



DIGBY WELLS
ENVIRONMENTAL



Baseline Fauna and Flora Impact Assessment Report Input for the Environmental Application Process for the Proposed Twyfelaar Coal Mining Project, Mpumalanga Province

Flora and Fauna Impact Assessment Report

Project Number:

DAG5603

Prepared for:

Dagsoom Coal Mining (Pty) Ltd

September 2019

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Report Type:	Flora and Fauna Impact Assessment Report
Project Name:	Baseline Fauna and Flora Impact Assessment Report Input for the Environmental Application Process for the Proposed Twyfelaar Coal Mining Project, Mpumalanga Province
Project Code:	DAG5603

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EXECUTIVE SUMMARY

Digby Wells Environmental (hereafter Digby Wells) has been commissioned by Dagsoom Coal Mining (Pty) Ltd (Dagsoom) to complete a baseline environmental survey of the terrestrial ecology (flora and fauna) associated with the proposed Dagsoom, Twyfelaar Coal Mining Project, Mpumalanga Province.

Dagsoom is the applicant for a mining right for coal and torbanite on portions of the farms Twyfelaar 298IT and Klipfontein 283IT in terms of the Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) These farms are located on the eastern escarpment of the Mpumalanga Highveld in the Ermelo Coalfield. .

The coal seams sub-outcrop on the eastern and southern side of the hill. There are numerous wetlands and hillside seepage areas around this hill and most of the potential opencast mineable resources are considered to be sterilised. The mine will, therefore, be an underground mine with all infrastructure around the mine access area on the eastern side of the Project Area on the farm Twyfelaar 298IT. It is envisaged that the impact of an underground mine on the environment will be limited and contained to the mine access area where all surface activities are concentrated.

The aim of the baseline Fauna and Flora Impact Assessment report is to describe the current terrestrial ecology in terms of vegetation, flora, mammals, avifauna, herpetofauna and invertebrates. Thereafter to identify the potential impacts that the construction, operational and decommissioning activities will have on the environment, and prescribe mitigation and management measures to negate negative impacts. .

After a scoping level assessment report was carried out to establish on a desktop level, the inherent ecological sensitivity of the receiving environment, it was revealed that several inherent ecological sensitivities are present. The most concerning of these was the fact that according to the National List of Threatened Terrestrial Ecosystems, the vulnerable Eastern Highveld Grassland covers the largest extent of the study area and Mpumalangs Biodiversity Sector Plan (MBSP) Terrestrial database (2014) indicates the presence of areas within three categories that are categorized as Critical Biodiversity Areas (CBA) Irreplaceable, CBA Optimal and Ecological Support Areas within the project area.

This proposed Coal Mining Project will be located on the farm Twyfelaar 298IT, within the Msukaligwa Local Municipality (MP302), situated in the Gert Sibande District Municipality in the Highveld sub-region of Mpumalanga. The closest towns are Sheepmoor which is approximately 4 km from the proposed project area and Ermelo which is approximately 30 km from the project area.

According to Mucina and Rutherford (2012), the proposed Twyfelaar Coal Mine is located in areas classified as Eastern Highveld Grassland (Gm 12) and Wakkerstroom Montane Grassland (Gm 14).

According to the National List of Threatened Terrestrial Ecosystems, the vulnerable Eastern Highveld Grassland covers the largest extent of the study area.

A total of seven (7) plant species of conservation concern listed under the national red list and protected under the Mpumalanga Nature Conservation Act 10 of 1998, could potentially occur in the project area. These include *Aloe kniphofioides* (Vulnerable), *Eucomis autumnalis* (Vulnerable), *Gladiolus malvinus* (Vulnerable), *Hypoxis hemerocallidea* (Near Threatened), *Kniphofia typhoides* (Rare), *Nerine gracilis* (Endangered) and *Ocotea bulata* (Burch.) Baill (Vulnerable).

Thirteen (13) plant species, listed by the National Environmental Management: Biodiversity Act (NEMBA) as Alien Invasive Plant Species may occur in the project areas and have the potential to spread due to site disturbance associated with project activities. These include *Eucalyptus* sp. (Gum tree), (1b) *Pinus* sp. (Pine tree) (2), *Verbena bonariensis* (Tall verbena) (1b), *Cirsium vulgare* (Spear thistle) (1b), *Pennisetum clandestinum* (Kikuyi grass) (1b), *Datura stramonium* (stinkweed) (1b), *Solanum mauritianum* (Bugweed) (1b), *Tribulus terrestris* and *Arundo donax* (Spanish reed) (1b).

Based on the results of a search of historical records for the Quarter Degree Square Grid (QDS) 2630CA and 2630CB on the Animal Demographics Unit (ADU) database, the following mammal Species of Special Concern (SCC) may potentially be recorded in the project area: Serval (Near Threatened (2016)), Brown Hyena (Near Threatened (2015)), Southern African Hedgehog (Near Threatened (2016)), Serval (Near Threatened (2016)), African Striped Weasel (Near Threatened (2016)) and Oribi (Endangered).

Recently acquired data (according to South African Bird Atlasing Project 2 (SABAP2) of the project area corresponding to the for the Quarter Degree Squares (QDS) 2630CA and 2630CB as well as old records from SABAP1 indicate that approximately 261 bird species are expected to occur in the study area. This includes a number of Red Data species and species that are endemic to southern Africa.

The site has been classified into six primary land management units, namely: Agricultural Areas, Alien Bushclumps, Secondary Grassland, Primary Grassland, Rocky Outcrops, and Riparian Areas. The Agricultural Areas are associated with the dominant land use (livestock and Cultivation) in the area did not account for any natural vegetation. Vegetation cover is sparse and includes alien plant species such as: *Cirsium vulgare* (Scotch Thistle) and *Solanum sisymbriifolium* (Dense-thorned Bitter Apple).

Floral diversity in the *Primary* Grassland was regarded as expected in comparison with the expected species. Alien invasive tree species were found to dominate many landscapes, including riparian, wetlands and primary and secondary grassland.

A total of two flora SSC were recorded for the site more species are expected, but was not recorded due to seasonal limitations. A total of two faunal SSC was recorded, namely: Vulnerable species, *Sagittarius serpentarius* (Secretary Bird) and Southern Bald Ibis (*Geronticus calvus*). The avifaunal assessment yielded a total of 51 bird species within the Dagsoom project area. Herpetofauna findings included, three reptile species, and no amphibian species. Faunal diversity was lower than expected, given the undisturbed nature of large parts of the project area.

An impact statement is required as per NEMA regulations with regards to the proposed development. Considering the conclusion of this report as well as the strict mitigation measures developed, it is the opinion of the specialist that the project be favourably considered.

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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	Kilometers
km ²	Square kilometers
LC	Least Concern
MPNCA	Mpumalanga Nature Conservation Act, 1998 (Act No.10 of 1998), Limpopo Environmental Management Act, 2003 (Act 7 of 2003)

m	Meters
mm	Millimeters
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

Dagsoom is the applicant for a mining right for coal and torbanite on portions of the farms Twyfelaar 298IT and Klipfontein 283IT in terms of the Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA).

The project is a greenfields site and is situated within the Msukaligwa Local Municipality (MP302), situated in the Gert Sibande District Municipality in the Highveld sub-region of the Mpumalanga Province.

1.1 Biodiversity of the Grassland Biome

Biodiversity is defined, according to the NEMBA, 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”. 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 to achieve this.

The Dagsoom study area falls within the Grassland Biome, one of nine biomes in South Africa (Mucina and Rutherford, 2012). This is the second largest of the South African biomes, covering approximately 30% of the country (SANBI, 2013). A common misconception is that grasslands are comprised primarily of grass species of the Poaceae family. On the contrary, grassland diversity is made up primarily of forbs such as gladioli, orchids and bulbs, although grasses are more abundant in area according to the World Wildlife Foundation (WWF), making it an exceptionally diverse ecosystem from a botanical perspective, supporting 3500 plant species (SANBI, 2013).

1.2 Terms of Reference

Digby Wells was commissioned by Dagsoom to complete a fauna and flora impact assessment as part of the Scoping and Environmental Impact Reporting process for the proposed Twyfelaar mine. This study addresses and adheres to the regulations and regulatory procedures of the Department of Mineral Resources.

2 Project Description

Dagsoom is the applicant for a mining right for coal and torbanite on portions of the farms Twyfelaar 298IT and Klipfontein 283IT in terms of the Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA).

The coal seams sub-outcrop on the east and southern side of the hill as indicated in Figure 6-1. There are numerous wetlands and hillside seepage areas around this hill and most of the potential opencast mineable resources are considered to be sterilised. The mine will, therefore, be an underground mine with all infrastructure around the mine access area on the eastern side of the Project Area on the farm Twyfelaar 298IT. The impact of an underground

mine on the environment will be limited and contained to the mine access area where all surface activities are concentrated. The focus of this report is on these surface impacted areas, and these were extensively covered from a field procedures perspective.

The C- seam and, in particular, the C-Lower seam, is the only seam that occurs at a mineable thickness (>1.4m for Continuous Miners) over the project area. There is a sandstone and shale parting of more than 3 meters that separates the C-Upper and C-Lower seams and no opportunity exists for these seams to be mined together as per the case at other mines in the area. No faults or dykes were discovered during the exploration phase and bord and pillar mining with continuous miners is the preferred mining option.

2.1 Reserves

There is in the order of 12% of the Mineable tonnes in-situ (MTIS) that is lost due to layout losses which is primarily due to barrier pillars left between mining panels and the inability to mine up to the exact border of the pre-defined resource. Another 5% is left behind during the mining process. The pillar sizes are determined based on the depth of cover, seam height and road width and the assumption is made that 60% of the pillars left behind will be mined during the stooping phase which gives more than 80% total extraction of the resource within the panels. The Run of Mine (ROM) reserve tonnes are determined as per the Life of Mine Plan.

2.2 Resource Access

The position for underground access is selected based on the most appropriate position for a mine access, together with the entire associated surface infrastructure positioned outside the wetlands as far as could be determined in the pre-feasibility phase, but with a practical view on the seam access, mine layout, ventilation considerations, terrace for product handling and access road from the tar road.

The resource will be accessed through a boxcut on the side of the mountain and the C-lower seam will be accessed directly without any declines. No detailed geotechnical analysis has been done on the strata formation stability where the boxcut is planned. Detailed designs will also reveal if the boxcut must access the seam at a dip or if the floor of the boxcut will be an extension of the coal floor of the C-lower seam. The access will then be called an adit. The resource will be accessed with at least three roads from the boxcut high wall; one road for men and material, one for the ROM conveyor and one the return airway which will be connected to the ventilation fans on the side high wall of the boxcut.

2.3 Production and Scheduling

The coal reserves are scheduled to be mined with two continuous miners. Each production section will be mined at a rate of about 240 kilotonnes per annum (ktpa) or 20 kilotonnes per month (ktpm), which is the industry benchmark due to the low seam height to be mined. Stooping production rates may increase up to 30ktpm due to less support requirements.

The total production for this mine is planned to be 480ktpa or slightly higher during stooping operations with two continuous miner sections.

The stooping operations will be at 50ktpm due to fewer support requirements and due to the fact that the geological challenges were already overcome during the development phase. The cost per ROMt will also be much less and an operating cost of approximately R250/ROMt is to be used in the techno-financial model.

This Life of Mine schedule allows for a life of mine of between four and five years pending the decision whether or not to stoop the main development.

The list of infrastructure required includes the following:

- Underground mine accessed by adit. Boxcut will produce limited rock dump;
- Access and haulage road – Maximum 9.6m wide, maximum 6km long;
- Adit;
- Two ventilation fans;
- Processing Plant;
- Pollution control dam (volumetric capacity of approximately 5 500m³ and measures 40x35x4 m);
- Raw water pump station and process water pump station;
- Pipelines;
- Both pipelines are 2-inch HPDE. Maximum requirement 22.1 m³/h;
- Raw water pipeline = 1.49km (traverses two watercourses and road);
- Process water pipeline;
- Electricity supply – 22kV line 2.3 km long;
- Potable water treatment plant and associated tanks;
- Sewage treatment plant;
- Reverse Osmosis plant;
- 2 x change houses;
- Offices and ablutions;
- Workshops and cable workshop;
- Refuel bay;
- Weighbridge and weighbridge control room; and
- Access control office.

3 Regulatory and Institutional Framework

The intention to undertake mining activities requires an application for a Mining Right (MR) in terms of the MPRDA. As per section 22(4) (a) of the MPRDA, an applicant is required to complete the required environmental authorisation application process to obtain regulatory approval (provided it is approved) prior to the commencement of any mining activities.

In terms of the NEMA and other applicable laws as listed in Table 3-1 below, it is required that the environmental and social impacts associated with mining activities be assessed to identify any potential negative and/or positive consequences as a result thereof. Following which, measures must be proposed to avoid or minimise these impacts.

The following legislative requirements were considered during this assessment:

- Section 24 of the Constitution – Environment, 1996 (Act No. 108 of 1996);
- The Minerals and Petroleum Resources Development Act, (Act No. 28 of 2002) (MPRDA) and its Regulations;
- National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2014) (NEM: BA);
- Section 5 of the National Environmental Management Act, 1998 (Act No. 7 of 1998) (NEMA);
- National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEM: PAA) as amended;
- National Forest Act, 1998, (Act No. 84 of 1998) (NFA);
- Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MPNCA); and
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA).

Table 3-1: Policy and Legislative context applicable to the application

Legislation	Applicable legislation requirements	Relevance to the Applicant
Constitution of the Republic of South Africa (Act No.108 of 1996)	Section 24: Environmental Rights for All	<p>Everyone has the right:</p> <ul style="list-style-type: none"> ▪ To an environment that is not harmful to their health or well-being; and ▪ To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that – ▪ Prevent pollution and ecological degradation; ▪ Promote conservation; and ▪ Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. <p>Section 24 of the constitution enshrines environmental rights in South Africa as a whole and the Mpumalanga Economic Growth Agency should note the protection of the environment in the Bill of Rights, especially in relation to justifiable economic and social development.</p>
	Section 32: Access to information	<p>Everyone has the right of access to:</p> <ul style="list-style-type: none"> ▪ Any information held by the state (unless it is information that is explicitly excluded by the Promotion of Access to Information Act, 2000 (Act No. 2 of 2000); ▪ Any information held by another person and that is required for the exercise or protection of any rights. <p>This is further extended by NEMA, Section 2(4)(k) of the NEMA specifically provides that “decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law”.</p> <p>The Mpumalanga Economic Growth Agency will make all information required to the public when required.</p>

Legislation	Applicable legislation requirements	Relevance to the Applicant
	<p>Section 33: Administrative Justice</p>	<p>Everyone has the right to administrative action that is lawful, reasonable and procedurally fair.</p> <p>Everyone whose rights have been adversely affected by administrative action has the right to be given written reasons.</p> <p>National legislation must be enacted to give effect to these rights, and must - (a) provide for the review of administrative action by a court or, where appropriate, an independent and impartial tribunal; (b) impose a duty on the state to give effect to the rights in subsections (1) and (2); and (c) promote an efficient administration</p> <p>This section of the Constitution guarantees that administrative action will be reasonable, lawful and procedurally fair, and it makes sure that people have the right to ask for written reasons if and when administrative action has a negative impact on them thus the Applicant.</p> <p>The provisions of NEMA and its Regulations dictate the manner in which environmental authorization processes are undertaken, decisions made, and the appeal process; all of which are applicable to the current application.</p>
	<p>Section 38 Enforcement of Rights and Administrative Review</p>	<p>Section 38 of the Constitution promotes the possibility to enforce all constitutional rights, including the section 24 environmental right</p> <p>In the context of this report the section 38 provisions on <i>locus standi</i> have been extended by section 32 of NEMA which states that :‘Any person or group of persons may seek appropriate relief in respect of any breach or threatened breach of any provision of this Act, including a principle contained in Chapter 1, or any other statutory provision concerned with the protection of the environment or the use of natural resources’</p>

Legislation	Applicable legislation requirements	Relevance to the Applicant
<p>Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act No. 28 of 2002)</p>	<p>(GNR527, 23 April 2004 as amended by GNR R1288 dated 29 October 2004; GNR1203 dated 30 November 2006; and GNR349 dated 18 April 2011).</p>	<p>The purpose of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) is to provide for equitable access to and sustainable development of the mineral and petroleum resources of South Africa.</p> <p>As per section 22(4)(a) of the MPRDA, an applicant is required to complete the required environmental authorization to obtain regulatory approval prior to the commencement of any mining.</p>
<p>NEMA Environmental Impact Assessment (EIA) Regulations of 2014: GNR 324 to 326 of 7 April 2017</p>		<p>The EIA Regulations, The EIA Regulations, GNR 327 of 4 December 2014, Regulation 21-26, and Regulation 39-44 set out the process required to undertake the Scoping and EIA Process including the public participation process to be undertaken as part of the EIA. Process including the public participation process to be undertaken as part of the EIA. This Act prohibits mining of minerals without a permit issued in terms of section 27(6)</p> <p>When submitting an application for a right or permit in terms of the MPRDA an applicant must obtain regulatory approval or the required environmental authorization as part of the application for a mining right in terms of the MPDRA and required to submit an environmental management program (section 24(1a) of NEMA), also referred to as an EMP, within 180 days once an application has been accepted.</p> <p>As part of this project, a Scoping and EIA Study is being followed in terms of the EIA Regulations. This report forms part of the scoping phase of the EIA being undertaken. This document serves as the Scoping Phase Report for the EIA process</p>

Legislation	Applicable legislation requirements	Relevance to the Applicant
		<p>The principles of NEMA have been considered. This Scoping Report aims to scope the potential environmental impacts that need to be investigated as part of the environmental impact assessment and is prepared in compliance with NEMA.</p>
<p>National Environmental Management Biodiversity Act (NEM: BA) (Act No. 10 of 2004)</p>		<p>Although NEM: BA makes no express reference to the CBD, this Act’s objectives mirror those of the Convention on Biological Diversity and its provisions seek to implement CBD objectives at a national level by providing for the following:</p> <ul style="list-style-type: none"> ■ Management and conservation of South Africa’s biodiversity within NEMA’s framework ■ Usage of indigenous biological resources in a sustainable manner ■ Fair and equitable sharing among stakeholders of the benefits arising from bio-prospecting involving indigenous biodiversity ■ Protection of species and ecosystems that warrant national protection; and ■ Establishment and functions of the South African National Biodiversity Institute (SANBI) <p>NEM: BA restricts activities on protected species via its associated Threatened or Protected Species Regulations (TOPS) and also provides for any activity (which must be identified in terms of this Act) which may impact on these species.</p> <p>In addition to this the Alien and Invasive Species Regulations (GNR 506 of 2013), promulgated in terms of Section 97(1) of NEM: BA apply as well as Alien Invasive Regulations (2014) and the Invasive Species List (2018) are also listed.</p> <p>A Biodiversity Survey will be undertaken for the receiving environment; it will also survey for protected species and determine the impact of the project on ecology. If any protected species are identified</p>

Legislation	Applicable legislation requirements	Relevance to the Applicant
		<p>within the proposed project area, a license to disturb protected flora will be obtained from the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA). Protected flora outside of the prospecting areas will be marked and left intact as much as possible.</p> <p>Dagsoom is submitting an application for EA. The application is subject to a scoping and EIA process and this report has been compiled to meet the requirements of the Scoping Phase.</p>
<p>National Forests Act (NFA) (Act No. 84 of 1998)</p>		<p>The National Forests Act (NFA) (Act No. 84 of 1998) provides for the protection of particular trees, a particular group of trees, particular woodland or trees belonging to a particular species by way of a declaration by Minister of the Department of Agriculture, Forestry and Fisheries (“DAFF”) – which is the custodian of all natural forest resources within the borders of the Republic of South Africa. According to section 15 of the NFA, the effect of this declaration means that no individual or persons may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport purchase, sell, donate any protected tree, unless under a license or in terms of an exemption.</p> <p>The project n activities would avoid removal of protected trees as far as possible. Instances where it cannot be avoided, a permit for removal will be obtained from DAFF.</p>

Legislation	Applicable legislation requirements	Relevance to the Applicant
National Environmental Management Protected Areas Act, 2003 (Act No. 57 of 2003) (NEM: PAA)	Section 50(5)	<p>Section 50(5) of NEM: PAA states that no development may be permitted in a nature reserve or world heritage site without the prior written consent and approval of the management authority.</p> <p>The project area traverses no protected areas, the Langcarel Private Nature Reserve is located 8 km west of the project area and the Jericho Dam Nature Reserve is located 9km to the north east.</p>

Legislation	Applicable legislation requirements	Relevance to the Applicant
Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MPNCA)	Section 69	The Mpumalanga Nature Conservation Act provides for the consolidation of laws relating for nature conservation and includes a section on protected plants including a schedule (schedule 11) in which a list of protected species is provided. The Act also specifies that all species listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora are protected. All species protected under the provincial legislation need to be specified on any clearing permit applications for the site.

