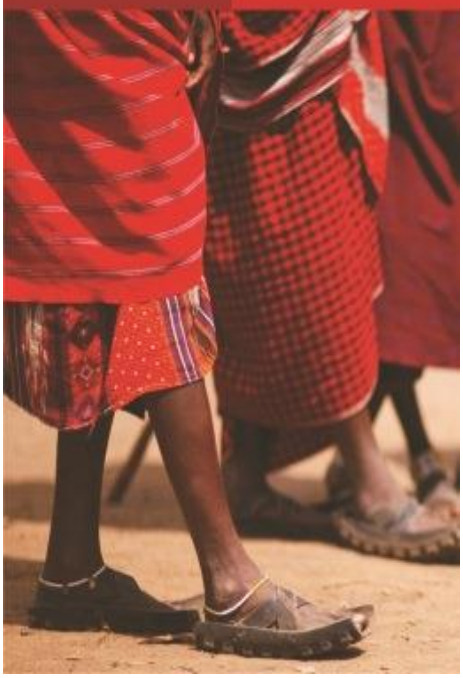

DIGBY WELLS
ENVIRONMENTAL

EMP Consolidation and Vaalkop Specialist Studies

Fauna and Flora Specialist Report

Project Number:

SAS3869

Prepared for:

Sasol Mining (Pty) Ltd

August 2017

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Project Name:	**EMP Consolidation and Vaalkop Specialist Studies**
Project Code:	**SAS3869**

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I, Rudi Greffrath as duly authorised representative of Digby Wells and Associates (South Africa) (Pty) Ltd., hereby confirm my independence (as well as that of Digby Wells and Associates (South Africa) (Pty) Ltd.) and declare that neither I nor Digby Wells and Associates (South Africa) (Pty) Ltd. have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of Sasol Mining (Pty) Ltd, other than fair remuneration for work performed, specifically in connection with the proposed development of an underground coal mine and associated infrastructure, on the farm Vaalkop, Mpumalanga Province.

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EXECUTIVE SUMMARY

Digby Wells Environmental (hereinafter Digby Wells) have been appointed by Sasol Mining (Pty) Ltd (hereinafter Sasol) to provide specialist studies to comply with the national legislative process for the consolidation of their Twistdraai Colliery: Thubelisha Shaft (TCTS), Trichardsfontein and Vaalkop Mining Right areas ("the Project"). The proposed consolidation of the Mining Right areas will be completed in terms of Section 102 of the Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) and Regulation 31 of the EIA regulations, 2014 (as amended) promulgated in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

The mining method proposed for the extraction of coal at Trichardsfontein included the conventional bord-and-pillar method, with the use of continuous miners feeding shuttle cars. Sasol is now proposing that in addition to the bord-and-pillar mining method, high extraction mining also be undertaken at the Trichardtsfontein Mine. Since this activity was excluded from the previous EMPR (2014), an amendment of the Trichardsfontein EMPR is required to identify and assess the impacts associated with high extraction mining, particularly relating to surface subsidence.

This report details the findings of the flora and fauna impact assessment for Vaalkop underground mining are, as fulfilment of the environmental authorisation for the proposed development and operation of an underground coal mine between the town of Trichardt and Bethal, Mpumalanga Province. The Vaalkop project area proposed to be mined (underground) has a footprint of 7846 ha, the Trichardsfontein project area is 3 005 ha in size, but only an area of approximately 1 500 ha will be undermined, these areas are located within the Gert Sibande District Municipality and the Govan Mbeki Local Municipality.

The site falls primarily within the regional vegetation type: Eastern Highveld Grasslands and partially in the Soweto Highveld Grasslands; both of which are listed as threatened ecosystems by the National Environmental Biodiversity Act (NEMBA), 2004.

The majority of the study area was dominated by cultivation (4029 ha) and the dominant natural habitat type was broadly classified as *Eragrostis* dominated Grassland, covering an area of 3206.2 ha. In addition, ephemeral pan habitat (27 ha), Rocky Grassland (7 ha) and Riparian habitat (516 ha) were delineated. A total of 137 plant species were recorded on site of the 201 recorded for the region.

Of the eleven plant species of special concern (SSC) recorded for the regional list and previous reports (six), four were recorded on site, including: *Aloe ecklonis* (provincially protected), *Crinum bulbispermum* (Red Data Declining and provincially protected), *Eucomis autumnalis* (Red Data Declining and provincially protected), *Haemanthus humilis* (provincially protected). *Aloe ecklonis* and the were found in the *Eragrostis* Grassland habitat; *Crinum bulbispermum* and *Eucomis autumnalis* were found in the riparian habitat and *Haemanthus humilis* was found in the rocky grassland. No SCC were recorded in the infrastructure areas, and none are expected.

A total of 18 mammal species have been recorded on site, two of which are SSC, including Near Threatened: African Clawless Otter (*Aonyx capensis*), and provincially protected Serval (*Felis serval*). A total of 83 bird species were recorded. Three frog species were recorded on site, namely: *Amietia angolensis* (Common River Frog), *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 sensitive landscapes due to subsidence that is caused by high extraction mining. Due to the large extent and the high sensitivity habitat, the impacts identified will be moderate negative after mitigation measures are implemented. Alien plant invasion is expected due to surface disturbance due to the construction of infrastructure (Vent shafts) and this should be managed by implementing an alien plant management plan including quarterly monitoring that should take place for the life of mine.

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1 Introduction

Sasol Mining (Pty) Ltd (hereafter Sasol) appointed Digby Wells Environmental (hereafter Digby Wells) as the independent environmental consultant to undertake a Section 102 process in accordance with the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA) and Regulation 31 of the EIA regulations, 2014 (as amended) promulgated in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

In support of the required environmental authorisations for the four ventilation shafts, amendment of the Trichardsfontein Environmental Management Programme Report (EMPR) and consolidation of the Twistdraai Colliery: Thubelisha Shaft (TCTS) EMPR, Vaalkop EMPR and the Trichardsfontein EMPR (referred to as the Thubelisha Project) are completed.

1.1 Project Background

Sasol Mining (Pty) Ltd (Sasol Mining) holds mining rights for the Twistdraai Colliery: Thubelisha Shaft (TCTS) and the Vaalkop mining area, which were both incorporated into the regional Sasol Mining Right (Ref: MP30/5/1/2/2/138MR). It must be noted that no EMPr was compile for the Vaalkop mining right area even though a mining right was approved. Further to this, the mining right for the Trichardtsfontein Mine (Ref: MP30/5/1/2/2/10056MR) was ceded from Glencore Operations South Africa (Pty) Ltd in accordance with Section 11 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) to Sasol Mining. Sasol Mining is proposing that the Trichardtsfontein mining right area be incorporated into the regional Sasol Mining Right (Ref: MP30/5/1/2/2/138MR). Therefore all mining right areas will operate under a single mining right (Sasol Mining Right).

It is therefore required that the Environmental Management Programme Reports (EMPrs) for the above mentioned mining right areas be compiled (Vaalkop), consolidated and updated to reflect changes in the mining plans and methodologies and consider additional infrastructure requirements.

The project which includes the Trichardtsfontein Mine, Vaalkop and TCTS is located between the town of Trichardt and Bethal in the province of Mpumalanga. The town of Evander is 17 km to the West and Secunda is 10 km South West of the Trichardtsfontein and TCTS mining area. Vaalkop is located 5 km southeast of Bethal and 17 km southwest of Trichardt. The consolidation project area and coal reserve are located within the Bethal Magisterial District, the Gert Sibande District Municipality (GSDM) and the Govan Mbeki Local Municipality (GMLM).

The mining method which is currently being undertaken at TCTS includes bord and pillar mining method as well as high extraction mining in some areas. This mining method has also been proposed for Vaalkop. However, the mining method proposed for the extraction of coal at Trichardtsfontein only included the conventional bord-and-pillar method, with the use of continuous miners feeding shuttle cars.

Twistdraai Thubelisha is now proposing that in addition to the bord-and-pillar mining method, high extraction mining will be undertaken at the Trichardtsfontein Mine. Since this activity was excluded from the previous approved EMPr (2014), an amendment of the Trichardtsfontein EMPr is required to identify and assess the impacts associated with high extraction mining, particularly relating to surface subsidence. Sasol Mining therefore undertook the required specialist studies to determine the impact that may be experienced from high extraction mining methods.

Additionally it is proposed that Twistdraai Thubelisha will construct two ventilation shafts at TCTS (known as East ventilation shaft) and two ventilation shafts on Trichardtsfontein (known as South ventilation shaft). A Listed activity under listing notice 1 is considered to be triggered in accordance with the new Environmental Impact Assessment (EIA) Regulations, 2014 (As amended) promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) for the construction and operation of the ventilation shafts.

A flora and vegetation assessment was completed by EcoInfo (Pty) Ltd in 2007 on behalf of Oryx Environmental for the Twistdraai Colliery: Thubelisha Shaft (TCTS). No fauna and flora assessment has been completed for Vaalkop, therefore Sasol Mining (Pty) Ltd (hereinafter Sasol) appointed Digby Wells Environmental (hereinafter Digby Wells) to complete a fauna and flora assessment for the Vaalkop Mining Right Area.

1.2 Terms of Reference

A environmental amendment process is currently being undertaken for Sasol and therefore the proposed project will be incorporated into this process.

The Scope of Work will include the following environmental regulatory processes:

- Compilation of the Vaalkop EMPR and its subsequent consolidation with the Thubelisha and Trichardsfontein Mining Right Areas to reflect the following:
  - Compilation of the Vaalkop EMPR. It is understood that no activities will be triggered in terms of the Environmental Impact Assessment Regulations, 20141 EIA Regulations (2014); and
  - Consolidation of the Vaalkop EMPR into the Thubelisha and Trichardsfontein EMPRs currently being undertaken.

To meet the scope of work, the following actions are required:

1.3 Project Description

The Thubelisha Project which includes the Trichardsfontein Mine, Vaalkop and TCTS is located between the town of Trichardt and Bethal in the province of Mpumalanga. The town of Evander is 17km to the West and Secunda is 10km South West of the Trichardsfontein and

[1] Published in GN R982 of 4 December 2014

TCTS mining area. Vaalkop is located 5 km southeast of Bethal and 17 km southwest of Trichardt. The Thubelisha Project area and coal reserve are located within the Highveld East Magisterial District, the Gert Sibande District Municipality and the Govan Mbeki Local Municipality.

The consolidation project area owned by Sasol Mining Twistdraai Thubelisha Colliery comprises three mining right areas namely TCTS, Trichardtsfontein and Vaalkop. Twistdraai Thubelisha Colliery is currently mining TCTS and proposes to start mining Trichardtsfontein within the next few months. Vaalkop mining area although a priority to Twistdraai Thubelisha Colliery will only start mining in 2029. To ensure the mines operate in a more efficient and effective manner Twistdraai Thubelisha Colliery intends to compile (Vaalkop) and consolidate all amended EMPrs into one merged EMPr.

The Trichardtsfontein project area is 3 170 ha in size, but only an area of approximately 1 382 ha will be undermined. The coal seam depth at Trichardtsfontein is estimated to be at an approximate depth of 140 – 160 m below surface. The infrastructure (including access shafts) will be on the adjacent mining property of Sasol Mining at the TCTS. However, two ventilation shafts (up and downcast) have been proposed to be construction on TCTS and two ventilation shafts (up and downcast) have been proposed to be construction on Trichardtsfontein which will assist in providing sufficient ventilation to the underground mining area.

The Vaalkop project area is approximately 8 600 ha in extent. The initial mining activities in this area will be conducted as green field operations as no existing infrastructure for coal mining exists in the area. It is foreseen that the Thubelisha conveyor could possibly be utilised. All mining activities will be conducted by means of underground mining operations, such as the bord-and-pillar and high extraction mining method. No infrastructure will be constructed on the Vaalkop project area as all required infrastructure will be located at the TCTS site. It is estimated that the coal seam depth at Vaalkop is approximately 80 - 120 m below surface.

The TCTS project area is 7 200 ha in size. The coal seam depth at TCTS is estimated to be at a depth of 140 - 170 m below the surface and the seam is approximately 2 – 5 m thick.

In all mining right areas will only mine the No 4 seam as it is the only seam of coal that is economically viable.

Due to the variation in depth of mining and coal seam an assumption has been made that mining will be undertaken between 30 m and 215 m. Therefore all impact assessments and specialist studies have assessed the impacts of mining utilising bord and pillar with high extraction at this depth.

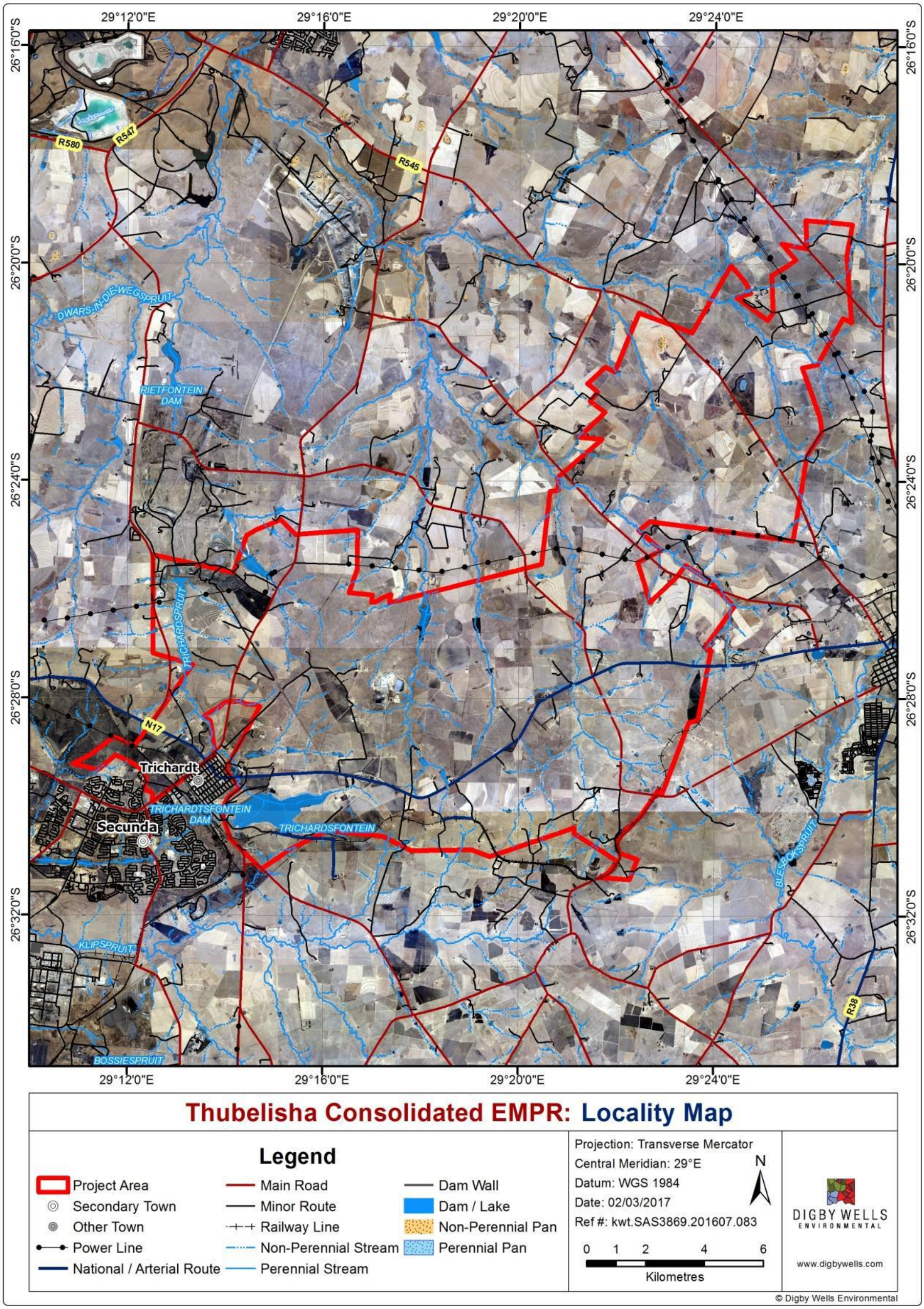

Figure 1-1: Locality Map

2 Methodology

2.1 Literature Review and Desktop Study

A desktop study was undertaken, aiming to identify:

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

2.2 Field Investigation

The site visit and detailed infield flora and fauna assessments took place from the 5th to 7th of June; 2017.

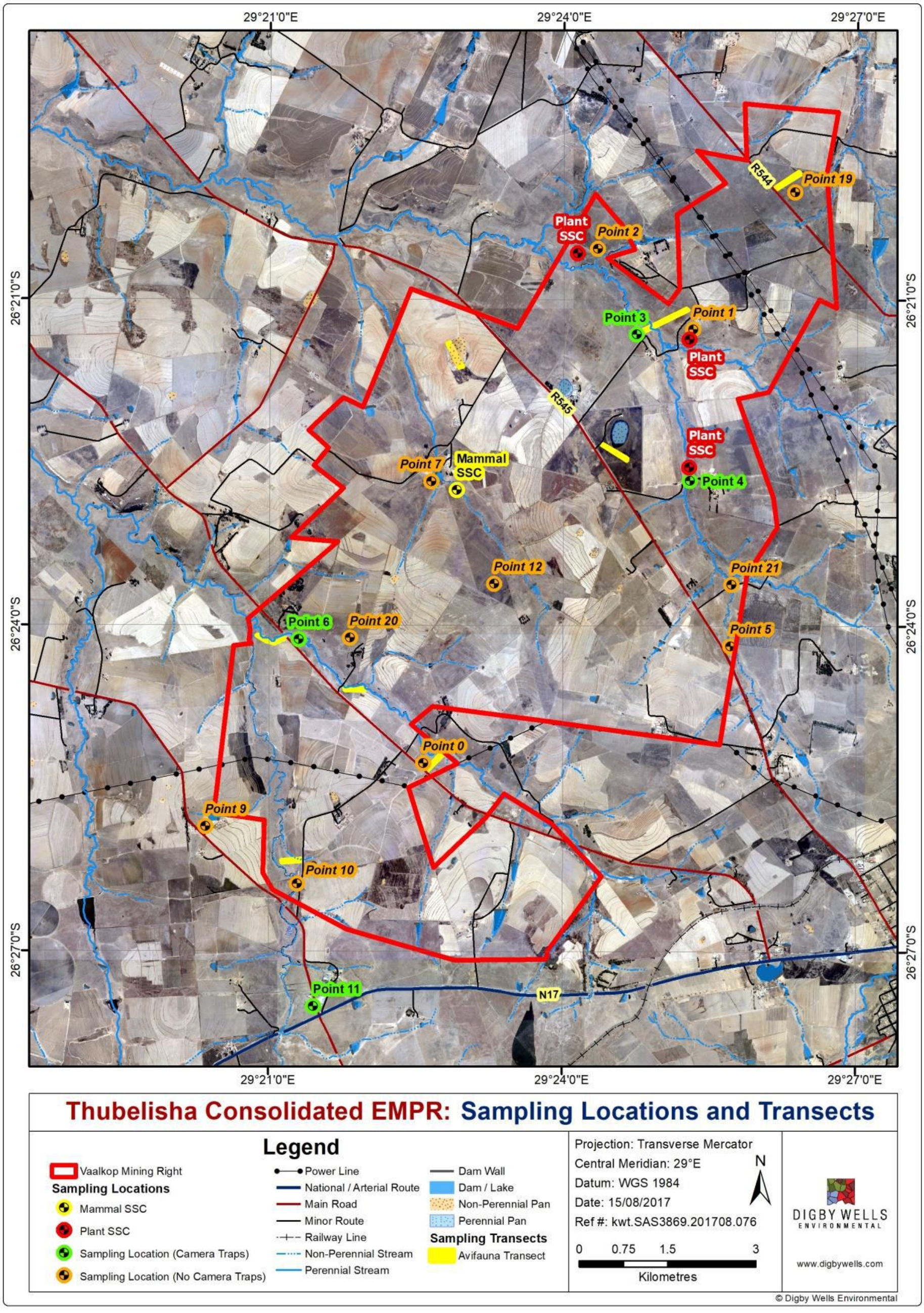

Figure 2-1: Fauna Flora sampling locations and SSC

2.2.1 Flora

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

At each sample site, a plot size of 100 m^2 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 2-1. A general species list was also compiled from random traversing through the site.

Table 2-1: 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: ▪ 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.

2.2.2 Species of Special Concern

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

- International Union for the Conservation of Nature (IUCN) Red Data list (2017);
- The South African National Biodiversity Institute (SANBI) Red Data list version 2017.1;
- The South African Red Data lists for mammals (2004), birds (2016), butterflies;
- The National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004); and
- The Convention on International Trade in Endangered Species of Flora and Fauna (CITES) list (2016).

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

The South African Red Data list uses the same criteria as that defined by the IUCN. According to the IUCN all species are classified in nine groups, set through criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation (IUCN, 2016). The categories are described in Table 2-2 below.

Table 2-2: Red Data Categories (taken from SANBI 2016)

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 species, but also those classified in the categories**, NT, LC** and **DD**
	Threatened	
	Other categories of conservation concern	
	Other categories	

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

2.3 Fauna

A single season survey, late summer (June 2017), was conducted for this project. A detailed desktop study was also conducted for mammals, birds, reptiles and amphibians, this information is contained in this report. All fauna species encountered on site were identified and recorded. The following methods were used during the survey.

2.3.1 Mammals

Small mammals were sampled through opportunistic sightings, as well as the use is Sherman traps and motion sensitive camera traps. The 20 Sherman and 3 camera traps were baited with small mammal bait and left for the duration of the field work time, 2 nights and two days. If no small mammals were captured after a day, the traps were moved to a different location and re-baited. If small mammals were captured, the traps were rebaited and re-set in the same position. 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).

2.3.2 Avifauna

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

The following was recorded:

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

Visual identification of birds was used to confirm bird calls where possible. Bird species were confirmed using Sinclair *et. al.* (2002) and Robert's birds (2015).

2.3.3 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.

