>Mitigation/ Management actions</i>			


Activity and Interaction: Clearing of vegetation and increased traffic during construction

Dimension	Rating	Motivation	Significance
Limited mitigation measures exist for loss of ecological services; however the following are recommended: <ul style="list-style-type: none"> ▪ If the sensitive areas in the road, pipeline and rail line servitude are not able to be avoided, retain as much natural vegetation within these habitats as possible. ▪ Use previously disturbed areas where possible ▪ Plan to relocate red data or protected species prior to site clearing commencing. ▪ A 100 m buffer is recommended for the pan, wetland and woodland habitats if possible. ▪ Ensure that the area is fenced off to limit the ingress of animal and plant species into the construction areas, including alien invasive species. ▪ To further mitigate the permanent loss of natural habitat, ecological offsetting must be done. 			
Post-mitigation			
Duration	Beyond project life (6)	Loss of ecological services will remain an impact beyond the project life.	Moderate negative (-84)
Extent	Local (3)	Local extending only as far as the development site area.	
Intensity	Moderate damage to sensitive environments (3)	With adequate mitigation, this can be moderate damage to sensitive biophysical resources limiting ecosystem function.	
Probability	Definite (7)	There are sound scientific reasons to expect that this impact will occur if the project goes ahead.	
Nature	Negative(-1)		



Activity and Interaction: Clearing of vegetation and increased traffic during construction			
Dimension	Rating	Motivation	Significance
Impact 3 Description:			
Indirect impacts due to construction activities occurring within a largely natural landscape.			
Construction activities requiring the use of existing, upgraded and new roads will disturb the natural environment. Road deaths of naturally occurring red data and other faunal species will increase and habitat fragmentation will occur.			
<i>Prior to mitigation/ management</i>			
Duration	Medium term (3)	Construction activities will occur within 1-5 years.	Moderate negative (-77)
Extent	Municipal (4)	Indirect impacts (such as road kills) will occur locally but will impact mobile faunal species of the greater area.	
Intensity	Serious damage to or loss of sensitive environments (4)	Serious damage to or loss of sensitive biophysical resources such as SCC.	
Probability	Definite (7)	There are sound scientific reasons that the impact will definitely occur.>80% probability	
Nature	Negative(-1)		
<i>Mitigation/ Management actions</i>			



Activity and Interaction: Clearing of vegetation and increased traffic during construction			
Dimension	Rating	Motivation	Significance
<ul style="list-style-type: none"> ▪ Ensure that the width and length of the road is kept to a minimum. ▪ Use previously disturbed areas or existing roads where possible. ▪ Plan to relocate red data or protected species prior to construction commencing. ▪ Ensure that noise levels are reduced as far as possible. ▪ Ensure that the project area is demarcated and no persons or vehicles permitted outside the demarcated area. ▪ Ensure that environmental awareness training is held prior and during construction operations are held. 			
Post- mitigation			
Duration	Medium term (3)	Construction activities will occur within 1-5 years.	Minor Negative -55
Extent	Municipal (4)	Loss of ecological services will occur locally but will impact mobile faunal species of a greater area utilising these habitats.	
Intensity	Serious damage to or loss of sensitive environments (4)	Serious damage to or loss of sensitive biophysical resources such as SCC.	
Probability	Likely: The impact may occur. <65% probability.(5)	The will always remain the possibility of deaths due to the mobility of the fauna	
Nature	Negative(-1)		

11.1.2 Operational Phase

11.1.2.1 Impact Description

The operation of the road pipeline and rail line within the line servitude will have impacts to the surrounding and remaining natural vegetation. The major impacts anticipated due to the proposed interaction are listed in Table 11-4 below.

Table 11-4: Interactions and Impacts of the Operational Phase

Interaction	Impact
Operation of infrastructure including the transport of coal, generation of noise and dust, generation of domestic and hazardous waste and the ingress of humans into the area.	Indirect impacts due to an industrial activity occurring within a largely natural landscape including increased road kills.
Maintenance of the pipe line, rail line servitude and the road through continual vegetation cut backs.	Direct and continual loss of the 313 ha of habitat in the transmission line servitude (Option 2) and continually compromised ecological services provided by areas of high sensitivity including the pans and woodland areas.

11.1.2.2 Management Objectives

Management objectives are to inform Temo Coal where there are ecological interactions with the proposed activities during the construction of the infrastructure. These objectives are to prevent/minimise the loss of or further damage to natural ecosystems and their buffer areas. This is important as the naturally occurring habitat and ecosystems play a major role in supporting a range of ecological processes and biodiversity in the region; particularly as this currently is a tourism area.

11.1.2.3 Management Actions and Targets

During the construction of the project related infrastructure, general mitigation and management actions provided in the following studies done by Digby Wells as part of this project should be used to guide the effective management of the ecological resources affected by the proposed project:

- Groundwater Assessment Report (Digby Wells, 2019);
- Rehabilitation Plan (Digby Wells, 2019); and
- Surface Water Report (Digby Wells, 2019).

The Ecological Management Plan detailed in Section 15 must be used as a guide to inform management actions. However, specific important management actions are briefly discussed below:

- The edge of the pans and at least a 30m buffer must be clearly demarcated in the field that will last for the duration of the servitude route maintenance. A 100 m buffer is recommended as a no go area.
- Ensure and AIP management plan is in place and adhered to at all times.

11.1.2.4 Impact Ratings

Table 11-5: Potential Impacts of the Operational Phase on the Ecological Environment

Activity and Interaction: Operation of local infrastructure including the transport of coal, generation of noise and dust, generation of domestic and hazardous waste and the ingress of humans into the area.			
Dimension	Rating	Motivation	Significance
Impact 1 Description:			
Indirect impacts due to activities occurring within a largely natural landscape.			
Habitat loss and continual pressure exerted by the operations on the ecosystem can lead to pressure on the populations of threatened species or could lead to direct loss of individuals.			
<i>Prior to mitigation/ management</i>			
Duration	Project Life (5)	The impact will remain for the life of the project but is not reversible even with management	Moderate negative (-91)
Extent	Municipal (4)	Impacts may occur locally but will impact mobile faunal species of a greater area	
Intensity	Serious damage to or loss of sensitive environments (4)	Serious damage to or loss of sensitive biophysical resources such as SCC.	


Activity and Interaction: Operation of local infrastructure including the transport of coal, generation of noise and dust, generation of domestic and hazardous waste and the ingress of humans into the area.

Dimension	Rating	Motivation	Significance
Probability	Definite (7)	There are sound scientific reasons that the impact will definitely occur.>80% probability	
Nature	Negative (-1)		
Mitigation/ Management actions			
<ul style="list-style-type: none"> ▪ Ensure that a Biodiversity Action Plan addresses these impacts in full. ▪ Ensure that the controls of noise, dust, waste generation, vehicle speed limits, food waste disposal, hazardous waste disposal, human interaction with the ecology are monitored regularly and controls to prevent adverse conditions arising from the activities which are likely to affect fauna are updated and implemented. ▪ Ensure continuous environmental awareness training takes place. 			
Post- mitigation			
Duration	Project Life (5)	The impact will remain for the life of the project but is not reversible even with management.	Minor negative (-72)
Extent	Local (3)	Sound mitigation and management measures may ensure the impacts occur locally.	
Intensity	Moderate damage to or loss of sensitive environments (4)	Sound mitigation and management measures may ensure the damage to or loss of sensitive biophysical resources is moderate.	
Probability	Highly probable (6)	Sound mitigation and management measures may ensure the impacts are less likely to occur.	



Activity and Interaction: Operation of local infrastructure including the transport of coal, generation of noise and dust, generation of domestic and hazardous waste and the ingress of humans into the area.			
Dimension	Rating	Motivation	Significance
Nature	Negative (-1)		
Activity and Interaction: Maintenance of the servitude through continual vegetation cut backs.			
Dimension	Rating	Motivation	Significance
Impact 2 Description:			
Direct and continual loss of the 313 ha of habitat in the servitude (line 2) and continually compromised ecological services provided by areas of medium sensitivity including the pan buffers and woodland areas.			
<i>Prior to mitigation/ management</i>			
Duration	Project Life (5)	The impact will remain for the life of the project but is not reversible even with management	Moderate negative (-84)
Extent	Municipal (4)	Impacts may occur locally but will impact mobile species of a greater area will be impacted by habitat loss	
Intensity	Moderate loss and/or damage to biological or physical resources (3)	Serious damage to or loss of sensitive biophysical resources.	
Probability	Definite (7)	There are sound scientific reasons that the impact will definitely occur.>80% probability	
Nature	Negative (-1)		
<i>Mitigation/ Management actions</i>			


Activity and Interaction: Operation of local infrastructure including the transport of coal, generation of noise and dust, generation of domestic and hazardous waste and the ingress of humans into the area.

Dimension	Rating	Motivation	Significance
		<ul style="list-style-type: none"> ▪ Use previously disturbed areas only; no new habitat is to be impacted. ▪ A 100 m buffer is recommended for the pan, wetland and woodland habitats if possible as a no go area. ▪ Ensure that environmental awareness training is held prior and during activity. ▪ No poaching or lighting of fires or feeding of fauna. ▪ To further mitigate the permanent loss of natural habitat, ecological offsetting must be done. 	
Post- mitigation			
Duration	Project Life (5)	The impact will remain for the life of the project but is not reversible even with management	Minor negative (-72)
Extent	Local (3)	Sound mitigation and management measures may ensure the impacts occur locally	
Intensity	Moderate damage to or loss of sensitive environments (4)	Sound mitigation and management measures may ensure the damage to or loss of sensitive biophysical resources is moderate.	
Probability	Highly probable (6)	Sound mitigation and management measures may ensure the impacts are less likely to occur	
Nature	Negative(-1)		

11.1.3 Decommissioning Phase

11.1.3.1 Impact Description

The demolition of the rail loop and associated infrastructure areas, and rehabilitation of access roads may have negative impacts similar to that of the construction activities due to the similarities of the actions. These areas will then need to be rehabilitated back to wilderness and game farming or according to the updated regional strategic goal for the area. The major impacts anticipated due to the proposed interaction are listed in Table 11-6 below.

Table 11-6: Interactions and Impacts of the Decommissioning Phase

Interaction	Impact
Decommissioning and removal of infrastructure including the rail loop.	Indirect impacts due to an industrial activity occurring within a largely natural landscape.
Rehabilitation of impacted areas to wilderness	Improvements from rehabilitation will be recognisable over time as area is returned to wilderness – this will however not be natural bushveld.

11.1.3.2 Management Objectives

Management objectives are to inform Temo Coal where there are ecological interactions with the proposed activities during the construction of the infrastructure. These objectives are to prevent/minimise the loss of or further damage to natural ecosystems and their buffer areas. This is important as the naturally occurring habitat and ecosystems play a major role in supporting a range of ecological processes and biodiversity in the region; particularly as this currently is a tourism area.

11.1.3.3 Management Actions and Targets

During the construction of the project related infrastructure, general mitigation and management actions provided in the following studies done by Digby Wells as part of this project should be used to guide the effective management of the ecological resources affected by the proposed project:

- Groundwater Assessment Report (Digby Wells, 2019);
- Rehabilitation Plan (Digby Wells, 2019); and
- Surface Water Report (Digby Wells, 2019).



The Ecological Management Plan detailed in Section 15 must be used as a guide to inform management actions. However, specific important management actions are briefly discussed below:

- Rehabilitate the area to wilderness that is in line with the local setting with expert knowledge.
- If an ecological offset area was established or contributed to, investigate the role this area can play in assisting rehabilitation.

11.1.3.4 Impact Ratings

Table 11-7: Potential impacts of the Decommissioning phase on the ecological environment

Activity and Interaction: Decommissioning of infrastructure including the demolition of the rail loop.			
Dimension	Rating	Motivation	Significance
Impact 1 Description:			
Indirect impacts due to activities occurring within a largely natural landscape.			
Habitat loss and continual pressure exerted by the operations on the ecosystem can lead to pressure on the populations of threatened species or could lead to direct loss of individuals.			
Prior to mitigation/ management			
Duration	Project Life (5)	The impact will remain for the life of the project but is not reversible even with management.	Moderate negative (-84)
Extent	Municipal (4)	Impacts may occur locally but will impact mobile faunal species of a greater area.	
Intensity	Moderate loss and/or damage to biological or physical resources (3)	Moderate damage to or loss of biophysical resources.	
Probability	Definite (7)	There are sound scientific reasons that the impact will definitely occur.>80% probability.	
Nature	Negative (-1)		
Mitigation/ Management actions			


Activity and Interaction: Decommissioning of infrastructure including the demolition of the rail loop.

Dimension	Rating	Motivation	Significance
<ul style="list-style-type: none"> ▪ Ensure that a Biodiversity Action Plan addresses these impacts in full. ▪ Ensure that the controls of noise, dust, waste generation, vehicle speed limits, food waste disposal, hazardous waste disposal, human interaction with the ecology are monitored regularly and controls to prevent adverse conditions arising from the activities which are likely to affect fauna are updated and implemented. ▪ Ensure continuous environmental awareness training takes place. 			
Post-mitigation			
Duration	Project Life (5)	The impact will remain for the life of the project but is not reversible even with management.	Minor negative (-72)
Extent	Local (3)	Sound mitigation and management measures may ensure the impacts occur locally.	
Intensity	Moderate damage to or loss of sensitive environments (4)	Sound mitigation and management measures may ensure the damage to or loss of sensitive biophysical resources is moderate.	
Probability	Highly probable (6)	Sound mitigation and management measures may ensure the impacts are less likely to occur.	
Nature	Negative (-1)		
Activity and Interaction: Rehabilitation of impacted areas to wilderness			
Dimension	Rating	Motivation	Significance


Activity and Interaction: Decommissioning of infrastructure including the demolition of the rail loop.

Dimension	Rating	Motivation	Significance
Impact 2 Description: Improvements from rehabilitation will be recognisable over time as area is returned to wilderness – this will however not be natural bushveld. These areas will have been transformed permanently from the natural state and this impact is captured in the construction phase. With well-planned and case specific rehabilitation actions the area will be improved from its previously impacted state.			
<i>Prior to mitigation/ management</i>			
Duration	Medium term (3)	The rehabilitation will be effective for 1 to 5 years before further degradation occurs	Negligible positive (36)
Extent	Local (3)	Local extending only as far as the development site area.	
Intensity	Average (3)	Ongoing positive benefits, not wide spread but felt by some elements of the baseline	
Probability	Probable (4)	Could occur < 50%	
Nature	Positive (-1)		
<i>Mitigation/ Management actions</i>			
<ul style="list-style-type: none"> ▪ Ensure that the rehabilitation plan is updated during the projects term. ▪ Ensure that the environmental liability assessments are done annually and that the cost for rehabilitation is updated annually and the funds are available. ▪ Ensure that expertise is made available well in advance to deal with all the aspects of decommissioning. ▪ Ensure that an ecologist is commissioned to guide the rehabilitation of the natural elements of the project site. ▪ Rehabilitate successfully to bushveld comprised of natural indigenous species with the carrying capacity of pre-disturbance standards. 			



