



DIGBY WELLS
ENVIRONMENTAL



Proposed Development of Palmietkuilen Open Pit Coal Mine and Associated Infrastructure, near Springs, Gauteng Province

Flora and Fauna Impact Assessment Report

DMR Reference Number:

Project Number:

CNC4065

Prepared for:

Canyon Coal

November 2016

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Report Type:	Flora and Fauna Impact Assessment Report
Project Name:	Proposed Development of Palmietkuilen Open Pit Coal Mine and Associated Infrastructure, near Springs, Gauteng Province
Project Code:	CNC4065

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DECLARATION OF INDEPENDENCE

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EXECUTIVE SUMMARY

Digby Wells Environmental (Digby Wells) has been appointed by Canyon Coal, owned by Canyon Resources (Pty) Ltd, hereafter referred to as Canyon, to complete a flora and fauna impact assessment, as part of the fulfilment of the environmental authorisation for the proposed development and operation of an opencast coal mine east of Springs, Gauteng Province. The Prospecting Right includes Portions 1, 2, 4, 9, 13 and 19 of the Farm Palmietkuilen IR located in Springs, Sedibeng District, Gauteng Province. The mine, and mining-related infrastructure, will be placed on Portion 2 and 19.

The site falls primarily within the regional vegetation types: Eastern Highveld Grasslands, Andesite Mountain Bushveld and the Soweto Highveld Grasslands; all 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 (1738 ha) and the dominant natural habitat type was broadly classified as *Eragrostis* dominated Grassland, covering an area of 807 ha. In addition, ephemeral pan habitat (27 ha), alien bushclumps comprised of *Eucalyptus camuldulensis* and *Acacia mearnsii* (10 ha) and Wetland habitat (835 ha) were delineated. A total of 90 plant species were recorded on site of the 102 recorded for the region.

Of the four plant Species of Special Concern (SSC) recorded from the regional list, none were recorded, these were: *Kniphofia typhoides*, *Khadia beswickii*, *Lithops lesliei* subsp. *lesliei* and *Nerine gracilllis*. Although no SCC were recorded at the time of the assessment in the general project area, they may potentially occur.

A total of 13 mammal species were recorded on site, two of these species are regarded as species of special concern, Cape Clawless Otter (*Aonyx capensis*) and Serval (*Felis serval*) are protected according to NEMBA TOPS list). A total of 89 bird species were recorded, one SSC was recorded namely, the Secretary Bird (*Sagittarius serpentarius*). 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 (280 ha) and Riparian vegetation type (52 ha) 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 as a result of infrastructure development and this should be managed by implementing an Alien Invader Plant species (AIPs) management plan for quarterly monitoring that should take place for at least two years after construction and an additional two years after decommissioning. AIPs monitoring during operational Phase on biannual base must also be completed.



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

Canyon Coal, owned by Canyon Resources (Pty) Ltd, hereafter referred to as Canyon, is planning the development of a new opencast coal mining operation located near Springs within the Gauteng Province. A coal processing plant and associated infrastructure will also be constructed. The Project is a greenfields development planned on Portions 1, 2, 4, 9, 13 and 19 of the Farm Palmietkuilen 241 IR. The proposed area of development is on the border of Gauteng and Mpumalanga, in the Sedibeng District Municipality and the Lesedi Local Municipality. The project borders the Ekurhuleni Metropolitan Municipality (Gauteng), the Nkangala District Municipality and the Victor Khanye Local Municipality (Mpumalanga).

1.1 Project Background

Palmietkuilen Mining Project is planning the development of a new open pit coal mining operation located near Springs within the Gauteng Province. The Project is a greenfields development planned on portions 1, 2, 4, 9, 13 and 19 of the farm Palmietkuilen 241 IRI. Coal mining will be undertaken by conventional truck and shovel operations. A coal processing plant and associated infrastructure will be constructed, where run-of-mine (RoM) coal will be processed at the proposed plant and sold to local and export markets. Key infrastructure will include:

- Open pit for mining;
- Processing plant and fuel storage;
- Haul roads from pit to plant and from plant to mine access point, and various conveyor belts;
- Various overburden dumps and RoM stockpile area;
- Pollution control dam (PCD), stormwater trenches and sewage management systems; and
- Site offices and security offices.

The project activities will include the following:

- Construction
 - Site establishment;
 - Site clearing, including the removal of topsoil and vegetation;
 - Construction of mine-related infrastructure, including haul roads, pipes, dams;
 - Construction of washing plant;
 - Relocation of Infrastructure
 - Blasting and development of initial box-cut for mining, including stockpiling from initial box-cuts; and



- Temporary storage of hazardous products, including fuel and explosives, as well as waste and sewage.
- Operation
 - Stripping topsoil and soft overburden;
 - Removal of overburden, including drilling and blasting of hard overburden;
 - Loading, hauling and stockpiling of overburden;
 - Drilling and blasting of coal.
 - Load, haul and stockpiling of RoM coal.
 - Use and maintenance of haul roads for the transportation of coal to the washing plant;
 - Water use and storage on-site; and
 - Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste.
- Decommissioning and closure
 - Demolition and removal of all infrastructure, including transporting materials off site;
 - Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring;
 - Environmental monitoring of decommissioning activities; and
 - Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste.
 - Post-closure monitoring and rehabilitation.

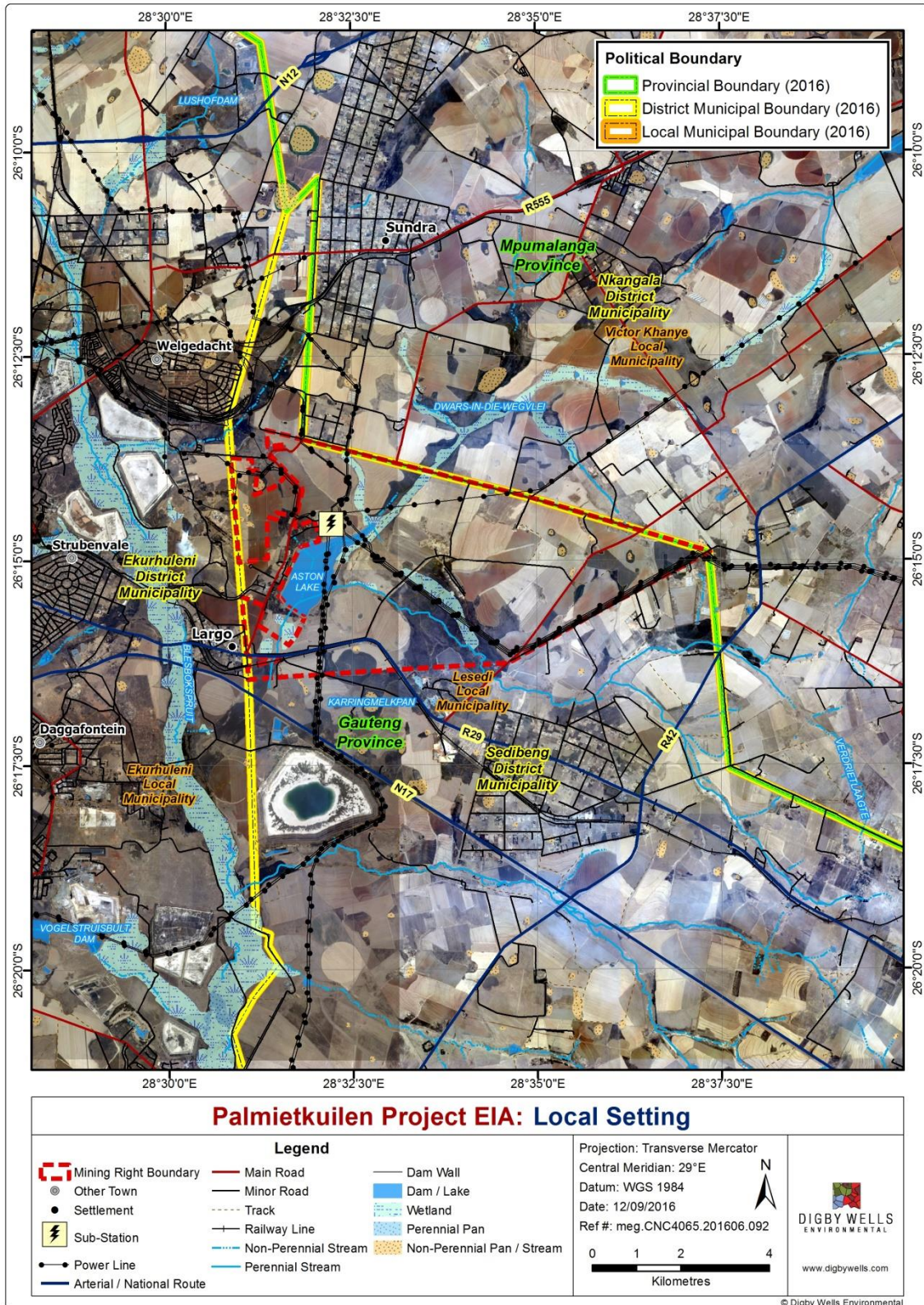


Figure 1-1: Site Locality of the proposed Palmietkuilen Project Area

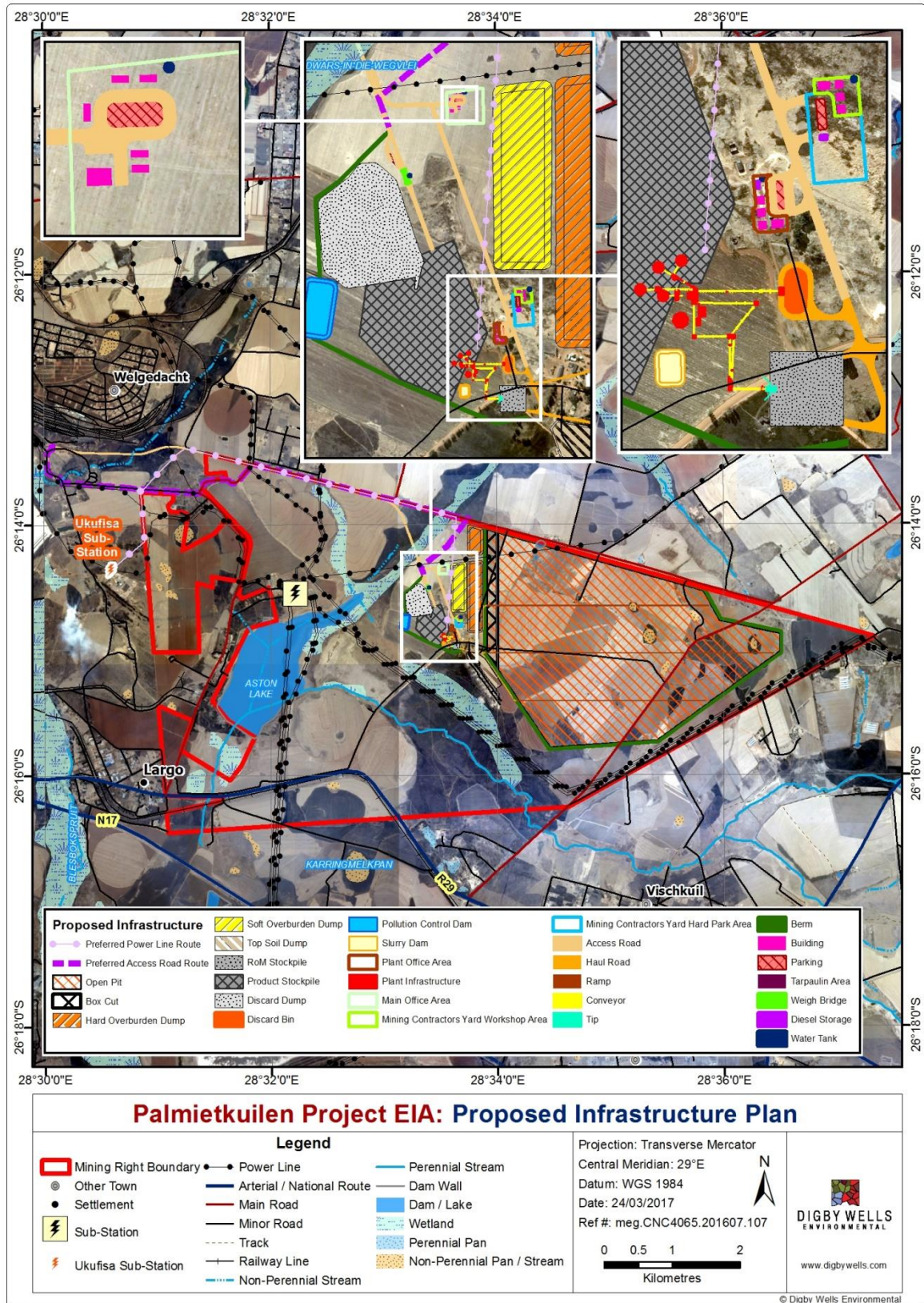


Figure 1-2: Study Area and proposed Mine Layout Plan



1.2 Terms of Reference

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

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

2 Details of the Specialist

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

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

3 Aims and Objectives

Information generated from this survey was used to identify the potential impacts that the construction, operational and decommissioning activities will have on the environment. In order to achieve this aim the following objectives were considered for this specialist study:

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

4 Methodology

4.1 Literature Review and Desktop Study

A desktop study was undertaken, aiming to identify:

- Potential species in the proposed development area/site area according to the (South African National Botanical Institute (SANBI), Pretoria Computerised Information System) PRECIS List's;
- South African Bird Atlasing Project (SABAP2);

- Potential Red Data Listed species and their current status according to Provincial legislation;
- Expected vegetation type and community structure, (Mucina and Rutherford 2006); and
- Current biodiversity and ecosystem status.

4.2 Field Investigations and Seasonal Influence

The site visits and detailed infield flora and fauna assessments took place from the 1st to the 3rd of November 2016 and winter 23th to the 24th of August 2016. Flora sampling points are indicated in Figure 4-1.