2.3.4 Macro-Invertebrates

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

2.3.5 Red Data Faunal Assessment

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

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

Probability of occurrence is presented in four categories, namely:

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

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

2.4 Study Limitations

The following limitations were encountered during this study:

- Whilst every effort is made to cover as much of the site as possible, representative sampling is done and it is possible that some plant and animal species that are present on site were not recorded during the field investigations, due to seasonality;
- Only a single season survey was completed.

3 Regional Vegetation

The project area falls within the Eastern Highveld Grassland and Soweto Highveld Grassland as described by Mucina and Rutherford (2006) in the Grassland Biome (Table 3-1). 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 km^2 (SANBI, 2012).

The term ‘grassland’ creates the impression that the biome consists only of grass species. In fact, it is a complex ecosystem, including rivers and wetlands, where only one in six plant species are grasses. These vegetation types occur within Mpumalanga Province at an altitude of 1520 to 1780 meters above sea level.

Thirty percent of the biome has been irreversibly transformed and only 1,9% is formally conserved. As a result, the National Biodiversity Strategy and Action Plan has identified the grasslands biome as one of the spatial priorities for conservation action (SANBI, 2012). The important biodiversity contained within the grasslands, which underpins life, is being eroded to such an extent that human wellbeing is threatened. Common and characteristic plant species of the Eastern Highveld and Soweto Highveld Grasslands are listed in Table 3-1 and displayed in Figure 3-1.

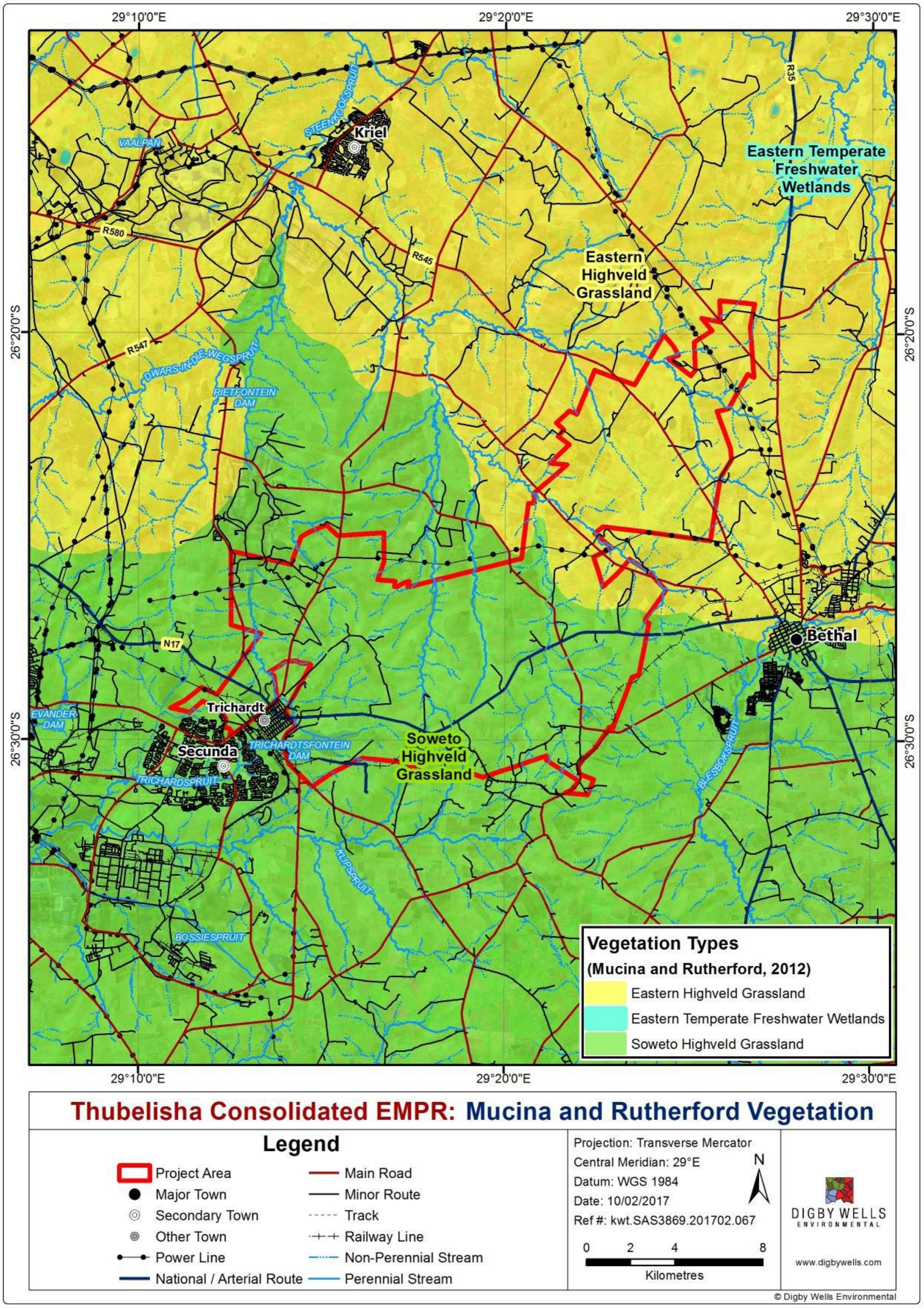

Figure 3-1: Regional Vegetation According to Mucina and Rutherford, 2012

Table 3-1: Common and Characteristic Plant Species of the Eastern Highveld Grassland

Plant form	Species
Graminoids (grasses and sedges)	*Heteropogon contortus, Aristida aequigluims, A. congesta , A. junciformis subsp. Galpini, Brachiaria serrata, Cynodon dactylon, Digitaria monodactyla, D. tricholaenoides, Elionurus muticus, Eragrostis chloromelas, E. curvula, E. plana, E. racemosa, E. sclerantha, Heteropogon contortus, Loudetia simplex, Microchloa caffra, Monocymbium cereiiforme, Setaria sphacelata, Sporobolus africanus, S. pectinatus, Themeda triandra, Trachypogon spicatus, Tristachya leucothrix, T. rhmanni, Alloteropsis semialata subsp. eckloniana, Andrpogon appendiculatus, A. schirensi, Bewsia biflora, Ctenuim concinnum, Diheteropogon amplectens, Eragrostis capensis, E. dummiflua, E. patentissima, Harpochloa falx, Panicum natalense, Rendlia altera, Schizachyruim sanguineum, Setaria nigrirostris, Urelytrum agropyroides*
Herbs	*Berkheya setifera, Haplocarpha scaposa, Euryops gifillani, Justicia anagalloides, Acalyha angusta, Cahmaecrista mimosoides, Dicoma anomala, E. transvalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. caespititium, H. oerophilum, H. rugulosum, lpomoea crassipes, Pentanisia prunelloides subsp. latifolia, Selago densiflora, Senecio coronatus, Hilliardiella oligocephala, Wahlenbergia undulata*
Geophytic herbs	*Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidulua var. pilosissima, Ledebouria ovatifolia*
Succulent herb	*Aloe ecklonis*
Low shrubs	*Anthospermum rigidum subsp. pumilum, Seriphium plumosa*

Table 3-2: Common and Characteristic Plant Species of the Soweto Highveld Grassland

Plant Forms	Species
Graminoids (grasses)	*Andropogon appendiculatus, Brachiaria serrata, Cymbopogon pospischillii, Cynodon dactylon, Elionurus muticus, Eragrostis capensis, E. chloromelas, E.curvula, E. plana, E. planiculmis, E. racemosa, Heteropogon contortus,Hyparrhenia hirta, Setaria nigrirostris, S. sphacelata, Themeda triandra, Tristachya leucothrix, Andropogon schirensis, Aristida adscensionis, A. bipartita, A. congesta, A. junciformis subsp. galpinii, Cymbopogon caesius, Digitaria diagonalis, Diheteropogon amplectens, Eragrostis micrantha, E. superba, Harpochloa falx, Microchloa caffra, Paspalum dilatatum*

Plant Forms	Species
Herbs	*Hermannia depressa, Acalypha angustata, Berkheya setifera, Dicoma anomala, Euryops gilfillanii, Geigeria aspera var. aspera, Graderia subintergra, Haplocarpha scaposa, Helichrysum miconiifolium, H. nudifolium var. nudifolium, H. rugulosum, Hibuscus pusillus, Justicia anagalloides, Lippia scaberrima, Rhynchosia effusa, Schistostephium crataegifolium, Selago densiflora, Senecio coronatus, Hilliardiella oligocephala, Wahlenbergia undulata*
Geophytic herbs	*Haemanthus humilis subsp. hirsutus, Haemanthus montanus*
Herbaceuos climber	*Rhynchosia totta*
Low shrubs	*Anthospermum hispidulum, A. rigidum subsp. pumilum, Berkheya annectens, Felicia muricata, Ziziphus zeyheriana*

4 Results

4.1 Flora

The majority of the Vaalkop study area (4029.8 ha and 51%), and indeed the Thubelisha and Trichardsfontein areas had undergone transformation due to cultivation for maize and the presence of pastures with alien vegetation also present. Livestock were also observed throughout most of the Vaalkop site and evidence of overgrazing was recorded in grassland areas; showing a dominance of increaser species and some erosion. Despite these impacts, areas that were left intact showed a high diversity of grasses and forbs, particularly members of the Asteraceae family and the *Helichrysum* genus.

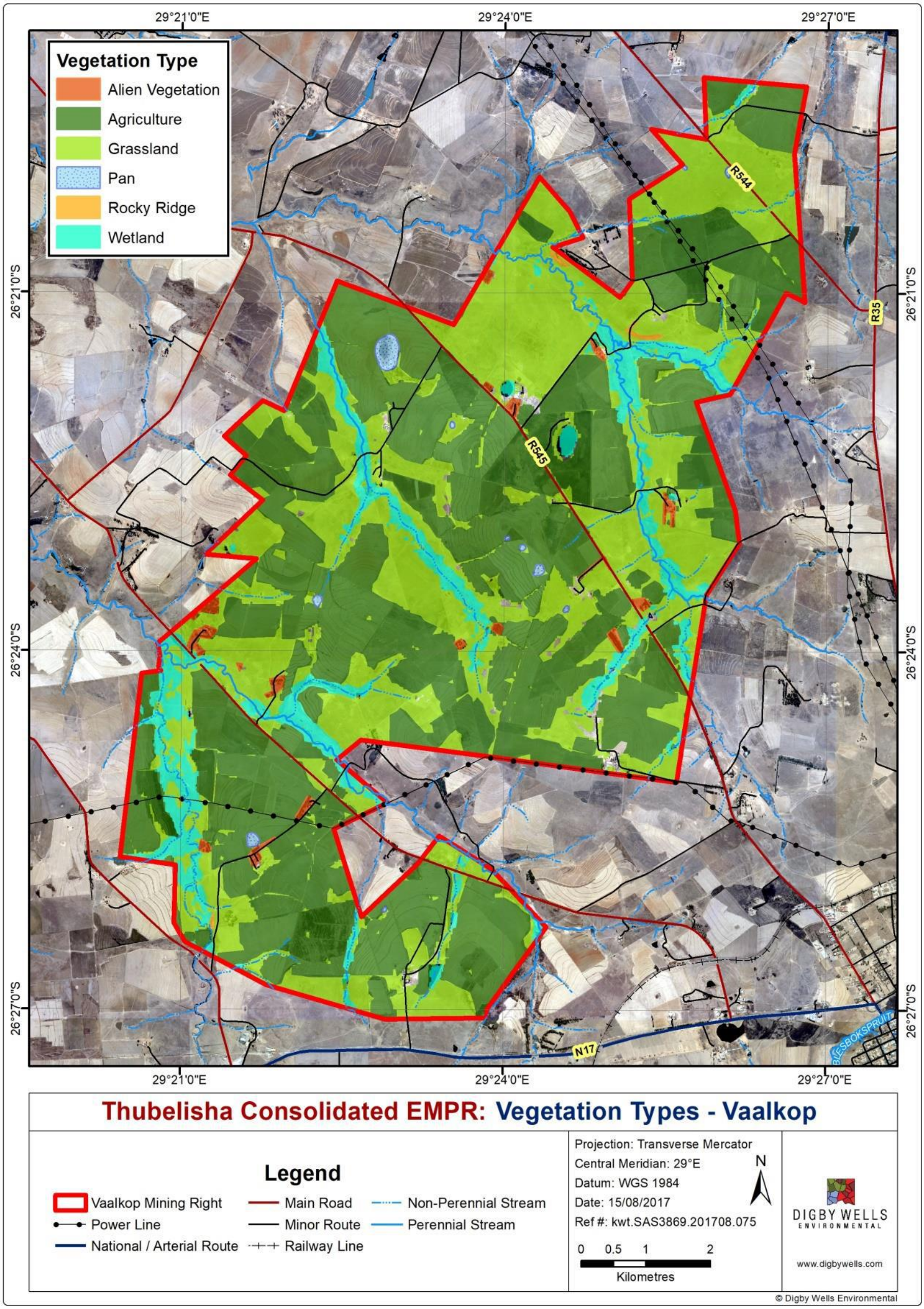

Figure 4-1: Delineated vegetation types on Vaalkop

A total of 134 plant species were recorded on site (Appendix C), of 201 listed (recorded by SANBI in the relevant grids 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 latest POSA website was under BETA testing when information was retrieved. The natural areas associated with the Vaalkop project area are discussed in more detail in the sections to follow. The primary land uses and vegetation habitats identified on site are listed in Table 4-1 for Vaalkop.

Table 4-1: Vegetation Habitats (and other land use) and Approximate Areas for Vaalkop

Vaalkop		
Vegetation type	**Area Hectares**	**% of total**
Grassland	3206.5	40.9
Agriculture	4029.0	51.4
Wetlands	516.8	6.6
Rocky Ridges	6.5	0.1
Alien Vegetation	59.1	0.8
Pan	27.8	0.4
Total	**7845.7**	**100.0**

The natural areas associated with the Thubelishia and Trichardsfontein areas are discussed in more detail in the sections to follow. The primary land uses and vegetation habitats identified on site are listed in Table 4-2 and Table 4-3. The maps that indicte the vegetatin types distribution are found below, Figure 4-2 and Figure 4-3.

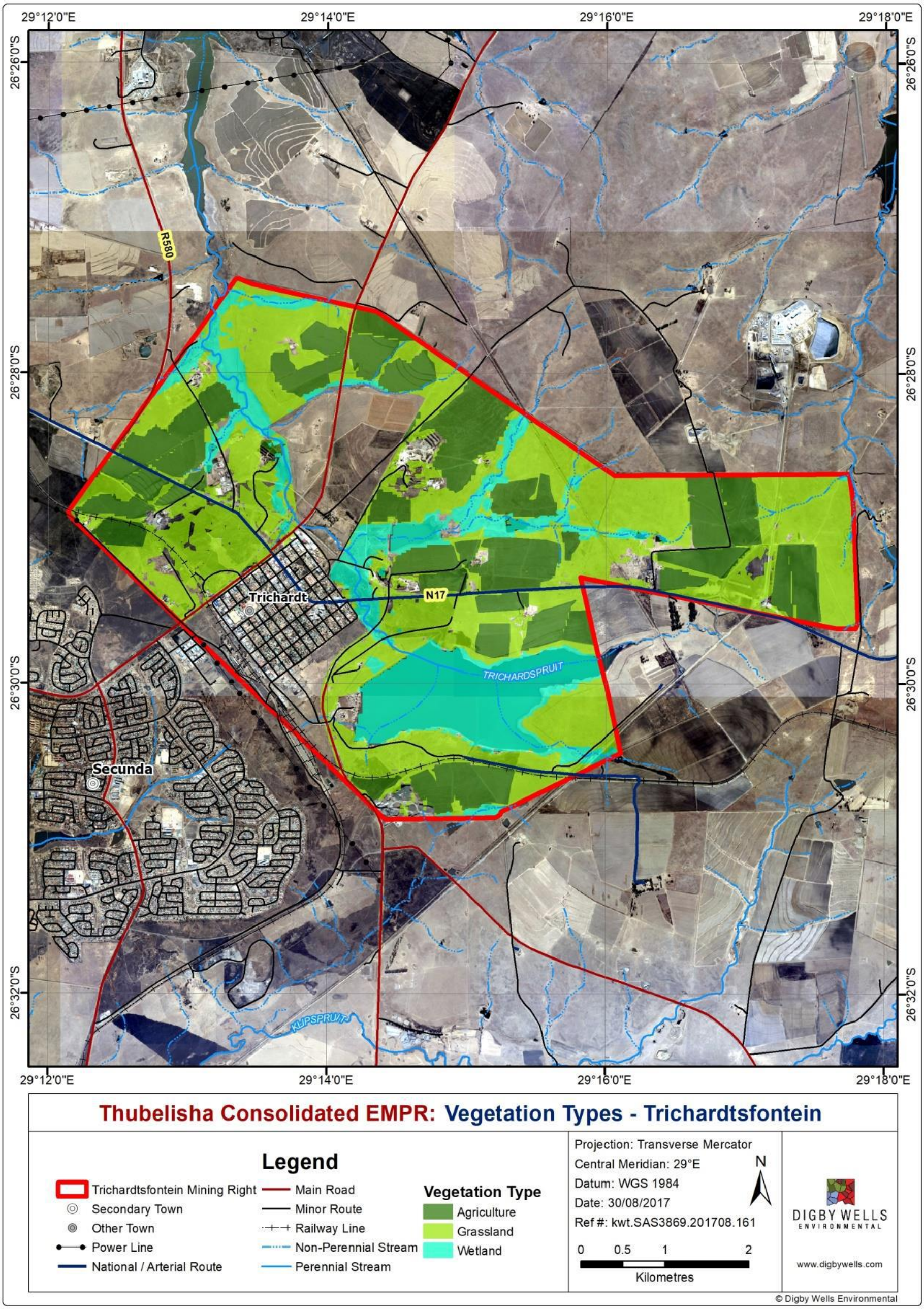

Figure 4-2: Delineated vegetation types on Trichardsfontein

From the map above (Figure 4-2), we can see that the Grassland vegetation type is the most prominent vegetation type, Agriculture is second closely followed by Wetlands, which is a sensitive landscape.

Table 4-2: Vegetation Habitats (and other land use) and Approximate Areas for Trichardsfontein

Trichardtsfontein		
Class Name	**Area Hectares**	**% of total**
Grassland	1260.9	52.56%
Agriculture	687.3	28.65%
Wetlands	450.6	18.78%
Total	**2398.8**	**100%**

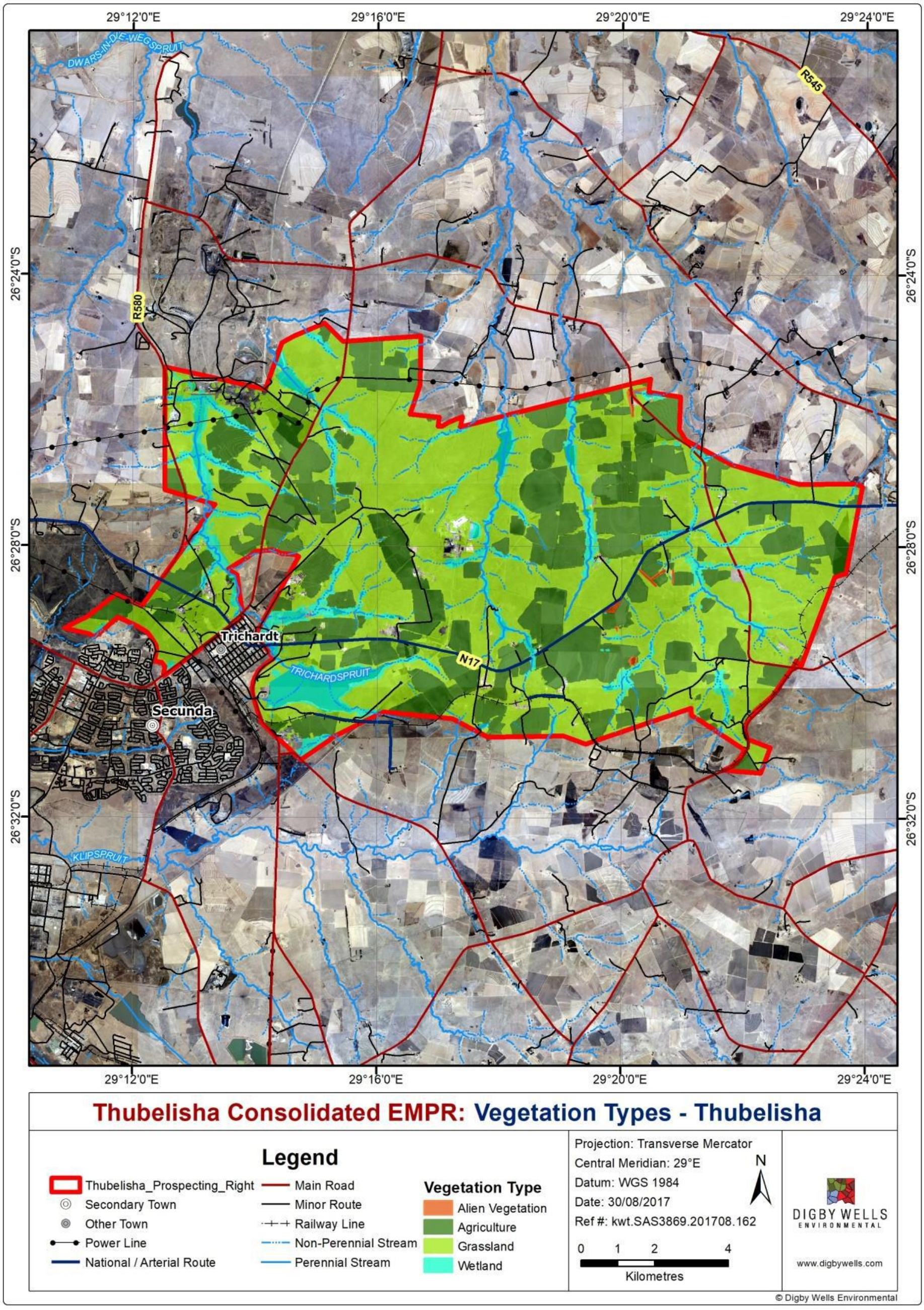

Figure 4-3: Delineated Vegetation types on Thubelisha

The delineated vegetation types encountered on Thubelisha are displayed in Figure 4-3 and Table 4-3 indocates the exact hectares and percentage that these vegetation types cover. Once more the grassland vegetation type is the most prominent.

