ECOLOGICAL BASIC ASSESSMENT REPORT

PROPOSED ZONNEBLOEM SWITCHING STATION (132/22KV) AND TWO LOOP-IN LOOP-OUT POWER LINES (132KV), MPUMALANGA PROVINCE

March 2018

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DECLARATION OF CONSULTANT'S INDEPENDENCE

I, Gerhard Botha, as the appointed specialist hereby declare that I:

- » act/ed as the independent specialist in this application;
- » regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- » do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- » have and will not have no vested interest in the proposed activity proceeding;
- » have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- » am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 326) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- » have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- » am aware that a false declaration is an offence in terms of regulation 48 of GN No. R. 326.

Gerhard Botha Pr.Sci.Nat 400502/14 (Botanical and Ecological Science)
March 2018

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1 INTRODUCTION

1.1 Applicant

Eskom Holdings SOC Limited.

1.2 Project

The project will be referred to as the two loop-in-loop-out (LILO) 132kV chickadee power lines from the existing Mafube/Pan Traction to the new Zonnebloem Switching Station.

1.3 Proposed Activity

Eskom Holdings SOC Ltd is proposing the establishment of the new Zonnebloem 132/22kV switching station and two loop-in loop-out power lines (132kV) connecting to the existing Mafube/Pan Traction power line approximately 25km east of Middelburg. Each power line will be 500m in length. The infrastructure associated with the switching station will include a new access road and a communication tower.

1.4 Terms of reference

The most important objective of this Ecological Impact Assessment is to determine the impacts that the proposed activity may have on the ecological character of the study area. The following are the tasks/objectives of the study:

» Field visit to identify important ecological features and habitats associated with the proposed study area as well as important (conservation worthy floral and faunal species that will potentially use these niches/features;
» A description of the current fauna and flora within the study area and the identification of Red Data Species potentially affected by the proposed development and associated infrastructure;
» Integration of the site data collected within faunal and floral databases (POSA, SANBI, SIBIS & ADU Databases) and counts within the area to develop a comprehensive database likely to be present within the development footprint;
» Identify potential negative impacts associated with the Zonnebloem Switching Station and associated infrastructure on the ecological integrity of the study

area (including faunal and floral diversity and species composition) and assess the significance of these impacts;
» To provide recommended mitigation measures for the potential impacts in order to avert or lower the significance of the negative impacts on the ecology of the study area.

1.5 Conditions of this report

Findings, recommendations and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of compilation. No form of this report may be amended or extended without the prior written consent of the author. Any recommendations, statements or conclusions drawn from or based on this report must clearly cite or make reference to this report. Whenever such recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety.

1.6 Limitations and Assumptions of the Study Approach

1.6.1 General assumptions

» This study assumes that the project proponent will always strive to avoid, mitigate and/or offset potentially negative project related impacts on the environment, with impact avoidance being considered the most successful approach, followed by mitigation and offset. It is further assumed that the project proponent will seek to enhance potential positive impacts on the environment.
» GIS spatial datasets used as part of the field surveys (site demarcation) and analyses are accurate.
» The project proponent will commission an additional study to assess the impact(s) if there is a change in the size, location and/or extent of the study area that is likely to have a potentially highly significant and/ or unavoidable impact on the natural environment.
» This study and the methodology used represents a sufficiently conservative and cautious approach which takes the study limitations into account.

The following refers to general limitations that affect the applicability of information represented within this report (also refer to Conditions of the Report):
» This report specifically focuses on the ecology of the area and immediate surroundings in terms of the phytosociology of the area.
» The faunal species lists for the site are those which were observed at the site, as well as those which may occur in the area based on distribution records and habitat requirements.

» Accuracy of the maps, routes and desktop assessments is based on the current 1:50 000 topographical map series of South Africa;
» Accuracy of Global Positioning System (GPS) coordinates was limited to 4m accuracy in the field.
» A single survey limited the amount of flora and flora identified at the site. In order to obtain a thorough comprehensive understanding of the dynamics of communities and the status of conservation worthy species[1] in an area, vegetation and faunal assessments should always consider investigations in terms of different time scales (across seasons/years) and through replication. However, due to time constraints, such long-term studies are not feasible and most conclusions will be based on instantaneous sampling bouts. Limitations associated with this method of sampling are as follows:
    - Temporal changes in biodiversity are not taken into account during instantaneous sampling bouts;
    - Variations in biodiversity due to temporal animal movements, such as migrations, are not taken into account;
    - Unusual environmental conditions (such as unusually high or unusually low rainfall) may cause unusual states of biodiversity during the period of study, which may not exist otherwise;
    - Imagery obtained was only 2.5m per pixel, thus the ability to accurately map vegetation communities was severely limited;
    - Time and budget constraints do not allow for an intensive survey of the entire project area, and as with any survey of this kind, rare and cryptic species may be overlooked during the study; and
    - Every possible precaution was taken to reduce the effect of the above-mentioned limitations on the data collected for this study.
» While every care is taken to ensure that the data presented are qualitatively adequate, inevitably conditions are never such that that is possible. The nature of the vegetation, seasonality, human intervention etc. limit the veracity of the material presented.
» Some of the hydrological systems located within the study area form part of larger systems expanding well beyond the focus area. Although their extent and down- / upstream nature and functions were taken into account, the focus of the study was restricted to the affected farm property.

1.7 Relevant legislation

The following legislation was taken into account whilst compiling this report:

Provincial

» The Mpumalanga Nature Conservation Act (Act 10 of 1998), in its entirety, with special reference to:

[1] Conservation worthy species refers to all endemic, rare or threatened species.

- Schedule 1: Specially Protected Game
- Schedule 2: Protected Game
- Schedule 4: Protected Wild Animals
- Schedule 7: Invertebrates
- Schedule 11: Protected Plants
- Schedule 12: Specially Protected Plants
- Schedule 13: Invader Weeds and Plants

The above-mentioned Nature Conservation Act accompanied by all amendments are regarded by the Mpumalanga Province as the legal binding, provincial documents, providing regulations, guidelines and procedures with the aim of protecting game and fish, the conservation of flora and fauna, and the destruction of problematic (vermin and invasive) species.

National

» National Environmental Management Act / NEMA (Act No 107 of 1998), and all amendments and supplementary listings and/or regulations
» Environment Conservation Act (ECA) (No 73 of 1989) and amendments
» National Environmental Management: Biodiversity Act / NEMA:BA (Act No. 10 of 2004) and amendments
» National Forest Act 1998 / NFA (No 84 of 1998)
» National Veld and Forest Fire Act (Act No. 101 of 1998)
» Conservation of Agricultural Resources Act / CARA (Act No. 43 of 1983) and amendments

International

» Convention on International Trade in Endangered Species of Fauna and Flora (CITES)
» Convention on Biological Diversity, 1995

2 STUDY AREA

2.1 Locality

The proposed facility will be located on the:

- Remaining Extent of the Farm Patattafontein 412;
- Remaining Extent of the Farm Zevenfontein 415; and
- Portion 4 of the Farm Gemsbokfontein 411 (Figure 1).

The proposed site falls within the jurisdiction of the Steve Tshwete Local Municipality and within the greater Nkangala District Municipality in the Mpumalanga Province.

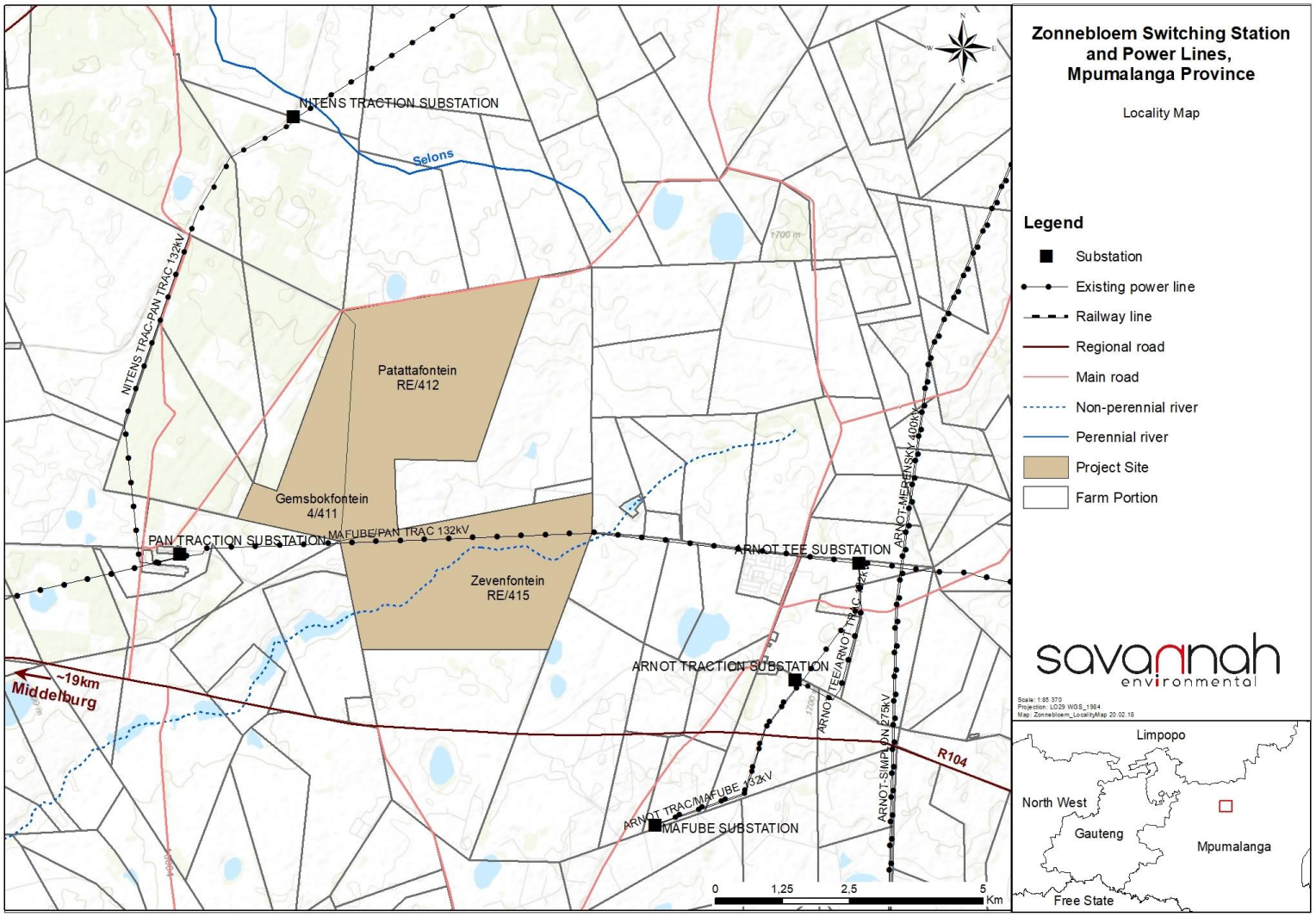


Figure 1: Locality map for the proposed Zonnebloem Switching Station and loop- development (courtesy of Savannah Environmental).

