

DIGBY WELLS

ENVIRONMENTAL

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Proposed Development of an Underground Coal Mine and Associated Infrastructure, near Hendrina, Mpumalanga Province

Flora and Fauna Impact Assessment Report

Project Number:

XST3791

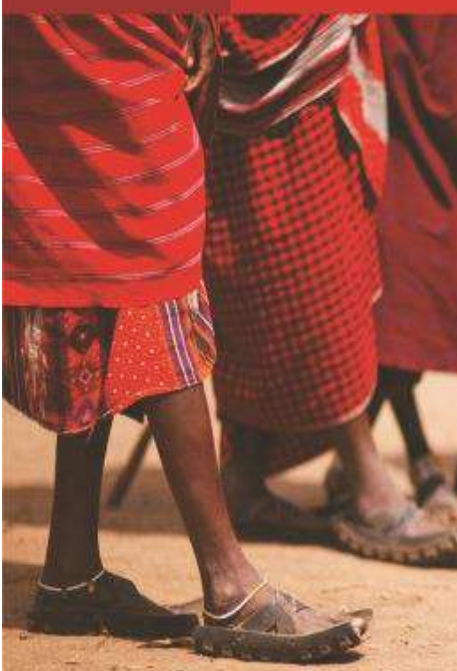
Prepared for:

Umcebo Mining (Pty) Ltd

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EXECUTIVE SUMMARY

Digby Wells Environmental (Digby Wells) has been appointed by Umcebo Mining (Pty) Ltd, a subsidiary of Glencore Operations South Africa (Pty) Ltd, to complete a flora and fauna impact assessment, as partial fulfilment of the environmental authorisation for the proposed development and operation of an underground coal mine south east of Hendrina, Mpumalanga Province. The project area proposed to be mined (underground) has a combined footprint of 6714 ha and is located within the Steve Tshwete Local Municipality (STLM) and Msukaligwa Local Municipality (MLM).

The site falls primarily within the regional vegetation type: Eastern Highveld Grasslands and partially in the Soweto Highveld Grasslands; both of which are listed as threatened ecosystems by the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004 (NEMBA)).

The majority of the study area was dominated by cultivation (3081 ha) and the dominant natural habitat type was broadly classified as *Eragrostis* dominated Grassland, covering an area of 2970 ha. In addition, ephemeral pan habitat (31ha), disturbed grassland (47 ha), alien bushclumps comprised of *Eucalyptus camuldulensis* and *Acacia mearnsii* (57 ha), *Gnidia* – *Diospyros* Rocky Grassland and *Crinum* – *Arundinella* Riparian habitat (428 ha) were delineated. A total of 137 plant species were recorded on site of the 273 recorded for the region.

Of the twelve plant Species of Special Concern (SSC) recorded for the regional list, five were recorded, including: *Aloe ecklonis* (provincially protected), *Crinum bulbispermum* (Red Data Declining and provincially protected), *Eucomis autumnalis* (Red Data Declining and provincially protected), *Haemanthus humilis* (provincially protected) and a *Satyrium* species (provincially protected). *Aloe ecklonis* and the *Satyrium* species were found in the *Eragrostis* Grassland habitat; *Crinum bulbispermum* and *Eucomis autumnalis* were found in the riparian habitat and *Haemanthus humilis* was found in the rocky grassland. Although no SCC were recorded in the infrastructure areas, they may occur.

A total of 22 mammal species have been recorded on site, five of which are SSC, including Near Threatened: African Clawless Otter (*Aonyx capensis*), and provincially protected: Steenbuck (*Raphicerus campestris*), Serval (*Felis serval*), Aardwolf (*Proteles cristatus*) and Aardvark (*Orycteropus afer*). A total of 83 bird species were recorded. Four frog species were recorded on site, namely: *Amietia angolensis* (Common River Frog), *Bufo gutturalis* (Guttural Toad), *Cacosternum boettgeri* (Common Caco) and *Strongylopus fasciatus* (Striped Stream Frog).

The primary impact of the proposed development is a loss of flora and fauna habitat in the form of *Eragrostis* dominated Grassland (43ha) due to infrastructure development. Due to the minimal extent and the moderate sensitivity assigned to this habitat, the impacts identified will be moderate. Alien plant invasion is expected due to surface disturbance due to infrastructure and this should be managed by implementing an alien plant management

plan for quarterly monitoring that should take place for at least two years after construction and an additional two years after decommissioning.

The direct impacts on fauna are expected to be low to negligible. The impact of habitat destruction will not affect fauna SSC as these species will move away from the area of construction and settle on other areas, probably within the project area.



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1 Introduction

Umcebo Mining (Pty) Ltd (Umcebo), a subsidiary of Glencore Operations South Africa (Pty) Ltd (Glencore) is proposing the development and operation of a new underground coal mine and associated infrastructure at a site situated approximately 10 to 22 kilometres (km) south east of Hendrina in the Mpumalanga Province of South Africa (the project).

Umcebo currently holds two Prospecting Rights (PRs), namely, MP 1265 PR and MP 1266 PR, located within the Ermelo Coal Field. The total extent of MP 1265 PR (referred to as Mooivley East and Mooivley West) is 3 923 ha and comprise the following farms and portions:

- Mooivley 219 IS – Portions 2, 4, 5 and Remaining Extent (RE) of the farm;
- Tweefontein 203 IS – Portions 2, 15, 16, 17 and Portion of Portion 14;
- Uitkyk 220 IS – Portions 2 and 3; and
- Orange Vallei 201 IS – Portions 1 and RE of the farm.

The total extent of MP 1266 PR (referred to as Hendrina South) is 2 787 ha and comprises the following farm and portions:

- Elim 247 IS - RE of the farm;
- Geluksdraai 240 IS – 1 and 2;
- Orpenskraal 238 IS – RE of the farm; and
- Bosmanskrans 217 IS – Portions 1, 3, 4, 6, 8, 9 and RE of the farm.

The project area proposed to be mined (underground) has a combined footprint of 6 714 ha and is located within the Steve Tshwete Local Municipality (STLM) and Msukaligwa Local Municipality (MLM). The site locality is represented in Figure 2-1.

2 Project Overview

The project area comprises three underground reserve blocks namely Mooivley East, Mooivley West and Hendrina South. The two Mooivley reserves comprise two incline shafts which will be developed to gain access to the two underground areas whilst the Hendrina South reserve comprises an incline shaft to gain access to one underground area. Mooivley West and Hendrina South will be mined at the same time. Mooivley East mining activities will commence following the mining of Mooivley West and Hendrina South.



The estimated Life of Mine (LoM) will be 30 years¹ for all mining areas with a production rate of 2.4 million tonnes per annum at full capacity, with a total of approximately 78 million tonnes of Run of Mine (ROM). The mine will reach full production within the first four years.

The grade of coal is poor and therefore not suitable for export. The coal product will be transported to a nearby Eskom power station (i.e. Kusile, Kendal, Kriel, and Grootvlei); via the existing road network.

The project is proposed to commence with construction and development when all required licences and authorisations have been granted.

Due to the depth of the resource (i.e. 32 m to 128 m), underground mining will be used to access the ore body. The proposed mining method for the extraction of coal will be bord and pillar. In mechanised bord and pillar mining, extraction is achieved by developing a series of roadways (bords) in the coal seam connected by splits (cut-throughs) to form pillars and is done through the use of machinery referred to as a continuous miner. Any overburden material extracted will be stockpiled and used to rehabilitate the incline shafts once mining is completed. The ROM will be transported, via conveyor, to a Crushing and Screening Plant (625 m²), which will be located within the footprint of the product stockpile. All proposed mine infrastructure has been reflected on Figure 2-2 and includes the following:

- Crushing and Screening Plant;
- Overburden and Product Stockpiles;
- Access and Service Roads (with weighbridge);
- Overland Conveyors;
- Three Access Points to the Underground Reserve (Two shafts per Access Point);
- Three Ventilation Shafts (One per Access Point);
- Office Complex (change house, workshop, offices);
- Three PCD and Water Pipelines;
- Five Aboveground Storage Tanks;
- Three Waste Bins per Shaft;
- Site Fencing located around the Conveyer Belt and each Mining Complex;
- Diesel Generator and Sub-station;
- Water Treatment Plant; and
- Package Sewage Treatment Plant.

¹ The MRA will be made for an initial period of 30 years, the maximum allowed in terms of the provisions of Section 23 of the MPRDA. At the end of this period an application for renewal of the mining right will be made for any remaining reserves.

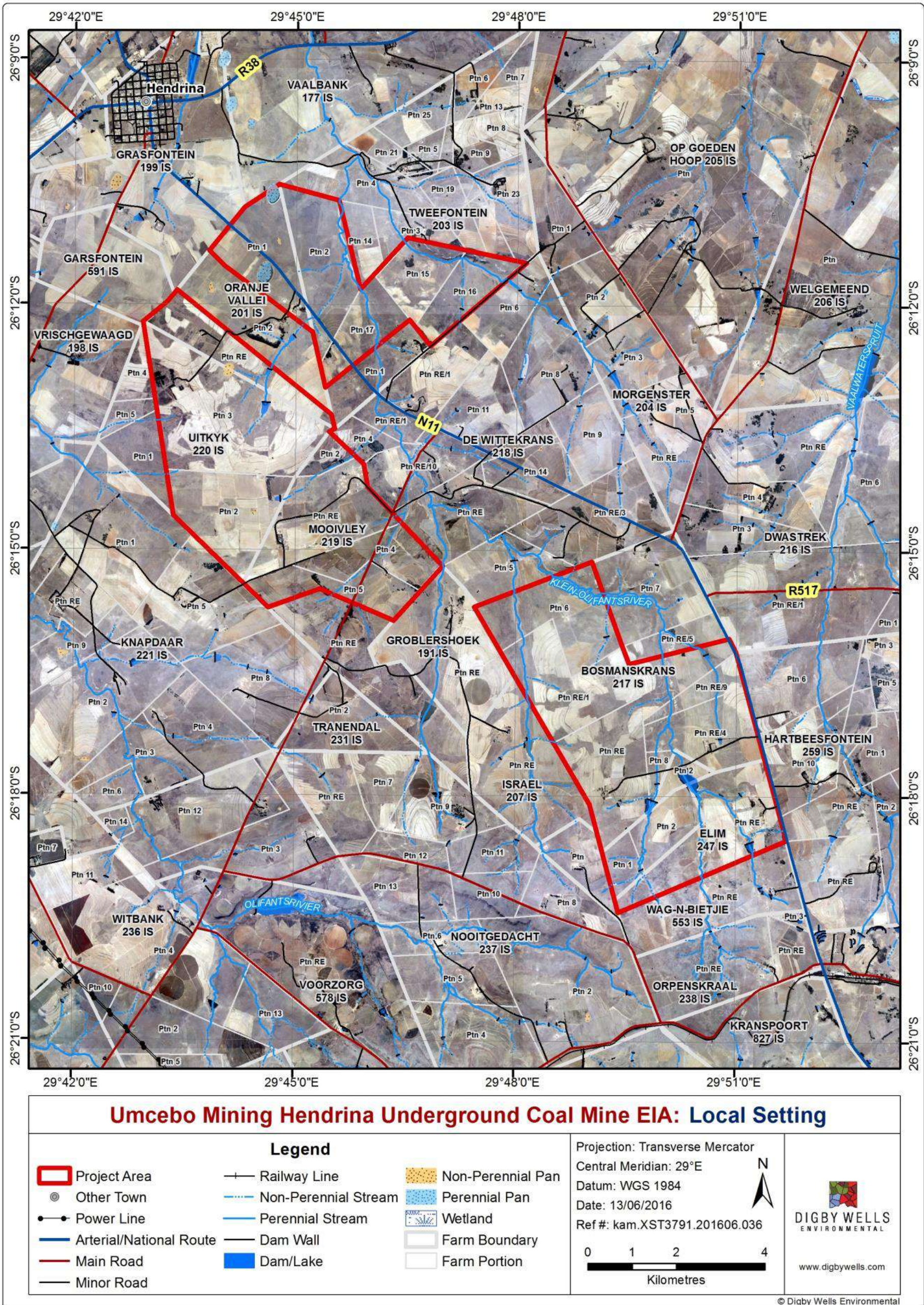


Figure 2-1: Site Locality

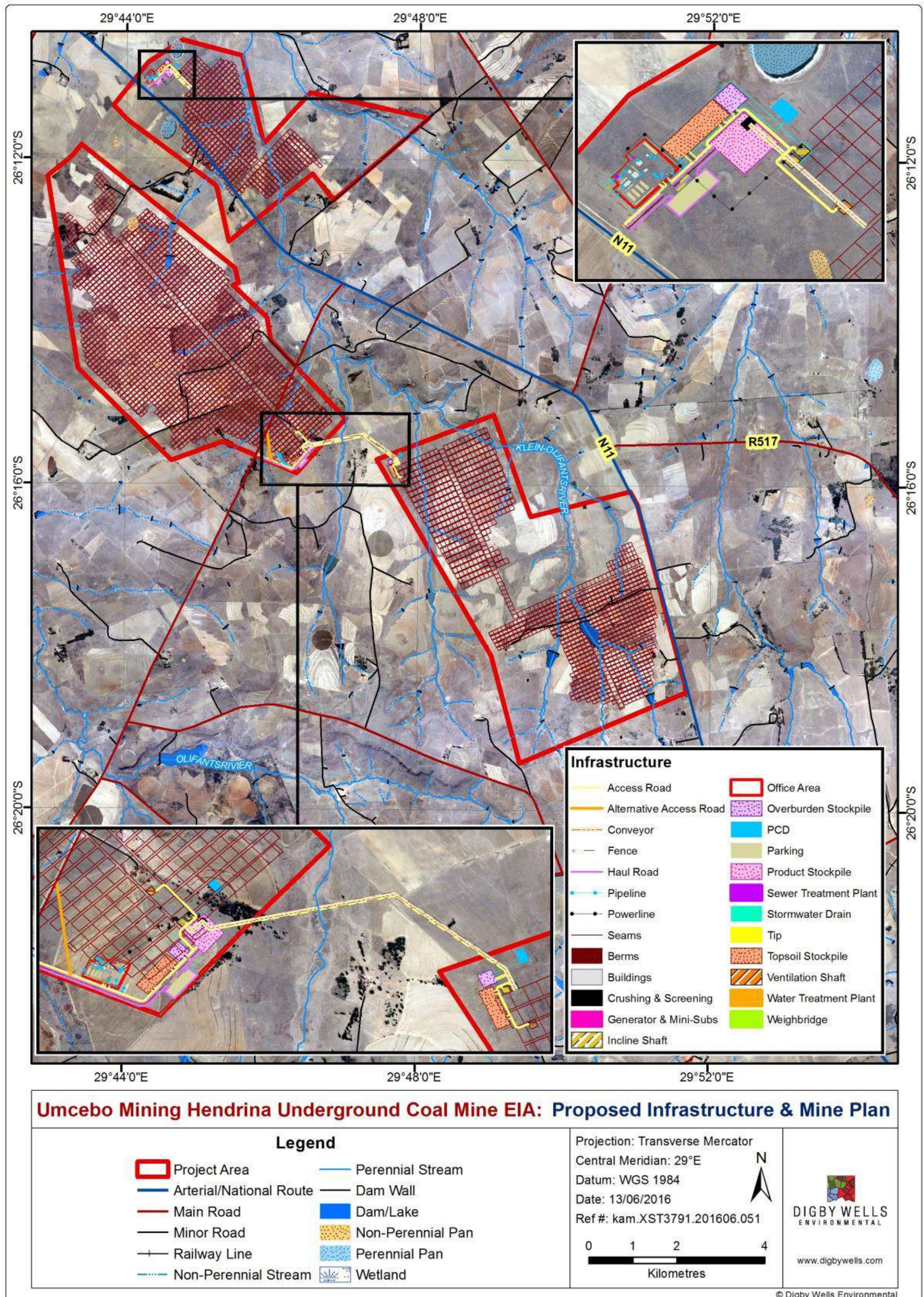


Figure 2-2: Study Area and Mine Plan



3 Terms of Reference

The agreed terms of reference include the following deliverables for this Flora and Fauna Impact Assessment Report include the following:

- Record the plant species that occur within the study area based on field surveys;
- Record the animal species (mammals, reptiles, amphibians, birds and invertebrates (butterflies and spiders) that occur within the study area based on field surveys;
- Identify which of these species are Species of Special Concern (SSC) based on the following lists:
 - International Union for the Conservation of Nature (IUCN) red data list,
 - The South African National Biodiversity Institute (SANBI) red data list,
 - The South African Red Data lists for mammals, birds, butterflies,
 - The National Environmental Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA), and
 - The Convention on International Trade in Endangered Species of Flora and Fauna (CITES) list.
- Determine if any of the recorded species are alien invasive species or problem species in terms of NEMBA alien invasive species;
- Using data gathered from the field, determine the vegetation communities occurring within the study area and map these;
- Map important habitats for fauna within the study area;
- Determine the biodiversity value of the study area using information gathered on both flora and fauna and map this; and
- Assess the identified impact of the proposed project and recommend mitigation measures.

4 Details of the Specialist

Rudi Greffrath is manager of Digby Well's Biophysical department's Fauna, Flora and Wetlands Unit and has a National diploma and B-tech in Nature Conservation from Nelson Mandela Metropolitan University's George Campus and is a Certificated Natural Scientist (Reg no. 200245/13). He has ten years' experience in the environmental consulting field specifically in the terrestrial ecology within the Highveld grasslands and Savanna regions of Southern and central Africa and the forest regions of central and West Africa. He specialises in fauna and flora surveys, biodiversity surveys, environmental management plans, environmental monitoring and rehabilitation for projects in accordance with the International Finance Corporation (IFC) and World Bank. Rudi has gained experience working throughout Africa specifically Sierra Leone, Ghana, Mali, Botswana, Namibia and Cote D'Ivoire.

Crystal Rowe specialises in flora and wetland ecology. She achieved a BSc in Botany and Geology and a BSc Hons in Botany at Nelson Mandela Metropolitan University (NMMU). Key experience includes ecological impact assessments, baseline vegetation assessments, estuarine ecological state assessments and wetland health assessments. Project experience includes various countries such as: the DRC, Ethiopia, the Ivory Coast, Mali, Mozambique, Sierra Leone and extensively within South Africa. Crystal is competent in plant identification and is experienced in IFC compliant assessments. She is also certified to complete wetland Ecosystem Services and is a registered professional natural scientist in South Africa (Reg. No. 400090/15).

Curricula Vitae of the specialists involved in this study can be found in Appendix A.

5 Methodology

5.1 Literature Review and Desktop Study

A desktop study was undertaken, aiming to identify:

- Potential species in the site area according to the SANBI PRECIS List's;
- South African Bird Atlasing Project (SABAP2);
- Potential Red Data species and their current status;
- Expected vegetation type and community structure, (Mucina and Rutherford 2006); and
- Current biodiversity and ecosystem status.

5.2 Field Investigation

The site visits and detailed infield flora and fauna assessments took place from the 14th to 17th of March; 23rd to 26th of May and 28th to 29th of April 2016. Flora sampling points are indicated in Figure 5-1.

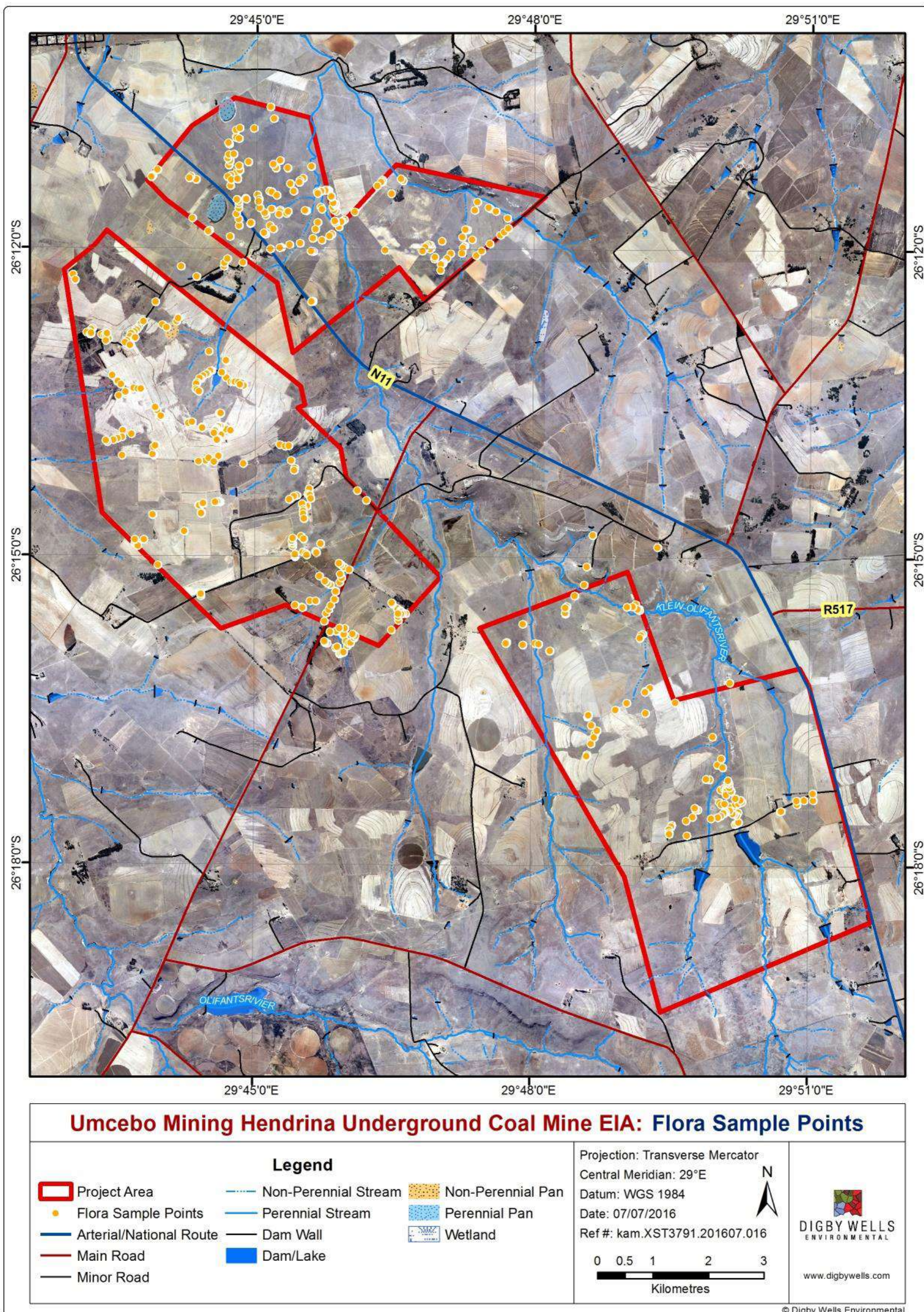


Figure 5-1: Flora Sampling Points



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 100 m² was sampled. 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.

5.2.2 Species of Special Concern

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 (2015),
- The South African National Biodiversity Institute (SANBI) Red Data list version 2015.1,
- The South African Red Data lists for mammals (2004), birds (2016), butterflies;
- The National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004), and
- The Convention on International Trade in Endangered Species of Flora and Fauna (CITES) list (2016).

An initial list of SSC expected to be found within the study area comprises PSSC (Possible Species of Special Concern). If any of these (and any additional species on the above lists) are recorded on site, they are ascribed the status Confirmed Species of Special Concern (CSSC).

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, 2010). The categories are described in Table 5-2 below.

Table 5-2: Red Data Categories (taken from SANBI 2012)

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.
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
	Threatened	



CATEGORY		DESCRIPTION
	Other categories of conservation concern	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
	Other categories	

The online IUCN data base was referenced in order to identify Red Data species and their various threat status categorisations.