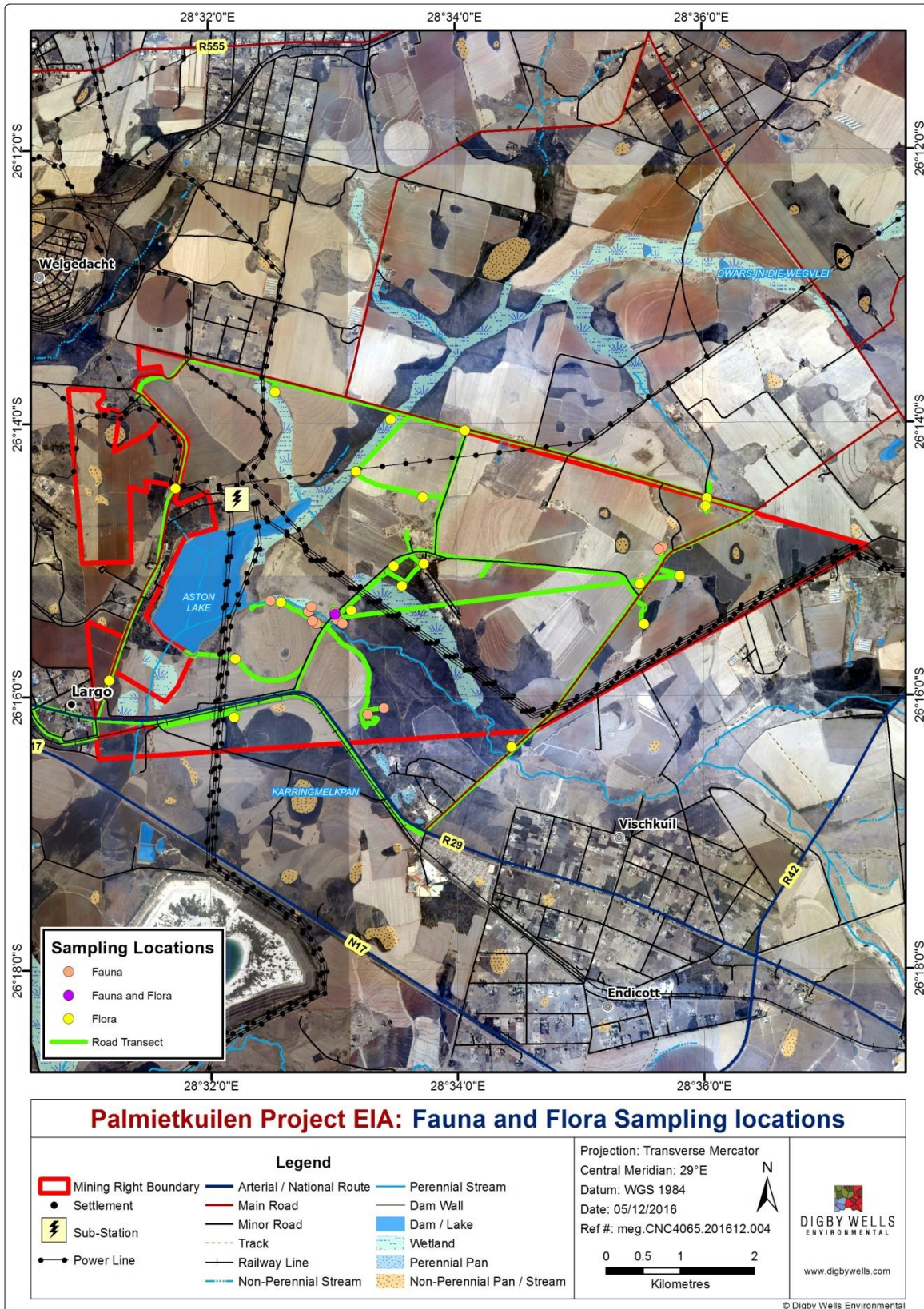


Figure 4-1: Location of the Fauna and Flora Sampling Points



4.2.1 Flora

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

At each sample site, a plot size of 50 m² was sampled. 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 4-1. A general species list was also compiled from random traversing through the site.

Table 4-1: 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.



4.2.2 Species of Special Concern (SSC)

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

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

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, 2016). The categories are described in Table 4-2 below.

Table 4-2: 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 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	
	Other categories of conservation concern	



CATEGORY		DESCRIPTION
	Other categories	threatened species, but also those classified in the categories, NT , LC and DD

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

4.3 Fauna

A two season survey, summer (1st to the 3rd of November 2016) and winter (23th to the 24th of August 2016), was conducted for this project. In support of this, 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 4-1.

4.3.1 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, two nights and three 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 through the sites, mainly at water points within the different vegetation units.

4.3.2 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 Robert's birds (2009).

4.3.3 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.

4.3.4 Macro-Invertebrates

A sweep net (750 mm diameter) was used to sample the grassland and riparian vegetation for macro-invertebrates. Day flying butterflies (Lepidoptera) and other flying insects were caught using a 750 mm butterfly net. Identification was done by using Picker *et al.* (2002).

During the wet season survey insects were caught using a 750 mm butterfly net, in addition 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, sweep netting was performed in areas not affected by fire.

4.3.5 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 Listed 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 Listed species (this is especially evident in wetland habitats); and
- 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 (2016) are used for the status identification of mammals, birds, reptiles and amphibians globally.

5 Assumptions and 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;



6 Regional Vegetation

The project area falls within the Andesite Mountain Bushveld, Soweto Highveld Grassland and Eastern 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, 2016).

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

Thirty percent of the biome has been irreversibly transformed and only 1,9% is formally conserved. As a result, the National Biodiversity Strategy and Action Plan has identified the grasslands biome as one of the spatial priorities for conservation action (SANBI, 2016). The important biodiversity contained within the grasslands, which underpins life, is being eroded to such an extent that human wellbeing is threatened. Common and characteristic plant species of the Eastern Highveld and Soweto Highveld Grasslands are listed in Table 6-1 and Table 6-2 with Andesite Mountain Bushveld in Table 6-3, 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 (names based on taxonomic names as in 2006)
Graminoids (grasses and sedges)	<i>Heteropogon contortus</i> , <i>Aristida aequigluims</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>Bewsia biflora</i> , <i>Ctenium concinnum</i> , <i>Diheteropogon amplexans</i> , <i>Eragrostis capensis</i> , <i>E. dummiiflua</i> , <i>E. patentissima</i> , <i>Harpochloa 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 (names based on taxonomic names as in 2006)
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 (names based on taxonomic names as in 2006)
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>



Table 6-3: Common and Characteristic species of the Andesite Mountain Bushveld

Plant Forms	Species (names based on taxonomic names as in 2006)
Graminoids (grasses)	<i>Eragrostis curvula</i> , <i>Hyparrhenia hirta</i> , <i>Setaria sphacelata</i> , <i>Themeda triandra</i> , <i>Cymbopogon pospischilii</i> , <i>Digitaria eriantha</i> subsp. <i>eriantha</i> , <i>Elionurus muticus</i> , <i>Eragrostis racemosa</i> , <i>E. superba</i> , <i>Panicum maximum</i> .
Herbs	<i>Commelina africana</i> , <i>Vernonia galpinii</i> , <i>V. oligocephala</i> . Succulent Herb: <i>Aloe</i> <i>greatheadii</i> var. <i>davyana</i>
Woody Climber	<i>Rhoicissus tridentata</i>
Tall Shrubs	<i>Asparagus larcinus</i> , <i>Euclea crispa</i> subsp. <i>crispa</i> , <i>Rhus pyroides</i> var. <i>pyroides</i> , <i>Diospyros lycioides</i> subsp. <i>lycioides</i> , <i>Gymnosporia polyacantha</i> , <i>Lippia javanica</i> , <i>Rhamnus prinoides</i>
Small Trees	<i>Acacia caffra</i> , <i>A. karroo</i> , <i>Celtis africana</i> , <i>Protea caffra</i> , <i>Zanthoxylum capense</i> , <i>Ziziphus mucronata</i>
Low shrubs	<i>Asparagus suaveolens</i> , <i>Rhus rigida</i> var. <i>margaretae</i> , <i>Teucrium trifidum</i> . Soft Shrub: <i>Isoglossa grantii</i>

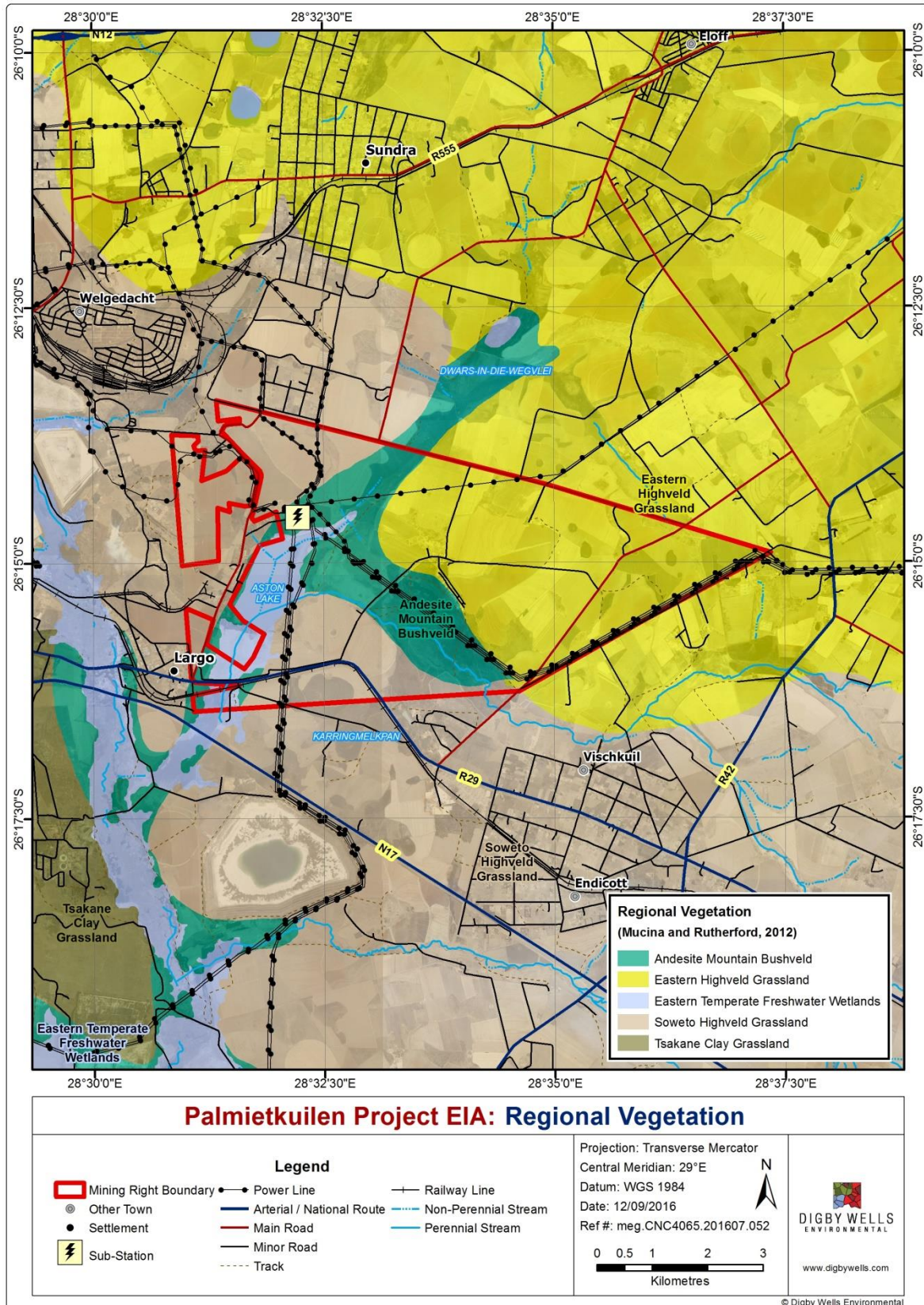


Figure 6-1: Vegetation types (Mucina and Rutherford, 2006)



7 Results of Baseline Fauna and Flora Assessment

7.1 Flora

The majority of the study area (1 740 ha or 50.3%) 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 moderate diversity of grasses and some forbs, particularly members of the Asteraceae family and the *Helichrysum* genus.

A total of 90 plant species were recorded on site (Appendix C), of 266 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 areas included former cultivated fields that had been colonised by alien plants and pioneer species. The primary landuses and vegetation habitats identified on site are listed in Table 7-1.

Acacia Name Change

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

Table 7-1: Vegetation

Habitats (and other landuse) and Approximate Areas

Vegetation Unit	Area (ha)	Proportion of total project area (%)
Wetland	25	2.11
Pan	26	2.1
Cultivated	851	71
Eragrostis Dominated Grassland	280	23
Alien Vegetation	0.005	0.004
Developed	1.7	0.14
Total	1184	100%



7.1.1 Riparian Habitat (Wetlands and Pans)

The riparian habitat is associated with the Ashton Lake which forms part of the unchanneled valley bottom wetland system and channelled valley bottom wetlands that run centrally through the site. A further five pans and various seeps were also encountered and delineated. The wetland delineation is represented in the Wetland Assessment Report (Digby Wells, 2016). The wetland/riparian vegetation type is composed of typical riparian plant species which are adapted to permanent or perennial saturation. This includes *Schoenoplectus* and *Cyperus* species as well as a number of wet grasses, such as Cotton Wool Grass (*Imperata cylindrica*), Rye Grass (*Lolium perenne*), Rescue Grass (*Bromus catharticus*) and swamp couch Grass (*Cynodon dactylon*).

Other forb species present include Edging lobelia (*Lobelia erinus*) and, as a result of the dams which have been constructed and grazing and trampling by livestock this vegetation type has been impacted. Additionally Cotton Wool Grass (*Imperata cylindrica*) patches occur in the study area, indicating surface water seep points. These water seep points are seen as areas where diversity will differ from the surrounding vegetation.

7.1.2 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 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: *Helichrysum oligocephala*, *Wahlenbergia* spp., and *Verbena brasiliensis* (Brazilian Vervain). 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).



Figure 7-1: Examples of Riparian Habitat



Figure 7-2: Examples of the Landscape and Common Features of the Grassland during the dry season



7.1.3 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 Listed or any protected plant species were recorded in this habitat.



Figure 7-3: Examples of Ephemeral Pan Habitat on Site

The distribution of vegetation units is represented in Figure 7-4.