4 Expertise of the 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 registered 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 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 South Africa, Sierra Leone, Ghana, Mali, Botswana, Senegal, Namibia and Cote D'Ivoire.

5 Methodology

5.1 Literature Review and Desktop Study

Baseline and background information was researched and used to understand the area prior to fieldwork and to complete the screening (desktop) assessment. A regional understanding of the project area is gained through this process which enables a more accurate ecological assessment to be done. During the undertaking of the desktop study relevant information was collected from the following sources:

- Mucina and Rutherford (2012), expected vegetation type and community structure:
- South African National Botanical Institute (SANBI), Pretoria Computerised Information System) PRECIS List's, potential species in the proposed development area/site area according to the;
- South African Bird Atlasing Project (SABAP2);
- Mpumalanga Provincial legislation, potential Red Data Listed species and their current status; and
- Current biodiversity and ecosystem status.

5.1.1 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 (2012) for each vegetation type found in the study area were used to add to the list of expected species for the study area.

5.1.2 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.

5.1.3 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 invertebrate species officially recorded by SANBI and associates for Quarter Degree Squares (QDS) 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.

5.1.4 Mpumalanga Biodiversity Sector Plan (2014)

The Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) is the custodian for the sustainable use of resources and environmental protection in the Mpumalanga Province. This department is responsible for the implementation of the Mpumalanga Biodiversity Sector Plan (MBSP) which is a spatial tool with associated land-use guidelines to inform permissible land-uses that support biodiversity and ecological processes. The main purpose of a biodiversity sector plan is to ensure that the most recent and best quality spatial biodiversity information can be accessed and used to inform land-use and development planning, environmental assessments and authorisations, and natural resource management.

The CBA maps show the following five broad map categories, some of which are further divided into sub-categories as follows:

- Protected Areas;
- Critical Biodiversity Areas (CBAs);
- Ecological Support Areas (ESAs);
- Other Natural Areas (ONAs); and
- Moderately or Heavily Modified Areas (sometimes called 'transformed').

The MBSP Terrestrial database (2014) indicates the presence of areas within three categories that are categorised as CBA Irreplaceable, CBA Optimal and Ecological Support Areas within the project area.

5.2 Field Investigations and Seasonal Influence

The site visit and detailed infield flora and fauna assessments took place from the 12 to the 16 of August 2019. Examples of the flora sampling points are indicated in Figure 5-1.

5.2.1 Flora

As the sampling of the entire study area is not possible, representative samples of the vegetation were assessed. Aerial imagery was utilized to identify and stratify homogenous vegetation units. Sampling points were then randomly selected within representative areas of this homogenous vegetation units and then groundtruth by means of detailed infield assessment. The number of sample sites visited was determined by the time available for the study as well as the accessibility of each of the sample sites. This methodology allows for more efficient sampling than overall random sampling.

At each sample site, a plot size of 50 m² was sampled, and a wandering line transect was performed. In each plot; the species were identified in the field. The Braun-Blanquet method was used for the listing of species and their associated cover. The Braun-Blanquet method incorporates seven cover-abundance categories as listed in Table 5-1. A general species list was also compiled from random traversing through the site.

Table 5-1: Braun-Blanquet Analysis Cover Abundance

Cover Abundance	Category
One or few individuals.	r
Occasional and less than 5% of total plot area.	+
Abundant and with very low cover, or less abundant but higher cover; in any case less than 5% cover of total plot area.	1
Very abundant and less than 5%, or 5-25% cover, of a total plot area: <ul style="list-style-type: none"> ▪ 2m – Very abundant ▪ 2a – 5-12.5 % cover, irrespective of number of individuals ▪ 2b – 12.5-25% cover, irrespective of number of individuals 	2
25-50% cover of total plot area, irrespective of number of individuals.	3
50-75% cover of total plot area, irrespective of number of individuals	4
75-100% cover of total plot area, irrespective of number of individuals	5

Vegetation was classified and the broad plant communities identified during the classification was then mapped to show their distribution. Species lists were compiled for each broad habitat type.

The Braun-Blanquet sampling method that was used during vegetation surveys, 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.

5.2.1.1 Species of Special Concern (SSC)

From the overall species list, a list of SSC was compiled. A comprehensive SSC species list was compiled taking the following Red Data Lists into consideration:

- International Union for the Conservation of Nature (IUCN) Red Data List (2019);
- The South African National Biodiversity Institute (SANBI) Red Data list version 2019.1;
- The South African Red Data lists for mammals (2004), birds (2016), butterflies and Herpetofauna;
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) Threatened or Protected Species Regulations, and
- The Convention on International Trade in Endangered Species of Flora and Fauna (CITES) list (2019).

The South African Red Data List uses the same criteria as that defined by the IUCN. According to the IUCN all species are classified in nine groups, set through criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation (IUCN, 2019). The categories are described in Table 5-2 below.

Table 5-2: Red Data Categories (taken from SANBI 2018)

CATEGORY		DESCRIPTION
Extinct	(EX)	No known individuals remaining.
Extinct in the Wild	(EW)	Known only to survive in captivity.
Critically Endangered	(CR)	Extremely high risk of extinction in the wild.

CATEGORY		DESCRIPTION
Endangered	(EN)	High risk of extinction in the wild..
Vulnerable	(VU)	High risk of endangerment in the wild.
Near Threatened	(NT)	Likely to become endangered in the near future.
Least Concern	(LC)	Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.
Data Deficient	(DD)	Not enough data to make an assessment of its risk of extinction.
Not Evaluated	(NE)	Has not yet been evaluated against the criteria.
	Extinct	Threatened species are species that are facing a high risk of extinction. Any species classified in the IUCN categories CR, EN or VU is a threatened species. Species of conservation concern are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories, NT, LC and DD
	Threatened	
	Other categories of conservation concern	
	Other categories	

The online IUCN, POSA and the SANBI species status data bases were referenced in order to identify Red Data Listed species and their various threat status categorisations.

5.2.2 Alien Invasive Species

Alien plant species in South Africa are categorised according to the Alien and Invasive Species Lists, 2014 (GN R864 in GG 40166 of 29 July 2016) of the NEMBA (Act 10 of 2004). The national list of invasive plant species listed in NEMBA represents 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.

The species recorded on site are categorised according to NEMBA, and management measures designed according to requirements of the act.

5.2.3 Fauna

A desktop analysis combined with a dry-season survey was undertaken to determine the species that occur in the study area, compared against historical records and survey results. Fauna occurring on site include assemblages within terrestrial and riparian 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 montane

grassland, highveld grassland and wetland and riparian areas. As the general area is used primarily for agricultural purposes such as cattle and maize farming, there are large numbers of cattle, utilising the natural grasslands for grazing.

5.2.3.1 Mammals

The mammal survey was conducted concurrently with the flora and vegetation 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 were recorded:

- All mammals encountered, noted or captured during the survey (rare, endangered and other);
- 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 applied by using non-fatal Sherman traps located within the various vegetation types. 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 every morning due to the fact that the small mammals are predominantly active at night.

Trapping was undertaken for four consecutive nights at the predetermined sites. Captured animals were photographed and identified. Species of conservation concern and provincially, nationally or internationally listed as protected and endemic within the study area, took priority and the Red Data status was identified and recorded.

5.2.3.2 Birds

Concurrently with the mammal survey, the principal ornithological field survey technique was used to record bird species present. A total distance of 89km was traversed through the entire project area. Transect counts were taken in sites representative of different avifauna habitat, such as montane grassland, highveld grassland, riparian areas and disturbed areas. 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.

The following were recorded:

- All birds encountered or noted during the survey; 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 Roberts Guide (Chittenden *et al.*, 2016).

Assessment of the conservation status of species recorded focused on the various categories of Globally Threatened Species (IUCN 2019) and birds listed by NEMBA.

5.2.3.3 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) were 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.

5.2.3.4 Invertebrates (Spiders, Scorpions, Beetles and Butterflies)

During the winter (dry) season, butterflies were identified when observed and transects were walked both within the various vegetation types and into the surrounding vegetation where necessary (approximately 50m at selected points) to identify any scorpion or 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 2019) and inverts listed by the NEMBA.

5.2.3.5 Red Data Faunal Assessment

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, 2019).
- Endangered (EN): A taxon is Endangered when it is considered to be facing a very high risk of extinction in the wild (IUCN, 2019).
- 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, 2019).
- 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, 2010).

Faunal sampling locations and sightings of SSC are represented in Figure 5-1.

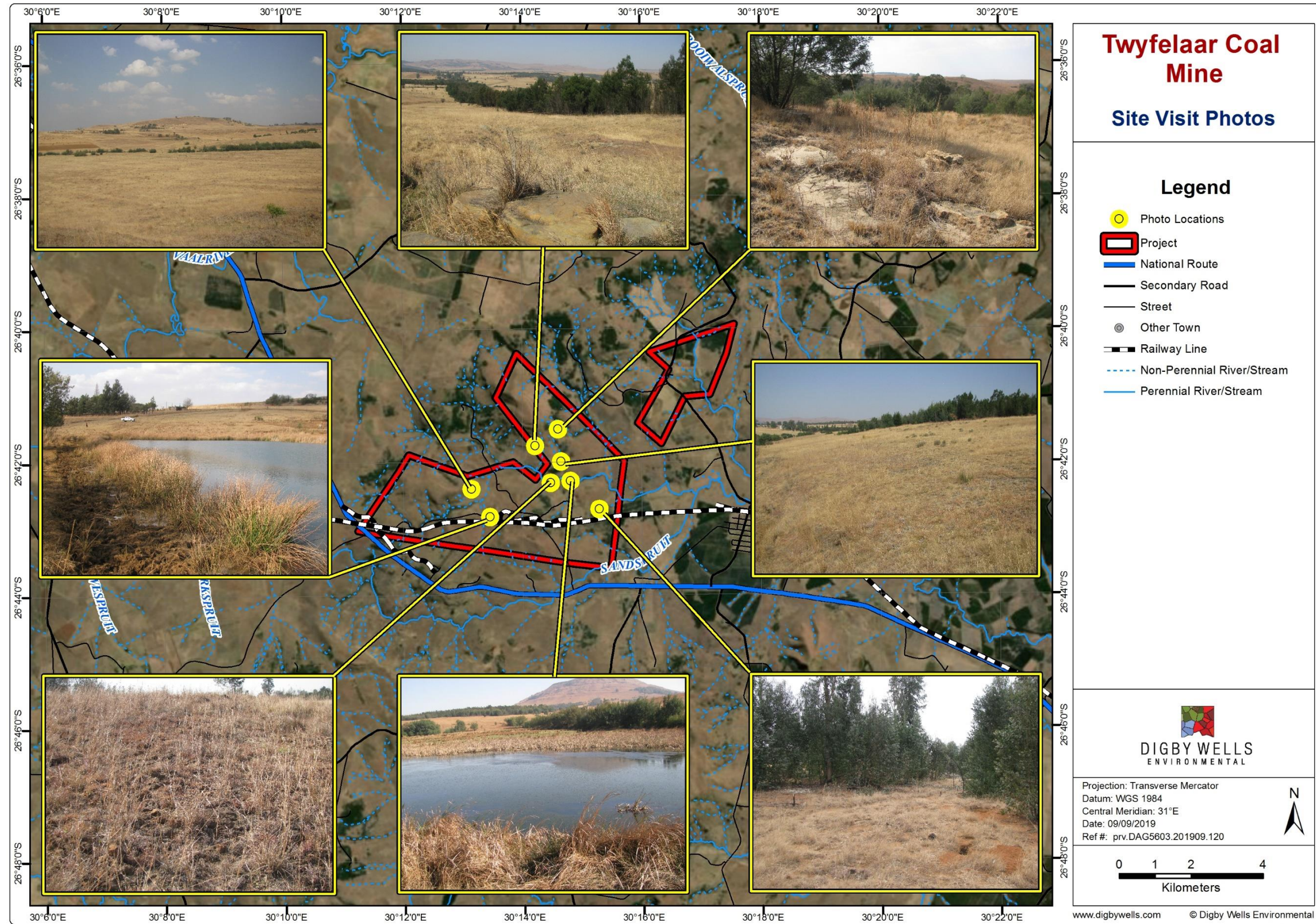


Figure 5-1: Examples of fauna and flora sampling locations

5.3 Impact Assessment

Details of the impact assessment methodology used to determine the significance of impacts to wetland ecosystems is provided below.

The significance rating process follows the established impact/risk assessment formula:

$$\text{Significance} = \text{Consequence} \times \text{Probability} \times \text{Nature}$$

Where

$$\text{Consequence} = \text{Intensity} + \text{Extent} + \text{Duration}$$

And

$$\text{Probability} = \text{Likelihood of an impact occurring}$$

And

$$\text{Nature} = \text{Positive (+1) or negative (-1) impact}$$

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 as indicated in Table 5-5. 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 Impact Assessment Report. The significance of an impact is then determined and categorised into one of eight categories, as indicated in Table 5-4, which is extracted from Table 5-3. The description of the significance ratings is discussed in Table 5-5. 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 5-3: Impact Assessment Parameter Ratings

Rating	Intensity/ Replicability		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/ Replicability		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/ Replicability		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/ Replicability		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 5-4: 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
			-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
		Consequence																																					

Table 5-5: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a significant and usually a long-term change to the (natural and / or social) environment and result in major changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

5.4 Assumptions and Limitations

Whilst every effort is made to cover as much of the site as possible, representative sampling was completed as per the nature of this type of investigation. It is therefore possible that some plant and animal species that are present on site were not recorded during the field investigations.

Every effort is made to identify all plant species on site in the late winter season, very few if any species will be seeding, fruiting and/or flowering at the times of sampling. Therefore, some species may not have been identified at all or only to species level due to the lack of identifying features.

This report lists the findings of an on-site baseline evaluation within the area selected by Dagsoom for its mining activities. Potential impacts of the proposed mining operations were evaluated based on the layout provided at the time of writing, and where necessary, recommendations for the most appropriate mitigation measures have been noted.

To obtain a comprehensive understanding of the dynamics of the biota on a site, including SSC, studies should include investigations through the different seasons of the year, over a number of years, and extensive sampling of the area. Due to project time constraints, such long term research was not feasible and information contained within this report is based on a dry season field survey.

In terms of limitations relevant to this study, it must be noted that field investigations did not include a night survey, for safety reasons, therefore nocturnal species (specifically bat and owl species) were not recorded.

5.4.1 Report Conditions

Findings, recommendations and conclusions provided in this report are based on the authors' best scientific and professional knowledge as well as information available at the time of compilation. The author, however, accept no liability for any actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document.

No form of this report may be amended or extended *without the prior written consent of the author*. Any recommendations, statements or conclusions drawn from or based on this report must clearly cite or make reference to this report. Whenever such recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety.

6 Description of the Study Area

6.1 Locality

The proposed coal mining project will be located on the farm Twyfelaar 298IT, within the Msukaligwa Local Municipality (MP302), situated in the Gert Sibande District Municipality in

the Highveld sub-region of Mpumalanga. The closest towns are Sheepmoor which is approximately 4 km from the proposed project area and Ermelo which is approximately 30 km from the project area. (Figure 6-1).

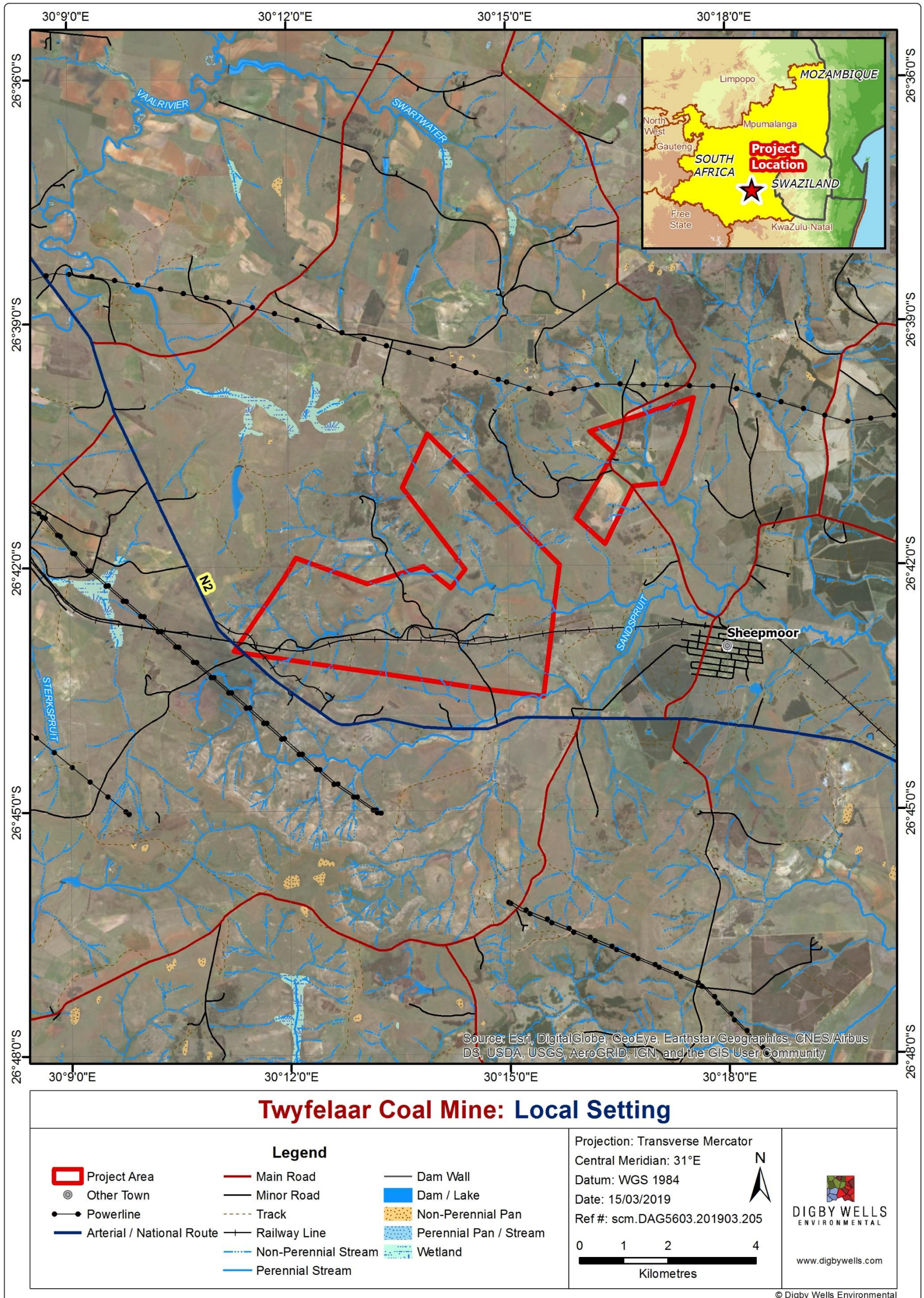


Figure 6-1: Locality of the Dagsoom study site

6.2 Topography and Climate

The Mpumalanga Province is characterised by diverse landscape topography, from undulating plains, to the rolling hills and rocky outcrops, to the many pan depressions and valleys. This type of landscape not only gives rise to differing climatic profiles but vegetation profiles owing to the climates. The Highveld has a cooler climate and very dry and cold winters. The rainfall season, much like the rest of South Africa, falls in the summer season (Mucina and Rutherford, 2012).

6.3 Regional Vegetation – Reference State

According to Mucina and Rutherford (2012), the proposed Twyfelaar Coal Mine is located in areas classified as Eastern Highveld Grassland (Gm 12) and Wakkerstroom Montane Grassland (Gm 14) (Figure 6-2).

The Grassland Biome covers roughly a third of the country. It occurs across six provinces and is the second largest of South Africa's nine biomes, covering an area of 339 237.68 km² (SANBI, 2016).

The term 'grassland' creates the impression that the biome consists only of grass species. In fact, it is a complex ecosystem, including rivers and wetlands, where only one in six plant species are grasses.

Thirty percent of the biome has been irreversibly transformed and only 1,9% is formally conserved. As a result, the National Biodiversity Strategy and Action Plan has identified the grasslands biome as one of the spatial priorities for conservation action (SANBI, 2016). The important biodiversity contained within the grasslands, which underpins life, is being eroded to such an extent that human wellbeing is threatened.

6.3.1 Eastern Highveld Grassland (Mapping Unit Gm12)

The Eastern Highveld Grassland is recorded on the plains between Belfast in the east and the eastern side of Johannesburg in the west, extending southwards to Bethal, Ermelo and west of Piet Retief within the Mpumalanga and Gauteng Provinces of South Africa (Mucina & Rutherford; 2006). The altitude varies between 1 520 and 1 780m, but also as low as 1 300m.