5.3 Fauna

A two season survey, summer (14th to the 18th of March 2016) and winter (23th to the 25th of May 2016), was conducted for this project. A detailed desktop study was also conducted for mammals, birds, reptiles and frogs, this information can be found in the relevant scoping report. All fauna species encountered on site were identified and recorded. The following methods were used during the survey, the location of the sampling areas are shown in Figure 5-2.

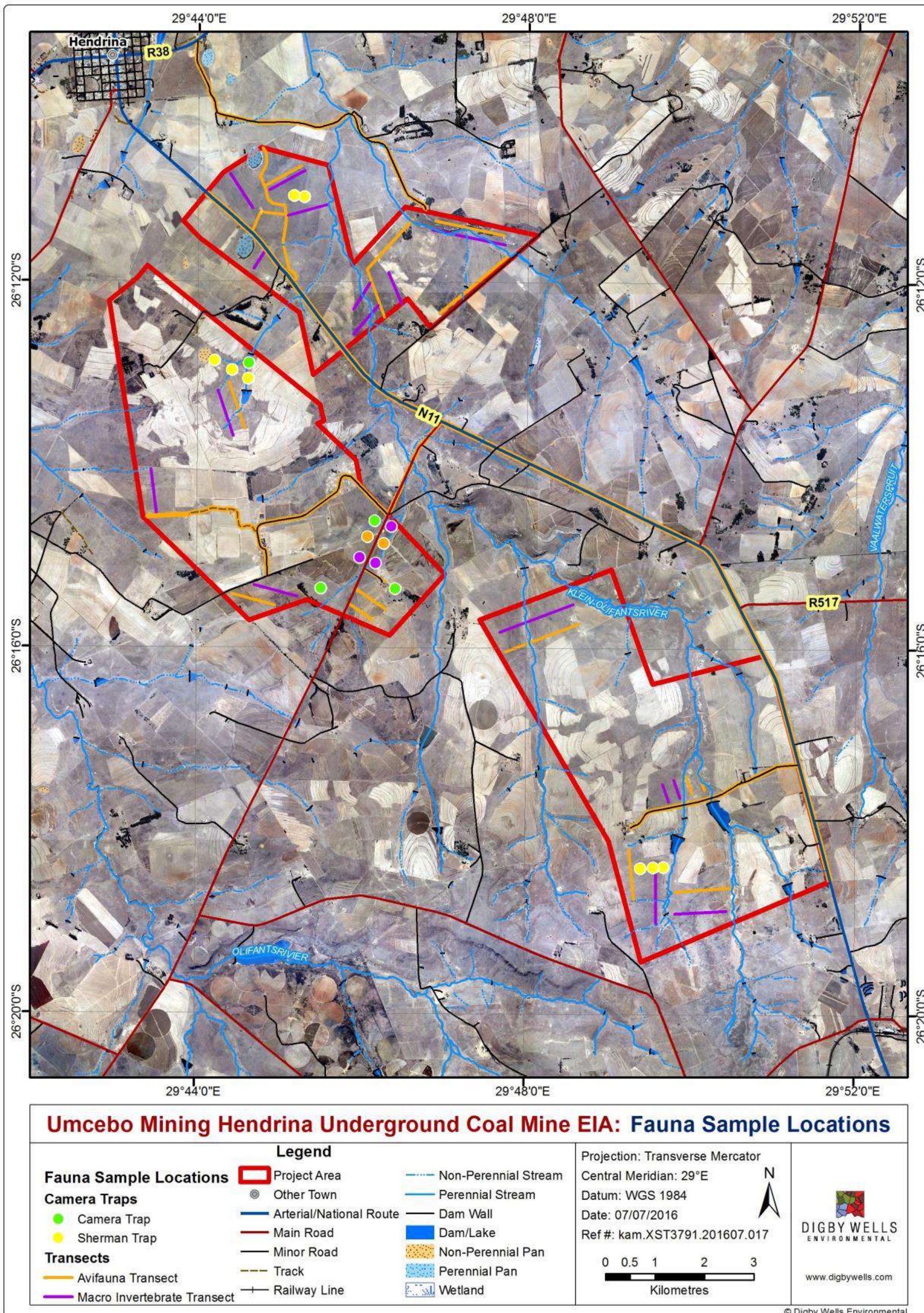


Figure 5-2: Fauna Sampling Points Locations



5.3.1 Mammals

Small mammals were sampled through opportunistic sightings, as well as the use of Sherman traps. The 20 traps were baited with small mammal bait and left for the duration of the field work time, three nights and two days. If no small mammals were captured after a day, the traps were moved to a different location and re-baited. If small mammals were captured, the traps were rebaited and re-set in the same position. All Sherman traps were checked once a day, in the early morning. Large mammals were recorded using scats, tracks and nesting or breeding sites such as burrows and dens. Scats and tracks found, during active searches, were photographed with a scale and identified. For identification purposes the following field guides were used, Mammals of Southern Africa (Smithers, 1983), The Mammals of the Southern African Sub-region (Skinner & Chimimba, 2005), Red Data Book of the Mammals of South Africa (Friedman & Daly 2004) and camera traps placed throughout the sites, mainly at water points.

5.3.2 Avifauna

The principal ornithological field survey technique used was transect surveys and random point surveys. Transect surveys were planned based on representative sites of different avifauna habitat, such as pans, dams, wetlands, open grassland and road reserves by simply following available roads and paths that transect over these habitat types. Transect procedures involve slow attentive walks along transects during which any bird seen or heard is identified and recorded; this was completed during diurnal surveys only. Species observed during the vegetation surveys and other field trips were also recorded.

The following was recorded:

- All birds encountered or noted during the survey;
- All birds observed by people residing in the study area; and
- A list of rare and endangered species encountered.

Visual identification of birds was used to confirm bird calls where possible. Bird species were confirmed using Sinclair *et. al.* (2002) and Robert's birds (2009).

5.3.3 Herpetofauna (Reptiles and Amphibians)

Herpetofauna include reptile and amphibian species. Direct/opportunistic observations were conducted 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 was refuge examinations using visual scanning of terrains to record smaller herpetofaunal species which often conceal themselves under rocks and in fallen logs, rotten tree stumps, under rocks, in leaf litter, rodent burrows, ponds, old termite mounds, etc. Amphibians and reptiles observed by people residing in the study area were also recorded. Branch (2001), Du Preez and Caruthers (2009) and Carruthers (2009) was used to confirm identification where necessary.



5.3.4 Macro-Invertebrates

During the wet season survey, butterflies were photographed and identified where and when they were seen. In the dry season, transects were walked within identified vegetation/habitat types in order to identify any invertebrate activity or individuals.

5.3.5 Red Data Faunal Assessment

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

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

Probability of occurrence is presented in four categories, namely:

- Low (unlikely to occur);
- Medium (could possibly occur);
- High (most likely could occur); or
- Recorded (does occur on site).

The IUCN Red Data categories are used for the status identification of mammals, birds, reptiles and amphibians globally.

5.4 Study Limitations

The following limitations were encountered during this study:

- Whilst every effort is made to cover as much of the site as possible, representative sampling is done and it is possible that some plant and animal species that are present on site were not recorded during the field investigations, due to seasonality;
- During faunal field sampling no pitfall traps were used due to excessive rain conditions which meant pitfalls flooded and no trapping was achieved; and



- Access to certain infrastructure areas (Tweefontein 203 and portion 2) was not granted at the onset of the project and as a result, these areas were assessed during the winter season. This places a limitation on the plant species identification, since many of the identifying features are not present during winter as most of flora species are dormant during the cold winter months in the highveld.

6 Regional Vegetation

The project area falls within the Eastern Highveld Grassland and Soweto Highveld Grassland as described by Mucina and Rutherford (2006) in the Grassland Biome (Table 6-1). 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, 2012).

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. These vegetation types occur within Mpumalanga Province at an altitude of 1520 to 1780 meters above sea level.

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, 2012). The important biodiversity contained within the grasslands, which underpins life, is being eroded to such an extent that human wellbeing is threatened. Common and characteristic plant species of the Eastern Highveld and Soweto Highveld Grasslands are listed in Table 6-1 and Table 6-2 and their distribution relative to the project area is found in Figure 6-1.

Table 6-1: Common and Characteristic Plant Species of the Eastern Highveld Grassland

Plant form	Species
Graminoids (grasses and sedges)	<i>Heteropogon contortus</i> , <i>Aristida aequiglumis</i> , <i>A. congesta</i> , <i>A. junciformis</i> subsp. <i>Galpini</i> , <i>Brachiaria serrata</i> , <i>Cynodon dactylon</i> , <i>Digitaria monodactyla</i> , <i>D. tricholaenoides</i> , <i>Elionurus muticus</i> , <i>Eragrostis chloromelas</i> , <i>E. curvula</i> , <i>E. plana</i> , <i>E. racemosa</i> , <i>E. sclerantha</i> , <i>Heteropogon contortus</i> , <i>Loudetia simplex</i> , <i>Microchloa caffra</i> , <i>Monocymbium cereiiforme</i> , <i>Setaria sphacelata</i> , <i>Sporobolus africanus</i> , <i>S. pectinatus</i> , <i>Themeda triandra</i> , <i>Trachypogon spicatus</i> , <i>Tristachya leucothrix</i> , <i>T. rhmanni</i> , <i>Alloteropsis semialata</i> subsp. <i>eckloniana</i> , <i>Andropogon appendiculatus</i> , <i>A. schirensi</i> , <i>Bewisia biflora</i> , <i>Ctenium concinnum</i> , <i>Diheteropogon amplexans</i> , <i>Eragrostis capensis</i> , <i>E. dummiiflua</i> , <i>E. patentissima</i> , <i>Harporchloa falx</i> , <i>Panicum natalense</i> , <i>Rendlia altera</i> , <i>Schizachyruim sanguineum</i> , <i>Setaria nigrirostris</i> , <i>Urelytrum agropyroides</i>



Plant form	Species
Herbs	<i>Berkheya setifera</i> , <i>Haplocarpha scaposa</i> , <i>Euryops gifillani</i> , <i>Justicia anagalloides</i> , <i>Acalyha angusta</i> , <i>Cahmaecrista mimosoides</i> , <i>Dicoma anomala</i> , <i>E. transvalensis</i> subsp. <i>setilobus</i> , <i>Helichrysum aureonitens</i> , <i>H. caespitium</i> , <i>H. callicomum</i> , <i>H. oreophilum</i> , <i>H. caespitium</i> , <i>H. oerophilum</i> , <i>H. rugulosum</i> , <i>Ipomoea crassipes</i> , <i>Pentanisia prunelloides</i> subsp. <i>latifolia</i> , <i>Selago densiflora</i> , <i>Senecio coronatus</i> , <i>Hilliardiella oligocephala</i> , <i>Wahlenbergia undulata</i>
Geophytic herbs	<i>Gladiolus crassifolius</i> , <i>Haemanthus humilis</i> subsp. <i>hirsutus</i> , <i>Hypoxis rigidulua</i> var. <i>pilosissima</i> , <i>Ledebouria ovatifolia</i>
Succulent herb	<i>Aloe ecklonis</i>
Low shrubs	<i>Anthospermum rigidum</i> subsp. <i>pumilum</i> , <i>Seriphium plumosa</i>

Table 6-2: Common and Characteristic Plant Species of the Soweto Highveld Grassland

Plant Forms	Species
Graminoids (grasses)	<i>Andropogon appendiculatus</i> , <i>Brachiaria serrata</i> , <i>Cymbopogon pospischillii</i> , <i>Cynodon dactylon</i> , <i>Elionurus muticus</i> , <i>Eragrostis capensis</i> , <i>E. chloromelas</i> , <i>E. curvula</i> , <i>E. plana</i> , <i>E. planiculmis</i> , <i>E. racemosa</i> , <i>Heteropogon contortus</i> , <i>Hyparrhenia hirta</i> , <i>Setaria nigrirostris</i> , <i>S. sphacelata</i> , <i>Themeda triandra</i> , <i>Tristachya leucothrix</i> , <i>Andropogon schirensis</i> , <i>Aristida adscensionis</i> , <i>A. bipartita</i> , <i>A. congesta</i> , <i>A. junciformis</i> subsp. <i>galpinii</i> , <i>Cymbopogon caesius</i> , <i>Digitaria diagonalis</i> , <i>Diheteropogon amplectens</i> , <i>Eragrostis micrantha</i> , <i>E. superba</i> , <i>Harpochloa falx</i> , <i>Microchloa caffra</i> , <i>Paspalum dilatatum</i>
Herbs	<i>Hermannia depressa</i> , <i>Acalypha angustata</i> , <i>Berkheya setifera</i> , <i>Dicoma anomala</i> , <i>Euryops gifillanii</i> , <i>Geigeria aspera</i> var. <i>aspera</i> , <i>Graderia subintergra</i> , <i>Haplocarpha scaposa</i> , <i>Helichrysum miconiifolium</i> , <i>H. nudifolium</i> var. <i>nudifolium</i> , <i>H. rugulosum</i> , <i>Hibiscus pusillus</i> , <i>Justicia anagalloides</i> , <i>Lippia scaberrima</i> , <i>Rhynchosia effusa</i> , <i>Schistostephium crataegifolium</i> , <i>Selago densiflora</i> , <i>Senecio coronatus</i> , <i>Hilliardiella oligocephala</i> , <i>Wahlenbergia undulata</i>
Geophytic herbs	<i>Haemanthus humilis</i> subsp. <i>hirsutus</i> , <i>Haemanthus montanus</i>
Herbaceous climber	<i>Rhynchosia totta</i>
Low shrubs	<i>Anthospermum hispidulum</i> , <i>A. rigidum</i> subsp. <i>pumilum</i> , <i>Berkheya annectens</i> , <i>Felicia muricata</i> , <i>Ziziphus zeyheriana</i>

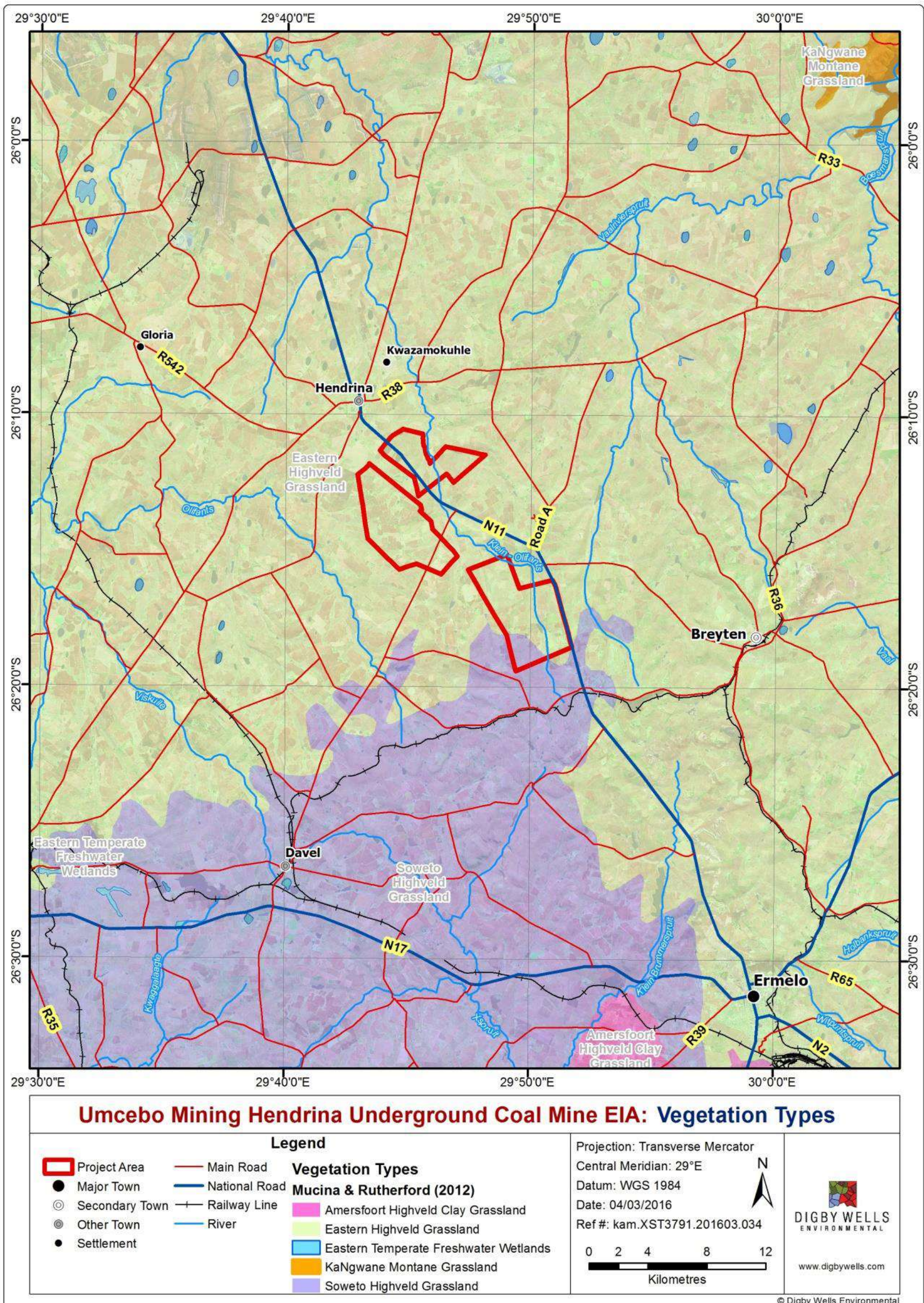


Figure 6-1: Vegetation types (Mucina and Rutherford, 2012)



7 Results of Baseline Fauna and Flora Assessment

7.1 Flora

The majority of the study area (3 081 ha and 46%) had undergone transformation due to cultivation for maize and soy beans. Livestock were also observed throughout most of the site and evidence of overgrazing was recorded in grassland areas; showing a dominance of increaser species and some erosion. Despite these impacts, areas that were left intact showed a high diversity of grasses and forbs, particularly members of the Asteraceae family and the *Helichrysum* genus.

A total of 137 plant species were recorded on site (Appendix C), of 273 listed (recorded by SANBI in the relevant grid in the past) in the regional list (Appendix B), however more may occur that was not recorded and identified by SANBI and therefore not on the PRECIS List.. The natural areas associated with the project area are discussed in more detail in the sections to follow. The disturbed grassland areas included former cultivated fields that had been colonised by alien plants and pioneer species. The primary land uses and vegetation habitats identified on site are listed in Table 7-1.

Table 7-1: Vegetation Habitats (and other land use) and Approximate Areas

Vegetation Unit	Area (ha)	Proportion of total project area (%)
Pan/Depressions	31	0.5
Infrastructure	41	0.6
Disturbed Grassland	47	0.7
Alien Bushclumps	57	0.8
<i>Gnidia</i> - <i>Diospyros</i> Rocky Grassland	61	0.9
<i>Crinum</i> - <i>Cymbopogon</i> Riparian Habitat	428	6.4
<i>Eragrostis</i> Grassland	2970	44.2
Cultivation (maize and soybean)	3081	45.9
Total	6716	100

7.1.1 *Crinum* –*Arundinella* Riparian Habitat

The riparian habitat is associated with the Klein Olifants River and channelled valley bottom wetlands that run through the site. The wetland delineation is represented in the Wetland Assessment Report (Digby Wells, 2016). The channel was mostly bare; comprised of exposed bedrock or river sand (examples of typical habitat features are shown in Figure 7-1). Where standing water was present; *Typha capensis* (Common Bulrush), *Imperata cylindrica* (Cottonwool Grass) and *Arundinella nepalensis* (River Grass) had colonised (examples in Figure 7-2). Terrestrial species typical of the *Eragrostis*-dominated Grassland



(description to follow in section 7.1.3) were found on the banks of the Klein Olifants River. A single Red Data listed plant species was recorded in this habitat, namely: *Eucomis autumnalis* (Pineapple Flower), listed as Declining. In addition, *Crinum bulbispermum* (River Lily), which is dominant in this vegetation unit, is provincially protected (according to Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998): Schedule 11). Alien plant species that had colonised this vegetation unit included: *Acacia mearnsii* (Black Wattle), *Salix babylonica* (Babylon Willow) and *Cirsium vulgare* (Scotch Thistle).



Figure 7-1: Examples of Riparian Habitat



Figure 7-2: Examples of Plant Species Characteristic of the Riparian Channel (A: *Typha capensis* (Common Bulrush) and B: *Arundinella nepalensis* (River Grass))



7.1.2 Gnidia - Diospyros Rocky Grassland

The rocky grassland was comprised of relatively short grass (<1.8cm) and a high diversity of epilithic (growing on rock surface) forb species. Rocky outcrops represented a type of ecological niche, characterised by shallow soils over sandstone outcrops. Rocky outcrops occurred primarily along riparian zones and were typified by shrubs such as: *Diospyros lycioides* (Bluebush); *Gnidia kraussiana* and *Searsia dentata* (Nana Berry); and characteristic species such as: *Leonotis leonurus* (Lion's Ear), *Psammotropha myriantha* and *Haemanthus humilis* (Rabbit's Ear). Examples of common plant species identified in the *Gnidia* – *Diospyros* Rocky Grassland are represented in Figure 7-3.

Alien plant invasion was limited in this habitat, which represented the most intact vegetation of all units delineated for the study area. Alien plants included: *Tagetes minuta* (Khakibos) and *Bidens pilosa* (Blackjacks). A single SSC plant was recorded on site, namely: *Haemanthus humilis* (Rabbit's Ear), a provincially protected plant species.



Figure 7-3: Examples of Plant Species found in Rocky Outcrops (A: *Psammotropha myriantha*; B: *Searsia dentata*; C: *Haemanthus humilis*; D: *Crassula* sp.; E: *Dicoma anomala*; F: *Diospyros lycioides* in flower)

7.1.3 *Eragrostis* - dominated Grassland

This *Eragrostis*-dominated Grassland covered the majority of the natural areas associated with the study site and can further be subdivided into wetland and terrestrial habitats. The substrate of the wetland areas was composed of moist clays and rocky outcrops which formed the top of hillslope seeps. *Eragrostis gummiflua* (Gum Grass), unfavoured by cattle, was dominant and additional *Eragrostis* species were prevalent, including: *Eragrostis curvula* (Lovegrass), *Eragrostis racemosa* (Narrow Heart Love Grass) and *Eragrostis chloromelas* (Curly Leaf). Additional grass species included *Aristida congesta* subsp. *congesta* (Spreading Three-awn), *Hyparrhenia hirta* (Common Thatching Grass), *Themeda triandra*



(Red Grass), *Agrostis lachnantha* (Bent Grass) and *Imperata cylindrica* (Cottonwool Grass) along hillslope seeps.

Common and characteristic forbs and succulents included: *Aloe ecklonis* (Grass Aloe), *Chironia palustris* (Transvaal Chironia), *Haplocarpha scaposa* (False Gerbera), *Helichrysum oligocephala*, *Wahlenbergia* spp., and *Verbena brasiliensis* (Brazilian Vervain). Examples of the landscape and characteristic features are represented in Figure 7-4. Alien plant invasion was moderate in certain areas adjacent to cultivated fields and along roadsides, including species such as: *Datura stramonium* (Downy Thorn Apple), *Solanum sysimbriifolium* (Sticky Nightshade) and *Verbena brasiliensis* (Brazilian Vervain). A single plant SSC was recorded on site, namely: *Aloe ecklonis* (Grass Aloe); provincially protected (Mpumalanga Nature Conservation Act no. 10 of 1998 – Schedule 12).