2.2 Climate and rainfall

The study area is situated in the subtropical high-pressure belt. The climate associated with the study area has been derived from recorded and extrapolated climatic data (https://en.climate-data.org/location/10646/) for Middelburg. The climate is regarded as mild, and generally warm and temperate. Rainfall for the region is relative moderate (683 mm) and peaks mainly during early to mid-summer months with very dry winters. Mean annual rainfall is as mentioned about 683 mm with November being the wettest month, averaging about 115 mm, and July being the driest, with an average of only 5 mm. The average annual temperature in Middelburg is 15.5°C with January being the warmest (Ave. 20.3°C) and June being the coldest (Ave 8.5°C). Frost is fairly infrequent (mean frost days around 13 days per year).

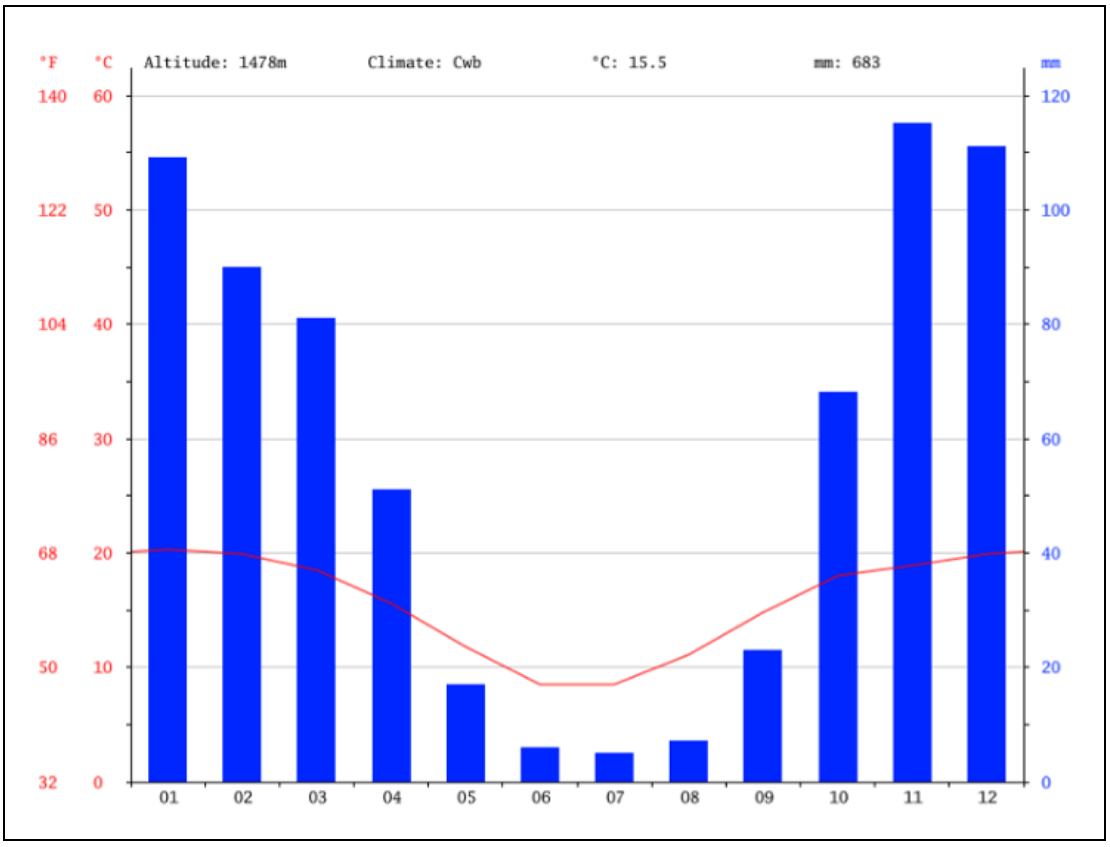


Figure 2: Climate graph of Middelburg (http://en.climate-data.org/location/10646/)

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	20.3	19.9	18.5	15.6	11.8	8.5	8.5	11.1	14.8	18	18.9	19.9
Min. Temperature (°C)	13.7	13.4	11.5	7.8	3	-1	-1	1.4	5.8	10.1	11.9	13.2
Max. Temperature (°C)	27	26.5	25.6	23.4	20.6	18.1	18.1	20.9	23.8	25.9	25.9	26.7
Avg. Temperature (°F)	68.5	67.8	65.3	60.1	53.2	47.3	47.3	52.0	58.6	64.4	66.0	67.8
Min. Temperature (°F)	56.7	56.1	52.7	46.0	37.4	30.2	30.2	34.5	42.4	50.2	53.4	55.8
Max. Temperature (°F)	80.6	79.7	78.1	74.1	69.1	64.6	64.6	69.6	74.8	78.6	78.6	80.1
Precipitation / Rainfall (mm)	109	90	81	51	17	6	5	7	23	68	115	111

Figure 3: Climate table of Middelburg (http://en.climate-data.org/location/10646/).

2.3 Physiography and soils

2.3.1 Landscape Features

According to Mucina and Rutherford (2006) the region can be described as highly variable with extensive sloping plains and a series of ridges slightly elevated over undulating surrounding plains. The landscape is furthermore covered by a species-rich, wiry, sour grassland alternating with low, sour shrubland on rocky outcrops and steeper slopes.

According to AGIS, 2007 the study area falls within a Ba19 land type and can be described as predominantly open plains or plateaus with low hills or ridges (local relief: 90 – 150m). Typically, the bulk of the B land type comprise of slopes less than 8% (between 50 and 80% of the antitype). Due to the undulating nature of the area the landscape regularly transitions between concave and convex shapes, generally with gradual slopes between 2 and 4%.

At a finer scale using a Google elevation profile for the study area, the area can be described as gradually sloping in a south-eastern direction with an average slope of 2% south-east. The study area is situated between elevations 1665m and 1636m.

» The western as well as north-western portion can be described as a higher lying area containing gentle, gradual slopes and moderate topographical variations. The general landscape shape of this section is largely convex to straight. A Wetland Flat located in the north-western corner contribute to this topographical variation and is situated within a shelf section of the slope.

» The eastern and south-eastern portion is characterised by a concave shape with a clear valley-bottom section. The slopes of this portion are more pronounced. Topographical features within this gradual sloping area includes seepages and a south to south-east flowing unchanneled valley-bottom wetland.

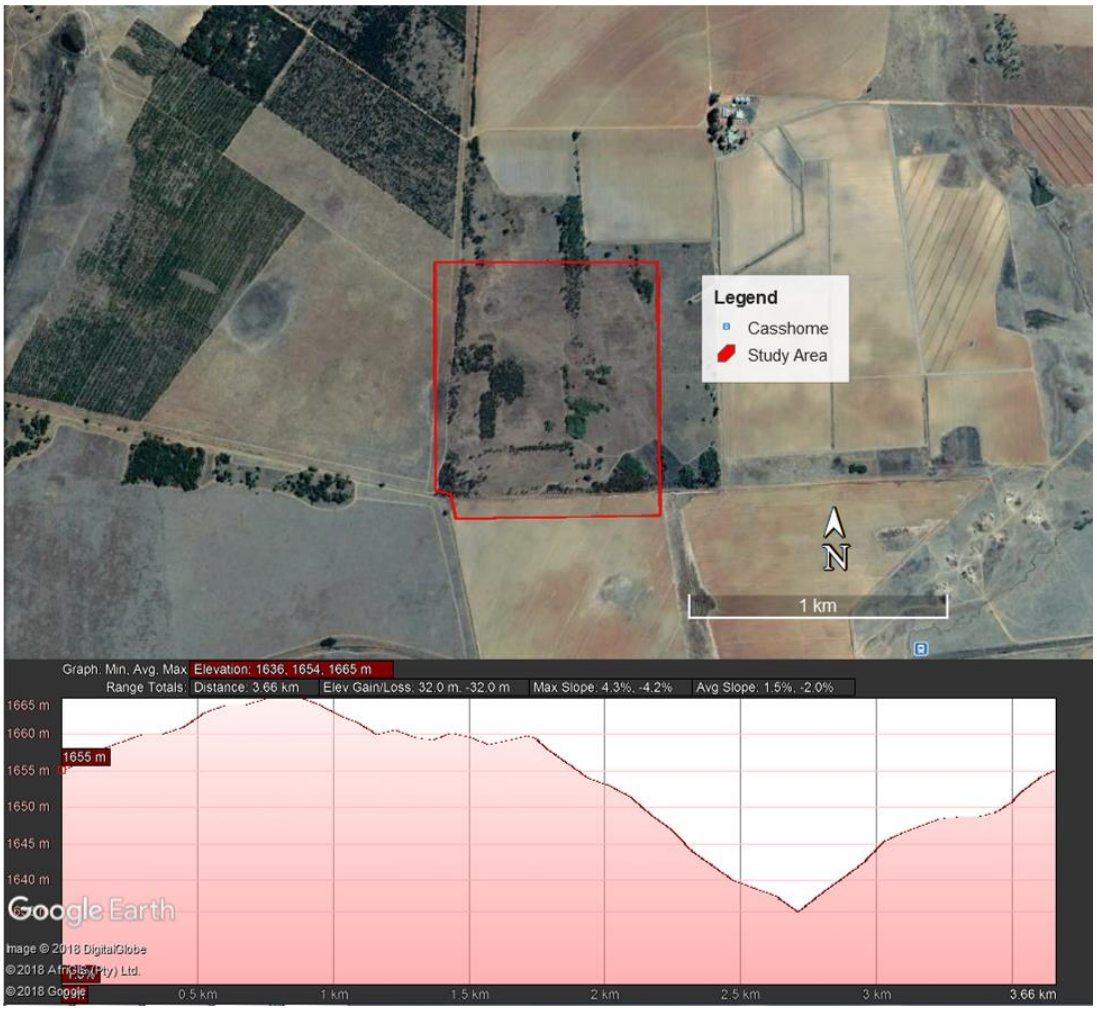


Figure 4: Google Image with elevation profile of the study area

2.3.2 Geology

The geology of the study area as well as surrounding area can be, primarily, divided into two major layers, namely the pre-Karoo basement and the Karoo Supergroup. The pre-Karoo basement largely encloses the Karoo Supergroup to the south, north and east, whilst the Karoo Supergroup extends over a large area to the south. Some isolated areas of Granophyre intrusions (Bushveld Complex) are also present throughout larger area. The study area itself is situated on a geological substrate consistent with the Karoo Supergroup (Vryheid Formation). These two layers are described below (also refer to Figures 5, 6 & 7).