Activity and Interaction: Decommissioning of infrastructure including the demolition of the rail loop.			
Dimension	Rating	Motivation	Significance
<i>Post- mitigation</i>			
Duration	Beyond project life (6)	Improvements and rehabilitation will be recognisable, ingress of fauna into the area overtime	Minor positive (65)
Extent	Local (3)	Will extend as far as the site	
Intensity	Average (4)	Average ongoing positive benefits felt by some elements of the baseline	
Probability	Likely (5)	Its most likely that this impact will occur	
Nature	Negative(-1)		

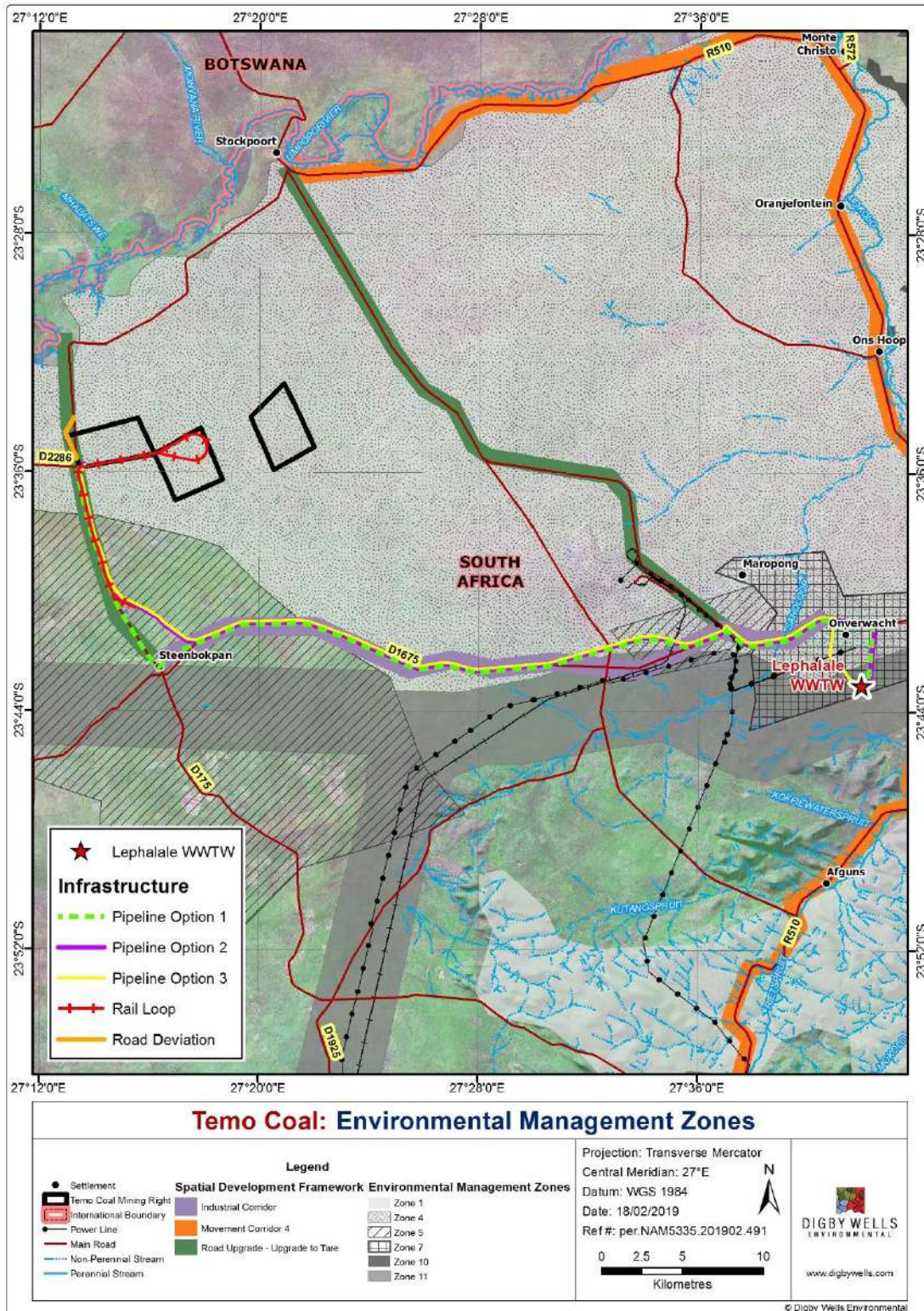


12 Cumulative Impacts

It is necessary to consider the impacts that the development will have from a regional perspective by considering land-use and transformation of natural habitat in areas surrounding the site in conjunction with this development. Cumulative impacts are assessed by considering past, present and anticipated changes to biodiversity. The project is associated with the Waterberg Coalfields, which occurs in the layers of the Karoo Super Group between Lephalale and the Limpopo River border and extends westwards into Botswana. This coal resource constitutes 50-60% of South Africa's remaining coal resources and has become the next target for South African mining.

Eskom has earmarked the Waterberg Coalfield to produce about 20% of South Africa's power in the new 20 year generation plans. Several coal mines and power stations (with associated transmission lines) have been proposed or have already been built within the region, including the Exxaro Resources Grootegeluk Mine and the Eskom Medupi Power Station, which may result in very large-scale cumulative impacts with international implications due to the proximity to the Botswana border.

The entire coalfield is zoned for future mining with surrounding land targeted for industrial growth. The Waterberg District Municipality Environmental Management Framework (WDM EMF) has strategically divided and classified areas into zones for management of future land uses, as shown on Plan 6. These areas include protected areas such as the Waterberg Biospher (Zone 1) as well as heavy industry and mining (Zone 4 and 5) associated with the coalfield. Major infrastructure corridors area mapped as Zone 11, which represents areas where the concentration of linear infrastructure should occur to prevent the unnecessary large impact that uncoordinated multiple infrastructure placement would have on the area. These strategic areas are shown on Plan 6, Appendix A together with the proposed project infrastructure placement.



Plan 6: Waterberg District Municipality Environmental Management Framework



13 Unplanned Events and Low Risks

Low risks can be monitored to gauge if the baseline changes and mitigation is required. Unplanned events may happen on any project; we need to provide information on the potential impacts of those events and how to manage them, if they occur. A summary of ecologically significant risks are listed in the table below.

Table 13-1: Unplanned Events, Low Risks and their Management Measures

Unplanned event	Potential impact	Mitigation/ Management/ Monitoring
Lightning strikes	Fires from lightning strikes	Collaboration with farmer and community fire prevention and fighting teams
Hydrocarbon spillage in/near wetlands	Wetland contamination and compromised integrity	Vehicles must only be serviced within designated service bays. Procedures should be put in place to clean-up spillages in the event that they should occur. Spill kits need to be obtained and should be available on site to clean up any leaks or spills. Spillages of magnitude should also be reported to the authorities within 24 hours and an internal incident reporting system implemented. Construction will take place in the dry-season.
Poaching of natural game of neighbouring natural areas.	Poaching has a serious negative effect of the ecological functioning of an area in general and impacts the targeted individual permanently.	Ensure continuous environmental awareness training takes place with regard to this with anti-poaching efforts taking place. This needs to be monitored and reported on and the appropriate actions should take place dependant on the results.

14 Suitability Matrix and Consideration of Alternatives

14.1 Methodology

The suitability of the proposed siting of infrastructures and alternatives given was subjected to a multi-criteria decision analysis (MCDA). The use of the MCDA has proven to be a quantifiable and defensible method when assessing the suitability of various alternative decision options, i.e. siting of infrastructures. The matrix used in these instances adopts a specific variant of MCDA, the Simple Linear Additive Evaluation Model (SLAEM). This model yields a single, overall value for each decision option that reflects the rating on each of the decision criteria under consideration. The ecological decision criteria were rated on a scale from according to Table 14-1 below to quantifiably compare the suitability of the various infrastructure sitings. Once the ratings were determined against the criteria above, these were calculated to determine the overall suitability ranking of the proposed infrastructures.

Table 14-1: MCDA Rating Scale

Rating	
Score	Definition
5	Most suitable
4	Suitable
3	Negligible / insignificant
2	Less suitable
1	Unsuitable

14.2 Project Alternatives Assessed

No alternatives for the location of the proposed rail loop and road diversion were considered as these areas were the only land available for their construction that didn't sterilise part of the coal resource. The suitability of these locations was however considered relative to the natural landscape in this section of the assessment. (As aligned with eth resgen development) Area however alternatives in terms of technology is looked at.

Three bulk water pipeline line routing options, as discussed under Section 2, have been considered.

- Option 1 – Pipeline Route (Green)

The pipeline alignment for Option 1 follows the following route:



- From the proposed pump station the pipeline runs on the western side of the Onverwacht Road road reserve toward Nelson Mandela Drive.
- At the intersection of Onverwacht Road and Nelson Mandela Drive the pipeline alignment changes direction and runs on the southern side of the Nelson Mandela Drive road reserve toward Grootegeluk mine.
- At the intersection of Nelson Mandela Drive and district road D1675 the alignment changes direction to the northern side of the D1675 road reserve toward Steenbokpan
- At the intersection of D1675 and D175, the alignment changes direction to the eastern side of the D175 road reserve all the way up to the mine.

- Option 2 – Pipeline Route (Purple preferred)

The pipeline alignment for Option 2 follows the following route:

- From the proposed pump station the pipeline runs on the western side of the Onverwacht Road road reserve toward Nelson Mandela Drive
- At the intersection of Onverwacht Road and Nelson Mandela Drive the pipeline alignment changes direction and runs on the southern side of the Nelson Mandela Drive road reserve toward Grootegeluk mine
- At the intersection of Nelson Mandela Drive and district road D1675 the alignment changes direction to the northern side of the D1675 road reserve toward Steenbokpan
- Before the intersection of D1675 and D175, the alignment changes direction to the eastern side of the railway reserve all the way up to the Mine.
- This option is approximately 62.4km in length. The water is pumped for the first 31.8km and then gravitates down the remaining 30.6km to Temo Mine

- Option 3 – Pipeline Route (Yellow)

The pipeline alignment for Option 3 follows the following route:

- From the proposed pump station, the pipeline runs through farm portion of Paarl and joins Palala Drive on the western side.
- At the intersection of Palala Drive and Nelson Mandela Drive the pipeline alignment changes direction and runs on the southern side of the Nelson Mandela Drive road reserve toward Grootegeluk mine
- At the intersection of Nelson Mandela Drive and district road D1675 the alignment changes direction to the northern side of the D1675 road reserve toward Steenbokpan

- Before the intersection of D1675 and D175, the alignment changes direction to the eastern side of the railway reserve all the way up to the Mine.
- This option is approximately 61.1km in length.

14.3 Ecological Criteria

Table 14-2 describes the chosen ecological criteria for the MCDA. These criteria take into consideration the knowledge gained from the screening as well as the baseline findings of this study. Floral, faunal and wetlands information is included herein into an ecological suitability study.

Table 14-2: Ecological criteria for the suitability MCD analysis

Criteria number	Description
Criteria 1	Presence of Red Data and / or protected fauna and flora species, which are dependent on the habitat (such as protected trees, baboon spider nests, nesting birds).
Criteria 2	General condition of the Bushveld as a result of land use; considering conservation related land uses such as game lodges, or natural veld with cattle grazing; or agricultural practices, or development such as settlements and towns. Taking into consideration the current level of habitat fragmentation present locally and regionally.
Criteria 3	Presence of ecological important and sensitive habitats such as pans and woodlands.
Criteria 4	The infrastructure under question is found within or close to a CBA or ESA according to LCP v2

14.4 Results

The assessment of the alternatives available for the bulk water supply pipeline was completed and it was concluded that Option 1 is 35% suitable Option 2 is 50% suitable and Option 3 is 45% suitable. All three options, as discussed through the findings of the baseline assessment, is predominantly natural habitat with some varied land uses affecting the state of the veld. The assessment highlighted sensitive environments that are playing a significant role in biodiversity maintenance amongst others. The results of this assessment are presented in Table 14-3 below.

Table 14-3: Results of the Ecological Suitability MCD Analysis



Alternatives	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Total %	Overall Designation
Option 1 (Blue)	1	2	1	4	35%	Unsuitable
Option 2 (Purple)	1	3	2	4	50%	Suitable
Option 3 (Yellow)	1	2	2	4	45%	Less Suitable

15 Environmental Management Plan

The Environmental Management Plan (EMP) has been described according to the project activities in order to provide an understanding of what objectives and recommended management measures are required to minimise the environmental impacts arising from these activities.

15.1 Project Activities with Potentially Significant Impacts

Table 15-1: Potentially Significant Impacts of the Rail Loop and Road Diversion

Rail Loop, Road Diversion and Pipeline, Construction, Operation and Decommissioning/Rehabilitation	
Aspects	Potential Significant impacts
Removal of vegetation	Loss of habitat and biodiversity, especially Red Data species
Excavation of soils	Loss of habitat and biodiversity, especially Red Data species
Noise	Disturbance to the natural breeding cycles, loss of biodiversity especially amongst birds and mammals
Influx of personnel	Loss of species due to poaching, presence of people will cause fauna to vacate the area causing a loss of biodiversity, habituation of wild life, removal of wood, fires, poaching will cause the decrease of biodiversity
Increased vehicle	Loss of species due to road deaths

activity	
Exposure of contaminated water	Loss of species consuming contaminated water
Dust	Dust generation will cause species to vacate the area loss of biodiversity
Generation of General and Hazardous Waste	Pollution of the environment may poison some species causing a loss in biodiversity
Decommissioning and Rehabilitation of the rail loop and access roads infrastructure and footprint	Fauna species may return to the area increasing biodiversity, revegetation of the exposed areas will increase the flora biodiversity

15.2 Summary of Mitigation and Management

Table 15-2 provides a description of the mitigation and management options for the environmental impacts anticipated during the construction, operational and decommissioning and closure phases. Table 15-2 to Table 15-5 provide a summary of the proposed project activities, environmental aspects and impacts on the receiving environment. Information on the frequency of mitigation, relevant legal requirements, recommended management plans, timing of implementation, and roles / responsibilities of persons implementing the EMP.