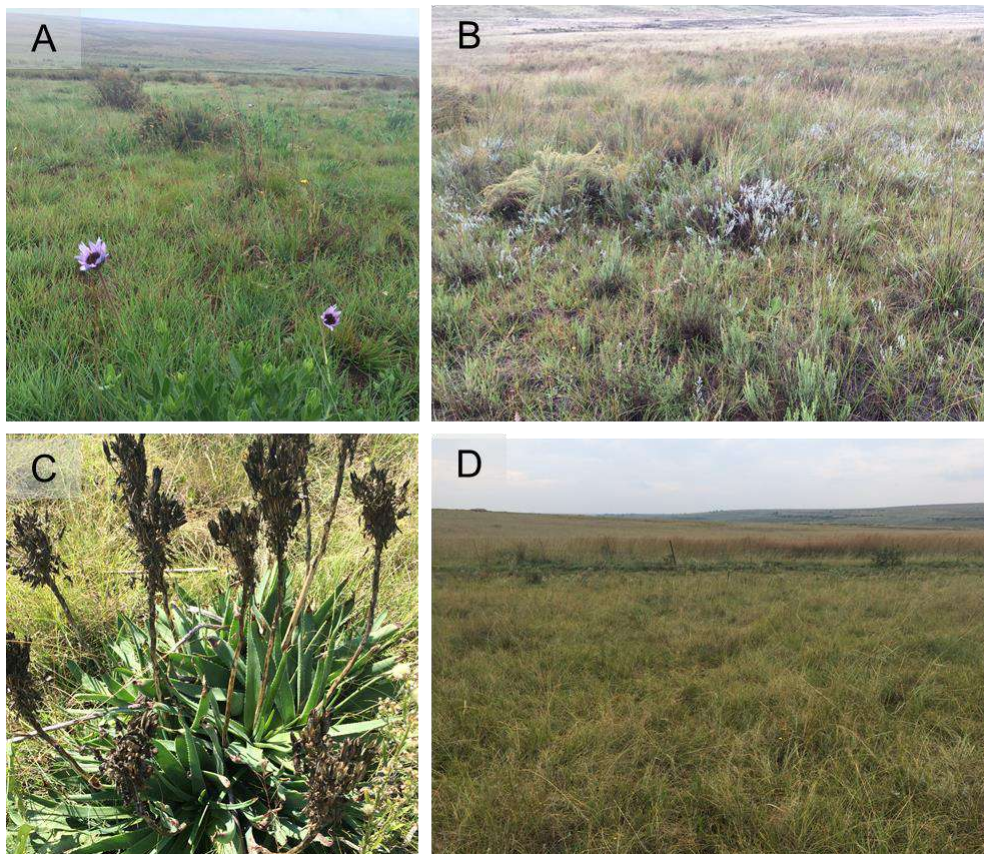


Figure 7-4: Examples of the Landscape and Common Features of the *Eragrostis*-dominated Grassland (A: intact grassland on Tweefontein 203 Farm portion 15; B: grassland dominated by *Helichrysum aureonitens*; C: *Aloe ecklonis* on Bosmanskrans portion 8; D: typical *Eragrostis*-dominated grassland adjacent to maize fields)

7.1.4 Ephemeral Pans

Pans represented unique environments on site and were typically not colonised by plant species, except for the seepage areas around them. Pans are depressions without outflow that occur mainly in the drier western parts of the country (including the Northern Cape, Free State and North-west Provinces), but are also found in the wetter eastern parts (Gauteng and Mpumalanga Provinces) and in the Kruger Park National Park. Common and characteristic plant species found to colonise pan edges included: *Cyperus semitrifidus*; *Juncus effusus* (Common Rush), *Persicaria lapatholia* and *Agrostis lachnantha* (Bent Grass). No Red Data or any protected plant species were recorded in this habitat.

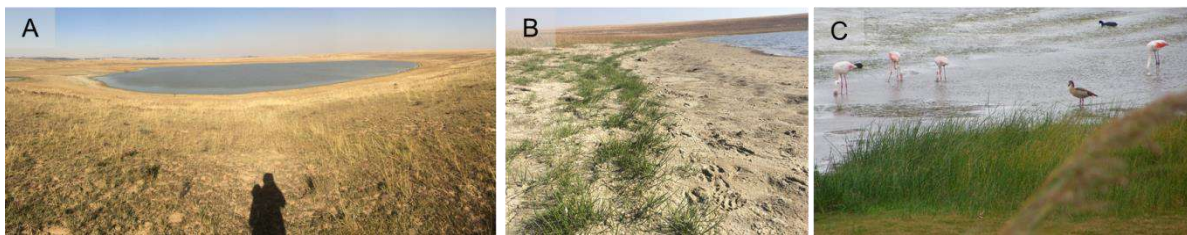


Figure 7-5: Examples of Ephemeral Pan Habitat on Site

The distribution of vegetation units is represented in Figure 7-6.

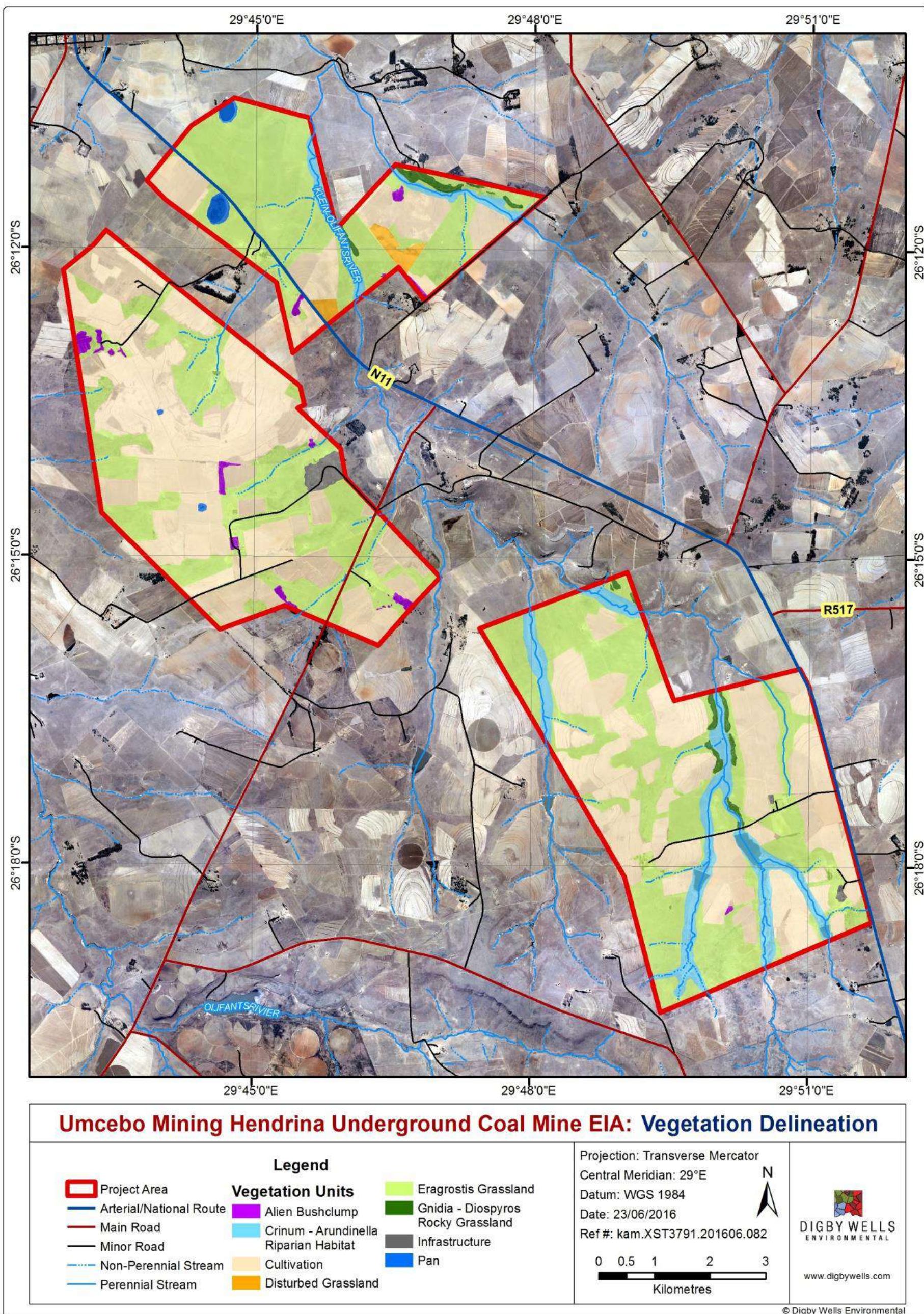


Figure 7-6: Vegetation Habitats



7.1.5 Plant Species of Special Concern

The study site lies within four QDS grids, namely: 2629BA, 2629BB, 2629BC and 2629BD. According to the PRECIS, eight Red Data species are expected to occur for the QDS's for the sites.

A detailed list of plant species recorded by the SANB PRECIS List for the above mentioned grids is included in Appendix B. These species are expected to be present within undisturbed areas with suitable habitat within the proposed development footprint area. The eight Red Data species identified in the PRECIS List are also listed by the Mpumalanga Nature Conservation Act, 1998 (Act No 10 of 1998) as Schedule 11 (Protected) species, as well as the South African Red Data List and the CITES list.

Table 7-2 lists the plant SSC that were recorded in the regional lists, as well as those recorded on site and examples of these are represented in Figure 7-7. Five plants SSC were recorded, all of which are provincially protected; including two declining species.

Aspidoglossum xanthosphaerum is unlikely to occur since this species has only been recorded in four locations in montane grassland. *Khadia carolinensis* is likely to occur and has been recorded by Digby Wells in the greater study region before, but was not encountered in plant sampling plots. The *Satyrium* species was recorded just outside of the study boundary and suitable habitat is found on site.

Table 7-2: Plant Species of Special Concern

Species	SA Red List	Provincial List	CITES	Recorded on site
<i>Aloe ecklonis</i>	LC	x	II	x
<i>Aspidoglossum xanthosphaerum</i>	VU	-		
<i>Crinum bulbispermum</i>	Declining	x		x
<i>Gladiolus crassifolius</i>	LC	x	-	
<i>Gladiolus robertsoniae</i>	NT	x	-	
<i>Eucomis autumnalis</i>	Declining	x		x
<i>Haemanthus humilis subsp. hirsutus</i>	-	x	-	x
<i>Hypoxis hemerocallidea</i>	Declining	-		
<i>Pachycarpus suaveolens</i>	VU	-		
<i>Satyrium</i> s.p.		x		x
<i>Nerine gracilis</i>	VU	-		
<i>Zantedeschia pentlandii</i>	VU	-		

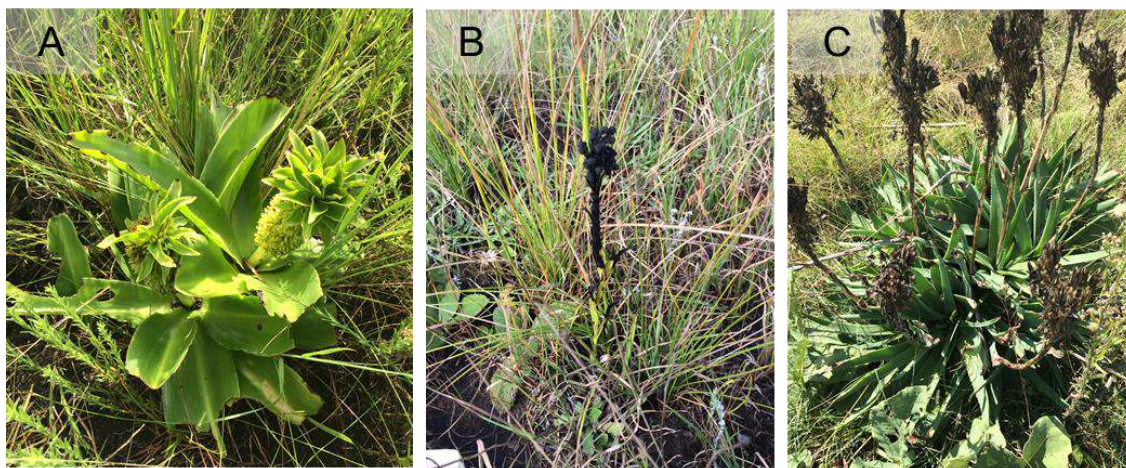


Figure 7-7: Examples of Plant SSC recorded on Site (A: *Eucomis autumnalis*; B: *Satyrium* sp. and *Aloe ecklonis*)

7.1.6 Alien Plant Species

Further to this, alien plant species have also been classified according to National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA), as published in August 2014 (GN R599 in GG 37886 of 1 August 2014) into the following categories:

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

A total of 17 alien plant species (AIP) were recorded on site (Table 7-3); seven of these have been assigned alien plant categories according to CARA and NEMBA. These species have established due to disturbance of the soil, largely due to cultivation in the area, as well as trampling by livestock. Large alien bushclumps have been delineated in Figure 7-6.

Table 7-3: Alien Plant Species recorded on Site

Family	Species	Category (CARA/NEMBA)
Amaranthaceae	<i>Guilleminea densa</i>	No category
	<i>Gomphrena celestioides</i>	No category
Asteraceae	<i>Bidens pilosa</i>	No category
	<i>Cirsium vulgare</i>	1; 1b
	<i>Conyza albida</i>	No category
	<i>Cosmos bipinnatus</i>	No category



Family	Species	Category (CARA/NEMBA)
	<i>Tagetes minuta</i>	No category
	<i>Taraxacum officinale</i>	No category
	<i>Xanthium strumarium</i>	1; 1b
Cactaceae	<i>Opuntia ficus-indica</i>	1; 1b
Fabaceae	<i>Acacia mearnsii</i>	2; 2
Myrtaceae	<i>Eucalyptus camuldulensis</i>	2; 1b
Salicaceae	<i>Salix babylonica</i>	No category
	<i>Datura ferox</i>	1; 1b
Solanaceae	<i>Solanum sp.</i>	/
	<i>Solanum sysimbriifolium</i>	1; 1b
Verbenaceae	<i>Verbena brasiliensis</i>	No category

7.2 Fauna

7.2.1 Mammals

Actual sightings, spoor, calls, dung and nesting sites, as well as active sampling by means of motion detection cameras and Sherman traps, were used to establish the presence of mammals on the proposed project site. The evidence of dung and spoor suggests that animals were present in the area although relatively few were recorded during the surveys. Table 7-4 lists mammals that were recorded in the Umcebo Underground Coal Mine project area during this survey; this includes personal communication with farmers. The mammals recorded were found within a variety of the vegetation communities present a full list can be seen in Table 7-4.

Five of these species are regarded as species of special concern; African Clawless Otter (*Aonyx capensis*) being Red Data species protected under IUCN. Steenbuck (*Raphicerus campestris*), Aardwolf (*Proteles cristatus*), Serval (*Felis serval*) and Aardvark (*Orycteropus afer*) are protected according to the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998). Examples of small mammal fauna identified on site are represented in Figure 7-8. Appendix D lists the expected mammal species for the site, based on the results of a desktop assessment.

Table 7-4: Mammal Species Recorded

Scientific Name	English Name	IUCN (2014.3)	NEMBA TOPS List (2007)	Mpumalanga Protected (1998)
<i>Aonyx capensis</i>	African clawless Otter	Near Threatened	Not Listed	Protected



Scientific Name	English Name	IUCN (2014.3)	NEMBA TOPS List (2007)	Mpumalanga Protected (1998)
<i>Atilax paludinosus</i>	Water Mongoose	Not Listed	Not Listed	Not Listed
<i>Galerella sanguinea</i>	Slender Mongoose*	Not Listed	Not Listed	Not Listed
<i>Hystrix africaeaustralis</i>	Porcupine	Least Concern	Not Listed	Not Listed
<i>Leptailurus serval</i>	Serval	Least Concern	Near Threatened	Protected
<i>Lepus saxatilis</i>	Scrub Hare	Least Concern	Not Listed	Not Listed
<i>Canis mesomelas</i>	Black-backed Jackal	Not Listed	Not Listed	Not Listed
<i>Caracal caracal</i>	Caracal**	Least Concern	Not Listed	Not Listed
<i>Cryptomys hottentotus</i>	Common Mole Rat*	Least Concern	Not Listed	Not Listed
<i>Crocidura cyanea</i>	Reddish-grey Musk Shrew	Least Concern	Not Listed	Not Listed
<i>Cynictis penicillata</i>	Yellow Mongoose	Least Concern	Not Listed	Not Listed
<i>Damaliscus pygargus phillipsi</i>	Blesbok**	Least Concern	Not Listed	Not Listed
<i>Ichneumia albicauda</i>	White-tailed Mongoose	Least Concern	Not Listed	Not Listed
<i>Mastomys coucha</i>	Multimammate Mouse	Least Concern	Not Listed	Not Listed
<i>Orycteropus afer</i>	Aardvark*	Least Concern	Protected	Protected
<i>Procavia capensis</i>	Rock Hyrax	Least Concern	Not Listed	Not Listed
<i>Proteles cristatus</i>	Aardwolf*	Least Concern	Protected	Protected



Scientific Name	English Name	IUCN (2014.3)	NEMBA TOPS List (2007)	Mpumalanga Protected (1998)
<i>Raphicerus campestris</i>	Steenbok	Least Concern	Protected	Protected
<i>Redunca arundinum</i>	Reedbuck	Least Concern	Protected	Protected
<i>Rhabdomys pumilio</i>	Striped Mouse	Least Concern	Not Listed	Not Listed
<i>Sylvicapra grimmia</i>	Common Duiker	Least Concern	Not Listed	Not Listed
<i>Tatera leucogaster</i>	Bushveld Gerbil*	Least Concern	Not Listed	Not Listed

* - Recorded previously

** - Recorded via personal communication with farmers

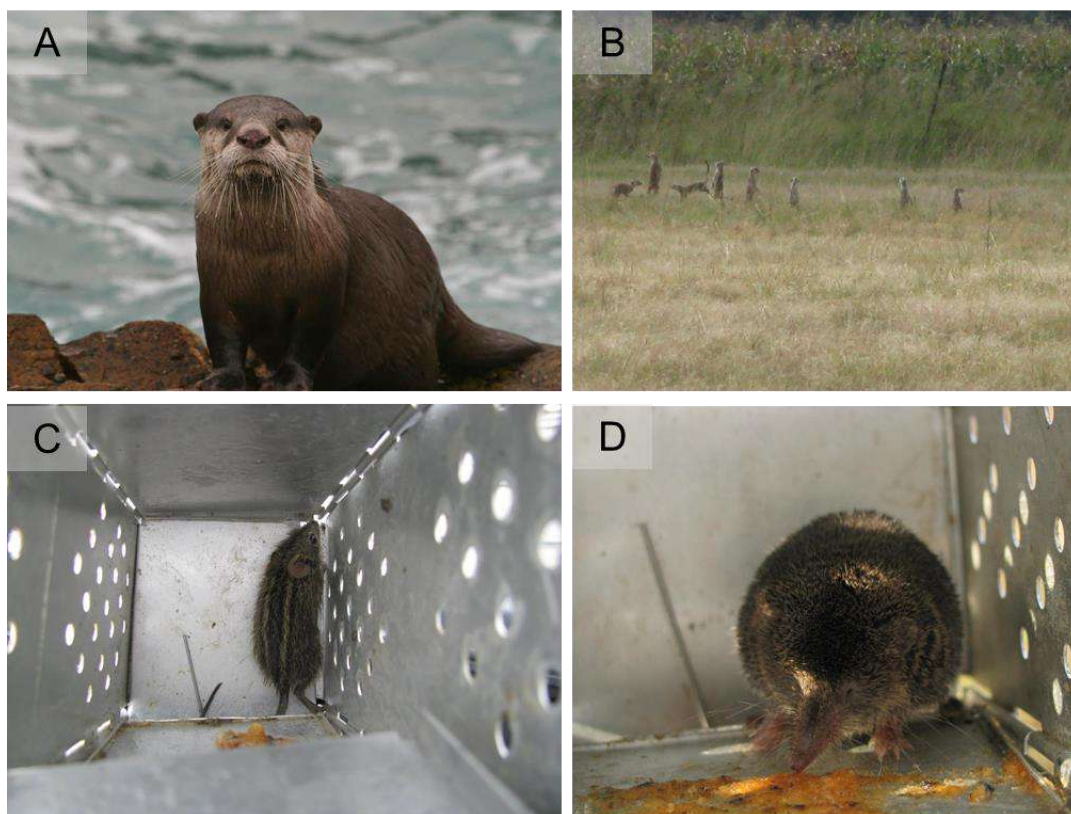


Figure 7-8: Examples of Small Mammals recorded on Site (A: *Aonyx capensis* (Cape Clawless Otter) – taken by Hardaker; B: *Suricata suricatta* (Meerkat); C: *Rhabdomys pumilio* (Striped Mouse); D: *Crocidura cyanea* (Reddish-Grey Musk Shrew)



Figure 7-9: Camer Trap findings, Reedbuck (*Redunco arundinum*)



Figure 7-10: Camera Trap findings, Reedbuck (*Redunco arundinum*)



7.2.2 Avifauna

A total of 83 species were identified during the dry season and the wet season survey (combined) (Refer to Appendix E). It is generally accepted that vegetation structure, rather than the actual plant species, influences bird species distribution and abundance (in Harrison *et al.*; 1997). Therefore, the vegetation description below does not focus on lists of plant species, but rather on factors which are relevant to bird distribution.

The natural habitat of the project areas consist predominantly of the Eastern Highveld Grassland vegetation type, which occurs on slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short, dense grassland dominated by the usual highveld grass composition (*Aristida*, *Digitaria*, *Ergrostris*, *Themeda*, *Tristachya* etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species. Rainfall is strongly summer seasonal (average 726 mm), with very dry winters (Mucina & Rutherford 2006).

7.2.2.1 Rocky Outcrops

Certain areas within the study area contain rocky outcrops. These areas are often found near rivers and streams. In places these rocky outcrops form sizable cliffs which could be utilised by Southern Bald Ibis, Martin's and Swallows. Rocky outcrops are a sensitive landscape as determined by the Mpumalanga Tourism and Parks Agency (MTPA), as per the minimum requirements set forth by MTPA. Reasons for the protection of these outcrops are that they provide habitat for plant and animal species that is not impacted on by agriculture due to the unsuitable rocky nature of these outcrops for ploughing.

7.2.2.2 Wetland Areas

Multiple wetland systems occur throughout all study sites. These areas are dominated by marshy vegetation that grows in seasonally to permanent wet soil. In addition to wetlands, pans are an important feature of the general site, Greater Flamingo (*Phoenicopterus roseus*) (Least Concern) was observed in the pans. Reed pans are mostly permanent, usually retaining water throughout the year. They have a diverse flora, characterized by *Phragmites*, which forms a dense extensive reedbed covering most of the pan basin. *Imperata cylindrica* (Cottonwool Grass) was identified on site, this is the preferred habitat type of the Grass Owl, and these birds were however not recorded during this survey. Sedge pans are semi-permanent, usually drying up during the winter and/or dry spells, when they are almost devoid of vegetation. Saline pans are characterized by their glaring white basins when dry and have extremely saline substrata and water. The basins of these pans usually lack vegetation. There is considerable overlap in the common plants between the three pan-types. The pans, and their functioning, remain intact, despite existing in a matrix that consists almost exclusively of maize (80%), interspersed with small fragmented patches of natural grassland (20%) (Barnes 1998).



The wetlands within the property are an important habitat for common water birds such as: Sacred Ibis (*Threskiornis aethiopicus*), Redknobbed Coot (*Fulica cristata*), Grey Heron (*Ardea cinerea*), Purple Heron (*Ardea purpurea*), Egyptian Goose (*Alopochen aegyptiacus*), Cape Shoveler (*Anas smithii*), Spurwinged Goose (*Plectropterus gambensis*), Yellowbilled Duck (*Anas undulata*), Cattle Egret (*Bubulcus ibis*) and Three banded Plover (*Charadrius tricollaris*) and the adjacent grasslands provide potential habitat (*Imperata cylindrica*) for the Vulnerable African Grass Owl (*Tyto capensis* (according to the national Red Data list).