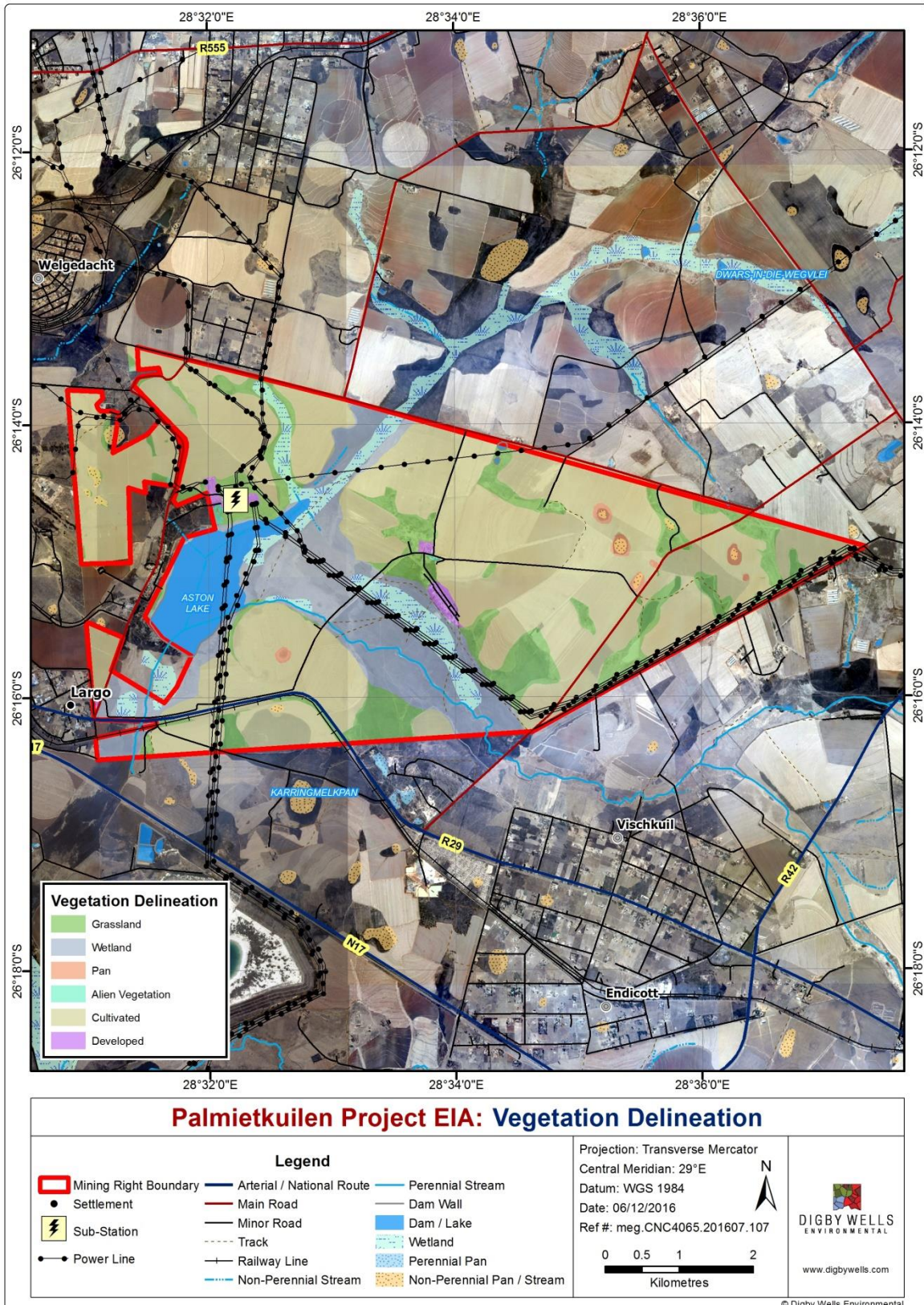


Figure 7-4: Vegetation delineation



7.1.4 Plant Species of Special Concern

The study area falls within the Quarter Degree Squares (QDS); 2628BC and 2628BA. The Gauteng Province has been extensively surveyed from a botanical perspective and as a result, the South African database, known as PRECIS, adequately represents species diversity for this part of the country. For the expected species lists generated for the QDS in which the study area occurs, 78 plant species have been recorded, 3 of which were allocated Red Data Status (one listed as Near-Threatened and one as Vulnerable), according to the the South African Red data list of Plants.

Based on desktop analysis, the vegetation consists of disturbed grassland, hydromorphic grassland (in wetland areas) and alien bush clumps. Alien species expected to make up the bush clumps include: *Eucalyptus*, *Phragmites* and *Pinus* species. Alien invasion is likely to be a potential concern for the Palmietkuilen project area, owing to the historic, large-scale soil disturbance that has taken place in the surrounding area, mostly due to agricultural activities.

According to Lorraine Mills from GDARD (personal communication), there are four Red/Orange List plant taxa that have been recorded in Red/Orange List plant taxa. These species are listed in Table 7-2, two Near Threatened and two Vulnerable species have been recorded here in the past. *Crinum bulbispermum* and *Hypoxis hemerocallidea* were recorded during this wet season survey, these are designated as Declining according to the South African Red List of Plants.

Table 7-2: Expected plant Species of Special Concern (SSC) for the QDS' in which the study area occurs

Family	Species	Threat Status
ASPHODELACEAE	<i>Kniphofia typhoides</i> Codd	Near threatened
MESEMBRYANTHEMACEAE	<i>Khadia beswickii</i> (L.Bolus) N.E.Br.	Vulnerable
AIZOACEAE	<i>Lithops lesliei</i> subsp. <i>lesliei</i>	Near threatened
AMARYLLIDACEAE	<i>Nerine gracillis</i>	Vulnerable



Figure 7-5: Examples of Plant SSC recorded on Site (Above; *Crinum bulbispermum* and below: *Hypoxis hemerocallidea*)

7.1.5 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 invader plant species (AIP) were recorded on site (Bromilow 2010) (Table 7-3); seven of these have been assigned alien invader 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 7-4.

Table 7-3: Alien Plant Species recorded on Site

Family	Species	Category (CARA/NEMBA)
Amaranthaceae	<i>Gomphrena celesioides</i>	No category
Amaranthaceae	<i>Guilleminea densa</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
	<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
Poaceae	<i>Paspalum notatum</i>	No category
	<i>Trichoneura grandiglumis</i>	No category
Salicaceae	<i>Salix babylonica</i>	No category
Solanaceae	<i>Datura ferox</i>	1; 1b
	<i>Solanum sp.</i>	No category
	<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 proposed project area during this survey, this includes personal communication with farmers. The mammals recorded were found within a variety of the vegetation communities recorded onsite. A full list of mammals recorded onsite are included in Table 7-4.

Two of these species are regarded as species of special concern and include the Cape Clawless Otter (*Aonyx capensis*) and Serval (*Felis serval*). These two species are protected according to NEMBA TOPS list. Examples of small mammal fauna identified on site are represented in Figure 7-6. 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 (2016.2)	NEMBA TOPS List (2007)
<i>Aonyx capensis</i>	Cape Clawless Otter	Near Threatened	Not Listed
<i>Hystrix africaeaustralis</i>	Porcupine	Least Concern	Not Listed
<i>Leptailurus serval</i>	Serval**	Least Concern	Protected
<i>Lepus saxatilis</i>	Scrub Hare	Least Concern	Not Listed
<i>Canis mesomelas</i>	Black-backed Jackal	Not Listed	Not Listed
<i>Cryptomys hottentotus</i>	Common Mole Rat	Least Concern	Not Listed
<i>Cynictis penicillata</i>	Yellow Mongoose	Least Concern	Not Listed
<i>Mastomys coucha</i>	Multimammate Mouse	Least Concern	Not Listed
<i>Potamochoerus larvatus</i>	Bushpig**	Least Concern	Not Listed
<i>Raphicerus campestris</i>	Steenbok**	Least Concern	Protected
<i>Rhabdomys pumilio</i>	Striped Mouse	Least Concern	Not Listed



Scientific Name	English Name	IUCN (2016.2)	NEMBA TOPS List (2007)
<i>Sylvicapra grimmia</i>	Common Duiker**	Least Concern	Not Listed
<i>Tatera leucogaster</i>	Bushveld Gerbil*	Least Concern	Not Listed

* - Recorded previously

** - Recorded via personal communication with landowner



Figure 7-6: Examples of Small Mammals recorded on Site (A: *Mastomys coucha* (Multimammate Mouse); B: *Leptailurus serval* (Serval); C: *Hystrix africaeaustralis* (Porcupine); D: *Aonyx capensis* (Cape Clawless Otter) – taken by Hardaker (2011)

7.2.2 Avifauna

A total of 89 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*, *Ergrostis*, *Themeda*, *Tristachya* etc.). Rainfall is strongly summer seasonal (average 726 mm), with very dry winters (Mucina & Rutherford 2012).

7.2.2.1 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* spp., 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 African Grass Owl (*Tyto capensis*), 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%). According to the land owner there are two breeding pairs of the endangered Secretary bird (*Sagittarius serpentarius*) present on the property in the grassland areas.



The wetlands within the property are an important habitat for common water birds such as: 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 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*).

7.2.2.2 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 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.

7.2.2.3 Alien Vegetation

Relatively small but prominent collection of alien invasive and exotic tree species is present the project site. 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 7-7.



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

Common name	Taxon name	IUCN 2016-2	SA Red List	NEMBA
Crane, Blue	<i>Anthropoides paradiseus</i>	VU	VU	Protected
Grass-Owl, African	<i>Tyto capensis</i>	LC	VU	Protected
Kestrel, Lesser	<i>Falco naumanni</i>	LC	LC	Protected
Korhaan, White-bellied	<i>Eupodotis senegalensis</i>	LC	VU	Protected
Marsh-Harrier, African	<i>Circus ranivorus</i>	LC	EN	Protected
Secretarybird*	<i>Sagittarius serpentarius</i>	VU	VU	Protected
Stork, Black	<i>Ciconia nigra</i>	LC	VU	Protected
Stork, Yellow-billed	<i>Mycteria ibis</i>	LC	EN	Protected

*-Recorded



Figure 7-7: Examples of Avifauna Species recorded on Site (A: *Sagittarius serpentarius* (Secretarybird); B: *Ceryle rudis* (Pied Kingfisher), (C: *Plegadis falcinellus* (Glossy Ibis) and *Burhinus capensis* (Spotted Thick knee). Hardaker (2011)

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 (Gerlanc et al). 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 (Deulman et al), means of active searching, with three species encountered during previous surveys. The expected amphibian species for the area are included as (Annexure/Appendix G). 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 7-8.

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

Scientific Name	English Name	IUCN (2016.2)	NEMBA TOPS List (2015)
<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	-	-

No reptile species were encountered during the field survey. No IUCN protected species were encountered.



Figure 7-8: Examples of Amphibians recorded on site (left: *Hylarana signata* (Striped Stream Frog) and right: *Afrana angolensis* (Common River Frog) taken by Hardaker)

7.2.4 Macro-Invertebrates

During the wet season survey, butterflies were recorded through sweep netting and 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/burrows/webs. Butterflies are a good indication of the habitats available in a specific area (Woodhall 2005). Although many species are eurytopes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised (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. Three butterfly species were observed within the proposed mining area, these included the, African Monarch (*Danaus chrysippus*), Brown-veined White (*Belenois aurota*), Broad Bordered Grass Yellow (*Eurema brigitta*). All the species were located within grassland or the wetland areas. 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.

Paracinema tricolor, a locust species was encountered in the grasslands of the project site, *Rhodometra sacraria* (Vestal) was found in the wetlands areas. *Spilostethus pandurus* or Seed Bug was found in the grassland areas and the Wolf spider (*Ctenus* spp.) was encountered by the pans to the north east of the project area (Figure 7-9).



Figure 7-9: Invertebrate species encountered, (A: *Paracinema tricolor*, B: *Rhodometra sacraria* (Vestel) C: *Spilostethus pandurus* (Seed bugs) D: *Ctenus* spp (Wolf Spider)

The diversity and density of the invertebrates was relatively high for the proposed Palmietkuilen Coal Mine 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 agricultural 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 Gauteng Province.

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 Gauteng C-Plan (Conservation Plan)

Knowledge of the distribution of biodiversity, the status of species, approaches for dealing with aspects such as climate change, methods of data analysis, and the nature of threats to biodiversity within a planning region are constantly changing, especially in the Gauteng province which is developing at an extremely rapid rate. This requires that the conservation plan be treated as a living document with periodic review and updates.

The Gauteng Conservation Plan (C-Plan) is based on the systematic conservation principles outlined by Margules and Pressey (2000): complementarity, efficiency, defensibility and flexibility, irreplaceability, retention, persistence and accountability. The Gauteng C-Plan is a living document that is constantly reviewed and updated and documents the distribution of conservation important areas for biodiversity. According to the Gauteng C-Plan the wetlands throughout the project are regarded as Important Areas, with a small patch of Irreplaceable habitat being present in the south, all of which forms part of the wetlands system present. Large parts of Ecological support areas are also present (Figure 8-1)

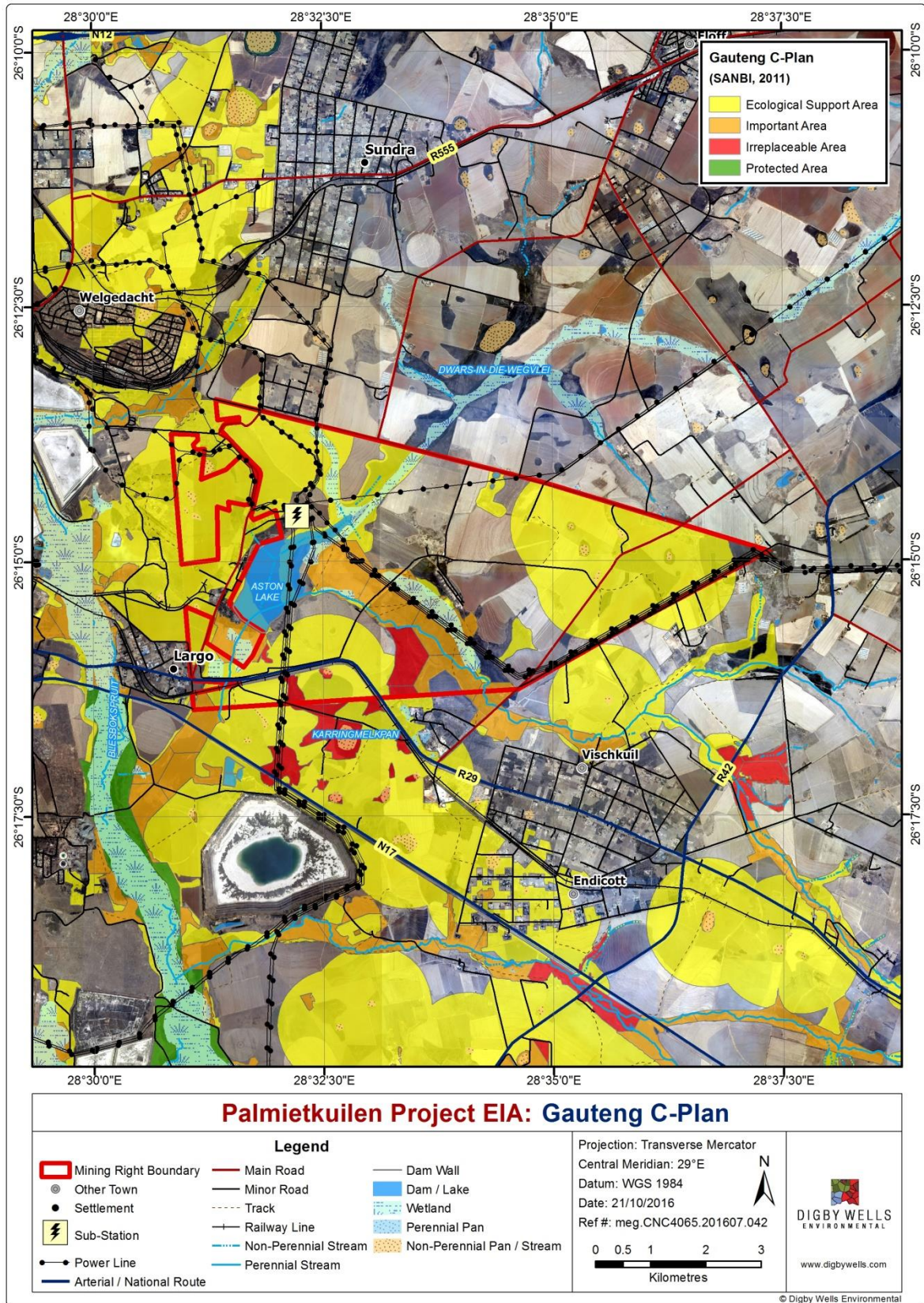


Figure 8-1: Gauteng Biodiversity Conservation Plan (2014)



8.2 Protected Areas

Officially 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, the Marievale Nature Reserve is less than 1 km west of the project boundary, this coincides with the Blesbokspruit Ramsar site. The protected areas within proximity to the project site are represented in Figure 8-2.