Table 15-2: Impacts

Activities	Phase	Mitigation Measures	Compliance with standards	Time period for implementation
Vegetation clearing for road diversion, rail loop, bulk water pipelines	Construction	<ul style="list-style-type: none"> ▪ Conduct a biodiversity walk through to locate protected species prior to commencement and relocate species where possible or required ▪ Limit the vegetation disturbance to the designated areas only and the legal minimum requirement width for road and water pipeline servitudes is strictly adhered to ▪ In the development areas plan the location of infrastructure in such a manner as to leave as many natural vegetation areas or individual species as possible ▪ Adhere to the guidelines and permit requirements for the removal of protected species. ▪ Developmental areas such as transmission lines and roads must be either be located on previously disturbed areas or existing development corridors 	<ul style="list-style-type: none"> ▪ National Environmental Management Act (NEMA),1998 (Act 107 of 1998) ▪ National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004) 	<ul style="list-style-type: none"> ▪ Pre commencement of construction activities
Topsoil removal and preparation of road bed and excavation infrastructure foundations	Construction	<ul style="list-style-type: none"> ▪ Stockpile soil in the correct layers avoid excessive height and slope. ▪ Ensure that dust control measures are implemented on the roads and stockpiles. ▪ Ensure that the developmental footprint is not exceeded. ▪ Demarcate overburden stockpile areas with in the development footprint or at an alternative suitable site. 	<ul style="list-style-type: none"> ▪ Conservation of Agricultural Resources Act (CARA), 1993 (Act 43 of 1983) ▪ National Environmental Management Act (NEMA),1998 (Act 107 of 1998) 	<ul style="list-style-type: none"> ▪ Pre and During Construction
Increased vehicle activities	Construction, Operation and Decommissioning	<ul style="list-style-type: none"> ▪ Ensure that noise control measures are implemented by reducing speed, ensure that exhaust systems are functioning according to manufacturer's specifications. ▪ Ensure that heavy vehicle traffic is limited to daylight hours only as far as practically possible. ▪ Ensure that speed limits are enforced 	<ul style="list-style-type: none"> ▪ 	<ul style="list-style-type: none"> ▪

Activities	Phase	Mitigation Measures	Compliance with standards	Time period for implementation
Increase of humans into the project site	Construction, Operation and Decommissioning	<ul style="list-style-type: none"> ▪ Limit the interaction of humans with the biophysical environment by ensuring that personnel remain within the demarcated areas. ▪ No fires allowed on site ▪ No poaching or harvesting flora ▪ No removal of trees for firewood. ▪ Ensure that food waste is stored in animal proof containers ▪ Ensure that there are waste disposal and littering prevention procedures in place ▪ No feeding of animals ▪ Ensure that environmental awareness training takes place a regular intervals ▪ Exclude fauna from the site where possible using passive means such as electrification of fences. 	<ul style="list-style-type: none"> ▪ National Environmental Management Act (NEMA),1998 (Act 107 of 1998) ▪ National Environmental Management Act (NEMA),1998 (Act 107 of 1998) 	<ul style="list-style-type: none"> ▪ Pre construction and during the life time of the project
Waste Management, Including collection and separation of general waste and the storage and handling of hazardous waste, especially concrete	Construction, Operation and Decommissioning	<ul style="list-style-type: none"> ▪ A waste management plan must be generated and implemented ▪ The system must be monitored to ensure that the environment is not polluted and that fauna do not consume the waste ▪ Ensure that there are spillage procedures in place so that any exposure to biophysical environment is limited ▪ Ensure that the appropriate training is given to staff and management. 	<ul style="list-style-type: none"> ▪ National Environmental Waste Act, Act 59 of 2008 	<ul style="list-style-type: none"> ▪ Pre construction and during the life time of the project
Maintenance of water pipeline servitudes	Operational	<ul style="list-style-type: none"> ▪ Only approved access routes may be used for the maintenance of the servitude ▪ Ensure that the highest standards for the maintenance of the servitude are adhered to. ▪ Ensure that should any aspect relating to the change of the biophysical environment along the servitude brought to the environmental manager's attention. 	<ul style="list-style-type: none"> ▪ National Environmental Management Act (NEMA),1998 (Act 107 of 1998) 	<ul style="list-style-type: none"> ▪ During Operational lifetime
Operation of the Pipeline, Road Diversion and Rail loop	Operational	<ul style="list-style-type: none"> ▪ At the design phase ensure that noise abatement measures are investigated and implemented to limit the noise generated by the infrastructure which may have an effect on the fauna. 	<ul style="list-style-type: none"> ▪ National Environmental Management Act (NEMA),1998 (Act 107 of 1998) 	<ul style="list-style-type: none"> ▪ Pre and during the life time of the IPP

Activities	Phase	Mitigation Measures	Compliance with standards	Time period for implementation
Decommissioning, removal of infrastructure and rehabilitation of the impacted areas.	Decommissioning and Rehabilitation	<ul style="list-style-type: none"> Provision must be made for the reestablishment of the soil profile Planting species naturally occurring in the area will be provided for Should alien invasive plants be noticed on site that an Alien Invasive Management Plan be formulated and implemented 	<ul style="list-style-type: none"> National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) Conservation of Agricultural Resources Act (CARA), 1993 (Act 43 of 1983) 	<ul style="list-style-type: none"> Prior, during and post rehabilitation

Table 15-3: Objectives and Outcomes of the EMP

Activities	Potential impacts	Aspects affected	Phase	Mitigation	Standard to be achieved/objective
Vegetation clearing for road diversion, rail loop, bulk water pipelines	<ul style="list-style-type: none"> Loss of habitat, loss of Biodiversity, loss of Red Data Species 	Fauna/ Flora	Construction	<ul style="list-style-type: none"> Conduct a protected flora and fauna species survey prior to commencement and relocate species where possible or required Limit the vegetation disturbance to the designated areas only and the legal minimum requirement width for road and powerline servitudes is strictly adhered to In the development areas plan the location of infrastructure in such a manner as to leave as many natural vegetation areas or individual species as possible Adhere to the guidelines and permit requirements for the removal of protected species. Developmental areas such as transmission lines and roads must be either be located on previously disturbed areas or existing development corridors. 	<ul style="list-style-type: none"> Limit the loss of biodiversity Increase the potential for a faster recovery to the areas pre construction state Enhance the recovery of Red Data and naturally occurring species.
Topsoil removal and preparation of road bed and excavation infrastructure foundations	<ul style="list-style-type: none"> Loss of soil properties 	Flora & Fauna	Construction and Rehabilitation	<ul style="list-style-type: none"> Stockpile soil in the correct layers avoid excessive height and slope. Ensure that dust control measures are implemented on the roads and stockpiles. Ensure that the developmental footprint is not exceeded. Demarcate overburden stockpile areas with in the development footprint or at an alternative suitable site. 	<ul style="list-style-type: none"> Ensure that the correct soils are used to rehabilitate the area which will aid the recovery of the vegetation

Activities	Potential impacts	Aspects affected	Phase	Mitigation	Standard to be achieved/objective
Increased vehicle activities	<ul style="list-style-type: none"> ▪ Destruction of flora ▪ Animal deaths ▪ Fauna will vacate the area ▪ Loss of biodiversity ▪ Loss of Red Data Species ▪ Excessive noise leading to fauna vacating the area ▪ Interruption of breeding and feeding cycles 	Flora/Fauna	All Phases	<ul style="list-style-type: none"> ▪ Ensure that noise control measures are implemented by reducing speed, ensure that exhaust systems are functioning according to manufacturer's specifications. ▪ Ensure that heavy vehicle traffic is limited to daylight hours as far as practically possible. ▪ Ensure that reasonable speed limits are enforced 	<ul style="list-style-type: none"> ▪ Minimise the impact of vehicles on the biodiversity ▪ Minimise death or destruction of fauna and flora
Increase of humans into the project site	<ul style="list-style-type: none"> ▪ Disturbance of the natural cycles ▪ Loss of biodiversity ▪ Loss of species ▪ Pollution ▪ Habituation of species to humans 	Fauna/Flora	All Phases	<ul style="list-style-type: none"> ▪ Limit the interaction of humans with the biophysical environment by ensuring that personnel remain within the demarcated areas. ▪ No fires allowed on site ▪ No poaching or harvesting flora ▪ No removal of trees for firewood. ▪ Ensure that food waste is stored in animal proof containers ▪ Ensure that there are waste disposal and littering prevention procedures in place ▪ No feeding of animals ▪ Ensure that environmental awareness training takes place a regular intervals ▪ Exclude fauna from the site where possible using passive means such as electrification of fences. 	<ul style="list-style-type: none"> ▪ Limit the influence that humans have on the environment in order to ensure that the biodiversity in the area is maintained ▪ Ensure that the natural cycles are maintained

Activities	Potential impacts	Aspects affected	Phase	Mitigation	Standard to be achieved/objective
Waste Management, Including collection and separation of general waste and the storage and handling of hazardous waste, especially concrete	<ul style="list-style-type: none"> Soil pollution Water pollution Loss of species and biodiversity 	Fauna/Flora	All Phases	<ul style="list-style-type: none"> A waste management plan must be generated and implemented The system must be monitored to ensure that the environment is not polluted and that fauna do not consume the waste Ensure that there are spillage procedures in place so that any exposure to biophysical environment is limited Ensure that the appropriate training is given to staff and management. 	<ul style="list-style-type: none"> Eliminate pollution from the environment Ensure that there are no occurrences latent pollution which may arise post rehabilitation
Maintenance of servitudes	<ul style="list-style-type: none"> Loss of species and biodiversity through incorrect maintenance practices 		Operational	<ul style="list-style-type: none"> Only approved access routes may be used for the maintenance of the servitude Ensure that should any aspect relating to the change of the biophysical environment along the servitude brought to the environmental managers. 	<ul style="list-style-type: none"> Eliminate the loss of species and biodiversity Promote the recovery of the servitude when the transmission line is removed
Operation of the road diversion and rail loop	<ul style="list-style-type: none"> Excessive continuous noise will disrupt feeding and breeding cycles Loss of biodiversity Loss of Red Data species 	Fauna	Operational	<ul style="list-style-type: none"> At the design phase ensure that noise abatement measures are investigated and implemented to limit the noise generated by the road diversion and rail loop which may have an effect on the fauna. 	<ul style="list-style-type: none"> Ensure a quieter operation to ensure that species remain in the area which will improve the biodiversity levels.
Decommissioning, removal of infrastructure and rehabilitation of the impacted areas.	<ul style="list-style-type: none"> Increase in biodiversity Reestablishment of the pre-construction ecological state Increase in Red Data Species Increase in ecosystem services 	Fauna/Flora	Decommissioning and Rehabilitation	<ul style="list-style-type: none"> Provision must be made for the reestablishment of the soil profile Planting species naturally occurring in the area will be provided for Should alien invasive plants be noticed on site that an Alien Invasive Management Plan be formulated and implemented 	<ul style="list-style-type: none"> Restoration of the ecology to the pre development state.

Table 15-4: Mitigation

Activities	Potential impacts	Aspects affected	Mitigation Type	Time Period for implementation	Compliance with standards
Vegetation clearing for access roads, road diversion, water pipeline and rail loop	<ul style="list-style-type: none"> Loss of habitat, loss of Biodiversity, loss of Red Data Species 	Fauna/ Flora	<ul style="list-style-type: none"> Conduct a protected flora and fauna species survey prior to commencement and relocate species where possible or required Limit the vegetation disturbance to the designated areas only and the legal minimum requirement width for road and powerline servitudes is strictly adhered to In the development areas plan the location of infrastructure in such a manner as to leave as many natural vegetation areas or individual species as possible Adhere to the guidelines and permit requirements for the removal of protected species. Developmental areas such as transmission lines and roads must be either be located on previously disturbed areas or existing development corridors. 	Daily	<ul style="list-style-type: none"> National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004) National Environmental Management Act (NEMA),1998 (Act 107 of 1998)
Topsoil removal and preparation of road bed and excavation infrastructure foundations	<ul style="list-style-type: none"> Loss of soil properties 	Flora & Fauna	<ul style="list-style-type: none"> Stockpile soil in the correct layers avoid excessive height and slope. Ensure that dust control measures are implemented on the roads and stockpiles. Ensure that the developmental footprint is not exceeded. Demarcate overburden stockpile areas with in the development footprint or at an alternative suitable site. 	Daily	<ul style="list-style-type: none"> Conservation of Agricultural Resources Act (CARA), 1993 (Act 43 of 1983) National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004) National Environmental Management Act (NEMA),1998 (Act 107 of 1998)

Activities	Potential impacts	Aspects affected	Mitigation Type	Time Period for implementation	Compliance with standards
Increased vehicle activities	<ul style="list-style-type: none"> ▪ Destruction of flora ▪ Animal deaths ▪ Fauna will vacate the area ▪ Loss of biodiversity ▪ Loss of Red Data Species ▪ Excessive noise leading to fauna vacating the area ▪ Interruption of breeding and feeding cycles 	Flora/Fauna	<ul style="list-style-type: none"> ▪ Ensure that noise control measures are implemented by reducing speed, ensure that exhaust systems are functioning according to manufacturer's specifications. ▪ Ensure that heavy vehicle traffic is limited to daylight hours as far as practically possible. ▪ Ensure that speed limits are enforced 	Daily	<ul style="list-style-type: none"> ▪ National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004)
Increase of humans into the project site	<ul style="list-style-type: none"> ▪ Disturbance of the natural cycles ▪ Loss of biodiversity ▪ Loss of species ▪ Pollution ▪ Habituation of species to humans 	Fauna/Flora	<ul style="list-style-type: none"> ▪ Limit the interaction of humans with the biophysical environment by ensuring that personnel remain within the demarcated areas. ▪ No fires allowed on site ▪ No poaching or harvesting flora ▪ No removal of trees for firewood. ▪ Ensure that food waste is stored in animal proof containers ▪ Ensure that there are waste disposal and littering prevention procedures in place ▪ No feeding of animals ▪ Ensure that environmental awareness training takes place a regular intervals ▪ Exclude fauna from the site where possible using passive means such as electrification of fences. 	Daily	<ul style="list-style-type: none"> ▪ National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004) ▪ National Environmental Management Act (NEMA),1998 (Act 107 of 1998) ▪ National Environmental Waste Act, Act 59 of 2008

Activities	Potential impacts	Aspects affected	Mitigation Type	Time Period for implementation	Compliance with standards
Waste Management, Including collection and separation of general waste and the storage and handling of hazardous waste, especially concrete	<ul style="list-style-type: none"> Soil pollution Water pollution Loss of species and biodiversity 	Fauna/Flora	<ul style="list-style-type: none"> A waste management plan must be generated and implemented The system must be monitored to ensure that the environment is not polluted and that fauna do not consume the waste Ensure that there are spillage procedures in place so that any exposure to biophysical environment is limited Ensure that the appropriate training is given to staff and management. 	Daily	<ul style="list-style-type: none"> National Environmental Waste Act, Act 59 of 2008
Maintenance of powerline servitudes	<ul style="list-style-type: none"> Loss of species and biodiversity through incorrect maintenance practices 	Fauna/Flora	<ul style="list-style-type: none"> Only approved access routes may be used for the maintenance of the servitude Ensure that the Eskom standards for the maintenance of the servitude are adhered to. Ensure that should any aspect relating to the change of the biophysical environment along the servitude brought to the environmental managers. 	During Project Life Time	<ul style="list-style-type: none"> National Environmental Management Act (NEMA),1998 (Act 107 of 1998) Standard For Bush Clearance. ESKSABG3 (Eskom) National Environmental Management Act (NEMA),1998 (Act 107 of 1998)
Operation of the pipeline, road diversion and rail loop	<ul style="list-style-type: none"> Excessive continuous noise will disrupt feeding and breeding cycles Loss of biodiversity Loss of Red Data species 	Fauna	<ul style="list-style-type: none"> At the design phase ensure that noise abatement measures are investigated and implemented to limit the noise generated by the road diversion and rail loop which may have an effect on the fauna. 	During Project Life Time	<ul style="list-style-type: none"> National Environmental Management Act (NEMA),1998 (Act 107 of 1998)
Decommissioning, removal of infrastructure and rehabilitation of the impacted areas.	<ul style="list-style-type: none"> Increase in biodiversity Reestablishment of the pre-construction ecological state Increase in Red Data Species Increase in ecosystem services 	Fauna/Flora	<ul style="list-style-type: none"> Provision must be made for the reestablishment of the soil profile Planting species naturally occurring in the area will be provided for Should alien invasive plants be noticed on site that an Alien Invasive Management Plan be formulated and implemented 	Daily	<ul style="list-style-type: none"> National Environmental Management Act (NEMA),1998 (Act 107 of 1998)

Table 15-5: Prescribed Environmental Management Standards, Practice, Guideline, Policy or Law

Specialist field	Applicable standard, practice, guideline, policy or law	
Ecological: Fauna and flora	National:	<ul style="list-style-type: none"> ▪ National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) ▪ National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004) ▪ National Environmental Waste Act, Act 59 of 2008 ▪ Standard for Bush Clearance. ESKSABG3 (Eskom) ▪ Conservation of Agricultural Resources Act (CARA), 1993 (Act 43 of 1983) ▪ National Water Act (NWA, Act 36 of 1998) ▪ Department of Water Affairs and Forestry (DWAF, 2005) “A practical field procedure for identification and delineation of wetlands and riparian areas” ▪ National Freshwater Ecosystems Priority Areas (NFEPA, Nel et al., 2011) ▪ SANBI, in collaboration with the DWS report on “Wetland offsets: a best-practice guideline for South Africa” (Macfarlane, et al., 2014)
	Provincial:	Limpopo Conservation Plan Version 2 (C-Plan 2) (Desmet <i>et al</i> , 2013).
	Municipal:	Waterberg District Municipality (WDM) Environmental Management Framework (EMF).