During the site visits a number of typical Mpumalanga Grassland species were observed. These areas also included the road infrastructure, farm boundary and isolated patches throughout the property and included species such as 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 exotic Feral Pigeons (*Columba livia domestica*).

7.2.2.3 Transformed/Cultivation

The habitat in the study area has been transformed through dryland cultivation, mostly maize. Areas of current cultivation are situated on the areas with the least gradient, but also on the hill slopes where the gradient is not too aggressive. The agricultural fields of the property harbour a number of typical highveld endemics. These included several widow, weaver and bishop species (within the wetter areas). A number of African Quailfinch's (*Ortygospiza fuscocrissa*) were observed within the fields – 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 property, although there is enough nesting habitat in the surrounding area for the more endangered lark species it is noted that the existing mining activities, increased traffic loads and earth movement have negatively impacted on the breeding of all lark and pipit species on the property, however once rehabilitation is concluded this is usually not a permanent impact. The altitude of the proposed Umcebo Underground Mine development and species type of the grassland suggests that the area could be home to some endemic and endangered lark and pipit species such as: Botha's Lark (*Spizocorys fringillaris*). This species, however were not observed during any of the surveys.

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 data from the Co-ordinated Road Count project (CAR) of the Avian Demography Unit shows that the wetlands in the Mpumalanga Highveld are extensively used by Spurwinged Goose (*Plectropterus gambensis*), Black-headed Heron (*Ardea melanocephala*) and Grey Crowned Crane (*Balearica regulorum*). Blue Cranes (*Anthropoides paradiseus*) have been recorded in the property QDS cell area before.



7.2.2.4 Alien Vegetation

Relatively small but prominent collection of alien invasive and exotic tree species is present at all three project sites. These tree species were either planted as windbreaks by local farmers, as is the case with *Pine* and *Eucalyptus spp.*, or they were transported to the area via waterways such as *Populus spp.* The alien vegetation habitat type is also present on the hill slopes of rolling hills and flat areas between these hills.

Examples of avifauna recorded on site are represented in Figure 7-11.

Table 7-5: Red Data Species Recorded in by SABAP2 that could potentially occur on Umcebo Mining area

Common Name	Species Name	Status	Habitat requirements
White-bellied Korhaan	<i>Eupodotis senegalensis</i>	SA Red Data: VU IUCN: NT NEMBA, TOPS: MTPA: Protected	Often in the interface between grassland and savanna. Avoids severely grazed and recently burnt sites. Could potentially be present in patches of tall grass.
Secretarybird	<i>Sagittarius serpentarius</i>	SA Red Data: VU IUCN: VU NEMBA, TOPS: MTPA: Protected	Prefer open grassland, densities lower in maize growing areas. Occasional presence confirmed by locals.
Blue Crane	<i>Anthropoides paradiseus</i>	SA Red Data: VU IUCN: VU NEMBA, TOPS: Protected MTPA: Protected	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.
Black Stork	<i>Ciconia nigra</i>	SA Red Data: VU IUCN: LC NEMBA, TOPS: Protected MTPA B: Protected	Occurs as a nomad at lakes, rivers, wetlands. Unlikely to be seen on site unless flying overhead.
African Grass Owl	<i>Tyto capensis</i>	SA Red Data: VU IUCN: LC NEMBA, TOPS: Protected MTPA: Protected	Roosts on the ground near marshes and grassland. It is likely that this species is found on the project area.



Common Name	Species Name	Status	Habitat requirements
African Marsh Harrier	<i>Circus ranivorus</i>	SA Red Data: EN IUCN: LC NEMBA, TOPS: Protected MTPA: Protected	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.
Yellow-billed Stork	<i>Mycteria ibis</i>	SA Red Data: EN IUCN: LC NEMBA, TOPS: Protected MTPA: Protected	Dams, large marshes, swamps, estuaries, margins of lakes and seasonal wetlands. Unlikely to occur in the study area due to limited suitable habitat.
Botha's Lark	<i>Certhilauda semitorquata</i>	SA Red Data: EN IUCN: EN NEMBA, TOPS: Protected MTPA: Protected	An uncommon and restricted species was only observed via SABAP1. In the region it would prefer shorter grazed grasslands. Unlikely to occur in the study area due to lack of suitable habitat and preferred range.
Lesser Kestrel	<i>Falco naumanni</i>	SA Red Data: LC IUCN: LC NEMBA, TOPS: Protected MTPA: Protected	Grassland and agricultural lands. Likely to be present in summer on the project site (Palearctic migrant).



Figure 7-11: Examples of Avifauna Species recorded on Site (A: *Phoenicopterus roseus* (Greater Flamingo); B: Greater Striped Swallow (*Cecropis cucullata*) and Barn Swallow (*Hirundo rustica*) C: *Sagittarius serpentarius* (Secretarybird))

7.2.3 Herpetofauna

According to Du Preez and Carruthers (2009), frogs occur throughout every habitat within Southern Africa. A number of factors influence their distribution, and they are generally restricted to the habitat type they prefer, especially in their choice of breeding site. The choices available of these habitats coincide with different biomes, these biomes in turn, are distinguished by means of biotic and abiotic features prevalent within them. Therefore a collection of amphibians associated with the Grassland Biome will all choose to breed under the prevailing biotic and abiotic features present. Further niche differentiation is encountered by means of geographic location within the biome, this differentiation includes, banks of pans, open water, inundated grasses, reed beds, trees, rivers and open ground, all of which are present within the area of interest.

Three amphibians were encountered during this field survey by, means of active searching, with three species encountered during previous surveys. The expected amphibian species for the area are included as (Annexure/Appendix. All species identified on site are listed in Table 7-6. The species listed as encountered below were all encountered within the wetlands habitat types. Examples of frogs recorded on site are represented in Figure 7-12.

**Table 7-6: Amphibian Species recorded in the Umcebo Project Area**

Scientific Name	English Name	IUCN (2014.3)	NEMBA TOPS List (2007)	Mpumalanga Protected (1998)
<i>Afrana angolensis</i>	Common River Frog	-	-	-
<i>Bufo gutturalis</i>	Guttural Toad	-	-	-
<i>Cacosternum boettgeri</i>	Common Caco	-	-	-
<i>Strongylopus fasciatus</i>	Striped Stream Frog	-	-	-

Two species of reptile, a Rinkhals (*Hemachatus haemachatus*) and Brown House Snake (*Lamprophis fuliginosus*) were identified during the field survey through opportunistic observations (Table 7-7). No IUCN protected species were encountered; however 10 species were recorded that are protected according to Mpumalanga protected species list (1998).

Table 7-7: Reptile Species of Umcebo

Scientific Name	English Name	IUCN (2014.3)	NEMBA TOPS List (2007)	Mpumalanga Protected (1998)
<i>Agama aculeata</i>	Ground Agama	Not Listed	Not Listed	Protected
<i>Bitis arietans</i> **	Puff Adder	Not Listed	Not Listed	Protected
<i>Cordylus vittifer</i>	Common Girdled Lizard	Not Listed	Not Listed	Protected
<i>Hemachatus haemachatus</i> **	Rinkhals	Not Listed	Not Listed	Protected
<i>Lamprophis fuliginosus</i> **	Brown House Snake	Not Listed	Not Listed	Protected
<i>Mabuya capensis</i> *	Cape Skink	Not Listed	Not Listed	Protected
<i>Mabuya striata</i> *	Striped Skink	Not Listed	Not Listed	Protected
<i>Pachydactylus affinus</i> *	Transvaal gecko	Not Listed	Not Listed	Protected
<i>Psammophylax rhombeatus</i> *	Spotted or Rhombic Skaapsteker	Not Listed	Not Listed	Protected



Scientific Name	English Name	IUCN (2014.3)	NEMBA TOPS List (2007)	Mpumalanga Protected (1998)
<i>Typhlops bibronii</i> *	Bibron's Blind Snake	Not Listed	Not Listed	Protected

- Recorded this assessment by DWE

* - Recorded previously

** - Recorded via personal communication with farmers



Figure 7-12: Examples of Amphibians recorded on site (left: *Hylarana signata* (Striped Stream Frog) and right: taken by Hardaker)

The Montane Dwarf Burrowing Skink *Scelotes mirus*, a South African endemic, has also been recorded in the IBA that this project falls within. The IBA (refer to Avifauna section) may hold other endemic reptiles, such as the rare Many-Spotted Snake *Ampborhinus multimaculatus*, berg adder *Bitis atropos*, Thin-tailed Legless Skink *Acontias gracilicauda*, Breyer's Long-tailed Seps *Tetradactylus breyeri*, Black-spotted Dwarf Gecko *Lygodactylus nigropunctatus* and Spotted Dwarf Gecko *L. ocellatus*, as well as Rough-haired Golden Mole *Chrysospalax villosus*.

7.2.4 Macro-Invertebrates

During the wet season survey, butterflies were recorded through opportunistic observations and photographed where possible. In the dry season, transects were walked along the roads, rehabilitated areas, exotic plantations and grassland area to identify any scorpion or spider nests. Butterflies are a good indication of the habitats available in a specific area (Woodhall 2005). Although many species are eurytropes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised (Woodhall 2005). Butterflies are useful indicators as they are relatively easy to locate and catch, and to identify. It is for this reason that Lepidoptera were used as the primary focus for the invertebrate survey. Five butterfly species were observed within the Umcebo Underground Mining area, these included the, Spotted Jonker (*Byblia ilythia*), African Monarch (*Danaus chrysippus*), Brown-veined White (*Belenois aurota*), Broad



Bordered Grass Yellow (*Eurema brigitta*) and the Citrus Swallowtail (*Papilio demodocus*). All the species were located within mixed grassland or the wetland areas adjacent to the farm. No butterfly species observed were considered to be Species of Special Concern. However according to SANBI, it is possible that the Near Threatened Marsh Sylph (*Metisella meninx*) can be located on the site. It is endemic to the wet vleis of highland grassland in northern KwaZulu-Natal, Mpumalanga, Gauteng, the northern part of the Orange Free State and the extreme east of the North West Province; they preferred *Leersia hexandra* dominated grassland. It has become extinct in many areas close to Johannesburg due to building developments.

Wasp robber flies (*Philodicus sp*) were located in the mixed grasslands area south of the existing overburden stockpile. The name "robber flies" reflects their notoriously aggressive predatory habits; they feed mainly or exclusively on other insects where they generally catch their prey in flight (Weaving, 2004). Adults are generally medium to large in size, with an average body length of 1 to 1.5 cm but with a range of 3 cm to more than 5 cm in length. The shape is generally elongated, due to the conformation of the long tapering abdomen; however there are also compact species with broad abdomens (Picker and Griffiths, 2004).

Dung beetles (*Scarabeus sp*) were located throughout the property and wherever cattle faeces were evident. These beetles eat dung excreted by herbivores and omnivores, and prefer that produced by the former. Many of them also feed on mushrooms and decaying leaves and fruits. All the species belong to the superfamily *Scarabaeoidea*, most of them to the subfamilies Scarabaeinae and Aphodiinae of the family Scarabaeidae (scarab beetles).

The diversity and density of the invertebrates was relatively high for the proposed Umcebo mining development footprint area and surroundings, and this in general could assist in providing an indication of the health of the regional ecology. Although existing mining activities has modified the immediate area, there is sufficient habitat within the surrounding unaffected areas to sustain moderate populations of the typical highveld grassland species of fauna. It would however be recommended that the management of any encroachment of alien invasive plant species is strictly enforced in order to retain the preferred faunal species types that currently dominate the grassland biome of Mpumalanga Province. Examples of invertebrate species recorded on site are represented in Figure 7-13.



Figure 7-13: Examples of Invertebrates recorded on site (A: Reduviidae; B: *Ectrichodia crux* (Millipede Assassin); C: Coreidae. D: Gastrimargus E: *Argiope australis* F: *Astylus atromaculatus* (Spotted Maize Beetle); G: *Belenois aurota* (Brown-veined White); H: *Cynthia carui* (Painted Lady) and I: *Junonia hierta* (Yellow Pansy))



8 Sensitivity Analysis and No-go Areas

There are several assessments for South Africa as a whole, as well as on provincial levels that allow for detailed conservation planning as well as meeting biodiversity targets for the country's variety of ecosystems. These guides are essential to consult for development projects, and will form an important part of the sensitivity analysis.

Areas earmarked for conservation in the future, or that are essential to meet biodiversity and conservation targets should not be developed, and have a high sensitivity as they are necessary for overall ecological functioning. Further to this, details of the field investigation are used to determine the site-specific sensitivity.

8.1 Mpumalanga Biodiversity Sector Plan (MBSP) (MTPA; 2014)

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. A biodiversity sector plan achieves this by providing a map (or maps) of terrestrial and freshwater areas that are important for conserving biodiversity pattern and ecological processes – these areas are called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). The maps are provided together with contextual information on biodiversity, and land-use guidelines (Figure 8-1) that can be incorporated into the policies and decisions of a wide range of sectors.

The sector plan is a living document that is constantly reviewed and updated and documents the distribution of conservation important areas for biodiversity. According to the Mpumalanga Sector Plan, the Umcebo Coal Mine project site contains CBA Irreplaceable areas (wetlands on the border and the Klein-Olifants River), CBA optimal areas (mostly undisturbed tributaries of the Klein-Olifants River), other natural areas (areas not under agriculture), moderately modified old land (grazing areas across the project site), and heavily modified areas (occurring across the project area). All these demarcations were taken into account during the field work studies as the Sector Plan's delineations were refined.

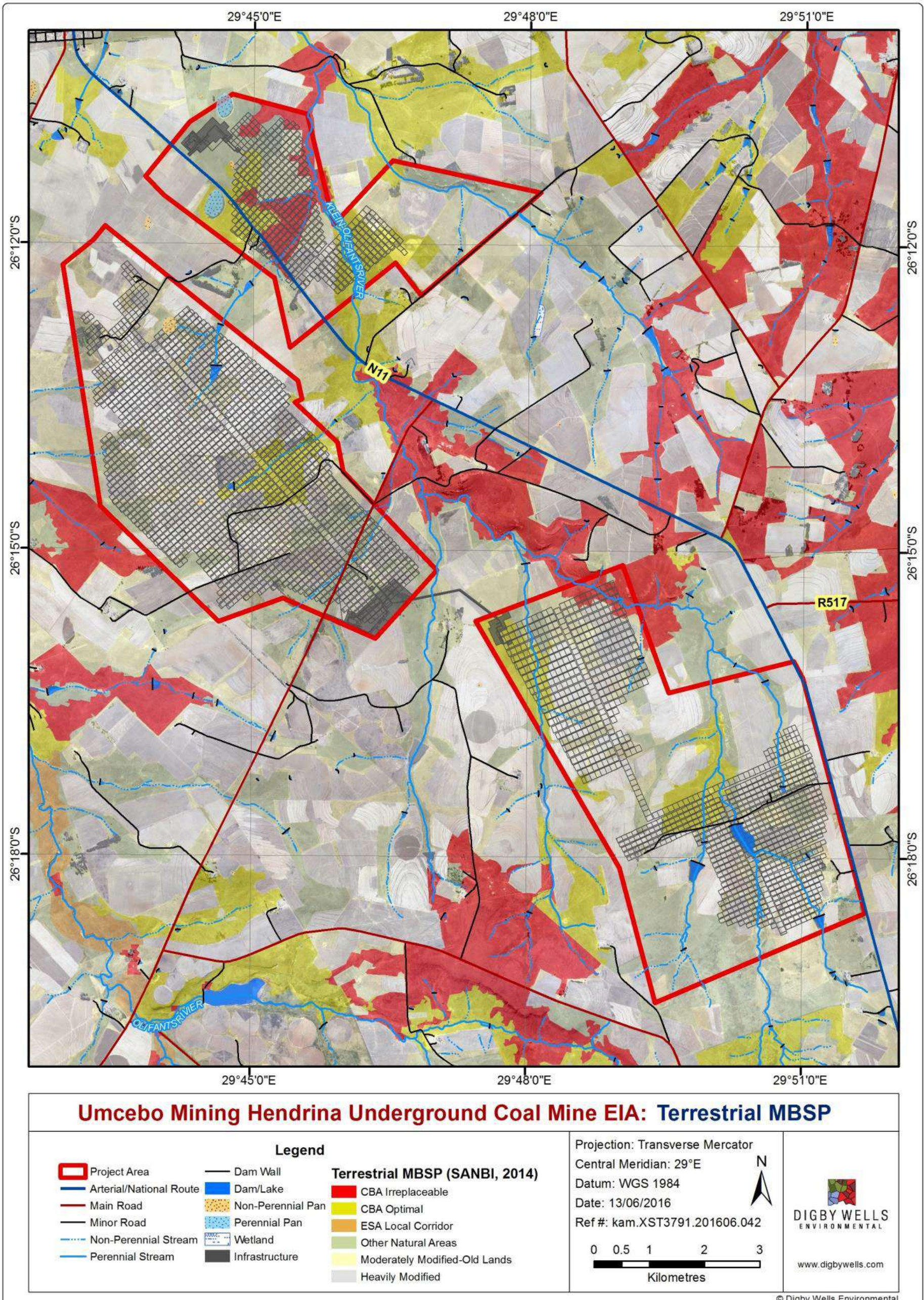


Figure 8-1: Mpumalanga Biodiversity Sector Plan (2014)



8.2 Protected Areas

Formerly protected areas, either provincially or nationally, that occur within proximity to the project site could have consequences as far as impact on these areas are concerned. For the project area however, there are no protected areas in close proximity; the closest protected area is approximately 30 km to the east. The protected areas within proximity to the project site are represented in Figure 8-2.

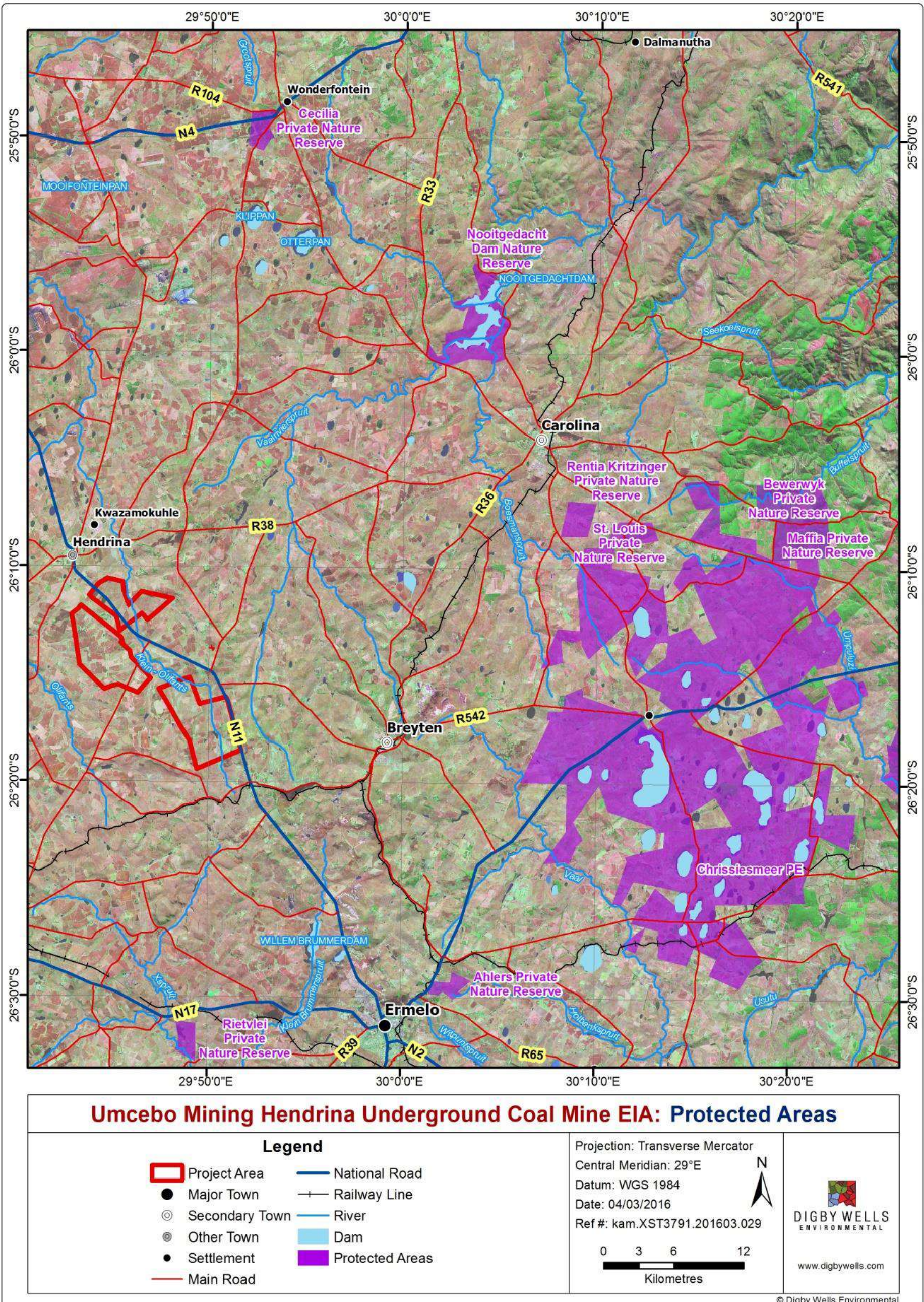


Figure 8-2: Protected Areas



8.3 Important Bird Areas (Birdlife SA, 2013)

An Important Bird Area (IBA) is an area recognised as being a globally important habitat for the conservation of bird populations. Currently there are about 10,000 IBAs worldwide. At present, South Africa has 124 IBA's, covering over 14 million hectares of habitat for threatened, endemic and congregatory birds. Yet only one million hectares of the total land surface covered by our IBA's are legally protected. BirdLife South Africa continues an IBA programme of stewardship which will ultimately achieve formal protection (BirdlifeSA, 2013).

The study area falls within the Amersfoort Bethal-Carolina IBA (refer to Figure 8-3). According to Barnes (1998), this IBA holds a large proportion (>10%) of the global population of the endangered Botha's Lark (*Spizocorys fringillaris*), although confirmation is required as to whether this is still the case. This lark generally avoids rocky areas, tall grass in bottomlands, vleis, croplands and planted pastures, but its preferred habitat consist of short, dense, natural grassland found on plateaus and upper hill slopes and are occurring within the IBA, and on site.

Data regarding the IBA's current species composition is limited, but the grassland areas occasionally hold Denham's Bustard (*Neotis denhami*), White-bellied Korhaan (*Eupodotis senegalensis*), Blue Korhaan (*E. caerulescens*), African Grass Owl (*Tyto capensis*), Buff-streaked Chat (*Campicoloides bifasciata*), Southern Bald Ibis (*Geronticus calvus*), Black-winged Pratincole (*Glareola nordmanni*) and Secretarybird (*Sagittarius serpentarius*). Blue Crane (*Anthropoides paradiseus*) and Whattled Crane (*Bugeranus carunculatus*) species can possible be found within the project area according to SABAB2. During field work the Blue Korhaan (*E. caerulescens*), Southern Bald Ibis (*Geronticus calvus*), and Secretarybird (*Sagittarius serpentarius*) were identified.