The Eastern Highveld Grassland is found on slightly to moderately undulating plains, including some low hills and pan depressions and consist of short, dense grassland, dominated by the usual Highveld grass composition (*Aristida*, *Digitaria*, *Eragrostis*, *Themeda*, *Tristachya*, etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (Mucina & Rutherford; 2006). Woody species include *Senegalia caffra*, *Celtis africana*, *Diospyros lycioides subsp. lycioides*, *Parinari capensis*, *Protea caffra* and *Searsia magalismontana*.

The soils of this Eastern Highveld Grassland consist of yellow sandy soils of the Ba (30%) and Bb (65%) land types found on shale and sandstone of the Karroo Supergroup.

The Eastern Highveld grassland is classified as an endangered vegetation type (Rouget *et al.*, 2004; Mucina & Rutherford, 2012, Ferrar & Lötter, 2007) due to mining activities within the

provinces (see Figure 6-2), with a conservation target of 24% (NSBAR, 2004). Approximately 44% of the Eastern Highveld Grassland has been transformed, primarily by cultivation, plantations, mining, urbanization and building of dams (Mucina & Rutherford; 2006). Erosion is very low, and no serious alien infestation is reported, although species such as *Acacia mearnsii* can become dominant in disturbed places.

6.3.2 Wakkerstroom Montane Grassland (Gm 14)

The Wakkerstroom Montane Grassland (Gm 14) occurs in the KwaZulu-Natal and Mpumalanga Provinces. It is found on the escarpment just north of Sheepmoor (north) to the southeast of Utrecht, and then from the vicinity of Volksrust in the west to Madlangempisi Mountain near Luneburg in the east.

This vegetation unit is a less obvious continuation of the escarpment that links the southern and northern Drakensberg escarpments. It straddles this divide and is comprised of low mountains and undulating plains.

The vegetation in this unit comprises predominantly short montane grasslands on the plateaus and the relatively flat area, with short forest and *Leucosidea* thickets occurring along steep, mainly east facing slopes and drainage areas. *L.Sericea* is the dominant woody pioneer species that invades areas as a result of grazing mismanagement.

Wakkerstroom Montane Grassland is listed as Less Threatened, with a conservation target of 27%, however, less than 1% is statutorily protected in the Paardeplaats Nature Reserve. There are 10 South African Natural Heritage Sites in this unit, although very little of it is formally protected.

Land use pressures from agriculture are low (5% cultivated) probably owing to the colder climate and shallower soils. The area is also suited to afforestation, with more than 1% under *Acacia mearnsii* and *Eucalyptus plantations*. The black wattle (*Acacia mearnsii*) is an aggressive invader of riparian areas and the erosion potential is very low.

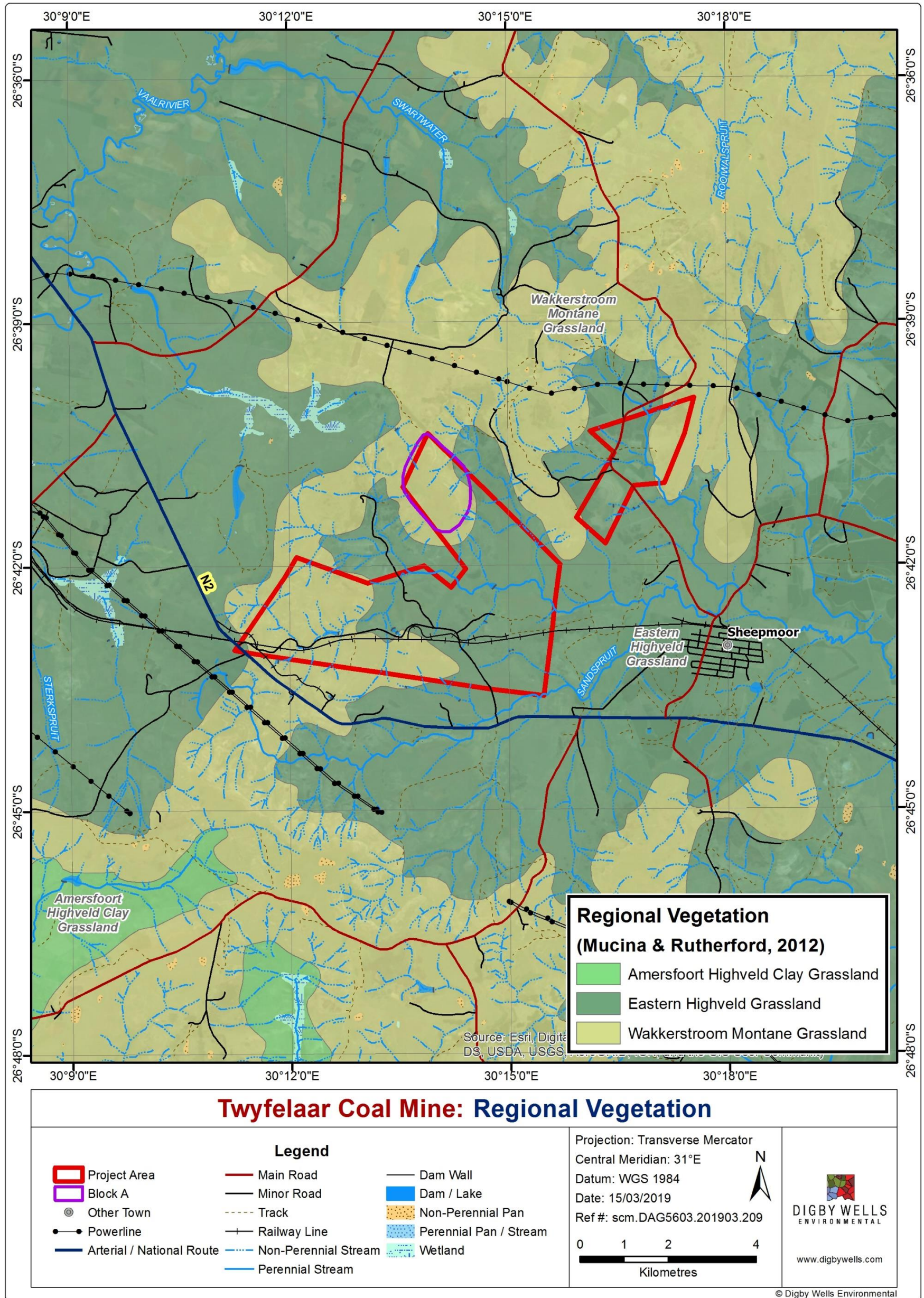


Figure 6-2: Regional Vegetation

6.4 Mpumalanga Biodiversity Sector Plan (2014)

DARDLEA is the custodian for the sustainable use of resources and environmental protection in the Mpumalanga Province. This department is responsible for the implementation of the Mpumalanga Biodiversity Sector Plan (MBSP) which is a spatial tool with associated Land-Use guidelines to inform permissible land-uses that support biodiversity and ecological processes. The main purpose of a biodiversity sector plan is to ensure that the most recent and best quality spatial biodiversity information can be accessed and used to inform Land-Use and development planning, environmental assessments and authorisations, and natural resource management.

The CBA maps show the following five broad map categories, some of which are further divided into sub-categories as follows:

- Protected Areas;
- Critical Biodiversity Areas (CBAs);
- Ecological Support Areas (ESAs);
- Other Natural Areas (ONAs); and
- Moderately or Heavily Modified Areas (sometimes called 'transformed').

The MBSP Terrestrial database (2014) indicates the presence of areas within three categories that are categorised as CBA Irreplaceable, CBA Optimal and Ecological Support Areas within the project area.

Descriptions and Land-Use objectives for the categories that the project relates to are CBA Irreplaceable, CBA Optimal, ESA Local Corridor and Other Natural Areas (Table 6-1).

Table 6-1: MBSP Map Categories and Land Management Objectives

Map Category	Description	Sub-Category	Description
CBA	All areas required to meet biodiversity pattern and process targets; Critically Endangered ecosystems, critical linkages (corridor pinch-points) to maintain connectivity; CBAs are areas of high biodiversity value that must be	CBA: Irreplaceable	This category includes: <ul style="list-style-type: none"> ■ Areas required to meet targets and with irreplaceability values of more than 80%; ■ Critical linkages or pinch-points in the landscape that must remain natural; ■ Critically Endangered Ecosystems.

	<p>maintained in a natural state.</p>	<p>CBA: Optimal</p>	<p>The CBA Optimal Areas (previously called ‘important and necessary’, are the areas optimally located to meet both the various biodiversity targets and other criteria defined in the analysis. Although these areas are not ‘irreplaceable’ they are the most efficient land configuration to meet all biodiversity targets and design criteria.</p>
<p>Ecological Support Areas (ESA)</p>	<p>Areas that are not essential for meeting targets, but that play an important role in supporting the functioning of CBAs and that deliver important ecosystem services</p>	<p>ESA: Landscape Corridor</p>	<p>The best option to support landscape-scale ecological processes, especially allowing for adaptation to the impacts of climate change.</p>
		<p>ESA: Local Corridor</p>	<p>Finer-scale alternative pathways that build resilience into the corridor network by ensuring connectivity between climate change focal areas, reducing reliance on single landscape-scale corridors.</p>
		<p>ESA: Species Specific</p>	<p>Areas required for the persistence of particular species. Although these may be production landscapes, a change in land-use may result in loss of this species from the area. (Only one species-specific ESA was included in the analysis — an over-wintering site for blue cranes).</p>
		<p>ESA: Protected Area Buffers</p>	<p>Areas surrounding protected areas that moderate the impacts of undesirable land-uses that may affect the ecological functioning or tourism potential of PAs. Buffer distance varies according to reserve status:</p> <ul style="list-style-type: none"> ■ National Parks — 10 km; ■ Nature Reserves — 5 km buffer; Protected Environments — 1 km buffer

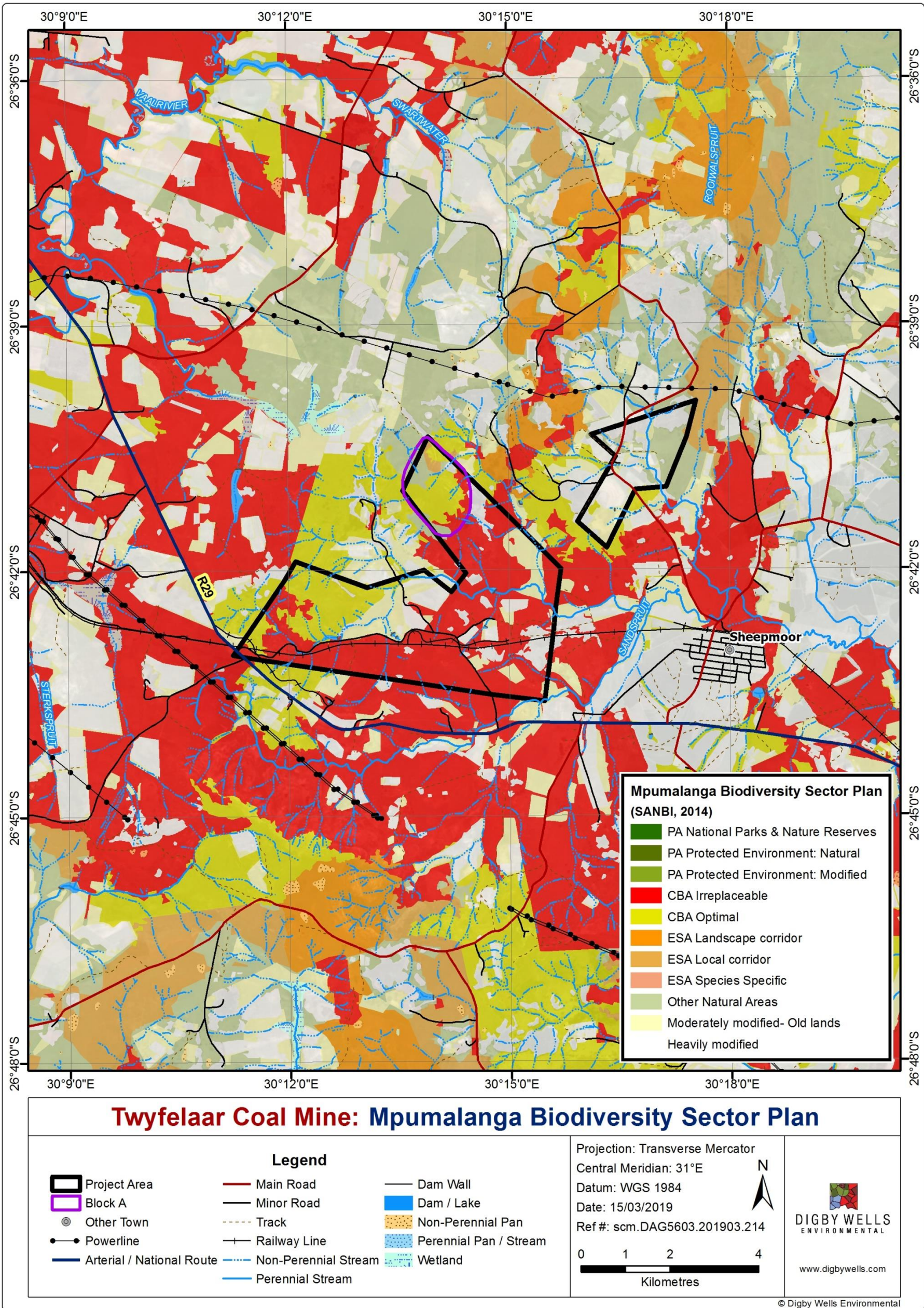


Figure 6-3: Mpumalanga Biodiversity Sector Plan (2014)

7 Findings

The following sections details the findings from the infield assessment of the fauna and flora species present and the general environmental observations completed during field work procedures.

7.1 Flora

Vegetation reflects the complex interaction between the abiotic and biotic environmental drivers of ecosystems. The heterogeneity of ecosystem processes is therefore often expressed by variation in vegetation patterns. In order to understand and manage the processes of southern Africa's rich and diverse ecosystems, it is important to describe and interpret vegetation patterns in an ecologically sensible manner. Plant communities derived from vegetation classification, are often considered to represent the basic ecological units useful for management purposes. These plant communities therefore provide the basic building blocks for the development and implementation of management units and systems. There is a growing interest in applying phytosociological knowledge in nature conservation and natural resource management (Schamineé & Stortelder 1996).

Mapping of heterogeneous vegetation in mountainous and semi-mountainous terrain is extremely challenging and the practical outcome or product is very much scale bound (Raal & Burns 1996; Kovar 2000; Cingolania *et al.* 2004). Due to the scale at which sampling was done and the topographic complexity of the study area, it was decided to restrict mapping resolution to the major vegetation types identified. The smaller patches and finer mosaic patterns formed by major vegetation types along the areas of more extreme morphological complexity was not mapped.

Vegetation communities were therefore delineated based on similarity of species composition and dominant habitat features present.

Portions of the study area had been altered from its natural state due to current and historical land use, and these variations were used as a basis of stratification. Owing to the effects of fragmentation, as well as the impacts of grazing livestock, primarily cattle, especially close to homesteads, much of the remaining natural vegetation on site had been altered and modified with alien plant species.

The proliferation of Black Wattle (*Acacia mearnsii*) in many if not all the banks of streams flowing through the study area was evident and a primary threat to the riparian areas and the native species dependant on these landscapes.

Further to this, heavy grazing results in a loss of palatable species and an increase in non-palatable ones. This decreases the carrying capacity of the veld and increases the likelihood of alien vegetation dominating the landscape.

The study area was divided into six primary vegetation units or land management units, namely: Agricultural Areas, Alien Bushclumps, Secondary Grassland, Primary Grassland, Rocky Outcrops and Transformed Areas. The vegetation units are represented in Figure 7-1.

Eighty plant species were recorded on site, as listed in Appendix B. The delineated vegetation units are displayed below in Table 7-1, the transformed and agricultural areas are omitted.

Table 7-1: Vegetation types encountered

Classification	Sensitivity	Area - Hectares	Percentage of Mining Infrastructure Footprint Covered
Rocky Outcrop	High	165.36	5.7409
AIP	Low	342.15	6.2757
Secondary Grassland/Wetland	High	662.1	0.3195
Primary Grassland	High	1058.1	87.6640
TOTAL		2227.71	100.0

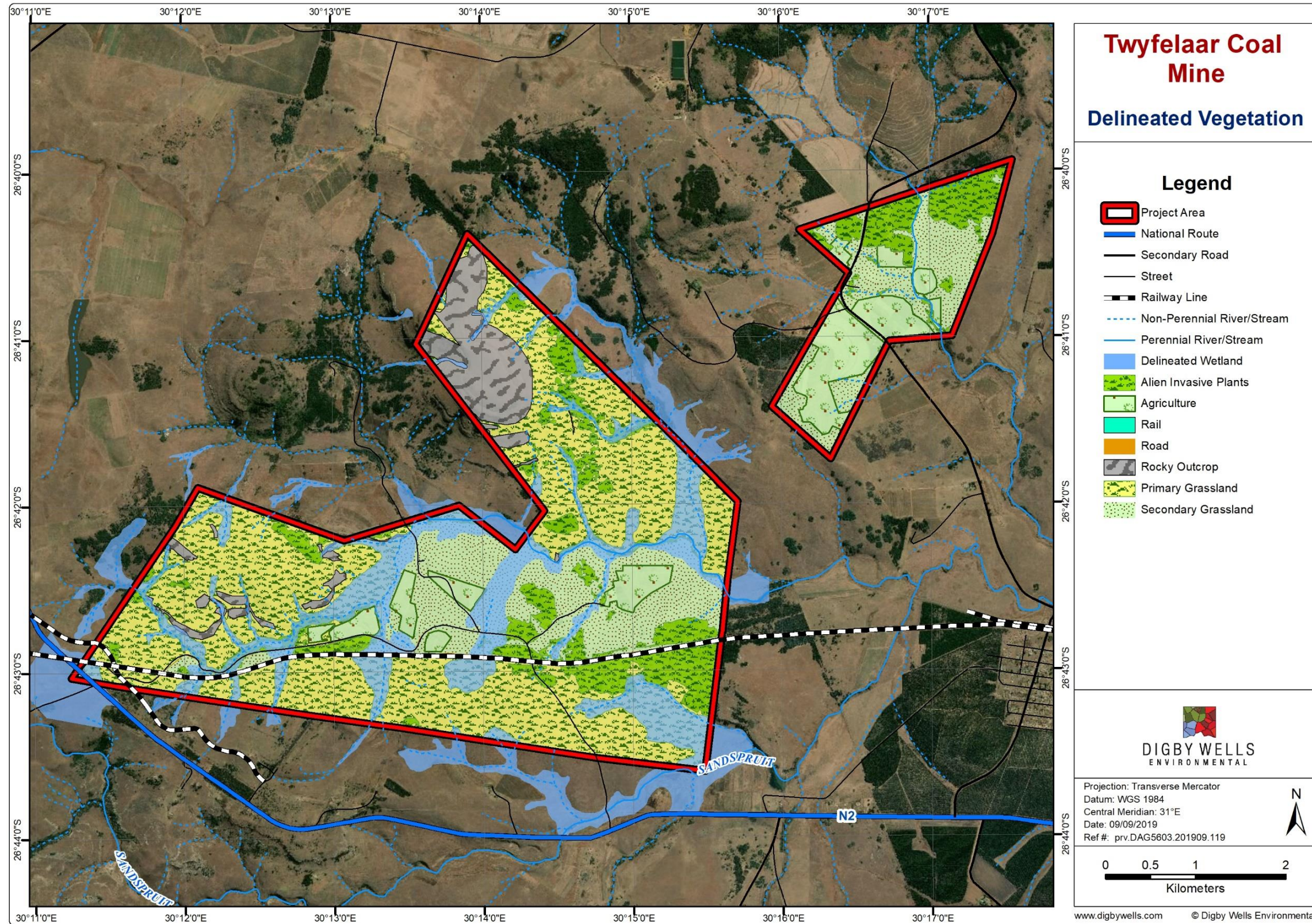


Figure 7-1: Vegetation communities map

7.1.1 Vegetation Communities

In this section the vegetation communities identified during the field work component of the study is discussed and characteristic features of these are highlighted.

7.1.1.1 Rocky Outcrops

Rocky outcrops/Ridges are a sensitive landscape as determined by the Mpumalanga Tourism and Parks Agency (MTPA), as per the minimum requirements set forth by Parks Board. Reasons for the protection of these outcrops is the fact that they provide habitat for plant and animal species that are not impacted on by agriculture due to the unsuitable rocky nature of these outcrops for ploughing. In certain instances, these areas also provide protection from frequent fires during the dry season.