15.3 Monitoring Plan

The monitoring of the flora environment is completed by investigating its constituent components specifically the herb, grass shrub and tree layers. These components have differentiation within them and these are Red Data/ protected, medicinal, endemic, alien invasive and weedy species. Fauna component include habitat condition, habitat availability, ecosystem function and the species within these ecosystems. A monitoring program needs to evaluate the management actions and their effects on each of these components and the focus needs to be on Red Data/protected species. The method of monitoring is the Braun Blanquet method for vegetation and line transects, point count transects and trapping and transects for fauna surveys.

- Monitoring must take place annually;
- Monitoring must be completed by qualified specialists;
- Adaptive management must be applied;
- Monitoring during the wet season is essential; and
- Findings must be compared to previous years to establish ecosystem change or trend.

Monitoring will also confirm the impact of the development on Red Data species and further mitigation can be suggested. The alien vegetation monitoring will be of importance due to the threat posed by surrounding land use, which is farming and other developments that could provide open areas where alien invasive species could establish. Therefore the open areas created during the construction phase could persist during the operational phase, and thereby create areas where alien invasive species could establish.

It is highly recommended that areas of intact natural Bushveld be managed on site and in adjacent sites where the pipe line infrastructure, road diversion and rail loop is proposed. This would be part of a Biodiversity Action Management Plan. Cleared areas should be monitored for colonisation by alien species and a proactive approach should be undertaken to control alien species as soon as they are established. Monitoring and eradication of alien species is part of the mine's responsibility and failure to do so in the early stages will result in greater investments of resources to remove them at a later stage.

Provided the decommissioning phase includes the dismantling of the entire infrastructure as well as the rehabilitation of any seriously disturbed areas, there will be a comparative gain in biodiversity (during and after the operational phase). This will in turn create faunal habitat with the potential to increase fauna diversity.



16 Consultation Undertaken

Consultation was undertaken with farm owners/occupiers to gain access to farm portions where specialist investigation was required. Given that the predominant land use of the area being game farming, most of the land owners were private and access required specific permission to be granted from each owner.

17 Conclusion and Recommendation

The study area falls within two regional vegetation types within the Savanna biome, namely: Limpopo Sweet Bushveld and Western Sandy Bushveld. Within the study area, eleven broad vegetation habitats were delineated within which approximately 90 of the 144 expected flora species were identified, including five protected plant species being large trees.

The fauna survey recorded a total of 16 mammals, 106 Birds, six herpetofaunal species and 12 invertebrates. Of these, a total of eight mammal species, six bird species and one invertebrate species were recorded as Red Data and/or protected. The habitats delineated in the flora and wetland assessment are found to be important habitat for the above mentioned fauna. Of particular importance are the area of very high sensitivity being the wetlands and woodlands as these area provide unique and varied habitats.

All Red Data and protected plant species, as well as the immediate habitat surrounding them, should be preserved and development should be restricted to areas outside of their immediate habitat. All pans and their catchments (or at least their 500 m buffer area) should be conserved and seen as a no-go area. In the case where this is not possible as all efforts to avoid these areas have been exhausted, mitigation measures discussed herein should be applied. In the case of protected SSC, permits may be applied for from the provincial authorities to either translocate these species (where possible) or remove them.

Based on the ecological findings in conjunction with results of previous surveys, it can be concluded that the area provides suitable habitat for many species including Red Data and protected species, which are dependent on the present habitat for refuge and resources. Therefore the impact of the proposed construction and operation of a rail loop, road diversion and water pipeline and associated infrastructure will have an immediate and lasting effect on the ecology. However the project is limited in extent and related to linear infrastructure, therefore impacts are manageable.



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Fauna and Flora Impact Assessment Report

Environmental Impact Assessment for Temo Rail Loop, Road Diversion and Pipeline

NAM5335



DIGBY WELLS
ENVIRONMENTAL

Appendix A: Flora Species List



Family	Species
Acanthaceae	<i>Blepharis integrifolia</i>
Acanthaceae	<i>Justicia exigua</i>
Acanthaceae	<i>Justicia flava</i>
Acanthaceae	<i>Peristrophe transvaalensis</i>
Amaranthaceae	<i>Hermbstaedtia fleckii</i>
Amaranthaceae	<i>Hermbstaedtia odorata</i>
Amaranthaceae	<i>Hermbstaedtia odorata</i> var. <i>albi-rosea</i>
Amaranthaceae	<i>Hermbstaedtia odorata</i> var. <i>aurantiaca</i>
Amaranthaceae	<i>Kyphocarpa angustifolia</i> ;
Amaranthaceae	<i>Leucosphaera baenesii</i>
Amaryllidaceae	<i>Crinum buphanoides</i>
Anacardiaceae	<i>Lansea discolour</i>
Anacardiaceae	<i>Sclerocarya birrea</i>
Apocynaceae	<i>Adenium oleifolium</i>
Asparagaceae	<i>Asparagus cooperi</i>
Asparagaceae	<i>Asparagus nelsii</i>
Asteraceae	<i>Felicia muricata</i>
Asteraceae	<i>Geigeria burkei</i>
Asteraceae	<i>Geigeria elongata</i>
Asteraceae	<i>Kleinia fulgens</i>
Asteraceae	<i>Vernonia fastigiata</i>
Bignoniaceae	<i>Catophractes alexandri</i>
Bignoniaceae	<i>Rhigozum brevispinosum</i>
Bignoniaceae	<i>Rhigozum obovatum</i>
Boraginaceae	<i>Heliotropium ciliatum</i> Kaplan
Boraginaceae	<i>Ehretia rigida</i>
Burseraceae	<i>Commiphora africana</i>
Burseraceae	<i>Commiphora angolensis</i>
Burseraceae	<i>Commiphora mollis</i>
Burseraceae	<i>Commiphora pyracanthoides</i>
Capparaceae	<i>Boscia albitrunca</i>



Family	Species
Capparaceae	<i>Cadaba aphylla</i>
Capparaceae	<i>Cleome maculata</i>
Celastraceae	<i>Gymnosporia senegalensis</i>
Celastraceae	<i>Gymnosporia tenuispina</i>
Combretaceae	<i>Combretum apiculatum</i>
Combretaceae	<i>Combretum hereroense</i>
Combretaceae	<i>Combretum imberbe</i>
Combretaceae	<i>Combretum zeyheri</i>
Combretaceae	<i>Terminalia sericea</i>
Commelinaceae	<i>Commelina benghalensis</i>
Convolvulaceae	<i>Evolvulus alsinoides</i>
Cucurbitaceae	<i>Acanthosicyos naudinianus</i>
Cyperaceae	<i>Bulbostylis hispidula</i> subsp. <i>pyriformis</i>
Cyperaceae	<i>Bulbostylis humilis</i>
Cyperaceae	<i>Cyperus chersinus</i>
Cyperaceae	<i>Cyperus rupestris</i> var. <i>rupestris</i>
Cyperaceae	<i>Kyllinga alba</i> Nees
Dichapetalaceae	<i>Dichapetalum cymosum</i>
Ebenaceae	<i>Diospyros lycioides</i> subsp. <i>lycioides</i>
Ebenaceae	<i>Euclea undulata</i>
Euphorbiaceae	<i>Croton gratissimus</i> var. <i>subgratissimus</i>
Euphorbiaceae	<i>Euphorbia rhombifolia</i>
Euphorbiaceae	<i>Jatropha erythropoda</i>
Fabaceae	<i>Albizia anthelmintica</i>
Fabaceae	<i>Bauhinia petersiana</i>
Fabaceae	<i>Crotalaria distans</i> subsp. <i>distans</i>
Fabaceae	<i>Crotalaria piscarpa</i>
Fabaceae	<i>Dichrostachys cinera</i>
Fabaceae	<i>Indigofera daleodes</i>
Fabaceae	<i>Indigofera filipes</i>
Fabaceae	<i>Neorautanenia ficifolia</i>



Family	Species
Fabaceae	<i>Peltophorum africanum</i>
Fabaceae	<i>Senegalia (Acacia) burkei</i>
Fabaceae	<i>Senegalia (Acacia) cinerea (Acacia fleckii)</i>
Fabaceae	<i>Senegalia (Acacia) erubescens</i>
Fabaceae	<i>Senegalia (Acacia) mellifera</i>
Fabaceae	<i>Senegalia (Acacia) senegal var. rostrata</i>
Fabaceae	<i>Senegalia (Acacia). nigrescens</i>
Fabaceae	<i>Tephrosia purpurea subsp. leptostachya var. pubescens</i>
Fabaceae	<i>Vachellia (Acacia) erioloba</i>
Fabaceae	<i>Vachellia (Acacia) nilotica</i>
Fabaceae	<i>Vachellia (Acacia) robusta</i>
Fabaceae	<i>Vachellia (Acacia) tenuispina</i>
Fabaceae	<i>Vachellia (Acacia) tortilis subsp. heterocantha</i>
Geraniaceae	<i>Monsonia glauca</i>
Geraniaceae	<i>Monsonia angustifolia</i>
Iridaceae	<i>Gladiolus permeabilis subsp. edulis</i>
Lamiaceae	<i>Clerodendrum ternatum</i>
Lamiaceae	<i>Hemizygia eliottii</i>
Lamiaceae	<i>Plectranthus neochilus</i>
Leguminosae	<i>Chamaecrista absus</i>
Malvaceae	<i>Corchorus kirkii</i>
Malvaceae	<i>Gossypium herbaceum subsp. africanum</i>
Malvaceae	<i>Grewia avellana Hiern</i>
Malvaceae	<i>Grewia bicolor</i>
Malvaceae	<i>Grewia flava</i>
Malvaceae	<i>Grewia monticola</i>
Malvaceae	<i>Hermannia modesta</i>
Malvaceae	<i>Hermannia tomentosa</i>
Malvaceae	<i>Hibiscus physaloides</i>
Malvaceae	<i>Hibiscus syriaca</i>
Molluginaceae	<i>Limeum fenestratum var. fenestratum</i>



Family	Species
Molluginaceae	<i>Limeum viscosum</i>
Molluginaceae	<i>Mollugo nudicaulis</i>
Nyctaginaceae	<i>Phaeoptilum spinosum</i>
Ochnaceae	<i>Ochna pulchra</i>
Olacaceae	<i>Ximenia americana var. microphylla</i>
Orobanchaceae	<i>Striga gesnerioides</i>
Pedaliaceae	<i>Harpagophytum procumbens subsp. transvaalense</i>
Poaceae	<i>Anthephora pubescens</i>
Poaceae	<i>Aristida adscensionis</i>
Poaceae	<i>Aristida congesta subsp. congesta</i>
Poaceae	<i>Aristida congesta subsp. Barbicollis</i>
Poaceae	<i>Aristida diffusa</i>
Poaceae	<i>Aristida meridionalis</i>
Poaceae	<i>Aristida stipitata</i>
Poaceae	<i>Brachiaria nigropedata</i>
Poaceae	<i>Chrysopogon serrulatus</i>
Poaceae	<i>Cymbopogon nardus</i>
Poaceae	<i>Digitaria eriantha Steud.</i>
Poaceae	<i>Echinochloa holubii</i>
Poaceae	<i>Enneapogon cenchroides</i>
Poaceae	<i>Enneapogon pretoriensis</i>
Poaceae	<i>Eragrostis barbinodis</i>
Poaceae	<i>Eragrostis biflora</i>
Poaceae	<i>Eragrostis lehmannia</i>
Poaceae	<i>Eragrostis pallens</i>
Poaceae	<i>Eragrostis rigidior</i>
Poaceae	<i>Eragrostis superba</i>
Poaceae	<i>Eragrostis trichophora</i>
Poaceae	<i>Ischaemum afrum</i>
Poaceae	<i>Leptochloa fusca</i>
Poaceae	<i>Megaloprotachne albescens</i>



Family	Species
Poaceae	<i>Panicum coloratum</i>
Poaceae	<i>Panicum maximum</i>
Poaceae	<i>Panicum schinzii</i>
Poaceae	<i>Perotis patens</i>
Poaceae	<i>Pogonarthria squarrosa</i>
Poaceae	<i>Schmidtia pappophoroides Steud.</i>
Poaceae	<i>Setaria verticillata</i>
Poaceae	<i>Stipagrostis uniplumis var. uniplumis</i>
Poaceae	<i>Tragus berteronianus</i>
Poaceae	<i>Triraphis schinzii</i>
Poaceae	<i>Urochloa brachyura</i>
Poaceae	<i>Urochloa mosambicensis</i>
Portulacaceae	<i>Portulaca kermesina</i>
Portulacaceae	<i>Talinum caffrum</i>
Rubiaceae	<i>Pavetta harborii</i>
Rubiaceae	<i>Coptosperma supra-axillare</i>
Solanaceae	<i>Solanum catombelense</i>
Solanaceae	<i>Solanum tettense var. renschii</i>
Verbenaceae	<i>Chascanum incisum</i>
Vitaceae	<i>Rhoicissus tridentata subsp. tridentata</i>

Table A2 1: Flora Species observed in Study Area

Family	Species	Threat Status
Amaryllidaceae	<i>Ammocharis coranica</i>	LC
Anacardiaceae	<i>Sclerocarya birrea</i>	LC
Apiaceae	<i>Alepidea spp</i>	LC
Apiaceae	<i>Foeniculum vulgare</i>	LC
Apocynaceae	<i>Adenium oleifolium</i>	LC
Apocynaceae	<i>Sarcostemma viminale</i>	LC
Bignoniaceae	<i>Catophractes alexandrii</i>	LC
Boraginaceae	<i>Heliotropum nelsonii</i>	LC