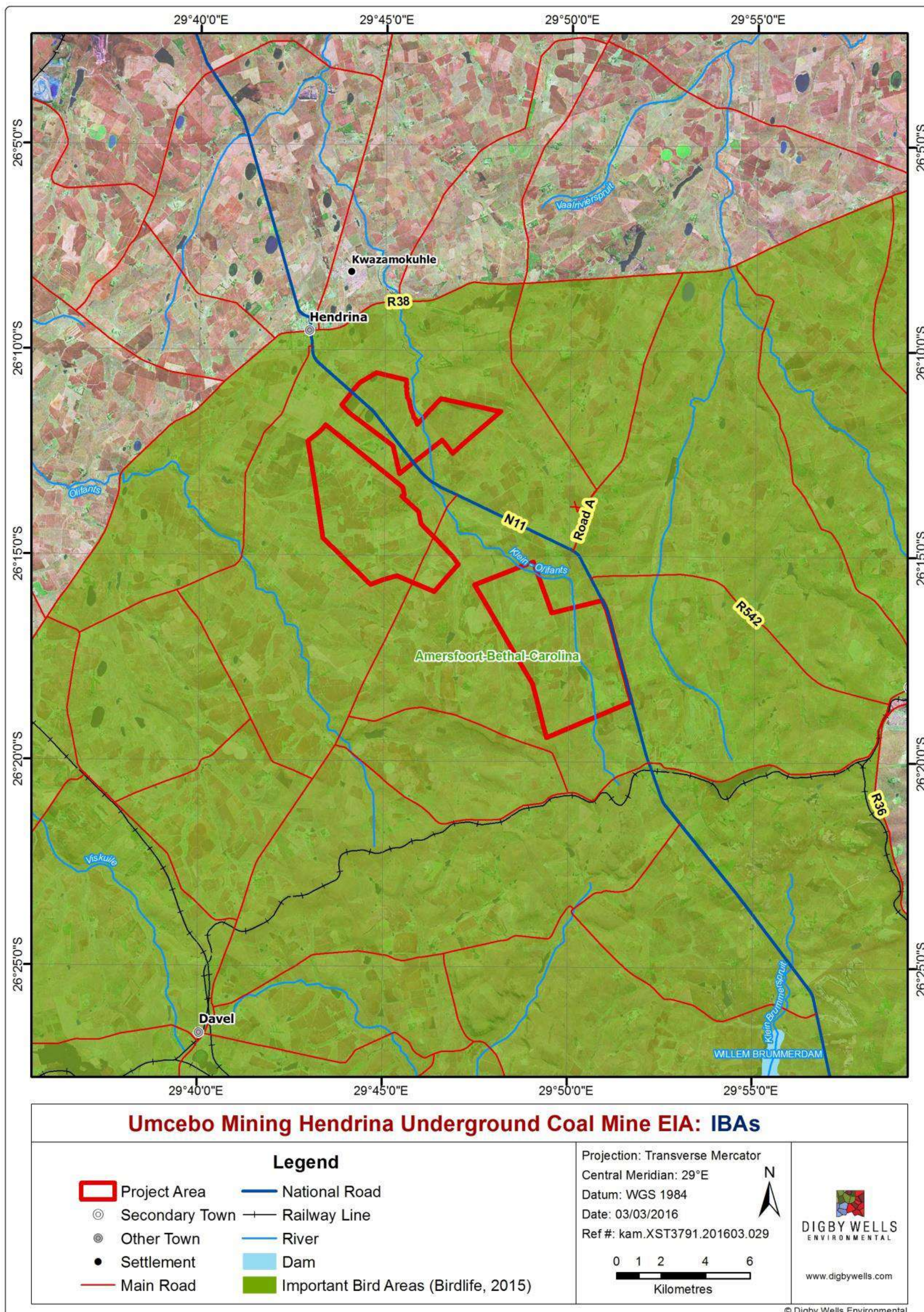


Figure 8-3: Important Bird Area (IBA) (Birdlife SA, 2013)



8.4 Nationally Threatened Ecosystems

The list of nationally threatened ecosystems has been gazetted (NEM:BA, Act 10 of 2004: National list of ecosystems that are threatened and in need of protection) and results in several implications in terms of development within these areas. Four basic principles were established for the identification of threatened ecosystems.

Areas were delineated based on as fine a scale as possible and are defined by one of several assessments:

- The South African Vegetation Map (Mucina and Rutherford 2006);
- National forest types recognised by the Department of Water Affairs and Forestry (DWAf), now Department of Water and Sanitation (DWS);
- Priority areas identified in a provincial systematic biodiversity plan; and
- High irreplaceability forest patches or clusters identified by DWAf (DWS).

The criteria for identifying threatened terrestrial ecosystems include six criteria overall, two of which are dormant due to lack of data (criteria B and E). The criteria are presented in Table 8-1 below and Figure 8-4 shows that the Eastern Highveld Grassland and Soweto Highveld Grassland (referred to in section 6) are listed as threatened ecosystems. Cumulative loss of these areas should be avoided.

Table 8-1: Criteria for the Listing of National Threatened Ecosystems

Criterion	Details
A1	Irreversible loss of natural habitat
A2	Ecosystem degradation and loss of integrity
B	Rate of loss of natural habitat
C	Limited extent and imminent threat
D1	Threatened plant species associations
D2	Threatened animal species associations
E	Fragmentation
F	Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan

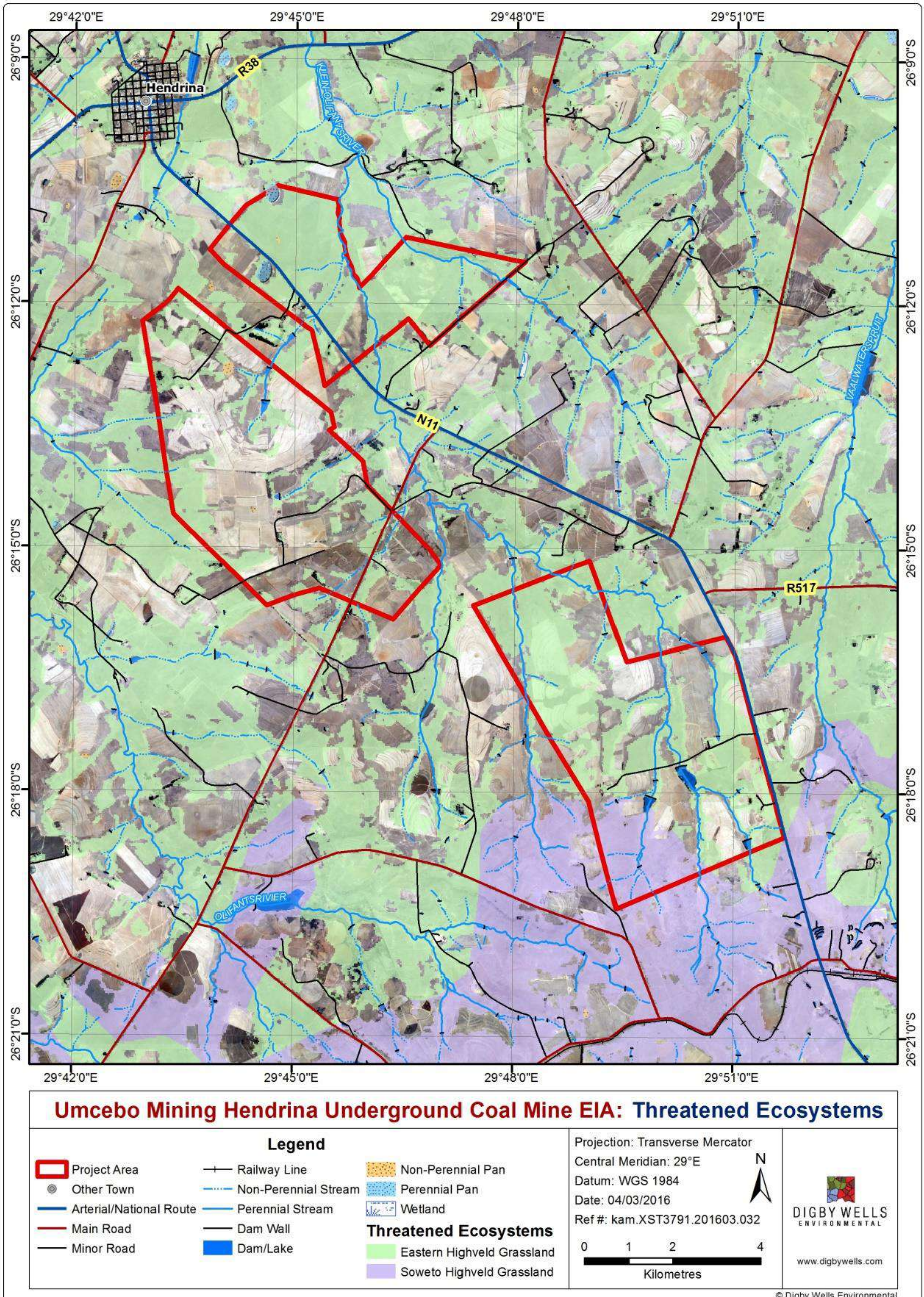


Figure 8-4: Nationally Threatened Ecosystems (SANBI)



8.5 Nationally Protected Areas Expansion Strategy

The National Protected Areas Expansion Strategy (NPAES) shows areas designated 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. There are no areas earmarked for conservation within 50 km of the proposed development (Figure 8-5). The closest area is approximately 60 km away, the Mpumalanga Mesic Grassland area.

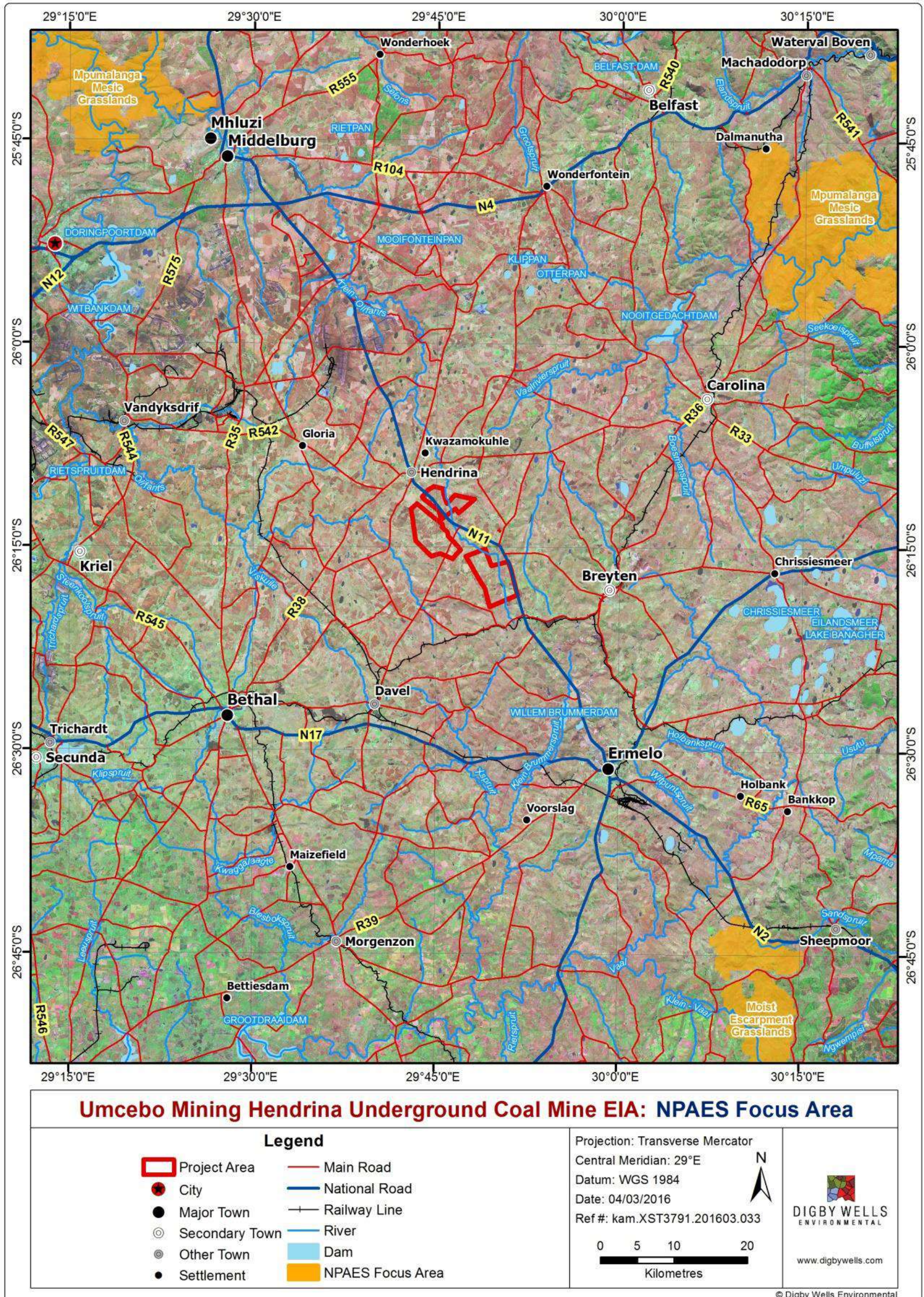


Figure 8-5: National Protected Areas Expansion Strategy



8.6 Site-specific Sensitivity

The ecological sensitivity map for the site is represented in Figure 8-6, overlaid with the infrastructure plan. The *Crinum – Arundinella* Riparian and pan vegetation units were allocated a very high sensitivity since wetlands are regarded as an important habitats that should be conserved due to the presence of plant SSC and habitat diversity. Further to this, a portion of *Eragrostis* – dominated Grassland in Mooivley West was assigned high ecological sensitivity due to the presence of plant SSC and high species diversity. High sensitivity was assigned to the *Gnidia – Diospyros* Rocky Grassland and moderate sensitivity was assigned to the remaining natural areas. Areas that were cultivated, disturbed or built up were allocated a low ecological sensitivity.

The infrastructure placement has been amended since the scoping phase of the project. Initially, the conveyor belt crossed two watercourses, correlating to high sensitivity. The conveyor route has been amended and now crosses a single watercourse. In addition, the locality of the shaft has been relocated to avoid important wetlands. This is further discussed in the wetlands report (Digby Wells, 2016) but has little influence on the flora and fauna impacts discussed in the next section (moderate ecological sensitivity).

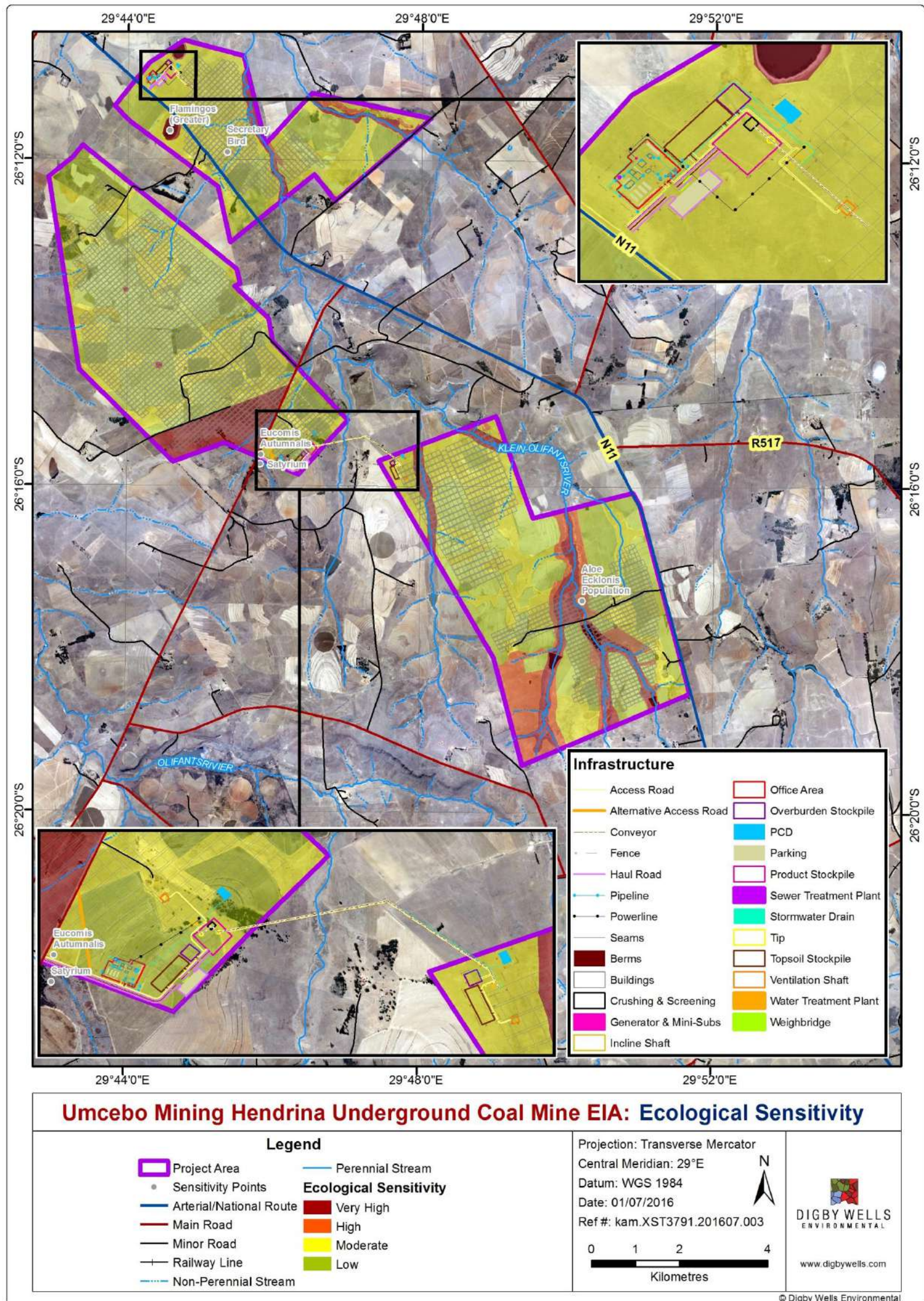


Figure 8-6: Ecological Sensitivity



9 Impact Assessment

9.1 Methodology

Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are 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 9-3. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this report. The significance of an impact is then determined and categorised into one of eight categories, as indicated in Table 9-2, which is extracted from Table 9-1. The description of the significance ratings is discussed in Table 9-3.

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 9-1: Impact Assessment Parameter Ratings

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

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



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

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

Table 9-2: Probability/Consequence Matrix

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



Table 9-3: 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 major and usually a long-term change to the (natural and / or social) environment and result in severe 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) (-)



9.2 Project Activities

A list of project activities to be assessed for the project has been discussed in Table 9-4.

Table 9-4: Description of Activities to be assessed

Project Phase	Project Activity	Project Structures
Construction	Site Clearance	Topsoil Stockpiles
	Blasting and Excavation	Two Shafts per mining right area
	Construction of Surface Infrastructure	Crushing and Screening Plant; Mine Offices; Change House; Workshop; Overburden and Product Stockpiles; Site Fencing; Access and Service Roads (with weighbridge); Overland Conveyor; Sewage Treatment Plant; Three Pollution Control Dam; Water Treatment Plant; Diesel Storage Tanks; and Ventilation Shaft per mining right area
	Water Abstraction and Use	Water Tanks and Pipes
	Waste Generation and Disposal	Waste Skips
	Power Generation	Diesel Generator
	Operations	Underground Blasting and Mining
Stockpiling		Waste Rock Berms; and Product Stockpile
Hauling/Conveying of Coal		Overland Conveyor Belt; and Haul and Access Roads.
Plant and Equipment Operations		Crushing and Screening Plant; Workshop and Diesel Storage. and Tanks
Water Use and Storage		Pollution Control Dam; and Jo Jo Tanks.
Waste Generation and Storage		Sewage Treatment Plant; and Waste Skips.



Project Phase	Project Activity	Project Structures
	Power Generation	Diesel Generator
Mine Decommissioning and Closure	Removal of infrastructure and surface rehabilitation	Crushing and Screening Plant; Mine Offices; Change House; Workshop; Overburden and Product Stockpiles; Site Fencing; Access and Service Roads (with weighbridge); Overland Conveyor; Sewage Treatment Plant; Three Pollution Control Dams; Water Treatment Plant; Diesel Storage Tanks; and Ventilation Shaft per mining right area.
	Waste Generation and Disposal	Waste Skips

9.3 Impact Assessment

9.3.1 Construction Phase

9.3.1.1 Project Activities Assessed

During the construction phase (construction of surface infrastructure), cultivated areas (43 ha), *Eragrostis* – dominated Grassland (58 ha) and alien bushclumps (7 ha) will be cleared (refer to Table 9-5). The impact of loss of cultivated fields and alien bushclumps is neutral but the loss of the *Eragrostis* – dominated Grassland (assigned a moderate sensitivity) will have negative impacts on biodiversity. It is not anticipated that any plant SSC will be lost. Should any plant SSC be recorded within the infrastructure development footprint area, it should be reported to the relevant authorities and a relocation strategy must be compiled. Once all permits are in place, such species must be relocated.

Table 9-5: Loss of Habitat from Surface Infrastructure

Mining Area	Vegetation	Areas Disturbed (ha)
Hendrina South	<i>Eragrostis</i> Grassland	13
Mooivley East	<i>Eragrostis</i> Grassland	33
Mooivley West	Alien bushclump	7
	Cultivated areas	43



Mining Area	Vegetation	Areas Disturbed (ha)
	<i>Eragrostis</i> Grassland	12
Total Natural Habitat		58

Table 9-6: Interactions and Impacts

Interaction	Impact
Site clearing	Loss of <i>Eragrostis</i> -dominated Grassland
	Habitat fragmentation and edge effects

9.3.1.2 Impact Description

For site clearing, none of the habitats that have been rated as high or very high will be impacted on. The *Eragrostis* – dominated Grassland (description in section 7.1.3) represents a ubiquitous habitat that shows moderate ecological sensitivity and as a result, the intensity of the impact was rated as moderate. Further to this, the extent of the impact is limited to a small area and will not have considerable negative impacts on overarching biodiversity of the site.

Ecosystem function is the measure of the combined functioning of the vegetation and associated species, faunal habitats and wetlands, all of which result in the ecosystem health. Clearing for the infrastructure will affect the ecosystem functioning in two main ways. The first is the fragmentation of the ecosystem, which will occur with land surface changes. Fragmentation occurs conjointly with edge-effects, which change the composition of the ecosystem on the edge of structures such as buildings and roads. The consequence of this is a loss of cohesiveness between larger fragments of habitat which limits the exchange of genes and resources across them. An additional contributor to loss of ecosystem function is the introduction of alien and invasive species. Disturbance to the soil after vegetation clearing results in the establishment of alien species, that may form dense monospecific stands.

9.3.1.3 Management Objectives

The objective of management measures is to ensure that the impact to habitat is restricted only to the footprint area and that alien plant invasion does not take place as a result of development.



9.3.1.4 Management Actions and Targets

In addition, the following mitigation and management measures have been prescribed:

- The footprint area should be kept as small as possible;
- 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 alien invader management plan should be implemented, whereby the disturbed site is monitored quarterly for at least two years to ensure that alien invasion does not take place.

9.3.1.5 Impact Ratings

The impacts of the construction phase are rated in the table below.