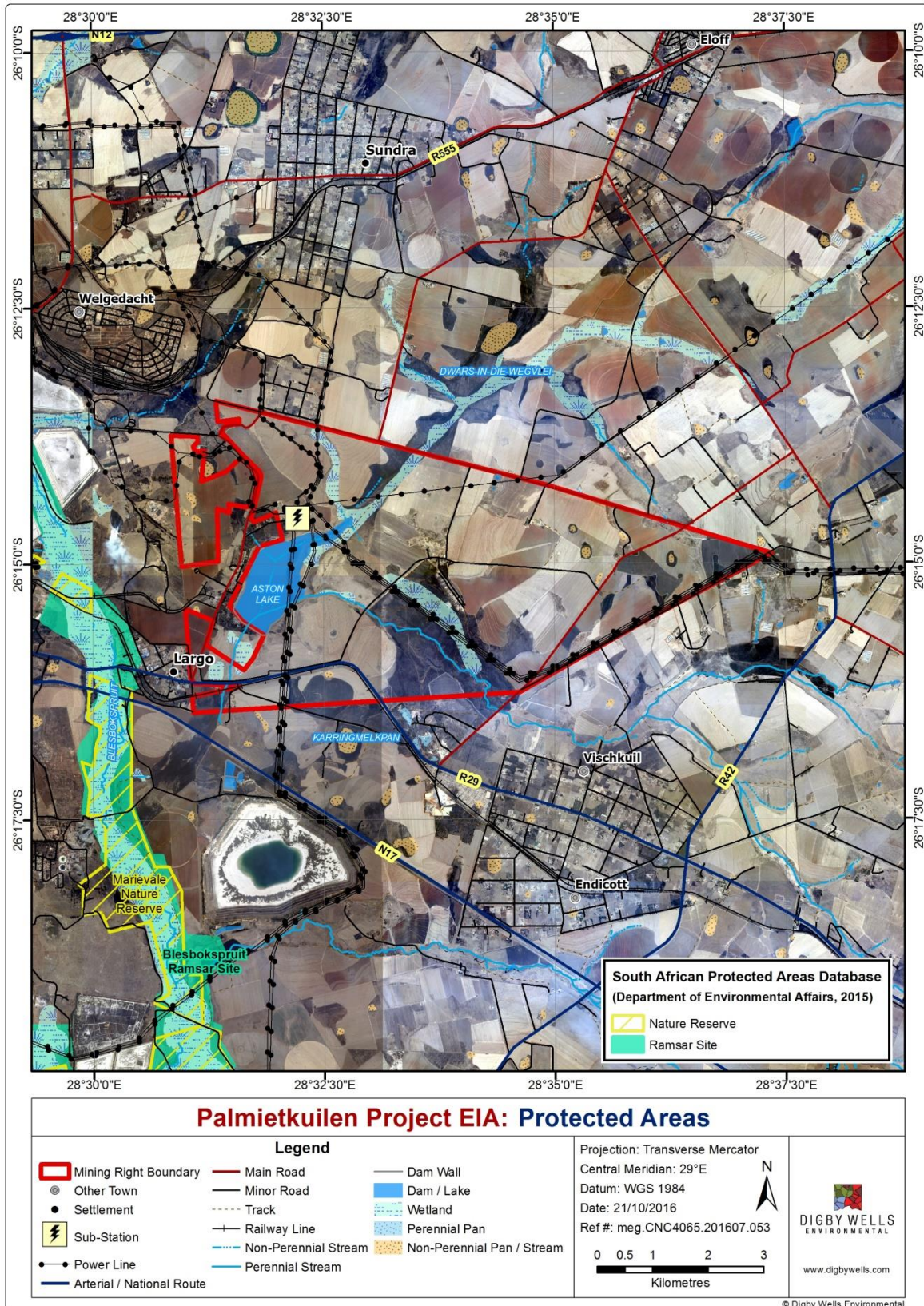


Figure 8-2: Protected Areas



8.3 Important Bird Areas (IBA) (Birdlife SA, 2013)

An IBA is an area recognised as being 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 our threatened, endemic and congregatory birds. Yet only a million hectares of the total land surface covered by our IBA's is legally protected. The BirdLife SA IBA programme continues a programme of stewardship which will ultimately achieve formal protection (Birdlife, 2013).

These areas are identified by BirdLife International. These sites are small enough to be entirely conserved and differ in their character, habitat or ornithological importance from the surrounding habitat. Often IBAs form part of a country's existing protected area network, and so are protected under national legislation. There is no formal National IBA Conservation Strategy for this area within South Africa (Birdlife, 2013).

The proposed project area coincides with the Blesbokspruit IBA, (Figure 8-3). Located 15 km southeast of Springs, at an altitude of 1 585 m a.s.l., Blesbokspruit is a modified high-altitude wetland. The IBA includes the entire system, from the Springs Bird Sanctuary in the north to Marievale Bird Sanctuary in the south. Blesbokspruit is one of the Vaal River's larger tributaries and its catchment covers 1 000 km². The vlei holds much open water, often shallow, with extensive fringing vegetation and some relatively small patches of emergent vegetation.

The dominant marginal vegetation includes *Phragmites australis*, *Typha capensis*, *Juncus spp.* and *Cyperus spp.* Water levels in the spruit are artificially maintained by the input of mining, industrial and municipal effluents that are contained by embankments. The input of additional organic matter produces highly eutrophic conditions favoured by marginal vegetation, such as vast reedbeds, which provide a variety of reed and edge habitats (Birdlife, 2013).

At least 286 species, 78 of which are waterbirds, have been recorded in the reserve. Blesbokspruit, which in the past regularly supported more than 20 000 waterbirds, was designated a Ramsar wetland of international importance for waterfowl in 1986. The vlei used to support large numbers of Great Crested Grebe (*Podiceps cristatus*), Yellow-billed Duck (*Anas undulate*) and Spur-winged Goose (*Plectropterus gambensis*) in the dry season when high water levels were artificially maintained at Blesbokspruit, and neighbouring wetlands dried up. Numbers of waterfowl at Blesbokspruit have decreased dramatically in the last 10 years, and no species has had numbers exceeding the 1% of the biogeographical population estimate for over a decade (Birdlife, 2013).

The highly productive water used to provide food for large numbers of Lesser Flamingo (*Phoeniconaias minor*) and Greater Flamingo (*Phoenicopterus ruber*) however, these have disappeared in recent years. The system still supports locally important numbers of Goliath Heron (*Ardea goliath*), Purple Heron (*Ardea purpurea*), African Spoonbill (*Platalea alba*), Glossy Ibis (*Plegadis falcinellus*), Pied Avocet (*Recurvirostra avosetta*), Red-knobbed Coot (*Fulica cristata*) and White-winged Tern (*Chlidonias leucopterus*). The African Marsh Harrier



(*Circus ranivorus*), which has been displaced from much of the surrounding veld by intense industrialisation, urbanisation and habitat modification, used to have a strong population here; this too has dwindled over the last 5 years, and now it is only an occasional visitor (Birdlife, 2013).

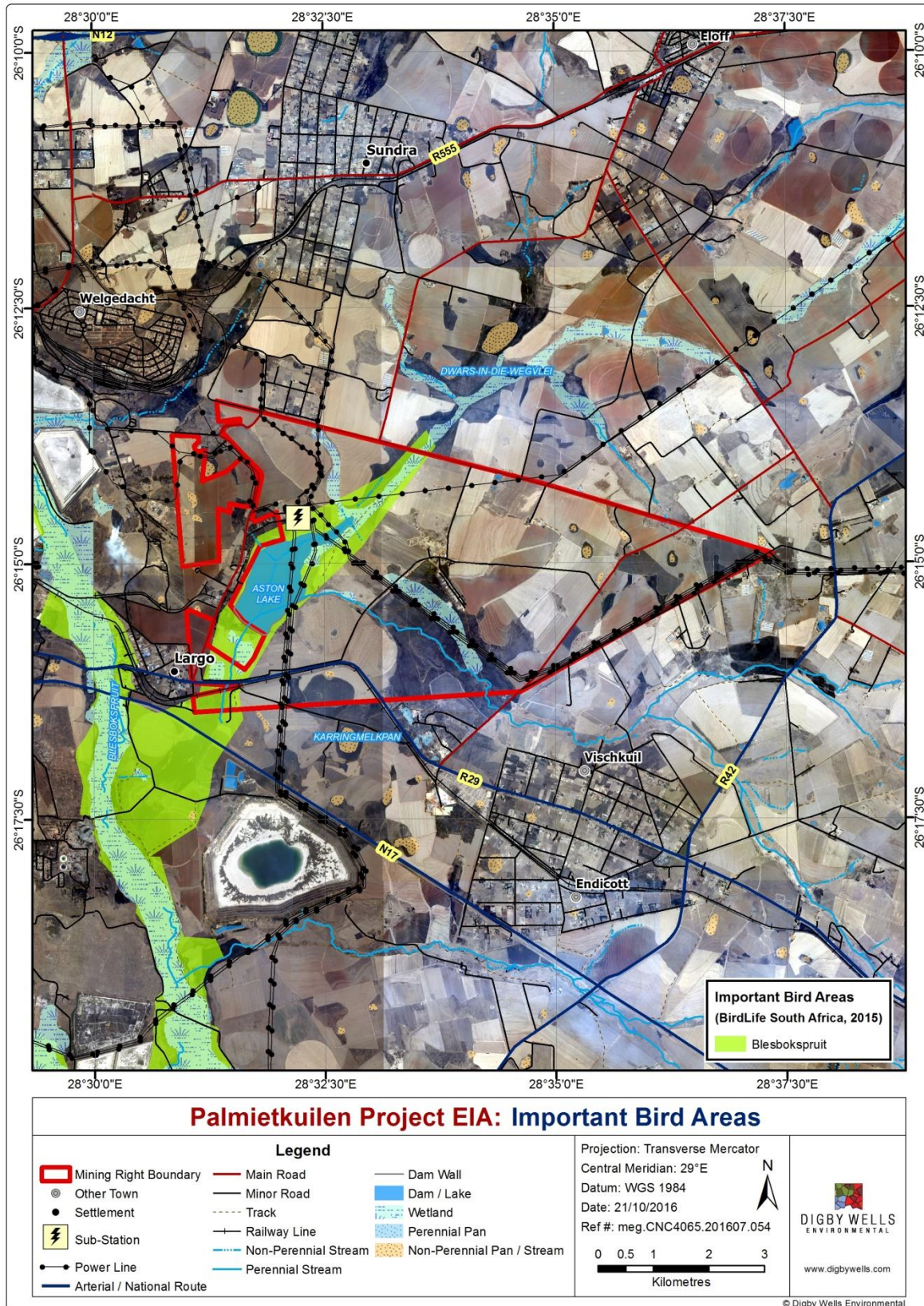


Figure 8-3: Important Bird Area (IBA) (Birdlife SA, 2013)

8.4 Nationally Threatened Ecosystems

The list of nationally threatened ecosystems has been gazetted by the NEM:BA, 2004) (Act No. 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 vegetation of South Africa, Lesotho and Swaziland (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 Blesbospruit highveld grassland (referred to in section 6) is listed as a threatened ecosystem. Cumulative loss of these areas must 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

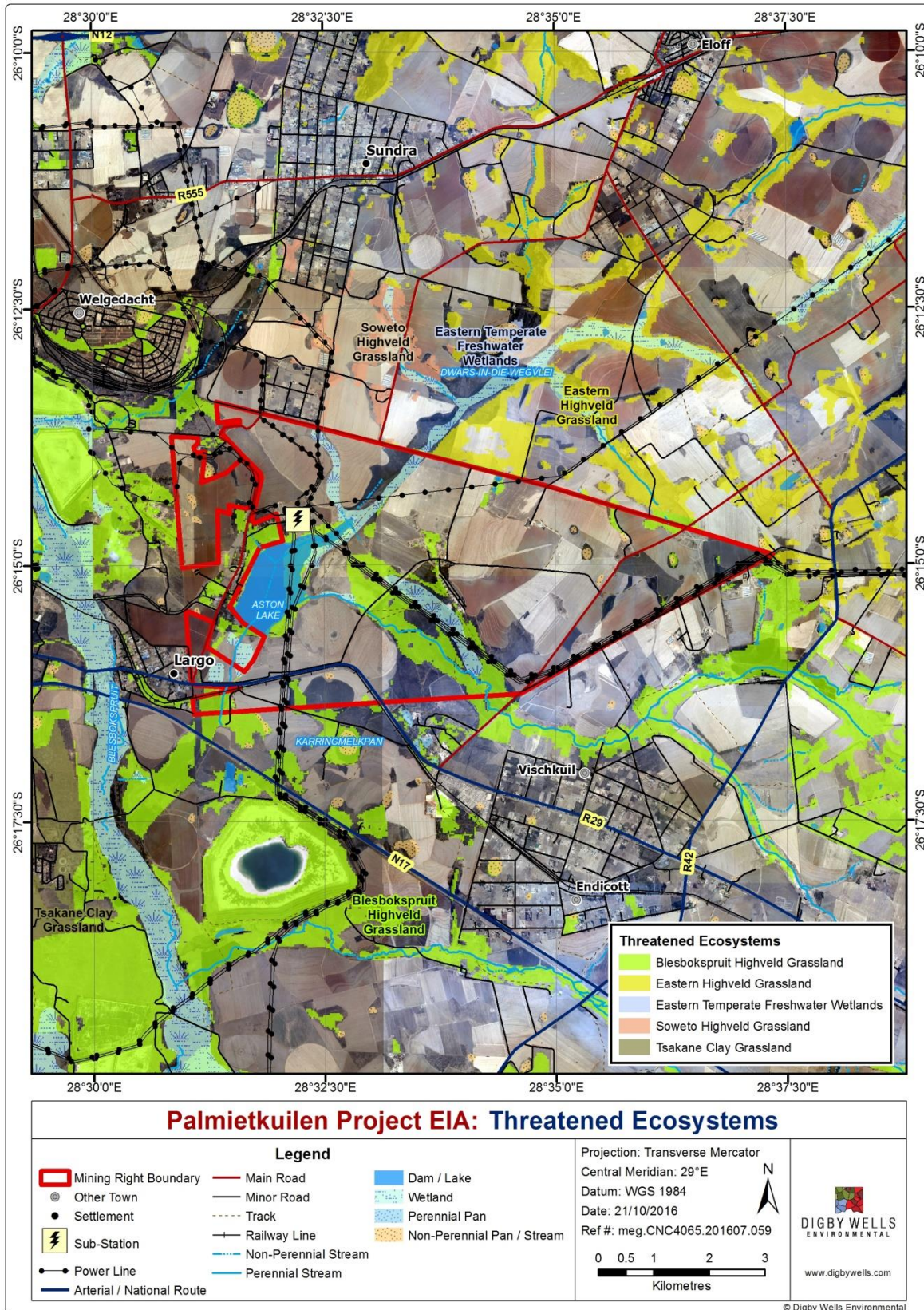


Figure 8-4: Nationally Threatened Ecosystems (SANBI)



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 70 km away, the NW/Gauteng Bushveld.