Family	Species	Threat Status
Burseraceae	<i>Commiphora africana</i>	LC
Burseraceae	<i>Commiphora angolensis</i>	LC
Burseraceae	<i>Commiphora pyracanthioides</i>	LC
Caesalpiniaceae	<i>Burkea africana</i>	LC
Campanulaceae	<i>Wahlenbergia sp.</i>	LC
Capparaceae	<i>Boscia albitrunca</i>	LC
Capparaceae	<i>Boscia foetida subsp rehamniana</i>	LC
Capparaceae	<i>Cleome maculata</i>	LC
Celastraceae	<i>Gymnosporia senegalensis</i>	LC
Celastraceae	<i>Gymnosporia tenuispina</i>	LC
Combretaceae	<i>Combretum apiculatum</i>	LC
Combretaceae	<i>Combretum hereroense</i>	LC
Combretaceae	<i>Combretum imberbe</i>	LC
Combretaceae	<i>Combretum molle</i>	LC
Combretaceae	<i>Terminalia sericea</i>	LC
Commelinaceae	<i>Commelina africana</i>	LC
Commelinaceae	<i>Commelina benghalensis</i>	LC
Convolvulaceae	<i>Convolvulus farinosus</i>	LC
Convolvulaceae	<i>Ipomoea purpurea</i>	LC
Crassulaceae	<i>Cotyledon sp</i>	LC
Crassulaceae	<i>Kalanchoe lanceolata</i>	LC
Cucurbitaceae	<i>Acanthosicyos naudinianus</i>	LC
Cyperaceae	<i>Cyperus dives</i>	LC
Cyperaceae	<i>Cyperus obtusiflorus</i>	LC
Dracaenaceae	<i>Sanseveiria hyacinthioides</i>	LC
Euphorbiaceae	<i>Spirostachys africana</i>	LC
Fabaceae	<i>Bauhinia petersiana</i>	LC
Fabaceae	<i>Dichrostachys cinerea</i>	LC
Fabaceae	<i>Elephantorrhiza elephantina</i>	LC
Fabaceae	<i>Indigofera daleoides</i>	LC
Fabaceae	<i>Lablab pupureus subsp. Purpureus</i>	LC



Family	Species	Threat Status
Fabaceae	<i>Peltephorum africanum</i>	LC
Fabaceae	<i>Pterocarpus rotundifolius</i>	LC
Fabaceae	<i>Senegalia burkei</i>	LC
Fabaceae	<i>Senegalia erubescens</i>	LC
Fabaceae	<i>Senegalia mellifera</i>	LC
Fabaceae	<i>Senegalia nigrescens</i>	LC
Fabaceae	<i>Vachellia erioloba</i>	Declining
Fabaceae	<i>Vachellia gerrardia</i>	LC
Fabaceae	<i>Vachellia karroo</i>	LC
Fabaceae	<i>Vachellia robusta</i>	LC
Fabaceae	<i>Vachellia tortilis</i>	LC
Hyacinthaceae	<i>Ledebouria marginata</i>	LC
Hyacinthaceae	<i>Ledebouria revoluta</i>	LC
Malvaceae	<i>Gossypium herbaceum</i>	LC
Malvaceae	<i>Grewia bicolor</i>	LC
Malvaceae	<i>Grewia flava</i>	LC
Malvaceae	<i>Grewia flavescens</i>	LC
Moraceae	<i>Ficus sp.</i>	LC
Ochnaceae	<i>Ochna pulcra</i>	LC
Pedaliaceae	<i>Sesamum alatum</i>	LC
Poaceae	<i>Aristida congesta var. congesta</i>	LC
Poaceae	<i>Aristida diffusa</i>	LC
Poaceae	<i>Aristida rhinochloa</i>	LC
Poaceae	<i>Aristida stipitata</i>	LC
Poaceae	<i>Cenchrus ciliaris</i>	LC
Poaceae	<i>Cynodon dactylon</i>	LC
Poaceae	<i>Dactyloctenium aegyptium</i>	LC
Poaceae	<i>Digitaria eriantha</i>	LC
Poaceae	<i>Eragrostis capensis</i>	LC
Poaceae	<i>Eragrostis lehmanniana</i>	LC
Poaceae	<i>Eragrostis pallens</i>	LC



Family	Species	Threat Status
Poaceae	<i>Eragrostis rigidior</i>	LC
Poaceae	<i>Melinis repens</i>	LC
Poaceae	<i>Panicum coloratum</i>	LC
Poaceae	<i>Panicum maximum</i>	LC
Poaceae	<i>Paspalum dilatatum</i>	LC
Poaceae	<i>Schmidtia pappophoroides</i>	LC
Poaceae	<i>Stipagrostis uniplumis</i>	LC
Poaceae	<i>Tragus berteronianus</i>	LC
Poaceae	<i>Tricholaena monachne</i>	LC
Poaceae	<i>Urochloa masambicensis</i>	LC
Rhamnaceae	<i>Ziziphus mucronata</i>	LC
Solanaceae	<i>Datura ferox</i>	LC
Solanaceae	<i>Datura stramonium</i>	Alien
Solanaceae	<i>Solanum incanum</i>	Alien
Solanaceae	<i>Solanum lichtensteinii</i>	Alien
Solanaceae	<i>Solanum mauritanium</i>	Alien
Zygophyllaceae	<i>Tribulus terrestris</i>	Alien

Appendix B: Mammals

Table B: 1: Regional Mammal Species List

Common Name	Scientific Name	IUCN(Global)	NEMBA	Probability
Aardvark	<i>Orycteropus afer</i>	Least Concern	Protected	High
Aardwolf	<i>Proteles cristata</i>	Least Concern	Least Concern	Medium
Acacia Rat	<i>Thallomys paedulcus</i>	Least Concern	Least Concern	High
African Buffalo	<i>Syncerus caffer</i>	Least Concern	Least Concern	Medium
African Civet	<i>Civettictis civetta</i>	Least Concern	Least Concern	High
African Clawless Otter	<i>Aonyx capensis</i>	Near Threatened	Least Concern	Low
African wild dog	<i>Lycaon pictus</i>	Endangered	Endangered	Low



Anchieta's Pipistrelle	<i>Hypsugo anchietae</i>	Least Concern	Least Concern	Medium
Angolan Free-tailed Bat	<i>Mops condylurus</i>	Least Concern	Least Concern	High
Angoni Vlei Rat	<i>Otomys angoniensis</i>	Least Concern	Least Concern	Low
Ansorge's Free-tailed Bat	<i>Chaerephon ansorgei</i>	Least Concern	Least Concern	Medium
Banana Pipistrelle	<i>Neoromicia nanus</i>	Not Assessed	Least Concern	Medium
Banded Mongoose	<i>Mungos mungo</i>	Least Concern	Least Concern	Observed
Bat-eared Fox	<i>Otocyon megalotis</i>	Least Concern	Protected	Observed
Bicolored Musk Shrew	<i>Crocidura fuscomurina</i>	Least Concern	Least Concern	High
Black Rhino	<i>Diceros bicornis</i>	Critically Endangered	Endangered	Low
Black-backed Jackal	<i>Canis mesomelas</i>	Least Concern	Least Concern	Observed
Black-footed Cat	<i>Felis nigripes</i>	Vulnerable	Protected	Medium
Blasius's Horseshoe Bat	<i>Rhinolophus blasii</i>	Least Concern	Least Concern	Low
Blesbok	<i>Damaliscus pygargus</i>	Least Concern	Least Concern	Low
Blue Wildebeest	<i>Connochaetes taurinus</i>	Least Concern	Least Concern	Observed
Botswanan Long-eared Bat	<i>Laephotis botswanae</i>	Least Concern	Least Concern	Medium
Brown Hyena	<i>Hyaena brunnea</i>	Near Threatened	Protected	Observed
Common Duiker	<i>Sylvicapra grimmia</i>	Least Concern	Least Concern	Observed
Bush Hyrax	<i>Heterohyrax brucei</i>	Least Concern	Least Concern	Medium
Bushbuck	<i>Tragelaphus scriptus</i>	Least Concern	Least Concern	Observed
Bushpig	<i>Potamochoerus larvatus</i>	Least Concern	Least Concern	Medium
Bushveld Elephant Shrew	<i>Elephantulus intufi</i>	Least Concern	Least Concern	Observed
Bushveld Gerbil	<i>Gerbilliscus leucogaster</i>	Least Concern	Least Concern	Observed



Bushveld Horseshoe Bat	<i>Rhinolophus simulator</i>	Least Concern	Least Concern	High
Butterfly Bat	<i>Glauconycteris variegata</i>	Least Concern	Least Concern	Low
Cape Fox	<i>Vulpes chama</i>	Least Concern	Protected	Medium
Cape Hare	<i>Lepus capensis</i>	Least Concern	Least Concern	High
Porcupine	<i>Hystrix africaeastralis</i>	Least Concern	Least Concern	Observed
Cape Serotine	<i>Neoromicia capensis</i>	Least Concern	Least Concern	High
Caracal	<i>Caracal caracal</i>	Least Concern	Least Concern	Observed
Chacma Baboon	<i>Papio ursinus</i>	Least Concern	Least Concern	Observed
Cheetah	<i>Acinonyx jubatus</i>	Vulnerable	Vulnerable	Medium
Common African Fat Mouse	<i>Steatomys pratensis</i>	Least Concern	Least Concern	High
Common Dasymys	<i>Dasymys incomtus</i>	Least Concern	Least Concern	Medium
Common Dwarf Mongoose	<i>Helogale parvula</i>	Least Concern	Least Concern	Observed
Common Eland	<i>Tragelaphus oryx</i>	Least Concern	Least Concern	Medium
Common Genet	<i>Genetta genetta</i>	Least Concern	Least Concern	Observed
Common Hippopotamus	<i>Hippopotamus amphibius</i>	Least Concern	Least Concern	Medium
Common Wart-hog	<i>Phacochoerus africanus</i>	Least Concern	Least Concern	Observed
Dark-footed Mouse Shrew	<i>Myosorex cafer</i>	Least Concern	Least Concern	Low
Darling's Horseshoe Bat	<i>Rhinolophus dalingi</i>	Not Listed	Least Concern	Medium
Desert Pygmy Mouse	<i>Mus indutus</i>	Least Concern	Least Concern	Medium
Dusky Pipistrelle	<i>Pipistrellus hesperidus</i>	Least Concern	Least Concern	Medium
Rock Elephant Shrew	<i>Elephantulus myurus</i>	Least Concern	Least Concern	Observed
Egyptian Free-tailed Bat	<i>Tadarida aegyptiaca</i>	Least Concern	Least Concern	Observed
Egyptian Slit-faced Bat	<i>Nycteris thebaica</i>	Least Concern	Least Concern	High



Gemsbok	<i>Oryx gazella</i>	Least Concern	Least Concern	Medium
Geoffroy's Horseshoe Bat	<i>Rhinolophus clivosus</i>	Least Concern	Least Concern	Medium
Giraffe	<i>Giraffa camelopardalis</i>	Least Concern	Least Concern	Medium
Gray African Climbing Mouse	<i>Dendromus melanotis</i>	Least Concern	Least Concern	High
Greater Cane Rat	<i>Thryonomys swinderianus</i>	Least Concern	Least Concern	Medium
Greater Dwarf Shrew	<i>Suncus lixus</i>	Least Concern	Least Concern	Medium
Greater Kudu	<i>Tragelaphus strepsiceros</i>	Least Concern	Least Concern	Observed
Grey Rhebok	<i>Pelea capreolus</i>	Least Concern	Least Concern	Medium
Gunning's Golden Mole	<i>Neamblysomus gunningi</i>	Endangered	Endangered	Low
Hartebeest	<i>Alcelaphus buselaphus</i>	Least Concern	Least Concern	High
Hildebrandt's Horseshoe Bat	<i>Rhinolophus hildebrandtii</i>	Least Concern	Least Concern	
Honey Badger	<i>Mellivora capensis</i>	Least Concern	Least Concern	Observed
House Mouse	<i>Mus musculus</i>	Least Concern	Least Concern	High
Impala	<i>Aepyceros melampus</i>	Least Concern	Least Concern	Observed
Juliana's Golden Mole	<i>Neamblysomus julianae</i>	Endangered	Endangered	Low
Klipspringer	<i>Oreotragus oreotragus</i>	Least Concern	Least Concern	Low
Lander's Horseshoe Bat	<i>Rhinolophus landeri</i>	Least Concern	Least Concern	Medium
Leopard	<i>Panthera pardus</i>	Near Threatened	Protected	Medium
Lesser Dwarf Shrew	<i>Suncus varilla</i>	Least Concern	Least Concern	Low
Lesser Gray-brown Musk Shrew	<i>Crocidura silacea</i>	Least Concern	Least Concern	Medium
Lesser Woolly Bat	<i>Kerivoula lanosa</i>	Least Concern	Least Concern	High
Lion	<i>Panthera leo</i>	Vulnerable	Vulnerable	Low



Long-tailed Serotine	<i>Eptesicus hottentotus</i>	Least Concern	Least Concern	Medium
Makwassie Musk Shrew	<i>Crocidura maquassiensis</i>	Least Concern	Least Concern	Low
Marsh Mongoose	<i>Atilax paludinosus</i>	Least Concern	Least Concern	Medium
Mauritian Tomb Bat	<i>Taphozous mauritanus</i>	Least Concern	Least Concern	Medium
Meerkat	<i>Suricata suricatta</i>	Least Concern	Least Concern	Observed
Lesser Bushbaby	<i>Galago moholi</i>	Least Concern	Least Concern	High
Namaqua Rock Mouse	<i>Aethomys namaquensis</i>	Least Concern	Least Concern	High
Natal Mastomys	<i>Mastomys natalensis</i>	Least Concern	Least Concern	High
Nyala	<i>Tragelaphus angasii</i>	Least Concern	Least Concern	Observed
Percival's Short-eared Trident Bat	<i>Cloeotis percivali</i>	Least Concern	Least Concern	High
Plains Zebra	<i>Equus quagga</i>	Least Concern	Least Concern	Observed
Red Hartebeest	<i>Alcelaphus buselaphus</i>	Least Concern	Least Concern	Medium
Red Veld Aethomys	<i>Aethomys namaquensis</i>	Least Concern	Least Concern	Observed
Reddish-gray Musk Shrew	<i>Crocidura cyanea</i>	Least Concern	Least Concern	High
Roan Antelope	<i>Hippotragus equinus</i>	Least Concern	Endangered	Low
Roberts's Flat-headed Bat	<i>Sauromys petrophilus</i>	Least Concern	Least Concern	High
Rock Dormouse	<i>Graphiurus platyops</i>	Least Concern	Least Concern	High
Rock Hyrax	<i>Procavia capensis</i>	Least Concern	Least Concern	High
Common Rat	<i>Rattus rattus</i>	Least Concern	Least Concern	High
Rusty Pipistrelle	<i>Pipistrellus rusticus</i>	Least Concern	Least Concern	Medium
Sable Antelope	<i>Hippotragus niger</i>	Least Concern	Vulnerable	Medium
Schlieffen's Twilight Bat	<i>Nycticeinops schlieffeni</i>	Least Concern	Least Concern	Low
Scrub Hare	<i>Lepus sacatilis</i>	Least Concern	Least Concern	Observed