Table 9-7: Potential Impacts of the Construction Phase – Loss of Habitat/Vegetation Types

Dimension	Rating	Motivation	Significance
Site Clearing			
Impact Description: Loss of <i>Eragrostis</i> – dominated Grassland			
Prior to Mitigation/Management			
Duration	Permanent (7)	Native vegetation will be removed for surface infrastructure and the impact will be permanent. Fauna species will move away with no permanent impact on them	Moderate (negative) 84
Extent	Very limited (2)	The area to be cleared is minor in comparison to the extent of the vegetation unit, as well as the extent of the total study area. No faunal or floral SSC was encountered in the area of disturbance; therefore no direct impact is expected.	
Intensity x type of impact	Moderate (-3)	Since the vegetation unit has been assigned moderate ecological sensitivity and as CBA areas are avoided, the impact is not regarded as particularly significant for terrestrial biodiversity.	
Probability	Certain (7)	Clearing of vegetation will definitely take place for the establishment of infrastructure.	
Nature	Negative	The impact will be negative.	
Mitigation/Management Actions			



Dimension	Rating	Motivation	Significance
<ul style="list-style-type: none"> ▪ Rehabilitation of the disturbed area should take place after construction, whereby a mixture of native grass species harvested from climax Themeda grassland and native grass species (such as <i>Cynodon dactylon</i>) are planted immediately to prevent erosion. ▪ The footprint area should be limited as far as possible. 			
Post-Mitigation			
Duration	Project Life (5)	The area can be reinstated to the former land use after decommissioning.	Minor (negative) 49
Extent	Very limited (1)	The area to be cleared is minor in extent.	
Intensity x type of impact	Minimal (1)	Loss of cultivated areas has a negligible impact on flora and fauna.	
Probability	Likely (7)	It is unlikely that compaction will have an effect after rehabilitation, should the area be compacted however the area can be ripped to combat compaction.	
Nature	negative	The impact will be negative.	

Table 9-8: Potential Impacts of the Construction Phase – Habitat Fragmentation and Alien Invasion

Dimension	Rating	Motivation	Significance
Site Clearing			
Impact Description: Habitat fragmentation and edge effects resulting in alien plant invasion			
Prior to Mitigation/Management			
Duration	Medium-term (3)	Habitat fragmentation and alien plant invasion will take place for a period of 2 – 5 years.	Minor (negative) 54
Extent	Limited (2)	Alien plants will establish around disturbed areas associated with the construction phase.	
Intensity x type of impact	Serious (4)	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	Highly probable (6)	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 compiled and implemented. 			
Post-Mitigation			
Duration	Medium-term (3)	As seedlings emerge, they will be removed bi-annually as part of an alien management plan.	Minor (negative) 42
Extent	Limited (2)	Alien plants will establish around disturbed areas associated with the construction phase.	
Intensity x type of impact	Minimal (1)	Alien plant invasion is serious for terrestrial biodiversity; however, if these species are controlled timeously, the impact will be reduced.	
Probability	Likely (7)	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	

9.3.2 Operations Phase

9.3.2.1 Project Activities Assessed

During the operational phase of the development, underground mining will take place with incline shafts at a depth of 75m. No planned loss of habitat or flora and fauna species is expected. The only activity that is considered at this time is increased vehicular movement and associated human activities on the site. The following impacts on fauna are expected per activity.

- Waste Rock Berms – noise during operational phase/expansion;
- Product Stockpile – noise and vehicle movement;
- Overland Conveyor Belt – noise impacts on animals / coal dust on vegetation/spills;



- Haul and Access Roads, faunal road deaths, dust and noise; and
- Crushing and Screening Plant – noise/dust on neighbouring vegetation and fauna.

9.3.2.2 Impact Description

Due to increased vehicular movement on site, fauna may be disturbed due to noise and dust. Further to this, roadkill of smaller fauna and birds may take place.

9.3.2.3 Management Objectives

The objective of management measures is to ensure that roadkill do not take place and faunal disturbance is kept to a minimum.

9.3.2.4 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.

9.3.2.5 Impact Ratings

The impacts of the operational phase are rated in the table below.

Table 9-9: Potential Risks of the Operational Phase – Increased Vehicular Movement on Site

Dimension	Rating	Motivation	Significance
Increased vehicular movement and noise on site			
Impact Description: Disturbance to fauna on site (noise, roadkill)			
<i>Prior to Mitigation/Management</i>			
Duration	Project life (5)	The impact will last for the project life.	Minor (negative) 40
Extent	Very limited (2)	The extent is limited since surface infrastructure is minimal.	
Intensity x type of impact	Moderate (3)	No Red Data fauna species are expected to be at risk and the impact will not be frequent.	
Probability	Probable (4)	This is a commonly observed impact but it is not definite.	
Nature	negative	The impact will be negative.	
<i>Mitigation/Management Actions</i>			
<ul style="list-style-type: none"> ■ Erect signage on site; ■ Adhere to speed limits; ■ Avoid vehicle movement at night. 			



Dimension	Rating	Motivation	Significance
Post-Mitigation			
Duration	Project Life (5)	The impact will last for the project life.	Negligible(negative) 14
Extent	Very limited (1)	The extent is limited since surface infrastructure is minimal.	
Intensity x type of impact	Minimal (1)	No Red Data fauna species are expected to be at risk and the impact will not be frequent.	
Probability	Rare (2)	Roadkill will be minimal if the speed limit is adhered to and activity is restricted to daylight hours.	
Nature	negative	The impact will be negative.	

9.3.3 Closure and Rehabilitation Phase

9.3.3.1 Project Activities Assessed

Decommissioning will take place after mining has commenced in 30 years. The dismantling of surface infrastructure will involve increased activity on site and minor disturbance of the soil. This may promote the establishment of alien plant species if seeds persist in the seedbank. The impact of this will be minor.

9.3.3.2 Impact Description

When the soil is disturbed, alien plants in the seedbank will establish and spread.

9.3.3.3 Management Objectives

The objective of the management actions is to ensure that alien plant species do not establish and erode the natural capital of the area.

9.3.3.4 Management Actions and Targets

An alien plant management plan should be implemented.

9.3.3.5 Impact Ratings

The impact ratings for the decommissioning phase are listed in the table below. Recommendations for the rehabilitation phase are included in the Rehabilitation Plan Report (Digby Wells, 2016a).



Table 9-10: Potential Impacts of the Decommissioning Phase – Establishment of Alien Plant Species

Dimension	Rating	Motivation	Significance
Dismantling and removal of infrastructure			
Impact Description: Alien plant invasion may take place			
Prior to Mitigation/Management			
Duration	Medium-term (3)	Alien plant invasion may occur for a short period of time.	Minor (negative) 36
Extent	Limited (2)	Alien plants will establish around disturbed areas associated with the decommissioning phase.	
Intensity x type of impact	Serious (4)	Alien plant invasion is a serious problem with significant ecological consequences; hence its reference in the NEMBA and CARA legislation.	
Probability	Probable (4)	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. 			
Post-Mitigation			
Duration	Medium-term (3)	As seedlings emerge, they will be removed quarterly as part of an alien management plan.	Negligible (negative) 24
Extent	Limited (2)	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.	



Dimension	Rating	Motivation	Significance
Probability	Probable (4)	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	

10 Cumulative Impacts

The cumulative impacts that are considered from a perspective of terrestrial biodiversity include the following:

- Loss of habitat on a national scale – the threatened ecosystems programme (described in section 8.4) outlines the most significant habitats that are important for conserving on a national scale. Minimal loss of the Eastern Highveld Grassland (correlating to the *Eragrostis*-dominated grassland in this report) is expected and the impact of this is regarded as minor.
- Loss of diversity on a regional scale – the *Eragrostis* Grassland is a broad habitat that encompasses many smaller plant communities. Due to the loss of 58 ha of this unit, the regional impact will be minor.

11 Unplanned Events and Low Risks

A summary of ecologically significant risks are listed in the table below.

Table 11-1: Unplanned Events, Low Risks and their Management Measures

Unplanned event	Potential impact	Mitigation/ Management/ Monitoring
Subsidence to underground mining	Loss of flora and fauna habitat. Loss of Red Data species.	Appropriate safety factors should be used, as determined by suitably qualified rock engineers.
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. Construction will take place in the dry-season.
Poaching of animal species on site due	Small mammals and reptiles may be	Ensure continuous environmental awareness training takes place. This needs to be monitored and reported



to increase activity on site.	at risk due to increased human activity on site.	on and the appropriate actions should take place dependant on the results.
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12 Environmental Management Plan

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

12.1 Project Activities with Potentially Significant Impacts

In summary, the impacts of the development on flora and fauna are primarily related to vegetation clearing, in addition to minor disturbance of fauna, as listed in Table 12-1.

Table 12-1: Potentially Significant Project Impacts

Activities	Potentially Significant Project Impacts
Clearing of vegetation	Loss of <i>Eragrostis</i> Grassland
	Habitat fragmentation and edge effects (alien plant invasion)
Increased vehicular movement on site	Faunal disturbance and potential roadkill

12.2 Summary of Mitigation and Management

Table 12-2 provides a description of the mitigation and management options for the environmental impacts anticipated during the construction, operations and closure and rehabilitations phases on the fauna and flora.

Table 12-2: 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
Clearing of vegetation	Loss of <i>Eragrostis</i> Grassland (58ha)	Moderate (negative) 84	Habitat loss for flora and fauna Loss of species diversity Potential loss of Red Data species	Construction phase	Relocation of infrastructure Rehabilitation with native grass species; Relocation of Red Data species, should any species be recorded in developing footprint area during vegetation clearing	National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004)	Rehabilitation should take place after decommissioning as outlined in the Rehabilitation Plan Report. Relocation of Red Data flora species prior to vegetation clearing – screening of areas prior to vegetation clearance
Clearing of vegetation	Habitat fragmentation and increased establishment of alien plant species.	Minor (negative) 54	Flora – alien plant invasion	Construction phase	Alien management plan	National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 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.
Increased vehicular activities	Roadkill and disturbance of fauna	Minor (negative) 40	Potential loss of fauna diversity	Construction, operation and decommissioning phases	Erection of signage Implementing speed limit on site Restricting driving at night	National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004)	Signage should be erected before the operational phase.

12.3 Monitoring Plan

The only aspect requiring monitoring, based on the flora and fauna assessment, is the establishment of alien plant species as described below. This should be completed by a qualified botanical specialist.

Table 12-3: 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
Soil disturbance	Establishment of alien plant species	Alien plant monitoring	Qualified botanist	Quarterly monitoring for two years



13 Consultation Undertaken

All comments related to wetlands have been addressed in the Wetland Assessment Report (Digby Wells, 2016). No comments directly related to flora and fauna have been received.

14 Discussion and Conclusions

The study area is located within the threatened ecosystems: Eastern Highveld Grassland and Soweto Highveld Grassland. Further to this, the site falls within areas that have been demarcated as irreplaceable according to the Mpumalanga Sector Plan. The results of the field investigations confirm that the irreplaceable areas are intact natural systems and should be conserved.

The surface infrastructure does not coincide within any of the irreplaceable areas according to the Mpumalanga Sector Plan; however, clearing will result in a loss of *Eragrostis*-dominated habitat. The loss of habitat due to the surface infrastructure will be moderate and minor within mitigation. The impact of habitat fragmentation will be minor and the impact of disturbance to fauna will be minor, reduced to negligible with mitigation. The overall impact of the proposed development on flora and fauna is expected to be moderate. The following recommendations have been made for this study:

- The site should be screened prior to construction, preferably between the months of November to March, for any plant SSC;
- If any plant SSC is recorded, these should be translocated with the involvement of a qualified botanist. The donor habitat should resemble the receiving habitat and the species/populations should be monitored monthly after translocation for up to one year;
- If any important fauna species (SSC) are identified (as listed in the expected species lists) that have not been included in the site-specific species lists, this should be reported to the Environmental Control Officer on site and the provincial authority (MPTA) for their reference. Further to this, measures should be undertaken to ensure that negative impacts to the species in question are not imposed due to the development; and
- The mine has an opportunity to reduce their overall liability in terms of spread of alien plant species. It is recommended that all alien plant species are controlled throughout the site as far as possible.

The specialist opinion is that the proposed project should go ahead, should all recommendations for mitigation and management be adhered to.



15 References

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Flora and Fauna Impact Assessment Report

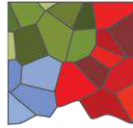
Proposed Development of an Underground Coal Mine and Associated Infrastructure, near
Hendrina, Mpumalanga Province

XST3791



DIGBY WELLS
ENVIRONMENTAL

Appendix A: Staff CV's



DIGBY WELLS

ENVIRONMENTAL

Ms. Crystal Rowe

Flora and Wetlands Ecologist

Biophysical

Digby Wells Environmental

1 Education

- 2008-2010: BSc Botany and Geology (Nelson Mandela Metropolitan University- (NMMU))
- 2011 BSc Honours in Botany (NMMU)

1.1 Short Courses

- 2012: Tools for Wetland Assessment - Rhodes University
- 2015: Constructed Wetlands – Melrose Training

2 Language Skills

- English (1st language); and
- Afrikaans (2nd language).

3 Employment

- June 2013 – *Present*: Digby Wells Environmental – Flora & Fauna Ecologist
- November 2011- June 2013: Natural Scientific Services (NSS) – Junior Ecologist

4 Experience

Crystal has completed numerous flora and wetland ecology assessments throughout Africa, for the following assessments:

- Wetland delineations and Health Assessments
- Biodiversity Baseline Assessments for Flora and Fauna
- Impact Assessments
- Aquatic Flora Assessments

5 Project Experience

Crystal Rowe specialises in flora and wetland ecology. She achieved a BSc in Botany and Geology and a BSc Hons in Botany at Nelson Mandela Metropolitan University (NMMU). Key experience includes ecological impact assessments, baseline vegetation assessments, estuarine ecological state assessments and wetland health assessments. Project experience includes various countries such as: the DRC, Ethiopia, the Ivory Coast, Mali, Mozambique, Sierra Leone and extensively within South Africa. Crystal is competent in plant identification and is experienced in IFC compliant assessments. She is also certified to complete wetland Ecosystem Services and is a registered professional natural scientist in South Africa (reg. no.: 400090/15). Some of Crystal's project experience is listed below:

Year	Client	Project	Responsibility	Location
2012	ERM for London Mining	Marampa Mine Sierra Leone Barge Route	Mangrove and estuarine flora assessment	Sierra Leone
2012	ERM for Allana Potash	Allana Potash Mine ESIA	Flora Assessment, assistant fauna assessment	Danakil Depression, Ethiopia
2012	ERM for Anadarko Petroleum	Anadarko Petroleum offshore LNG project	Aquatic Baseline (involvement in floral component) Assessment	Northern Mozambique, Palma
2012	Sedibelo Platinum Mines (Pty) Ltd	Sedibelo West Platinum Mining Project	Flora Assessment (assistant)	North-west Province
2012	Eskom Holdings SOC Ltd	Lethabo Powerstation	Biodiversity Assessment	Free State Province
2012	Eskom Holdings SOC Ltd	Matimba Powerstation	Biodiversity Assessment	Free State Province
2013	Dube Tradeport	Dube Tradeport Wetland Assessment	Wetland Assessment	Durban, KZN, South Africa
2014	Randgold Resources	GIS training for the BAP for Goukoto and Loulo Gold Mines	Biodiversity Action Plan	Mali
2014	Randgold Resources	Flora and Fauna Assessments for Kibali Gold Mine	Flora and wetland assessments	Oriental Province, Democratic Republic of Congo



		ESIA		
2014	Randgold Resources	Biodiversity Action Plan for Tongon Gold Mine	Flora assessment	Ivory Coast
2014	Sasol Mining (Pty) Ltd	Sigma Ash Back-filling Project	Wetland Assessment	Free State Province, South Africa
2014	Exxaro Coal (Pty) Ltd	Grootegeeluk Wetland Offset Strategy	Wetland Offset Strategy	Limpopo Province, South Africa
2014	Anglo Operations	Dalyshope Environmental Impacts Assessment	Flora and Wetlands Assessment	Limpopo Province, South Africa
2015	Northern Coal	Jagtlust Wetland Offset Strategy	Wetland Offset Strategy	Carolina, Mpumalanga Province, South Africa
2015	Aureus Mining Inc.	New Liberty Constructed Wetland	Constructed wetland design	Liberia
2015	Universal Coal (Pty) Ltd	Roodekop Wetland Offset Strategy	Wetland Offset Strategy	Mpumalanga Province, South Africa
2015	Anglo Coal (Pty) Ltd	Goedehoop Mine Wetland Assessment	Wetland Assessment	Mpumalanga Province, South Africa
2015	Exxaro Coal (Pty) Ltd	Matla Brine Ponds and Water Treatment Plant	Wetland Offset Strategy	Mpumalanga Province, South Africa
2015	Eskom Holdings Soc Ltd	Kriel Powerstation IWULA	Wetland Assessment	Mpumalanga Province, South Africa
2015	Exxaro Coal (Pty) Ltd	Schoornoord Coal Mine EIA	Wetland Assessment	Mpumalanga Province, South Africa
2016	Natural Habitats	Makpele Palm Oil Plantation	Flora, wetland and High Conservation Value Assessment	Makpele Chiefdom, Sierra Leone
2016	Anglo Coal (Pty) :td	Isibonelo Wetland Offset	Wetland Offset Strategy	Mpumalanga Province, South Africa

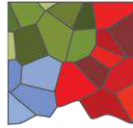
		Strategy		
2016	Randgold Resources	Loulo Gold Mine Constructed Wetland – <i>in process</i>	Design of constructed wetland to treat mine effluent	Mali

6 Professional Registration

- South African Council for Natural Scientific Professions: Professional Natural Scientist – Botanical Science. Registration number: 400090/15

7 Publications

Adams J.B., Grobler A., Rowe C., Riddin T. Bornaman T.G. and Ayrns D. 2012. Plant traits and spread of the invasive salt marsh grass, *Spartina alterniflora* Loisel., in the Great Brak Estuary, South Africa. African Journal of Marine Science. Volume 34, Issue 3: 312-322.



DIGBY WELLS

ENVIRONMENTAL

Mr. Rudolph Greffrath
Manager: Fauna, Flora and Wetlands Unit,
Senior Terrestrial Ecology specialist
Biophysical Department
Digby Wells Environmental

1 Education

- 2005-2006: B-tech Degree in Nature Conservation, Nelson Mandela Metropolitan University (NMMU).
- 2001- 2004: National Diploma in Nature Conservation, Nelson Mandela Metropolitan University (NMMU).

1.1 Courses

- African Reptiles and Venom: Venomous Snake Handling, 2014.
- African Reptiles and Venom: Snake identification and Snakebite Treatment, 2014.
- Dr Phil Tanner: Land Rehabilitation Seminar, 2014.
- Executrain: Microsoft Excel, 2012.
- Executrain: Microsoft Word, 2012.
- Measurements of Biodiversity at the University of the Free State, by Prof. M. T. Seaman. September 2008.
- Bird Identification course, by Ettiene Marais November 2009.
- Introduction to VEGRAI and Eco-classification, by Dr. James Mackenzie December 2009.
- Rehabilitation of Mine impacted areas, with Fritz van Oudshoorn, Dr Wayne Truter and Gustav le Roux 2011.

2 Language Skills

English : Fluent

Afrikaans : Fluent

3 Employment

- 2006 – Present: Digby Wells Environmental, Johannesburg, South Africa.

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Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

Directors: AJ Reynolds (Chairman) (British)*, GE Trusler (C.E.O), GB Beringer, LF Koeslag, J Leaver*, NA Mehlomakulu, DJ Otto

*Non-Executive

- 2002 - 2003: Shamwari Game Reserve, Eastern Cape, South Africa.
- 2001: Kop-Kop Geotechnical instrumentation specialists, Johannesburg, South Africa.

4 Experience

As Senior Ecologist

Rudi's current role is that of a terrestrial ecology, specifically fauna and flora specialist, in this capacity he is responsible for planning and conducting fauna and flora surveys/studies that are either completed in support of environmental authorisations or are focused specialist studies which meet local and international standards. In addition to this, Rudi is responsible for compiling Biodiversity Land Management Programs where different specialist studies are collated into a working document for clients in order to aid in pre or post mining management. He is also involved in rehabilitation studies which entail the planning, implementation and monitoring of vegetative rehabilitation in designated areas on mines. Rudi also fulfils the role of project manager here he manages national and international projects across Africa, specifically west, central and southern Africa, managing a multi-disciplinary team of specialists.

Rudi is also involved in the acquisition of permits for mines, this includes the planning of relocation strategies for protected and endangered plant species in areas where mines are to be established. This involves the planning and execution of data gathering surveys, thereafter he manages the process involving relevant provincial and National authorities in order to obtain the specific permit that allows for a development to continue.

Information pertaining to the technical expertise of Rudi includes the following:

- Environmental Impact Assessments (EIAs), Basic Assessments and Environmental Management Plans (EMPs) for environmental authorisations in terms of the South African National Environmental Management Act (NEMA), 1998 (Act 107 of 1998);
- Environmental pre-feasibility studies for gold tailings reclamation and iron ore mining projects;
- International Finance Corporation (IFC) related projects across Africa, applying performance standards and Equator Principles on the Environmental Health and Safety Guidelines set down by the IFC;
- Environmental and Social Impact Assessments (ESIA) for Environmental Authorisation;
- Biodiversity Assessments including Mammalia, Avifauna, Herpetofauna and Arthropoda;
- Impact assessments based on the terrestrial environment;
- Biodiversity and Land Management Programs;

- Protected plant species management strategies planning and implementation;
- Monitoring of rehabilitation success through vegetation establishment;
- Rehabilitation planning;
- Environmental auditing of rehabilitated areas;
- Project management of ecological specialist studies;
- Planning and design of Rehabilitation off-set strategies.

As Unit Manager

Rudi is also responsible for the team of specialists within the fauna, flora and wetlands unit, in the capacity of workload planning and execution. Project planning, reviewing of project reports and field work plans. The management and planning of each individual in the unit's further studies, Key Performance Indicators and subsequent performance reviews. A more detailed list of roles and responsibilities are given in the table below.

Task
Workload delegation
Timesheet control
Inter-departmental projects coordination
Up-to-date schedule of projects and proposals
Formal and on-the job training
Bi-annual Staff reviews
Salary and Bonus review
Preparation and presentation of budget – monitoring
Recruitment of new staff
Disciplinary procedures
Quality of work and review of documents
Employee leave and administration
MANCO input
Proposals compilation, review, submission

Feedback from employees

5 Project Experience

Project	Location	Client	Main project features	Positions held	Activities performed
Mmamabula Energy Project (MEP).	Botswana	CIC energy	Construction of a railway, opencast mine, wellfield, conveyors, addits, housing.	Technical Specialist Ecologist	IFC level specialist studies, Fauna and Flora surveys for the project features, including impact assessments, management plans. Alien eradication plans.
Orlight Solar PV Power Project	South Africa	Orlight SA	Environmental Impact Assessment (EIA) process for five proposed Solar Photovoltaic (PV) Power Plants	Technical Specialist Ecologist	EIA Terrestrial Biodiversity studies, IFC level specialist studies
Twenty Nine Capitol	South Africa	CSIR	Photovoltaic Power stations	Technical Specialist Ecologist	EIA Terrestrial Biodiversity studies, in support of the EIA report, IFC level specialist studies



Tongan Biodiversity Land Management Plan	Ivory Coast	Randgold	Design, compilation and implementation of the BLMP	Technical Specialist Ecologist, Project Manager	Fauna and Flora surveys for the BLMP, compilation of BLMP. Alien eradication plans. IFC level specialist studies
Kibali Gold mine	DRC Congo	Randgold	Gold mine infrastructure	Technical Specialist Ecologist	Technical specialist, fauna and flora, for the Kibali ESIA. IFC level specialist studies
Kibali Gold mine	DRC Congo	Randgold	ESIA Update	Technical Specialist Ecologist	Technical specialist, fauna and flora, for the Kibali ESIA. IFC level specialist studies
Nzoro Hydroelectric station	DRC Congo	Randgold	Hydroelectric plant	Technical Specialist Ecologist	Technical specialist, fauna and flora, for the Nzoro ESIA. IFC level specialist studies.
Loulo Biodiversity Land	Mali	Randgold	Design, compilation and	Technical Specialist	Fauna and Flora surveys for the project



Management Plan			implementation of the BLMP	Ecologist, Project Manager	features, compilation of BLMP.
Koidu Diamond Mine	Sierra Leone	Koidu Resources	Construction of new open pit	Technical Specialist Ecologist	Technical specialist, fauna and flora, for the Koidu ESIA. IFC level specialist studies, terrestrial ecology management plans
Resource Generation	South Africa	Temo Coal	Coal mine/Railway Line	Technical Specialist Ecologist	Fauna and Flora surveys, Protected plant species management plans, Permitting and Rehabilitation design.
Impunzi Rehabilitation monitoring	South Africa	Glencore	Monitoring of rehabilitation success and suggested management measures	Technical Specialist Flora specialist, Project manager	Vegetation surveys, rehabilitation monitoring. Alien eradication plan.