Ridges as biodiversity hotspots and future refuges

Varied topography is recognised as one of the most powerful influences contributing to the high biodiversity of southern Africa. The interplay between topography and climate over a long period of time has led to the evolution of a rich biodiversity (Samways & Hatton, 2000). Landscapes composed of spatially heterogeneous abiotic conditions provide a greater diversity of potential niches for plants and animals than do homogeneous landscapes. The richness and diversity of flora has been found to be significantly higher in sites with high geomorphological heterogeneity and it can reasonably be assumed that associated faunal communities will also be significantly more diverse in spatially heterogeneous environments (Burnett *et al.*, 1998). Ridges are characterised by high spatial heterogeneity due to the range of differing aspects (north, south, east, west and variations thereof), slopes and altitudes all resulting in differing soil (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions. The temperature and humidity regimes of microsites vary on both a seasonal and daily basis (Samways & Hatton, 2000). Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes (Lowrey & Wright, 1987). Variation in aspect, soil drainage (Burnett *et al.*, 1998) and elevation/altitude (Primack, 1995) have been found to be especially important predictors of biodiversity. It follows that ridges will be characterised by a particularly high biodiversity, as such their protection will contribute significantly to the conservation of biodiversity. The diversity of plant communities on ridges can easily be observed, with grassland communities associated with the crests of hills and the southern slopes while woody species grow on warmer northern aspects (Lowrey & Wright, 1987) as well as on protected areas on southern slopes and on rocky outcrops (Grobler, 2000).

The sandstone outcrops vegetation type was limited to the hillslopes at approximately 1 540 meters above mean sea level (mamsl) with the rocky ridges encountered at approximately 1 470 mamsl adjacent to riparian areas (Figure 7-1), and covered approximately 165ha.

These exposed rocky areas were found to harbour a variety of epilithic (growing on the surface of rock) plant species that are characteristic of rocky habitats. Floral growth forms such as herbs, sedges and reeds were all represented. Trees are commonly absent in rocky areas; however Black Wattle trees were found extensively invading this habitat type. Grasses were

found on the periphery of the rocky outcrops and these most often were grassland species pioneer subclimax and climax species were found in equal numbers.

Observed plants including woody plants: Blue Bush (*Diospyros lycoides*) and an understorey layer comprised of grasses: mostly *Hyparrhenia hirta* (Common Thatching Grass), *Themeda triandra* (Red Grass) and *Cymbopogon excavatus* (Common Turpentine Grass).

7.1.1.2 Riparian areas

The wetland/riparian vegetation type is composed of typical riparian plant species which are adapted to permanent or perennial saturation. This includes *Schoenoplectus* and *Cyperus* species as well as a number of wet grasses, such as Cotton Wool Grass (*Imperata cylindrica*), Rye Grass (*Lolium perenne*), Rescue Grass (*Bromus catharticus*) and Swamp Couch Grass (*Cynodon dactylon*).

Livestock were found to often visit riparian areas for drinking water, therefore the edges of the dams and the stream banks were extensively trampled. Additionally, Cotton Wool Grass (*I. cylindrica*) patches occur in the study area, indicating surface water seep points. These water seep points are seen as areas where diversity will differ from the surrounding vegetation (Figure 7-1).

7.1.1.3 Agricultural Fields

The agricultural fields are comprised of Maize (*Zea mays*). These areas have been colonised by problem plants on the periphery such as Common Black Jack (*Bidens pilosa*) and Flax-leaf fleabane (*Conyza bonariensis*).

7.1.1.4 Primary Grassland

The grassland unit was identified as the original or primary vegetation type in the area (Figure 7-1) and covered an area of approximately 1 058ha. The grasslands have formed and are maintained as a result of natural factors such as fire periodic grazing and frost, all of which are important in not allowing trees to start dominating the area, thereby creating a savanna landscape. The grassland habitat type identified at the project site was the remaining grassland after the majority of the area was utilized for agricultural activities predominantly maize farming. The effects of the anthropogenic activities, in the form of declining habitat, are a major threat to these grassland areas present in the study area and the Province as a whole. The grassland was encountered on the slopes of mountains and relatively flat rolling hill slopes, with the patches of the very flat and agriculturally suitable areas used for maize farming. The ecological integrity and sensitivity were found to be high, and the grasslands are seen as very important with regards to its biodiversity maintenance function. Integrity in this instance is a function of the level of disturbance and the percentage of native vegetation still present.

The grass layer was largely dominated by Gum Grass (*Eragrostis gummiflua*), Weeping Love grass (*E. curvula*), Common Thatch grass (*Hyparrhenia hirta*), Red Grass, (*Themeda triandra*) the few forbs present were, False gerbera (*Haplocarpha scaposa*), Vaal River Lilly (*Crinum*

bulbispermum), and Star Flower (*Hypoxis hemerocallidea*). Few alien invasive plant species were encountered however Bankrupt Bush (*Seriphium plumosum*) was recorded.

7.1.1.4.1 Secondary Grassland

The secondary grassland vegetation type is composed of original grassland vegetation, which has been largely impacted on/transformed previously by agricultural activities (specifically grazing). The grass layer is dominated by Weeping Love Grass (*Eragrostis curvula*) and Tough Love Grass (*Eragrostis plana*). Forbs present include *Pelargonium luridum* and possibly *Monopsis decipiens*. Alien and invasive vegetation includes White Flower Mexican Poppy (*Argemone ochroleuca*), Yellow Nut Sedge (*Cyperus esculentus*), and Sticky Nightshade (*Solanum sisimbriifolium*).

Much of the Secondary Grasslands have been impacted upon by grazing, however in consideration of the broader landscape matrix, this vegetation type provides valuable natural grassland habitat for both flora and fauna. The ecological integrity of this vegetation community varies according to the specific disturbance. No Red Data/protected flora species were recorded in this vegetation type. The suitability of the Secondary Grassland vegetation community as habitat for other Red Data and/or protected species of both flora and fauna is not regarded as high and accordingly, the conservation importance of these areas is regarded to be moderate.

7.1.1.5 Exotic Tree Stands

Stands of Exotic Trees including Red River Gum (*Eucalyptus camaldulensis*) and Black Wattle (*Acacia mearnsii*) are found within the study area. The Black Wattle infestation was evident in the riparian areas and the mountainous rocky areas. The Eucalyptus tree stands are believed to have been historically planted to provide timber or screening for the farmhouses. This is regarded to be a highly disturbed vegetation community. Little vegetation is supported below the tree canopy. No Red Data, protected or medicinal species were recorded in this community and the probability of occurrence of such species is considered low. The conservation importance of these areas is therefore considered low. A full assessment of the alien invasive species encountered on the study area is provided in Section 7.1.2 below.



Figure 7-2: Alien Vegetation within the Twyfelaar Project Area; A. Red River Gum (*Eucalyptus camaldulensis*), B. Black Wattle (*Acacia mearnsii*), C. Black Wattle (*Acacia mearnsii*)

7.1.2 Alien Plant Invasion

Alien plant species invasion is significant on site with alien bushclumps of woody species covering an area of 342.1 ha. Invasion by destructive alien plant species erodes the natural capital of ecosystems, compromises their stability and is a growing problem in South Africa (Richardson and Van Wilgen, 2004). Species such as *Acacia mearnsii* (Black Wattle) and *Eucalyptus* spp. out-compete native species, forming dense mono-specific stands. This reduces the area available for potential plant SSC, as well as land for grazing by domestic and wild animals. The sandstone ridges are found to be under Radiata Pine (*Pinus radiate*) infestation in certain areas. Disturbed areas in general were largely colonised by *Solanum sisymbriifolium* (Dense-Thorned Bitter Apple) as well as Khaki Weed (*Tagetes minuta*) and Blackjack (*Bidens pilosa*).

Certain species have different alien invasive categories for different provinces in South Africa. Table 7-2 lists the alien plant species that were recorded on the Twyfelaar project area, including invasive categories for those species that have been recognised as invasive.

Table 7-2: Alien plant species recorded on site

Family	Species Name	Common Name	Status	NEMBA
Asteraceae	<i>Bidens pilosa</i>	Common Blackjack	Alien Invasive	-
Asteraceae	<i>Cirsium vulgare</i>	Scotch thistle	Alien Invasive	1b
Asteraceae	<i>Hypochaeris radicata</i>	Hairy wild lettuce	Alien Invasive/Edible	-
Asteraceae	<i>Senecia madagascariensis</i>	Canary Weed	Weed	-
Asteraceae	<i>Seriphium plumosum</i>	Bankrupt Bush	Weed	-
Brassicaceae	<i>Lepidium africanum</i>	Pepperweed	Weed	-
Cactaceae	<i>Opuntia ficus-indica</i>	Sweet Prickly Pear	Alien Invasive	1b
Fabaceae	<i>Acacia mearnsii</i>	Black Wattle	Alien Invasive	2
Myrtaceae	<i>Eucalyptus camaldulensis</i>	Red River Gum	Alien Invasive	1b
Pinaceae	<i>Pinus radiata</i>	Radiata Pine	Alien invader	1b

Poaceae	<i>Arundo donax</i>	Spanish Reed	Alien	1b
Poaceae	<i>Pennisetum clandestinum</i>	Kikuyu Grass	Exotic	-
Solanaceae	<i>Solanum sisymbriifolium</i>	Wild Tomato	Alien Invasive	1b
	<i>Tagetes minuta</i>	Tall Khaki Weed	Alien Invasive	-

7.2 Fauna

Fauna occurring on site include assemblages within terrestrial and wetland ecosystems, these include mammals, birds, reptiles, amphibians and invertebrates. As described in the floral section (section 7.1), montane grassland and plains grasslands are the main habitat available to fauna. Grassland is the dominant habitat and the grassland that remains intact on site showed a marked reduction in plant diversity from the former reference state, as described in the previous sections.

7.2.1 Mammals

Actual sightings, spoor, calls, dung and burrow sites were used to establish the presence of animals on the proposed project site. The evidence of dung and spoor suggests that animals were present in the area although very few were recorded during the survey. The observations of local land owners were used to supplement the findings of the mammal survey.

Three rodents were caught in the Sherman traps, some of the traps had been disturbed possibly from larger species or cattle. These species were Swamp Musk Shrew, (*Crocidura mariquensis*) Striped Mouse (*Rhabdomys pumilio*) and Multimammate Mouse (*Mastomys natalensis*). All of these rodent species are listed as least concern. The large number of burrows seen predominantly in the sandy areas of the site in general, indicates that there is a dense population of rodents, particularly of multimammate mice. However, despite the high numbers, there is a low diversity of species. Therefore, there is a high abundance of small mammals but a low diversity (large number of small mammals, however limited to a few species), leading to a relatively low biodiversity of small mammals. However, relatively high numbers may be important in adding to avian, amphibian and the reptilian diversity, as they are a potentially valuable food source.

The majority of the farms in the area are involved in agriculture and cattle grazing and the local farmers were able to give an indication on a number of larger mammal species that are found in the area, all of which were recorded during this survey. Mammal activity is most prominent in the Grassland habitat, although it was found that small mammal activity is high in the other habitat types present as well. Species recorded from the study area include Cape Clawless Otter (*Aonyx capensis*), Common Duiker (*Sylvicapra grimmia*) and Striped Polecat (*Ictonyx striatus*), African Civet (*Civettictis civetta*), Scrub hare (*Lepus saxatilis*), Water Mongoose (*Atilax paludinosus*), Angoni Vlei Rat (*Otomys angoniensis*), Common Molerat (*Cryptomys hottentotus*), Highveld Gerbil (*Tatera brantsi*), Yellow mongoose (*Cynictis penicillata*) and Porcupine (*Hystrix africaeaustralis*). Serval (*Felis serval*) and Large-spotted Genet (*Genetta tigrina*), are expected to occur in the project area, but was not recorded.

The Common Duiker (*S. grimmia*) was found in the Grassland vegetation type. These small antelope flourish in a range of different habitats in woodlands, grasslands and savanna (Kingdon, 1997). They benefit from reduced predation and patches of low secondary growth, even in urban areas.

The Cape Clawless Otter (*Aonyx capensis*) was observed near the central farm dams, in the Natural Grassland, located on the central northern section of the study area. Signs of this species were also identified on the eastern section of the site, within the grassland system and associated streams. This species range extends across the African continent, from Senegal to Ethiopia and to South Africa. A variety of habitats are preferred, ranging from semi-arid, open plains to rainforests. Their front paws are completely clawless with minimal webbing, giving them an appearance very similar to human hands. They use their incredibly dexterous paws to grab prey such as molluscs and crustaceans.

The Striped polecat (*Ictonyx striatus*) is nocturnal, hunting mostly at night. During the day it will burrow into the undergrowth or sleep in the burrows of other animals. Most often striped polecats are found in habitats with large ungulate populations, because of the lower level of shrub that often accompanies the presence of these grazers. In this case the large assemblages of cows perform the function of these large ungulates. The striped polecat was found run over by a vehicle.

7.2.2 Avifauna

The habitat of the proposed mining and surrounding area generally includes mesic Highveld grassland dominated by agriculture (Maize production and grazing). A total of 51 bird species were observed during the surveys, these species are listed in Appendix C.

The southern central areas which were dominated by agricultural fields and farm roads included species such as the Redeyed Dove (*Streptopelia semitorquata*), Laughing Dove (*Spilopelia senegalensis*), Cape Turtle Dove (*Streptopelia capicola*), Common Fiscal (*Lanius collaris*), Cape Sparrow (*Passer melanurus*), Neddicky (*Cisticola fulvicapilla*), Swainsons Spurfowl (*Pternistis swainsonii*), Helmeted Guineafowl (*Numida meleagris*), Black Shouldered Kite (*Elanus axillaris*) and large numbers of Feral Pigeons (*Columba livia domestica*). Throughout the more natural grassland vegetation type of the central section of the study area a Secretary Bird (VU) (*Sagittarius serpentarius*) was observed in the open grasslands. Within the burnt grassland areas, around one of the farm houses, a pair of Southern Bald Ibis (VU) (*Geronticus calvus*) were recorded while foraging (Figure 7-3). Both these SSC are threatened because of habitat destruction in grasslands, caused by mainly agriculture.

Although not seen on the days of the site visit, a number of birds of prey should be present periodically throughout the year and would in all likelihood include Red Data summer migrant species such as Pallid Harrier (*Circus macrourus*) and Montagu's Harrier (*Circus pygargus*). These species do however prefer the less impacted grassland areas to sustain their preferred prey species.

The grasslands and agricultural fields of the study area harbour a number of typical highveld endemics. These included several White Storks along with widow, weaver and bishop species (within the wetter areas). A number of African Quailfinch's (*Ortygospiza fuscocrissa*) were observed within the grasslands – these species generally feed on the seeds of the wetter grass species and are renowned wetland indicators. African Pipit (*Anthus cinnamomeus*) and Cape Longclaw (*Macronyx capensis*) were observed throughout the project area – although there is enough nesting habitat for the more endangered lark and pipit species in the general area it must be noted that any explosives, increased traffic loads and earth movement will negatively impact on the breeding of all lark and pipit species, however this is usually not a permanent impact. The grassland area is also ideal habitat for quail and button-quail species although these species are highly nomadic and were not identified during the site investigation. The altitude and species type of the grassland suggests that the area could be home to some endemic and endangered lark and pipit species such as Rudd's Lark (*Heteromirafra ruddi*) and Botha's Larks (*Spizocorys fringillaris*).

A number of water birds were identified within the open water of the farm dam in the central section of the study area, these included Red-knobbed Coot (*Fulica cristata*), African Snipe (*Gallinago nigripennis*), Grey Heron (*Ardea cinerea*), Egyptian Goose (*Alopochen aegyptiaca*), Spurwinged Goose (*Plectropterus gambensis*) Yellowbilled Duck (*Anas undulata*), White-faced Duck (*Dendrocygna viduata*), Great White Egret (*Ardea alba*), Cattle Egret (*Bubulcus ibis*), Common Sandpiper (*Actitis hypoleucos*) and Three-banded Plover (*Charadrius tricollaris*). Appendix C includes a complete bird list for the greater area of the properties (including the list in bold that was observed during the site investigation). Although the habitat on the site could not cater for a number of species on this list, it presents an indication of what is and can be found in the vicinity.

It is very likely that any disturbance to the area will impact the birdlife within all habitats of the property. The wetlands and natural grassland (containing rocky outcrops) areas are the most sensitive and there is a concern that any mining will have a negative impact on the quality of the water and a possible de-watering effect that would impact on the wetland system permanently. It is proposed that should any disturbance occur within the property that the two most sensitive habitats are conserved and managed accordingly. It is also highly recommended that a detailed faunal monitoring system is implemented to assist in the mitigation of disturbance.

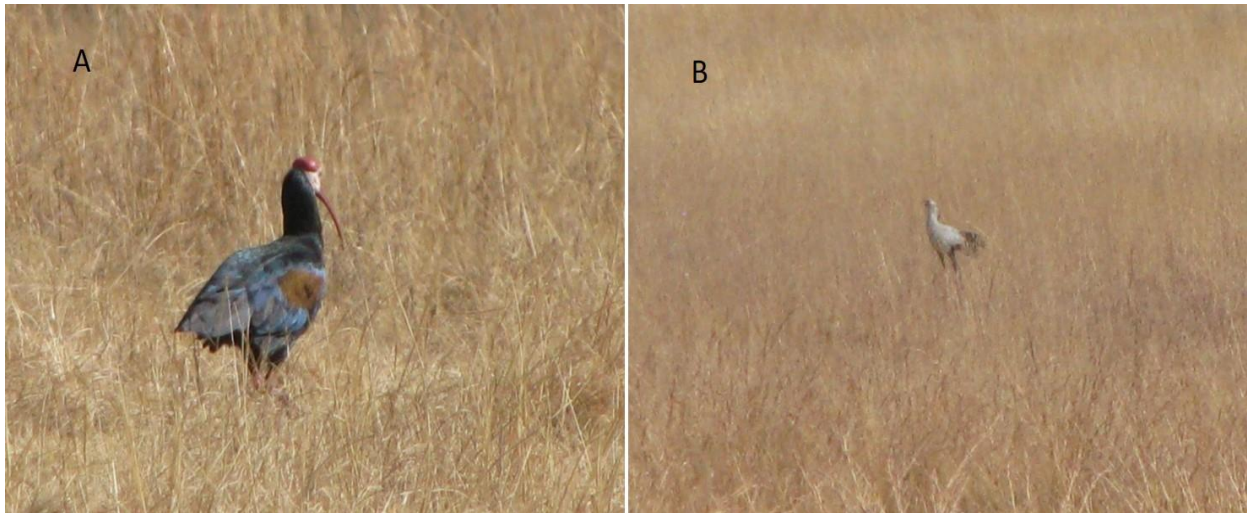


Figure 7-3: Avifauna SSC recorded, A. Southern Bald Ibis (VU) (*Geronticus calvus*), B. Secretary Bird (VU) (*Sagittarius serpentarius*)

7.2.3 Reptiles

Similarly, to the amphibians, the reptiles within the project area will prefer certain habitats over others and they are important ecological indicators. Due to amphibians (frogs and toads) being a major food source for a number of reptile species, the investigation on the microhabitats can be beneficial in understanding the propensity for both animal groups to occur.

The reptile population in the area is expected to be representative of the vegetation and habitat types present. Through interviews with land owners, it was determined that the Brown House Snake (*Lamprophis capensis*), Mole Snake (*Pseudaspia cana*) Figure 7-4, Rhombic Night Adder (*Causus rhombeatus*), and the Mozambique Spitting Cobra (*Naja mossambica*) are present.



Figure 7-4: Mole Snake (*Pseudaspia cana*) (light and dark morphs)

7.2.4 Amphibians

Of the 54 amphibian species endemic to South Africa, 16 (30%) are found in the Grassland Biome (Passmore and Carruthers, 1995). Of these, eight species (50%) are endemic to the

biome. A list of 10 frog species expected to occur within the study area is presented in Appendix F.

Amphibians are viewed to be good indicators of changes to the whole ecosystem because they are sensitive to changes in the aquatic and terrestrial environments (Waddle, 2006). Most species of amphibians are dependent on the aquatic environment for reproduction (Duellman and Trueb, 1986). Additionally, amphibians are sensitive to water quality and UV radiation because of their permeable skin (Gerlanc and Kaufman 2005, Taylor *et al.*, 2005). Activities such as feeding and dispersal are spent in terrestrial environments (Waddle, 2006). According to Carruthers (2001), a number of factors influence the distribution of amphibians, but because amphibians have porous skin they generally prosper in warm and damp habitats. The presence of suitable habitat within the study area provides refuge to a number of different species of amphibians however no frog species were identified within the Dagsoom study area during the field survey. This is a limitation that is presented in the dry season, when most frogs aestivate in a variety of areas including under logs and rocks, streambanks and inside termitaria. No amphibian SSC were recorded, and none are expected according to historic records obtained from Fitzpatrick Institute (2019).

7.2.5 Invertebrates

Insects are the most abundant macroscopic organisms in terrestrial and aquatic habitats (Picker *et al.*, 2004). Human activities pose significant threats to insect populations. Threats to butterflies in South Africa include: the establishment of alien invasive vegetation, changing fire regimes (either increased or reduced frequency), agricultural activities, urbanisation, plantation forestry, increased grazing and road construction (Ball, 2006).