Selous' Mongoose	<i>Paracynictis selousi</i>	Least Concern	Least Concern	Medium
Serval	<i>Leptailurus serval</i>	Least Concern	Protected	High
Sharpe's Grysbok	<i>Raphicerus sharpei</i>	Least Concern	Protected	Medium
Side-striped Jackal	<i>Canis mesomelas</i>	Near Threatened	Least Concern	Low
Single-Striped Lemniscomys	<i>Lemniscomys rosalia</i>	Least Concern	Least Concern	High
Slender Mongoose	<i>Gelerella sanguinea</i>	Least Concern	Least Concern	Observed
Smith's Bush Squirrel	<i>Paraxerus cepapi</i>	Least Concern	Least Concern	Medium
South African Spring Hare	<i>Pedetes capensis</i>	Least Concern	Least Concern	Observed
Southern African Hedgehog	<i>Atelerix frontalis</i>	Near Threatened	Protected	Medium
Southern African Mastomys	<i>Mastomys coucha</i>	Least Concern	Least Concern	Medium
Southern African Mole-rat	<i>Cryptomys hottentotus</i>	Least Concern	Least Concern	High
Southern African Pouched Mouse	<i>Saccostomus campestris</i>	Least Concern	Least Concern	High
Southern African Pygmy Mouse	<i>Mus minutoides</i>	Least Concern	Least Concern	Medium
Southern African Spiny Mouse	<i>Acomys spinosissimus</i>	Least Concern	Least Concern	High
Southern Reedbuck	<i>Redunca arudinum</i>	Least Concern	Least Concern	Medium
Spotted Hyena	<i>Crocuta crocuta</i>	Least Concern	Protected	Medium
Steenbok	<i>Raphicerus campestris</i>	Least Concern	Least Concern	Observed
Striped Leaf-nosed Bat	<i>Hipposideros vittatus</i>	Near Threatened	Least Concern	Low
Striped Polecat	<i>Ictonyx striatus</i>	Least Concern	Least Concern	Medium
Sundevall's Leaf-nosed Bat	<i>Hipposideros caffer</i>	Least Concern	Least Concern	High
Swamp Musk Shrew	<i>Crocidura mariquensis</i>	Least Concern	Least Concern	Medium
Swinny's Horseshoe Bat	<i>Rhinolophus swinnyi</i>	Least Concern	Least Concern	Medium



Temminck's Ground Pangolin	<i>Smutsia temminckii</i>	Vulnerable	Vulnerable	Medium
Temminck's Myotis	<i>Myotis tricolor</i>	Least Concern	Least Concern	High
Tete Veld Aethomys	<i>Aethomys namaquensis</i>	Least Concern	Least Concern	Medium
Thick-tailed Greater Galago	<i>Otolemur crassicaudatus</i>	Least Concern	Least Concern	High
Tsessebe	<i>Damaliscus lunatus</i>	Least Concern	Protected	Unlikely
Vervet Monkey	<i>Chlorocebus pygerythrus</i>	Least Concern	Least Concern	Observed
Wahlberg's Epauletted Fruit Bat	<i>Epomophorus wahlbergi</i>	Least Concern	Least Concern	Observed
Waterbuck	<i>Kobus ellipsiprymnus</i>	Least Concern	Least Concern	Observed
Welwitsch's Myotis	<i>Myotis welwitschii</i>	Least Concern	Least Concern	High
White Rhino	<i>Ceratotherium simum</i>	Near Threatened	Protected	Low
White-tailed Mongoose	<i>Ichneumia albicauda</i>	Least Concern	Least Concern	Medium
African Wildcat	<i>Felis silvestris</i>	Least Concern	Least Concern	High
Woodland Dormouse	<i>Graphiurus murinus</i>	Least Concern	Least Concern	High
Woodland Thicket Rat	<i>Grammomys dolichurus</i>	Least Concern	Least Concern	High
Wood's Slit-faced Bat	<i>Nycteris woodi</i>	Least Concern	Least Concern	Medium
Xeric Four-striped Grass Rat	<i>Rhabdomys pumilio</i>	Least Concern	Least Concern	High
Yellow Golden Mole	<i>Calcochloris obtusirostris</i>	Vulnerable	Least Concern	Medium
Yellow Mongoose	<i>Cynictis penicillata</i>	Least Concern	Least Concern	Medium
Yellow-bellied House Bat	<i>Scotophilus dinganii</i>	Least Concern	Least Concern	Medium
Zulu Serotine	<i>Pipistrellus zuluensis</i>	Least Concern	Least Concern	High

Appendix C: Avifauna Species List

Common Name	Scientific Name	IUCN	NEMBA
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Common Name	Scientific Name	IUCN	NEMBA
Apalis, Bar-throated	<i>Apalis thoracica</i>		
Babbler, Arrow-marked	<i>Turdoides jardineii</i>		
Babbler, Southern Pied	<i>Turdoides bicolor</i>		
Barbet, Acacia Pied	<i>Tricholaema leucomelas</i>		
Barbet, Black-collared	<i>Lybius torquatus</i>		
Barbet, Crested	<i>Trachyphonus vaillantii</i>		
Batis, Chinspot	<i>Batis molitor</i>		
Bee-eater, European	<i>Merops apiaster</i>		
Bee-eater, Little	<i>Merops pusillus</i>		
Bee-eater, Swallow-tailed	<i>Merops hirundineus</i>		
Boubou, Southern	<i>Laniarius ferrugineus</i>		
Brubru, Brubru	<i>Nilaus afer</i>		
Buffalo-weaver, Red-billed	<i>Bubalornis niger</i>		
Bulbul, African Red-eyed	<i>Pycnonotus nigricans</i>		
Bulbul, Dark-capped	<i>Pycnonotus tricolor</i>		
Bunting, Cinnamon-breasted	<i>Emberiza tahapisi</i>		
Bunting, Golden-breasted	<i>Emberiza flaviventris</i>		
Bunting, Lark-like	<i>Emberiza impetuani</i>		
Bush-shrike, Grey-headed	<i>Malaconotus blanchoti</i>		
Bush-shrike, Orange-breasted	<i>Telophorus sulfureopectus</i>		
Bustard, Kori	<i>Ardeotis kori</i>	Vulnerable	Protected
Camaroptera, Grey-backed	<i>Camaroptera brevicaudata</i>		
Canary, Black-throated	<i>Crithagra atrogularis</i>		
Canary, Yellow	<i>Crithagra flaviventris</i>		
Canary, Yellow-fronted	<i>Crithagra mozambicus</i>		
Chat, Anteating	<i>Myrmecocichla formicivora</i>		
Cisticola, Desert	<i>Cisticola aridulus</i>		
Cisticola, Rattling	<i>Cisticola chiniana</i>		
Common_name	Taxon_name		
Coucal, Burchell's	<i>Centropus burchellii</i>		
Courseer, Bronze-winged	<i>Rhinoptilus chalcopterus</i>		



Common Name	Scientific Name	IUCN	NEMBA
Crombec, Long-billed	<i>Sylvietta rufescens</i>		
Crow, Pied	<i>Corvus albus</i>		
Cuckoo, African	<i>Cuculus gularis</i>		
Cuckoo, Black	<i>Cuculus clamosus</i>		
Cuckoo, Diderick	<i>Chrysococcyx caprius</i>		
Cuckoo, Jacobin	<i>Clamator jacobinus</i>		
Cuckoo, Klaas's	<i>Chrysococcyx klaas</i>		
Cuckoo, Levillant's	<i>Clamator levillantii</i>		
Cuckoo, Red-chested	<i>Cuculus solitarius</i>		
Cuckoo-shrike, Black	<i>Campephaga flava</i>		
Dove, Laughing	<i>Streptopelia senegalensis</i>		
Dove, Namaqua	<i>Oena capensis</i>		
Dove, Red-eyed	<i>Streptopelia semitorquata</i>		
Dove, Rock	<i>Columba livia</i>		
Drongo, Fork-tailed	<i>Dicrurus adsimilis</i>		
Eagle, Martial	<i>Polemaetus bellicosus</i>	Endangered	
Eagle, Verreaux's	<i>Aquila verreauxii</i>		
Eagle, Wahlberg's	<i>Aquila wahlbergi</i>		
Egret, Cattle	<i>Bubulcus ibis</i>		
Eremomela, Burnt-necked	<i>Eremomela usticollis</i>		
Eremomela, Yellow-bellied	<i>Eremomela icteropygialis</i>		
Finch, Cut-throat	<i>Amadina fasciata</i>		
Finch, Scaly-feathered	<i>Sporopipes squamifrons</i>		
Firefinch, Jameson's	<i>Lagonosticta rhodopareia</i>		
Firefinch, Red-billed	<i>Lagonosticta senegala</i>		
Fish-eagle, African	<i>Haliaeetus vocifer</i>		
Flycatcher, Marico	<i>Bradornis mariquensis</i>		
Flycatcher, Southern Black	<i>Melaenornis pammelaina</i>		
Flycatcher, Spotted	<i>Muscicapa striata</i>		
Francolin, Coqui	<i>Peliperdix coqui</i>		
Francolin, Crested	<i>Dendroperdix sephaena</i>		



Common Name	Scientific Name	IUCN	NEMBA
Go-away-bird, Grey	<i>Corythaixoides concolor</i>		
Goose, Egyptian	<i>Alopochen aegyptiacus</i>		
Goshawk, Gabar	<i>Melierax gabar</i>		
Goshawk, Southern Pale Chanting	<i>Melierax canorus</i>		
Grebe, Little	<i>Tachybaptus ruficollis</i>		
Greenbul, Yellow-bellied	<i>Chlorocichla flaviventris</i>		
Guineafowl, Helmeted	<i>Numida meleagris</i>		
Hawk-eagle, African	<i>Aquila spilogaster</i>		
Helmet-shrike, White-crested	<i>Prionops plumatus</i>		
Hoopoe, African	<i>Upupa africana</i>		
Hornbill, African Grey	<i>Tockus nasutus</i>		
Hornbill, Red-billed	<i>Tockus erythrorhynchus</i>		
Hornbill, Southern Yellow-billed	<i>Tockus leucomelas</i>		
House-martin, Common	<i>Delichon urbicum</i>		
Ibis, Hageda	<i>Bostrychia hagedash</i>		
Kingfisher, Brown-hooded	<i>Halcyon albiventris</i>		
Kingfisher, Striped	<i>Halcyon chelicuti</i>		
Kingfisher, Woodland	<i>Halcyon senegalensis</i>		
Kite, Black-shouldered	<i>Elanus caeruleus</i>		
Korhaan, Red-crested	<i>Lophotis ruficrista</i>		
Lapwing, Blacksmith	<i>Vanellus armatus</i>		
Lapwing, Crowned	<i>Vanellus coronatus</i>		
Lark, Dusky	<i>Pinarocorys nigricans</i>		
Lark, Monotonous	<i>Mirafrapa passerina</i>		
Lark, Rufous-naped	<i>Mirafrapa africana</i>		
Lark, Sabota	<i>Calendulauda sabota</i>		
Martin, Rock	<i>Hirundo fuligula</i>		
Masked-weaver, Lesser	<i>Ploceus intermedius</i>		
Masked-weaver, Southern	<i>Ploceus velatus</i>		
Mousebird, Red-faced	<i>Urocolius indicus</i>		
Myna, Common	<i>Acridotheres tristis</i>		



Common Name	Scientific Name	IUCN	NEMBA
Neddicky, Neddicky	<i>Cisticola fulvicapilla</i>		
Nightjar, Fiery-necked	<i>Caprimulgus pectoralis</i>		
Oriole, Black-headed	<i>Oriolus larvatus</i>		
Ostrich, Common	<i>Struthio camelus</i>		
Owlet, Pearl-spotted	<i>Glaucidium perlatum</i>		
Oxpecker, Red-billed	<i>Buphagus erythrorhynchus</i>		
Palm-swift, African	<i>Cypsiurus parvus</i>		
Paradise-flycatcher, African	<i>Terpsiphone viridis</i>		
Paradise-whydah, Long-tailed	<i>Vidua paradisaea</i>		
Parrot, Meyer's	<i>Poicephalus meyeri</i>		
Penduline-tit, Cape	<i>Anthoscopus minutus</i>		
Petronia, Yellow-throated	<i>Petronia superciliaris</i>		
Pigeon, Speckled	<i>Columba guinea</i>		
Pipit, African	<i>Anthus cinnamomeus</i>		
Pipit, Striped	<i>Anthus lineiventris</i>		
Plover, Three-banded	<i>Charadrius tricollaris</i>		
Prinia, Black-chested	<i>Prinia flavicans</i>		
Prinia, Tawny-flanked	<i>Prinia subflava</i>		
Puffback, Black-backed	<i>Dryoscopus cubla</i>		
Pytilia, Green-winged	<i>Pytilia melba</i>		
Quailfinch, African	<i>Ortygospiza atricollis</i>		
Quelea, Red-billed	<i>Quelea quelea</i>		
Robin-chat, White-throated	<i>Cossypha humeralis</i>		
Roller, European	<i>Coracias garrulus</i>		
Roller, Lilac-breasted	<i>Coracias caudatus</i>		
Roller, Purple	<i>Coracias naevius</i>		
Sandgrouse, Burchell's	<i>Pterocles burchelli</i>		
Sandgrouse, Double-banded	<i>Pterocles bicinctus</i>		
Sandpiper, Wood	<i>Tringa glareola</i>		
Scimitarbill, Common	<i>Rhinopomastus cyanomelas</i>		
Scops-owl, Southern White-faced	<i>Ptilopusus granti</i>		



Common Name	Scientific Name	IUCN	NEMBA
Scrub-robin, Kalahari	<i>Cercotrichas paena</i>		
Scrub-robin, White-browed	<i>Cercotrichas leucophrys</i>		
Seedeater, Streaky-headed	<i>Crithagra gularis</i>		
Shikra, Shikra	<i>Accipiter badius</i>		
Shrike, Crimson-breasted	<i>Laniarius atrococcineus</i>		
Shrike, Lesser Grey	<i>Lanius minor</i>		
Shrike, Magpie	<i>Corvinella melanoleuca</i>		
Shrike, Red-backed	<i>Lanius collurio</i>		
Shrike, Southern White-crowned	<i>Eurocephalus anguitimens</i>		
Snake-eagle, Black-chested	<i>Circaetus pectoralis</i>		
Snake-eagle, Brown	<i>Circaetus cinereus</i>		
Sparrow, Cape	<i>Passer melanurus</i>		
Sparrow, Great	<i>Passer motitensis</i>		
Sparrow, House	<i>Passer domesticus</i>		
Sparrow, Southern Grey-headed	<i>Passer diffusus</i>		
Sparrowhawk, Little	<i>Accipiter minullus</i>		
Sparrow-weaver, White-browed	<i>Plocepasser mahali</i>		
Spurfowl, Natal	<i>Pternistis natalensis</i>		
Spurfowl, Swainson's	<i>Pternistis swainsonii</i>		
Starling, Burchell's	<i>Lamprotornis australis</i>		
Starling, Cape Glossy	<i>Lamprotornis nitens</i>		
Starling, Red-winged	<i>Onychognathus morio</i>		
Starling, Violet-backed	<i>Cinnyricinclus leucogaster</i>		
Starling, Wattled	<i>Creatophora cinerea</i>		
Stilt, Black-winged	<i>Himantopus himantopus</i>		
Sunbird, Amethyst	<i>Chalcomitra amethystina</i>		
Sunbird, Marico	<i>Cinnyris mariquensis</i>		
Sunbird, White-bellied	<i>Cinnyris talatala</i>		
Swallow, Barn	<i>Hirundo rustica</i>		
Swallow, Lesser Striped	<i>Hirundo abyssinica</i>		
Swallow, Red-breasted	<i>Hirundo semirufa</i>		