Table 4-3: Vegetation Habitats (and other land use) and Approximate Areas for Thubelisha

Thubelisha		
Class Name	**Area Hectares**	**% of total**
Grassland	9039.5	62.47%
Agriculture	4306.6	29.76%
Wetlands	1097.0	7.58%
Alien Vegetation	25.9	0.18%
Total	**14469.1**	**100%**

4.1.1 Riparian Habitat

The riparian habitat is associated with the Steenkoolspruit (Vaalkop) and channelled valley bottom wetlands that run through the site. The wetland delineation is represented in the Wetland Assessment Report (Digby Wells, 2017). The Vaalkop Project area is characterised by multiple wetland systems, totalling 2940 ha. There are two major floodplain systems, which drain into one another to the west of the project site. There is also a large channelled valley bottom system which drains into the northern floodplain system. The remainder of the area is characterised by extensive hillslope seeps that drain into the floodplains and valley bottom wetlands. Where standing water was present; *Typha capensis* (Common Bulrush), *Imperata cylindrica* (Cottonwool Grass) and *Arundinella nepalensis* (River Grass) had colonised. Terrestrial species typical of the *Eragrostis*-dominated Grassland were found on the banks of the Steenkoolspruit. A single Red Data listed plant species was recorded in this habitat, namely: *Eucomis autumnalis* (Pineapple Flower), listed as Declining. In addition, *Crinum bulbispermum* (River Lily), which is dominant in this vegetation unit, is provincially protected (according to Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998): Schedule 11). Alien plant species that had colonised this vegetation unit included: *Acacia mearnsii* (Black Wattle), *Salix babylonica* (Babylon Willow) and *Cirsium vulgare* (Scotch Thistle).

Figure 4-4: Examples of Riparian Habitat

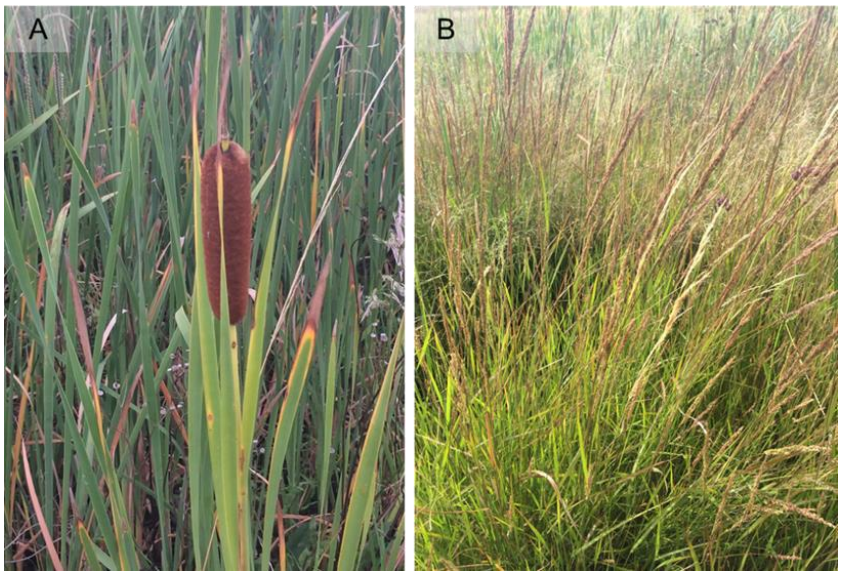

Figure 4-5: Examples of Plant Species Characteristic of the Riparian Channel (A: *Typha capensis* (Common Bulrush) and B: *Arundinella nepalensis* (River Grass))

4.1.2 Rocky Grassland

The rocky grassland was comprised of relatively short grass (<1.8cm) and a high diversity of epilithic (growing on rock surface) forb species. Rocky outcrops represented a type of ecological niche, characterised by shallow soils over sandstone outcrops. Rocky outcrops occurred primarily along riparian zones and were typified by shrubs such as: *Diospyros lycioides* (Bluebush); *Gnidia kraussiana* and *Searsia dentata* (Nana Berry); and characteristic species such as*: Leonotis leonurus* (Lion's Ear), *Psammotropha myriantha* and *Haemanthus humilis* (Rabbit's Ear). Examples of common plant species identified in the *Gnidia – Diospyros* Rocky Grassland are represented in Figure 4-6.

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

Figure 4-6: Examples of Plant Species found in Rocky Outrops (A: *Psammotropha myriantha*; B: *Searsia dentata*; C: *Haemanthus humulis*; D: *Crassula* sp.; E: *Dicoma anomala*; F: *Diospyros lycioides* in flower)

4.1.3 *Eragrostis* - dominated Grassland

This *Eragrostis*-dominated Grassland covered the majority of the natural areas associated with the Vaalkop study site and can further be subdivided into wetland and terrestrial habitats with Avalon being the dominant soil type. The Avalon soil form consists of orthic topsoil, on a yellow-brown apedal B, over a soft plinthic B horizon. Avalon soils are freely draining and chemically active. Manganese and iron oxides accumulate under conditions of a fluctuating water table forming localised mottles or soft iron concretions of the soft plinthic B horizon. Mottling in the samples found within the study site was yellow-brown in colour and occupied at least 10% of the horizon (Fey *et al*., 2010). Avalon soils are highly suitable for crop production, particularly for growing maize. Fey *et al*. (2010) explains that this is due to the freely draining nature of the soil and soft plinthic B horizon which traps water and makes it available for root uptake. The substrate of the wetland areas was composed of moist clays and rocky outcrops which formed the top of hillslope seeps. *Eragrostis gummiflua* (Gum Grass), not favoured by cattle, was dominant and additional *Eragrostis* species were prevalent, including: *Eragrostis curvula* (Lovegrass), *Eragrostis racemosa* (Narrow Heart Love Grass) and *Eragrostis chloromelas* (Curly Leaf). Additional grass species included *Aristida congesta* subsp. *congesta* (Spreading Three-awn), *Hyparrhenia hirta* (Common Thatching Grass), *Themeda triandra* (Red Grass), *Agrostis lachnantha* (Bent Grass) and *Imperata cylindrica* (Cottonwool Grass) along hillslope seeps.

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

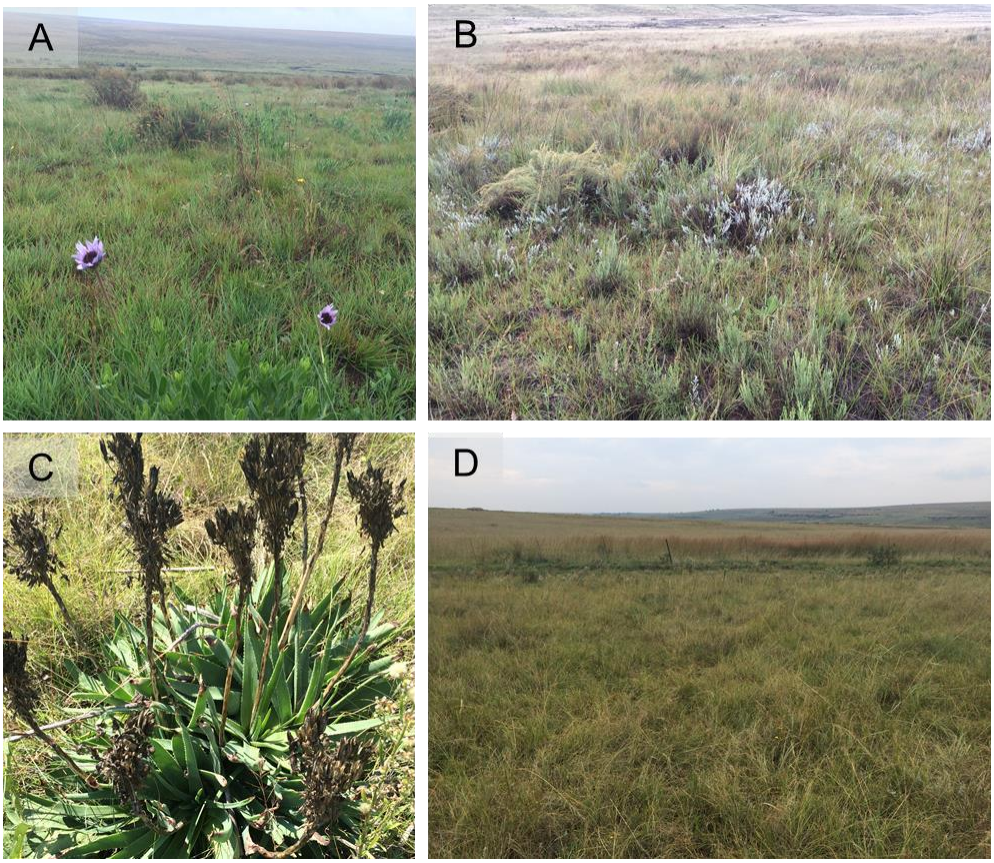

Figure 4-7: Examples of the Landscape and Common Features of the *Eragrostis*-dominated Grassland (A: intact grassland; B: grassland dominated by *Helichrysum aureonitens*; C: *Aloe ecklonis*; D: typical *Eragrostis*-dominated grassland).

Figure 4-8: Eragrostis Grassland

4.1.4 Ephemeral Pans

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

Figure 4-9: Examples of Ephemeral Pan Habitat on Site

4.1.5 Plant Species of Special Concern

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

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

Table 4-4 lists the plant SSC that were recorded in the regional lists, as well as those recorded on site. Four plant SSC were recorded, all of which are provincially protected; including two declining species.

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

Table 4-4: Plant Species of Special Concern

Species	SA Red List	Provincial List	CITES	Recorded on site
Aloe ecklonis	LC	x	II	x
Aspidoglossum xanthosphaerum	VU	-		
Crinum bulbispermum	Declining	x		x
Gladiolus crassifolius	LC	x	-	

Species	SA Red List	Provincial List	CITES	Recorded on site
Gladiolus robertsoniae	NT	x	-	
Eucomis autumnalis	Declining	x		x
Haemanthus humilis subsp. hirsutus	-	x	-	x
Hypoxis hemerocallidea	Declining	-		
Pachycarpus suaveolens	VU	-		
Nerine gracilis	VU	-		
Zantedeschia pentlandii	VU	-		

4.1.5.1 Thubelishia and Trichardsfontein

According to the South African National Biodiversity Institute (SANBI)'s interim Red Data flora list of January 2007, 435 species are listed for Mpumalanga Province. The number of species considered threatened within this list is 72, of which 49 are Vulnerable (VU), 17 are Endangered (EN) and 8 are Critical Endangered (CR). The eight species considered critical endangered within Mpumalanga province. Of which only one species, *Holothrix culveri*, could potentially occur within the study area, in association with Community three, the other species are associated with bushland and/ or woodland. Sixteen species are considered endangered in Mpumalanga. Based on the study area's biophysical attributes, suitable habitat for six of these endangered species occurs within the study area. These species are:

- Disa clavicornis
- Disa zuluensis
- Erica rivularis
- Gerbera aurantiaca
- Gladiolus cataractarum
- Pachycarpus suaveolens

They are associated with either rocky areas or wetlands. It should be noted that one species from the following genera of which all species are protected in terms of the Mpumalanga Conservation Ordinance were recorded in community three and four: *Gladiolus* species.

4.1.6 Alien Plant Species

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

- Category 1a: Species requiring compulsory control;

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

A total of 17 alien plant species (AIP) were recorded on site (Table 4-5); seven of these have been assigned alien plant categories according to CARA and NEMBA. These species have established due to disturbance of the soil, largely due to cultivation in the area, as well as trampling by livestock. Small alien bushclumps have been delineated in the vegetation delineation of the project area.

Table 4-5: Alien Plant Species Recorded on Site

Family	Species	Category (CARA/NEMBA)
Amaranthaceae	*Guilleminea densa*	No category
	Gomphrena celesioides	No category
Asteraceae	*Bidens pilosa*	No category
	Cirsium vulgare	1; 1b
	Conyza albida	No category
	Cosmos bippinatus	No category
	Tagetes minuta	No category
	Taraxacum offininale	No category
	Xanthium strumarium	1; 1b
Cactaceae	*Opuntia ficus-indica*	1; 1b
Fabaceae	*Acacia mearnsii*	2; 2
Myrtaceae	*Eucalyptus camuldulensis*	2; 1b
Salicaceae	*Salix babylonica*	No category
Solanaceae	*Datura ferox*	1; 1b
	Solanum sp.	/
	Solanum sysimbriifolium	1; 1b
Verbenaceae	*Verbena brasiliensis*	No category

4.2 Fauna

4.2.1 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 Vaalkop 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 4-6 lists mammals that were recorded in the Vaalkop Mine project area during this survey; this includes personal communication with farmers. The mammals recorded were found within a variety of the vegetation communities present a full list can be seen in Table 4-6.

Two of these species are regarded as species of special concern; African Clawless Otter (*Aonyx capensis)* being Red Data species protected under IUCN. Serval (*Felis serval*) is protected according to the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998). Examples of small mammal fauna identified on site are represented in Figure 4-10 . Appendix D lists the expected mammal species for the site, based on the results of a desktop assessment.

Table 4-6: Mammal Species Recorded

Scientific Name	English Name	IUCN (2016.3)	NEMBA TOPS List (2007)	Mpumalanga Protected (1998)
Aonyx capensis	African clawless Otter	Near Threatened	Not Listed	Protected
Atilax paludinosus	Water Mongoose	Not Listed	Not Listed	Not Listed
Galerella sanguinea	Slender Mongoose	Not Listed	Not Listed	Not Listed
Hystrix africaeaustralis	Porcupine	Least Concern	Not Listed	Not Listed
Leptailurus serval	Serval	Least Concern	Near Threatened	Protected
Lepus saxatilis	Scrub Hare	Least Concern	Not Listed	Not Listed
Canis mesomelas	Black-backed Jackal	Not Listed	Not Listed	Not Listed
Caracal caracal	Caracal**	Least Concern	Not Listed	Not Listed

Scientific Name	English Name	IUCN (2016.3)	NEMBA TOPS List (2007)	Mpumalanga Protected (1998)
Cryptomys hottentotus	Common Mole Rat	Least Concern	Not Listed	Not Listed
Crocidura cyanea	Reddish-grey Musk Shrew	Least Concern	Not Listed	Not Listed
Cynictis penicillata	Yellow Mongoose	Least Concern	Not Listed	Not Listed
Damaliscus pygargus phillipsi	Blesbok**	Least Concern	Not Listed	Not Listed
Ichneumia albicauda	White-tailed Mongoose	Least Concern	Not Listed	Not Listed
Mastomys coucha	Multimammate Mouse	Least Concern	Not Listed	Not Listed
Procavia capensis	Rock Hyrax	Least Concern	Not Listed	Not Listed
Rhabdomys pumilio	Striped Mouse	Least Concern	Not Listed	Not Listed
Sylvicapra grimmia	Common Duiker	Least Concern	Not Listed	Not Listed
Tatera leucogaster	Bushveld Gerbil	Least Concern	Not Listed	Not Listed

** - Recorded via personal communication with local residents.

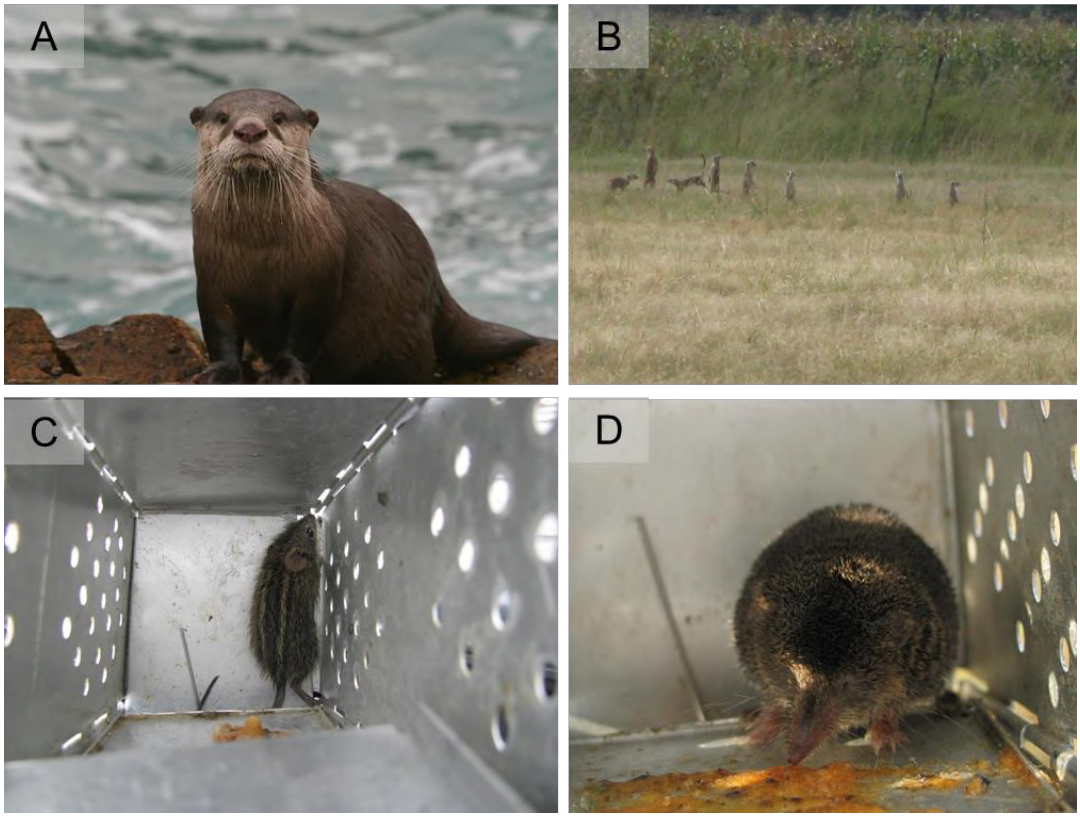

Figure 4-10: Examples of Small Mammals Recorded on Site (A: *Aonyx capensis* (Cape Clawless Otter) – taken by Hardaker; B: *Suricata suricatta* (Meerkat); C: *Rhabdomys pumilio (*Striped Mouse); D: *Crocidura cyanea* (Reddish-Grey Musk Shrew)

4.2.2 Avifauna

A total of 67 species were identified during the survey (expected species in 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.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species. Rainfall is strongly summer seasonal (average 726 mm), with very dry winters (Mucina & Rutherford 2006).

4.2.2.1 Rocky Outcrops

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

4.2.2.2 Wetland Areas

Multiple wetland systems occur throughout all study sites. These areas are dominated by marshy vegetation that grows in seasonally to permanent wet soil. In addition to wetlands, pans are an important feature of the general site, Greater Flamingo (*Phoenicopterus roseus)* (Least Concern) was observed in the pans. Reed pans are mostly permanent, usually retaining water throughout the year. They have a diverse flora, characterized by *Phragmites*, which forms a dense extensive reedbed covering most of the pan basin. *Imperata cylindrica* (Cottonwool Grass) was identified on site, this is the preferred habitat type of the Grass Owl, and these birds were recorded during this survey. Sedge pans are semi-permanent, usually drying up during the winter and/or dry spells, when they are almost devoid of vegetation. Saline pans are characterized by their glaring white basins when dry and have extremely saline substrata and water. The basins of these pans usually lack vegetation. There is considerable overlap in the common plants between the three pan-types. The pans, and their functioning, remain intact, despite existing in a matrix that consists almost exclusively of maize (80%), interspersed with small fragmented patches of natural grassland (20%) (Barnes 1998).

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

During the site visits a number of typical Mpumalanga Grassland species were observed. These areas also included the road infrastructure, farm boundary and isolated patches throughout the property and included species such as Black Shouldered Kite *(Elanus axillaris),* Neddicky *(Cisticola fulvicapilla),* Redeyed Dove *(Streptopelia semitorquata)*, Laughing Dove *(Spilopelia senegalensis),* Helmeted Guineafowl *(Numida meleagris),* Cape Turtle Dove *(Streptopelia capicola),* Common Fiscal *(Lanius collaris),* Cape Sparrow *(Passer melanurus),* Swainsons Spurfowl *(Pternistis swainsonii)* and large numbers of exotic Feral Pigeons *(Columba livia domestica)*.

Blue Korhaan was recorded durng this survey, and is found on high grassveld, usually above 1,500 m (del Hoyo *et al.* 1996), where it inhabits open, fairly short grassland and a mixture of grassland and karoo dwarf-shrubland within 1km of water, with termite mounds and few or no trees (del Hoyo *et al.* 1996, Taylor *et al.* 2015). It also inhabits old and fallow cropland, pastures and winter cultivation (del Hoyo *et al.* 1996). It feeds on insects, scorpions, small lizards and vegetable matter. It apparently benefits from small-scale agriculture, as it regularly forages in crop fields and planted pastures.

4.2.2.3 Transformed/Cultivation

The habitat in the study area has been transformed through dryland cultivation, mostly maize. Areas of current cultivation are situated on the areas with the least gradient, but also on the hill slopes where the gradient is not too aggressive. The altitude of the proposed Vaalkop Underground Mine development and species type of the grassland suggests that the area could be home to some endemic and endangered lark and pipit species such as: Botha's Lark *(Spizocorys fringillaris).* This species, however were not observed during any of the surveys. The 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 grassland area is also ideal habitat for Quail and Button-quail species although these species are highly nomadic and were not identified during the site investigation. The data from the Co-ordinated Road Count project (CAR) of the Avian Demography Unit shows that the wetlands in the Mpumalanga Highveld are extensively used by Spurwinged Goose *(Plectropterus gambensis),* Black-headed Heron *(Ardea melanocephala)* and Grey Crowned Crane *(Balearica regulorum)*.