According to local literature and with reference to the existing vegetation, it is expected that members of the Orthoptera (grasshoppers, locusts and crickets), Hemiptera (bugs, cicadas, and leaf hoppers), Lepidoptera (butterflies and moths), Coleoptera (beetles), Hymenoptera (wasps and ants) and flies (Diptera) (Picker, *et al.*, 2002) would be present on site. Five butterflies were recorded on site and are tabulated below.

No invertebrate SSC were observed on the Twyfelaar project area during the site visits in August 2019. Species recorded are listed in Table 7-3.

Table 7-3: Recorded list of butterfly species on the Twyfelaar project area

Species Name	Common Name	Status
<i>Junonia octavia</i>	Gaudy Commodore	LC
<i>Junonia hierta</i>	Yellow pansy	LC
<i>Junonia orithya madagascariensis</i>	Eyed pansy	LC
<i>Catopsilia florella</i>	African migrant	LC
<i>Belenois aurota</i>	Brown Veined White	LC

8 Impact Assessment

The activities associated with the underground mining project are listed in Table 8-1. Figure 8-1 represents the vegetation habitats delineation map with the proposed mine plan and infrastructure layout.

Table 8-1: Activities associated with the mining project

Project Phase	Project Activity
Construction Phase	Site/vegetation clearance
	Access and haul road construction
	Infrastructure construction
	Power line construction
	Diesel storage and explosives magazine
	Topsoil stockpiling
Operational Phase	Removal of rock (blasting)
	Stockpiling (rock dumps, soils, ROM, discard dump) establishment and operation
	Diesel storage and explosives magazine
	Operation of the underground workings
	Operating processing plant
	Operating sewage treatment plant
	Water use and storage on-site – during the operation water will be required for various domestic and industrial uses. Dams will be constructed that capture water from the mining area which will be stored and used accordingly
	Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste
Decommissioning Phase	Demolition and removal of infrastructure – once mining activities have been concluded infrastructure will be demolished in preparation of the final land rehabilitation.
	Rehabilitation – rehabilitation mainly consists of spreading of the preserved subsoil and topsoil, profiling of the land and re-vegetation



Project Phase	Project Activity
	Post-closure monitoring and rehabilitation.

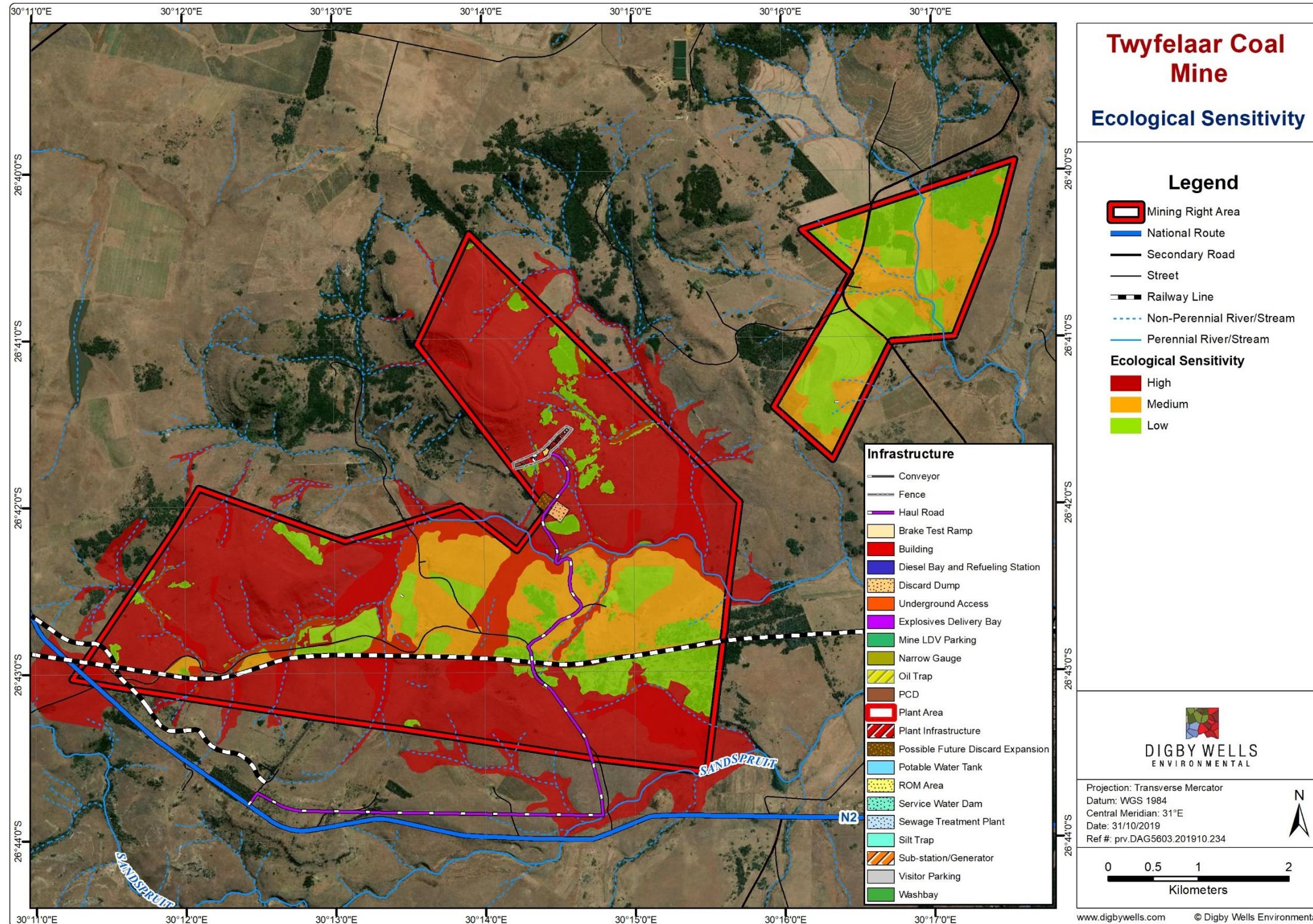


Figure 8-1: Mine plan and Ecological Sensitivities Map

8.1 Construction Phase

The construction phase activities that will have an impact on the fauna and flora are summarised below.

Table 8-2: Construction phase interaction with flora and fauna associated with the site

Interaction		Impact
1	Site Clearance within vegetated areas	<ul style="list-style-type: none"> ▪ Loss of 5.7 ha of habitat representing high ecological sensitivity. ▪ Loss of 1.9 ha of remaining habitat of low ecological sensitivity.

8.1.1 Impact Description

Construction of infrastructure will lead to the direct loss of the vegetation on site due to vegetation clearing. There are four main vegetation units found on site (Table 8-3). The primary grassland, wetlands and rocky outcrops have been rated as Highly Sensitive for the majority of the site including construction areas, owing to a lack of major disturbance and a predominantly natural state. The wetlands vegetation has been rated as having a Very High Sensitivity owing to their ecological importance. The proposed infrastructure plan for the preferred site coincides with primary grassland, wetlands and rocky outcrops and secondary grasslands. The highly sensitive areas also coincides with CBA's and is therefore not compatible with mining due its support for biodiversity patterns, processes and ecosystems services (Figure 8-1).

The proposed development will result in a loss of approximately 21 ha of habitat, 5.7 ha of which is of high ecological sensitivity. Table 8-3 shows the total areas of each habitat that will be lost to the development.

Table 8-3: Vegetation habitat loss

Name	Hectares	Percentage of Mining Infrastructure Footprint Covered
Alien Invasive Plants	1.9	8.8
Primary Grassland	4.7	21.8
Secondary Grassland, Wetland	14.1	65.5
Rocky Outcrop	0.8	3.7
TOTAL	21.63	100

8.1.2 Management Objectives

The objectives of management actions and mitigation measures are to avoid and reduce impacts to flora and fauna habitat on site and to mitigate any impacts that cannot be avoided. Management objectives rooted in the mitigation hierarchy, will ensure that impacts from clearing and site establishment are limited and sensitive vegetation, plants and habitats are avoided during this process (biodiversity process and pattern). To this end, no fauna or fauna SSC may be disturbed without the correct permitting procedure in place. No sensitive landscapes may be disturbed.

8.1.3 Management Actions and Targets

If possible, infrastructure associated with the mine should be concentrated in a single area (rather than being spread out) occupying as little footprint area as possible. It is recommended that the current infrastructure layout, represented in Figure 8-1 be relocated outside of the highly sensitive habitat, into less sensitive areas.

Areas that are not directly affected by development should be conserved. This entails restricting access, and controlling any alien invasive species as well as keeping clearing to a minimum. Rehabilitation of small areas disturbed during construction and not needed for operation should occur concurrent to mining activity. A nursery is recommended which will serve to propagate indigenous species in order that they can restore disturbed areas, immediately after activity has ceased.

In the case where Very High Sensitive and High Sensitive Areas cannot be avoided, an offset strategy should be employed whereby natural areas are conserved, rehabilitated or expanded. To this end the 'like-for-like' approach should be undertaken and areas that show similar biodiversity value and functionality, within proximity to the site, should be conserved. The proliferation of alien tree infestations is covered in detail in this report, most of these infestations occur within sensitive areas and CBA's. In keeping with the theory of CBA's and the design of offsets, it is recommended that the removal of all alien tree species within the mining right be considered for an offset. This will expand and aim to conserve the CBA and associated sensitive areas present on site. A biodiversity offset report will be required to quantify the offset requirements, assign responsibilities and define the goal of the final offset.

The *Hyparrhenia-Themeda* (Primary) grassland vegetation type as well as the Riparian and Sandstone rocky outcrops should be excluded from the mine plan to prevent deterioration or destruction of it. During the construction of the project related infrastructure, general mitigation and management actions provided in the following studies completed 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:

- Aquatic Ecology Report;
- Wetland Report;
- Rehabilitation Plan; and

■ Surface Water Report.

The Ecological Management Plan detailed in Section 9 must be developed and used as a guide to inform management actions. However, specific important management actions pertinent to this phase and activity are briefly discussed below.

A detailed sweep of the impacted areas or project area must be completed where:

- All protected SSC are located and counted for the permitting process;
- All floral SSC observed are located and documented;
- Ensure that the Present Ecological State as determined at the inception of the project is monitored annually to determine if there is a decline or increase of species or vegetation types and appropriate management actions are determined and executed;
- Ensure the establishment of an integrated Alien Invasive Management Plan; and
- Investigate the potential to establish or contribute to an ecological offset area, if the residual impact after mitigation is significant.

8.1.4 Impact Ratings

The impact of the loss of the Primary grassland and Sandstone outcrops on site is rated in Table 8-4. The loss of the remaining habitat on site is rated in Table 8-5.

Table 8-4: Impacts of the Construction Phase – Interaction 1: loss of high sensitivity grassland

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site Clearance within vegetated areas			
Impact Description: Loss of high sensitivity vegetation type and landscape (<i>Hyparrhenia – Themeda</i> Grassland, Sandstone Ridges, Riparian areas)			
Prior to Mitigation/Management			
Duration	Permanent (7)	Native vegetation will be removed (5.7 ha) for the infrastructure placement and the impact will be permanent. Fauna species will move away with no permanent impact on them.	- 84 Moderate
Extent	Limited (2)	The area to be cleared covers 21 ha of the study site. No faunal SSC were encountered in the area of disturbance; therefore, no direct impact is expected.	
Intensity x type of impact	Moderate (-3)	These habitats are not confined to the footprint of disturbance, and occurs in other localities within the project area.	

Dimension	Rating	Motivation	Significance
Probability	Certain (7)	Clearing of vegetation will definitely take place for the construction of infrastructure.	
Nature	Negative	The impact will be negative.	
Mitigation/Management Actions			
<ul style="list-style-type: none"> ▪ The Primary grassland, Riparian areas and Sandstone ridges should be excluded from the mine plan to prevent deterioration of these areas as far as possible. ▪ All Primary grassland and Sandstone ridges must be managed as sensitive landscapes and designated as no- go areas. ▪ Residual Impacts must be offset by completing an offset report. ▪ The footprint of disturbance area should be kept as small as possible and only existing access roads should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road. ▪ An AIP management plan must be implemented, whereby existing AIP's within the project area are eradicated as well as the disturbed site is monitored quarterly for at least two years to ensure that alien invasion does not take place. 			
Post-Mitigation			
Duration	Project Life (5)	The area can be reinstated to grazing landuse.	-49 (minor)
Extent	Very limited (1)	The area to be cleared is minor in extent.	
Intensity x type of impact	Minimal (1)	Loss of less sensitive habitat has a negligible impact on flora and fauna.	
Probability	Likely (7)	Edge effects will still impact on the grassland area if mining is to take palce immediately adjacent to it.	
Nature	negative	The impact will be negative.	

Table 8-5: Impacts of the Construction Phase – loss of habitat of moderate to low ecological sensitivity

Dimension	Rating	Motivation	Significance
Activity and interaction: Site Clearance within vegetated areas			
Impact Description: Loss of habitat of moderate to low sensitivity (AIP vegetation types)			
Prior to Mitigation/Management			
Duration	Permanent (7)	Native vegetation will be removed for the haul road and the impact will be permanent. Fauna species will move away with no permanent impact on them.	- 70 Moderate
Extent	Limited (2)	The area to be cleared covers 1.9 ha.	
Intensity x type of impact	Minimal (1)	Owing to the sensitivity rating, the impact will be minimal.	
Probability	Certain (7)	Clearing of vegetation will definitely take place for the establishment of haul road.	
Nature	Negative	The impact will be negative.	
Mitigation/Management Actions			
<ul style="list-style-type: none"> ▪ The footprint area should be kept as small as possible and only existing access roads should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road. ▪ An AIP management plan must be implemented, whereby existing AIP's within the project area are eradicated as well as the disturbed site is monitored quarterly for at least two years to ensure that alien invasion does not take place. 			
Post-Mitigation			
Duration	Project Life (5)	The area can be reinstated to grazing landuse after decommissioning.	- 49 Minor
Extent	Very limited (1)	The area to be cleared is minor in extent.	
Intensity x type of impact	Minimal (1)	The impact intensity can be reduced through mitigation.	
Probability	Likely (7)	Edge effects will still impact on the grassland area if mining is to take place immediately adjacent to it.	
Nature	negative	The impact will be negative.	

8.2 Operational Phase

The operational phase activities that will have an impact on the flora and fauna are summarised below.

Table 8-6: Operational phase interaction with flora and fauna associated with the site

Interaction		Impact
1	Underground Coal mining.	During the operational phase of the development, stockpiling (rock dumps, soils, ROM, discard dump) expansion and operation will occur. The planned loss of habitat and flora and fauna species is expected. The clearing of areas will occur in a phased approach, however the rating within the construction phase has already accounted for this clearing as the incremental clearing cannot be accurately split between the two phases at this stage. Alien plant species may establish due to soil disturbance.
2	Transportation of material to relevant stockpiles.	Increased vehicular movement and associated human activities on the site. There is potential for roadkills due to increased traffic on site. Increased dust, noise light pollution will occur.
3	Operation of Powerlines	Collisions and Electrocutions

8.2.1 Impact Description

During the operational phase of the development, stockpiling (rock dumps, soils, ROM, discard dump) establishment and operation will occur. No further planned loss of habitat or flora and fauna species is expected. The activities considered at this time are increased vehicular movement and mining, which will increase dust noise and light pollution and associated human activities on the site. The presence of powerlines will mean that their impact on the avifauna present through collisions and electrocutions are highly likely. The confirmed presence avifaunal SSC means that this impact could be potentially high.

8.2.2 Management Objectives

The objectives of the management measures are to ensure that operational areas do not expand into natural vegetation or habitat, in addition, roadkills, electrocutions and collisions do not take place and faunal disturbance is kept to a minimum.

8.2.3 Management Actions and Targets

Signage should be erected to indicate a minimum speed limit of 30 km/hr on access roads on site. Signage should also warn drivers of the risk of animal kills on the road. Further to this, driving of vehicles should be restricted to daylight hours.

Additional surveys should be conducted to determine the presence of Grass Owl and Serval on site. If these species are present, a management plan should be implemented specifically for it.

Bird diverters must be installed on powerlines that cross wetlands, riparian areas and grasslands, these are the areas where the large heavy bodied birds, that are prone to collision, forage and prefer to nest in. Furthermore, bird friendly designs and innovations must be used when deciding on the type of pylons.

Concurrent rehabilitation should take place to ensure that habitat is restored to a certain extent as soon as possible. An AIP management plan must be implemented.

8.2.4 Impact Ratings

The impacts of both interaction 1 and 2 are rated in Table 8-7 below.

Table 8-7: Potential Impacts of Operational Phase Interaction 1 and 2 on flora and fauna habitat on site: Mining of coal and transportation of material to relevant stockpiles

Dimension	Rating	Motivation	Significance
Activity and Interaction 1: Underground mining of coal and the operation of the rock dumps, soils, ROM, discard dump.			
Impact Description: Potential for roadkills and faunal disturbance			
Prior to Mitigation/Management			
Duration	Project Life (5)	The impact will only persist as long as vehicles are on site during the operational phase.	-40 Minor
Extent	Limited (2)	The impact is restricted to the areas where vehicular activity and machinery are active.	
Intensity	Moderate (3)	The impact is moderate; since the impact of construction would have been more pronounced.	
Probability	Probable (4)	Roadkills and faunal disturbance are commonly observed in mining operations without appropriate mitigation.	
Nature	Negative		
Mitigation/Management Actions			
<ul style="list-style-type: none"> ▪ Erect signage with speed limits. ▪ Restrict vehicle movement to daylight hours. ▪ Additional surveys should be conducted to determine the presence of Grass Owl and Serval on site. If these species are present, a management plan should be implemented. ▪ Concurrent rehabilitation should take place. 			

Dimension	Rating	Motivation	Significance
Post-Mitigation			
Duration	Project Life (5)	The impact will only persist as long as vehicles are on site during the operational phase.	-30 Negligible
Extent	Limited (2)	The impact is restricted to the areas where vehicular activity and machinery are active.	
Intensity	Moderate (3)	The impact is moderate; since the site is largely disturbed prior to the development.	
Probability	Unlikely (3)	If the speed limits are adhered to and noise is restricted, then the impact is reduced.	
Nature	Negative		

Table 8-8: Potential Impacts of Operational Phase Interaction 3 on avifauna present on site: Powerlines

Dimension	Rating	Motivation	Significance
Activity and Interaction 3: Operation of powerlines that could cause bird fatalities through collisions and electrocutions.			
Impact Description: Collisions and electrocutions			
Prior to Mitigation/Management			
Duration	Project Life (5)	The impacts will occur in the operational phase, as far as specific habitat is crossed.	-40 Minor
Extent	Limited (2)	The impact is restricted to the areas where bird activity is expected.	
Intensity	Moderate (3)	The impact is moderate; as few SSC were identified.	
Probability	Probable (4)	High probability due to presence if certain bird species.	
Nature	Negative		
Mitigation/Management Actions			
<ul style="list-style-type: none"> ▪ Install Bird Diverters ▪ Utilise best practice wrt pylon construction and type and design. 			
Post-Mitigation			
Duration	Project Life (5)	More visible wires and protected live points will decrease the potential for electrocution.	-30 Negligible
Extent	Limited (2)	The impact is very restricted.	

Dimension	Rating	Motivation	Significance
Intensity	Moderate (3)	The impact is of moderate intensity; since SSC birds were encountered.	
Probability	Unlikely (3)	Mitigation measures will decrease the likelihood considerably.	
Nature	Negative		

8.3 Decommissioning Phase

The decommissioning activities have been rated together as one phase activities that will have an impact on the terrestrial ecological environment are summarised below (Table 8-9).

Table 8-9: Closure and rehabilitation phase interaction associated with the site

Interaction	Impact
Decommissioning of the project infrastructure including the demolition and removal of infrastructure, removal of rubble, removal of roads and fences, rehabilitation of the all buildings, ingress of humans from the area.	Indirect impacts due to decommissioning 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 grassveld.

8.3.1 Impact Description

The demolition of infrastructure will have negative impacts similar to that of the construction activities due to the similarities of the actions. Affected areas will then need to be rehabilitated back to wilderness, or according to the updated regional strategic goal for the region. When the soil is disturbed, alien plants present in the seedbank will establish and spread. Rehabilitation must take place using local indigenous grass species that are sown in the correct depth and method, and type of topsoil, which is layered on the correct slope.

8.3.2 Management Objectives

The primary objectives of mitigation measures for the rehabilitation and closure phase is to ensure that the project site is rehabilitated to a reasonable ecological state, representing species diversity and suitable habitat for indigenous fauna species. The disturbed areas should be rehabilitated to grazing land use at least taking into consideration legal requirements and making use of a consultative process including specialis studies that will determine the most appropriate land use. Further to this, it is important that alien plant species do not colonise and spread throughout the site.