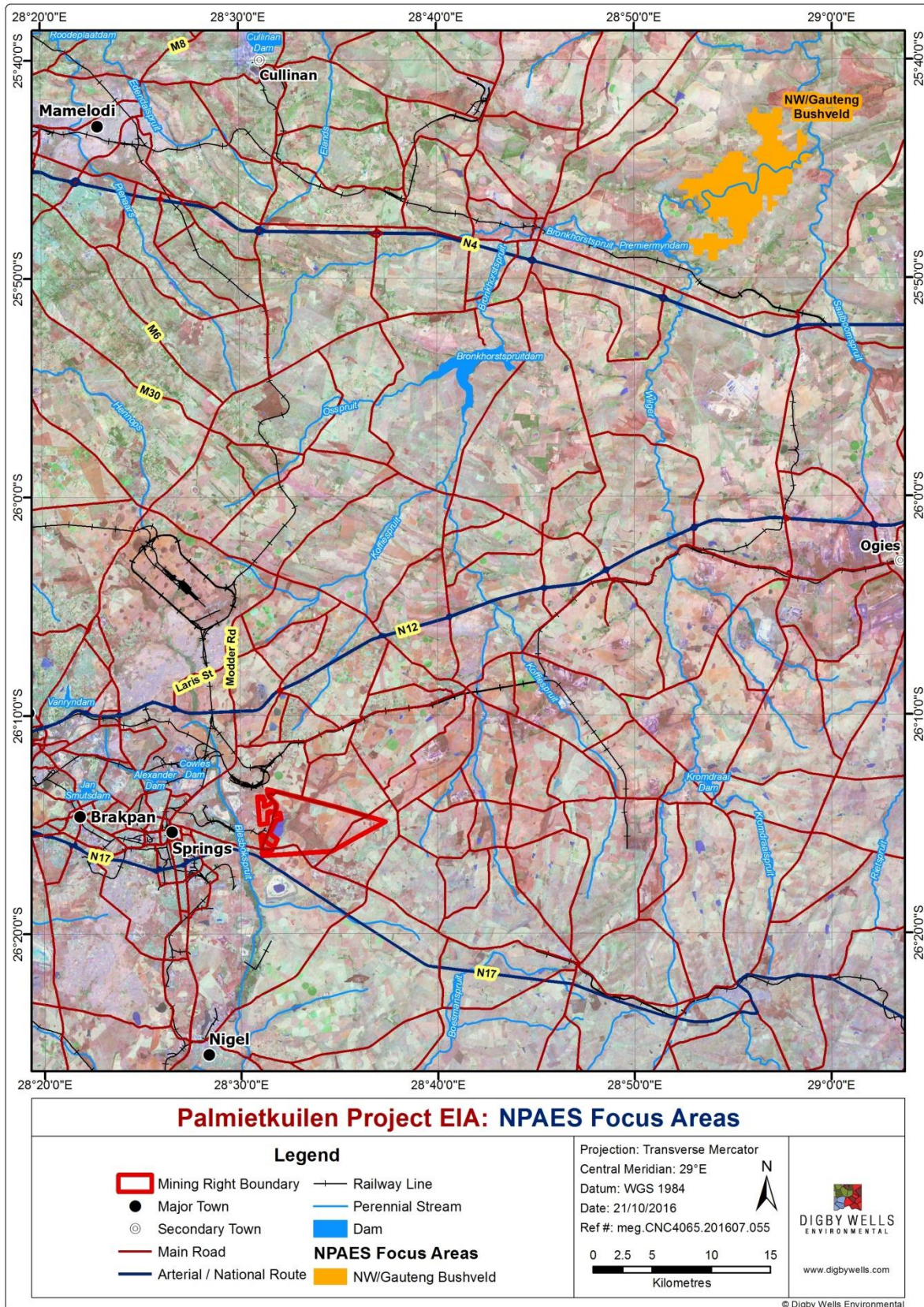


Figure 8-5: National Protected Areas Expansion Strategy

8.6 Site-specific Sensitivity

The ecological sensitivity map for the site is represented in Figure 8-6. The Wetland/Riparian and pan vegetation units were allocated a high sensitivity since wetlands are regarded as important habitats that should be conserved due to the presence of plant SSC and habitat diversity. Further to this *Eragrostis* – dominated Grassland was assigned moderate ecological sensitivity due to the potential presence of plant SSC and current high species diversity and ecosystems function.

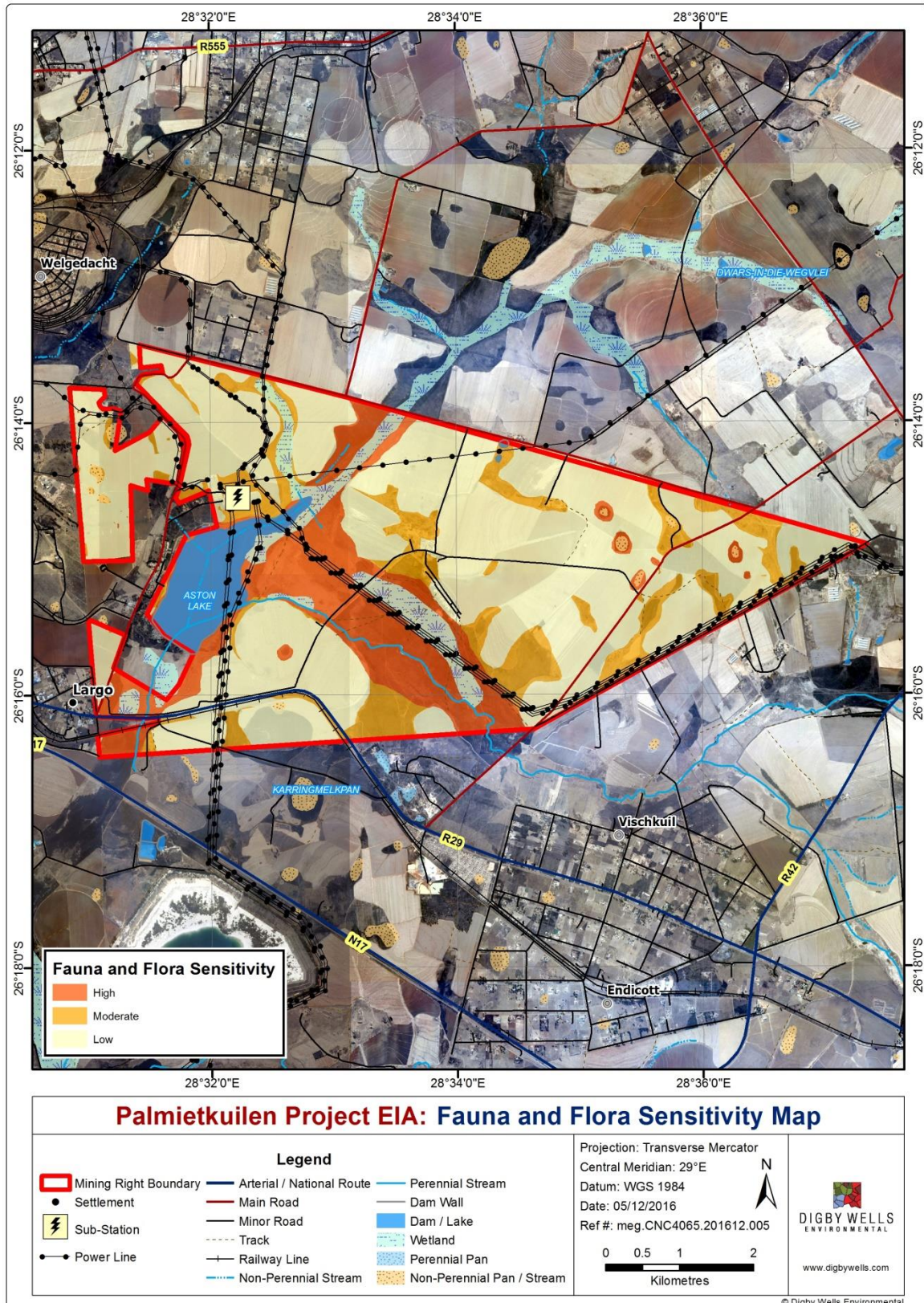


Figure 8-6: Ecological Sensitivity



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																																					
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

The following activities are envisioned for each of the project phases:

- Construction:
 - Site establishment;
 - Site clearing, including the removal of topsoil and vegetation;
 - Construction of mine related infrastructure, including haul roads, pipes, dams;
 - Construction of washing plant;
 - Relocation of Infrastructure;
 - Blasting and development of initial box-cut for mining, including stockpiling from initial box-cuts; and
 - Temporary storage of hazardous products, including fuel and explosives, as well as waste and sewage.
- Operational:
 - Stripping topsoil and soft overburden;
 - Removal of overburden, including drilling and blasting of hard overburden;
 - Loading, hauling and stockpiling of overburden;
 - Drilling and blasting of coal;
 - Load, haul and stockpiling of RoM coal;
 - Use and maintenance of haul roads for the transportation of coal to the washing plant;
 - Water use and storage on-site; and
 - Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste.
- Decommissioning and closure:
 - Demolition and removal of all infrastructure, including transporting materials off site;
 - Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring;
 - Environmental monitoring of decommissioning activities;
 - Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste; and
 - Post-closure monitoring and rehabilitation



9.3 Impact Assessment

9.3.1 Construction Phase

9.3.1.1 Project Activities, Site Clearing

During the construction phase (construction of surface infrastructure), cultivated areas (851 ha), *Eragrostis* – dominated Grassland (280 ha), Riparian areas (Pan-26 ha and Wetlands 26 ha, with a portion of this being *Irriplaceble* according to the Gaunteng C-Plan) will be cleared (refer to Table 9-4). The impact of loss of cultivated fields and alien bushclumps is neutral but the loss of the *Eragrostis* – dominated Grassland and Riparian areas (assigned a high 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 9-4: Loss of Habitat from Surface Infrastructure

Vegetation/Habitat Type	Areas Disturbed (ha)
<i>Eragrostis</i> Grassland	280
Wetland (<i>Irriplaceble</i>)	26
Pan	26
Cultivated	851
	332 ha (excluding Cultivated)

Table 9-5: Interactions and Impacts

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

9.3.1.2 Impact Description

For site clearing, one of the habitats that have been rated as high or very high will be impacted on, the Wetlands unit. The *Eragrostis* – dominated Grassland, 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 in conjunction 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 Plant species (AIPs) 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 9-6: Potential Impacts of the Construction Phase – Loss of Habitat/Vegetation Types, Grassland

Dimension	Rating	Motivation	Significance
Site Clearing			
Impact Description: Loss of <i>Eragrostis</i> – dominated Grassland			
Prior to Mitigation/Management			
Duration	Permanent (7)	Native vegetation/ fauna habitat will be removed (52ha) for surface infrastructure and the impact will be permanent. Fauna species will move away with no permanent impact on them. Occasional and accidental mortalities may occur.	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 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.	



Dimension	Rating	Motivation	Significance
Mitigation/Management Actions			
<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 <i>Themeda</i> grassland and native grass species (such as <i>Cynodon dactylon</i>) are planted immediately to prevent erosion; and ▪ The footprint area should be limited as far as possible. 			
Post-Mitigation			
Duration	Project Life (5)	The area can be reinstated to the former landuse, such as grazing 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, the area can be ripped.	
Nature	negative	The impact will be negative.	

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

Dimension	Rating	Motivation	Significance
Site Clearing			
Impact Description: Loss of Riparian areas, Wetlands and Pans			
Prior to Mitigation/Management			
Duration	Permanent (7)	Native vegetation/ fauna habitat will be removed for surface infrastructure and the impact will be permanent. Fauna species will move away with no permanent impact on them. Occasional and accidental mortalities may occur.	Moderate (negative) 98
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 SSC was encountered in the area of disturbance; therefore no direct impact is expected.	



Dimension	Rating	Motivation	Significance
Intensity x type of impact	Moderate (-5)	Since the vegetation unit has been assigned moderate ecological sensitivity, and C-Planilrrriplaceble category, and is earmarked for destruction, the impact is regarded as particularly significant for riparian, wetlands and pans biodiversity.	
Probability	Certain (7)	Clearing of vegetation in wetlands will definitely take place for the establishment of infrastructure.	
Nature	Negative	The impact will be negative.	
Mitigation/Management Actions			
<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 wetland areas are planted immediately to prevent erosion; and ▪ The footprint area should be limited as far as possible. 			
Post-Mitigation			
Duration	Project Life (5)	The area can be reinstated to the former landuse after decommissioning as far as possible, or a more suited land use.	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 Riparian, wetlands and pans 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, the area can be ripped	
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			



Dimension	Rating	Motivation	Significance
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.	
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 Operational Phase

9.3.2.1 Project Activities Assessed

During the operational phase of the development, topsoils and overburden will be stripped and topsoils stockpiled. Progressive Open Cast Mining will cause planned loss of habitat and flora and fauna species, this is however discussed in the construction section. Furthermore the activity of increased vehicular movement and associated human activities on the site will occur. The following impacts on fauna are expected per activity.