» The pre-Karoo basement within and around the study area comprises the Formations of the Rooiberg Group (Damwal and Selons River Formations); the Proto-Waterberg Unit namely; Loskop Formation and the Wilgerivier Formation belonging to the Waterberg Group. Disruption of the stratigraphy of the Rooiberg Group as well as within the rocks of the Loskop occurred through the intrusion of porphyritic granites of the Rashoop Granophyre Suite (Bushveld Complex).

- The Rooiberg Group (Transvaal Supergroup) form the oldest rocks in the study area and comprise of two billion-year old volcanic rocks of the Proterozoic (Vaalian erathem). Furthermore, the Rooiberg Group from part of the Bushveld Magmatic Province (Buchanan, 2006). These rocks were formed through basaltic to rhyolitic lava that erupted from fissural volcanism. Minor explosive eruptions are represented by pyroclastic rocks, and subordinate sedimentary inter-beds originated from sandy fluvial and lacustrine processes.

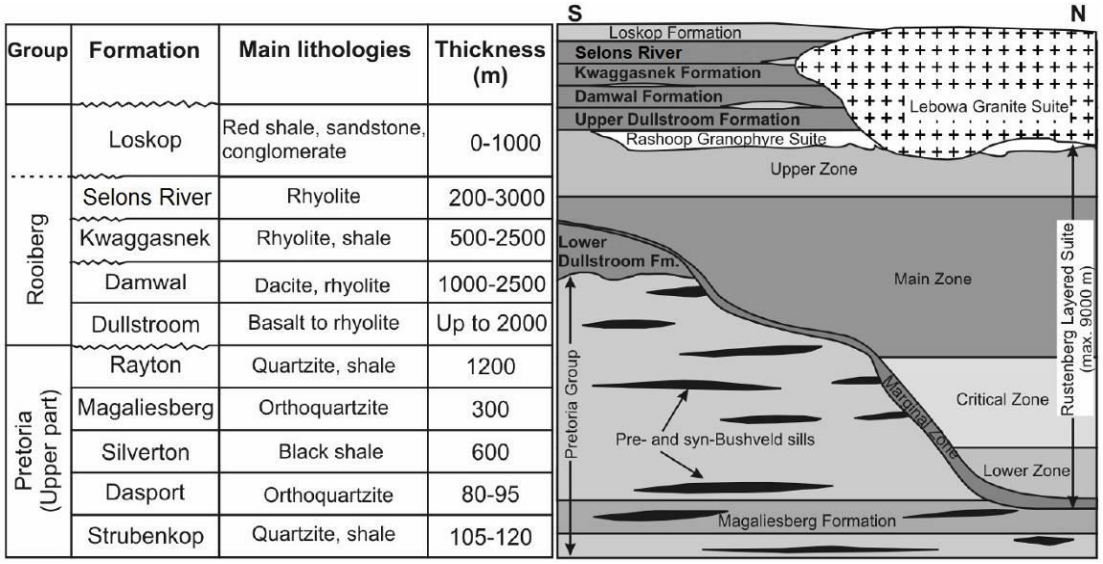
(a) Damwal Formation: Rhyolite with subordinate pyroclastic rocks and minor sandstone.

(b) The Selons River Formation: Distinguished by the homogenous layer of red porphyritic lava (felsic rock).

- Rashoop Granophyre Suite (Bushveld Complex) disrupted the stratigraphy of the Rooiberg Group through intrusion. This Suite comprise homogenous granophyre (predominant), granophyric granite, granophyre porphyry and pseudogranophyre. According to Walraven (1987) the granophyre is a shallow intrusive facies of a magma which intruded below the rhyolite roof of the Rooiberg Group or Pretoria Group (underlying Rooiberg) sediments and also extruded to form volcanic piles.
- The Loskop Formation (Proto-Waterberg) follows approximately concordantly on the Rooiberg Group where grading occurs conformably into red shales of this Formation (of the Mokalian erathem). The Loskop Formation in this region is characterized by fine grained, thin bedded, clastic sedimentary rocks with a prominent weathering basal conglomerate and subordinate sandstones as well as basic to acidic lavas. Loskop Dam porphyritic granite intrusions may locally occur into this formation.
- North and north-east of Middelburg the Selons River Formation is overlain by Early Proterozoic (1.7 – 2 billion-years old) continental "red bed" sediments and grit of the Waterberg Group (Wilgerivier Formation). These course-grained continental red beds (reddish-brown and purple, medium to course-grained sandstone. Subordinate conglomerate and minor shale) underlie most of the Highveld terrain between Middelburg and the Selons River Valley. The depositional settings responsible for the rocks of this formation includes alluvial fans, fan deltas and occasional wave reworking along the margins of lakes (Van der Neut *et al*., 1991). Minor volcanic

subunits within the Wilgerivier Formation include pyroclastic beds and andesitic lavas.

- Major post-Waterberg intrusions into the Wilgerivier successions are in the form of dykes and sills of microgabbro of poorly-defined age (Barker *et al*. 2006).



Group	Formation	Main lithologies	Thickness (m)
Rooiberg	Loskop	Red shale, sandstone, conglomerate	0-1000
	Selons River	Rhyolite	200-3000
	Kwaggasnek	Rhyolite, shale	500-2500
	Damwal	Dacite, rhyolite	1000-2500
	Dullstroom	Basalt to rhyolite	Up to 2000
Pretoria (Upper part)	Rayton	Quartzite, shale	1200
	Magaliesberg	Orthoquartzite	300
	Silverton	Black shale	600
	Dasport	Orthoquartzite	80-95
	Strubenkop	Quartzite, shale	105-120

Figure 5: Schematic presentation of the pre-Karoo profile showing the relationship between the Rooiberg Group, the underlying Pretoria Group (Transvaal Supergroup) and the intrusion of the different Granite Suites of the Bushveld Complex (Adapted from Lehardt & Eriksson, 2012, which represents the geological profile around Loskop Dam). The pre-Karoo profile of the study area is very similar and is overlain with rocks of the Wilgerivier Formation (Waterberg Group).

» The Karoo Supergroup sediments unconformably overlie the Proterozoic sedimentary and igneous rocks of the Mpumalanga Highveld regions. Within the study area the Karoo Supergroup is characterised by river-deposited sediments of the Ecca Group (Palaeozoic erathem) overlying glacial tillites of the Dwyka group.

» Depositions of the Ecca Group sequence are associated with ancient fluvial to shallow marine environments which occupied the area during climatic conditions, favourable for plant growth leading to peat and coal formations. Generally, the Ecca Group consists of dark-grey, carbonaceous mud rocks, with lamination and displaying weathering. Covering the typically dark-coloured Ecca shale is a generally thick sequence dominated by light grey sandstones, called the Vryheid Formation. The Vryheid Formation sequence comprises of conglomerates grading into granule-grade sandstones and minor shale lenses that may be capped by coal seams. Typically, the coal seams are covered by varying interbedded and coarse-grained silt- and sandstone and granulestone

capped by shale. The depositional environment for the project area is thought to be fluvio-lacustrine comprising braided river streams and natural lakes and dams. The structure of the Karoo Supergroup is consistent with that of a retro-arc foreland basin, which has formed behind the Cape fold-thrust belt.

» The Dwyka Group are typically absent over palaeohighs and may become surface exposed in lower lying areas. This group unconformably overly the pre-Karoo surface and comprise of basal diamictite units (conglomerate with sand/or clay matrix containing angular pebbles, cobbles and boulders). These materials are regarded as tillite and are of glacial origin and accumulated as ground moraine and glaciomarine moraine.