Common Name	Scientific Name	IUCN	NEMBA
Swift, Common	<i>Apus apus</i>		
Swift, Horus	<i>Apus horus</i>		
Swift, Little	<i>Apus affinis</i>		
Swift, White-rumped	<i>Apus caffer</i>		
Tchagra, Black-crowned	<i>Tchagra senegalus</i>		Feb
Tchagra, Brown-crowned	<i>Tchagra australis</i>		
Teal, Cape	<i>Anas capensis</i>		
Teal, Red-billed	<i>Anas erythrorhyncha</i>		
Thrush, Groundscraper	<i>Psophocichla litsipsirupa</i>		
Thrush, Kurrichane	<i>Turdus libonyanus</i>		
Tinkerbird, Yellow-fronted	<i>Pogoniulus chrysoconus</i>		
Tit, Ashy	<i>Parus cinerascens</i>		
Tit, Southern Black	<i>Parus niger</i>		
Tit-babbler, Chestnut-vented	<i>Parisoma subcaeruleum</i>		
Turtle-dove, Cape	<i>Streptopelia capicola</i>		
Vulture, Lappet-faced	<i>Torgos tracheliotus</i>	Endangered	
Vulture, White-backed	<i>Gyps africanus</i>	Endangered	
Warbler, Willow	<i>Phylloscopus trochilus</i>		
Waxbill, Black-faced	<i>Estrilda erythronotos</i>		
Waxbill, Blue	<i>Uraeginthus angolensis</i>		
Waxbill, Violet-eared	<i>Granatina granatina</i>		
Weaver, Red-headed	<i>Anaplectes rubriceps</i>		
Weaver, Village	<i>Ploceus cucullatus</i>		
White-eye, Cape	<i>Zosterops virens</i>		
Whydah, Shaft-tailed	<i>Vidua regia</i>		
Wood-dove, Emerald-spotted	<i>Turtur chalcospilus</i>		
Wood-hoopoe, Green	<i>Phoeniculus purpureus</i>		
Woodpecker, Bearded	<i>Dendropicos namaquus</i>		
Woodpecker, Cardinal	<i>Dendropicos fuscescens</i>		
Woodpecker, Golden-tailed	<i>Campethera abingoni</i>		
Wren-warbler, Barred	<i>Calamonastes fasciolatus</i>		



Appendix D: Herpetofauna Species List

Table D

Common name	Scientific Name	IUCN	NEMBA
Abel Erasmus Flat Gecko	<i>Afroedura rupestris</i>	Not listed	
African Bull Frog	<i>Pyxicephalus edulis</i>	Least Concern	
Arnold's Velvet Gecko	<i>Homopholis arnoldi</i>	Not evaluated	
Aurora House Snake	<i>Lamprophis aurora</i>	Least Concern (SARCA 2017)	
Banded Rubber Frog	<i>Phrynomantis bifaciatus</i>	Least Concern	
Bibron's Blind Snake	<i>Afrotyphlops bibronii</i>	Least Concern (SARCA 2017)	
Bibron's Gecko	<i>Chondrodactylus bibronii</i>	Least Concern (SARCA 2017)	
Bibron's Stiletto Snake	<i>Atractaspis bibronii</i>	Least Concern (SARCA 2017)	
Bicoloured Quill-snouted Snake	<i>Xenocalamus bicolor</i>	Least Concern (SARCA 2017)	
Black File Snake	<i>Gonionotophis nyassae</i>	Least Concern (SARCA 2017)	
Black Mamba	<i>Dendroaspis polylepis</i>	Least Concern (SARCA 2017)	
Black-headed Centipede-eater	<i>Aparallactus capensis</i>	Least Concern (SARCA 2017)	
Black-spotted Dwarf Gecko	<i>Lygodactylus nigropunctatus</i>	Least Concern (SARCA 2017)	
Blouberg Flat Lizard	<i>Platysaurus intermedius inopinus</i>	Endangered (SARCA 2017)	
Blyde River Flat Gecko	<i>Afroedura rondavelica</i>	Not listed	
Boomslang	<i>Dispholidus typus</i>	Least Concern (SARCA 2017)	
Boulenger's Garter Snake	<i>Elapsoidea boulengeri</i>	Least Concern (SARCA 2017)	
Bradfield's Dwarf Gecko	<i>Lygodactylus bradfieldi</i>	Least Concern (SARCA 2017)	



Common name	Scientific Name	IUCN	NEMBA
Breyer's Long-tailed Seps	<i>Tetradactylus breyeri</i>	Vulnerable (SARCA 2017)	
Broadbanded Grass Frog	<i>Ptychadena mossambica</i>	Least Concern	
Broadley's Flat Gecko	<i>Afroedura broadleyi</i>	Not listed	
Bronze Caco	<i>Cacosternum nanum</i>	Least Concern	
Brown House Snake	<i>Boaedon capensis</i>	Least Concern (SARCA 2017)	
Brown Water Snake	<i>Lycodonomorphus rufulus</i>	Least Concern (SARCA 2017)	
Brownbacked Tree Frog	<i>Leptopelis massambicus</i>	Least Concern	
Bubbling Kassina	<i>Kassina senegalensis</i>	Least Concern	
Bushveld Lizard	<i>Heliobolus lugubris</i>	Least Concern (SARCA 2017)	
Bushveld Rain Frog	<i>Breviceps adspersus</i>	Least Concern	
Cape Gecko	<i>Pachydactylus capensis</i>	Least Concern (SARCA 2017)	
Cape Grass Lizard	<i>Chamaesaura anguina</i>	Least Concern (SARCA 2017)	
Cape Skink	<i>Trachylepis capensis</i>	Least Concern (SARCA 2017)	
Cape Wolf Snake	<i>Lycophidion capense capense</i>	Least Concern (SARCA 2017)	
Central Marsh Terrapin	<i>Pelomedusa subrufa</i>	Least Concern (SARCA 2017)	
Clicking Stream Frog	<i>Strongylopus grayii</i>	Least Concern	
Common Barking Gecko	<i>Ptenopus garrulus garrulus</i>	Least Concern (SARCA 2017)	
Common Caco	<i>Cacosternum boettgeri</i>	Least Concern	
Common Crag Lizard	<i>Pseudocordylus melanotus melanotus</i>	Least Concern (SARCA 2017)	
Common Dwarf Gecko	<i>Lygodactylus capensis capensis</i>	Least Concern (SARCA 2017)	
Common File Snake	<i>Gonionotophis capensis capensis</i>	Least Concern (SARCA 2017)	



Common name	Scientific Name	IUCN	NEMBA
Common Flap-neck Chameleon	<i>Chamaeleo dilepis dilepis</i>	Least Concern (SARCA 2017)	
Common Flat Lizard	<i>Platysaurus intermedius intermedius</i>	Least Concern (SARCA 2017)	
Common Giant Plated Lizard	<i>Matobosaurus validus</i>	Least Concern (SARCA 2017)	
Common Girdled Lizard	<i>Cordylus vittifer</i>	Least Concern (SARCA 2017)	
Common Ground Agama	<i>Agama aculeata</i>	Not evaluated	
Common Platanna	<i>Xenopus laevis</i>	Least Concern	
Common Purple-glossed Snake	<i>Amblyodipsas polylepis polylepis</i>	Least Concern (SARCA 2017)	
Common Rough-scaled Lizard	<i>Meroles squamulosus</i>	Least Concern (SARCA 2017)	
Common Sand Lizard	<i>Pedioplanis lineocellata pulchella</i>	Least Concern (SARCA 2017)	
Common Tropical House Gecko	<i>Hemidactylus mabouia</i>	Least Concern (SARCA 2017)	
Coppery Grass Lizard	<i>Chamaesaura aenea</i>	Near Threatened (SARCA 2017)	
Cregoi's Blind Legless Skink	<i>Acontias cregoi</i>	Least Concern (SARCA 2017)	
Cross-marked Grass Snake	<i>Psammophis crucifer</i>	Least Concern (SARCA 2017)	
Cryptic Dwarf Gecko	<i>Lygodactylus incognitus</i>	Data Deficient (SARCA 2017)	
Delalande's Beaked Blind Snake	<i>Rhinotyphlops lalandei</i>	Least Concern (SARCA 2017)	
Delalande's Sandveld Lizard	<i>Nucras lalandii</i>	Least Concern (SARCA 2017)	
Distant's Ground Agama	<i>Agama aculeata distanti</i>	Least Concern (SARCA 2017)	
Distant's Thread Snake	<i>Leptotyphlops distanti</i>	Least Concern (SARCA 2017)	
Duerden's Stiletto Snake	<i>Atractaspis duerdeni</i>	Least Concern (SARCA 2014)	



Common name	Scientific Name	IUCN	NEMBA
Dusky Worm Lizard	<i>Monopeltis infuscata</i>	Least Concern (SARCA 2014)	
Dusky-bellied Water Snake	<i>Lycodonomorphus laevisissimus</i>	Least Concern (SARCA 2014)	
Dwarf Flat Lizard	<i>Platysaurus guttatus</i>	Least Concern (SARCA 2014)	
Dwarf Puddle Frog	<i>Phrynobatrachus mabaiensis</i>	Least Concern	
Dwarf Sand Snake	<i>Psammophis angolensis</i>	Least Concern (SARCA 2014)	
East African Shovel-snout	<i>Prosymna stuhlmannii</i>	Least Concern (SARCA 2014)	
Eastern Bark Snake	<i>Hemirhagerrhis nototaenia</i>	Least Concern (SARCA 2014)	
Eastern Black-lined Plated Lizard	<i>Gerrhosaurus intermedius</i>	Least Concern (SARCA 2014)	
Eastern Coastal Skink	<i>Trachylepis depressa</i>	Least Concern (SARCA 2014)	
Eastern Natal Green Snake	<i>Philothamnus natalensis natalensis</i>	Least Concern (SARCA 2014)	
Eastern Thread Snake	<i>Leptotyphlops scutifrons conjunctus</i>	Not listed	
Eastern Tiger Snake	<i>Telescopus</i>	Least Concern (SARCA 2014)	
FitzSimons' Blind Legless Skink	<i>Acontias aurantiacus fitzsimonsi</i>	Least Concern (SARCA 2014)	
FitzSimons' Flat Lizard	<i>Platysaurus orientalis fitzsimonsi</i>	Near Threatened (SARCA 2014)	
Flat Girdled Lizard	<i>Smaug depressus</i>	Least Concern (SARCA 2014)	
Flat-headed Tropical House Gecko	<i>Hemidactylus platycephalus</i>	Not evaluated	
Flatbacked Toad	<i>Amietophrynus maculatus</i>	Least Concern	
Floodplain Water Snake	<i>Lycodonomorphus obscuriventris</i>	Least Concern (SARCA 2014)	
Forest Cobra	<i>Naja melanoleuca</i>	Least Concern (SARCA 2014)	



Common name	Scientific Name	IUCN	NEMBA
Fork-marked Sand Snake	<i>Psammophis trinasalis</i>	Least Concern (SARCA 2014)	
Giant Bull Frog	<i>Pyxicephalus adspersus</i>	Near Threatened	
Giant Legless Skink	<i>Acontias plumbeus</i>	Least Concern (SARCA 2014)	
Giant Plated Lizard (subsp. ?)	<i>Matobosaurus validus</i>	Not listed	
Golden Leaf-folding Frog	<i>Afrixalus</i>	Least Concern	
Golden Plated Lizard	<i>Gerrhosaurus auritus</i>	Not assessed (SARCA 2014)	
Granite Dwarf Gecko	<i>Lygodactylus graniticolus</i>	Near Threatened (SARCA 2014)	
Guinea Shovel-nosed Frog (subsp. <i>broadleyi</i>)	<i>Hemisus guineensis broadleyi</i>	Least Concern	
Guttural Toad	<i>Amietophrynus gutturalis</i>	Least Concern	
Highveld Garter Snake	<i>Elapsoidea sundevallii media</i>	Not listed	
Holub's Sandveld Lizard	<i>Nucras holubi</i>	Least Concern (SARCA 2014)	
Intermediate Shield Cobra	<i>Aspidelaps scutatus intermedius</i>	Least Concern (SARCA 2014)	
Jacobsen's Thread Snake	<i>Leptotyphlops jacobseni</i>	Least Concern (SARCA 2014)	
Jalla's Sand Snake	<i>Psammophis jallae</i>	Least Concern (SARCA 2014)	
Jones' Girdled Lizard	<i>Cordylus jonesii</i>	Least Concern (SARCA 2014)	
Kalahari Dwarf Worm Lizard	<i>Zygaspis quadrifrons</i>	Least Concern (SARCA 2014)	
Kalahari Ground Gecko	<i>Colopus wahlbergii wahlbergii</i>	Least Concern (SARCA 2014)	
Kalahari Purple-glossed Snake	<i>Amblyodipsas ventrimaculata</i>	Not listed	
Knocking Sand Frog	<i>Tomopterna krugerensis</i>	Least Concern	
Lang's Flat Gecko	<i>Afroedura langi</i>	Least Concern (SARCA 2014)	
Lang's Worm Lizard	<i>Chirindia langi langi</i>	Least Concern (SARCA 2014)	



Common name	Scientific Name	IUCN	NEMBA
Large-scaled Grass Lizard	<i>Chamaesaura macrolepis</i>	Near Threatened (SARCA 2014)	
Leopard Tortoise	<i>Stigmochelys pardalis</i>	Least Concern (SARCA 2014)	
Lesser Flat Lizard	<i>Platysaurus intermedius parvus</i>	Least Concern (SARCA 2014)	
Lillie Flat Gecko	<i>Afroedura granitica</i>	Not listed	
Limpopo Dwarf Burrowing Skink	<i>Scelotes limpopoensis limpopoensis</i>	Least Concern (SARCA 2014)	
Lined Shovel-snout	<i>Prosymna lineata</i>	Least Concern (SARCA 2014)	
Lobatse Hinged Tortoise	<i>Kinixys lobatsiana</i>	Least Concern (SARCA 2014)	
Long-tailed Garter Snake	<i>Elapsoidea sundevallii longicauda</i>	Not listed	
Long-tailed Thread Snake	<i>Myriopholis longicauda</i>	Least Concern (SARCA 2014)	
Lowveld Dwarf Burrowing Skink	<i>Scelotes bidigitatus</i>	Least Concern (SARCA 2014)	
Makgabeng Dwarf Gecko	<i>Lygodactylus montiscaeruli</i>	Data Deficient (SARCA 2014)	
Many-spotted Snake	<i>Amplorhinus multimaculatus</i>	Least Concern (SARCA 2014)	
Marbled Tree Snake	<i>Dipsadoboa aulica</i>	Least Concern (SARCA 2014)	
Mariepskop Flat Gecko	<i>Afroedura maripi</i>	Not listed	
Methuen's Dwarf Gecko	<i>Lygodactylus methueni</i>	Vulnerable (SARCA 2014)	
Mole Snake	<i>Pseudaspis cana</i>	Least Concern (SARCA 2014)	
Montane Dwarf Burrowing Skink	<i>Scelotes mirus</i>	Least Concern (SARCA 2014)	
Mozambique Dwarf Burrowing Skink	<i>Scelotes mossambicus</i>	Least Concern (SARCA 2014)	
Mozambique Rain Frog	<i>Breviceps mossambicus</i>	Least Concern	