4.2.2.4 Alien Vegetation

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

Table 4-7: Red Data Species Recorded in by SABAP2 that could potentially occur on Vaalkop, Trichardsfontein and Thubelisia Mining areas

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

Common Name	Species Name	Status	Habitat requirements
African Marsh Harrier	*Circus ranivorus*	SA Red Data: EN IUCN: LC NEMBA, TOPS: Protected MTPA: Protected	Large permanent wetlands with dense reed beds. Sometimes forages over smaller wetlands and grassland. Wetland habitat present on the study site too small and fragmented to support this species.
Yellow-billed Stork	*Mycteria ibis*	SA Red Data: EN IUCN: LC NEMBA, TOPS: Protected MTPA: Protected	Dams, large mashes, swamps, estuaries, margins of lakes and seasonal wetlands. Unlikely to occur in the study area due to limited suitable habitat.
Botha's Lark	*Certhilauda semitorquata*	SA Red Data: EN IUCN: EN NEMBA, TOPS: Protected MTPA: Protected	An uncommon and restricted species was only observed via SABAP1. In the region it would prefer shorter grazed grasslands. Unlikely to occur in the study area due to lack of suitable habitat and preferred range.
Lesser Kestrel	*Falco naumanni*	SA Red Data: LC IUCN: LC NEMBA, TOPS: Protected MTPA: Protected	Grassland and agricultural lands. Likely to be present in summer on the project site (Palearctic migrant).

4.2.3 Herpetofauna

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

Three amphibians were encountered during this field survey by means of active searching. The expected amphibian species for the area are included as (Annexure/Appendix. All species identified on site are listed in Table 4-8. The species listed as encountered below were all encountered within the wetlands habitat types. Examples of frogs recorded on site are represented in Figure 4-11.

Table 4-8: Amphibian Species Recorded in the Vaalkop Project Area

Scientific Name	English Name	IUCN (2014.3)	NEMBA TOPS List (2007)	Mpumalanga Protected (1998)
Afrana angolensis	Common River Frog	-	-	-
Cacosternum boettgeri	Common Caco	-	-	-
Strongylopus fasciatus	Striped Stream Frog	-	-	-

Two species of reptile, a Rinkhals (*Hemachatus haemachatus*) and Brown House Snake (*Lamprophis fuliginosus*) were identified during the field survey through opportunistic observations (Table 4-9). No IUCN protected species were encountered; however 10 species were recorded that are protected according to Mpumalanga protected species list (1998).

Table 4-9: Reptile Species Recorded on Vaalkop

Scientific Name	English Name	IUCN (2014.3)	NEMBA TOPS List (2007)	Mpumalanga Protected (1998)
*Bitis arietans***	Puff Adder	Not Listed	Not Listed	Protected
Cordylus vittifer	Common Girdled Lizard	Not Listed	Not Listed	Protected
*Hemachatus haemachatus***	Rinkhals	Not Listed	Not Listed	Protected
*Lamprophis fuliginosus***	Brown House Snake	Not Listed	Not Listed	Protected
Pachydactylus affinus	Transvaal gecko	Not Listed	Not Listed	Protected
Psammophylax rhombeatus	Spotted or Rhombic Skaapsteker	Not Listed	Not Listed	Protected

- Recorded this assessment by DWE

** - Recorded via personal communication with local people

Figure 4-11: Examples of Amphibians recorded on site (left: *Hylarana signata* (Striped Stream Frog) and right: taken by Hardaker)

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

4.2.4 Macro-Invertebrates

During the survey, butterflies were recorded through opportunistic observations and photographed where possible. Furthermore transects were walked along the roads, rehabilitated areas, exotic plantations and grassland area to identify any scorpion or spider nests. Butterflies are a good indication of the habitats available in a specific area (Woodhall 2005). Although many species are eurytropes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised (Woodhall 2005). Butterflies are useful indicators as they are relatively easy to locate and catch, and to identify. It is for this reason that Lepidoptera were used as the primary focus for the invertebrate survey. Five butterfly species were observed within the Vaalkop Underground Mining area, these included the, Spotted Jonker *(Byblia ilythia)*, African Monarch *(Danaus chrysippus)*, Brown-veined White *(Belenois aurota),* Broad Bordered Grass Yellow *(Eurema brigitta)* and the Citrus Swallowtail *(Papilio demodocus).* All the species were located within grassland or the riparian areas adjacent to the farm. No butterfly species observed were considered to be Species of Special Concern. However according to SANBI, it is possible that the Near Threatened Marsh Sylph *(Metisella meninx)* can be located on the site. It is endemic to the wet vleis of highland grassland in northern KwaZulu-Natal, Mpumalanga, Gauteng, the northern part of the Orange Free State and the extreme east of the North West Province, they preferred *Leersia hexandra* dominatd grassland. It has become extinct in many areas close to Johannesburg due to building developments.

Wasp robber flies *(Philodicus sp)* were located in the grasslands. The name "robber flies" reflects their notoriously aggressive predatory habits; they feed mainly or exclusively on

other insects where they generally catch their prey in flight (Weaving, 2004). Adults are generally medium to large in size, with an average body length of 1 to 1.5 cm but with a range of 3 cm to more than 5 cm in length. The shape is generally elongated, due to the conformation of the long tapering abdomen; however there are also compact species with broad abdomens (Picker and Griffiths, 2004).

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

The diversity and density of the invertebrates was relatively high for the proposed Vaalkop mining development footprint area and surroundings, and this in general could assist in providing an indication of the health of the regional ecology. Although existing mining activities has modified the immediate area, there is sufficient habitat within the surrounding unaffected areas to sustain moderate populations of the typical highveld grassland species of fauna. It would however be recommended that the management of any encroachment of alien invasive plant species is strictly enforced in order to retain the preferred faunal species types that currently dominate the grassland biome of Mpumalanga Province. Examples of invertebrate species recorded on site are represented in Figure 4-12.

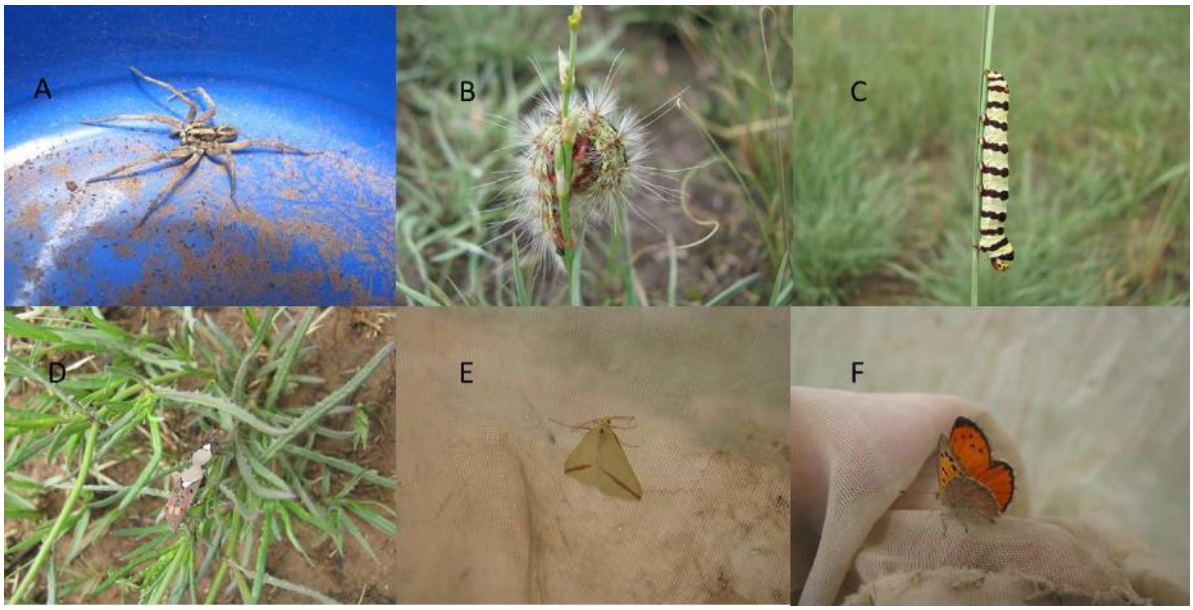

Figure 4-12: Examples of Invertebrates Recorded on Site (*Ctenus spp* (Wolf Spider); B: *Apanteles acrae*; C: In identification. D: *Spilostethus pandurus* (Seed bugs) E: *Rhodometra sacraria* (Vestel) F: *Chrysoritis dicksoni*

5 Sensitivity Analysis and No-go Areas

There are several ecological 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.

5.1 Mpumalanga Biodiversity Sector Plan (MBSP) (MTPA; 2016)

The main purpose of a biodiversity sector plan is to ensure that the most recent and best quality spatial biodiversity information can be accessed and used to inform land-use and development planning, environmental assessments and authorisations, and natural resource management. A biodiversity sector plan achieves this by providing a map (or maps) of terrestrial and freshwater areas that are important for conserving biodiversity pattern and ecological processes – these areas are called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). The maps are provided together with contextual information on biodiversity, and land-use guidelines (Figure 5-1) that can be incorporated into the policies and decisions of a wide range of sectors.

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

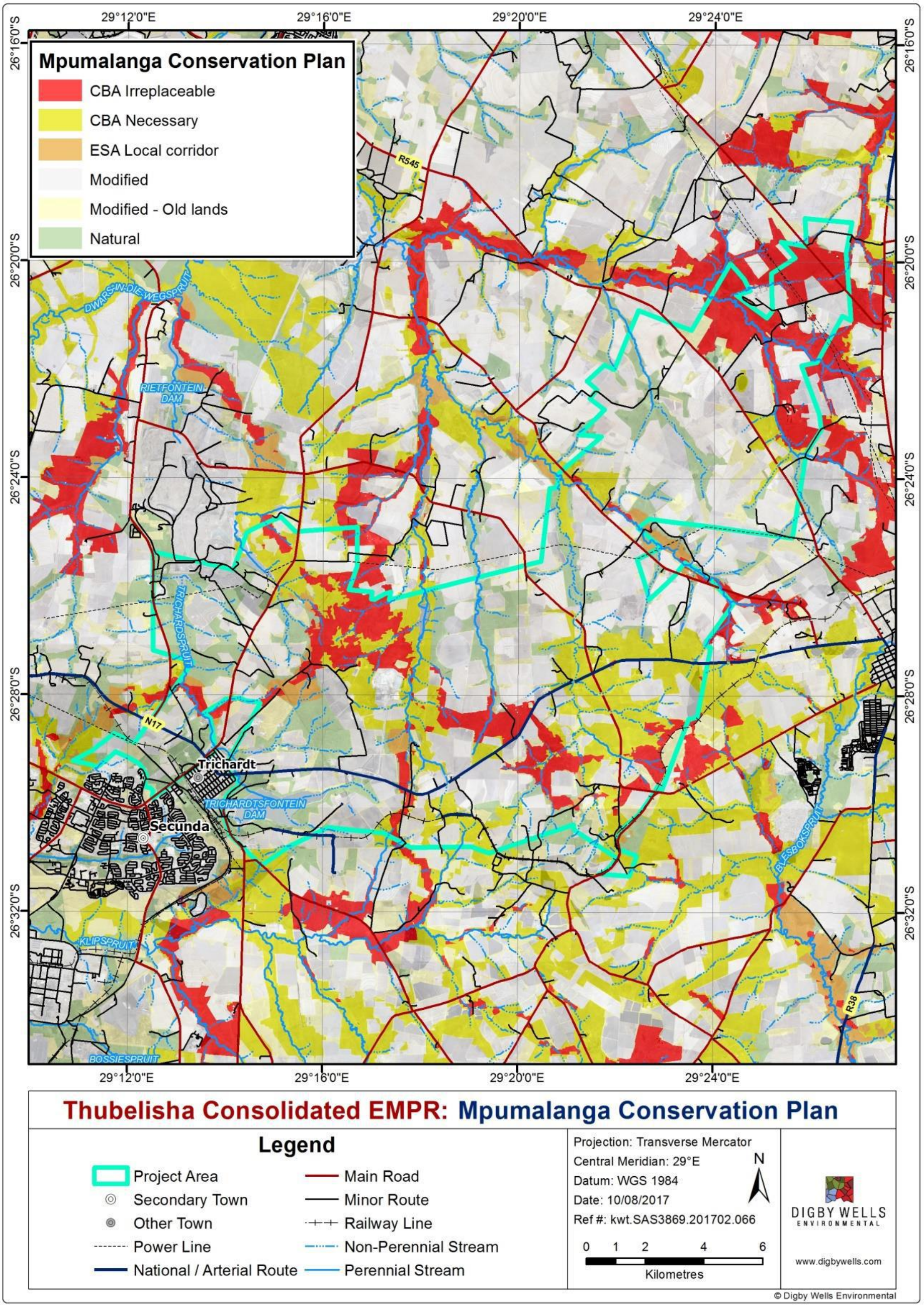

Figure 5-1: Mpumalanga Sector Plan

5.2 Protected Areas

Formerly protected areas, either provincially or nationally, that occur within proximity to the project site could have consequences as far as impact on these areas are concerned. For the project area however, there are no protected areas in close proximity. The closest protected area is approximately 30 km to the east. The protected areas within proximity to the project site are represented in Figure 5-2.

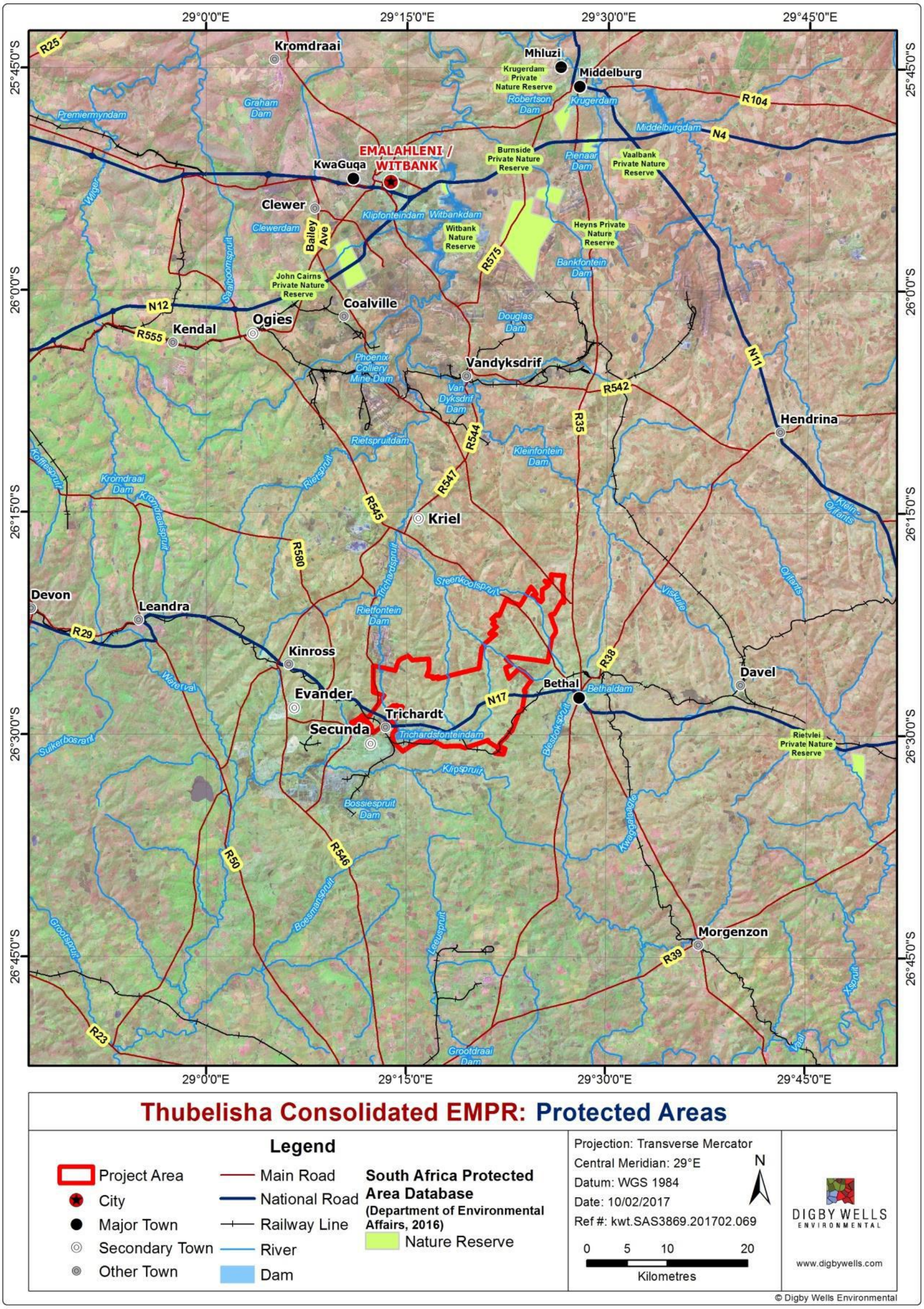

Figure 5-2: Protected Areas

5.3 Important Bird Areas (Birdlife SA, 2013)

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

The study area is 4km east of the Amersfoort Bethal-Carolina IBA (refer to Figure 5-3). According to Barnes (1998), this IBA holds a large proportion (>10%) of the global population of the endangered Botha's Lark (*Spizocorys fringillaris)*, although confirmation is required as to whether this is still the case. This Lark generally avoids rocky areas, tall grass in bottomlands, vleis, croplands and planted pastures, but its preferred habitat consist of short, dense, natural grassland found on plateaus and upper hill slopes and are occuring within the IBA, and on site.

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

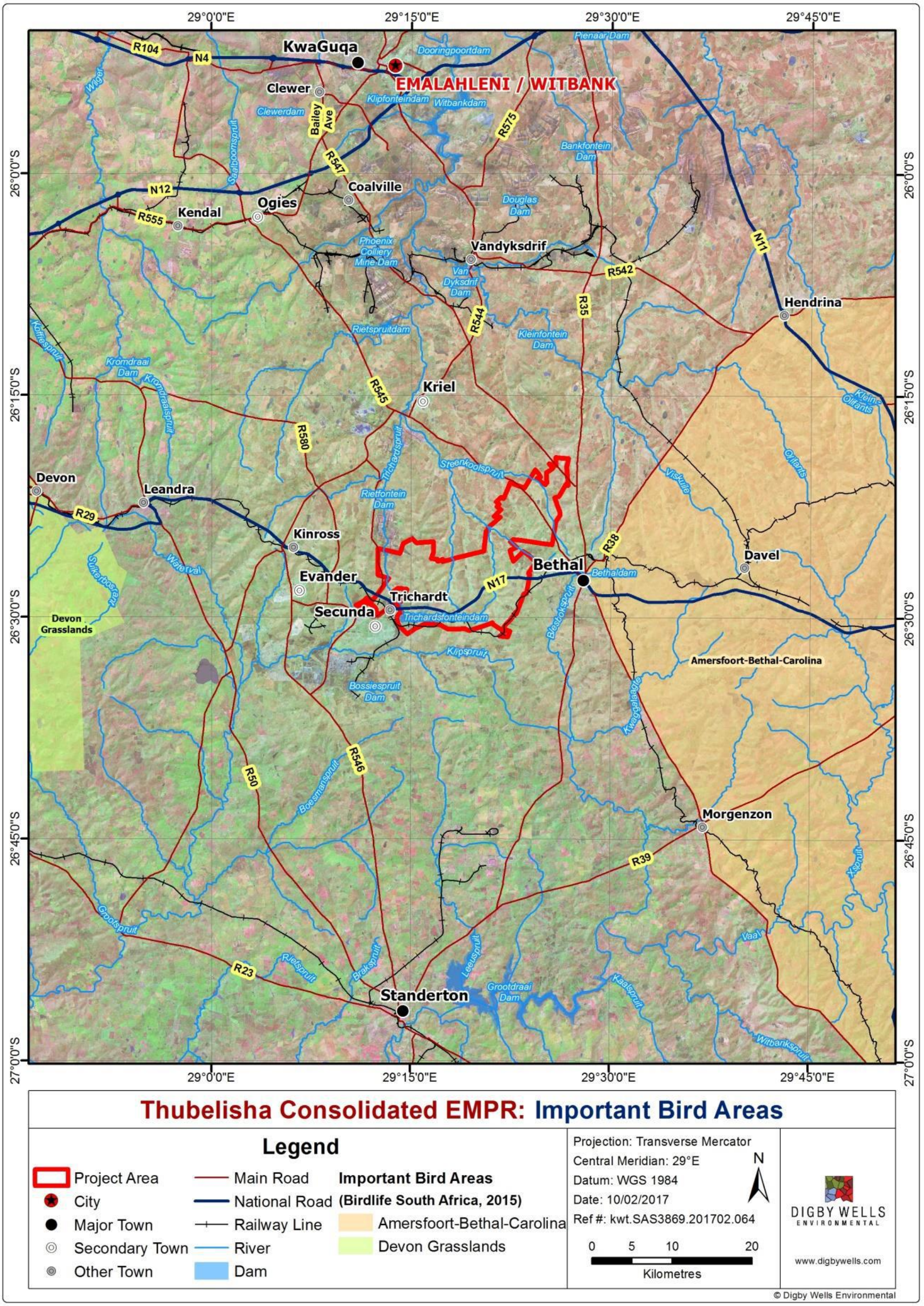

Figure 5-3: Important Bird Areas

5.4 Nationally Threatened Ecosystems

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

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

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

The criteria for identifying threatened terrestrial ecosystems include six criteria overall, two of which are dormant due to lack of data (criteria B and E). The criteria are presented in Table 5-1 below and Figure 5-4 shows that the Eastern Highveld Grassland and Soweto Highveld Grassland are listed as threatened ecosystems. Cumulative loss of these areas should be avoided.