6 Professional Affiliations

- Birdlife International;
- Endangered Wildlife Trust (EWT);
- Grassland Society of Southern Africa.

- Botanical Society of South Africa;

7 Professional Registration

- South African Council for Natural Scientific Professions (Membership No. 200245/13);
- IAIA, International Association for Impact assessments;
- The Land Rehabilitation Society of Southern Africa, LARSA (Membership No. 0085);

8 Publications

- Biodiversity Action Plans for faunal habitat maintenance and expansion in mining. Poster presented at the 48th Annual Grassland Society of Southern Africa (GSSA) conference.
- *Limpopo Province South Africa – the Biodiversity perspective* Paper presentation, presented at the Limpopo Minerals Conference and Trade show, hosted by the fossil fuel foundation and LEDET, 2015/11/11.



Appendix B: Expected Plant Species List



Species	Threat status	SA Endemic
<i>Acalypha angustata</i> Sond.	LC	No
<i>Acalypha caperonioides</i> Baill. var. <i>caperonioides</i>	DDT	No
<i>Acalypha wilmsii</i> Pax ex Prain & Hutch.	LC	No
<i>Aeschynomene rehmannii</i> Schinz var. <i>leptobotrya</i> (Harms ex Baker f.) J.B.Gillett	LC	No
<i>Agrostis continuata</i> Stapf	LC	No
<i>Agrostis eriantha</i> Hack. var. <i>eriantha</i>	LC	No
<i>Agrostis gigantea</i> Roth		No
<i>Agrostis lachnantha</i> Nees var. <i>lachnantha</i>	LC	No
<i>Alchemilla capensis</i> Thunb.	LC	No
<i>Alepidea peduncularis</i> A.Rich.	DDT	No
<i>Alloteropsis semialata</i> (R.Br.) Hitchc. subsp. <i>eckloniana</i> (Nees) Gibbs Russ.	LC	No
<i>Alysicarpus zeyheri</i> Harv.	LC	No
<i>Andropogon eucomus</i> Nees	LC	No
<i>Andropogon schirensis</i> Hochst. ex A.Rich.	LC	No
<i>Anisotoma pedunculata</i> N.E.Br.	LC	No
<i>Aponogeton junceus</i> Lehm.	LC	No
<i>Argyrolobium harveyanum</i> Oliv.	LC	No
<i>Argyrolobium humile</i> E.Phillips	LC	No
<i>Argyrolobium rupestre</i> (E.Mey.) Walp. subsp. <i>rupestre</i>	LC	No
<i>Argyrolobium transvaalense</i> Schinz	LC	No
<i>Argyrolobium tuberosum</i> Eckl. & Zeyh.	LC	No
<i>Aristida congesta</i> Roem. & Schult. subsp. <i>congesta</i>	LC	No
<i>Aristida scabrivalvis</i> Hack. subsp. <i>scabrivalvis</i>	LC	No
<i>Asclepias aurea</i> (Schltr.) Schltr.	LC	No
<i>Asclepias cultriformis</i> (Harv. ex Schltr.) Schltr.	LC	No
<i>Asclepias eminens</i> (Harv.) Schltr.	LC	No
<i>Asclepias gibba</i> (E.Mey.) Schltr. var. <i>gibba</i>	LC	No
<i>Asclepias gibba</i> (E.Mey.) Schltr. var. <i>gibba</i>	LC	No
<i>Asclepias multicaulis</i> (E.Mey.) Schltr.	LC	No



Species	Threat status	SA Endemic
<i>Asclepias stellifera</i> Schltr.	LC	No
<i>Ascolepis capensis</i> (Kunth) Ridl.	LC	No
<i>Asparagus larycinus</i> Burch.	LC	No
<i>Asparagus virgatus</i> Baker	LC	No
<i>Aspidoglossum biflorum</i> E.Mey.	LC	No
<i>Aspidoglossum glanduliferum</i> (Schltr.) Kupicha	LC	No
<i>Aspidoglossum lamellatum</i> (Schltr.) Kupicha	LC	No
<i>Aspidoglossum ovalifolium</i> (Schltr.) Kupicha	LC	No
<i>Aspidoglossum xanthosphaerum</i> Hilliard	VU	No
<i>Aster bakerianus</i> Burtt Davy ex C.A.Sm.	LC	No
<i>Athrixia elata</i> Sond.	LC	No
<i>Berkheya pinnatifida</i> (Thunb.) Thell. subsp. <i>ingrata</i> (Bolus) Roessler	LC	No
<i>Berkheya zeyheri</i> Oliv. & Hiern subsp. <i>zeyheri</i>	LC	No
<i>Brachiaria serrata</i> (Thunb.) Stapf	LC	No
<i>Brachycorythis pubescens</i> Harv.	LC	No
<i>Brachystelma foetidum</i> Schltr.	LC	No
<i>Bryum cellulare</i> Hook.		No
<i>Bryum dichotomum</i> Hedw.		No
<i>Bulbine capitata</i> Poelln.	LC	No
<i>Canoparmelia texana</i> (Tuck.) Elix & Hale		No
<i>Carex rhodesiaca</i> Nelmes		No
<i>Catalepis gracilis</i> Stapf & Stent	LC	No
<i>Ceratiosicyos laevis</i> (Thunb.) A.Meeuse	LC	No
<i>Chaenostoma neglectum</i> J.M.Wood & M.S.Evans	LC	No
<i>Chaetacanthus burchellii</i> Nees	LC	No
<i>Chironia palustris</i> Burch. subsp. <i>transvaalensis</i> (Gilg) I.Verd.	LC	No
<i>Chironia purpurascens</i> (E.Mey.) Benth. & Hook.f. subsp. <i>humilis</i> (Gilg) I.Verd.	LC	No
<i>Chlorophytum cooperi</i> (Baker) Nordal	LC	No
<i>Chlorophytum fasciculatum</i> (Baker) Kativu	LC	No



Species	Threat status	SA Endemic
<i>Commelina africana</i> L. var. <i>africana</i>	LC	No
<i>Convolvulus sagittatus</i> Thunb.	LC	No
<i>Cordylogyne globosa</i> E.Mey.	LC	No
<i>Corycium dracomontanum</i> Parkman & Schelpe	LC	No
<i>Corycium nigrescens</i> Sond.	LC	No
<i>Crassula setulosa</i> Harv. var. <i>setulosa forma setulosa</i>	Not Evaluated	No
<i>Crotalaria eremicola</i> Baker f. <i>subsp. eremicola</i>	LC	No
<i>Crotalaria globifera</i> E.Mey.	LC	No
<i>Crotalaria sphaerocarpa</i> Perr. ex DC. <i>subsp. sphaerocarpa</i>	LC	No
<i>Cynodon hirsutus</i> Stent	LC	No
<i>Cynoglossum austroafricanum</i> Hilliard & B.L.Burtt	LC	No
<i>Cyperus congestus</i> Vahl	LC	No
<i>Cyperus difformis</i> L.	LC	No
<i>Cyperus esculentus</i> L. var. <i>esculentus</i>	LC	No
<i>Cyperus laevigatus</i> L.	LC	No
<i>Cyperus marginatus</i> Thunb.	LC	No
<i>Cyperus rigidifolius</i> Steud.	LC	No
<i>Dichilus strictus</i> E.Mey.	LC	No
<i>Diclis rotundifolia</i> (Hiern) Hilliard & B.L.Burtt	LC	No
<i>Dierama insigne</i> N.E.Br.	LC	No
<i>Dierama mossii</i> (N.E.Br.) Hilliard	LC	No
<i>Digitaria ternata</i> (A.Rich.) Stapf	LC	No
<i>Digitaria tricholaenoides</i> Stapf	LC	No
<i>Dipcadi marlothii</i> Engl.	LC	No
<i>Disa aconitoides</i> Sond. <i>subsp. aconitoides</i>	LC	No
<i>Disa cooperi</i> Rchb.f.	LC	No
<i>Dolichos angustifolius</i> Eckl. & Zeyh.	LC	No
<i>Drimia multisetosa</i> (Baker) Jessop	LC	No
<i>Dryopteris athamantica</i> (Kunze) Kuntze	LC	No



Species	Threat status	SA Endemic
<i>Elephantorrhiza elephantina</i> (Burch.) Skeels	LC	No
<i>Elephantorrhiza praetermissa</i> J.H.Ross	LC	No
<i>Eragrostis chloromelas</i> Steud.	LC	No
<i>Eragrostis curvula</i> (Schrad.) Nees	LC	No
<i>Eragrostis mexicana</i> (Hornem.) Link subsp. <i>virescens</i> (J.Presl.) S.D.Koch & Sánchez Vega	Not Evaluated	No
<i>Eragrostis patentissima</i> Hack.	LC	No
<i>Eragrostis remotiflora</i> De Winter	LC	No
<i>Eragrostis sclerantha</i> Nees subsp. <i>sclerantha</i>	LC	No
<i>Eriocaulon abyssinicum</i> Hochst.	LC	No
<i>Eriosema cordatum</i> E.Mey.	LC	No
<i>Eriosema salignum</i> E.Mey.	LC	No
<i>Eriospermum cooperi</i> Baker var. <i>cooperi</i>	LC	No
<i>Eriospermum porphyrium</i> Archibald	LC	No
<i>Erythrina zeyheri</i> Harv.	LC	No
<i>Eucomis autumnalis</i> (Mill.) Chitt. subsp. <i>clavata</i> (Baker) Reyneke	Not Evaluated	No
<i>Eulophia aculeata</i> (L.f.) Spreng. subsp. <i>huttonii</i> (Rolfe) A.V.Hall	LC	No
<i>Eulophia cooperi</i> Rchb.f.	LC	No
<i>Eulophia hians</i> Spreng. var. <i>hians</i>	LC	No
<i>Eulophia hians</i> Spreng. var. <i>inaequalis</i> (Schltr.) S.Thomas	LC	No
<i>Eulophia hians</i> Spreng. var. <i>nutans</i> (Sond.) S.Thomas	LC	No
<i>Eulophia ovalis</i> Lindl. var. <i>ovalis</i>	LC	No
<i>Eulophia welwitschii</i> (Rchb.f.) Rolfe	LC	No
<i>Euphorbia epicyparissias</i> E.Mey. ex Boiss.	LC	No
<i>Euphorbia natalensis</i> Bernh. ex Krauss	LC	No
<i>Felicia filifolia</i> (Vent.) Burt Davy subsp. <i>filifolia</i>	LC	No
<i>Fimbristylis complanata</i> (Retz.) Link	LC	No
<i>Fingerhuthia sesleriiformis</i> Nees	LC	No
<i>Fuirena coerulescens</i> Steud.	LC	No
<i>Geigeria burkei</i> Harv. subsp. <i>valida</i> Merxm.	LC	No



Species	Threat status	SA Endemic
<i>Gladiolus dalenii</i> Van Geel subsp. <i>dalenii</i>	LC	No
<i>Gladiolus paludosus</i> Baker	LC	No
<i>Gladiolus papilio</i> Hook.f.	LC	No
<i>Gladiolus robertsoniae</i> F.Bolus	NT	NO
<i>Gladiolus vinosomaculatus</i> Kies	LC	No
<i>Gnidia kraussiana</i> Meisn. var. <i>kraussiana</i>	LC	No
<i>Gnidia microcephala</i> Meisn.	LC	No
<i>Habenaria clavata</i> (Lindl.) Rchb.f.	LC	No
<i>Habenaria falcicornis</i> (Burch. ex Lindl.) Bolus subsp. <i>caffra</i> (Schltr.) J.C.Manning	LC	No
<i>Haemanthus humilis</i> Jacq. subsp. <i>hirsutus</i> (Baker) Snijman	LC	No
<i>Haplocarpha scaposa</i> Harv.	LC	No
<i>Hebenstretia comosa</i> Hochst.	LC	No
<i>Hebenstretia rehmannii</i> Rolfe	LC	No
<i>Helichrysum adenocarpum</i> DC. subsp. <i>adenocarpum</i>	LC	No
<i>Helichrysum caespitium</i> (DC.) Harv.	LC	No
<i>Helichrysum cephaloideum</i> DC.	LC	No
<i>Helichrysum nudifolium</i> (L.) Less. var. <i>nudifolium</i>	LC	No
<i>Helichrysum oreophilum</i> Klatt	LC	No
<i>Helichrysum rugulosum</i> Less.	LC	No
<i>Helictotrichon turgidulum</i> (Stapf) Schweick.	LC	No
<i>Hermannia cordata</i> (E.Mey. ex E.Phillips) De Winter	LC	No
<i>Hermannia cristata</i> Bolus	LC	No
<i>Hesperantha coccinea</i> (Backh. & Harv.) Goldblatt & J.C.Manning	LC	No
<i>Heteropogon contortus</i> (L.) Roem. & Schult.	LC	No
<i>Hibiscus aethiopicus</i> L. var. <i>ovatus</i> Harv.	LC	No
<i>Hibiscus microcarpus</i> Garcke	LC	No
<i>Hibiscus trionum</i> L.		No
<i>Hilliardiella aristata</i> (DC.) H.Rob.	LC	No
<i>Holcus lanatus</i> L.	Not Evaluated	No



Species	Threat status	SA Endemic
<i>Hyparrhenia hirta</i> (L.) Stapf	LC	No
<i>Hypericum lalandii</i> Choisy	LC	No
<i>Hypoxis filiformis</i> Baker	LC	No
<i>Hypoxis hemerocallidea</i> Fisch., C.A.Mey. & Avé-Lall.	Declining	No
<i>Indigofera evansiana</i> Burt Davy	LC	No
<i>Indigofera frondosa</i> N.E.Br.	LC	No
<i>Indigofera hiliaris</i> Eckl. & Zeyh. var. <i>hiliaris</i>	LC	No
<i>Indigofera sanguinea</i> N.E.Br.	LC	No
<i>Ipomoea crassipes</i> Hook. var. <i>crassipes</i>	LC	No
<i>Ipomoea simplex</i> Thunb.	LC	No
<i>Isolepis costata</i> Hochst. ex A.Rich.	LC	No
<i>Isolepis sepulcralis</i> Steud.	LC	No
<i>Isolepis setacea</i> (L.) R.Br.	LC	No
<i>Jamesbrittenia montana</i> (Diels) Hilliard	LC	No
<i>Juncus dregeanus</i> Kunth subsp. <i>dregeanus</i>	LC	No
<i>Juncus exsertus</i> Buchenau	LC	No
<i>Juncus oxycarpus</i> E.Mey. ex Kunth	LC	No
<i>Juncus punctorius</i> L.f.	LC	No
<i>Justicia anagalloides</i> (Nees) T.Anderson	LC	No
<i>Khadia carolinensis</i> (L.Bolus) L.Bolus	VU	No
<i>Kiggelaria africana</i> L.	LC	No
<i>Kniphofia albescens</i> Codd	LC	No
<i>Kniphofia porphyrantha</i> Baker	LC	No
<i>Koeleria capensis</i> (Steud.) Nees	LC	No
<i>Kohautia amatymbica</i> Eckl. & Zeyh.	LC	No
<i>Kyllinga pulchella</i> Kunth	LC	No
<i>Lactuca inermis</i> Forssk.	LC	No
<i>Ledebouria cooperi</i> (Hook.f.) Jessop	LC	No
<i>Ledebouria leptophylla</i> (Baker) S.Venter	LC	No
<i>Leersia hexandra</i> Sw.	LC	No



Species	Threat status	SA Endemic
<i>Lespedeza cuneata</i> (Dum.Cours.) G.Don	Not Evaluated	No
<i>Linum thunbergii</i> Eckl. & Zeyh.	LC	No
<i>Lobelia flaccida</i> (C.Presl) A.DC. subsp. <i>flaccida</i>	LC	No
<i>Lotus discolor</i> E.Mey. subsp. <i>discolor</i>	LC	No
<i>Loudetia simplex</i> (Nees) C.E.Hubb.	LC	No
<i>Medicago laciniata</i> (L.) Mill. var. <i>laciniata</i>	Not Evaluated	No
<i>Melanospermum rupestre</i> (Hiern) Hilliard	LC	No
<i>Melasma scabrum</i> P.J.Bergius var. <i>scabrum</i>	LC	No
<i>Melinis nerviglumis</i> (Franch.) Zizka	LC	No
<i>Melolobium wilmsii</i> Harms	LC	No
<i>Mimulus gracilis</i> R.Br.	LC	No
<i>Miraglossum pulchellum</i> (Schltr.) Kupicha	LC	No
<i>Monopsis decipiens</i> (Sond.) Thulin	LC	No
<i>Moraea elliotii</i> Baker	LC	No
<i>Moraea pallida</i> (Baker) Goldblatt	LC	No
<i>Mossia intervallis</i> (L.Bolus) N.E.Br.	LC	No
<i>Myosotis graminifolia</i> A.DC.	LC	No
<i>Nemesia fruticans</i> (Thunb.) Benth.	LC	No
<i>Nerine angustifolia</i> (Baker) Baker	LC	No
<i>Nesaea sagittifolia</i> (Sond.) Koehne var. <i>sagittifolia</i>	LC	No
<i>Nidorella anomala</i> Steetz	LC	No
<i>Oenothera parodiana</i> Munz subsp. <i>parodiana</i>	Not Evaluated	No
<i>Oenothera stricta</i> Ledeb. ex Link subsp. <i>stricta</i>	Not Evaluated	No
<i>Oenothera tetraptera</i> Cav.	Not Evaluated	No
<i>Ornithogalum flexuosum</i> (Thunb.) U.& D.Müll.-Doblies	LC	No
<i>Orthotrichum diaphanum</i> (Schrad. ex Brid.) Lindb.		No
<i>Othonna natalensis</i> Sch.Bip.	LC	No



Species	Threat status	SA Endemic
<i>Oxygonum dregeanum</i> Meisn. subsp. <i>canescens</i> (Sond.) Germish. var. <i>canescens</i>	LC	No
<i>Pachycarpus grandiflorus</i> (L.f.) E.Mey. subsp. <i>grandiflorus</i>	LC	No
<i>Pachycarpus suaveolens</i> (Schltr.) Nicholas & Goyder	VU	No
<i>Panicum schinzii</i> Hack.	LC	No
<i>Parapodium costatum</i> E.Mey.	LC	No
<i>Pelargonium luridum</i> (Andrews) Sweet	LC	No
<i>Pelargonium pseudofumarioides</i> R.Knuth	LC	No
<i>Pellaea calomelanos</i> (Sw.) Link var. <i>calomelanos</i>	LC	No
<i>Pennisetum thunbergii</i> Kunth	LC	No
<i>Pentanisia prunelloides</i> (Klotzsch ex Eckl. & Zeyh.) Walp. subsp. <i>latifolia</i> (Hochst.) Verdc.	LC	No
<i>Persicaria decipiens</i> (R.Br.) K.L.Wilson	LC	No
<i>Persicaria lapathifolia</i> (L.) Gray	Not Evaluated	No
<i>Pityrogramma argentea</i> (Willd.) Domin	LC	No
<i>Polygala gracilentata</i> Burt Davy	LC	No
<i>Polygala uncinata</i> E.Mey. ex Meisn.	LC	No
<i>Pycreus macranthus</i> (Boeckeler) C.B.Clarke	LC	No
<i>Pycreus nitidus</i> (Lam.) J.Raynal	LC	No
<i>Pycreus rehmannianus</i> C.B.Clarke	LC	No
<i>Raphionacme hirsuta</i> (E.Mey.) R.A.Dyer	LC	No
<i>Rendlia altera</i> (Rendle) Chiov.	LC	No
<i>Rhynchosia nervosa</i> Benth. ex Harv. var. <i>nervosa</i>	LC	No
<i>Rhynchosia reptabunda</i> N.E.Br.	LC	No
<i>Riccia cavernosa</i> Hoffm. emend. Raddi		No
<i>Riccia crystallina</i> L. emend. Raddi		No
<i>Riccia natalensis</i> Sim		No
<i>Riccia rosea</i> O.H.Volk & Perold		No
<i>Riccia stricta</i> (Lindenb.) Perold		No
<i>Rubus ludwigii</i> Eckl. & Zeyh. subsp. <i>ludwigii</i>	LC	No



Species	Threat status	SA Endemic
<i>Rumex acetosella</i> L. subsp. <i>angiocarpus</i> (Murb.) Murb.		No
<i>Rumex lanceolatus</i> Thunb.	LC	No
<i>Salvia repens</i> Burch. ex Benth. var. <i>repens</i>	LC	No
<i>Satyrium hallackii</i> Bolus subsp. <i>ocellatum</i> (Bolus) A.V.Hall	LC	No
<i>Satyrium longicauda</i> Lindl. var. <i>longicauda</i>	LC	No
<i>Satyrium neglectum</i> Schltr. subsp. <i>neglectum</i> var. <i>neglectum</i>	LC	No
<i>Satyrium parviflorum</i> Sw.	LC	No
<i>Satyrium trinerve</i> Lindl.	LC	No
<i>Scabiosa columbaria</i> L.	LC	No
<i>Schizachyrium sanguineum</i> (Retz.) Alston	LC	No
<i>Schizocarpus nervosus</i> (Burch.) Van der Merwe	LC	No
<i>Schizochilus zeyheri</i> Sond.	LC	No
<i>Schkuhria pinnata</i> (Lam.) Kuntze ex Thell.	Not Evaluated	No
<i>Schoenoplectus decipiens</i> (Nees) J.Raynal	LC	No
<i>Scirpoides burkei</i> (C.B.Clarke) Goetgh., Muasya & D.A.Simpson	LC	No
<i>Searsia dentata</i> (Thunb.) F.A.Barkley	LC	No
<i>Searsia discolor</i> (E.Mey. ex Sond.) Moffett	LC	No
<i>Searsia rigida</i> (Mill.) F.A.Barkley var. <i>rigida</i>	LC	No
<i>Sebaea leiostyla</i> Gilg	LC	No
<i>Senecio laevigatus</i> Thunb. var. <i>integrifolius</i> Harv.	LC	No
<i>Senecio laevigatus</i> Thunb. var. <i>laevigatus</i>	LC	No
<i>Setaria pumila</i> (Poir.) Roem. & Schult.	LC	No
<i>Sisyranthus imberbis</i> Harv.	LC	No
<i>Solanum lichtensteinii</i> Willd.	LC	No
<i>Sporobolus albicans</i> (Nees ex Trin.) Nees	LC	No
<i>Striga elegans</i> Benth.	LC	No
<i>Thesium costatum</i> A.W.Hill var. <i>costatum</i>	LC	No
<i>Thunbergia atriplicifolia</i> E.Mey. ex Nees	LC	No
<i>Trachypogon spicatus</i> (L.f.) Kuntze	LC	No