8.3.3 Management Actions and Targets

During the demolition 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:

- Aquatic Ecology Report (Digby Wells, 2019); and
- Surface Water Report (Digby Wells, 2019).

Areas where demolition is to take place must be kept to a minimum and care must be taken not to disturb any sensitive landscapes or species.

An AIP management plan should be implemented and all alien plant species should be removed as emergent or juveniles.

8.3.4 Impact Ratings

The impacts of the rehabilitation and closure phase are represented in Table 8-10.

Table 8-10: Potential Impacts of the Rehabilitation and Closure Phase – Establishment of Alien Plant Species

Dimension	Rating	Motivation	Significance
Dismantling and removal of infrastructure			
Impact Description: Demolition could induce habitat loss and continual pressure by the operations on the ecosystem can lead to pressure on the populations of threatened species or could lead to direct loss of individuals. Alien plant invasion may take place due to soil disturbance.			
Prior to Mitigation/Management			
Duration	Medium-term (3)	This activity will only take place for a limited time only. Alien plant invasion may occur for a short period of time.	Minor (negative) 36
Extent	Limited (2)	Demolition activities will occur in isolated areas. Alien plants will establish around disturbed areas associated with the decommissioning phase.	
Intensity x type of impact	Serious (4)	Demolition will be comparative to construction intensity. Alien plant invasion is a serious problem with significant ecological consequences; hence its reference in the NEMBA and CARA legislation.	

Dimension	Rating	Motivation	Significance
Probability	Probable (4)	This activity will occur. Since alien plants have already been recorded on site, the spread of these species due to disturbance will invariably take place. The seedbank in the soil will contain alien species.	
Nature	negative	The impact will be negative	
Mitigation/Management Actions			
<ul style="list-style-type: none"> ▪ An alien plant species management plan should be implemented for two years after rehabilitation is completed. ▪ All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. ▪ 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 and flora are updated and implemented. ▪ Ensure continuous environmental awareness training takes place. 			
Post-Mitigation			
Duration	Medium-term (3)	Demolition and removal will be of short duration. As seedlings emerge, they will be removed quarterly as part of an alien management plan.	Negligible (negative) 24
Extent	Limited (2)	Demolition and removal will take place in isolated areas. Alien plants will establish around disturbed areas associated with decommissioned infrastructure.	
Intensity x type of impact	Minimal (1)	The impact is significantly reduced if controls are implemented.	
Probability	Probable (4)	Demolition and removal will occur. Since alien plants have already been recorded on site, the spread of these species due to disturbance will invariably take place. The seedbank in the soil will contain alien species.	
Nature	Negative	The impact will be negative	

Table 8-11: Potential Impacts of the Closure and Rehabilitation Phase: Rehabilitation of infrastructure footprint areas

Activity and Interaction: Rehabilitation of infrastructure footprint areas			
Dimension	Rating	Motivation	Significance
Impact Description: Restoration of vegetation and habitat types.			
Duration	Short term (2)	Rehabilitation activities will be restricted to a short period of time.	21 Small positive
Extent	Limited (2)	Only certain parts of the site will have revegetated cover, this will include all open areas left behind by infrastructure removal.	
Intensity	Moderate (3)	The effectiveness of the rehab will determine the intensity.	
Probability	Unlikely (3)	It's unlikely that the rehabilitation will be for restoration of former habitat.	
Nature	Positive		
Mitigation/Management Actions			
<ul style="list-style-type: none"> ▪ An alien plant species management plan should be implemented for two years. ▪ All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. ▪ At least five species should be used for rehabilitation and only species that are native to the area and stipulated in the Rehabilitation and Closure Plan (Digby Wells, 2019) should be utilised. 			
Impact Description: Rehabilitation of infrastructure footprint areas			
Duration	Permanent (7)	If rehabilitation is completed successfully this impact will be permanent	78 Moderate positive
Extent	Limited (2)	The general area beyond the project site will be positively impacted on.	
Intensity	Positive (4)	Vegetation will be restored.	
Probability	Almost certain (6)	With correct implementation this impact has a high probability of occurring	
Nature	Positive		

8.4 Cumulative Impacts

The Wakkerstroom Montane Grassland and Eastern Highveld Grassland vegetation types are present within the project area, the latter has been listed as Vulnerable (VU). Impacts through project activities are expected to impact the aforementioned grasslands as well as Sandstone

rocky outcrops and Alien tree stands. Further loss of the sensitive habitats should be prevented and therefore, all grassland and sandstone rocky areas within the site must be preserved by excluding them from development as far as possible. Consideration must be given to amending the layout of the surface mine infrastructure to reduce the overall footprint area. Rehabilitation to restore the impacted areas must be carried out and successful prior to closure. Further to this, there will be a loss of wetland areas, due to the haul road that will have to cross a river system, this will have a negative cumulative impact (refer to Wetlands Impact Assessment) specifically for amphibians riparian and aquatic biota.

8.5 Unplanned Events and Low Risks

The planned activities will have known impacts as discussed above; however, unplanned events may happen on any project that may have potential impacts which will need mitigation and management. Table 8-12 is a summary of the findings from a flora and fauna perspective.

Table 8-12: Unplanned Events, Low Risks and their Management Measures

Unplanned event	Potential impact	Mitigation/ Management/ Monitoring
Hydrocarbon spillage in/near wetlands	Contamination of waterbodies utilised by terrestrial fauna.	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.
Poaching of animal species on site due to increase activity on site.	Small mammals and reptiles may be at risk due to increased human activity on site.	Ensure continuous environmental awareness training takes place. This needs to be monitored and reported on and the appropriate actions should take place dependant on the results.
Occurrences of unplanned fires	Primary and Secondary grasslands vegetation and habitat types will be destroyed	Ensure a fire management plan is in place and that appropriate and dedicated equipment is available for fire fighting.

9 Environmental Management Plan

The objective of an EMP is to present (a) mitigation measures to manage undue or reasonably avoidable adverse impacts associated with the development of a project and (b) to enhance potential positives.

9.1 Project Activities with Potentially Significant Impacts

The following is a summary of the identified significant impacts to flora and fauna habitat that will require mitigation measures for the project to go ahead.

Table 9-1: Potentially significant project impacts

Activity		Impact
Construction Phase		
1	Site Clearance	<ul style="list-style-type: none"> ▪ Loss of 5.7 ha of habitat representing high ecological sensitivity. ▪ Loss of 1.9 ha of remaining habitat of low ecological sensitivity
Operational Phase		
1	Mining of coal from underground.	<ul style="list-style-type: none"> ▪ During the operational phase of the development, topsoils and overburden of the box cut will be stripped and topsoils stockpiled. No planned loss of habitat or flora and fauna species is expected. The activities that are considered at this time are increased vehicular movement and associated human activities on the site, increased noise dust and light pollution. ▪ Alien plant species may establish due to soil disturbance.
2	Transportation of material to relevant stockpiles.	<ul style="list-style-type: none"> ▪ Increased vehicular movement and associated human activities on the site. There is potential for roadkills due to increased traffic on site.
3	Operation of Powerlines	<ul style="list-style-type: none"> ▪ Electrocutions and collisions of birds with powerline infrastructure.
Closure and Rehabilitation Phase		
1	Decommissioning of the project infrastructure including the demolition and removal of infrastructure, removal of rubble, removal of roads and fences, rehabilitation of the all buildings, ingress of humans from the area	<ul style="list-style-type: none"> ▪ Indirect impacts due to decommissioning activity occurring within a largely natural landscape. ▪ Establishment and spread of alien plant species.
2	Rehabilitation of impacted areas to wilderness	<ul style="list-style-type: none"> ▪ Improvements from rehabilitation will be recognisable over time as area is returned to wilderness – this will however not be natural grassveld.

9.1 Summary of Mitigation and Management

Table 9-2 provides 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. All of the mitigation measures have been previously listed in the impact assessment tables as well.

Table 9-2: Mitigation and Management Plan

Activities	Potential Impact	Size and scale of disturbance	Aspects Affected	Phase	Mitigation Type/Measures	Compliance with standards/Standard to be achieved	Time period for Implementation
Site clearance including vegetation removal	Loss of 5.7 ha of habitat of high sensitivity. Loss of 1.9 ha of remaining habitat.	Limited	Flora and Fauna	Construction	<ul style="list-style-type: none"> The Primary grassland area should be excluded from the mine plan. Through a detailed sweep all protected SSC are located and counted for the permitting process. Through a detailed sweep all floral SSC observed are located and documented. Ensure a monitoring and management plan is implemented for all SSC recorded on site. The footprint area should be kept as small as possible and only existing access roads should be used. An alien invader management plan should be implemented. Implement a Biodiversity offset report, aiming to offset the residual impact of infrastructure placement. 	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004)	Design and construction phases.
Underground Coal Mining	Increased vehicular movement and associated human activities on the site.	Limited	Flora and Fauna	Operational	<ul style="list-style-type: none"> Erect signage with speed limits. Restrict non essential vehicle movement to daylight hours. Concurrent rehabilitation should take place. Additional surveys should be conducted to determine the presence of Grass Owl and Serval on site. If these species are present, a management plan should be implemented. 	Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004)	Construction and operational phases
Transportation of material to relevant stockpiles.	Potential for roadkills and faunal disturbance	Limited			<ul style="list-style-type: none"> Erect signage with speed limits. Restrict non essential vehicle movement to daylight hours. Concurrent rehabilitation should take place. 	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004) Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983)	Signage should be erected before the operational phase.

Activities	Potential Impact	Size and scale of disturbance	Aspects Affected	Phase	Mitigation Type/Measures	Compliance with standards/Standard to be achieved	Time period for Implementation
Operation of Powerlines	Electrocutions and Collisions	Limited		Operational	<ul style="list-style-type: none"> Bird diverters must be installed on powerlines that cross wetlands, riparian areas and grasslands, these are the areas where the large heavy bodied birds, that are prone to collision, forage and prefer to nest in. Furthermore, bird friendly designs and innovations must be used when deciding on the type of pylons 	Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004)	Mitigation measures must be implemented during construction of the powerlines, and stay for the duration.
Demolition of Infrastructure, removal of rubble	Disturbance to largely natural landscape	Limited		Decommissioning Phase	<ul style="list-style-type: none"> The footprint area should be kept as small as possible and only existing access roads should be used. An alien invader management plan should be implemented. 	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004)	Before Decommissioning phase commences
Rehabilitation of mine footprint area	When the soil is disturbed, alien plants in the seedbank will establish and spread. Rehabilitation must take by using local indigenous grass species that are sown in the correct depth and method, and type of topsoil, which is layered on the correct slope.	Limited	Flora and Fauna	Decommissioning Phase	<ul style="list-style-type: none"> An alien plant species management plan should be implemented for two years. All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. 	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004) Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983)	Alien management plan to be implemented after construction quarterly for 2 years and after decommissioning quarterly for two years.

9.2 Monitoring Plan

The aspects requiring monitoring, based on the flora and fauna assessment, are described below. These should be completed by qualified specialists. Further to this, a survey should be conducted to determine the presence of Grass Owl and Serval on site and if they are present, a management plan should be implemented.

Table 9-3: Monitoring Plan

Activities	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions
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Fauna and Flora Monitoring	Impacts on vegetation structure and health. Impacts on faunal populations and numbers	Ensuring sustainable populations of both fauna and flora persist until closure	Terrestrial Ecologist	Every year, during the wet season
Avifaunal Monitoring	The length of the powerline must be monitored to identify areas of bird fatalities	Ensuring areas of confirmed bird mortality os adequetly equipped with mitigation measures	Ornothologist	Twice Yearly
Rehabilitation	Success of rehabilitation	Rehabilitation success	Rehabilitation Specialist	Quarterly for 2 years after closure
Soil disturbance	Establishment of alien plant species	Alien plant monitoring	Qualified Botanist	Quarterly monitoring for two years

10 Consultation Undertaken

No comments directly related to flora and fauna have been received.

11 Comments and Responses

No Comments have been received thus far.

12 Discussion and Conclusion

The Dagsoom project area is situated in the transition zone between the Wakkerstroom Montane Grassland and Eastern Highveld Grassland vegetation types. A species composition that is representative of the transition zone between these two vegetation types were encountered. Impacts to the natural vegetation currently counts livestock use and cultivation. As aforementioned, the site is located in the second most diverse biome in the country, supporting a vast range of flora and fauna. The implementation of strict mitigation measures if of considerable importance, specifically from a biodiversity perspective and should be implemented in a sustainable and responsible way.

The site has been classified into six primary land management units, namely: agricultural areas, alien bushclumps, secondary grassland, primary grassland, rocky outcrops, and riparian areas. The agricultural areas are associated with the dominant land use in the area did not harbour any natural vegetation. Vegetation cover is sparse and includes alien plant species such as: *Cirsium vulgare* (Scotch Thistle) and *Solanum sisymbriifolium* (Dense-thorned Bitter Apple).

Floral diversity in the Primary Grassland was regarded as expected in comparison with the expected species. Alien invasive tree species were found to dominate many landscapes, including riparian, wetlands and primary and secondary grassland.

Few flora SSC were recorded on site and this is most likely attributable to disturbance related to agriculture. Two avifaunal SSC were recorded, namely: Vulnerable species, Secretary Bird (*Sagittarius serpentarius*) and Southern Bald Ibis (*Geronticus calvus*). A number of bird species could be present within the study area but was not recorded due to seasonality. Similarly, a few SSC that are highly likely to occur on site was not recorded, and if these were to be identified, strict management plans must be implemented, these species are the Grass Owl (*Tyto capensis*) and Serval (*Leptailurus serval*). Herpetofauna findings included, three reptile species, and no amphibian species. Faunal diversity was lower than expected, given the undisturbed nature of large parts of the project area.

The disturbance of high value biodiversity assets is foreseen for this project, this centers on the infrastructure placement within CBA's which coincides with highly sensitive grassland areas. After the mitigation hierarchy was followed it was decided that an offset strategy will have to be employed in order for the residual impact of the project on priority biodiversity to be offset. Only if this process is established and audited can this project be seen be acceptable.

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Appendix A: Regional Vegetation

Family	Scientific name	Red list status	Occurrence
Asphodelaceae	<i>Aloe kniphofioides</i>	Vulnerable	Highly likely
Poaceae	<i>Andropogon appendiculatus</i>	Least Concern	Highly likely
Poaceae	<i>Andropogon eucomus</i>	Least Concern	Highly likely
Poaceae	<i>Aristida congesta</i>	Least Concern	Highly likely
Poaceae	<i>Aristida junciformis</i>	Least Concern	Highly likely
Poaceae	<i>Arundinella nepalensis</i>	Least Concern	Highly likely
Orchidaceae	<i>Bletilla ochracea</i>	Least Concern	Highly likely
Amaryllidaceae	<i>Brunsvigia randulosa</i>	Least Concern	Highly likely
Brassicaceae	<i>Cardamine Africana</i>	Least Concern	Highly likely
Cyperaceae	<i>Carex acutiformis</i>	Least Concern	Highly likely
Cyperaceae	<i>Carex cognata</i>	Least Concern	Highly likely
Colchicaceae	<i>Colchicum striatum</i>	Least Concern	Highly likely
Amaryllidaceae	<i>Crinum bulbispermum</i>	Least Concern	Highly likely
Poaceae	<i>E.curvula</i>	Least Concern	Highly likely
Poaceae	<i>Eragrostis lachnantha</i>	Least Concern	Highly likely
Poaceae	<i>Eragrostis plana</i>	Least Concern	Highly likely
Hyacinthaceae	<i>Eucomis autumnalis</i>	Vulnerable	Highly likely
Cyperaceae	<i>Fimbristylis complanata</i>	Least Concern	Highly likely
Cyperaceae	<i>Fuirena pubescens</i>	Least Concern	Highly likely
Asteraceae	<i>Gazania krebsiana</i>	Least Concern	Highly likely
Geraniaceae	<i>Geranium wakkerstroomianum</i>	Least Concern	Highly likely

Family	Scientific name	Red list status	Occurrence
Poaceae	<i>Gladiolus crassifolius</i>	Least Concern	Highly likely
Iridaceae	<i>Gladiolus malvinus</i>	Vulnerable	Highly likely
Gunneraceae	<i>Gunnera perpensa</i>	Declining	Highly likely
Amaryllidaceae	<i>Hermanthus hirsutus</i>	Declining	Highly likely
Hypoxidaceae	<i>Hypoxis hemerocalledea</i>	Near Threatened	Likely
Aquifoliaceae	<i>Ilex mitis</i>	Declining	Highly likely
Poaceae	<i>Imperata cylindrical</i>	Least Concern	Highly likely
Oleaceae	<i>Jasminum streptopus</i>	Least Concern	Highly likely
Asphodelaceae	<i>Kniphofia typhoides</i>	Rare	Likely
Cyperaceae	<i>Kyllinga erecta</i>	Least Concern	Highly likely
Lobeliaceae	<i>Lobelia flaccid</i>	Least Concern	Highly likely
Poaceae	<i>Miscanthus capensis</i>	Least Concern	Highly likely
Anemiaceae	<i>Mohria nudiuscula</i>	Least Concern	Highly likely
Myrsinaceae	<i>Myrsine africana</i>	Least Concern	Highly likely
Amaryllidaceae	<i>Nerine gracilis</i>	Endangered	Likely
Ocotea	<i>Ocotea bulata (Burch.) Baill</i>	Vulnerable	Likely
Lythraceae	<i>Nesaea sagittifolia</i>	Least Concern	Highly likely
Cyperaceae	<i>Pycreus macranthus</i>	Least Concern	Highly likely
Rubiaceae	<i>Richardia brasiliensis</i>	Least Concern	Highly likely
Cyperaceae	<i>Schoenoplectus brachyceras</i>	Least Concern	Highly likely
Cyperaceae	<i>Schoenoplectus pugens</i>	Least Concern	Highly likely
Anacardiaceae	<i>Searsia dentata</i>	Least Concern	Highly likely
Poaceae	<i>Setaria nigrirostis</i>	Least Concern	Highly likely

Family	Scientific name	Red list status	Occurrence
Poaceae	<i>Sporobolus africanus</i>	Least Concern	Highly likely
Poaceae	<i>Stipagrostis uniplumis</i>	Least Concern	Highly likely
Poaceae	<i>Themeda triandra</i>	Least Concern	Highly likely
Typhaceae	<i>Typha capensis</i>	Least Concern	Highly likely
Poaceae	<i>Urochloa panicoides</i>	Least Concern	Highly likely
Campanulaceae	<i>Wahlenbergia undulata</i>	Least Concern	Highly likely

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Appendix B: Plant Species List



Species Name	Common Name	Status	Growth form
<i>Acacia mearnsii</i>	Black Wattle	Alien Invasive**	Tree
<i>Adiantum capillus-veneris</i>	Maiden Hair Fern	-	Fern
<i>Aloe maculata</i>	Soap aloe	LC	Aloe
<i>Andropogon eucomus</i>	Snowflake grass	Increaser 2 - Subclimax	Grass
<i>Andropogon schirensis</i>	Stab grass	Increaser 1 - Climax	Grass
<i>Aristida congesta congesta</i>	Tassel Tree-awn	Increaser 2 - Pioneer	Grass
<i>Aristida junciformis</i>	Ngongoni Three-awn	Increaser 3 - Climax	Grass
<i>Arundo donax</i>	Spanish Reed	Alien	Reed
<i>Asparagus africanus</i>	Bush asparagus	Medicinal	Herb
<i>Berkheya insignis</i>	-	-	Herb
<i>Berkheya speciosa</i>	-	Medicinal	Herb
<i>Bidens pilosa</i>	Common Blackjack	Alien Invasive	Herb
<i>Boophane disticha</i>	Poison bulb	MPB Protected	Bulb
<i>Brachiaria serrata</i>	Velvet Signal Grass	Decreaser - Climax	Grass
<i>Bromus catharticus</i>	Rescue Grass	Alien Invasive	Grass
<i>Buddleja auriculata</i>	Weeping Sagewood	-	Shrub
<i>Buddleja salviifolia</i>	Sagewood	-	Shrub
<i>Cirsium vulgare</i>	Scotch thistle	Alien Invasive	Herb
<i>Conyza bonariensis</i>	Flax-leaf fleabane	-	Herb
<i>Crinum bulbispermum</i>	Orange/Vaal River Lily	Medicinal, MPB Protected Declining	Herb
<i>Cussonia spicata</i>	Common Cabbage tree	Medicinal	Tree
<i>Cymbopogon caesius</i>	Broad-leaved Turpentine Grass	Increaser 1 - Climax	Grass
<i>Cymbopogon pospischilli</i>	Narrow-leaved Turpentine Grass	Increaser 3 - Climax	Grass
<i>Cynodon dactylon</i>	Couch Grass	Increaser 2 - Pioneer	Grass
<i>Cyrtanthus contractus</i>	Fire Lilly	-	Bulb
<i>Dicoma zeyheri</i>	Dicoma	-	Shrublet
<i>Diheteropogon amplexans</i>	Broad-leaved Bluestem	Decreaser - Climax	Grass
<i>Diospyros lycoides</i>	Blue bush	-	Shrub
<i>Elionurus muticus</i>	Wire Grass	Increaser 3 - Climax	Grass
<i>Enneopogon scoparius</i>	Bottlebrush Grass	Increaser 3 - Climax	Grass
<i>Eragrostis chloromelas</i>	(Narrow) Curly Leaf	Increaser 2 - Subclimax to climax	Grass
<i>Eragrostis curvula</i>	Weeping Love Grass	Increaser 2 - Subclimax to climax	Grass
<i>Eragrostis gummiflua</i>	Gum Grass	Increaser 2 - Subclimax	Grass
<i>Eragrostis nindensis</i>	Whether love grass	Increaser 2 - Subclimax	Grass
<i>Eragrostis plana</i>	Tough love grass	Increaser 2 - Subclimax	Grass
<i>Eragrostis racemosa</i>	Narrow Heart Love Grass	Increaser 2 - Subclimax	Grass
<i>Eragrostis trichophora</i>	Hairy Love Grass	Increaser 2 - Subclimax	Grass
<i>Eucalyptus camaldulensis</i>	Red River Gum	Alien Invasive**	Tree
<i>Gladiolus c.f. crassifolius</i>	Thick-leaved Gladiolus	MPB Protected	Shrub
<i>Gnidia burchelli</i>	-	-	Herb