Table 5-1: 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

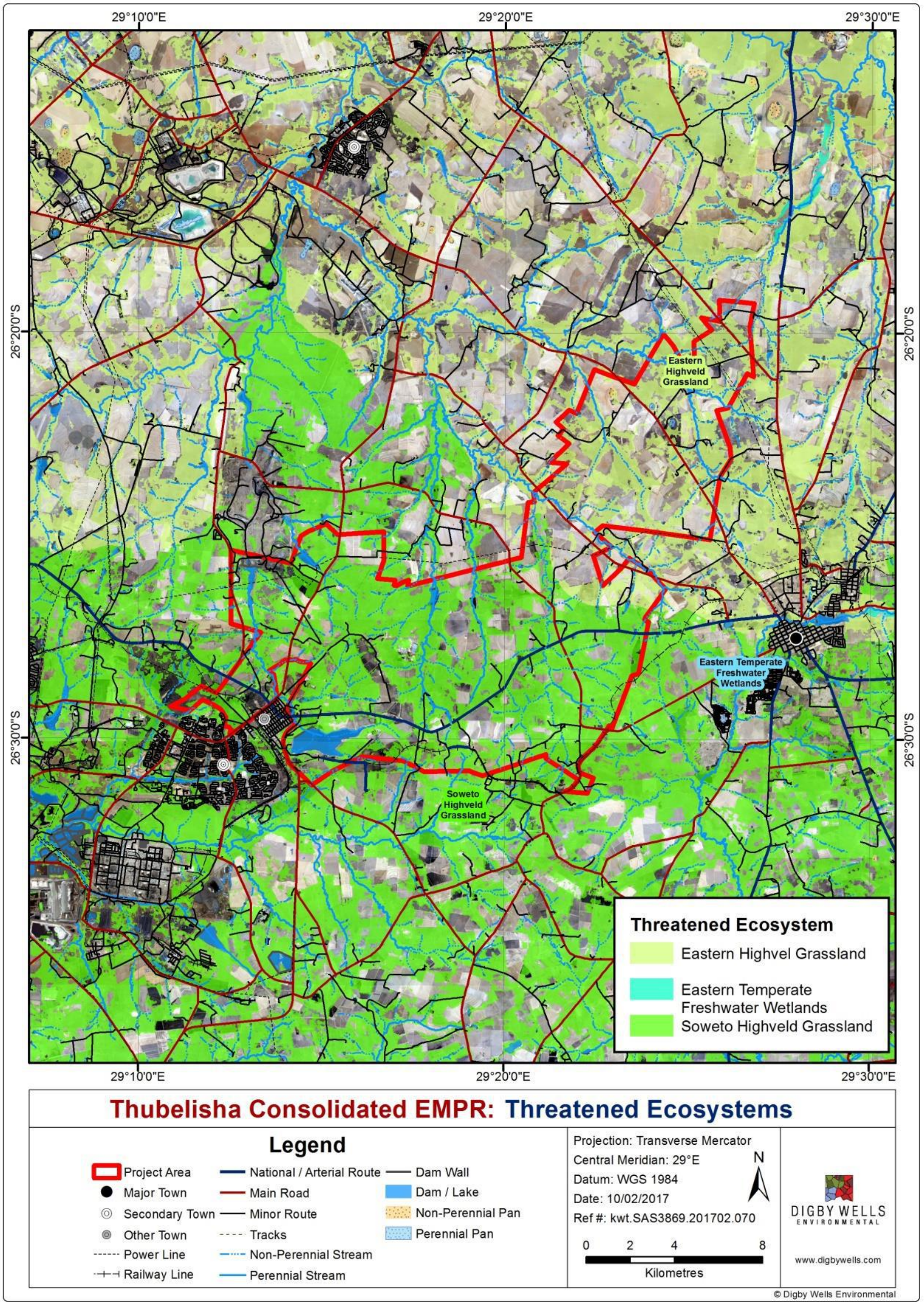

Figure 5-4: Nationally Threatened Ecosystems

5.5 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 5-5). The closest area is approximately 60 km away, the Mpumalanga Mesic Grassland area.

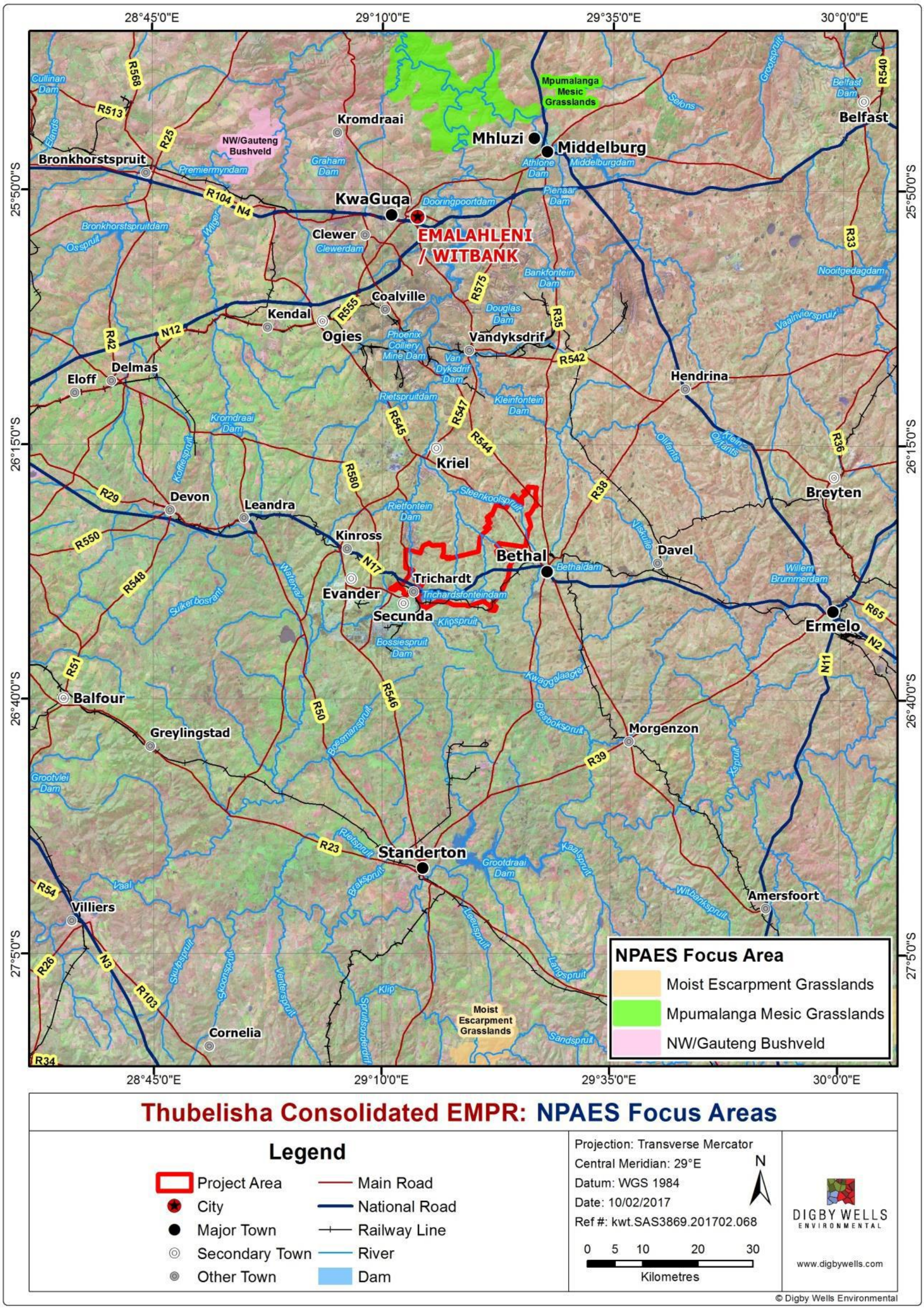

Figure 5-5: National Protected Areas Expansion Strategy

5.6 Site-specific Sensitivity

The ecological sensitivity map for the site is represented in Figure 5-6, overlaid with the mine plan. The riparian and pan vegetation units were allocated a very 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, a portion of Grassland on Vaalkop was assigned high ecological sensitivity due to the presence of plant SSC and high species diversity. High sensitivity was assigned to the Rocky Grassland and moderate sensitivity was assigned to the remaining natural areas. Areas that were cultivated, disturbed or built up were allocated a low ecological sensitivity.

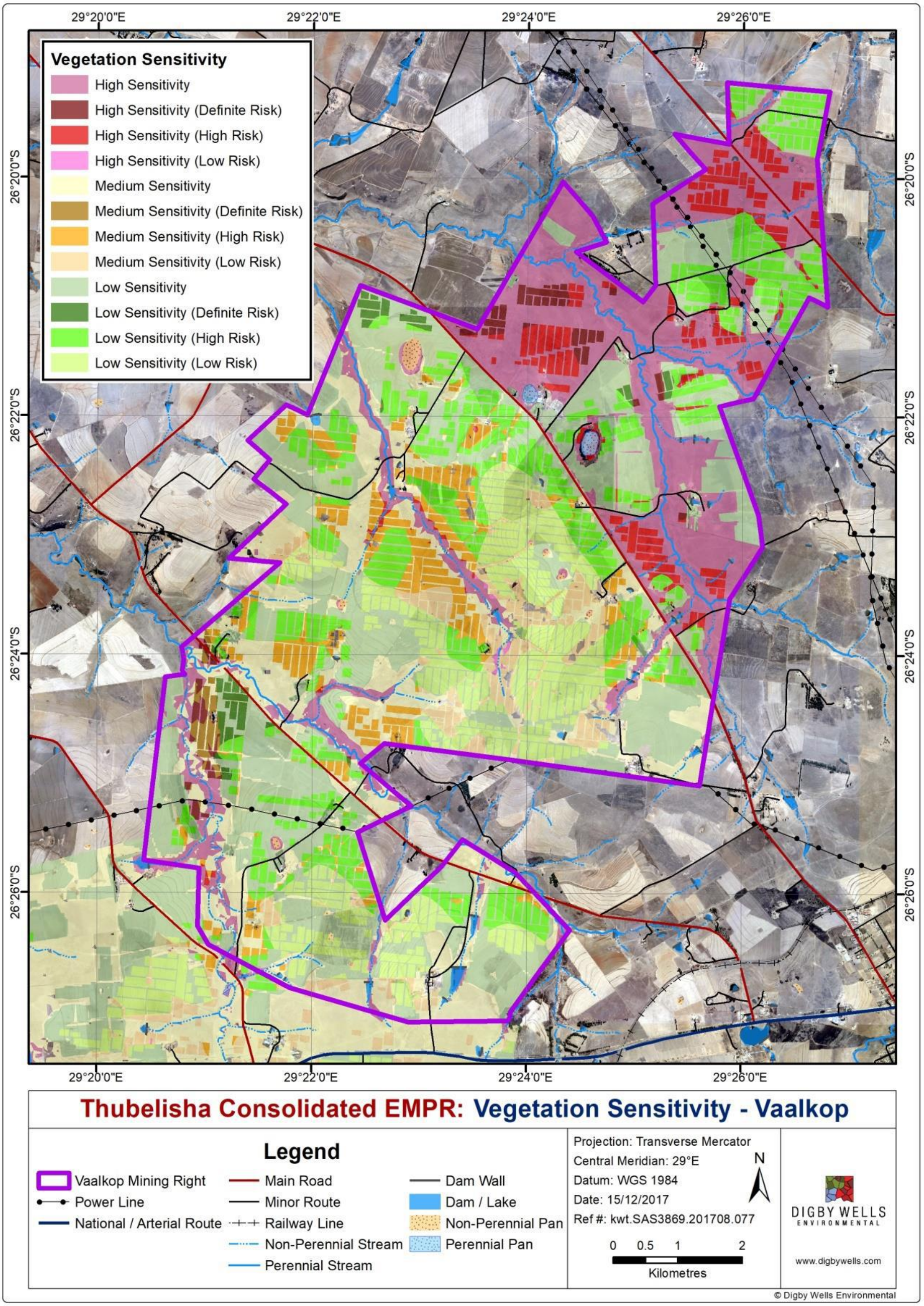

Figure 5-6: Sensitive Areas

5.7 Risk of subsidence

As indicated in Figure 5-7, the risk of subsidence is rated in areas having a definite to high probability, the areas where these occurences are going to happen is marked on the map, where these definite and high risk occur in association with areas where highly sensitive vegetation types occur, it is marklded under the first tab (purple).

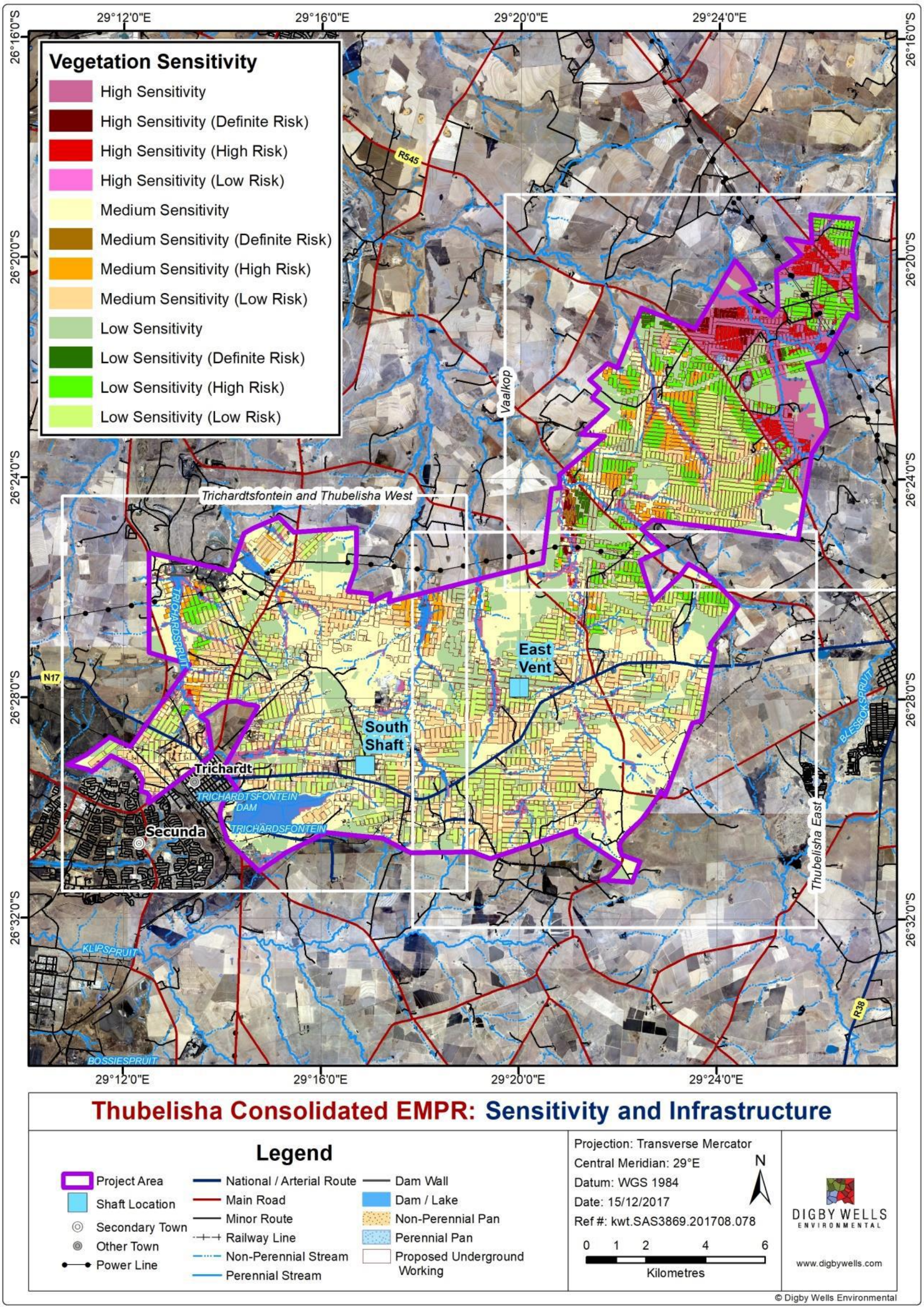

Figure 5-7: Sensitive vegetation types and the risk of subsidence

6 Impact Assessment

Before the impacts associated with the project are assessed, and mitigation measures recommended, it is important to note the following:

6.1 Mitigation Hierarchy

The mitigation hierarchy is international best practice for managing risks and impacts. This mitigation hierarchy is represented in Figure 6-1.

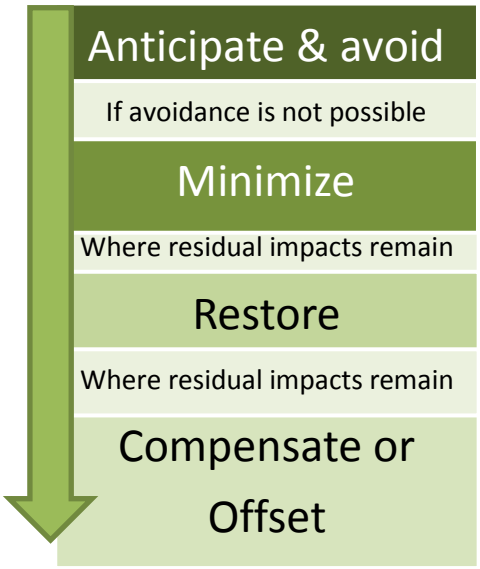

Figure 6-1: The Mitigation Hierarchy as defined by the IFC

The hierarchy follows a strict progression of best practice for dealing with impacts; these are explained in Table 6-1 below.

Table 6-1: The Different Levels of the Mitigation Hierarchy Defined

Avoidance	If impacts on the natural environment can be avoided, this is the best possible way of reducing impacts. Avoidance can involve changes in the location of infrastructure, even though, in mining developments, the pit itself cannot be moved.
Minimization	If impacts cannot be avoided, it is important that these are minimized. This is where mitigation measures usually described in an EIA fall. Minimization may include reducing the footprint of the development as far as possible, restricting access to loggers using drilling roads, or utilising already existing infrastructure.
Restore	If there are still residual impacts, restoration or rehabilitation may be employed to increase the biodiversity value of the site after development activities.

Offset	If residual impacts remain after all efforts to avoid, minimize and restore have been taken into consideration, offsets may be needed. These include the setting aside of areas within the mining lease area as corridors and conservation areas, as well as the setting aside of other areas for conservation. Offsets are difficult to determine and manage, and a separate study is often needed in order to identify the best options and those which compensate identical (or as close as possible) biodiversity to that which was impacted by the development.

6.2 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:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = 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 6-4. 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 6-3, which is extracted from Table 6-2. The description of the significance ratings is discussed in Table 6-4.

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 6-2: Impact Assessment Parameter Ratings

Rating	Intensity/Replaceability		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.	International 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.	National 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/Replaceability		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.	Province/ Region 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.	Municipal Area 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/Replaceability		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.	Local 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.	Limited 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/Replaceability		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.	Very limited/Isolated 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 6-3: Probability/Consequence Matrix

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

Consequence

Table 6-4: 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) (-)

6.3 Project Activities

The proposed mining method is the conventional 'bord-and-pillar' method and this will take place up to a depth of 200m for coal seam 4 (depth of the resource 160 m to 180 m). A high extraction method of mining using bord-and-pillar mining with pillar extraction is currently being used at the TCTS and is proposed to be utilised at the Trichardsfontein and Vaalkop Mines.

In mechanised bord-and-pillar mining, extraction is achieved by developing a series of roadways (bords) in the coal seam connected by splits (cut-throughs) to form pillars. In high extraction mining, all the pillars are extracted to allow the roof to collapse in a controlled manner (stooping).

Access to the reserves will be achieved via a vertical man and materials shaft and an incline coal shaft located at TCTS. Therefore, no surface infrastructure is proposed to be constructed at the Trichardsfontein or Vaalkop except for the two ventilation shafts (ventilation downcast shaft and ventilation upcast shaft) will be constructed at Trichardsfontein and TCTS. The total estimated size of the ventilation upcast shaft with small substation and services (stonedust silo and batching plant) will be 1.5 ha. The total estimated size of the ventilation downcast shaft will be 0.25 ha.

The major risk associated with underground mining, however, is the risk of subsidence of unconsolidated sediments. Figure 6-2 represents the Life of Mine (LoM) plan for the proposed underground coal mine as well as the sensitivity delineation completed for Vaalkop.

The impacts discussed below are the additional impacts to those discussed in the previous reports for the TCTS and Trichardsfontein areas, as a result of the decision to convert to high extraction mining and to construct two new vent shafts. The high extraction impacts are also applicable to the Vaalkop project area, however no infrastructure is expected there currently so construction phase impacts are therefore not applicable.