Species	Threat status	SA Endemic
<i>Trifolium africanum</i> Ser. var. <i>africanum</i>	LC	No
<i>Urochloa panicoides</i> P.Beauv.		No
<i>Usnea dichroa</i> Motyka var. <i>dichroa</i>		No
<i>Utricularia prehensilis</i> E.Mey.	LC	No
<i>Verbena rigida</i> Spreng.	Not Evaluated	No
<i>Vernonia fastigiata</i> Oliv. & Hiern	LC	No
<i>Vernonia galpinii</i> Klatt	LC	No
<i>Vigna unguiculata</i> (L.) Walp. subsp. <i>unguiculata</i> var. <i>unguiculata</i>	LC	No
<i>Wahlenbergia virgata</i> Engl.	LC	No
<i>Xysmalobium parviflorum</i> Harv. ex Scott-Elliot	LC	No
<i>Xysmalobium undulatum</i> (L.) Aiton f. var. <i>undulatum</i>	LC	No
<i>Zaluzianskya spathacea</i> (Benth.) Walp.	LC	No
<i>Zantedeschia pentlandii</i> (R. Whyte ex W. Watson) Wittm.	VU	No
<i>Zornia milneana</i> Mohlenbr.	LC	No



Appendix C: Site Plant Species List



Family	Species	Threat Status	Riparian	Rocky	Eragrostis	Disturbed	Pans
Acanthaceae	<i>Blepharis acuminata</i>	LC		x			
Acanthaceae	<i>Crabbea acaulis</i>	LC		x	x		
Alliaceae	<i>Tulbagia violacea</i>	LC			x		
Amaranthaceae	<i>Guilleminea densa</i>	Alien	x		x	x	
Amaranthaceae	<i>Amaranthus hybridus</i>	LC					
Amaranthaceae	<i>Gomphrena celesioides</i>	Alien				x	
Amaryllidaceae	<i>Haemanthus humilis</i>	LC		x			
Apiaceae	<i>Centella asiatica</i>	No status	x	x			
Apocynaceae	<i>Raphionacme sp.</i>				x		
Asclepiadaceae	<i>Gomphocarpus fruticosus</i>	LC			x		
Asparagaceae	<i>Asparagus sp.</i>					x	
Asphodelaceae	<i>Aloe ecklonis</i>	LC		x			
Asphodelaceae	<i>Crinum bulbispermum</i>	Declining	x				
Asphodelaceae	<i>Trachyandra cooperi</i>	LC		x	x		
Asteraceae	<i>Berkheya erysithales</i>	LC	x		x	x	
Asteraceae	<i>Berkheya setifera</i>	LC	x			x	
Asteraceae	<i>Bidens pilosa</i>	Alien				x	
Asteraceae	<i>Cirsium vulgare</i>	Alien	x		x	x	
Asteraceae	<i>Conyza albida</i>	Alien				x	
Asteraceae	<i>Cosmos bipinnatus</i>	Alien				x	
Asteraceae	<i>Dicoma anomala</i>	LC		x	x		
Asteraceae	<i>Geigeria burkei</i>	LC	x		x		
Asteraceae	<i>Gerbera galpinii</i>	LC			x		
Asteraceae	<i>Haplocarpha scaposa</i>	LC		x	x		
Asteraceae	<i>Helichrysum aureonitens</i>	LC		x	x		
Asteraceae	<i>Helichrysum inornatum</i>	LC		x	x		



Family	Species	Threat Status	Riparian	Rocky	Eragrostis	Disturbed	Pans
Asteraceae	<i>Hilliardella oligocephala</i>	LC			x		
Asteraceae	<i>Hypochaeris radicata</i>	LC			x		
Asteraceae	<i>Senecio inaequidens</i>	LC			x		
Asteraceae	<i>Senecio inornatus</i>	LC			x		
Asteraceae	<i>Senecio sp.</i>				x		
Asteraceae	<i>Seriphium plumosum</i>	LC			x	x	
Asteraceae	<i>Tagetes minuta</i>	Alien				x	
Asteraceae	<i>Taraxacum officinale</i>	Alien				x	
Asteraceae	<i>Vernonia centaureoides</i>	LC		x	x		
Asteraceae	<i>Xanthium strumarium</i>	Alien					
Cactaceae	<i>Opuntia ficus-indica</i>	Alien					
Campanulaceae	<i>Wahlenbergia sp.</i>			x	x		
Capparaceae	<i>Cleome maculata</i>	LC		x			
Caryophyllaceae	<i>Silene burchellii</i>	LC			x		
Chrysobalanaceae	<i>Parinari capensis</i>	LC		x			
Commelinaceae	<i>Commelina africana</i>	LC	x		x		
Commelinaceae	<i>Commelina bengalensis</i>	LC					
Commelinaceae	<i>Commelina subulata</i>	LC		x			
Convolvulaceae	<i>Ipomoea crassipes</i>	LC		x	x		
Convolvulaceae	<i>Ipomoea sp.</i>						
Crassulaceae	<i>Crassula alba</i>	LC		x			
Crassulaceae	<i>Crassula pellucida</i>	LC		x			
Cyperaceae	<i>Cyperus congestus</i>	LC	x				
Cyperaceae	<i>Cyperus esculentus</i>	LC	x				
Cyperaceae	<i>Cyperus semitrifidus</i>	LC	x				x
Cyperaceae	<i>Schoenoplectus brachyceras</i>	LC	x				



Family	Species	Threat Status	Riparian	Rocky	Eragrostis	Disturbed	Pans
Cyperaceae	<i>Schoenoplectus corymbosus</i>	LC	x				
Cyperaceae	<i>Schoenoplectus decipiens</i>	LC	x				
Ebenaceae	<i>Diospyros lycioides</i>	LC		x			
Ebenaceae	<i>Searsia dentata</i>	LC		x			
Euphorbiaceae	<i>Acalypha angustata</i>	LC		x	x		
Euphorbiaceae	<i>Euphorbia clavarioides</i>	LC		x			
Fabaceae	<i>Acacia mearnsii</i>	Alien					
Fabaceae	<i>Erythrina zeyheria</i>	LC			x		
Fabaceae	<i>Polygala hottentotta</i>	LC		x			
Fabaceae	<i>Tephrosia sp.</i>				x		
Fabaceae	<i>Trifolium africanum</i>	LC		x	x	x	
Fabaceae	<i>Vigna vexillata</i>	LC				x	
Gentianaceae	<i>Chironia palustris</i>	LC			x		
Gentianaceae	<i>Sebaea grandis</i>	LC			x		
Geraniaceae	<i>Dianthus mooiensis</i>	LC		x	x		
Geraniaceae	<i>Monsonia grandifolia</i>	LC			x		
Geraniaceae	<i>Pelargonium luridum</i>	LC	x		x		
Hyacinthaceae	<i>Eucomus autumnalis</i>	Declining	x				
Hyacinthaceae	<i>Ledebouria sp.</i>		x				
Juncaceae	<i>Juncus effusus</i>	LC	x			x	
Juncaceae	<i>Juncus exsertus</i>	LC	x				
Lamiaceae	<i>Acrotome hispida</i>	LC			x		
Lamiaceae	<i>Leonotis leonurus</i>	LC		x			
Lobeliaceae	<i>Monopsis decipiens</i>	LC	x				
Lythraceae	<i>Nesaea radicans</i>	LC	x				
Malvaceae	<i>Hermannia depressa</i>	LC			x		



Family	Species	Threat Status	Riparian	Rocky	Eragrostis	Disturbed	Pans
Malvaceae	<i>Hermannia transvaalensis</i>	LC			x		
Malvaceae	<i>Hibiscus pusilis</i>				x	x	
Malvaceae	<i>Hibiscus trionum</i>				x		
Mesembreanthemaceae	<i>Delosperma cooperi</i>	LC		x			
Mesembreanthemaceae	<i>Khadia sp.</i>			x			
Molluginaceae	<i>Psammotropha myriantha</i>	LC		x			
Molluginaceae	<i>Psammotropha sp.</i>			x			
Myrtaceae	<i>Eucalyptus camuldulensis</i>	Alien					
Onagraceae	<i>Oenothera rosea</i>	LC				x	
Orchidaceae	<i>Satyrium sp.</i>	Protected			x		
Orobanchaceae	<i>Alectra capensis</i>	LC	x				
Orobanchaceae	<i>Cynium tubulosum</i>	LC					
Oxalaceae	<i>Oxalis sp.</i>		x		x	x	
Oxalidaceae	<i>Oxalis corniculata</i>	LC			x		
Plantaginaceae	<i>Plantago minor</i>	LC		x	x		
Poaceae	<i>Agrostis lachnantha</i>	LC	x		x		x
Poaceae	<i>Andropogon appendiculatus</i>	LC			x	x	
Poaceae	<i>Andropogon eucomis</i>	LC			x		x
Poaceae	<i>Andropogon huillensis</i>	LC			x		
Poaceae	<i>Aristida congesta subsp. barbicollis</i>	LC		x	x	x	x
Poaceae	<i>Arundinella nepalensis</i>	LC	x				
Poaceae	<i>Bromus catharticus</i>	LC			x		



Family	Species	Threat Status	Riparian	Rocky	Eragrostis	Disturbed	Pans
Poaceae	<i>Ctenium concinnum</i>	LC		x			
Poaceae	<i>Cynodon dactylon</i>	LC	x	x	x	x	
Poaceae	<i>Eragrostis capensis</i>	LC			x	x	
Poaceae	<i>Eragrostis curvula</i>	LC	x		x	x	
Poaceae	<i>Eragrostis gummiflua</i>	LC	x	x	x		x
Poaceae	<i>Eragrostis racemosa</i>	LC		x	x		
Poaceae	<i>Fingerhuthia africana</i>	LC			x		
Poaceae	<i>Hyparrhenia hirta</i>	LC	x	x	x	x	
Poaceae	<i>Hyparrhenia tamba</i>	LC			x		
Poaceae	<i>Imperata cylindrica</i>	LC	x		x		
Poaceae	<i>Leersia hexandra</i>	LC	x				
Poaceae	<i>Melinis nerviglumis</i>	LC		x			
Poaceae	<i>Melinis repens</i>	LC		x			
Poaceae	<i>Panicum coloratum</i>	LC			x		
Poaceae	<i>Paspalum dilatatum</i>	LC					
Poaceae	<i>Paspalum notatum</i>	Alien	x			x	
Poaceae	<i>Setaria sphacelata</i>	LC	x				
Poaceae	<i>Sporobolus africanus</i>	LC			x	x	
Poaceae	<i>Sporobolus pyramidalis</i>	LC		x	x	x	
Poaceae	<i>Themeda triandra</i>	LC		x	x		
Poaceae	<i>Trichoneura grandiglumis</i>	Alien		x			
Poaceae	<i>Tristachya leucothrix</i>	LC		x			
Polygonaceae	<i>Persicaria lapathifolia</i>	LC					x
Polygonaceae	<i>Persicaria senegalensis</i>	LC					x
Rubiaceae	<i>Pentanisia prunelloides</i>	LC		x	x		
Salicaceae	<i>Salix babylonica</i>	Alien	x				
Scrophulariaceae	<i>Chaenostoma leve</i>	No status			x		



Family	Species	Threat Status	Riparian	Rocky	Eragrostis	Disturbed	Pans
Scrophulariaceae	<i>Nemesia fruticans</i>	LC		x			
Scrophulariaceae	<i>Selago densiflora</i>	LC		x			
Sellaginellaceae	<i>Selaginella dregei</i>	LC		x			
Sinopteridaceae	<i>Pellaea calemelanos</i>	LC		x			
Solanaceae	<i>Datura ferox</i>	Alien					
Solanaceae	<i>Solanum sp.</i>	Alien					
Solanaceae	<i>Solanum sysimbriifolium</i>	Alien			x		
Thymeleaceae	<i>Gnidia kraussiana</i>	LC		x			
Typhaceae	<i>Typha capensis</i>	LC	x				
Verbenaceae	<i>Verbena brasiliensis</i>	Alien	x	x	x	x	x

Flora and Fauna Impact Assessment Report

Proposed Development of an Underground Coal Mine and Associated Infrastructure, near
Hendrina, Mpumalanga Province

XST3791



DIGBY WELLS
ENVIRONMENTAL

Appendix D: Expected Mammal Species List



TABLE C1 - MAMMAL LIST

Family	Species	Common Name	P.o.O.
Bathyergidae	<i>Cryptomys hottentotus</i>	African Mole Rat	Medium
Bovidae	<i>Damaliscus pygargus</i>	Blesbok	Recorded
Bovidae	<i>Raphicerus campestris</i>	Steenbok	Recorded
Bovidae	<i>Sylvicapra grimmia</i>	Common Duiker	Recorded
Chrysochloridae	<i>Amblysomus septentrionalis</i>	Highveld Golden Mole	High
Erinaceidae	<i>Atelerix frontalis</i>	Southern African hedgehog	Medium
Felidae	<i>Leptailurus serval</i>	Serval	Recorded
Herpestidae	<i>Atilax paludinosus</i>	Water Mongoose	Medium
Herpestidae	<i>Cynictis penicillata</i>	Yellow Mongoose	High
Herpestidae	<i>Suricata suricatta</i>	Meerkat	Recorded
Hyaenidae	<i>Proteles cristata</i>	Aardwolf	Low
Mustelidae	<i>Aonyx capensis</i>	Cape Clawless Otter	Low
Mustelidae	<i>Poecilogale albinucha</i>	African Striped Weasel	High
Nesomyidae	<i>Mystromys albicaudatus</i>	White-tailed Mouse	Medium
Orycteropodidae	<i>Orycteropus afer</i>	Aardvark	Low
Procaviidae	<i>Procavia capensis</i>	Rock Hyrax	Recorded
Soricidae	<i>Crocidura cyanea</i>	Reddish-Gray Musk Shrew	Low
Soricidae	<i>Crocidura mariquensis</i>	Swamp musk Shrew	Low
Soricidae	<i>Crocidura silacea</i>	Lesser Gray-brown Musk Shrew	Low
Soricidae	<i>Myosorex varius</i>	Forest Shrew	Low
Soricidae	<i>Suncus infinitesimus</i>	Least Dwarf Shrew	Low
Soricidae	<i>Suncus varilla</i>	Lesser Dwarf Shrew	Low



TABLE C – 2 BAT SPECIES LIST (DIGBY WELLS SCOPING REPORT)

Species	Common Name
<i>Chaerephon ansorgei</i>	Ansorge's free-tailed bat
<i>Chaerephon pumilus</i>	Little free-tailed bat
<i>Cloeotis percivali</i>	Short-eared trident bat
<i>Eidolon helvum</i>	Straw-coloured fruit bat
<i>Epomophorus crypturus</i>	Angolan epauletted fruit bat
<i>Epomophorus wahlbergi</i>	Wahlberg's epauletted fruit bat
<i>Hipposideros caffer</i>	Sundevall's roundleaf bat
<i>Hypsugo anchietae</i>	Anchieta's pipistrelle
<i>Miniopterus fraterculus</i>	Lesser long-fingered bat
<i>Miniopterus inflatus</i>	Greater long-fingered bat
<i>Miniopterus natalensis</i>	Greater long-fingered bat
<i>Mops condylurus</i>	Angola free-tailed bat
<i>Myotis bocagii</i>	Rufous mouse-eared bat
<i>Myotis tricolor</i>	Temminck's hairy bat
<i>Myotis welwitschii</i>	-
<i>Neoromicia nana</i>	-
<i>Neoromicia capensis</i>	Cape serotine bat
<i>Neoromicia zuluensis</i>	Aloe serotine bat
<i>Nycteris thebaica</i>	Egyptian slit-faced bat
<i>Nycticienops schlieffeni</i>	Schlieffen's bat
<i>Pipistrellus hesperidus</i>	African pipistrelle
<i>Rhinolophus blasii</i>	Blasius's horseshoe bat
<i>Rhinolophus clivosus</i>	Geoffroy's horseshoe bat
<i>Rhinolophus darlingi</i>	Darling's horseshoe bat
<i>Rhinolophus simulator</i>	Bushveld horseshoe bat
<i>Rhinolophus swinnyi</i>	Swinny's horseshoe bat
<i>Rousettus aegyptiacus</i>	Egyptian rousette



Species	Common Name
<i>Scotoecus dinganii</i>	African yellow bat
<i>Scotophilus viridis</i>	Greenish yellow bat
<i>Tadarida aegyptiaca</i>	Egyptian free-tailed bat



Appendix E: Expected Bird Species List



Roberts no.	English Name	Scientific Name	IUCN Status
8	Little Grebe	<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
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
90	Yellowbilled Stork	<i>Mycteria ibis</i>	Least Concern
91	Sacred Ibis	<i>Threskiornis aethiopicus</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	White faced 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



Roberts no.	English Name	Scientific Name	IUCN Status
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
116	Spurwinged Goose	<i>Plectropterus gambensis</i>	Least Concern
118	Secretarybird	<i>Sagittarius serpentarius</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
149	Steppe Buzzard	<i>Buteo vulpinus</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
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
169	Gymnogene	<i>Polyboroides typus</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>	Vulnerable
190	Orange-river Francolin	<i>Scleroptila levillantoides</i>	Least Concern
192	Redwing Francolin	<i>Scleroptila levillantii</i>	Least Concern



Roberts no.	English Name	Scientific Name	IUCN Status
199	Swainson's Spurfowl	<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
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
223	Purple Gallinule	<i>Porphyrio madagascariensis</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
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 Lapwing	<i>Vanellus coronatus</i>	Least Concern
257	Blackwinged Plover	<i>Vanellus melanopterus</i>	Least Concern
258	Blacksmith Lapwing	<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



Roberts no.	English Name	Scientific Name	IUCN Status
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
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
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	African Olive 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
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
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



Roberts no.	English Name	Scientific Name	IUCN Status
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
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
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



Roberts no.	English Name	Scientific Name	IUCN Status
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>Mirafra africana</i>	Least Concern
495.2	Eastern Clapper Lark	<i>Mirafra fasciolata</i>	Least Concern
496	Flappet Lark	<i>Mirafra rufocinnamomea</i>	Least Concern
498	Sabota Lark	<i>Calendulauda sabota</i>	Least Concern
499	Bothas Lark	<i>Heteromirafra ruddi</i>	Endangered
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	Barn Swallow	<i>Hirundo rustica</i>	Least Concern
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
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



Roberts no.	English Name	Scientific Name	IUCN Status
554	Southern Black Tit	<i>Parus niger</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
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
593	Mocking Chat	<i>Thamnolaea cinnamomeiventris</i>	Least Concern
595	Anteating 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
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 schoenobaenus</i>	Least Concern
635	Cape Reed Warbler	<i>Acrocephalus gracillirostris</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
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



Roberts no.	English Name	Scientific Name	IUCN Status
667	Ayres' Cisticola	<i>Cisticola ayresii</i>	Least Concern
677	Levaillant's Cisticola	<i>Cisticola tinniens</i>	Least Concern
681	Neddicky	<i>Cisticola fulvicapillus</i>	Least Concern
683	Tawnyflanked Prinia	<i>Prinia subflava</i>	Least Concern
685	Blackchested Prinia	<i>Prinia flavicans</i>	Least Concern
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
710	Paradise Flycatcher	<i>Terpsiphone viridis</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
746	Bokmakierie	<i>Telophorus zeylonus</i>	Least Concern
758	Indian Myna*	<i>Acridotheres tristis</i>	Least Concern
759	Pied Starling	<i>Spreo bicolor</i>	Least Concern
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



Roberts no.	English Name	Scientific Name	IUCN Status
769	Redwinged Starling	<i>Onychognathus morio</i>	Least Concern
772	Redbilled Oxpecker	<i>Buphagus erythrorhynchus</i>	Least Concern
787	Whitebellied Sunbird	<i>Cinnyris talatala</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	Yellow-crowned 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
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



Roberts no.	English Name	Scientific Name	IUCN Status
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

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Appendix F: Expected Reptile Species List



Family	Species	Common Name
Agamidae	<i>Agama aculeata</i>	Ground agama
Aparallactus	<i>Aparallactus capensis</i>	Black Headed centipede-eater
Colubridae	<i>Psammophylax tritaeniatus</i>	Three-lined grass snake
Colubridea	<i>Psammophylax rhombeatus</i>	Spotted skaapsteker
Colubridea	<i>Lycodonomorphus rufulus</i>	Common water snake
Colubridea	<i>Lamprophis capensis</i>	Brown house snake
Colubridea	<i>Lamprophis inornatus</i>	Olive house snake
Colubridea	<i>Lamprophis guttatus</i>	Spotted rock snake
Colubridea	<i>Lamprophis aurora</i>	Aurora house snake (LC)
Colubridea	<i>Lycophidion capensis</i>	Common wolf snake
Colubridea	<i>Duberria lutrix</i>	Common slug eater
Colubridea	<i>Pseudaspis cana</i>	Mole snake
Colubridea	<i>Amplorhinus mutimaculatus</i>	Many spotted snake
Colubridea	<i>Dasypeltis inornata</i>	Southern brown egg-eater
Colubridea	<i>Crotaphopeltis hotamboeia</i>	Herald snake
Colubridea	<i>Lamprophis fuscus</i>	Yellow bellied house snake
Cordylidae	<i>Cordylus giganteus</i>	Giant girdled lizard
Cordylidae	<i>Pseudocordylus melanotus</i>	Drakensberg crag lizard
Elapidea	<i>Elapsoidea sundevalli</i>	Sundevall's garter snake
Elapidea	<i>Hemachatus haemachatus</i>	Rinkhals
Elapidea	<i>Homoroselaps dorsalis</i>	Striped Harlequin Snake
Gekkonidae	<i>Lygodactylus ocellatus</i>	Spotted dwarf gecko
Gerrhosauridae	<i>Tetradactylus breyeri</i>	Breyer's long-tailed seps
Homoroselaps	<i>Homoroselaps lacteus</i>	Spotted harlequin snake
Lamprophiidae	<i>Psammophylax rhombeatus rhombeatus</i>	Spotted Grass Snake
Leptotyphlopidae	<i>Leptotyphlops scutifrons</i>	Peters thread snake
Pelomedusidae	<i>Pelomedusa subrufa</i>	Marsh terrapin
Pythonidae	<i>Python natalensis</i>	Southern African python (V)
Scincidae	<i>Acontias gracilicauda</i>	Slendertail lance skink
Scincidae	<i>Trachylepis punctatissima</i>	Speckled Rock Skink
Scincidea	<i>Acontias breviceps</i>	Short headed legless skink



Family	Species	Common Name
Scincidea	<i>Trachylepsis capensis</i>	Cape skink
Scincidea	<i>Trachylepsis varia</i>	Variable skink
Scincidea	<i>Trachylepsis striata</i>	Striped skink
Typhlopidae	<i>Typhlops bibronii</i>	Bibron's blind snake
Varanidea	<i>Veranus niloticus</i>	Water monitor
Viperidea	<i>Causus rhombeatus</i>	Rhombic night adder
Viperidea	<i>Bitis arietans</i>	Puff adder

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Appendix G: Expected Amphibian Species List



Family	Species	Common Name
Bufonidae	<i>Bufo gutturalis</i>	Guttural toad
	<i>Amietophrynus regularis</i>	African common toad
	<i>Amietophrynus maculatus</i>	Flat-backed toad
Hyperoliidae	<i>Hyperolius marmoratus</i>	Painted reed frog
	<i>Kassina senegalensis</i>	Bubbling Kasina
	<i>Semnodactylus wealii</i>	Rattling frog
Pipidae	<i>Xenopus laevis</i>	Common platanna
Pyxicephalidae	<i>Amietia angolensis</i>	Common river frog
	<i>Amietia fuscigula</i>	Cape river frog
	<i>Cacosternum boettgeri</i>	Common Caco
	<i>Strongylopus fasciatus</i>	Striped stream frog
	<i>Strongylopus grayii</i>	Clicking stream frog
	<i>Strongylopus wageri</i>	Plain stream frog (NT)
	<i>Tomopterna cryptotis</i>	Tremelo's sand frog
<i>Tomopterna natalensis</i>	Tandy's sand frog	
Ranidae	<i>Hyperolius sp.</i>	-
	<i>Ptychadena porosissima</i>	Striped grass frog
	<i>Amietia angolensis</i>	Common river frog
	<i>Rana fasciatus</i>	-
	<i>Rana sp.</i>	-