- Vegetation clearing in opencast mining area as pit expand;
- Blasting and vibration;
- 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 roadkills 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, roadkills)			



Dimension	Rating	Motivation	Significance
Prior to Mitigation/Management			
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.	
Mitigation/Management Actions			
<ul style="list-style-type: none"> ▪ Erect signage on site; ▪ Adhere to speed limits; ▪ Make use of internal fencing; and ▪ Avoid vehicle movement at night. 			
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)	Roadkills 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 ceased production. The dismantling of surface infrastructure will involve increased activity on site and minor disturbance of the fauna and flora. This may promote the establishment of alien plant species if seeds persist in the seedbank. The impact of this will be minor. Rehabilitation of all open and disturbed areas must take place. This will be a positive impact.



9.3.3.2 Impact Description

When the soil is disturbed, alien plants in the seedbank will establish and spread. Rehabilitation must take by using local indigenous grass species that are sown in the correct depth and method, and type of topsoil, which is layered on the correct slope.

9.3.3.3 Management Objectives

The objective for this phase will be to maximise the success of the rehabilitation that will take place after infrastructure is removed, and to furthermore reduce any impacts that may occur during this phase. In addition the objective of the management actions will be 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

Decommissioning of infrastructure in the proposed Palmietkuilen Coal Mine MRA will be predominantly a rehabilitation activity of footprint areas including surface infrastructure and the open pit. In order for this to be a positive impact the removal of the infrastructure must be completed so as to not harm or negatively impact surrounding vegetation. Furthermore the rehabilitation must be conducted in such a manner to achieve rehabilitation objectives for the process. These objectives will be to ensure the footprint areas are re-vegetated and that erosion through runoff and wind does not occur. Efforts will be maximised if rehabilitation is completed in the before the first rains fall so as to make use of the rainfall to assist in plant recruitment. 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			
<i>Prior to Mitigation/Management</i>			
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.	



Dimension	Rating	Motivation	Significance
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.	
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	

Table 9-11: Potential Impacts of the Decommissioning Phase Rehabilitation of infrastructure footprint areas

Activity and Interaction: Rehabilitation of infrastructure footprint areas			
Dimension	Rating	Motivation	Significance
Impact Description: Restoration of vegetation and habitat types.			



Duration	Short term (2)	If rehabilitation is not completed effectively it will have to be re-done.	21 "Small Positive"
Extent	Limited (2)	Only certain parts of the site will have re-vegetated cover, this will include all open areas left behind by infrastructure removal, this will include the open pit.	
Intensity	Moderate (3)	The effectiveness of the rehabilitation will determine the intensity.	
Probability	Unlikely (3)	It's unlikely that the rehabilitation will be as effective as pre-mining vegetations cover	
Nature	Positive	The impact will be positive.	
Impact Description: Rehabilitation of infrastructure footprint areas			
Duration	Permanent (7)	If rehabilitation is completed successfully this impact will be permanent	84 "Moderate positive"
Extent	Local (3)	The general area beyond the project site will be positively impacted on.	
Intensity	Positive (4)	Vegetation will be restored.	
Probability	Almost certain (6)	With correct implementation this impact has a high probability of occurring	
Nature	Positive	The impact will be positive.	

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 280 ha of this unit, the regional impact will be minor.
- Loss of diversity on a regional scale – the Riparian vegetation type is a broad habitat that encompasses wetlands and pans plant and habitat communities. Due to the loss of 52 ha of this unit, the regional impact will be minor.

11 Unplanned Events and Low Risks

A summary of exologically 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
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 to increase activity on site.	Small mammals and reptiles may be at risk due to increased human activity on site.	Ensure continuous environmental awareness training takes place. This needs to be monitored and reported on and the appropriate actions should take place dependant on the results.



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)
	Loss of Riparian habitat and vegetation type
Increased vehicular movement on site	Faunal disturbance and potential roadkills

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 (280ha) Loss of Riparian Vegetation/habitat type (51ha)	Moderate (negative) 84/99	Habitat loss for flora and fauna; Loss of species diversity; and Potential loss of Red Data plant species	Construction phase	Relocation of infrastructure; Rehabilitation with native grass species; and 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); and National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004).	Rehabilitation should take place after decommissioning as outlined in the Rehabilitation Plan Report; and 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) 54/36	Flora – alien plant invasion	Construction, operation and decommissioning phases	Alien management plan.	National Environmental Management Act (NEMA), 1998 (Act 107 of 1998); and National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004).	Alien management plan to be implemented after construction quarterly for 2 years and after decommissioning quarterly for two years., Monitoring frequency during operation phase must be seasonal.
Increased vehicular activities	Roadkills and disturbance of fauna	Minor (negative) 54/40	Potential loss of fauna diversity	Construction, operation and decommissioning phases	Erection of signage; Implementing speed limit on site; and Restricting driving at night	National Environmental Management Act (NEMA), 1998 (Act 107 of 1998); and 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
Fauna and Flora Monitoring	Impacts on vegetation structure and health; and Impacts on faunal populations and numbers; Red Data Listed fauna and flora species (should it be recorded going forward)	Ensuring sustainable populations of both fauna and flora persist till closure	Terrestrial Ecologist	Annually
Rehabilitation	Success of rehabilitation	Rehabilitation success	Rehabilitation Specialist and/or botanist	Quarterly for 2 years after closure
Soil disturbance	Establishment of alien plant species	Alien plant monitoring	Qualified botanist	Seasonal monitoring for two years



13 Consultation Undertaken

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

14 Comments and Responses

No Comments have been received thus far.

15 Discussion and Conclusions

The study area is located within the threatened ecosystems: Blesbospruit Highveld Grassland. According to the Gauteng C-Plan the wetlands throughout the project area is regarded as Important Areas, with a small patch of Irriplaceable habitat being present in the south according to the Gauteng C-Plan. The results of the field investigations confirm that the irreplaceable areas are intact natural systems and should be conserved, and if disturbed off sets will be required.

The surface infrastructure coincide with irreplaceable and ecological support areas according to the Gauteng C-Plan. The loss of habitat due to the surface infrastructure will be moderate negative 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 are 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.

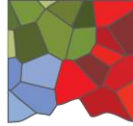
The specialist opinion is that the proposed project should go ahead, should all recommendations for mitigation and management be adhered to.



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DIGBY WELLS
ENVIRONMENTAL

Appendix A: Staff CV's

Mr. Rudolph Greffrath

Manager: Biodiversity, Senior Terrestrial Ecology specialist

Biophysical Department

Digby Wells Environmental

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).

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.

Language Skills

English : Fluent

Afrikaans : Fluent

Employment

- 2006 – Present: Digby Wells Environmental, Johannesburg, South Africa.
- 2002 - 2003: Shamwari Game Reserve, Eastern Cape, South Africa.
- 2001: Kop-Kop Geotechnical instrumentation specialists, Johannesburg, South Africa.

Experience

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;
- No Net Loss (NNL) and Net Positive Impact on Biodiversity (NPI) strategies and implementation;
- Planning and design of Rehabilitation off-set strategies.

Biodiversity Manager



Rudi is also responsible for the team of specialists within the fauna, flora and wetlands department, 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 departments 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
Management Committee (MANCO) member
Proposals compilation, review, submission
Feedback from employees

Project Experience

Project	Location	Client	Main project features	Positions held	Activities performed
Mmamabula	Botswana	CIC	Construction of	Technical	IFC level



Energy Project (MEP).		energy	a railway, opencast mine, wellfield, conveyors, addits, housing.	Specialist Ecologist	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 Management Plan	Mali	Randgold	Design, compilation and implementation of the BLMP	Technical Specialist Ecologist, Project Manager	Fauna and Flora surveys for the project 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.

Professional Affiliations

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

Professional Registration

- South African Council for Natural Scientific Professions, *Professional Natural Scientist in the field of practice Conservation Science, registration number is 400018/17.*
- IAIA, International Association for Impact assessments;
- The Land Rehabilitation Society of Southern Africa, LARSA (Membership No. 0085);

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

Family	Species
CYPERACEAE	<i>Abildgaardia ovata</i> (Burm.f.) Kral
FABACEAE	<i>Acacia baileyana</i> F.Muell.
FABACEAE	<i>Acacia dealbata</i> Link
EUPHORBIACEAE	<i>Acalypha angustata</i> Sond.
EUPHORBIACEAE	<i>Acalypha caperonioides</i> Baill. var. <i>caperonioides</i>
ASTERACEAE	<i>Acanthospermum glabratum</i> (DC.) Wild
AMARANTHACEAE	<i>Achyranthes aspera</i> L. var. <i>aspera</i>
LAMIACEAE	<i>Acrotome hispida</i> Benth.
APIACEAE	<i>Afroscidium magalismontanum</i> (Sond.) P.J.D.Winter
POACEAE	<i>Agrostis avenacea</i> C.C.Gmel.
POACEAE	<i>Agrostis lachnantha</i> Nees var. <i>lachnantha</i>
APIACEAE	<i>Alepidea peduncularis</i> A.Rich.
POACEAE	<i>Alloteropsis semialata</i> (R.Br.) Hitchc. subsp. <i>eckloniana</i> (Nees) Gibbs Russ.
AMARANTHACEAE	<i>Amaranthus hybridus</i> L. subsp. <i>hybridus</i> var. <i>erythrostachys</i> Moq.
POACEAE	<i>Andropogon eucomus</i> Nees
APONOGETONACEAE	<i>Aponogeton junceus</i> Lehm.
ASTERACEAE	<i>Arctotis arctotoides</i> (L.f.) O.Hoffm.
FABACEAE	<i>Argyrolobium speciosum</i> Eckl. & Zeyh.
APOCYNACEAE	<i>Asclepias albens</i> (E.Mey.) Schltr.
APOCYNACEAE	<i>Asclepias aurea</i> (Schltr.) Schltr.
APOCYNACEAE	<i>Asclepias eminens</i> (Harv.) Schltr.
APOCYNACEAE	<i>Asclepias gibba</i> (E.Mey.) Schltr. var. <i>gibba</i>
APOCYNACEAE	<i>Asclepias stellifera</i> Schltr.
APOCYNACEAE	<i>Aspidoglossum interruptum</i> (E.Mey.) Bullock
APOCYNACEAE	<i>Aspidoglossum lamellatum</i> (Schltr.) Kupicha
APOCYNACEAE	<i>Aspidoglossum restioides</i> (Schltr.) Kupicha
ASPLENIACEAE	<i>Asplenium adiantum-nigrum</i> L. var. <i>adiantum-nigrum</i>
ASTERACEAE	<i>Aster harveyanus</i> Kuntze
ASTERACEAE	<i>Aster peglerae</i> Bolus
ASTERACEAE	<i>Aster squamatus</i> (Spreng.) Hieron.
ASTERACEAE	<i>Athrixia elata</i> Sond.
CHENOPODIACEAE	<i>Atriplex suberecta</i> I.Verd.
AZOLLACEAE	<i>Azolla filiculoides</i> Lam.
IRIDACEAE	<i>Babiana bainesii</i> Baker
ELATINACEAE	<i>Bergia decumbens</i> Planch. ex Harv.
ASTERACEAE	<i>Berkheya insignis</i> (Harv.) Thell.
ASTERACEAE	<i>Berkheya pinnatifida</i> (Thunb.) Thell. subsp. <i>ingrata</i> (Bolus) Roessler
ASTERACEAE	<i>Berkheya radula</i> (Harv.) De Wild.



ASTERACEAE	<i>Berkheya setifera</i> DC.
ASTERACEAE	<i>Berkheya zeyheri</i> Oliv. & Hiern subsp. <i>zeyheri</i>
ACANTHACEAE	<i>Blepharis stainbankiae</i> C.B.Clarke
APOCYNACEAE	<i>Brachystelma barberae</i> Harv. ex Hook.f.
BRYACEAE	<i>Bryum argenteum</i> Hedw.
BORAGINACEAE	<i>Buglossoides arvensis</i> (L.) I.M.Johnst.
ASPHODELACEAE	<i>Bulbine abyssinica</i> A.Rich.
ASPHODELACEAE	<i>Bulbine favosa</i> (Thunb.) Schult. & Schult.f
ASPHODELACEAE	<i>Bulbine narcissifolia</i> Salm-Dyck
CYPERACEAE	<i>Bulbostylis burchellii</i> (Ficalho & Hiern) C.B.Clarke
CYPERACEAE	<i>Bulbostylis oritrephes</i> (Ridl.) C.B.Clarke
CYPERACEAE	<i>Bulbostylis scleropus</i> C.B.Clarke
CYPERACEAE	<i>Carex acutiformis</i> Ehrh.
CYPERACEAE	<i>Carex glomerabilis</i> V.I.Krecz.
APIACEAE	<i>Centella asiatica</i> (L.) Urb.
DIPSACACEAE	<i>Cephalaria zeyheriana</i> Szabó
CARYOPHYLLACEAE	<i>Cerastium capense</i> Sond.
FABACEAE	<i>Chamaecrista biensis</i> (Steyaert) Lock
SINOPTERIDACEAE	<i>Cheilanthes hirta</i> Sw. var. <i>brevipilosa</i> W. & N.Jacobsen
CHENOPODIACEAE	<i>Chenopodium album</i> L.
CHENOPODIACEAE	<i>Chenopodium phillipsianum</i> Aellen
ANTHERICACEAE	<i>Chlorophytum cooperi</i> (Baker) Nordal
ANTHERICACEAE	<i>Chlorophytum fasciculatum</i> (Baker) Kativu
ANTHERICACEAE	<i>Chlorophytum transvaalense</i> (Baker) Kativu
ASPHODELACEAE	<i>Chortolirion angolense</i> (Baker) A.Berger
ASPHODELACEAE	<i>Chortolirion angolense</i> (Baker) A.Berger
ASTERACEAE	<i>Cirsium vulgare</i> (Savi) Ten.
BRUCHIACEAE	<i>Cladophascum gymnomitrioides</i> (Dixon) Dixon
CAPPARACEAE	<i>Cleome monophylla</i> L.
COLCHICACEAE	<i>Colchicum striatum</i> (Hochst. ex A.Rich.) J.C.Manning & Vinn.
COMMELINACEAE	<i>Commelina africana</i> L. var. <i>krebsiana</i> (Kunth) C.B.Clarke
COMMELINACEAE	<i>Commelina livingstonii</i> C.B.Clarke
COMMELINACEAE	<i>Commelina subulata</i> Roth
CONVOLVULACEAE	<i>Convolvulus farinosus</i> L.
ASTERACEAE	<i>Conyza bonariensis</i> (L.) Cronquist
ASTERACEAE	<i>Conyza podocephala</i> DC.
APOCYNACEAE	<i>Cordylogyne globosa</i> E.Mey.
CARYOPHYLLACEAE	<i>Corrigiola litoralis</i> L. subsp. <i>litoralis</i> var. <i>litoralis</i>
ASTERACEAE	<i>Cotula coronopifolia</i> L.
CRASSULACEAE	<i>Cotyledon orbiculata</i> L. var. <i>oblonga</i> (Haw.) DC.
ACANTHACEAE	<i>Crabbea acaulis</i> N.E.Br.
CRASSULACEAE	<i>Crassula lanceolata</i> (Eckl. & Zeyh.) Endl. ex Walp. subsp. <i>lanceolata</i>
CRASSULACEAE	<i>Crassula natans</i> Thunb. var. <i>natans</i>