<i>Gomphocarpus physocarpus</i>	Milkweed	-	Shrub
<i>Gymnospora nemorosa</i>	-	-	Shrub
<i>Haplocarpha scaposa</i>	False Gerbera	Medicinal	Herb
<i>Harpochloa falx</i>	Caterpillar Grass	Increaser 1 - Climax	Grass
<i>Helichrysum appendiculatum</i>	Everlasting	-	Herb
<i>Helichrysum aureonitens</i>	Golden everlasting	Medicinal	Herb
<i>Heteropogon contortus</i>	Spear Grass	Increaser 2 - Subclimax	Grass
<i>Hirpicium armeroides</i>	Mountain gerbera	-	Herb
<i>Hyparrhenia filipendula</i>	Fine Thatching Grass	Climax Increaser 1	Grass
<i>Hyparrhenia hirta</i>	Common Thatching Grass	Increaser 1 - Subclimax to climax	Grass
<i>Hypochoeris radicata</i>	Hairy wild lettuce	Alien Invasive/Edible	Herb
<i>Hypoxis hemerocallidea</i>	Star-flower	Medicinal	Herb
<i>Hypoxis rigidula</i>	Silver-leaved star-flower	Medicinal	Herb
<i>Hypoxis rigidula</i>	Silver-leaved star-flower	Medicinal	Herb
<i>Imperata cylindrica</i>	Cotton Wool Grass	Increaser 1	Grass
<i>Lepidium africanum</i>	Pepperweed	Weed	Herb
<i>Leucosidea sericea</i>	Ouhout	-	Shrub
<i>Lolium perenne</i>	Rye Grass	Pioneer Alien Invasive	Grass
<i>Loudetia simplex</i>	Common Russet Grass	Increaser 2 - Climax	Grass
<i>Monocymbium ceresiiforme</i>	Boat grass	Decreaser - Climax	Grass
<i>Opuntia ficus-indica</i>	Sweet Prickly Pear	Alien Invasive*	Tree/Shrub
<i>Pennisetum clandestinum</i>	Kikuyu Grass	Exotic	Grass
<i>Pennisetum macrourum</i>	River Bed Grass	Increaser 1 - Climax	Grass
<i>Pinus radiata</i>	Radiata Pine	Alien invader	Tree
<i>Pseudognaphalium luteo-album</i>	Jersey Cudweed	Medicinal/Cultural	Herb
<i>Schoenoplectus corymbosus</i>		Cultural-weaving	Reed
<i>Searsia pyroides</i>	Firethorn current	-	Shrub
<i>Senecia madagascariensis</i>	Canary Weed	Weed	Herb
<i>Senecio inornatus</i>		Medicinal	Herb
<i>Seriphium plumosum</i>	Bankrupt Bush	Weed	Shrub
<i>Solanum sisymbriifolium</i>	Wild Tomato	Alien Invasive*	Shrublet
<i>Sporobolus pyramidalis</i>	Catstail dropseed	Subclimax increaser 2	Grass
<i>Tagetes minuta</i>	Tall Khaki Weed	Alien Invasive	Herb
<i>Themeda triandra</i>	Red Grass	Decreaser - Climax	Grass
<i>Trachypogon spicatus</i>	Giant Spear Grass	Increaser 1 - Climax	Grass
<i>Tristachya leucothrix</i>	Hairy Trident Grass	Increaser 1 - Climax	Grass
<i>Typha capensis</i>	Bulrush	Medicinal	Reed
<i>Verbena braziliensis</i>	-	-	Shrub
<i>Zea mays</i>	Maize meal	-	Grass

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Appendix C: Expected Mammal Species List



Species Name	Common Name	Status	Order
<i>Lepus saxatalis</i>	Scrub Hare	LC	Mammal
<i>Naja mossambica</i>	Mozambique spitting cobra		Reptile
<i>Boaedon capensis</i>	Brown House Snake		Reptile
<i>Sylvicapra grimmia</i>	Duiker		Mammal
<i>Junonia octavia</i>	Gaudy Commodore		Invertebrate
<i>Junonia hierta</i>	Yellow pansy		Invertebrate
<i>Sylvicarpa grimmia</i>	Common Duiker		Mammal
<i>Redunca fulvorufula</i>	Southern Mountain Reedbuck		Mammal
<i>Aonyx capensis</i>	Cape Clawless Otter		Mammal
<i>Ictonyx striatus</i>	Striped Polecat		Mammal
<i>Civettictis civetta</i>	African Civet		Mammal
<i>Orycteropus afer</i>	Aardvark		Mammal
<i>Atilax paludinosus</i>	Water Mongoose		Mammal
<i>Junonia orithya madagascariensis</i>	Eyed pansy		Invertebrate
<i>Catopsilia florella</i>	African migrant		Invertebrate
<i>Belenois aurota</i>	Brown Veined White		Invertebrate

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Appendix D: Potential Red Data Avifauna



Species	Common Name	Threat Status	Habitat requirements (Barnes 2000; Hockey <i>et al</i> 2005; Harrison <i>et al</i> 1997; Young <i>et al</i> 2003; personal observations)
<i>Geronticus calvus</i>	Southern Bald Ibis	VU	High altitude grassland, also agricultural fields. Often in recently burnt veld. Likely to occur on the study area from time to time when suitable habitat exists either in the grasslands or cultivated fields.
<i>Eupodotis senegalensis</i>	White-bellied Korhaan	VU	Often in the interface between grassland and savanna. Avoids severely grazed and recently burnt sites. Could potentially be present in patches of tall grass.
<i>Sagittarius serpentarius</i>	Secretary Bird	NT	Prefer open grassland, densities lower in maize growing areas. Occasional presence confirmed by EWT and landowner.
<i>Anthropoides paradiseus</i>	Blue Crane	VU	Short grassland, pastures, stubble lands and wetlands. Unlikely to occur in the study area due to largely unsuitable fragmented habitat, extensive disturbance, and habitat transformation.
<i>Vanellus melanopterus</i>	Black-winged Lapwing	NT	Prefers high altitude short or burnt grasslands. Due to the limited amount of suitable habitat on the study site it is unlikely to occur there. Could sporadically appear in the area shortly after veld fires or in the natural grassland area.
<i>Circus ranivorus</i>	African Marsh Harrier	VU	Large permanent wetlands with dense reed beds. Sometimes forages over smaller wetlands and grassland. Wetland habitat present on the study site too small and fragmented to support this species, therefore unlikely to occur.
<i>Falco peregrinus</i>	Peregrine Falcon	NT	Usually associated with sheer cliffs that are used as breeding and roosting sites. Unlikely to occur in the study area ~ no suitable habitat.



Species	Common Name	Threat Status	Habitat requirements (Barnes 2000; Hockey <i>et al</i> 2005; Harrison <i>et al</i> 1997; Young <i>et al</i> 2003; personal observations)
<i>Falco naumanni</i>	Lesser Kestrel	VU	Grassland and agricultural lands. Could be present in summer (Palearctic migrant).

Roberts no.	English Name	Scientific Name	IUCN Status
6	Great Crested Grebe	<i>Podiceps cristatus</i>	Least Concern
8	Dabchick	<i>Tachybaptus ruficollis</i>	Least Concern
55	Whitebreasted Cormorant	<i>Phalacrocorax lucidus</i>	Least Concern
58	Reed Cormorant	<i>Phalacrocorax africanus</i>	Least Concern
60	Darter	<i>Anhinga rufa</i>	Least Concern
62	Grey Heron	<i>Ardea cinerea</i>	Least Concern
63	Blackheaded Heron	<i>Ardea melanocephala</i>	Least Concern
64	Goliath Heron	<i>Ardea goliath</i>	Least Concern
65	Purple Heron	<i>Ardea purpurea</i>	Least Concern
66	Great White Egret	<i>Egretta alba</i>	Least Concern
67	Little Egret	<i>Egretta garzetta</i>	Least Concern
68	Yellowbilled Egret	<i>Egretta intermedia</i>	Least Concern
69	Black Egret	<i>Egretta ardesiaca</i>	Least Concern
71	Cattle Egret	<i>Bubulcus ibis</i>	Least Concern
72	Squacco Heron	<i>Ardeola ralloides</i>	Least Concern
74	Greenbacked Heron	<i>Butorides striatus</i>	Least Concern
76	Blackcrowned Night Heron	<i>Nycticorax nycticorax</i>	Least Concern
78	Little Bittern	<i>Ixobrychus minutus</i>	Least Concern
80	Bittern	<i>Botaurus stellaris</i>	Least Concern
81	Hamerkop	<i>Scopus umbretta</i>	Least Concern
83	White Stork	<i>Ciconia ciconia</i>	Least Concern
84	Black Stork	<i>Ciconia nigra</i>	Near Threatened
85	Abdim's Stork	<i>Ciconia abdimii</i>	Least Concern
89	Marabou Stork	<i>Leptoptilos crumeniferus</i>	Least Concern



Roberts no.	English Name	Scientific Name	IUCN Status
90	Yellowbilled Stork	<i>Mycteria ibis</i>	Least Concern
91	Sacred Ibis	<i>Threskiornis aethiopicus</i>	Least Concern
92	Bald Ibis	<i>Geronticus calvus</i>	Least Concern
93	Glossy Ibis	<i>Plegadis falcinellus</i>	Least Concern
94	Hadedda Ibis	<i>Bostrychia hagedash</i>	Least Concern
95	African Spoonbill	<i>Platalea alba</i>	Least Concern
96	Greater Flamingo	<i>Phoenicopterus ruber</i>	Near Threatened
97	Lesser Flamingo	<i>Phoenicopterus minor</i>	Near Threatened
99	Whitefaced Duck	<i>Dendrocygna viduata</i>	Least Concern
100	Fulvous Duck	<i>Dendrocygna bicolor</i>	Least Concern
101	Whitebacked Duck	<i>Thalassornis leuconotus</i>	Least Concern
102	Egyptian Goose	<i>Alopochen aegyptiacus</i>	Least Concern
103	South African Shelduck	<i>Tadorna cana</i>	Least Concern
104	Yellowbilled Duck	<i>Anas undulata</i>	Least Concern
105	African Black Duck	<i>Anas sparsa</i>	Least Concern
106	Cape Teal	<i>Anas capensis</i>	Least Concern
107	Hottentot Teal	<i>Anas hottentota</i>	Least Concern
108	Redbilled Teal	<i>Anas erythrorhyncha</i>	Least Concern
112	Cape Shoveller	<i>Anas smithii</i>	Least Concern
113	Southern Pochard	<i>Netta erythrophthalma</i>	Least Concern
115	Knobbilled Duck	<i>Sarkidiornis melanotos</i>	Least Concern
116	Spurwinged Goose	<i>Plectropterus gambensis</i>	Least Concern
117	Maccoa Duck	<i>Oxyura maccoa</i>	Near threatened
118	Secretarybird	<i>Sagittarius serpentarius</i>	Vulnerable
122	Cape Vulture	<i>Gyps coprotheres</i>	Vulnerable
126	Black Kite	<i>Milvus migrans</i>	Least Concern
126.1	Yellowbilled Kite	<i>Milvus aegyptius</i>	Least Concern
127	Blackshouldered Kite	<i>Elanus caeruleus</i>	Least Concern
130	Honey Buzzard	<i>Pernis apivorus</i>	Least Concern
131	Black Eagle	<i>Aquila verreauxii</i>	Least Concern
133	Steppe Eagle	<i>Aquila nipalensis</i>	Least Concern



Roberts no.	English Name	Scientific Name	IUCN Status
136	Booted Eagle	<i>Hieraaetus pennatus</i>	Least Concern
137	African Hawk Eagle	<i>Hieraaetus spilogaster</i>	Least Concern
138	Ayres' Eagle	<i>Hieraaetus ayresii</i>	Least Concern
140	Martial Eagle	<i>Polemaetus bellicosus</i>	Vulnerable
141	Crowned Eagle	<i>Stephanoaetus coronatus</i>	Least Concern
142	Brown Snake Eagle	<i>Circaetus cinereus</i>	Least Concern
143	Blackbreasted Snake Eagle	<i>Circaetus pectoralis</i>	Least Concern
148	African Fish Eagle	<i>Haliaeetus vocifer</i>	Least Concern
149	Steppe Buzzard	<i>Buteo vulpinus</i>	Least Concern
152	Jackal Buzzard	<i>Buteo rufofuscus</i>	Least Concern
155	Rufous breasted Sparrowhawk	<i>Accipiter rufiventris</i>	Least Concern
157	Little Sparrowhawk	<i>Accipiter minullus</i>	Least Concern
158	Black Sparrowhawk	<i>Accipiter melanoleucus</i>	Least Concern
159	Little Banded Goshawk	<i>Accipiter badius</i>	Least Concern
160	Ovambo Sparrowhawk	<i>Accipiter ovampensis</i>	Least Concern
161	Gabar Goshawk	<i>Melierax gabar</i>	Least Concern
164	Eurasian Marsh Harrier	<i>Circus aeruginosus</i>	Rare in SA
165	African Marsh Harrier	<i>Circus ranivorus</i>	Vulnerable
166	Montagu's Harrier	<i>Circus pygargus</i>	Least Concern
167	Pallid Harrier	<i>Circus macrourus</i>	Near threatened
168	Black Harrier	<i>Circus maurus</i>	Vulnerable
169	Gymnogone	<i>Polyboroides typus</i>	Least Concern
170	Osprey	<i>Pandion haliaetus</i>	Least Concern
171	Peregrine Falcon	<i>Falco peregrinus</i>	Near threatened
172	Lanner Falcon	<i>Falco biarmicus</i>	Least Concern
173	Northern Hobby Falcon	<i>Falco subbuteo</i>	Least Concern
179	Western Redfooted Kestrel	<i>Falco vespertinus</i>	Least Concern
180	Eastern Redfooted Kestrel	<i>Falco amurensis</i>	Least Concern
181	Rock Kestrel	<i>Falco rupicolis</i>	Least Concern
182	Greater Kestrel	<i>Falco rupicoloides</i>	Least Concern
183	Lesser Kestrel	<i>Falco naumanni</i>	Least Concern



Roberts no.	English Name	Scientific Name	IUCN Status
188	Coqui Francolin	<i>Peliperdix coqui</i>	Least Concern
190	Orange-river Francolin	<i>Scleroptila levaillantoides</i>	Least Concern
192	Redwing Francolin	<i>Scleroptila levaillantii</i>	Least Concern
199	Swainson's Francolin	<i>Pternistis swainsonii</i>	Least Concern
200	Common Quail	<i>Coturnix coturnix</i>	Least Concern
201	Harlequin Quail	<i>Coturnix delegorguei</i>	Least Concern
203	Helmeted Guineafowl	<i>Numida meleagris</i>	Least Concern
205	Kurriehane Buttonquail	<i>Turnix sylvatica</i>	Least Concern
207	Wattled Crane	<i>Grus carunculatus</i>	Vulnerable
208	Blue Crane	<i>Anthropoides paradisea</i>	Vulnerable
209	Crowned Crane	<i>Balearica regulorum</i>	Endangered
210	African Rail	<i>Rallus caerulescens</i>	Least Concern
211	Corncrake	<i>Crex crex</i>	Least Concern
213	Black Crake	<i>Amaurornis flavirostris</i>	Least Concern
215	Baillon's Crake	<i>Porzana pusilla</i>	Least Concern
217	Redchested Flufftail	<i>Sarothrura rufa</i>	Least Concern
222	Whitewinged Flufftail	<i>Sarothrura ayresi</i>	Critical
223	Purple Gallinule	<i>Porphyrio madagascarensis</i>	Least Concern
226	Common Moorhen	<i>Gallinula chloropus</i>	Least Concern
228	Redknobbed Coot	<i>Fulica cristata</i>	Least Concern
229	African Finfoot	<i>Podica senegalensis</i>	Least Concern
231	Stanley's Bustard	<i>Neotis denhami</i>	Least Concern
233	Whitebellied Korhaan	<i>Eupodotis barrowii</i>	Vulnerable
234	Blue Korhaan	<i>Eupodotis caerulescens</i>	Near threatened
240	African Jacana	<i>Actophilornis africanus</i>	Least Concern
242	Greater Painted Snipe	<i>Rostratula benghalensis</i>	Vulnerable
245	Ringed Plover	<i>Charadrius hiaticula</i>	Least Concern
248	Kittlitz's Plover	<i>Charadrius pecuarius</i>	Least Concern
249	Threebanded Plover	<i>Charadrius tricollaris</i>	Least Concern
252	Caspian Plover	<i>Charadrius asiaticus</i>	Least Concern
255	Crowned Plover	<i>Vanellus coronatus</i>	Least Concern



Roberts no.	English Name	Scientific Name	IUCN Status
257	Blackwinged Plover	<i>Vanellus melanopterus</i>	Least Concern
258	Blacksmith Plover	<i>Vanellus armatus</i>	Least Concern
260	Wattled Plover	<i>Vanellus senegallus</i>	Least Concern
262	Ruddy Turnstone	<i>Arenaria interpres</i>	Least Concern
264	Common Sandpiper	<i>Actitis hypoleucos</i>	Least Concern
265	Green Sandpiper	<i>Tringa ochropus</i>	Least Concern
266	Wood Sandpiper	<i>Tringa glareola</i>	Least Concern
269	Marsh Sandpiper	<i>Tringa stagnatilis</i>	Least Concern
270	Greenshank	<i>Tringa nebularia</i>	Least Concern
272	Curlew Sandpiper	<i>Calidris ferruginea</i>	Least Concern
274	Little Stint	<i>Calidris minuta</i>	Least Concern
284	Ruff	<i>Philomachus pugnax</i>	Least Concern
286	African Snipe	<i>Gallinago nigripennis</i>	Least Concern
290	Whimbrel	<i>Numenius phaeopus</i>	Least Concern
294	Pied Avocet	<i>Recurvirostra avosetta</i>	Least Concern
295	Blackwinged Stilt	<i>Himantopus himantopus</i>	Least Concern
297	Spotted Dikkop	<i>Burhinus capensis</i>	Least Concern
298	Water Dikkop	<i>Burhinus vermiculatus</i>	Least Concern
300	Temminck's Courser	<i>Cursorius temminckii</i>	Least Concern
305	Blackwinged Pratincole	<i>Glareola nordmanni</i>	Least Concern
315	Greyheaded Gull	<i>Larus cirrocephalus</i>	Least Concern
322	Caspian Tern	<i>Sterna caspia</i>	Vulnerable
338	Whiskered Tern	<i>Chlidonias hybridus</i>	Least Concern
339	Whitewinged Tern	<i>Chlidonias leucopterus</i>	Least Concern
348	Feral Pigeon	<i>Columba livia</i>	Least Concern
349	Rock Pigeon	<i>Columba guinea</i>	Least Concern
350	Rameron Pigeon	<i>Columba arquatrix</i>	Least Concern
352	Redeyed Dove	<i>Streptopelia semitorquata</i>	Least Concern
354	Cape Turtle Dove	<i>Streptopelia capicola</i>	Least Concern
355	Laughing Dove	<i>Streptopelia senegalensis</i>	Least Concern
356	Namaqua Dove	<i>Oena capensis</i>	Least Concern