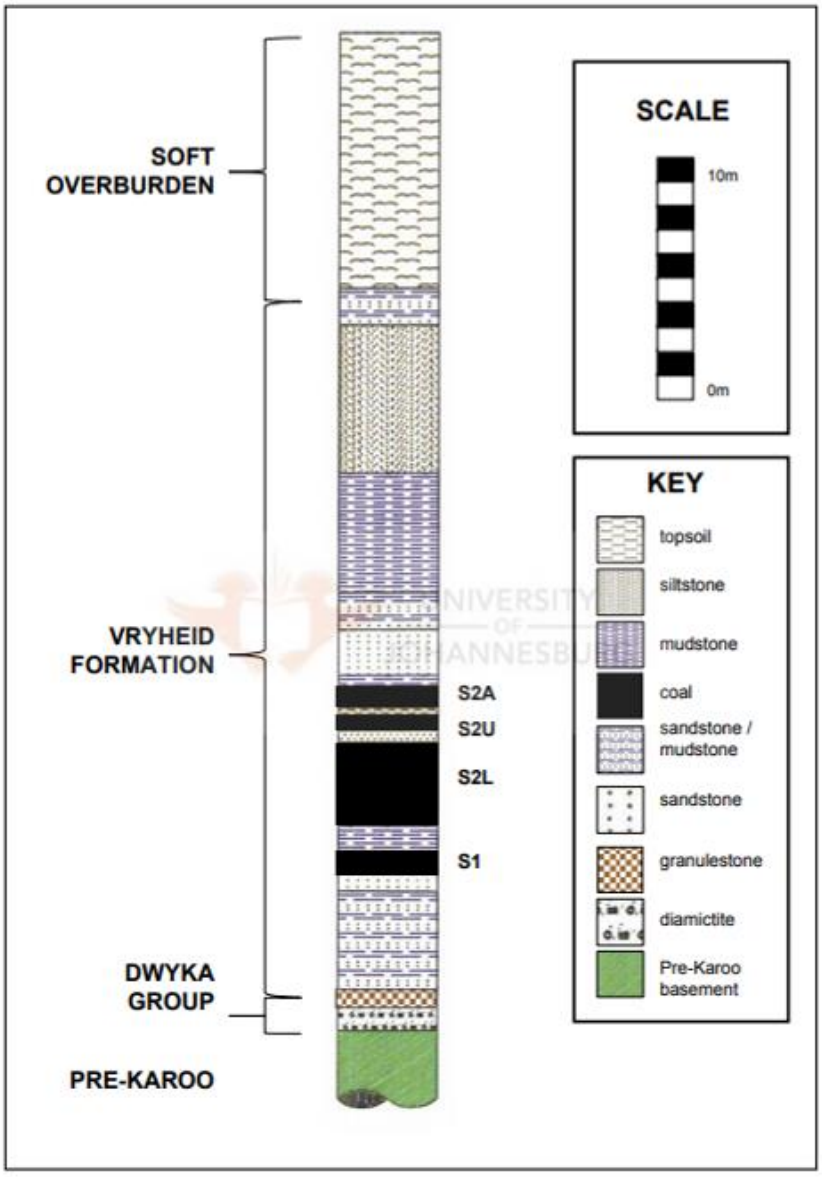


Figure 6: Stratigraphic presentation of the Karoo Supergroup sediments at the Arnot Colliery (Adapted from Uys, 2007).

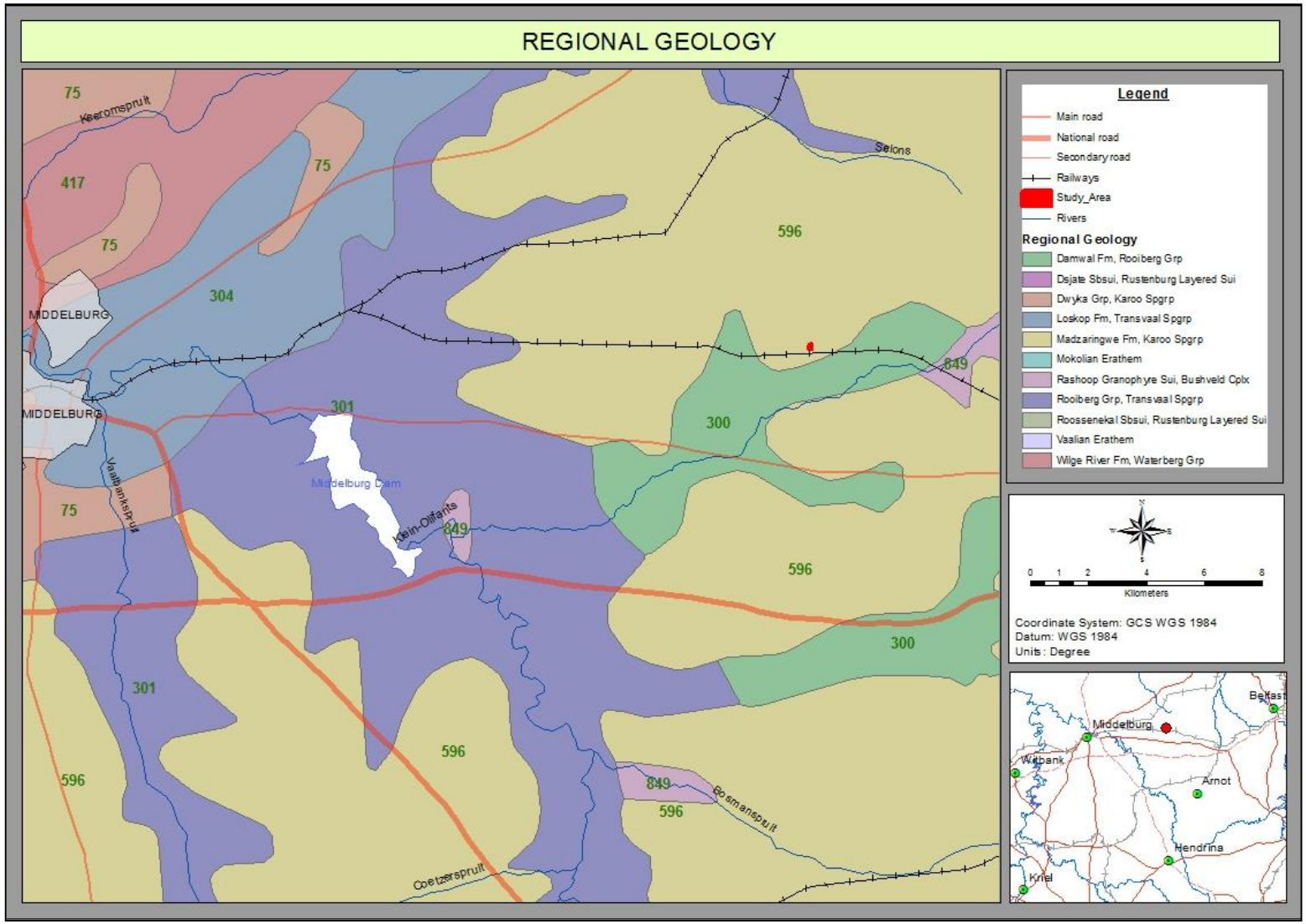


Figure 7: The geological stratification of the study area as well as surrounding environment.

2.3.3 Soil and Land Types

Pedology:

Detailed soil information is not available for broad areas of the country. Furthermore, due to the variation in topography and the weathering of different geological substrate types, the pedology is expected to be complex.

Acidic soils are quite common, especially where the underlying geology is sandstone and rhyolite rock types. Soil types vary significantly over short distances. High lying areas (e.g. Plateaus) are characterised by relative shallow sandy to sandy-loam soils that are acidic. Foothills and valley floors have deeper soils classified as sandy-loam to sandy-clay-loam and which tend to be less acidic. A variety of slope types occur as a result of the broken topography, resulting in a myriad of soil types that vary from talus like soils just below ridges, to very shallow soils on steeper slopes and ridges, to deeper soils close to and in valley sections.

Soil depth is one of the most significant environmental factors influencing vegetation patterns and types.

Land Type:

Due to the fact that detailed soil information is not available for broad areas of the country land type data is also used as a surrogate to provide a general description of soils in the study area (land types are areas with largely uniform soils, topography and climate). The study area and surrounding areas is primarily divided into two main regions according to their land type units, mainly due to underlying geology and topographical position. The higher lying areas underlain by sediments of the Vryheid Formation (this includes the study area) is characterised by the Ba land type (Ba 19), whilst the lower lying valleys underlain by rocks of the Rooiberg Group (Damwal and Selons River Formations) is characterised by the Bb land type (Bb 14) (Land Type Survey Staff, 1987) (refer to **Error! Reference source not found.**).

» **Ba land type** consists of plinthic catena characterised by dystrophic and/or mesotrophic, red and/or yellow soils. The presence of duplex and margalithic soils is rare.
  - These soils are moderately (mesotrophic) to highly (dystrophic) leached with a high texture range.
  - Soils contain a greyish subsoil layer (plinthic) where iron and manganese accumulate in the form of mottles, due to seasonally fluctuating water tables. With time these mottles may harden (or even cement) to form concretions. These plinthic layers will cause restricted water infiltration

and root penetration. In drier areas, however, they may help to hold water in the soil that plants can use.

- A catena is defined as a sequence of soils of similar age derived from similar parent material formed under similar macroclimatic conditions, but has different characteristics.
- In its perfect form this land type is represented by (in order from highest to lowest in the upland landscape) Hutton, Bainsvlei, Avalon and Longlands forms. The valley bottom is occupied by one or other gley soil (e.g. Rensburg, Willowbrook, Katspruit, Champagne forms).

» The **Bb land type** also consists of a plinthic catena where red soils are not widespread, as described below

- Plinthic properties occur in subsoil horizons. A subsoil horizon is a subsurface horizon that consists of 10% or more of an iron rich, humus-poor mixture of kaolinitic clay with quartz and other diluents. This horizon changes irreversibly to a hardpan or to irregular aggregates on exposure to repeated wetting and drying with free access to oxygen; and
- A catena is defined as a sequence of soils of similar age derived from similar parent material formed under similar macroclimatic conditions, but has different characteristics.
- In its perfect form this land type is represented by (in order from highest to lowest in the upland landscape) Mispah, Hutton, Glenrosa, Glenco, Cartef, Avalon, Wasbank, Longlands and Clovely forms. The valley bottom is occupied by one or other gley soil (e.g. Rensburg, Katspruit, Kroonstad and Dundee forms).

Soil Forms

The Ba 19 land type unit comprises 31.6% of the Hutton soil form, 4% of the Glenrosa soil form, 23.8 % of the Avalon soil form, 5.5 of the Pinedene soil form, 4.8% Wasbank soil form, 8.8% of the Longlands soil form, 7.5 % of the Clovelly soil form, 2.5% of the Fernwood soil form, 2% of the Katspruit soil form, 1% of the Dundee soil form and 4% consisting of pans.

Hydrology and Geohydrology

The study area is situated within the upper reaches of the Olifants Catchment Water Management Area (WMA), and is located in the Middelburg Dam sub-catchment, forming part of the Loskop Dam catchment, and within the quaternary sub-catchment B12C of the Limpopo-Olifants primary drainage region. Local watercourses drain into the Klein-Olifants River, which in turn drains into

Middelburg Dam. Thereafter the Klein-Olifants flows into the Olifants River, which drains into the Loskop Dam.

The Klein-Olifants quaternary catchment (B12C) is drained by the Mooifontein Spruit, the Springbok Spruit, and ultimately the Klein Olifants River.