CRASSULACEAE	<i>Crassula setulosa</i> Harv. var. <i>setulosa</i> forma <i>setulosa</i>
ASTERACEAE	<i>Crepis hypochaeridea</i> (DC.) Thell.
AMARYLLIDACEAE	<i>Crinum bulbispermum</i> (Burm.f.) Milne-Redh. & Schweick.
AMARYLLIDACEAE	<i>Crinum graminicola</i> I. Verd.
FABACEAE	<i>Crotalaria globifera</i> E. Mey.
CONVOLVULACEAE	<i>Cuscuta australis</i> R. Br.
CONVOLVULACEAE	<i>Cuscuta campestris</i> Yunck.
COMMELINACEAE	<i>Cyanotis speciosa</i> (L.f.) Hassk.
BORAGINACEAE	<i>Cynoglossum lanceolatum</i> Forssk.
CYPERACEAE	<i>Cyperus congestus</i> Vahl
CYPERACEAE	<i>Cyperus difformis</i> L.
CYPERACEAE	<i>Cyperus esculentus</i> L. var. <i>esculentus</i>
CYPERACEAE	<i>Cyperus fastigiatus</i> Rottb.
CYPERACEAE	<i>Cyperus longus</i> L. var. <i>tenuiflorus</i> (Rottb.) Boeck.
CYPERACEAE	<i>Cyperus marginatus</i> Thunb.
CYPERACEAE	<i>Cyperus obtusiflorus</i> Vahl var. <i>flavissimus</i> (Schrad.) Boeck.
CYPERACEAE	<i>Cyperus obtusiflorus</i> Vahl var. <i>obtusiflorus</i>
CYPERACEAE	<i>Cyperus rigidifolius</i> Steud.
CYPERACEAE	<i>Cyperus semitrifidus</i> Schrad.
CYPERACEAE	<i>Cyperus uitenhagensis</i> (Steud.) C. Archer & Goetgh.
CYPERACEAE	<i>Cyperus usitatus</i> Burch.
AMARYLLIDACEAE	<i>Cyrtanthus breviflorus</i> Harv.
ASTERACEAE	<i>Denekia capensis</i> Thunb.
BRASSICACEAE	<i>Descurainia sophia</i> (L.) Webb ex Prantl
POACEAE	<i>Diandrochloa namaquensis</i> (Nees) De Winter
CARYOPHYLLACEAE	<i>Dianthus mooiensis</i> F.N. Williams subsp. <i>kirkii</i> (Burt Davy) S.S. Hooper
FABACEAE	<i>Dichilus gracilis</i> Eckl. & Zeyh.
FABACEAE	<i>Dichilus lebeckioides</i> DC.
FABACEAE	<i>Dichilus strictus</i> E. Mey.
ASTERACEAE	<i>Dicoma anomala</i> Sond. subsp. <i>anomala</i>
POACEAE	<i>Diheteropogon filifolius</i> (Nees) Clayton
ASTERACEAE	<i>Dimorphotheca caulescens</i> Harv.
ASTERACEAE	<i>Dimorphotheca caulescens</i> Harv.
ASTERACEAE	<i>Dimorphotheca spectabilis</i> Schltr.
EBENACEAE	<i>Diospyros lycioides</i> Desf. subsp. <i>guerkei</i> (Kuntze) De Winter
FABACEAE	<i>Dolichos angustifolius</i> Eckl. & Zeyh.
FABACEAE	<i>Elephantorrhiza elephantina</i> (Burch.) Skeels
POACEAE	<i>Eragrostis curvula</i> (Schrad.) Nees
POACEAE	<i>Eragrostis gummiflua</i> Nees
POACEAE	<i>Eragrostis micrantha</i> Hack.
POACEAE	<i>Eragrostis planiculmis</i> Nees
POACEAE	<i>Eragrostis tef</i> (Zuccagni) Trotter
FABACEAE	<i>Eriosema burkei</i> Benth. ex Harv. var. <i>burkei</i>



FABACEAE	<i>Eriosema nutans</i> Schinz
FABACEAE	<i>Eriosema nutans</i> Schinz
FABACEAE	<i>Eriosema salignum</i> E.Mey.
ERIOSPERMACEAE	<i>Eriospermum flagelliforme</i> (Baker) J.C.Manning
FABACEAE	<i>Erythrina zeyheri</i> Harv.
EUPHORBIACEAE	<i>Euphorbia prostrata</i> Aiton
EUPHORBIACEAE	<i>Euphorbia striata</i> Thunb. var. <i>striata</i>
EXORMOTHECACEAE	<i>Exormotheca holstii</i> Steph.
CONVOLVULACEAE	<i>Falkia oblonga</i> Bernh. ex C.Krauss
ASTERACEAE	<i>Felicia muricata</i> (Thunb.) Nees subsp. <i>muricata</i>
CYPERACEAE	<i>Fimbristylis complanata</i> (Retz.) Link
POACEAE	<i>Fingerhuthia sesleriiformis</i> Nees
CYPERACEAE	<i>Fuirena pubescens</i> (Poir.) Kunth var. <i>pubescens</i>
RUBIACEAE	<i>Galium capense</i> Thunb. subsp. <i>garipense</i> (Sond.) Puff var. <i>garipense</i>
ASTERACEAE	<i>Gazania krebsiana</i> Less. subsp. <i>serrulata</i> (DC.) Roessler
ASTERACEAE	<i>Geigeria aspera</i> Harv. var. <i>aspera</i>
ASTERACEAE	<i>Gerbera piloselloides</i> (L.) Cass.
IRIDACEAE	<i>Gladiolus elliotii</i> Baker
IRIDACEAE	<i>Gladiolus sericeovillosus</i> Hook.f. subsp. <i>calvatus</i> (Baker) Goldblatt
ASTERACEAE	<i>Gnaphalium confine</i> Harv.
ASTERACEAE	<i>Gnaphalium filagopsis</i> Hilliard & B.L.Burt
APOCYNACEAE	<i>Gomphocarpus fruticosus</i> (L.) Aiton f. subsp. <i>fruticosus</i>
ASTERACEAE	<i>Haplocarpha scaposa</i> Harv.
ASTERACEAE	<i>Helichrysum argyrosphaerum</i> DC.
ASTERACEAE	<i>Helichrysum aureonitens</i> Sch.Bip.
ASTERACEAE	<i>Helichrysum caespitium</i> (DC.) Harv.
ASTERACEAE	<i>Helichrysum callicomum</i> Harv.
ASTERACEAE	<i>Helichrysum lepidissimum</i> S.Moore
ASTERACEAE	<i>Helichrysum nudifolium</i> (L.) Less. var. <i>nudifolium</i>
ASTERACEAE	<i>Helichrysum rugulosum</i> Less.
ASTERACEAE	<i>Helichrysum setosum</i> Harv.
ASTERACEAE	<i>Helichrysum stenopterum</i> DC.
BORAGINACEAE	<i>Heliotropium curassavicum</i> L.
MALVACEAE	<i>Hibiscus sabdariffa</i> L.
MALVACEAE	<i>Hibiscus trionum</i> L.
ASTERACEAE	<i>Hilliardiella hirsuta</i> (DC.) H.Rob.
APOCYNACEAE	<i>Huernia stapelioides</i> Schltr.
POACEAE	<i>Hyparrhenia anamesa</i> Clayton
POACEAE	<i>Hyparrhenia hirta</i> (L.) Stapf
FABACEAE	<i>Indigostrum burkeanum</i> (Benth. ex Harv.) Schrire
FABACEAE	<i>Indigofera confusa</i> Prain & Baker f.
FABACEAE	<i>Indigofera evansiana</i> Burt Davy
FABACEAE	<i>Indigofera hybrida</i> N.E.Br.



FABACEAE	<i>Indigofera oxytropis</i> Benth. ex Harv.
FABACEAE	<i>Indigofera zeyheri</i> Spreng. ex Eckl. & Zeyh.
CONVOLVULACEAE	<i>Ipomoea bathycolpos</i> Hallier f.
CONVOLVULACEAE	<i>Ipomoea crassipes</i> Hook. var. <i>crassipes</i>
CONVOLVULACEAE	<i>Ipomoea crassipes</i> Hook. var. <i>crassipes</i>
CONVOLVULACEAE	<i>Ipomoea obscura</i> (L.) Ker Gawl. var. <i>obscura</i>
CONVOLVULACEAE	<i>Ipomoea oenotherae</i> (Vatke) Hallier f. var. <i>oenotherae</i>
CONVOLVULACEAE	<i>Ipomoea ommanneyi</i> Rendle
CONVOLVULACEAE	<i>Ipomoea simplex</i> Thunb.
POACEAE	<i>Ischaemum fasciculatum</i> Brongn.
CYPERACEAE	<i>Isolepis fluitans</i> (L.) R.Br. var. <i>fluitans</i>
ACANTHACEAE	<i>Justicia anagalloides</i> (Nees) T.Anderson
MESEMBRYANTHEMACEAE	<i>Khadia beswickii</i> (L.Bolus) N.E.Br.
ASPHODELACEAE	<i>Kniphofia porphyrantha</i> Baker
ASPHODELACEAE	<i>Kniphofia typhoides</i> Codd
CYPERACEAE	<i>Kyllinga alata</i> Nees
CYPERACEAE	<i>Kyllinga erecta</i> Schumach. var. <i>erecta</i>
CYPERACEAE	<i>Kyllinga melanosperma</i> Nees
CYPERACEAE	<i>Kyllinga pulchella</i> Kunth
ASTERACEAE	<i>Lactuca inermis</i> Forssk.
ASTERACEAE	<i>Launaea rarifolia</i> (Oliv. & Hiern) Boulos var. <i>rarifolia</i>
HYACINTHACEAE	<i>Ledebouria cooperi</i> (Hook.f.) Jessop
HYACINTHACEAE	<i>Ledebouria ovatifolia</i> (Baker) Jessop
HYACINTHACEAE	<i>Ledebouria revoluta</i> (L.f.) Jessop
BRASSICACEAE	<i>Lepidium bonariense</i> L.
FABACEAE	<i>Lessertia affinis</i> Burt Davy
FABACEAE	<i>Lessertia prostata</i> DC.
LINACEAE	<i>Linum thunbergii</i> Eckl. & Zeyh.
BORAGINACEAE	<i>Lithospermum cinereum</i> A.DC.
FABACEAE	<i>Lotononis laxa</i> Eckl. & Zeyh.
FABACEAE	<i>Melolobium wilmsii</i> Harms
CONVOLVULACEAE	<i>Merremia verecunda</i> Rendle
ANEMIACEAE	<i>Mohria vestita</i> Baker
IRIDACEAE	<i>Moraea pallida</i> (Baker) Goldblatt
ASTERACEAE	<i>Nidorella anomala</i> Steetz
ASTERACEAE	<i>Nidorella hottentotica</i> DC.
ASTERACEAE	<i>Nolletia rarifolia</i> (Turcz.) Steetz
ASTERACEAE	<i>Oncosiphon piluliferum</i> (L.f.) Källersjö
APOCYNACEAE	<i>Pachycarpus schinzianus</i> (Schltr.) N.E.Br.
APOCYNACEAE	<i>Pachycarpus suaveolens</i> (Schltr.) Nicholas & Goyder
POACEAE	<i>Panicum stapfianum</i> Fourc.
CHRYSOBALANACEAE	<i>Parinari capensis</i> Harv. subsp. <i>capensis</i>
POACEAE	<i>Paspalum dilatatum</i> Poir.



POACEAE	<i>Paspalum distichum</i> L.
FABACEAE	<i>Pearsonia cajanifolia</i> (Harv.) Polhill subsp. <i>cajanifolia</i>
FABACEAE	<i>Pearsonia sessilifolia</i> (Harv.) Dummer subsp. <i>sessilifolia</i>
POLYGONACEAE	<i>Persicaria limbata</i> (Meisn.) H.Hara
ASTERACEAE	<i>Phymaspermum athanasioides</i> (S.Moore) Källersjö
CARYOPHYLLACEAE	<i>Pollichia campestris</i> Aiton
POACEAE	<i>Polypogon monspeliensis</i> (L.) Desf.
ASTERACEAE	<i>Pseudognaphalium luteo-album</i> (L.) Hilliard & B.L.Burt
CYPERACEAE	<i>Pycnus macranthus</i> (Boeckeler) C.B.Clarke
APOCYNACEAE	<i>Raphionacme hirsuta</i> (E.Mey.) R.A.Dyer
FABACEAE	<i>Rhynchosia adenodes</i> Eckl. & Zeyh.
FABACEAE	<i>Rhynchosia nervosa</i> Benth. ex Harv. var. <i>nervosa</i>
RICCIACEAE	<i>Riccia albovestita</i> O.H.Volk
RICCIACEAE	<i>Riccia angolensis</i> Steph.
RICCIACEAE	<i>Riccia stricta</i> (Lindenb.) Perold
POLYGONACEAE	<i>Rumex crispus</i> L.
LAMIACEAE	<i>Salvia reflexa</i> Hornem.
DIPSACACEAE	<i>Scabiosa columbaria</i> L.
ASTERACEAE	<i>Schistostephium crataegifolium</i> (DC.) Fenzl ex Harv.
APOCYNACEAE	<i>Schizoglossum periglossoides</i> Schltr.
CYPERACEAE	<i>Schoenoplectus decipiens</i> (Nees) J.Raynal
CYPERACEAE	<i>Schoenoplectus lateriflorus</i> (J.F.Gmel.) Lye
CYPERACEAE	<i>Schoenoplectus muricinux</i> (C.B.Clarke) J.Raynal
CYPERACEAE	<i>Schoenoplectus muriculatus</i> (Kük.) Browning
CYPERACEAE	<i>Schoenoplectus pulchellus</i> (Kunth) J.Raynal
CYPERACEAE	<i>Scirpoides burkei</i> (C.B.Clarke) Goetgh., Muasya & D.A.Simpson
ANACARDIACEAE	<i>Searsia discolor</i> (E.Mey. ex Sond.) Moffett
ANACARDIACEAE	<i>Searsia pyroides</i> (Burch.) Moffett var. <i>pyroides</i>
ASTERACEAE	<i>Senecio coronatus</i> (Thunb.) Harv.
ASTERACEAE	<i>Senecio erubescens</i> Aiton var. <i>erubescens</i>
ASTERACEAE	<i>Senecio inornatus</i> DC.
ASTERACEAE	<i>Senecio isatideus</i> DC.
ASTERACEAE	<i>Senecio laevigatus</i> Thunb. var. <i>laevigatus</i>
ASTERACEAE	<i>Senecio lydenburgensis</i> Hutch. & Burt Davy
ASTERACEAE	<i>Senecio madagascariensis</i> Poir.
ASTERACEAE	<i>Senecio othonniflorus</i> DC.
ASTERACEAE	<i>Senecio oxyriifolius</i> DC. subsp. <i>oxyriifolius</i>
ASTERACEAE	<i>Senecio venosus</i> Harv.
CARYOPHYLLACEAE	<i>Silene gallica</i> L.
ASTERACEAE	<i>Sonchus nanus</i> Sond. ex Harv.
ASTERACEAE	<i>Tagetes minuta</i> L.
FABACEAE	<i>Tephrosia semiglabra</i> Sond.
ACANTHACEAE	<i>Thunbergia natalensis</i> Hook.