Roberts no.	English Name	Scientific Name	IUCN Status
361	African Green Pigeon	<i>Treron calva</i>	Least Concern
373	Grey Go away Bird	<i>Corythaixoides concolor</i>	Least Concern
374	Eurasian Cuckoo	<i>Cuculus canorus</i>	Least Concern
375	African Cuckoo	<i>Cuculus gularis</i>	Least Concern
377	Redchested Cuckoo	<i>Cuculus solitarius</i>	Least Concern
378	Black Cuckoo	<i>Cuculus clamorus</i>	Least Concern
380	Great Spotted Cuckoo	<i>Clamator glandarius</i>	Least Concern
381	Striped Cuckoo	<i>Clamator levaillantii</i>	Least Concern
382	Jacobin Cuckoo	<i>Clamator jacobinus</i>	Least Concern
385	Klaas's Cuckoo	<i>Chrysococcyx klaas</i>	Least Concern
386	Diederik Cuckoo	<i>Chrysococcyx caprius</i>	Least Concern
391	Burchell's Coucal	<i>Centropus burchellii</i>	Least Concern
392	Barn Owl	<i>Tyto alba</i>	Least Concern
393	Grass Owl	<i>Tyto capensis</i>	Near threatened
395	Marsh Owl	<i>Asio capensis</i>	Least Concern
401	Spotted Eagle Owl	<i>Bubo africanus</i>	Least Concern
404	Eurasian Nightjar	<i>Caprimulgus europaeus</i>	Least Concern
405	Fierynecked Nightjar	<i>Caprimulgus pectoralis</i>	Least Concern
408	Freckled Nightjar	<i>Caprimulgus tristigma</i>	Least Concern
411	Eurasian Swift	<i>Apus apus</i>	Least Concern
412	Black Swift	<i>Apus barbatus</i>	Least Concern
415	Whiterumped Swift	<i>Apus caffer</i>	Least Concern
416	Horus Swift	<i>Apus horus</i>	Least Concern
417	Little Swift	<i>Apus affinis</i>	Least Concern
418	Alpine Swift	<i>Tachymarptis melba</i>	Least Concern
421	Palm Swift	<i>Cypsiurus parvus</i>	Least Concern
424	Speckled Mousebird	<i>Colius striatus</i>	Least Concern
426	Redfaced Mousebird	<i>Urocolius indicus</i>	Least Concern
428	Pied Kingfisher	<i>Ceryle rudis</i>	Least Concern
429	Giant Kingfisher	<i>Megaceryle maxima</i>	Least Concern
430	Halfcollared Kingfisher	<i>Alcedo semitorquata</i>	Near threatened



Roberts no.	English Name	Scientific Name	IUCN Status
431	Malachite Kingfisher	<i>Alcedo cristata</i>	Least Concern
433	Woodland Kingfisher	<i>Halcyon senegalensis</i>	Least Concern
435	Brownhooded Kingfisher	<i>Halcyon albiventris</i>	Least Concern
438	Eurasian Bee-eater	<i>Merops apiaster</i>	Least Concern
443	Whitefronted Bee-eater	<i>Merops bullockoides</i>	Least Concern
444	Little Bee-eater	<i>Merops pusillus</i>	Least Concern
446	Eurasian Roller	<i>Coracias garrulus</i>	Near threatened
451	African Hoopoe	<i>Upupa africana</i>	Least Concern
452	Redbilled Woodhoopoe	<i>Phoeniculus purpureus</i>	Least Concern
454	Scimitarbilled Woodhoopoe	<i>Rhinopomastus cyanomelas</i>	Least Concern
464	Blackcollared Barbet	<i>Lybius torquatus</i>	Least Concern
465	Pied Barbet	<i>Tricholaema leucomelas</i>	Least Concern
470	Yellowfronted Tinker Barbet	<i>Pogoniulus chrysoconus</i>	Least Concern
473	Crested Barbet	<i>Trachyphonus vaillantii</i>	Least Concern
474	Greater Honeyguide	<i>Indicator indicator</i>	Least Concern
476	Lesser Honeyguide	<i>Indicator minor</i>	Least Concern
478	Sharpbilled Honeyguide	<i>Prodotiscus regulus</i>	Least Concern
480	Ground Woodpecker	<i>Geocolaptes olivaceus</i>	Least Concern
483	Golden tailed Woodpecker	<i>Campethera abingoni</i>	Least Concern
486	Cardinal Woodpecker	<i>Dendropicos fuscescens</i>	Least Concern
489	Redthroated Wryneck	<i>Jynx ruficollis</i>	Least Concern
494	Rufousnaped Lark	<i>Mirafrā africana</i>	Least Concern
495.2	Eastern Clapper Lark	<i>Mirafrā fasciolata</i>	Least Concern
496	Flappet Lark	<i>Mirafrā rufocinnamomea</i>	Least Concern
498	Sabota Lark	<i>Calendulauda sabota</i>	Least Concern
499	Rudd's Lark	<i>Heteromirafrā ruddi</i>	Vulnerable
500.2	Eastern Longbilled Lark	<i>Certhilauda semitorquata</i>	Least Concern
506	Spikeheeled Lark	<i>Chersomanes albofasciata</i>	Least Concern
507	Redcapped Lark	<i>Calandrella cinerea</i>	Least Concern
508	Pinkbilled Lark	<i>Spizocorys conirostris</i>	Least Concern
518	Eurasian Swallow	<i>Hirundo rustica</i>	Least Concern



Roberts no.	English Name	Scientific Name	IUCN Status
520	Whitethroated Swallow	<i>Hirundo albigularis</i>	Least Concern
523	Pearlbreasted Swallow	<i>Hirundo dimidiata</i>	Least Concern
524	Redbreasted Swallow	<i>Hirundo semirufa</i>	Least Concern
526	Greater Striped Swallow	<i>Hirundo cucullata</i>	Least Concern
528	South African Cliff Swallow	<i>Hirundo spilodera</i>	Least Concern
529	Rock Martin	<i>Hirundo fuligula</i>	Least Concern
530	House Martin	<i>Delichon urbica</i>	Least Concern
531	Greyrumped Swallow	<i>Pseudhirundo griseopyga</i>	Least Concern
532	Sand Martin	<i>Riparia riparia</i>	Least Concern
533	Brownthroated Martin	<i>Riparia paludicola</i>	Least Concern
534	Banded Martin	<i>Riparia cincta</i>	Least Concern
536	Black Sawwing Swallow	<i>Psaldoprocne holomelaena</i>	Least Concern
538	Black Cuckooshrike	<i>Campephaga flava</i>	Least Concern
541	Forktailed Drongo	<i>Dicrurus adsimilis</i>	Least Concern
545	Blackheaded Oriole	<i>Oriolus larvatus</i>	Least Concern
547	Black Crow	<i>Corvus capensis</i>	Least Concern
548	Pied Crow	<i>Corvus albus</i>	Least Concern
554	Southern Black Tit	<i>Parus niger</i>	Least Concern
558	Grey Penduline Tit	<i>Anthoscopus caroli</i>	Least Concern
560	Arrowmarked Babbler	<i>Turdoides jardineii</i>	Least Concern
568	Blackeyed Bulbul	<i>Pycnonotus tricolor</i>	Least Concern
576	Kurrichane Thrush	<i>Turdus libonyanus</i>	Least Concern
577	Olive Thrush	<i>Turdus olivaceus</i>	Least Concern
579	Orange Thrush	<i>Zoothera gurneyi</i>	Least Concern
580	Groundscraper Thrush	<i>Psophocichla litsipsirupa</i>	Least Concern
581	Cape Rockthrush	<i>Monticola rupestris</i>	Least Concern
582	Sentinel Rockthrush	<i>Monticola explorator</i>	Least Concern
586	Mountain Chat	<i>Oenanthe monticola</i>	Least Concern
587	Capped Wheatear	<i>Oenanthe pileata</i>	Least Concern
588	Buffstreaked Chat	<i>Oenanthe bifasciata</i>	Least Concern
589	Familiar Chat	<i>Cercomela familiaris</i>	Least Concern



Roberts no.	English Name	Scientific Name	IUCN Status
593	Mocking Chat	<i>Thamnolaea cinnamiventris</i>	Least Concern
595	Anteater Chat	<i>Myrmecocichla formicivora</i>	Least Concern
596	Stonechat	<i>Saxicola torquata</i>	Least Concern
600	Natal Robin	<i>Cossypha natalensis</i>	Least Concern
601	Cape Robin	<i>Cossypha caffra</i>	Least Concern
619	Garden Warbler	<i>Sylvia borin</i>	Least Concern
621	Titbabbler	<i>Parisoma subcaeruleum</i>	Least Concern
625	Icterine Warbler	<i>Hippolais icterina</i>	Least Concern
628	Great Reed Warbler	<i>Acrocephalus arundinaceus</i>	Least Concern
631	African Marsh Warbler	<i>Acrocephalus baeticatus</i>	Least Concern
633	Eurasian Marsh Warbler	<i>Acrocephalus palustris</i>	Least Concern
634	Eurasian Sedge Warbler	<i>Acrocephalus schoenobaes</i>	Least Concern
635	Cape Reed Warbler	<i>Acrocephalus gracilirostris</i>	Least Concern
637	Yellow Warbler	<i>Chloropeta natalensis</i>	Least Concern
638	African Sedge Warbler	<i>Bradypterus baboecala</i>	Least Concern
643	Willow Warbler	<i>Phylloscopus trochilus</i>	Least Concern
645	Barthroated Apalis	<i>Apalis thoracica</i>	Least Concern
648	Yellowbreasted Apalis	<i>Apalis flavida</i>	Least Concern
651	Longbilled Crombec	<i>Sylvietta rufescens</i>	Least Concern
661	Grassbird	<i>Sphenoeacus afer</i>	Least Concern
664	Zitting Cisticola	<i>Cisticola juncidis</i>	Least Concern
665	Desert Cisticola	<i>Cisticola aridulus</i>	Least Concern
666	Cloud Cisticola	<i>Cisticola textrix</i>	Least Concern
667	Ayres' Cisticola	<i>Cisticola ayresii</i>	Least Concern
668	Palecrowned Cisticola	<i>Cisticola cinnamomeus</i>	Least Concern
670	Wailing Cisticola	<i>Cisticola lais</i>	Least Concern
677	Levaillant's Cisticola	<i>Cisticola tinniens</i>	Least Concern
679	Lazy Cisticola	<i>Cisticola aberrans</i>	Least Concern
681	Neddicky	<i>Cisticola fulvicapillus</i>	Least Concern
683	Tawnyflanked Prinia	<i>Prinia subflava</i>	Least Concern
685	Blackchedsted Prinia	<i>Prinia flavicans</i>	Least Concern



Roberts no.	English Name	Scientific Name	IUCN Status
686.1	Spotted Prinia	<i>Prinia hypoxantha</i>	Least Concern
689	Spotted Flycatcher	<i>Muscicapa striata</i>	Least Concern
690	Dusky Flycatcher	<i>Muscicapa adusta</i>	Least Concern
694	Black Flycatcher	<i>Melaenornis pammelaina</i>	Least Concern
698	Fiscal Flycatcher	<i>Sigelus silens</i>	Least Concern
700	Cape Batis	<i>Batis capensis</i>	Least Concern
706	Fairy Flycatcher	<i>Stenostira scita</i>	Least Concern
710	Paradise Flycatcher	<i>Terpsiphone viridis</i>	Least Concern
711	African Pied Wagtail	<i>Motacilla aguimp</i>	Least Concern
712	Longtailed Wagtail	<i>Motacilla clara</i>	Least Concern
713	Cape Wagtail	<i>Motacilla capensis</i>	Least Concern
716	African Pipit	<i>Anthus cinnamomeus</i>	Least Concern
717	Longbilled Pipit	<i>Anthus similis</i>	Least Concern
718	Plainbacked Pipit	<i>Anthus leucophrys</i>	Least Concern
719	Buffy Pipit	<i>Anthus vaalensis</i>	Least Concern
720	Striped Pipit	<i>Anthus lineiventris</i>	Least Concern
725	Yellowbreasted Pipit	<i>Anthus chloris</i>	Least Concern
727	Cape Longclaw	<i>Macronyx capensis</i>	Least Concern
731	Lesser Grey Shrike	<i>Lanius minor</i>	Least Concern
732	Fiscal Shrike	<i>Lanius collaris</i>	Least Concern
733	Redbacked Shrike	<i>Lanius collurio</i>	Least Concern
736	Southern Boubou	<i>Laniarius ferrugineus</i>	Least Concern
740	Puffback	<i>Dryoscopus cubla</i>	Least Concern
741	Brubru	<i>Nilaus afer</i>	Least Concern
743	Threestreaked Tchagra	<i>Tchagra australis</i>	Least Concern
744	Blackcrowned Tchagra	<i>Tchagra senegala</i>	Least Concern
746	Bokmakierie	<i>Telophorus zeylonus</i>	Least Concern
751	Greyheaded Bush Shrike	<i>Malaconotus blanchoti</i>	Least Concern
753	White Helmetshrike	<i>Prionops plumatus</i>	Least Concern
758	Indian Myna	<i>Acridotheres tristis</i>	Least Concern
759	Pied Starling	<i>Spreo bicolor</i>	Least Concern



Roberts no.	English Name	Scientific Name	IUCN Status
760	Wattled Starling	<i>Creatophora cinerea</i>	Least Concern
761	Plumcoloured Starling	<i>Cinnyricinclus leucogaster</i>	Least Concern
764	Glossy Starling	<i>Lamprotornis nitens</i>	Least Concern
769	Redwinged Starling	<i>Onychognathus morio</i>	Least Concern
772	Redbilled Oxpecker	<i>Buphagus erythrorhynchus</i>	Least Concern
775	Malachite Sunbird	<i>Nectarinia famosa</i>	Least Concern
783	Lesser Doublecollared Sunbird	<i>Cinnyris chalybea</i>	Least Concern
785	Greater Doublecollared Sunbird	<i>Cinnyris afra</i>	Least Concern
787	Whitebellied Sunbird	<i>Cinnyris talatala</i>	Least Concern
791	Scarletched Sunbird	<i>Chalcomitra senegalensis</i>	Least Concern
792	Black Sunbird	<i>Chalcomitra amethystina</i>	Least Concern
796	Cape White-eye	<i>Zosterops virens</i>	Least Concern
799	Whitebrowed Sparrowweaver	<i>Plocepasser mahali</i>	Least Concern
801	House Sparrow	<i>Passer domesticus</i>	Least Concern
803	Cape Sparrow	<i>Passer melanurus</i>	Least Concern
804	Southern Greyheaded Sparrow	<i>Passer diffusus</i>	Least Concern
805	Yellowthroated Sparrow	<i>Petronia superciliaris</i>	Least Concern
807	Thickbilled Weaver	<i>Amblyospiza albifrons</i>	Least Concern
810	Spectacled Weaver	<i>Ploceus ocularis</i>	Least Concern
811	Spottedbacked Weaver	<i>Ploceus cucullatus</i>	Least Concern
813	Cape Weaver	<i>Ploceus capensis</i>	Least Concern
814	Masked Weaver	<i>Ploceus velatus</i>	Least Concern
816	Golden Weaver	<i>Ploceus xanthops</i>	Least Concern
820	Cuckoofinch	<i>Anomalospiza imberbis</i>	Least Concern
821	Redbilled Quelea	<i>Quelea quelea</i>	Least Concern
824	Red Bishop	<i>Euplectes orix</i>	Least Concern
826	Golden Bishop	<i>Euplectes afer</i>	Least Concern
827	Yellowrumped Widow	<i>Euplectes capensis</i>	Least Concern
828	Redshouldered Widow	<i>Euplectes axillaris</i>	Least Concern
829	Whitewinged Widow	<i>Euplectes albonotatus</i>	Least Concern
831	Redcollared Widow	<i>Euplectes ardens</i>	Least Concern

Roberts no.	English Name	Scientific Name	IUCN Status
832	Longtailed Widow	<i>Euplectes progne</i>	Least Concern
840	Bluebilled Firefinch	<i>Lagonosticta rubricata</i>	Least Concern
842	Redbilled Firefinch	<i>Lagonosticta senegala</i>	Least Concern
844	Blue Waxbill	<i>Uraeginthus angolensis</i>	Least Concern
846	Common Waxbill	<i>Estrilda astrild</i>	Least Concern
850	Swee Waxbill	<i>Estrilda melanotis</i>	Least Concern
852	Quail Finch	<i>Ortygospiza atricollis</i>	Least Concern
854	Orangebreasted Waxbill	<i>Amandava subflava</i>	Least Concern
855	Cutthroat Finch	<i>Amadina fasciata</i>	Least Concern
856	Redheaded Finch	<i>Amadina erythrocephala</i>	Least Concern
857	Bronze Mannikin	<i>Lonchura cucullata</i>	Least Concern
860	Pintailed Whydah	<i>Vidua macroura</i>	Least Concern
862	Paradise Whydah	<i>Vidua paradisaea</i>	Least Concern
864	Black Indigobird	<i>Vidua funerea</i>	Least Concern
867	Village Indigobird	<i>Vidua chalybeata</i>	Least Concern
869	Yelloweyed Canary	<i>Serinus mozambicus</i>	Least Concern
870	Blackthroated Canary	<i>Serinus atrogularis</i>	Least Concern
872	Cape Canary	<i>Serinus canicollis</i>	Least Concern
877	Bully Canary	<i>Serinus sulphuratus</i>	Least Concern
881	Streakyheaded Canary	<i>Serinus gularis</i>	Least Concern
884	Goldenbreasted Bunting	<i>Emberiza flaviventris</i>	Least Concern
885	Cape Bunting	<i>Emberiza capensis</i>	Least Concern
886	Rock Bunting	<i>Emberiza tahapisi</i>	Least Concern

Flora and Fauna Impact Assessment Report

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Appendix E: Expected Reptile Species List



Family	Species	Common name	Threat Status
Atractaspididae	<i>Aparallactus capensis</i>	Black-headed Centipede-eater	LC
Chamaeleonidae	<i>Chamaeleo dilepis</i>	Common Flap-neck Chameleon	LC
Colubridae	<i>Boaedon capensis</i>	Brown House Snake	LC
Colubridae	<i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	LC
Colubridae	<i>Dasypeltis scabra</i>	Rhombic Egg-eater	LC
Colubridae	<i>Duberria lutrix</i>	South African Slug-eater	LC
Colubridae	<i>Lamprophis aurora</i>	Aurora House Snake	LC
Colubridae	<i>Lycodonomorphus rufulus</i>	Brown Water Snake	LC
Colubridae	<i>Lycophidion capense</i>	Cape Wolf Snake	LC
Colubridae	<i>Psammophis brevirostris</i>	Short-snouted Grass Snake	LC
Colubridae	<i>Psammophis subtaeniatus</i>	Western Yellow-bellied Sand Snake	LC
Colubridae	<i>Psammophylax rhombeatus</i>	Spotted Grass Snake	LC
Colubridae	<i>Pseudaspis cana</i>	Mole Snake	LC
Cordylidae	<i>Chamaesaura aenea</i>	Coppery Grass Lizard	LC
Cordylidae	<i>Chamaesaura macrolepis</i>	Large-scaled Grass Lizard	LC
Cordylidae	<i>Cordylus vittifer</i>	Common Girdled Lizard	LC
Elapidae	<i>Hemachatus haemachatus</i>	Rinkhals	LC
Gekkonidae	<i>Pachydactylus capensis</i>	Cape Gecko	LC
Gerrhosauridae	<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	LC
Leptotyphlopidae	<i>Leptotyphlops distanti</i>	Distant's Thread Snake	LC
Scincidae	<i>Afroablepharus wahlbergii</i>	Wahlberg's Snake-eyed Skink	LC
Scincidae	<i>Mochlus sundevallii</i>	Sundevall's Writhing Skink	LC
Scincidae	<i>Trachylepis capensis</i>	Cape Skink	LC
Scincidae	<i>Trachylepis punctatissima</i>	Speckled Rock Skink	LC
Scincidae	<i>Trachylepis varia</i>	Variable Skink	LC
Viperidae	<i>Bitis arietans</i>	Puff Adder	LC
Viperidae	<i>Causus rhombeatus</i>	Rhombic Night Adder	LC

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Appendix F: Expected Amphibian Species List

Family	Species	Common name	Threat Status	Atlas region endemic
Bufonidae	<i>Amietophrynus gutturalis</i>	Guttural Toad	LC	
	<i>Schismaderma carens</i>	Red Toad	LC	
Hyperoliidae	<i>Kassina senegalensis</i>	Bubbling Kassina	LC	
Phrynobatrachidae	<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog	LC	
Pipidae	<i>Xenopus laevis</i>	Common Platanna	LC	
Pyxicephalidae	<i>Amietia queckettii</i>	Drakensberg River Frog	LC	x
	<i>Cacosternum boettgeri</i>	Common Caco	LC	
	<i>Strongylopus fasciatus</i>	Striped Stream Frog	LC	
	<i>Strongylopus grayii</i>	Clicking Stream Frog	LC	
	<i>Tomopterna natalensis</i>	Natal Sand Frog	LC	