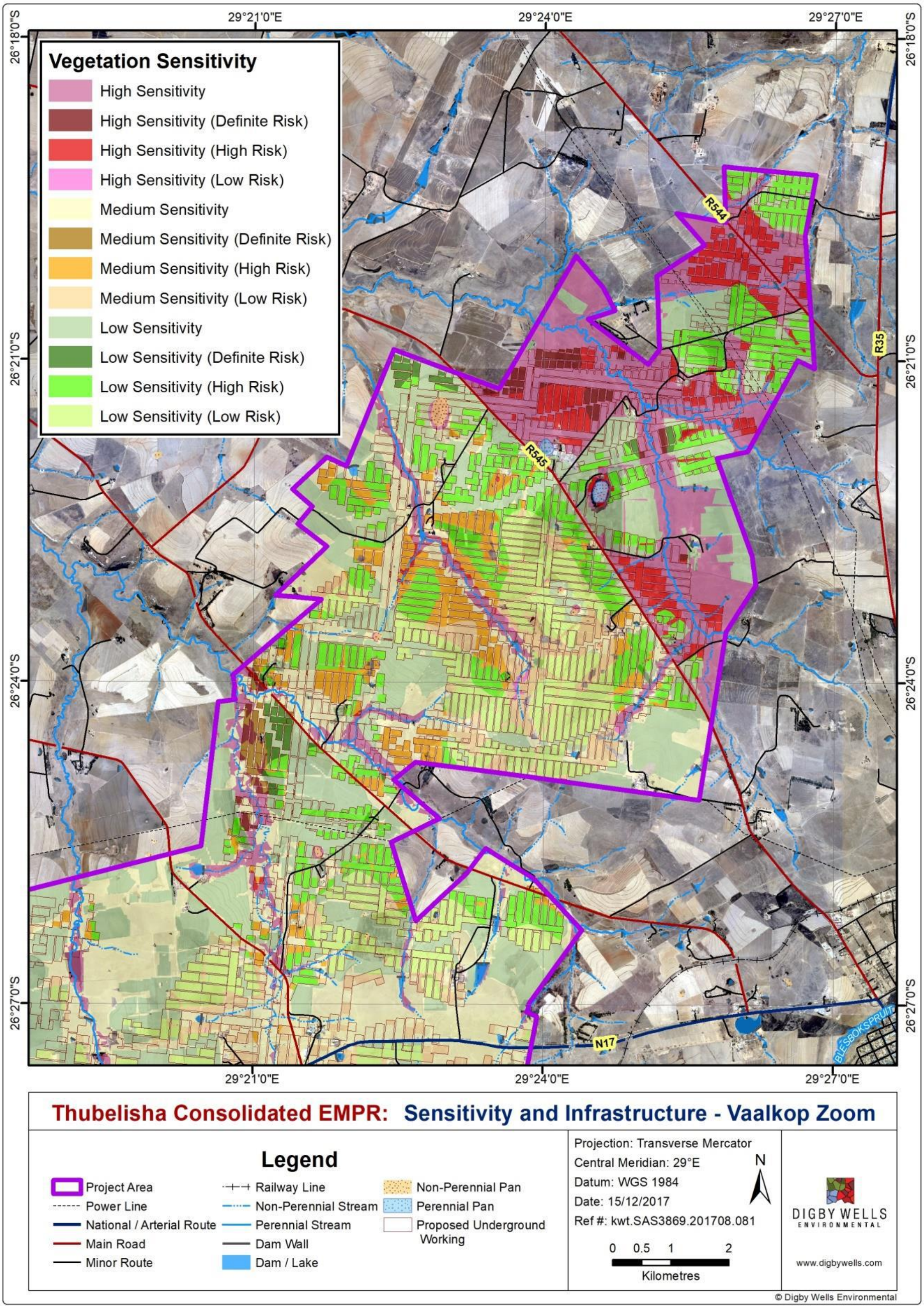

Figure 6-2: Sensitive landscapes and underground Mine Plan

The ventilation shafts that will be constructed are 1.5 in size and displayed in Figure 6-3 and Figure 6-4, respectively, during field work it was confirmed that both vent shafts are lcated in the least sensitive agricultural vegetation type.

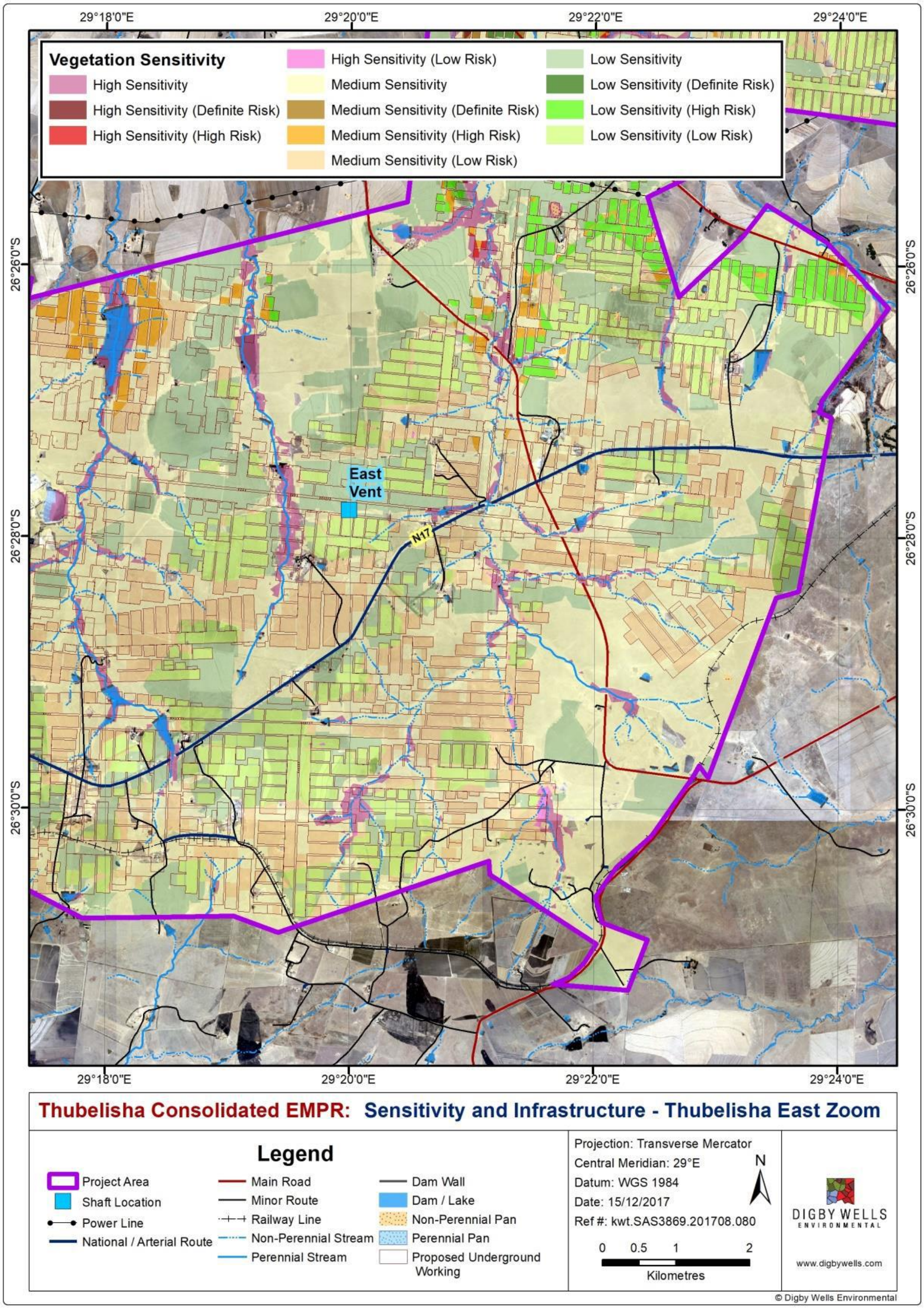

Figure 6-3: East Vent Shaft Location and Vegetation types Sensitivity

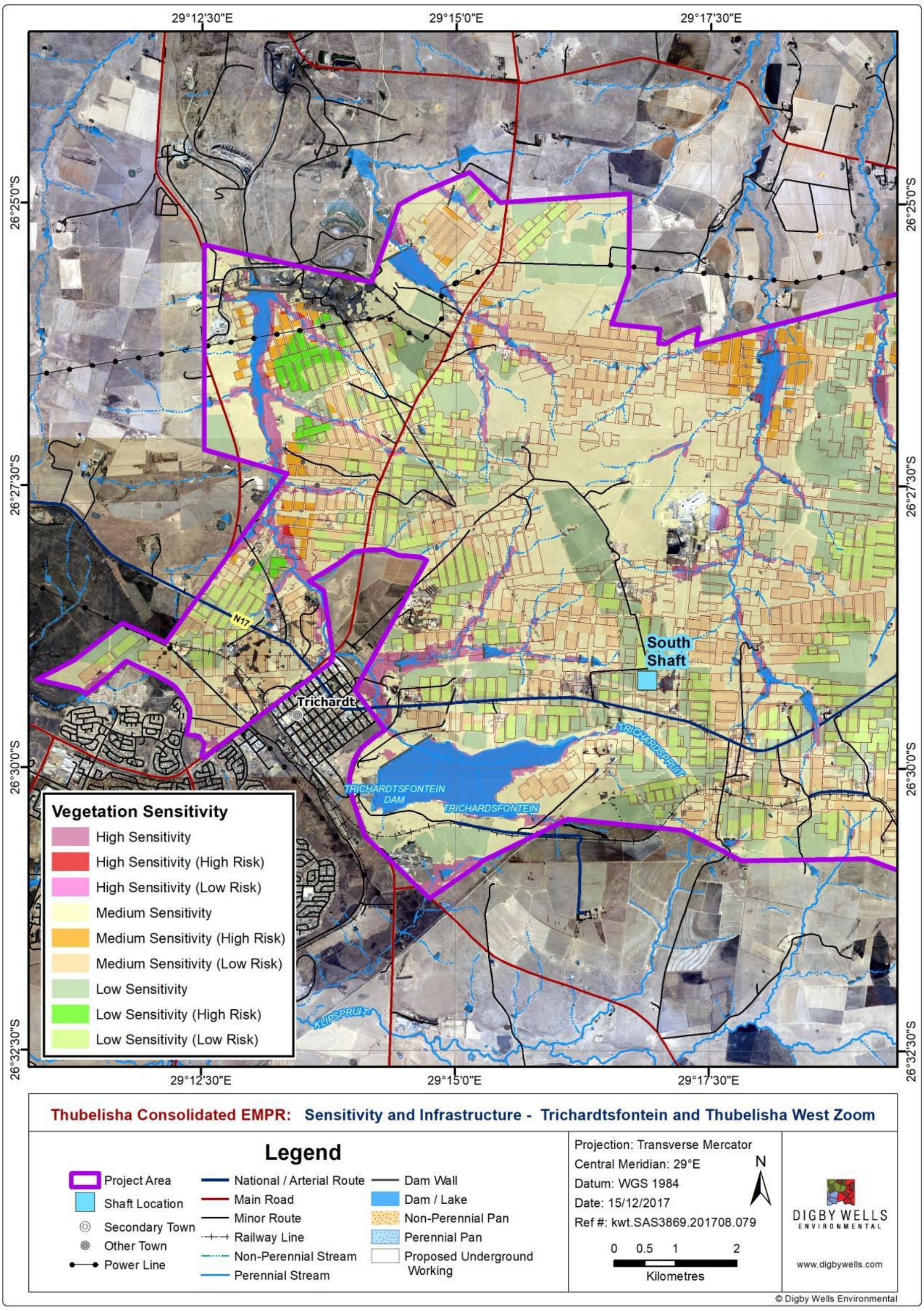

Figure 6-4: South Vent shaft Location and Vegetation types Sensitivity

6.4 Impact Assessment

6.4.1 Construction Phase

Construction will only take place on the areas earmarked for the ventilation shafts, both these shafts are located within existing agricultural areas that has no natural vegetation remaining.

The proposed mining operation will require the removal of coal at a depth of 200 m. Access to the mining areas will be from the adjacent underground workings and no surface entry is required. The only surface infrastructure required are two vent shafts. The construction of the vent shafts is outside of the 100m wetland buffer and therefore will only have an indirect impact on the wetlands. The vent shafts are located within the 500 m WUL buffer and therefore a WUL will need to be applied for.

6.4.1.1 Project Activities Assessed

During the construction phase (construction of surface infrastructure), cultivated areas (3 ha), will be cleared. The impact of loss of cultivated fields is neutral. It is not anticipated that any plant SSC will be lost. Alien plant infestation is a threat and must be controlled through appropriate management plans.

Table 6-5: Interactions and Impacts

Interaction	Impact
Site clearing	Loss of agricultural areas, alien plant infestation

6.4.1.2 Impact Description

The site clearing activity will not have an impact on the habitats that have been rated as having a high or very high sensitivity rating. The extent of the impact is limited to a small area and will not have considerable negative impacts on overarching biodiversity of the project area.

6.4.1.3 Management Objectives

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

6.4.1.4 Management Actions and Targets

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

- The footprint area should be kept as small as possible;
- Existing access roads should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road;

- An alien invader management plan should be implemented, whereby the disturbed site is monitored quarterly for at least two years to ensure that alien invasion does not take place.

6.4.1.5 Impact Ratings

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

Table 6-6: Potential Impacts of the Construction Phase – Loss of Habitat/Vegetation Types

Dimension	Rating	Motivation	Significance
Site Clearing			
Impact Description: Site clearing resulting in alien plant invasion			
Prior to Mitigation/Management			
Duration	Medium-term (3)	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			
▪ 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.	Negligible (negative) 30
Extent	Limited (2)	Alien plants will establish around disturbed areas associated with the construction phase.	

Dimension	Rating	Motivation	Significance
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 (5)	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	

6.4.2 Operations Phase

6.4.2.1 Project Activities Assessed

During the operational phase of the development, underground mining will take place. No planned loss of habitat or flora and fauna species is expected. The only impact considered at this stage is subsidence that may occur and impact sensitive landcapes.

6.4.2.2 Impact Description

The underground mining will occur from a depth of 30m. Sensitive habitat such as wetlands will be affected due to subsidence in areas where subsidence is rated as definite, this will have an impact on both plants and animals that depend on these sensitive ecosystems. For example grass owls present in the area utilized wetlands which may be lost or negatively impacted upon by subsidence.

High extraction mining and shallower mining activities will have greater negative impacts as the surface is at great risker from destabilisation, resulting in possible subsidence if appropriate mitigation measures are not carried out.

6.4.2.3 Management Objectives

To prevent/minimise the loss of, or further damage to, natural ecosystems and their buffer areas, specifically wetlands. This is important as the naturally occurring habitat and ecosystems play a major role in supporting a range of ecological processes in the region, even more so due to the fact that mining is prevalent in the area.

6.4.2.4 Management Actions and Targets

- A comprehensive geotechnical investigation should be undertaken for the following:
  - Provide appropriate design parameters for pillar and overburden stability, in line with the actual geotechnical rockmass properties,

- Indicate any areas (undermining of the natural ecosystems) that may fall outside of these design parameters, and
- Following the geotechnical investigation, where required a provision must be made for the rehabilitation of these areas in the event of a possible risk of subsidence / intersection collapse.

- The edge of the wetlands and a 100 m buffer must be demarcated near where the vent shafts are to be located to reduce the risk of being impacted on from undesirable activities;
- Sensitive landscape monitoring must be carried out to ensure no unnecessary impact to these areas is realised; and if so that a remedy is put in place as soon as possible; and
- In addition, general mitigation and management actions provided in the specialist studies completed by Digby Wells as part of this project should be used to guide the effective management of the ecological resources affected by the proposed project.

6.4.2.5 Impact Ratings

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

Table 6-7: Potential Risks of the Operational Phase – Subsidence

Dimension	Rating	Motivation	Significance
Activity and Interaction 1: High Extraction Underground Mining			
Impact Description: No direct loss of fauna, flora or sensitive ecosystems will occur, except if subsidence occurs. However, undermining of sensitive areas/landscapes leading to changes that will negatively affect the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mine varies from 30 to 215 m.			
Prior to Mitigation/Management			
Duration	Permanent (7)	Undermining of sensitive landscapes where depth of coal is 30 to 50m below surface will lead to subsidence, which in turn will have an irreversible impact to the functioning of sensitive ecosystems. The mining will also be a permanent change to the riparian areas in the form of dewatering. Lowering of the water table could result in depletion of aquifers. Failure of the pillars or total extraction could lead to subsidence.	-112 Major Negative
Extent	Local (3)	The remaining natural areas (grassland, wetlands are regarded as sensitive according to field work results and the Mpumalanga sector plan.	

Dimension	Rating	Motivation	Significance
Intensity	Irreplaceable loss of highly sensitive environments (6)	These rivers and riparian areas are important for the ecological services they provide to society; particularly due to the high level of cumulative loss of riparian functioning in the area. Many sensitive and protected fauna and flora species depend on the natural ecosystems present. Undermining of these areas may lead to the loss of some of these areas and this is seen as an irreplaceable loss of these highly sensitive systems. Subsidence will have a very negative impact if it occurs.	
Probability	Definite (7)	Where the depth of coal is 30 – 50 meters subsidence will occur.	
Nature	Negative (-)		
Mitigation/Management Actions			
▪ The highest safety factor possible must be used. ▪ Underground dykes and sills must be carefully managed as this can lead to dewatering of rivers and riparian areas if undesired aquifers are punctured. ▪ Mining should not occur above 100m below rivers and riparian areas. ▪ Monitoring should take place for excessive inflow into the underground workings.			
Post-Mitigation			
Duration	Permanent (7)	Although mitigation measures may lessen the impact somewhat, the mining will be a permanent change to the hydrology setting and groundwater functioning (decant etc).	
Extent	Local (3)	The impacts may be managed to be contained within the development area and not to have negative impacts of a municipal scale.	-105 Moderate Negative
Intensity	Serious damage to sensitive environments (5)	Even with mitigation, the residual impact will still have serious damaging effects on the natural functioning of the sensitive wetland ecosystems.	
Probability	Definite (7)	Where the depth of coal is 30 – 50 meters subsidence will occur.	
Nature	Negative (-)		

6.4.3 Closure and Rehabilitation Phase

6.4.3.1 Project Activities Assessed

Table 6-8: Closure and Rehabilitation Phase Interactions with sensitive landscapes

Interaction		Impact
1	Underground mine closure and rehabilitation	Post-mining decant of groundwater will have negative impacts on the wetlands as this water is likely to be of a poor water quality.

6.4.3.2 Impact Description

During this phase all mining has stopped and infrastructure will be removed, in this case the ventilation shafts will be removed and the disturbed areas rehabilitated.

The post-mining landscape will have groundwater impacts due to decant being realised at some point as the mine voids fill up naturally with water once dewatering stops. Given the altered underground conditions, the water quality may be compromised. This will need to be confirmed once the Groundwater Impact Assessment has been compiled as this represents one of the largest negative impacts to the riparian areas and water resources, all of which are depended on by sensitive fauna and flora species.

6.4.3.3 Management Objectives

The objectives of management actions are to prevent/minimise the loss of or further damage to natural ecosystems that sensitive fauna and flora are dependent on. This is important as the naturally occurring habitat and ecosystems play a major role in supporting a range of ecological processes and biodiversity in the region.

6.4.3.4 Management Actions and Targets

- An alien invasive plant management plan should be implemented.
- Riparian habitat and river biomonitoring must be carried out during rehabilitation to ensure these areas are not impacted upon; and if they are remedial action must be implemented. Transects should be set up through representative sites and monitored regularly;
- Should there be decant, the water will need to be treated with active or passive treatment and a Rehabilitation Plan will need to be compiled to rectify any damages.

In addition, general mitigation and management actions provided in the specialist studies compiled by Digby Wells as part of this project should be used to guide the effective management of the ecological wetland resources affected by the proposed project.

6.4.3.5 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, 2017).

Table 6-9: Potential Impacts of the Decommissioning Phase – Establishment of Alien Plant Species

Dimension	Rating	Motivation	Significance
Dismantling and removal of infrastructure			
Impact Description: Alien plant invasion may take place			
Prior to Mitigation/Management			
Duration	Medium-term (3)	Alien plant invasion may occur for a short period of time.	Minor (negative) 36
Extent	Limited (2)	Alien plants will establish around disturbed areas associated with the decommissioning phase.	
Intensity x type of impact	Serious (4)	Alien plant invasion is a serious problem with significant ecological consequences; hence its reference in the NEMBA and CARA legislation.	
Probability	Probable (4)	Since alien plants have already been recorded on site, the spread of these species due to disturbance will invariably take place. The seedbank in the soil will contain alien species.	
Nature	negative	The impact will be negative	
Mitigation/Management Actions			
▪ An alien plant species management plan should be implemented for two years.			
Post-Mitigation			
Duration	Medium-term (3)	As seedlings emerge, they will be removed quarterly as part of an alien management plan.	Negligible (negative) 24
Extent	Limited (2)	Alien plants will establish around disturbed areas associated with decommissioned infrastructure.	
Intensity x type of impact	Minimal (1)	The impact is significantly reduced if controls are implemented.	

Dimension	Rating	Motivation	Significance
Probability	Probable (4)	Since alien plants have already been recorded on site, the spread of these species due to disturbance will invariably take place. The seedbank in the soil will contain alien species.	
Nature	Negative	The impact will be negative	

7 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 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.

8 Unplanned Events and Low Risks

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

Table 8-1: 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. These needs to be monitored and reported on and the appropriate actions should take place dependant on the results.

9 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.

10 Project Activities with Potentially Significant Impacts

In summary, the impacts of the development on flora and fauna are primarily related to vegetation loss due to possible subsidence, as listed in Table 10-1.

Table 10-1: Potentially Significant Project Impacts

Activities	Potentially Significant Project Impacts
Subsidence	Loss of Natural Grassland
	Loss of Riparian Areas

10.1 Summary of Mitigation and Management

Table 10-2 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 10-2: Mitigation and Management Plan

Activities	Potential Impact	Aspects Affected	Phase	Mitigation Type/Measures	Compliance with standards/Standard to be achieved	Time period for Implementation
Clearing of vegetation	Habitat fragmentation and increased establishment of alien plant species.	Flora – alien plant invasion	Construction phase	Alien management plan	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004) Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983)	Alien management plan to be implemented after construction for 2 years and after decommissioning for two years.
High extraction mining	Subsidence close to sensitive lanscpaes, such as riparian areas.	Sensitive landscaeps and species dependant on these	Operational Phase	▪ The highest safety factor possible must be used. ▪ Underground dykes and sills must be carefully managed as this can lead to dewatering of wetlands if undesired aquifers are punctured. ▪ Mining should not occur above 100m below wetlands. ▪ Monitoring should take place for excessive inflow into the underground workings	National Environmental Management Act (NEMA),1998 (Act 107 of 1998) National Environmental Biodiversity Act (NEMBA),2004 (Act10 of 2004) Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983)	As soon as mining starts

10.2 Monitoring Plan

The only two aspects requiring monitoring, based on the flora and fauna assessment, is the establishment of alien invasive plant species and River/Riparian areas Biomonitoring, as described below. This should be completed by a qualified botanical specialist.