ASTERACEAE	<i>Tolpis capensis</i> (L.) Sch.Bip.
ASPHODELACEAE	<i>Trachyandra asperata</i> Kunth var. <i>macowanii</i> (Baker) Oberm.
ASPHODELACEAE	<i>Trachyandra saltii</i> (Baker) Oberm. var. <i>saltii</i>
FABACEAE	<i>Trifolium africanum</i> Ser. var. <i>africanum</i>
ASTERACEAE	<i>Tripteris aghillana</i> DC. var. <i>aghillana</i>
IRIDACEAE	<i>Tritonia nelsonii</i> Baker
ALLIACEAE	<i>Tulbaghia acutiloba</i> Harv.
ALLIACEAE	<i>Tulbaghia leucantha</i> Baker
ASTERACEAE	<i>Ursinia nana</i> DC. subsp. <i>leptophylla</i> Prassler
ASTERACEAE	<i>Vernonia galpinii</i> Klatt
SCROPHULARIACEAE	<i>Veronica anagallis-aquatica</i> L.
LEMNACEAE	<i>Wolffia arrhiza</i> (L.) Horkel ex Wimm.
APOCYNACEAE	<i>Xysmalobium brownianum</i> S.Moore



DIGBY WELLS
ENVIRONMENTAL



Appendix C: Site Plant Species List

Family	Species	Threat Status	Riparian	Eragrostis	Disturbed	Pans
Mimosaceae	<i>Acacia karoo</i>	Medicinal				x
Fabaceae	<i>Acacia mearnsii</i>	Alien			x	x
Poaceae	<i>Agrostis lachnantha</i>	LC	x	x		x
Orobanchaceae	<i>Alectra capensis</i>	LC	x			
Amaranthaceae	<i>Amaranthus hybridus</i>	LC	x		x	
Poaceae	<i>Andropogon appendiculatus</i>	LC		x	x	
Poaceae	<i>Andropogon eucomus</i>	LC		x		x
Poaceae	<i>Andropogon huillensis</i>	LC		x		
Poaceae	<i>Aristida congesta subsp. barbicollis</i>	LC		x	x	x
Poaceae	<i>Arundinella nepalensis</i>	LC	x			
	<i>Asclepias gibba var gibba</i>		x			
Asparagaceae	<i>Asparagus sp.</i>			x	x	
	<i>Berkheya echinacea</i>	Medicinal				
Asteraceae	<i>Berkheya erysithales</i>	LC	x	x	x	
Asteraceae	<i>Berkheya setifera</i>	LC	x		x	
Asteraceae	<i>Bidens pilosa</i>	Alien			x	
Acanthaceae	<i>Blepharis acuminata</i>	LC		x		
Poaceae	<i>Bromus catharticus</i>	LC		x		
Asteraceae	<i>Cirsium vulgare</i>	Alien	x	x	x	
Commelinaceae	<i>Commelina africana</i>	LC	x	x		
Commelinaceae	<i>Commelina subulata</i>	LC		x		
Asteraceae	<i>Conyza albida</i>	Alien			x	
Asteraceae	<i>Cosmos bipinnatus</i>	Alien			x	
Acanthaceae	<i>Crabbea acaulis</i>		x			
Amaryllidaceae	<i>Crinum bulbispermum</i>	Declining	x	x		
Poaceae	<i>Ctenium concinnum</i>	LC		x		
Poaceae	<i>Cynodon dactylon</i>	LC	x	x	x	
Cyperaceae	<i>Cyperus congestus</i>	LC	x			
Cyperaceae	<i>Cyperus esculentus</i>	LC	x			
Cyperaceae	<i>Cyperus semitrifidus</i>	LC	x			x
Solanaceae	<i>Datura ferox</i>	Alien			x	
Asteraceae	<i>Dicoma anomala</i>	Medicinal				



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
Poaceae	<i>Eragrostis racemosa</i>	LC		x		
Fabaceae	<i>Erythrina zeyheri</i>	Medicinal	x	x		
Myrtaceae	<i>Eucalyptus camaldulensis</i>	Alien Invasive 1b			x	
Euphorbiaceae	<i>Euphorbia clavarioides</i>	Medicinal (LC)		x		
Asteraceae	<i>Felicia muricata</i>	Medicinal	x	x		
Poaceae	<i>Fingerhuthia africana</i>	LC		x		
Asteraceae	<i>Geigeria burkei</i>	LC	x	x		
Asclepiadaceae	<i>Gomphocarpus fruticosus</i>	LC		x		
Amaranthaceae	<i>Gomphrena celesioides</i>	Alien			x	
Amaranthaceae	<i>Guilleminea densa</i>	Alien	x	x	x	
Asteraceae	<i>Haplocarpha scaposa</i>	LC		x		
Asteraceae	<i>Helichrysum aureonitens</i>	LC		x		
Asteraceae	<i>Helichrysum inornatum</i>	LC		x		
Poaceae	<i>Hyparrhenia hirta</i>	LC	x	x	x	
Poaceae	<i>Hyparrhenia tamba</i>	LC		x		
Asteraceae	<i>Hypochoeris radicata</i>	LC		x		
Hypoxidaceae	<i>Hypoxis hemerocallidea</i>	Declining	x	x		
Hypoxidaceae	<i>Hypoxis acuminata</i>	LC	x			
Poaceae	<i>Imperata cylindrica</i>	LC	x	x		
	<i>Ipomoea crassipes</i>	Medicinal	x			
Convolvulaceae	<i>Ipomoea sp.</i>			x		
Juncaceae	<i>Juncus effusus</i>	LC	x		x	
Juncaceae	<i>Juncus exsertus</i>	LC	x			
Hyacinthaceae	<i>Ledebouria ovatifolia</i>	Medicinal	x	x		
Poaceae	<i>Melinis repens</i>	LC	x	x		
Lobeliaceae	<i>Monopsis decipiens</i>	LC	x			
	<i>Hirpicium armeroides</i>	Mountain gerbera		x		x
Onagraceae	<i>Oenothera rosea</i>	LC			x	
Cactaceae	<i>Opuntia ficus-indica</i>	Alien			x	
Poaceae	<i>Panicum coloratum</i>	LC		x		
Poaceae	<i>Paspalum dilatatum</i>	LC			x	x
Poaceae	<i>Paspalum notatum</i>	Alien	x		x	
Polygonaceae	<i>Persicaria lapathifolia</i>	LC				x
Poaceae	<i>Phragmites australis</i>	Decreaser	x			x
Plantaginaceae	<i>Plantago minor</i>	LC		x		
Salicaceae	<i>Salix babylonica</i>	Exotic	x			



Cyperaceae	<i>Schoenoplectus brachyceras</i>	LC	x			
Cyperaceae	<i>Schoenoplectus corymbosus</i>	LC	x			
Cyperaceae	<i>Schoenoplectus decipiens</i>	LC	x			
Asteraceae	<i>Senecio inornatus</i>	LC		x		
Asteraceae	<i>Seriphium plumosum</i>	LC		x	x	
Poaceae	<i>Setaria sphacelata</i>	LC	x			
Solanaceae	<i>Solanum sysimbriifolium</i>	Alien		x		
Poaceae	<i>Sporobolus africanus</i>	LC		x	x	
Poaceae	<i>Sporobolus pyramidalis</i>	LC		x	x	
Asteraceae	<i>Tagetes minuta</i>	Alien			x	
Asteraceae	<i>Taraxacum officinale</i>	Alien			x	
Poaceae	<i>Themeda triandra</i>	LC		x		
Asphodelaceae	<i>Trachyandra asperata</i>	Medicinal		x		
Poaceae	<i>Trichoneura grandiglumis</i>	Alien		x		
Poaceae	<i>Tristachya leucothrix</i>	LC		x		
Typhaceae	<i>Typha capensis</i>	LC	x			x
Verbenaceae	<i>Verbena brasiliensis</i>	Alien	x	x	x	x
Asteraceae	<i>Vernonia oligocephala</i>	Medicinal		x		
Asteraceae	<i>Xanthium strumarium</i>	Alien	x			



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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 simulador</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



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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



Roberts no.	English Name	Scientific Name	IUCN Status
101	Whitebacked Duck	<i>Thalassornis leuconotus</i>	Least Concern
102	Egyptian Goose	<i>Alopochen aegyptiacus</i>	Least Concern
103	South African Shelduck	<i>Tadorna cana</i>	Least Concern
104	Yellowbilled Duck	<i>Anas undulata</i>	Least Concern
105	African Black Duck	<i>Anas sparsa</i>	Least Concern
106	Cape Teal	<i>Anas capensis</i>	Least Concern
107	Hottentot Teal	<i>Anas hottentota</i>	Least Concern
108	Redbilled Teal	<i>Anas erythrorhyncha</i>	Least Concern
112	Cape Shoveller	<i>Anas smithii</i>	Least Concern
113	Southern Pochard	<i>Netta erythrophthalma</i>	Least Concern
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	Gymnogone	<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



Roberts no.	English Name	Scientific Name	IUCN Status
190	Orange-river Francolin	<i>Scleroptila levaillantoides</i>	Least Concern
192	Redwing Francolin	<i>Scleroptila levaillantii</i>	Least Concern
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	Kurrichane 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



Roberts no.	English Name	Scientific Name	IUCN Status
262	Ruddy Turnstone	<i>Arenaria interpres</i>	Least Concern
264	Common Sandpiper	<i>Actitis hypoleucos</i>	Least Concern
265	Green Sandpiper	<i>Tringa ochropus</i>	Least Concern
266	Wood Sandpiper	<i>Tringa glareola</i>	Least Concern
269	Marsh Sandpiper	<i>Tringa stagnatilis</i>	Least Concern
270	Greenshank	<i>Tringa nebularia</i>	Least Concern
272	Curlew Sandpiper	<i>Calidris ferruginea</i>	Least Concern
274	Little Stint	<i>Calidris minuta</i>	Least Concern
284	Ruff	<i>Philomachus pugnax</i>	Least Concern
286	African Snipe	<i>Gallinago nigripennis</i>	Least Concern
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



Roberts no.	English Name	Scientific Name	IUCN Status
391	Burchell's Coucal	<i>Centropus burchellii</i>	Least Concern
392	Barn Owl	<i>Tyto alba</i>	Least Concern
393	Grass Owl	<i>Tyto capensis</i>	Near threatened
395	Marsh Owl	<i>Asio capensis</i>	Least Concern
401	Spotted Eagle Owl	<i>Bubo africanus</i>	Least Concern
404	Eurasian Nightjar	<i>Caprimulgus europaeus</i>	Least Concern
405	Fierynecked Nightjar	<i>Caprimulgus pectoralis</i>	Least Concern
408	Freckled Nightjar	<i>Caprimulgus tristigma</i>	Least Concern
411	Eurasian Swift	<i>Apus apus</i>	Least Concern
412	Black Swift	<i>Apus barbatus</i>	Least Concern
415	Whiterumped Swift	<i>Apus caffer</i>	Least Concern
416	Horus Swift	<i>Apus horus</i>	Least Concern
417	Little Swift	<i>Apus affinis</i>	Least Concern
418	Alpine Swift	<i>Tachymarptis melba</i>	Least Concern
421	Palm Swift	<i>Cypsiurus parvus</i>	Least Concern
424	Speckled Mousebird	<i>Colius striatus</i>	Least Concern
426	Redfaced Mousebird	<i>Urocolius indicus</i>	Least Concern
428	Pied Kingfisher	<i>Ceryle rudis</i>	Least Concern
429	Giant Kingfisher	<i>Megaceryle maxima</i>	Least Concern
430	Halfcollared Kingfisher	<i>Alcedo semitorquata</i>	Near threatened
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



Roberts no.	English Name	Scientific Name	IUCN Status
465	Pied Barbet	<i>Tricholaema leucomelas</i>	Least Concern
470	Yellowfronted Tinker Barbet	<i>Pogoniulus chrysoconus</i>	Least Concern
473	Crested Barbet	<i>Trachyphonus vaillantii</i>	Least Concern
474	Greater Honeyguide	<i>Indicator indicator</i>	Least Concern
476	Lesser Honeyguide	<i>Indicator minor</i>	Least Concern
478	Sharpbilled Honeyguide	<i>Prodotiscus regulus</i>	Least Concern
480	Ground Woodpecker	<i>Geocolaptes olivaceus</i>	Least Concern
483	Golden tailed Woodpecker	<i>Campethera abingoni</i>	Least Concern
486	Cardinal Woodpecker	<i>Dendropicos fuscescens</i>	Least Concern
489	Redthroated Wryneck	<i>Jynx ruficollis</i>	Least Concern
494	Rufousnaped Lark	<i>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



Roberts no.	English Name	Scientific Name	IUCN Status
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
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 gracilirostris</i>	Least Concern
637	Yellow Warbler	<i>Chloropeta natalensis</i>	Least Concern



Roberts no.	English Name	Scientific Name	IUCN Status
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
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	Blackchedsted 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



Roberts no.	English Name	Scientific Name	IUCN Status
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
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



Roberts no.	English Name	Scientific Name	IUCN Status
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
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



Family	Species	Common Name
Scincidea	<i>Acontias breviceps</i>	Short headed legless skink
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>	-