The water users in the catchment vary and include agriculture (irrigation), forestation, municipal including commercial and domestic and natural aquatic ecosystems. The water quality in the Middelburg Dam has deteriorated steadily since the 1970's when mining started in the catchment.

Klein Olifants River Catchment and forms part of quaternary catchment B12C. This catchment area forms part of the Middelburg Dam Sub-Water Management Area (Olifants Water Management Area).

Due to the geomorphological setting of the extended (local drainage network), the area is characterized by numerous small, short non-perennial streams flowing in a largely south-eastern and south western direction to join the Springbokspruit River (south of the study area). The Springbokspruit is approximately 25.9 km in length and flows in a south-westerly direction to terminate into the Klein Olifants River (22.18km south-west of the study area). According to DWAF's 1999 Present Ecological State (PES 1999) the condition of the Springbokspruit as well as Klein Olifants River, are classified as Class C, which indicates that the rivers have undergone moderate levels of modifications. Two such small non-perennial streams drain the eastern half of the study area and flow in a southern direction for approximately 2km to drain into the Springbokspruit.

Associated with these non-perennial streams are valley-bottom wetlands and small lateral seepages. The upper portion of this hydrological system comprises a largely unchanneled valley-bottom wetland (covers an extensive area of the south-eastern portion of the study area) which transitions into a channelled valley-bottom wetland south of the service road for the Mafube/Pan Traction power lines. A few isolated wetland bodies are furthermore dotted throughout region include small to medium sized depression wetland, seepages and wetland flats. Such a wetland flat is present north-west of the study area with the distal portion of the wetland extending into study area. A highly transformed and impacted depression wetland (pan) is located in the centre of the western boundary of the study area.

Most of these wetlands are seasonally to temporary saturated with small isolated sections which may be permanently saturated, especially the southern portion of the unchanneled valley-bottom wetland just above the Mafube/Pan Power Line's service road.

It is important to take note that these wetland bodies were identified purely based on vegetation composition and topographical positions. A formal wetland assessment did not form part of the scope of this ecological assessment.

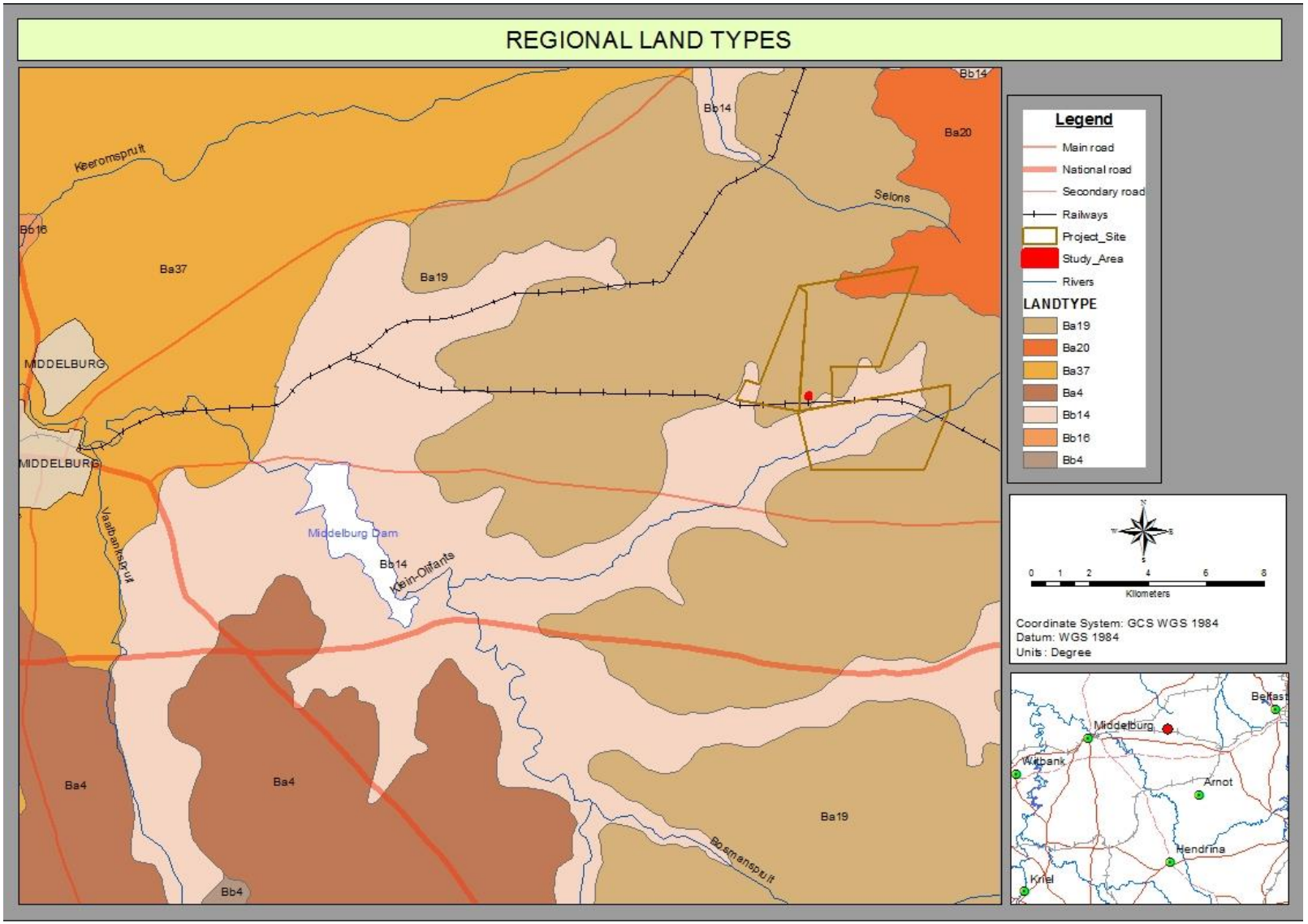


Figure 8: Land types found within the study area as well as the surrounding environment.

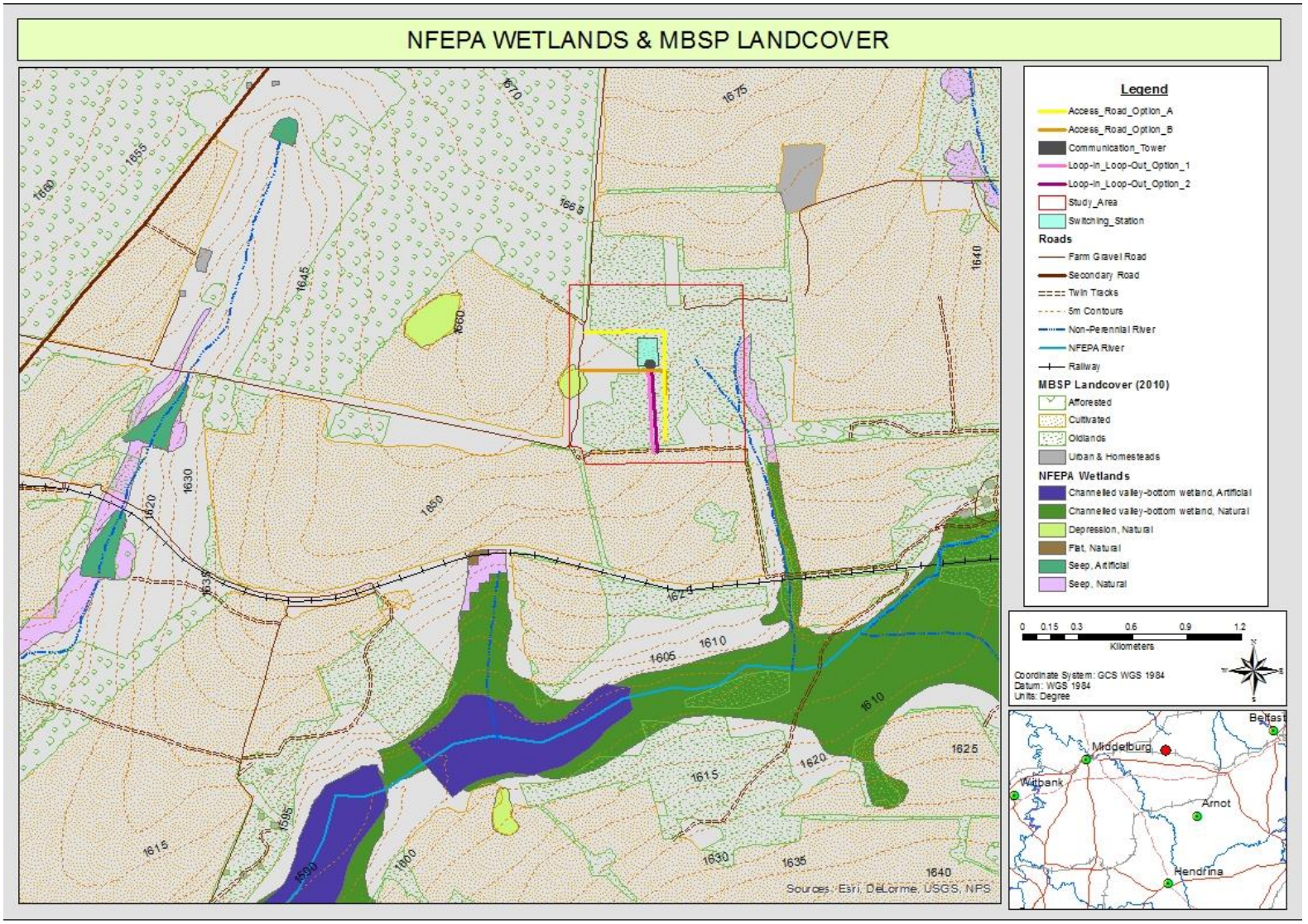


Figure 9: NFEPA wetlands and streams.