Table 10-3: Monitoring Plan

Activities	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions
Soil disturbance	Establishment of alien plant species	Alien plant monitoring	Qualified botanist	Quarterly monitoring for two years
High extraction miinng	Subsidence	Riparian and River biomonitoring specifically aimed at river vegetetation and fauna species dependant on it	Qualified Aquatic scientist	Quarterly monitoring for life of mine

11 Consultation Undertaken

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

12 Discussion and Conclusions

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

The surface infrastructure does not coincide within any of the irreplaceable areas according to the Mpumalanga Sector Plan. 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;
- The Engineers Rock Report will be required to show where the risk of subsidence is high, if at all, as this will result in loss of sensitive landscapes;
- 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 invasive plant species. It is recommended that all alien invasive plant species are controlled throughout the site as far as possible.

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

13 References

Digby Wells, 2016. Wetland Assessment Report: Proposed Development of an Underground Coal Mine and Associated Infrastructure near Hendrina, Mpumalanga Province.

Digby Wells, 2016a. Rehabilitation, Decommissioning and Mine Closure Plan: Proposed Development of an Underground Coal Mine and Associated Infrastructure near Hendrina, Mpumalanga Province.

Birdlife International, 2013. Important Birding Areas, Available Online at www.birdlife.org/action/science/sites/

Branch, B. 2001. Snakes and Other Reptiles of Southern Africa. Struik Publishers, South Africa.

Bromilow, C (2010). Problem Plants and Alien Weeds of South Africa. Briza Publications. Pretoria, South Africa.

Carruthers, V. 2009. Frog and Frogging in Southern Africa. Struik Publishers (Pty) Ltd, Cape Town.

Convention on wetlands of international importance especially as Waterfowl Habitat, Ramsar (Iran), 2 February 1971. UN Treaty Series No. 14583 As amended by the Paris Protocol, 3 December 1982 and Regina Amendments, 28 May 1987

Coombes, P .2004. Anglo American: Best Practice Environmental Guideline Series, Guideline for preparing Biodiversity Action Plans (BAP).

Department of Environmental Affairs and Tourism, 2005. South African Country Study, Situational Assessment undertaken to inform South Africa's National Biodiversity Strategy and Action Plan (NBSAP).

Duellman, W.E and Trueb, L 1986. Biology of Amphibians. JHU Press. 1986.

Ferrar, A. F. and Lotter, M. C. Mpumalanga Biodiversity: Conservation Plan handbook. Mpumalanga Tourism an Park Agency, Scientific services. Mpumalanga Provincial Government, Nelspruit. 2007.

Gerlanc, N. M. and Kaufman, G. A. Habitat of Origin and Changes in Water Chemistry Influence Development of Western Chorus Frogs. Journal of Herpetology 39 (2): 254-265 2005.

Hannekens, S.M. 1996b. TURBO (VEG) – Software pakage for input, processing and presentation of phytosociological data. Users guide. University of Lancaster, Lancaster.

Hockey PAR, Dean WRJ and Ryan PG 2005. Roberts - Birds of southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town

Kingdon, J. 2007. The Kingdon field guide to African Mammals. A&C Black publishers, London.

Low, A.B. & Rebelo, A.G. (eds) 1996. Vegetation of South Africa, Lesotho and Swaziland.

Lotter M,(Mpumalanga Tourism and Parks Authority), Email correspondence; Mon 2013/03/18 4:34 PM

Monadjem, A. Taylor, P.J. Cotterill, F.P.D. Schoeman, M. C. 2010: Bats of Southern and Central Africa. Ultra Litho. Johannesburg

Mucina, L.and Rutherford, M.C. (eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Passmore N.I., & Carruthers, V.C. 1995. South African Frogs: A complete Guide. Southern Book Publishers, Witwatersrand University Press, South Africa.

Picker, M., C. Griffiths and Weaving .A. 2002. Field Guide to Insects. Random House Struik (Pty) Ltd

Pooley, E.S. 1998. A Field Guide to Wildflowers Kwazulu-Natal and the eastern region. Natal Flora Publishers Trust: Durban, South Africa

Roberts 2009. Roberts' Multimedia Birds of Southern Africa. Southern African Birding, Westville.

Smithers, R.H.N. 1986. South African Red Data Book – Terrestrial Mammals. South African National Scientific Programme Report no 125.

Sinclair, I., Hockey, P & Warwick, T. 1993. Sasol Voëlgids van Suider-Afrika. Struik Uitgewers, Kaapstad.

SoER: http://soer.deat.gov.za/dm_documents/TOR_Specialist_Studies_1qWDC.pdf

South African National Botanical Institute (2013). Grasslands Available Online at http://www.grasslands.org.za/

Waddle, J.H. 2006. Use of amphibians as ecosystem indicator species. Dissertation, University of Florida.

Appendix A: Staff CVs

Appendix B: Expected Plant List

Family	*Genus*	*Sp1*	Rank1	*Sp2*	Ecology
Polygalaceae	*Polygala*	*transvaalensis*	subsp.	*transvaalensis*	Indigenous
Agavaceae	*Chlorophytum*	*cooperi*			Indigenous
Rubiaceae	*Anthospermum*	*rigidum*	subsp.	*rigidum*	Indigenous
Orobanchaceae	*Striga*	*bilabiata*	subsp.	*bilabiata*	Indigenous
Poaceae	*Cynodon*	*dactylon*			Indigenous
Orchidaceae	*Habenaria*	*epipactidea*			Indigenous
Poaceae	*Eragrostis*	*racemosa*			Indigenous
Scrophulariaceae	*Gomphostigma*	*virgatum*			Indigenous
Linderniaceae	*Lindernia*	*nana*			Indigenous
Alliaceae	*Tulbaghia*	*acutiloba*			Indigenous; Endemic
Brassicaceae	*Erucastrum*	*austroafricanum*			Indigenous
Hypoxidaceae	*Empodium*	*elongatum*			Indigenous
Plantaginaceae	*Linaria*	*vulgaris*			notIndigenous; Naturalised; Invasive
Apocynaceae	*Cordylogyne*	*globosa*			Indigenous
Asteraceae	*Helichrysum*	*aureonitens*			Indigenous
Asteraceae	*Gerbera*	*ambigua*			Indigenous
Orchidaceae	*Eulophia*	*ovalis*	var.	*ovalis*	Indigenous
Cyperaceae	*Cyperus*	*schlechteri*			Indigenous

Family	*Genus*	*Sp1*	Rank1	*Sp2*	Ecology
Poaceae	*Harpochloa*	*falx*			Indigenous
Campanulaceae	*Wahlenbergia*	*undulata*			Indigenous
Fabaceae	*Indigofera*	*dimidiata*			Indigenous
Poaceae	*Panicum*	*schinzii*			Indigenous
Brassicaceae	*Lepidium*	*transvaalense*			Indigenous
Asteraceae	*Geigeria*	*aspera*	var.	*aspera*	Indigenous
Rubiaceae	*Pentanisia*	*prunelloides*	subsp.	*prunelloides*	Indigenous
Dipsacaceae	*Scabiosa*	*columbaria*			Indigenous
Asteraceae	*Gazania*	*krebsiana*	subsp.	*serrulata*	Indigenous
Poaceae	*Andropogon*	*appendiculatus*			Indigenous
Poaceae	*Aristida*	*junciformis*	subsp.	*junciformis*	Indigenous
Thymelaeaceae	*Lasiosiphon*	*kraussianus*			Indigenous
Poaceae	*Eragrostis*	*planiculmis*			Indigenous
Euphorbiaceae	*Acalypha*	*caperonioides*	var.	*caperonioides*	Indigenous
Fabaceae	*Indigofera*	*hedyantha*			Indigenous
Rhamnaceae	*Ziziphus*	*zeyheriana*			Indigenous
Solanaceae	*Datura*	*stramonium*			notIndigenous; Naturalised; Invasive
Commelinaceae	*Cyanotis*	*speciosa*			Indigenous

Family	*Genus*	*Sp1*	Rank1	*Sp2*	Ecology
Poaceae	*Aristida*	*canescens*	subsp.	*canescens*	Indigenous
Polygonaceae	*Rumex*	*lanceolatus*			Indigenous
Acanthaceae	*Dyschoriste*	*burchellii*			Indigenous
Asphodelaceae	*Trachyandra*	*saltii*	var.	*saltii*	Indigenous
Poaceae	*Catalepis*	*gracilis*			Indigenous
Convolvulaceae	*Convolvulus*	*sagittatus*			Indigenous
Asteraceae	*Denekia*	*capensis*			Indigenous
Orchidaceae	*Orthochilus*	*foliosus*			Indigenous
Rosaceae	*Sanguisorba*	*minor*	subsp.	*muricata*	notIndigenous; Naturalised
Asphodelaceae	*Kniphofia*	*typhoides*			Indigenous; Endemic
Juncaceae	*Juncus*	*oxycarpus*			Indigenous
Asteraceae	*Ursinia*	*nana*	subsp.	*nana*	Indigenous
Asteraceae	*Nidorella*	*resedifolia*	subsp.	*resedifolia*	Indigenous
Poaceae	*Setaria*	*nigrirostris*			Indigenous
Scrophulariaceae	*Limosella*	*maior*			Indigenous
Poaceae	*Tragus*	*racemosus*			Indigenous
Asphodelaceae	*Aloe*	*ecklonis*			Indigenous
Poaceae	*Digitaria*	*eriantha*			Indigenous

Family	*Genus*	*Sp1*	Rank1	*Sp2*	Ecology
Lamiaceae	*Salvia*	*runcinata*			Indigenous
Asteraceae	*Senecio*	*othonniflorus*			Indigenous
Hyacinthaceae	*Dipcadi*	*marlothii*			Indigenous
Amaryllidaceae	*Nerine*	*gracilis*			Indigenous; Endemic
Fabaceae	*Rhynchosia*	*adenodes*			Indigenous
Asteraceae	*Conyza*	*podocephala*			Indigenous
Fabaceae	*Vigna*	*luteola*	var.	*luteola*	Indigenous
Asteraceae	*Senecio*	*subcoriaceus*			Indigenous
Amaryllidaceae	*Cyrtanthus*	*tuckii*	var.	*tuckii*	Indigenous; Endemic
Ranunculaceae	*Ranunculus*	*multifidus*			Indigenous
Iridaceae	*Moraea*	*pallida*			Indigenous
Fabaceae	*Argyrolobium*	*harveyanum*			Indigenous
Zygophyllaceae	*Tribulus*	*terrestris*			Indigenous
Asteraceae	*Senecio*	*laevigatus*	var.	*laevigatus*	Indigenous; Endemic
Fabaceae	*Zornia*	*capensis*	subsp.	*capensis*	Indigenous
Hyacinthaceae	*Drimia*	*elata*			Indigenous
Rubiaceae	*Kohautia*	*caespitosa*	subsp.	*brachyloba*	Indigenous
Asteraceae	*Pseudognaphalium*	*luteo-album*			notIndigenous; Naturalised

Family	*Genus*	*Sp1*	Rank1	*Sp2*	Ecology
Malvaceae	*Hermannia*	*cordata*			Indigenous; Endemic
Caryophyllaceae	*Herniaria*	*erckertii*	subsp.	*erckertii*	Indigenous
Rubiaceae	*Kohautia*	*amatymbica*			Indigenous
Phrymaceae	*Mimulus*	*gracilis*			Indigenous
Polygalaceae	*Polygala*	*albida*	subsp.	*albida*	Indigenous
Asteraceae	*Hilliardiella*	*aristata*			Indigenous
Iridaceae	*Gladiolus*	*elliotii*			Indigenous
Poaceae	*Eragrostis*	*tef*			notIndigenous; Naturalised
Asteraceae	*Nidorella*	*anomala*			Indigenous; Endemic
Oxalidaceae	*Oxalis*	*obliquifolia*			Indigenous
Brassicaceae	*Rorippa*	*fluviatilis*	var.	*fluviatilis*	Indigenous
Fabaceae	*Eriosema*	*salignum*			Indigenous
Fabaceae	*Melolobium*	*calycinum*			Indigenous
Asteraceae	*Berkheya*	*zeyheri*	subsp.	*zeyheri*	Indigenous
Convolvulaceae	*Falkia*	*oblonga*			Indigenous
Apocynaceae	*Asclepias*	*gibba*	var.	*gibba*	Indigenous
Hyacinthaceae	*Eucomis*	*autumnalis*	subsp.	*clavata*	Indigenous
Caryophyllaceae	*Silene*	*burchellii*	subsp.	*pilosellifolia*	Indigenous

Family	*Genus*	*Sp1*	Rank1	*Sp2*	Ecology
Scrophulariaceae	*Diclis*	*rotundifolia*			Indigenous
Polygalaceae	*Polygala*	*gracilenta*			Indigenous
Amaryllidaceae	*Crinum*	*graminicola*			Indigenous
Asteraceae	*Haplocarpha*	*scaposa*			Indigenous
Fabaceae	*Indigofera*	*hilaris*	var.	*hilaris*	Indigenous
Convolvulaceae	*Ipomoea*	*crassipes*	var.	*crassipes*	Indigenous
Hyacinthaceae	*Dipcadi*	*viride*			Indigenous
Aponogetonaceae	*Aponogeton*	*junceus*			Indigenous
Asteraceae	*Dimorphotheca*	*caulescens*			Indigenous
Asteraceae	*Schkuhria*	*pinnata*			notIndigenous; Naturalised
Fabaceae	*Erythrina*	*zeyheri*			Indigenous
Poaceae	*Elionurus*	*muticus*			Indigenous
Cyperaceae	*Scirpoides*	*burkei*			Indigenous
Cyperaceae	*Cyperus*	*longus*	var.	*longus*	Indigenous
Poaceae	*Koeleria*	*capensis*			Indigenous
Hyacinthaceae	*Albuca*	*baurii*			Indigenous
Solanaceae	*Solanum*	*campylacanthum*	subsp.	*panduriforme*	Indigenous

Family	*Genus*	*Sp1*	Rank1	*Sp2*	Ecology
Convolvulaceae	*Convolvulus*	*arvensis*			notIndigenous; Naturalised; Invasive
Apocynaceae	*Asclepias*	*aurea*			Indigenous
Fabaceae	*Vigna*	*oblongifolia*	var.	*oblongifolia*	Indigenous
Apocynaceae	*Brachystelma*	*foetidum*			Indigenous
Scrophulariaceae	*Jamesbrittenia*	*sp.*			
Cyperaceae	*Pycreus*	*chrysanthus*			Indigenous
Rubiaceae	*Pentanisia*	*angustifolia*			Indigenous
Poaceae	*Eragrostis*	*capensis*			Indigenous
Poaceae	*Eragrostis*	*obtusa*			Indigenous
Euphorbiaceae	*Acalypha*	*angustata*			Indigenous
Amaranthaceae	*Gomphrena*	*celosioides*			notIndigenous; Naturalised
Asteraceae	*Conyza*	*bonariensis*			notIndigenous; Naturalised
Orobanchaceae	*Cycnium*	*tubulosum*	subsp.	*tubulosum*	Indigenous
Santalaceae	*Thesium*	*scirpioides*			Indigenous
Asteraceae	*Osteospermum*	*scariosum*	var.	*scariosum*	Indigenous
Asteraceae	*Senecio*	*affinis*			Indigenous
Caryophyllaceae	*Cerastium*	*capense*			Indigenous

Family	*Genus*	*Sp1*	Rank1	*Sp2*	Ecology
Polygalaceae	*Polygala*	*africana*			Indigenous
Hypoxidaceae	*Hypoxis*	*argentea*	var.	*argentea*	Indigenous
Gentianaceae	*Chironia*	*purpurascens*	subsp.	*humilis*	Indigenous
Malvaceae	*Hermannia*	*sp.*			
Lobeliaceae	*Monopsis*	*decipiens*			Indigenous
Cyperaceae	*Cyperus*	*obtusiflorus*	var.	*flavissimus*	Indigenous
Iridaceae	*Hesperantha*	*longicollis*			Indigenous
Malvaceae	*Hibiscus*	*aethiopicus*	var.	*ovatus*	Indigenous
Polygalaceae	*Polygala*	*transvaalensis*			Indigenous
Asteraceae	*Helichrysum*	*rugulosum*			Indigenous
Scrophulariaceae	*Hebenstretia*	*rehmannii*			Indigenous; Endemic
Commelinaceae	*Commelina*	*africana*	var.	*krebsiana*	Indigenous
Apocynaceae	*Asclepias*	*multicaulis*			Indigenous
Poaceae	*Heteropogon*	*contortus*			Indigenous
Convolvulaceae	*Ipomoea*	*ommanneyi*			Indigenous
Euphorbiaceae	*Euphorbia*	*inaequilatera*	var.	*inaequilatera*	Indigenous
Asteraceae	*Helichrysum*	*nudifolium*	var.	*nudifolium*	Indigenous
Scrophulariaceae	*Nemesia*	*fruticans*			Indigenous
Asteraceae	*Senecio*	*erubescens*	var.	*erubescens*	Indigenous; Endemic

Family	*Genus*	*Sp1*	Rank1	*Sp2*	Ecology
Apiaceae	*Afrosciadium*	*magalismontanum*			Indigenous
Asteraceae	*Schistostephium*	*crataegifolium*			Indigenous
Asteraceae	*Felicia*	*muricata*	subsp.	*muricata*	Indigenous
Thymelaeaceae	*Gnidia*	*gymnostachya*			Indigenous
Malvaceae	*Hibiscus*	*microcarpus*			Indigenous
Fabaceae	*Trifolium*	*africanum*	var.	*africanum*	Indigenous
Scrophulariaceae	*Selago*	*densiflora*			Indigenous
Hypoxidaceae	*Hypoxis*	*rigidula*	var.	*rigidula*	Indigenous
Polygonaceae	*Rumex*	*acetosella*	subsp.	*angiocarpus*	notIndigenous; Naturalised
Caryophyllaceae	*Silene*	*undulata*			Indigenous
Asteraceae	*Senecio*	*sp.*			
Boraginaceae	*Cynoglossum*	*hispidum*			Indigenous
Asteraceae	*Tolpis*	*capensis*			Indigenous
Cucurbitaceae	*Cucumis*	*myriocarpus*	subsp.	*myriocarpus*	Indigenous
Hyacinthaceae	*Schizocarphus*	*nervosus*			Indigenous
Commelinaceae	*Commelina*	*benghalensis*			Indigenous
Apocynaceae	*Aspidoglossum*	*lamellatum*			Indigenous
Valerianaceae	*Valeriana*	*capensis*	var.	*capensis*	Indigenous

Family	*Genus*	*Sp1*	Rank1	*Sp2*	Ecology
Asteraceae	*Gazania*	*sp.*			
Hypoxidaceae	*Hypoxis*	*multiceps*			Indigenous
Orobanchaceae	*Sopubia*	*cana*	var.	*cana*	Indigenous
Asteraceae	*Senecio*	*bupleuroides*			Indigenous
Poaceae	*Fingerhuthia*	*sesleriiformis*			Indigenous
Agavaceae	*Chlorophytum*	*fasciculatum*			Indigenous
Fabaceae	*Melolobium*	*alpinum*			Indigenous
Fabaceae	*Listia*	*heterophylla*			Indigenous
Iridaceae	*Gladiolus*	*sericeovillosus*	subsp.	*sericeovillosus*	Indigenous; Endemic
Geraniaceae	*Monsonia*	*brevirostrata*			Indigenous; Endemic
Lobeliaceae	*Lobelia*	*sonderiana*			Indigenous
Fabaceae	*Lessertia*	*frutescens*	subsp.	*microphylla*	Indigenous
Cyperaceae	*Cyperus*	*esculentus*	var.	*esculentus*	Indigenous
Geraniaceae	*Pelargonium*	*luridum*			Indigenous
Geraniaceae	*Geranium*	*multisectum*			Indigenous; Endemic
Asteraceae	*Gnaphalium*	*filagopsis*			Indigenous
Hyacinthaceae	*Ledebouria*	*ovatifolia*			Indigenous; Endemic
Fabaceae	*Eriosema*	*simulans*			Indigenous
Asteraceae	*Helichrysum*	*nudifolium*	var.	*pilosellum*	Indigenous

Family	*Genus*	*Sp1*	Rank1	*Sp2*	Ecology
Iridaceae	*Gladiolus*	*longicollis*	subsp.	*platypetalus*	Indigenous
Fabaceae	*Dolichos*	*falciformis*			Indigenous
Asphodelaceae	*Bulbine*	*capitata*			Indigenous
Solanaceae	*Solanum*	*lichtensteinii*			Indigenous
Anacardiaceae	*Searsia*	*dentata*			Indigenous
Rubiaceae	*Galium*	*capense*	subsp.	*capense*	Indigenous
Amaryllidaceae	*Crinum*	*bulbispermum*			Indigenous
Asteraceae	*Hilliardiella*	*oligocephala*			Indigenous
Asteraceae	*Berkheya*	*setifera*			Indigenous
Onagraceae	*Oenothera*	*tetraptera*			notIndigenous; Naturalised
Fabaceae	*Pearsonia*	*sessilifolia*	subsp.	*sessilifolia*	Indigenous
Pontederiaceae	*Pontederia*	*cordata*	var.	*ovalis*	notIndigenous; Naturalised

Appendix C: Site Plant List

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

Family	Species	Threat Status	Grassland	Riparian	Rocky	Disturbed	Pans
Asteraceae	*Hypochaeris radicata*	LC	x				
Asteraceae	*Senecio inaequidens*	LC	x				
Asteraceae	*Senecio inornatus*	LC	x				
Asteraceae	*Senecio sp.*		x				
Asteraceae	*Seriphium plumosum*	LC	x			x	
Asteraceae	*Tagetes minuta*	Alien				x	
Asteraceae	*Taraxacum offininale*	Alien				x	
Asteraceae	*Vernonia centaureoides*	LC	x		x		
Asteraceae	*Xanthium strumarium*	Alien					
Cactaceae	*Opuntia ficus-indica*	Alien					
Campanulaceae	*Wahlenbergia sp.*		x		x		
Capparaceae	*Cleome maculata*	LC			x		
Caryophyllaceae	*Silene burchellii*	LC	x				
Chrysobalanaceae	*Parinari capensis*	LC			x		
Commelinaceae	*Commelina africana*	LC	x	x			
Commelinaceae	*Commelina bengalensis*	LC					
Commelinaceae	*Commelina subulata*	LC			x		
Convolvulaceae	*Ipomoea crassipes*	LC	x		x		
Convolvulaceae	*Ipomoea sp.*						
Crassulaceae	*Crassula alba*	LC			x		
Crassulaceae	*Crassula pellucida*	LC			x		
Cyperaceae	*Cyperus congestus*	LC		x			
Cyperaceae	*Cyperus esculentus*	LC		x			
Cyperaceae	*Cyperus semitrifidus*	LC		x			x
Cyperaceae	*Schoenoplectus brachyceras*	LC		x			
Cyperaceae	*Schoenoplectus corymbosus*	LC		x			
Cyperaceae	*Schoenoplectus decipiens*	LC		x			
Ebenaceae	*Diospyros lycioides*	LC			x		
Ebenaceae	*Searsia dentata*	LC			x		