Common name	Scientific Name	IUCN	NEMBA
Mozambique Spitting Cobra	<i>Naja mossambica</i>	Least Concern (SARCA 2014)	
Muller's Velvet Gecko	<i>Homopholis mulleri</i>	Vulnerable (SARCA 2014)	
Natal Ghost Frog	<i>Hadromophryne natalensis</i>	Least Concern	
Natal Green Snake (subsp. ?)	<i>Philothamnus natalensis</i>	Not listed	
Natal Hinged Tortoise	<i>Kinixys natalensis</i>	Least Concern (SARCA 2014)	
Natal Purple-glossed Snake	<i>Amblyodipsas concolor</i>	Least Concern (SARCA 2014)	
Natal Sand Frog	<i>Tomopterna natalensis</i>	Least Concern	
Nile Crocodile	<i>Crocodylus niloticus</i>	Vulnerable (SARCA 2014)	Vulnerable
Northern Boomslang	<i>Dispholidus typus viridis</i>	Not evaluated	
Northern Crag Lizard	<i>Pseudocordylus transvaalensis</i>	Near Threatened (SARCA 2014)	
Northern Pygmy Toad	<i>Poyntonophrynus fenoulheti</i>	Least Concern	
Olive Grass Snake	<i>Psammophis mossambicus</i>	Least Concern (SARCA 2014)	
Olive House Snake	<i>Lycodonomorphus inornatus</i>	Least Concern (SARCA 2014)	
Olive Toad	<i>Amietophrynus garmani</i>	Least Concern	
Orange-throated Flat Lizard	<i>Platysaurus monotropis</i>	Endangered (SARCA 2014)	
Ornate Frog	<i>Hildebrandtia ornata</i>	Least Concern	
Ornate Rough-scaled Lizard	<i>Ichnotropis capensis</i>	Least Concern (SARCA 2014)	
Ornate Sandveld Lizard	<i>Nucras ornata</i>	Least Concern (SARCA 2014)	
Painted Reed Frog	<i>Hyperolius marmoratus</i>	Least Concern	
Peters' Ground Agama	<i>Agama armata</i>	Least Concern (SARCA 2014)	
Peters' Thread Snake	<i>Leptotyphlops scutifrons scutifrons</i>	Not listed	
Pienaar's Flat Gecko	<i>Afroedura pienaari</i>	Not listed	



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Plain Grass Frog	<i>Ptychadena anchietae</i>	Least Concern	
Plaintive Rain Frog	<i>Breviceps verrucosus</i>	Least Concern	
Power's Rain Frog	<i>Breviceps poweri</i>	Least Concern (IUCN 2013)	
Power's Toad	<i>Amietophrynus poweri</i>	Least Concern	
Poynton's River Frog	<i>Amietia poyntoni</i>	Not evaluated	
Puff Adder	<i>Bitis arietans arietans</i>	Least Concern (SARCA 2014)	
Queckett's River Frog	<i>Amietia queckettii</i>	Least Concern	
Rainbow Skink	<i>Trachylepis margaritifer</i>	Least Concern (SARCA 2014)	
Rattling Frog	<i>Semnodactylus wealii</i>	Least Concern	
Raucous Toad	<i>Amietophrynus rangeri</i>	Least Concern	
Red Toad	<i>Schismaderma carens</i>	Least Concern	
Redlegged Kassina	<i>Kassina maculata</i>	Least Concern	
Red-lipped Snake	<i>Crotaphopeltis hotamboeia</i>	Least Concern (SARCA 2014)	
Red-sided Skink	<i>Trachylepis homalocephala</i>	Least Concern (SARCA 2014)	
Reticulated Centipede-eater	<i>Aparallactus lunulatus lunulatus</i>	Least Concern (SARCA 2014)	
Rhombic Egg-eater	<i>Dasypeltis scabra</i>	Least Concern (SARCA 2014)	
Rhombic Night Adder	<i>Causus rhombeatus</i>	Least Concern (SARCA 2014)	
Rock Monitor	<i>Varanus albigularis albigularis</i>	Least Concern (SARCA 2014)	
Rough-scaled Plated Lizard	<i>Broadleysaurus major</i>	Least Concern (SARCA 2014)	
Rufous Beaked Snake	<i>Rhamphiophis rostratus</i>	Least Concern (SARCA 2014)	
Russetbacked Sand Frog	<i>Tomopterna marmorata</i>	Least Concern	
Schlegel's Beaked Blind Snake	<i>Afrotyphlops schlegelii</i>	Least Concern (SARCA 2014)	
Schlegel's Giant Blind Snake	<i>Afrotyphlops schlegelii</i>	Not listed	



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Sekhukhune Flat Lizard	<i>Platysaurus orientalis orientalis</i>	Least Concern (SARCA 2014)	
Sekhukhuneland Flat Gecko	<i>Afroedura leoloensis</i>	Not listed	
Semiornate Snake	<i>Meizodon semiornatus semiornatus</i>	Least Concern (SARCA 2014)	
Serrated Hinged Terrapin	<i>Pelusios sinuatus</i>	Least Concern (SARCA 2014)	
Serrated Tent Tortoise	<i>Psammobates oculifer</i>	Least Concern (SARCA 2014)	
Sharpnosed Grass Frog	<i>Ptychadena oxyrhynchus</i>	Least Concern	
Short-snouted Grass Snake	<i>Psammophis brevirostris</i>	Least Concern (SARCA 2014)	
Shovel-footed Squeaker	<i>Arthroleptis stenodactylus</i>	Least Concern	
Slender Worm Lizard	<i>Monopeltis sphenorhynchus</i>	Least Concern (SARCA 2014)	
Snoring Puddle Frog	<i>Phrynobatrachus natalensis</i>	Least Concern	
Snouted Cobra	<i>Naja annulifera</i>	Least Concern (SARCA 2014)	
Snouted Night Adder	<i>Causus defilippii</i>	Least Concern (SARCA 2014)	
South African Marsh Terrapin	<i>Pelomedusa galeata</i>	Not evaluated	
South African Slug-eater	<i>Duberria lutrix lutrix</i>	Least Concern (SARCA 2014)	
South Eastern Green Snake	<i>Philothamnus hoplogaster</i>	Least Concern (SARCA 2014)	
Southern African Python	<i>Python natalensis</i>	Least Concern (SARCA 2014)	Protected
Southern Brown Egg-eater	<i>Dasypeltis inornata</i>	Least Concern (SARCA 2014)	
Southern Foam Nest Frog	<i>Chiromantis xarampelina</i>	Least Concern	
Southern Pygmy Toad	<i>Poyntonophrynus vertebralis</i>	Least Concern	
Southern Rock Agama	<i>Agama atra</i>	Least Concern (SARCA 2014)	
Southern Tree Agama	<i>Acanthocercus atricollis atricollis</i>	Least Concern (SARCA 2014)	



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Southern Twig Snake	<i>Thelotornis capensis capensis</i>	Least Concern (SARCA 2014)	
Soutpansberg Dwarf Gecko	<i>Lygodactylus soutpansbergensis</i>	Near Threatened (SARCA 2014)	
Soutpansberg Flat Lizard	<i>Platysaurus relictus</i>	Least Concern (SARCA 2014)	
Soutpansberg Purple-glossed snake	<i>Amblyodipsas microphthalma nigra</i>	Least Concern (SARCA 2014)	
Soutpansberg Rock Lizard	<i>Vhembelacerta rupicola</i>	Near Threatened (SARCA 2014)	
Soutpansberg Worm Lizard	<i>Chirindia langi occidentalis</i>	Vulnerable (SARCA 2014)	
Speckled Gecko	<i>Pachydactylus punctatus</i>	Least Concern (SARCA 2014)	
Speckled Quill-snouted Snake	<i>Xenocalamus transvaalensis</i>	Least Concern (SARCA 2014)	
Speckled Rock Skink	<i>Trachylepis punctatissima</i>	Least Concern (SARCA 2014)	
Speckled Sand Skink	<i>Trachylepis punctulata</i>	Least Concern (SARCA 2014)	
Speckled Shield Cobra	<i>Aspidelaps scutatus scutatus</i>	Least Concern (SARCA 2014)	
Speke's Hinged Tortoise	<i>Kinixys spekii</i>	Least Concern (SARCA 2014)	
Spotted Bush Snake	<i>Philothamnus semivariegatus</i>	Least Concern (SARCA 2014)	
Spotted Dwarf Gecko	<i>Lygodactylus ocellatus</i>	Least Concern (SARCA 2014)	
Spotted Grass Snake	<i>Psammophylax rhombeatus rhombeatus</i>	Least Concern (SARCA 2014)	
Spotted Harlequin Snake	<i>Homoroselaps lacteus</i>	Least Concern (SARCA 2014)	
Spotted House Snake	<i>Lamprophis guttatus</i>	Least Concern (SARCA 2014)	
Spotted Sand Lizard	<i>Pedioplanis lineocellata lineocellata</i>	Least Concern (SARCA 2014)	



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Spotted Sandveld Lizard	<i>Nucras intertexta</i>	Least Concern (SARCA 2014)	
Spotted Shovel-nosed Frog	<i>Hemisus marmoratus</i>	Least Concern	
Spotted-neck Snake-eyed Skink	<i>Afroablepharus maculicollis</i>	Least Concern (SARCA 2014)	
Stevenson's Dwarf Gecko	<i>Lygodactylus stevensoni</i>	Least Concern (SARCA 2014)	
Striped Grass Frog	<i>Ptychadena porosissima</i>	Least Concern	
Striped Grass Snake	<i>Psammophylax tritaeniatus</i>	Least Concern (SARCA 2014)	
Striped Quill-snouted Snake	<i>Xenocalamus bicolor lineatus</i>	Least Concern (SARCA 2014)	
Striped Skink	<i>Trachylepis striata</i>	Least Concern (SARCA 2014)	
Striped Stream Frog	<i>Strongylopus fasciatus</i>	Least Concern	
Sundevall's Shovel-snout	<i>Prosymna sundevallii</i>	Least Concern (SARCA 2014)	
Sundevall's Writhing Skink	<i>Mochlus sundevallii sundevallii</i>	Least Concern (SARCA 2014)	
Swazi Rock Snake	<i>Inyoka swazicus</i>	Least Concern (SARCA 2014)	
Tandy's Sand Frog	<i>Tomopterna tandyi</i>	Least Concern	
Tiger Gecko	<i>Pachydactylus tigrinus</i>	Least Concern (SARCA 2014)	
Transvaal Gecko	<i>Pachydactylus affinis</i>	Least Concern (SARCA 2014)	
Transvaal Rain Frog	<i>Breviceps sylvestrus</i>	Vulnerable	
Tremelo Sand Frog	<i>Tomopterna cryptotis</i>	Least Concern	
Tropical Platanna	<i>Xenopus muelleri</i>	Least Concern	
Turner's Gecko	<i>Chondrodactylus turneri</i>	Least Concern (SARCA 2014)	
Two-striped Shovel-snout	<i>Prosymna bivittata</i>	Least Concern (SARCA 2014)	
Udzungwa Grass Frog	<i>Ptychadena uzungwensis</i>	Least Concern	
Van Dam's Dwarf Worm Lizard	<i>Zygaspis vandami vandami</i>	Not listed	



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Van Dam's Girdled Lizard	<i>Smaug vandami</i>	Least Concern (SARCA 2014)	
Van Son's Gecko	<i>Pachydactylus vansoni</i>	Least Concern (SARCA 2014)	
Variable Skink	<i>Trachylepis varia</i>	Least Concern (SARCA 2014)	
Variiegated Wolf Snake	<i>Lycophidion variegatum</i>	Least Concern (SARCA 2014)	
Wahlberg's Snake-eyed Skink	<i>Afroablepharus wahlbergii</i>	Least Concern (SARCA 2014)	
Wahlberg's Velvet Gecko	<i>Homopholis wahlbergii</i>	Least Concern (SARCA 2014)	
Water Lily Frog	<i>Hyperolius pusillus</i>	Least Concern	
Water Monitor	<i>Varanus niloticus</i>	Least Concern (SARCA 2014)	
Waterberg Dwarf Gecko	<i>Lygodactylus waterbergensis</i>	Least Concern (SARCA 2014)	
Waterberg Flat Gecko	<i>Afroedura waterbergensis</i>	Not listed	
Waterberg Flat Lizard	<i>Platysaurus minor</i>	Least Concern (SARCA 2014)	
Waterberg Girdled Lizard	<i>Smaug breyeri</i>	Least Concern (SARCA 2014)	
Waterberg Quill-snouted Snake	<i>Xenocalamus bicolor australis</i>	Least Concern (SARCA 2014)	
Western Legless Skink	<i>Acontias occidentalis</i>	Least Concern (SARCA 2014)	
Western Natal Green Snake	<i>Philothamnus natalensis occidentalis</i>	Least Concern (SARCA 2014)	
Western Yellow-bellied Sand Snake	<i>Psammophis subtaeniatus</i>	Least Concern (SARCA 2014)	
White-bellied Dwarf Burrowing Skink	<i>Scelotes limpopoensis albiventris</i>	Near Threatened (SARCA 2014)	
Wilhelm's Flat Lizard	<i>Platysaurus intermedius wilhelmi</i>	Least Concern (SARCA 2014)	
Wolkberg Dwarf Chameleon	<i>Bradypodion transvaalense</i>	Least Concern (SARCA 2014)	



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Woodbush Flat Gecko	<i>Afroedura multiporus</i>	Vulnerable (SARCA 2014)	
Woodbush Legless Skink	<i>Acontias rieppeli</i>	Endangered (SARCA 2014)	
Yellow-bellied House Snake	<i>Lamprophis fuscus</i>	Least Concern (SARCA 2014)	
Yellow-throated Plated Lizard	<i>Gerrhosaurus flavigularis</i>	Least Concern (SARCA 2014)	
Zimbabwe Flat Gecko	<i>Afroedura transvaalica</i>	Least Concern (SARCA 2014)	
Zimbabwe Flat Lizard	<i>Platysaurus intermedius rhodesianus</i>	Least Concern (SARCA 2014)	