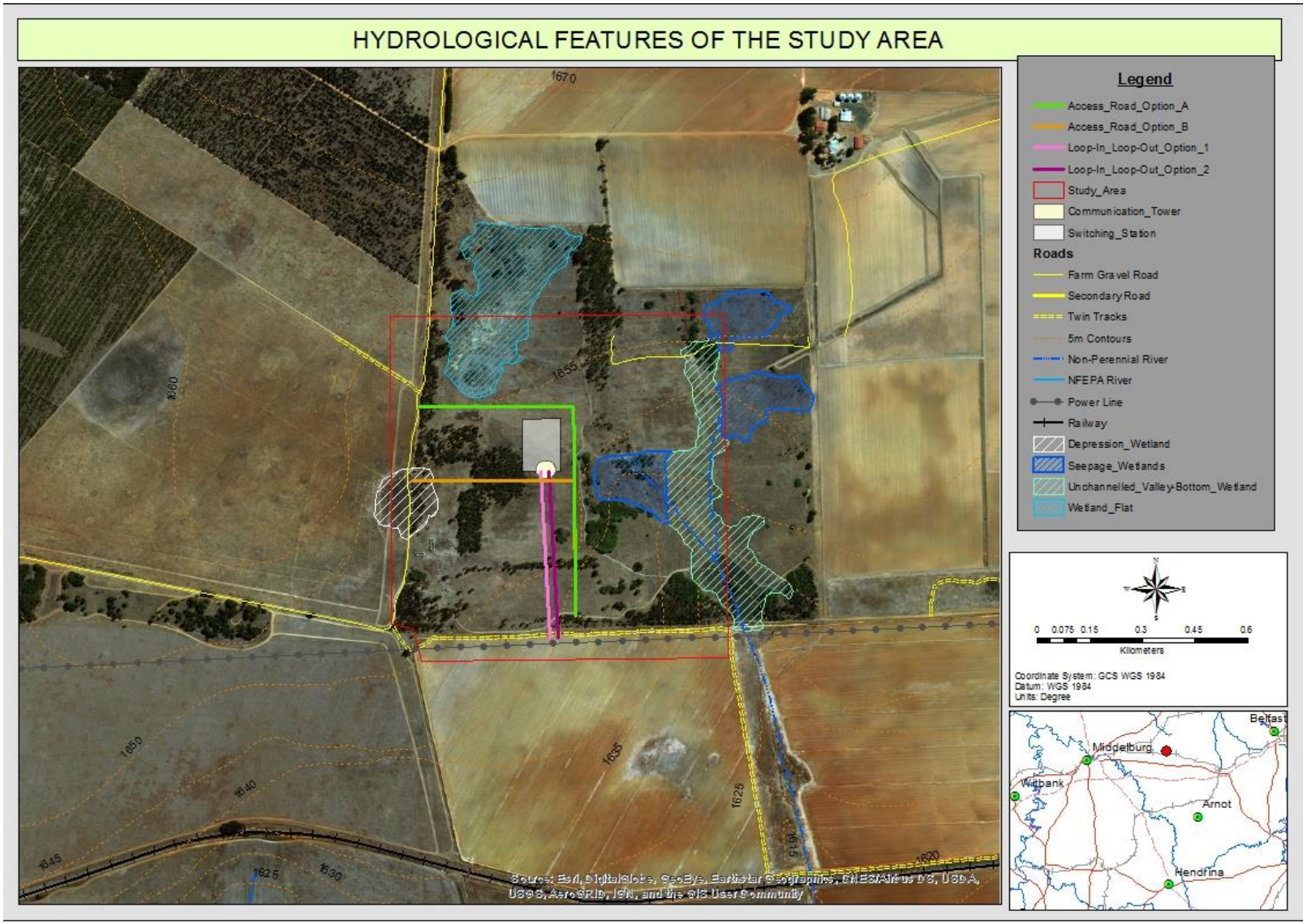


Figure 10: Map illustrating the hydrological features located within the study area.

2.4 Existing Land Use

The study area is in a highly disturbed and transformed state due to both current and historical land use activities (Figure 12). Negligible natural grassland remains within the study area with barely semi-natural grasslands confined to small, isolated patches within and around wetland areas. Approximately 97.2% of the study area is in a disturbed condition with only 2.38ha of the 83.9ha regarded as slightly disturbed to semi-natural. Most of the vegetation cover have undergone transformation, currently comprising of a dominant weed and alien cover with some pioneer and sub-climatic grasses. Woodlots of *Acacia mearnsii* and *Eucalyptus camaldulensis* are also a prominent feature of the study area. This current state can be attributed to mainly historical land use activities, primarily cultivation and afforestation (more extensive patches of woodlots).

Current land use includes existing woodlots as mentioned mainly comprising of *Acacia mearnsii* and *Eucalyptus camaldulensis* although *Acacia dealbata* and *Eucalyptus globulus* have also been recorded within these woodlots. These woodlots are actively utilised, with the wood mainly cut for building material and fence posts. Some of the woodlot patches have been aggressively utilized resulting in most of the trees occurring as shrubs that have resprouted from stumps with few species of usable size. A small portion to the south of the study area forms part of an extensive cultivated land (maize), however, this cultivated area is separated from the rest of the study area through a farm fence as well as a deep trench. The function of this trench is unclear, but likely functions as a drain for excessive moisture, in order to avoid over-saturation of the cultivated areas. This drain feature has had a significant impact on the hydrology of the down-stream portion of the valley-bottom wetland located along the eastern border of the study area. A similar trench feature is present in the north-eastern corner of the study area extending north-wards beyond the study area. This trench extends into the upper reaches of the valley bottom-wetland. A small portion of the north-western corner of the study area forms part of a fallow land that was recently (up to 2010) utilised for Afforestation (*Pinus* plantations). Most farm fences to the west and north have been removed, although fences still persist along the southern and eastern boundary. Other features in the study area includes the existing Mafube/Pan Traction Power Line and service road, farm dirt roads and smaller twin track.

Historical Satellite Imagery indicates that the current woodlots covered a much larger extent of the study area than the current situation. Furthermore, the bulk of the study area, not covered by woodlots and mostly outside wetland areas, was under cultivation (historical plough lines visible from satellite imagery). The study area was furthermore traversed by numerous additional farm roads and smaller twin tracks. Most of these historically disturbed areas have been reinstated with a

weedy vegetation cover comprising of numerous weedy Asteraceae species (*Senecio, Helichrysum, Seriphium* and *Berkheya* species), alien plants (*Conyza, Plantago, Richardia, Tagetes*, *Bidens* and *Verbena* species) as well as some pioneer and sub-climatic grasses such as *Aristida species, Eragrostus curvula, E. gummiflua, Heteropogon contortus* and *Microchloa caffra.*

A summary of the different land use activities (historical and current) as well as their extent within the study area is provided in the figure below.

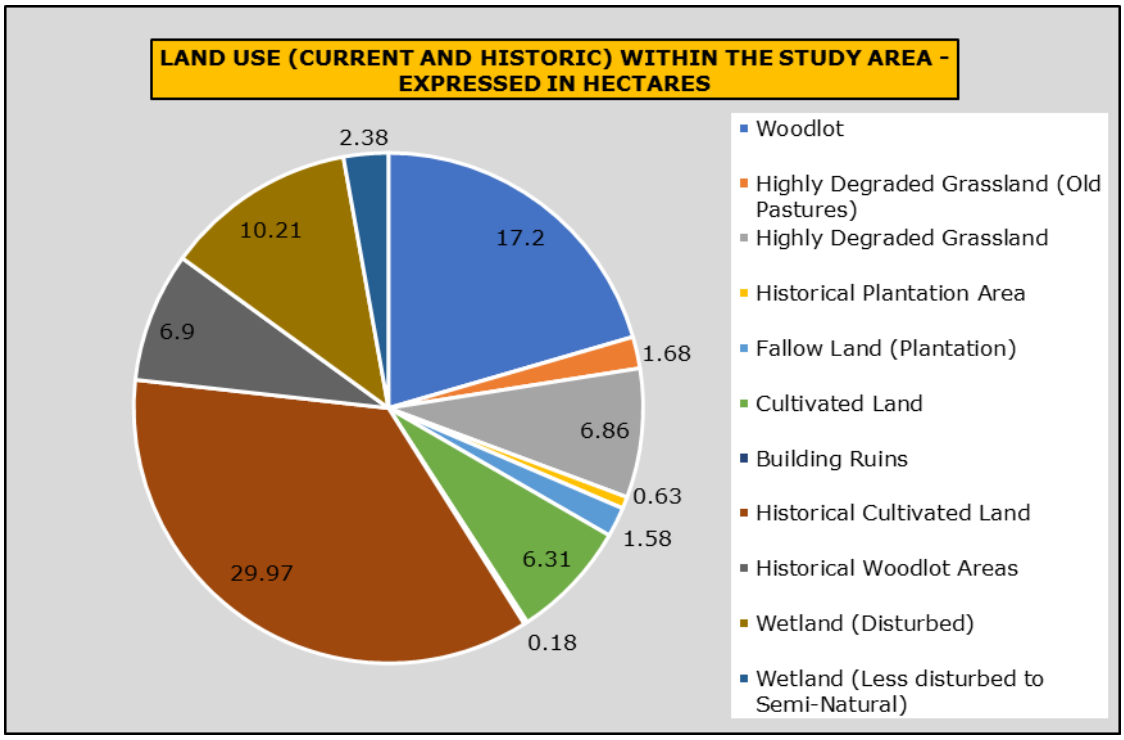


Figure 11: Land use activities (current and historical) and extent within the study area.

Surrounding land use activities mainly include activities associated with agricultural practices such as maize cultivation (extensive areas under cultivation to the north, south and east) and Afforestation (*Pinus* plantations) to the west and north west. Small patches of grazing land persist as fractured islands (isolated from each other by ploughed areas and plantations), and are mainly associated with lower lying wetland areas where ploughing mostly cannot occur. However most of the grazing lands outside of wetlands have been historically subjected to some form of disturbance, mainly ploughing.