Family	Species	Threat Status	Grassland	Riparian	Rocky	Disturbed	Pans
Euphorbiaceae	*Acalypha angustata*	LC	x		x		
Euphorbiaceae	*Euphorbia clavarioides*	LC			x		
Fabaceae	*Acacia mearnsii*	Alien					
Fabaceae	*Erythrina zeyheria*	LC	x				
Fabaceae	*Polygala hottentotta*	LC			x		
Fabaceae	*Tephrosia sp.*		x				
Fabaceae	*Trifolium africanum*	LC	x		x	x	
Fabaceae	*Vigna vexillata*	LC				x	
Gentianaceae	*Chironia palustris*	LC	x				
Gentianaceae	*Sebaea grandis*	LC	x				
Geraniaceae	*Dianthus mooiensis*	LC	x		x		
Geraniaceae	*Monsonia grandifolia*	LC	x				
Geraniaceae	*Pelargonium luridum*	LC	x	x			
Hyacinthaceae	*Eucomus autumnalis*	Declining		x			
Hyacinthaceae	*Ledebouria sp.*			x			
Juncaceae	*Juncus effusus*	LC		x		x	
Juncaceae	*Juncus exsertus*	LC		x			
Lamiaceae	*Acrotome hispida*	LC	x				
Lamiaceae	*Leonotis leonurus*	LC			x		
Lobeliaceae	*Monopsis decipiens*	LC		x			
Malvaceae	*Hermannia depressa*	LC	x				
Malvaceae	*Hermannia transvaalensis*	LC	x				
Malvaceae	*Hibiscus pusilis*		x			x	
Malvaceae	*Hibiscus trionum*		x				
Mesembreanthemaceae	*Delosperma cooperi*	LC			x		
Mesembreanthemaceae	*Khadia sp.*				x		
Molluginaceae	*Psammotropha myriantha*	LC			x		

Family	Species	Threat Status	Grassland	Riparian	Rocky	Disturbed	Pans
Molluginaceae	*Psammotropha sp.*				x		
Myrtaceae	*Eucalyptus camuldulensis*	Alien					
Onagraceae	*Oenothera rosea*	LC				x	
Orobanchaceae	*Alectra capensis*	LC		x			
Orobanchaceae	*Cynium tubulosum*	LC					
Oxalaceae	*Oxalis sp.*		x	x		x	
Oxalidaceae	*Oxalis corniculata*	LC	x				
Plantaginaceae	*Plantago minor*	LC	x		x		
Poaceae	*Agrostis lachnantha*	LC	x	x			x
Poaceae	*Andropogon appendiculatus*	LC	x			x	
Poaceae	*Andropogon eucomus*	LC	x				x
Poaceae	*Andropogon huillensis*	LC	x				
Poaceae	*Aristida congesta subsp. barbicollis*	LC	x		x	x	x
Poaceae	*Arundinella nepalensis*	LC		x			
Poaceae	*Bromus catharticus*	LC	x				
Poaceae	*Ctenium concinnum*	LC			x		
Poaceae	*Cynodon dactylon*	LC	x	x	x	x	
Poaceae	*Eragrostis capensis*	LC	x			x	
Poaceae	*Eragrostis curvula*	LC	x	x		x	
Poaceae	*Eragrostis gummiflua*	LC	x	x	x		x
Poaceae	*Eragrostis racemosa*	LC	x		x		
Poaceae	*Fingerhuthia africana*	LC	x				
Poaceae	*Hyparrhenia hirta*	LC	x	x	x	x	
Poaceae	*Hyparrhenia tamba*	LC	x				
Poaceae	*Imperata cylindrica*	LC	x	x			
Poaceae	*Leersia hexandra*	LC		x			
Poaceae	*Melinis nerviglumis*	LC			x		
Poaceae	*Melinis repens*	LC			x		

Family	Species	Threat Status	Grassland	Riparian	Rocky	Disturbed	Pans
Poaceae	*Panicum coloratum*	LC	x				
Poaceae	*Paspalum dilatatum*	LC					
Poaceae	*Paspalum notatum*	Alien		x		x	
Poaceae	*Setaria sphacelata*	LC		x			
Poaceae	*Sporobolus africanus*	LC	x			x	
Poaceae	*Sporobolus pyramidalis*	LC	x		x	x	
Poaceae	*Themeda triandra*	LC	x		x		
Poaceae	*Trichoneura grandiglumis*	Alien			x		
Poaceae	*Tristachya leucothrix*	LC			x		
Polygonaceae	*Persicaria lapathifolia*	LC					x
Polygonaceae	*Persicaria senegalensis*	LC					x
Rubiaceae	*Pentanisia prunelloides*	LC	x		x		
Salicaceae	*Salix babylonica*	Alien		x			
Scrophulariaceae	*Chaenostoma leve*	No status	x				
Scrophulariaceae	*Selago densiflora*	LC			x		
Sellaginellaceae	*Selaginella dregei*	LC			x		
Sinopteridaceae	*Pellaea calemelanos*	LC			x		
Solanaceae	*Datura ferox*	Alien					
Solanaceae	*Solanum sp.*	Alien					
Solanaceae	*Solanum sysimbriifolium*	Alien	x				
Thymeleaceae	*Gnidia kraussiana*	LC			x		
Typhaceae	*Typha capensis*	LC		x			
Verbenaceae	*Verbena brasiliensis*	Alien	x	x	x	x	x

Appendix D: Expected Mammals List

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

Expected Bats

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

Appendix E: Expected Bird List

QDGC	Common_name	Taxon_name
2629AD	Ostrich, Common	*Struthio camelus*
2629AD	Quail, Common	*Coturnix coturnix*
2629AD	Spurfowl, Swainson's	*Pternistis swainsonii*
2629AD	Francolin, Red-winged	*Scleroptila levaillantii*
2629AD	Francolin, Orange River	*Scleroptila levaillantoides*
2629AD	Guineafowl, Helmeted	*Numida meleagris*
2629AD	Duck, White-faced	*Dendrocygna viduata*
2629AD	Goose, Egyptian	*Alopochen aegyptiacus*
2629AD	Teal, Cape	*Anas capensis*
2629AD	Teal, Red-billed	*Anas erythrorhyncha*
2629AD	Duck, Mallard	*Anas platyrhynchos*
2629AD	Shoveler, Cape	*Anas smithii*
2629AD	Duck, African Black	*Anas sparsa*
2629AD	Duck, Yellow-billed	*Anas undulata*
2629AD	Pochard, Southern	*Netta erythrophthalma*
2629AD	Duck, Maccoa	*Oxyura maccoa*
2629AD	Goose, Spur-winged	*Plectropterus gambensis*
2629AD	Duck, Comb	*Sarkidiornis melanotos*
2629AD	Shelduck, South African	*Tadorna cana*
2629AD	Honeyguide, Lesser	*Indicator minor*
2629AD	Woodpecker, Cardinal	*Dendropicos fuscescens*
2629AD	Wryneck, Red-throated	*Jynx ruficollis*
2629AD	Barbet, Black-collared	*Lybius torquatus*
2629AD	Barbet, Crested	*Trachyphonus vaillantii*
2629AD	Barbet, Acacia Pied	*Tricholaema leucomelas*
2629AD	Hoopoe, African	*Upupa africana*
2629AD	Wood-hoopoe, Green	*Phoeniculus purpureus*
2629AD	Kingfisher, Malachite	*Alcedo cristata*
2629AD	Kingfisher, Pied	*Ceryle rudis*
2629AD	Kingfisher, Giant	*Megaceryle maximus*
2629AD	Mousebird, Speckled	*Colius striatus*

QDGC	Common_name	Taxon_name
2629AD	Mousebird, Red-faced	*Urocolius indicus*
2629AD	Cuckoo, Diderick	*Chrysococcyx caprius*
2629AD	Cuckoo, Red-chested	*Cuculus solitarius*
2629AD	Swift, Little	*Apus affinis*
2629AD	Swift, African Black	*Apus barbatus*
2629AD	Swift, White-rumped	*Apus caffer*
2629AD	Swift, Horus	*Apus horus*
2629AD	Palm-swift, African	*Cypsiurus parvus*
2629AD	Owl, Marsh	*Asio capensis*
2629AD	Eagle-owl, Spotted	*Bubo africanus*
2629AD	Pigeon, Speckled	*Columba guinea*
2629AD	Dove, Rock	*Columba livia*
2629AD	Turtle-dove, Cape	*Streptopelia capicola*
2629AD	Dove, Red-eyed	*Streptopelia semitorquata*
2629AD	Dove, Laughing	*Streptopelia senegalensis*
2629AD	Korhaan, Blue	*Eupodotis caerulescens*
2629AD	Crake, African	*Crecopsis egregia*
2629AD	Coot, Red-knobbed	*Fulica cristata*
2629AD	Moorhen, Lesser	*Gallinula angulata*
2629AD	Moorhen, Common	*Gallinula chloropus*
2629AD	Swamphen, African Purple	*Porphyrio madagascariensis*
2629AD	Sandpiper, Common	*Actitis hypoleucos*
2629AD	Stint, Little	*Calidris minuta*
2629AD	Snipe, African	*Gallinago nigripennis*
2629AD	Ruff, Ruff	*Philomachus pugnax*
2629AD	Sandpiper, Wood	*Tringa glareola*
2629AD	Greenshank, Common	*Tringa nebularia*
2629AD	Thick-knee, Spotted	*Burhinus capensis*
2629AD	Plover, Kittlitz's	*Charadrius pecuarius*
2629AD	Plover, Three-banded	*Charadrius tricollaris*
2629AD	Stilt, Black-winged	*Himantopus himantopus*

QDGC	Common_name	Taxon_name
2629AD	Avocet, Pied	*Recurvirostra avosetta*
2629AD	Lapwing, Blacksmith	*Vanellus armatus*
2629AD	Lapwing, Crowned	*Vanellus coronatus*
2629AD	Lapwing, African Wattled	*Vanellus senegallus*
2629AD	Pratincole, Black-winged	*Glareola nordmanni*
2629AD	Tern, Whiskered	*Chlidonias hybrida*
2629AD	Gull, Grey-headed	*Larus cirrocephalus*
2629AD	Sparrowhawk, Black	*Accipiter melanoleucus*
2629AD	Buzzard, Jackal	*Buteo rufofuscus*
2629AD	Buzzard, Steppe	*Buteo vulpinus*
2629AD	Harrier, Montagu's	*Circus pygargus*
2629AD	Kite, Black-shouldered	*Elanus caeruleus*
2629AD	Harrier-Hawk, African	*Polyboroides typus*
2629AD	Secretarybird, Secretarybird	*Sagittarius serpentarius*
2629AD	Falcon, Amur	*Falco amurensis*
2629AD	Falcon, Lanner	*Falco biarmicus*
2629AD	Kestrel, Lesser	*Falco naumanni*
2629AD	Kestrel, Greater	*Falco rupicoloides*
2629AD	Grebe, Great Crested	*Podiceps cristatus*
2629AD	Grebe, Black-necked	*Podiceps nigricollis*
2629AD	Grebe, Little	*Tachybaptus ruficollis*
2629AD	Darter, African	*Anhinga rufa*
2629AD	Cormorant, Reed	*Phalacrocorax africanus*
2629AD	Cormorant, White-breasted	*Phalacrocorax carbo*
2629AD	Heron, Grey	*Ardea cinerea*
2629AD	Heron, Goliath	*Ardea goliath*
2629AD	Heron, Black-headed	*Ardea melanocephala*
2629AD	Heron, Purple	*Ardea purpurea*
2629AD	Heron, Squacco	*Ardeola ralloides*
2629AD	Egret, Cattle	*Bubulcus ibis*
2629AD	Egret, Great	*Egretta alba*

QDGC	Common_name	Taxon_name
2629AD	Egret, Yellow-billed	*Egretta intermedia*
2629AD	Egret, Little	*Egretta garzetta*
2629AD	Night-Heron, Black-crowned	*Nycticorax nycticorax*
2629AD	Hamerkop, Hamerkop	*Scopus umbretta*
2629AD	Flamingo, Lesser	*Phoenicopterus minor*
2629AD	Flamingo, Greater	*Phoenicopterus ruber*
2629AD	Ibis, Hadeda	*Bostrychia hagedash*
2629AD	Ibis, Southern Bald	*Geronticus calvus*
2629AD	Spoonbill, African	*Platalea alba*
2629AD	Ibis, Glossy	*Plegadis falcinellus*
2629AD	Ibis, African Sacred	*Threskiornis aethiopicus*
2629AD	Stork, White	*Ciconia ciconia*
2629AD	Fiscal, Common (Southern)	*Lanius collaris*
2629AD	Shrike, Red-backed	*Lanius collurio*
2629AD	Shrike, Lesser Grey	*Lanius minor*
2629AD	Crow, Pied	*Corvus albus*
2629AD	Paradise-flycatcher, African	*Terpsiphone viridis*
2629AD	Robin-chat, Cape	*Cossypha caffra*
2629AD	Flycatcher, Spotted	*Muscicapa striata*
2629AD	Chat, Anteating	*Myrmecocichla formicivora*
2629AD	Wheatear, Mountain	*Oenanthe monticola*
2629AD	Wheatear, Capped	*Oenanthe pileata*
2629AD	Stonechat, African	*Saxicola torquatus*
2629AD	Flycatcher, Fiscal	*Sigelus silens*
2629AD	Thrush, Olive	*Turdus olivaceus*
2629AD	Thrush, Karoo	*Turdus smithi*
2629AD	Myna, Common	*Acridotheres tristis*
2629AD	Starling, Wattled	*Creatophora cinerea*
2629AD	Starling, Cape Glossy	*Lamprotornis nitens*
2629AD	Starling, Pied	*Spreo bicolor*
2629AD	House-martin, Common	*Delichon urbicum*

QDGC	Common_name	Taxon_name
2629AD	Swallow, White-throated	*Hirundo albigularis*
2629AD	Swallow, Greater Striped	*Hirundo cucullata*
2629AD	Martin, Rock	*Hirundo fuligula*
2629AD	Swallow, Barn	*Hirundo rustica*
2629AD	Cliff-swallow, South African	*Hirundo spilodera*
2629AD	Martin, Banded	*Riparia cincta*
2629AD	Martin, Brown-throated	*Riparia paludicola*
2629AD	Bulbul, Dark-capped	*Pycnonotus tricolor*
2629AD	Cisticola, Wing-snapping	*Cisticola ayresii*
2629AD	Cisticola, Pale-crowned	*Cisticola cinnamomeus*
2629AD	Cisticola, Zitting	*Cisticola juncidis*
2629AD	Cisticola, Wailing	*Cisticola lais*
2629AD	Cisticola, Cloud	*Cisticola textrix*
2629AD	Cisticola, Levaillant's	*Cisticola tinniens*
2629AD	Prinia, Black-chested	*Prinia flavicans*
2629AD	White-eye, Cape	*Zosterops virens*
2629AD	Reed-warbler, Great	*Acrocephalus arundinaceus*
2629AD	Reed-warbler, African	*Acrocephalus baeticatus*
2629AD	Swamp-warbler, Lesser	*Acrocephalus gracilirostris*
2629AD	Warbler, Dark-capped Yellow	*Chloropeta natalensis*
2629AD	Warbler, Willow	*Phylloscopus trochilus*
2629AD	Lark, Red-capped	*Calandrella cinerea*
2629AD	Lark, Spike-heeled	*Chersomanes albofasciata*
2629AD	Lark, Eastern Clapper	*Mirafra fasciolata*
2629AD	Sunbird, Malachite	*Nectarinia famosa*
2629AD	Finch, Red-headed	*Amadina erythrocephala*
2629AD	Waxbill, Orange-breasted	*Amandava subflava*
2629AD	Finch, Cuckoo	*Anomalospiza imberbis*
2629AD	Pipit, African	*Anthus cinnamomeus*
2629AD	Waxbill, Common	*Estrilda astrild*
2629AD	Bishop, Yellow-crowned	*Euplectes afer*

QDGC	Common_name	Taxon_name
2629AD	Widowbird, White-winged	*Euplectes albonotatus*
2629AD	Widowbird, Red-collared	*Euplectes ardens*
2629AD	Widowbird, Fan-tailed	*Euplectes axillaris*
2629AD	Bishop, Southern Red	*Euplectes orix*
2629AD	Widowbird, Long-tailed	*Euplectes progne*
2629AD	Longclaw, Cape	*Macronyx capensis*
2629AD	Wagtail, Cape	*Motacilla capensis*
2629AD	Quailfinch, African	*Ortygospiza atricollis*
2629AD	Sparrow, Southern Grey-headed	*Passer diffusus*
2629AD	Sparrow, House	*Passer domesticus*
2629AD	Sparrow, Cape	*Passer melanurus*
2629AD	Weaver, Cape	*Ploceus capensis*
2629AD	Southern Masked-weaver, Southern	*Ploceus velatus*
2629AD	Quelea, Red-billed	*Quelea quelea*
2629AD	Mannikin, Bronze	*Spermestes cucullatus*
2629AD	Whydah, Pin-tailed	*Vidua macroura*
2629AD	Canary, Black-throated	*Crithagra atrogularis*
2629AD	Canary, Cape	*Serinus canicollis*
2629AD	Canary, Yellow	*Crithagra flaviventris*
QDGC	Common_name	*Taxon_name*
2629AC	Duck, White-backed	*Thalassornis leuconotus*
2629AC	Teal, Hottentot	*Anas hottentota*
2629AC	Swift, Common	*Apus apus*
2629AC	Dove, Namaqua	*Oena capensis*
2629AC	Crane, Blue	*Anthropoides paradiseus*
2629AC	Crake, Black	*Amaurornis flavirostris*
2629AC	Flufftail, Red-chested	*Sarothrura rufa*
2629AC	Sandpiper, Curlew	*Calidris ferruginea*
2629AC	Sandpiper, Marsh	*Tringa stagnatilis*
2629AC	Tern, White-winged	*Chlidonias leucopterus*
2629AC	Tern, Caspian	*Sterna caspia*

QDGC	Common_name	Taxon_name
2629AC	Harrier, Pallid	*Circus macrourus*
2629AC	Marsh-harrier, African	*Circus ranivorus*
2629AC	Fish-eagle, African	*Haliaeetus vocifer*
2629AC	Eagle, Long-crested	*Lophaetus occipitalis*
2629AC	Kite, Yellow-billed	*Milvus aegyptius*
2629AC	Falcon, Red-footed	*Falco vespertinus*
2629AC	Heron, Black	*Egretta ardesiaca*
2629AC	Bittern, Little	*Ixobrychus minutus*
2629AC	Crow, Cape	*Corvus capensis*
2629AC	Flycatcher, Fairy	*Stenostira scita*
2629AC	Bokmakierie, Bokmakierie	*Telophorus zeylonus*
2629AC	Neddicky, Neddicky	*Cisticola fulvicapilla*
2629AC	Prinia, Tawny-flanked	*Prinia subflava*
2629AC	Rush-warbler, Little	*Bradypterus baboecala*
2629AC	Sparrowlark, Chestnut-backed	*Eremopterix leucotis*
2629AC	Pipit, Plain-backed	*Anthus leucophrys*
2629AC	Sparrow-weaver, White-browed	*Plocepasser mahali*
2629AC	Weaver, Village	*Ploceus cucullatus*
2629AC	Seedeater, Streaky-headed	*Crithagra gularis*
2629AC	Canary, Yellow-fronted	*Crithagra mozambicus*
2629CB	Francolin, Grey-winged	*Scleroptila africanus*
2629CB	Parakeet, Rose-ringed	*Psittacula krameri*
2629CB	Kestrel, Rock	*Falco rupicolus*
2629CB	Openbill, African	*Anastomus lamelligerus*
2629CB	Oriole, Black-headed	*Oriolus larvatus*
2629CB	Thrush, Groundscraper	*Psophocichla litsipsirupa*
2629CB	Warbler, Sedge	*Acrocephalus schoenobaenus*
2629CB	Lark, Rufous-naped	*Mirafra africana*
2629CB	Lark, Pink-billed	*Spizocorys conirostris*
2629CB	Pipit, Yellow-breasted	*Anthus chloris*
2629CB	Bunting, Cinnamon-breasted	*Emberiza tahapisi*

QDGC	Common_name	Taxon_name
2629CA	Duck, Fulvous	*Dendrocygna bicolor*
2629CA	Buttonquail, Kurrichane	*Turnix sylvaticus*
2629CA	Turnstone, Ruddy	*Arenaria interpres*
2629CA	Painted-snipe, Greater	*Rostratula benghalensis*
2629CA	Plover, Common Ringed	*Charadrius hiaticula*
2629CA	Plover, White-fronted	*Charadrius marginatus*
2629CA	Plover, Chestnut-banded	*Charadrius pallidus*
2629CA	Cisticola, Desert	*Cisticola aridulus*
2629CA	Warbler, Marsh	*Acrocephalus palustris*
2629CA	Wagtail, Yellow	*Motacilla flava*

Appendix F: Expected Herpetafauna List

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

Family	Species	Common Name
Scincidea	*Trachylepsis striata*	Striped skink
Typhlopidae	*Typhlops bibronii*	Bibron's blind snake
Varanidea	*Veranus niloticus*	Water monitor
Viperidea	*Causus rhombeatus*	Rhombic night adder
Viperidea	*Bitis arietans*	Puff adder

Amphibians

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