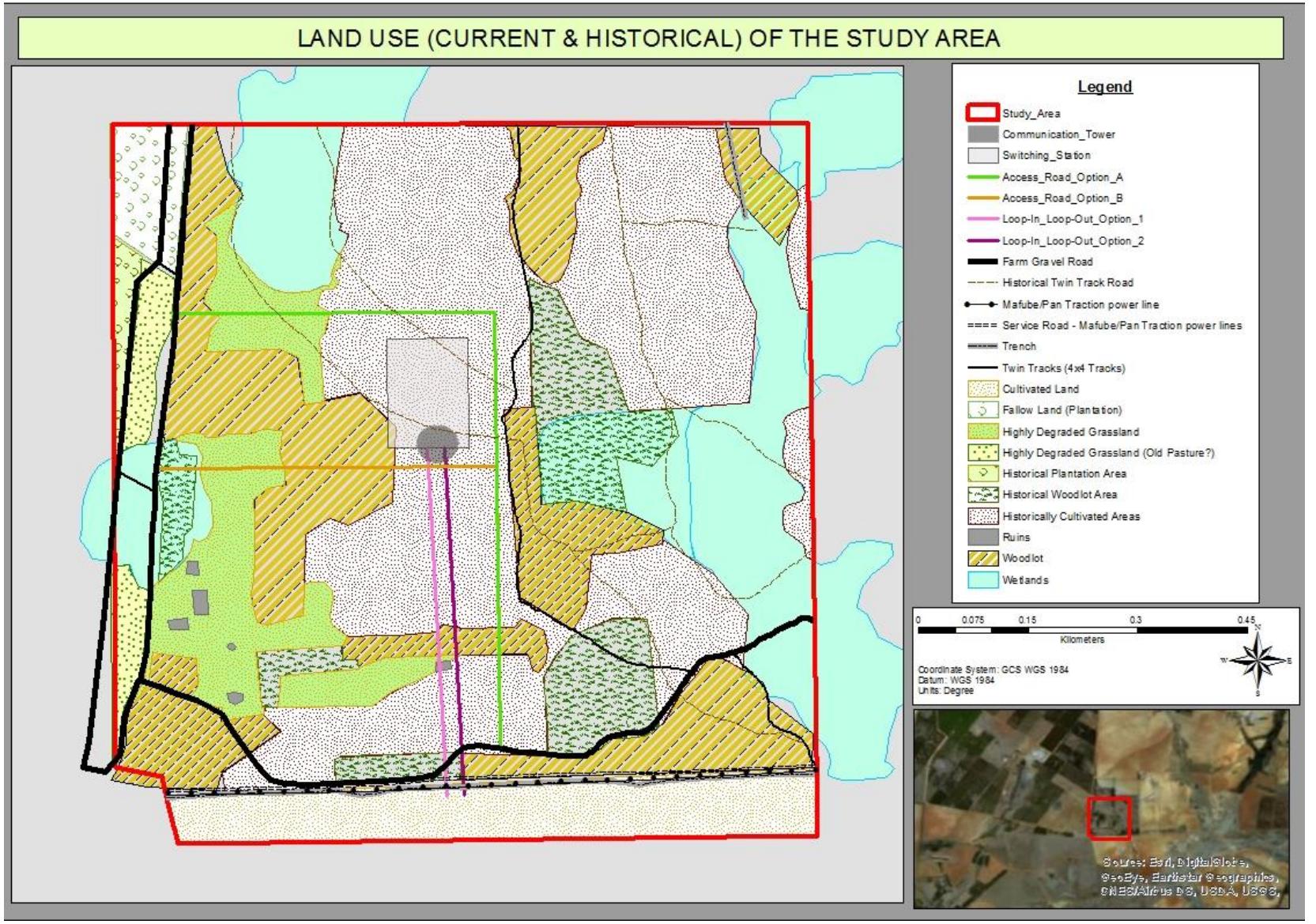


Figure 12: Map illustrating land cover and land use within the study area and includes historical land use.

2.5 Contamination risk

The seepages, valley-bottom wetland and non-perennial watercourses within the eastern part of the study are vulnerable to contamination. Furthermore, most of these watercourses and drainage systems are connected to the Springbokspruit River and associated wetlands, which eventually terminate in the Klein Olifants River, thus making downstream environments also vulnerable to potential contamination. However, it is highly unlikely that the proposed development will pose a contamination threat to these hydrological features.

3 VEGETATION OVERVIEW

3.1 Broad vegetation types

The study area is situated in the Grassland biome and Mesic Highveld Grassland Bioregion. The study area comprises the Rand Highveld Grassland (Gm11) vegetation type (refer to Figure 14).

Rand Highveld Grassland:

The distribution of the vegetation type is spread across the Mpumalanga, Gauteng and North-West Provinces. This unit occupies areas between rocky ridges from Pretoria to Witbank, extending onto ridges in the Stoffberg and Roossenekal regions as well as west of Krugerdorp centred in the vicinity of Derby and Potchfstroom, extending southwards and northeastwards from there. The Rand Highveld Grassland occupies areas between 1 300m and 1 635m, but may extend to altitudes of 1 760m. As mentioned the typical landscape associated with this vegetation is highly variable, containing extensive sloping plains and a series of ridges slightly elevated over undulating surrounding plains. The vegetation is species-rich, wiry, sour grassland alternating with low, sour shrubland on rocky outcrops and steeper slopes. Most common grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon* and *Elionurus*. High diversity of herbs, many of which belong to the Asteraceae, is also a typical feature. Rocky hills and ridges carry sparse (savannoid) woodlands with *Protea caffra* subsp. *caffra, P. welwitschii, Acacia caffra* and *Celtis africana*, accompanied by a rich suite of shrubs among which the genus Searsia is most prominent (Mucina and Rutherford (2006)). The herbaceous layer is dominated by grasses.

Important taxa found within this vegetation unit include:

» Succulent Shrubs: *Lopholaena coriifolia.*
» Low Shrubs: *Anthospermum rigidum subsp. pumilum, Indigofera comosa, Searsia magalismontana, Stoebe plumosa.*
» Succulent Herbs: *Aloe greatheadii var. davyana*.

» Geophytic Herbs: *Boophone disticha, Cheilanthes hirta, Haemanthus humilis subsp. humilis, Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia, Oxalis coniculata.*
» Herbs: *Acanthospermum australe, Justicia anagalloides, Pollichia campestris, Acalypha angustata, Chamaecrista mimosoides, Dicoma anomala, Helichrysum caespititium, H. nudifolium var. nudifolium, H. rugulosum, Ipomoea crassipes, Kohautia amatymbica, Lactuca inermis, Macledium zeyheri subsp. argyrophylum, Nidorella hottentotica, Oldenlandia herbacea, Rotheca hirsuta, Selago densiflora, Senecio coronatus, Sonchus dregeanus, Vernonia oligocephala, Xerophyta retinervis.*
» Graminoids: *Ctenium concinnum, Cynodon dactylon, Digitaria monodactyla, Diheteropogon amplectens, Eragrostis chloromelas, Heteropogon contortus, Loudetia simplex, Monocymbium ceresiiforme, Panicum natalense, Schizachyrium sanguineum, Setaria sphacelata, Themeda triandra, Trachypogon spicatus, Tristachya biseriate, Tristachya rehmannii, Andropogon schirensis, Aristida aequiglumis, A. congesta, A. juncifromis subsp. Galpinii, Bewsia biflora, Brachiaria nigropedata, B. serrata, Bulbostylis burchellii, Cymbopogon caesius, Digitaria tricholaenoides, Elionurus muticus, Eragrostis capensis, E. curvula, E. gummiflua, E. plana, E. racemosa, Hyparrhenia hirta, Melinis nerviglumis, M. repens subsp. Repens, Microchloa caffra, Setaria nigrirostris, Sporobolus pectinatus, Trichoneura grandiglumis, Urelytrum agropyroides*.
» Geoxylic Suffrutex: *Elephantorrhiza elephantina*

A species list from Plants of Southern Africa (POSA) (http://posa.sanbi.org, Degree Grid; 2529D with special emphasis on Quarter Degree Grid; 2529DC) containing the species that have been recorded to date within the surroundings of the study area have been extracted. POSA generated species lists also contain updated Red Data species status according to the Red List of South African Plants published by SANBI in Strelitzia 25 (Raimondo *et al*. 2009, updated 2013). Only protected and red data species that may potentially occur in the study area have been listed under results. The actual field survey undertaken between the 15th and 17th of March 2018 confirmed which of the species already recorded actually occur in the study area, and reveaedl the presence of additional species that have not have been recorded in official databases to date.

A total of 504 species have been recorded within the 2529D Degree Grid with Quarter Degree Grid 2529DC being relatively underrepresented (likely due to lack of sampling in this grid) with 101 species being recorded. It is highly unlikely that all of these species will occur within the project area. Eight Red Data species are listed within the POSA generated species list, whilst only 1 of these species were listed within the quarter degree grid. A number of exotic species (total of 30

species) have been recorded within the degree grid of which 6 species are regarded as invasive alien plants.

3.2 Conservation status of broad vegetation types

The vegetation types of South Africa have been categorized according to their conservation status which is, in turn, assessed according to the degree of transformation and rates of conservation. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. On a national scale these thresholds are as depicted in the table below, as determined by best available scientific approaches (Driver *et al*. 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver *et al*. 2005).

Table 1: Determining ecosystem status (from Driver et al. 2005). *BT = biodiversity target (the minimum conservation requirement.

Habitat remaining (%)			
	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

The National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011), published under the National Environment Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA), lists national vegetation types that are afforded protection on the basis of rates of transformation. The threshold for listing in this legislation is higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in the scientific literature.

Table 2: Conservation status of the vegetation type occurring in and around the study area.

Vegetation Type	**Target (%)**	**Transformed (%)**	**Conserved (Statutorily & other reserves)**	**Conservation Status**	
				Driver *et al*., 2005; Mucina & Rutherford, 2006	National Ecosystem List (NEM:BA)
Rand Highveld Grassland	24%	41.5%	1%	Endangered	Vulnerable

According to Mucina and Rutherford (2006) transformations within these units are mainly due to cultivation, plantations, mines, urbanisation and by building of dams. No serious alien plant invasions are currently reported, but Acacia mearnsii can

become dominant in disturbed sites. Erosion is very low (Mucina & Rutherford, 2006).

3.3 Red List and protected plant species of the region

As previously mentioned, a species list was obtained from POSA for the relevant degree grid as well as quarter degree grids. The species on this list were evaluated to determine the likelihood of any of them occurring in the study area. Of the species that are considered to occur within the geographical area under consideration, nine species which are regarded conservation worthy. Eight species recorded in the degree grids are listed on the Red List plant species. According to the South African Red List Categories, three is listed as Vulnerable (*Miraglossum davyi, Khadia carolinensis* and *Anacampseros subnuda* subsp. *lubbersii*), 1 species as Near Threatened (*Jamesbrittenia macrantha),* 1 species as rare (*Khadia alticola*) and 3 species as Declining (*Eucomis montana, Ilex mitis var. mitis, Callilepis leptophylla*). One species were listed within the POSA species list wich are protected within the National Forests Act, 1998 (Act No. 84 of 1998), namely *Pittosporum viridiflorum*.

According to Mucina and Rutherford (2006) four species are known to be Northern sourveld endemics (*Agapanthus inapertus* subsp. *pendulus, Eucomis vandermerwei, Huernia insigniflora* and *Melhania randii*) with 8 species being South African endemics (*Melanospermum rudolfii, Polygala spicata, Anacampseros subnuda subsp. lubbersii, Frithia humilis, Crassula arborescens subsp. undulatifolia, Delosperma purpureum, Encephalartos lanatus and Encephalartos middelburgensis).*

Apart from the Red Data species a further 28 species are protected within the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) (MNCA).

During the survey none of the above mentioned Red Data species were recorded within the study area. However, two species that were listed within the POSA species list and are protected according to schedule 11 of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) were confirmed within the study area during the survey (*Aloe ecklonis* and *Eucomis autumnalis*). A further one Red Data Species (*Hypoxis hemerocallidea* – Declining) and two MNCA protected species (*Gladiolus* spp. and *Habenaria galpinii*) were recorded within the study area and which were not listed within the POSA species list.

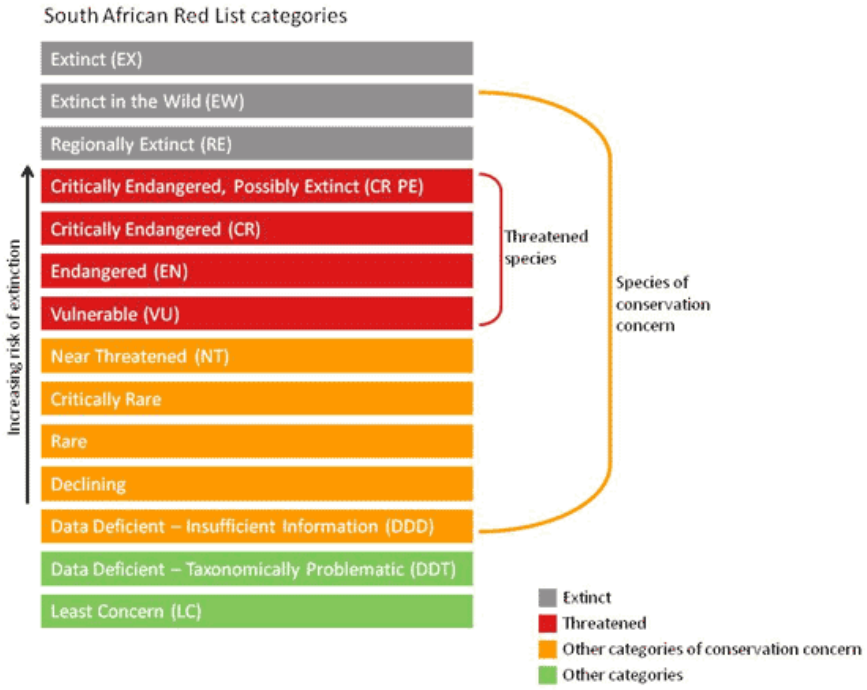


Figure 13: Schematic representation of the South African Red List categories. Taken from http://redlist.sanbi.org/redcat.php

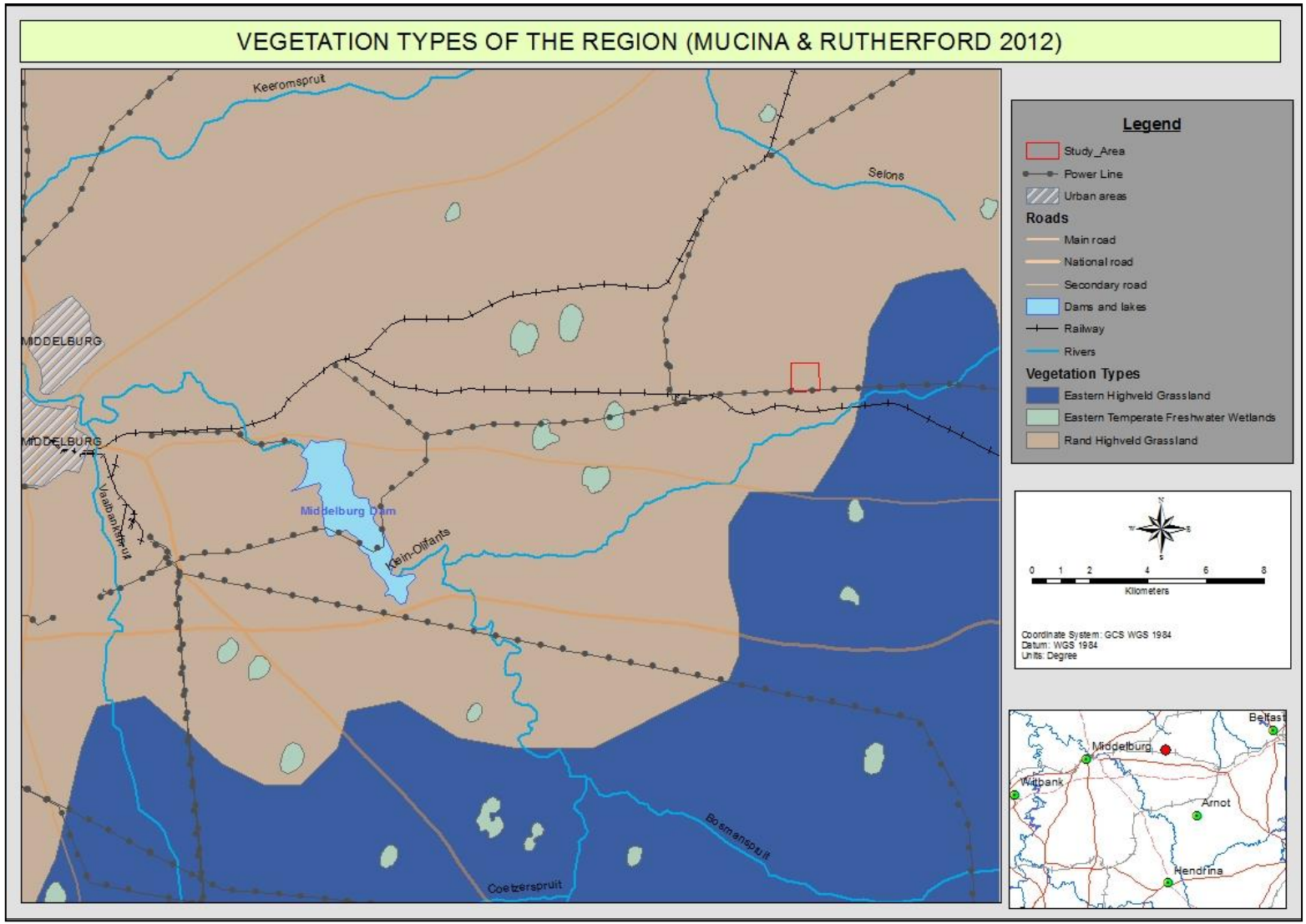


Figure 14: Map illustrating the vegetation types of the region according to Mucina and Rutherford (2012).

4 CRITICAL BIODIVERSITY AREAS AND BROAD SCALE ECOLOGICAL PROCESSES

4.1 Definitions and descriptions of Critical Biodiversity Areas as classified within the Mpumalanga Biodiversity Sector Plan Handbook

A Critical Biodiversity Areas (CBA) Map was developed using systematic biodiversity planning methodology, following the approaches of Margules & Pressey (200) and Ardron *et al.,* (2010). In the terrestrial CBA map, two sub-categories of CBA (CBA Irreplaceable and CBA Optimal) and four sub-categories of Ecological Support Areas (ESA) are recognised. These categories along with other categories occurring within the maps are summarised below.

4.2 Desktop description of CBAs within the study area.

According to the MBSP the majority of the site is classified as Moderately Modified (Old Lands) with some sections along the southern, northern and western boundary classified as Other Natural Areas (refer to figure 15). These CBA units were confirmed to represent the study area during the survey. Most of the study area is covered by areas historically ploughed (cultivated) with large areas furthermore covered by woodlots (refer to section on land use). Almost the entire study area comprises of a highly disturbed and transformed vegetation cover with very little elements of the original vegetation type preserved. As such the study area provide minimal no contribution to the conservation of the Rand Highveld Grassland and as such the development will have no impact on any Critical Biodiversity Areas.

Table 3: Summary of the different categories occurring within the Mpumalanga Terrestrial CBA map

Map Category	Description	Sub-Category	Description
Protected Areas	Areas that are formally protected by law and recognized in terms of the Protected Areas Act, including contract protected areas declared through the biodiversity stewardship programme.	National Parks & Nature Reserves	Includes formally proclaimed National Parks, Nature Reserves, Special Nature Reserves, and Forest Nature Reserves.
		Protected Environments: Natural	Includes Protected Environments, declared in terms of Protected Areas Act (Act 57 of 2003, as amended).
		Protected Environments: Modified	Heavily modified areas in formally proclaimed Protected Environments.
Critical Biodiversity Areas (CBAs)	All areas required to meet biodiversity pattern and process targets; Critically Endangered ecosystems, critically linkages (corridor pinch-points) to maintain connectivity; CBAs are areas of high biodiversity value that must be maintained in a natural state.	CBA: Irreplaceable	This category includes: (1) Areas required to meet targets and with irreplaceable values of more than 80%; (2) Critical linkages or pinch-points in the landscape that must remain natural; (3) Critically Endangered Ecosystems.
		CBA: Optimal	The CBA Optimal Areas (previously called 'important and necessary' in the MBCP) are the areas optimally located to meet both the various biodiversity targets and other criteria defined in the analysis. Although these areas are not 'irreplaceable' they are the most efficient land configuration to meet all biodiversity targets and design criteria.
	Areas that are not essential for meeting targets, but that play an	ESA: Landscape Corridor	The best option to support landscape-scale ecological processes, especially allowing for adaptation to the impacts of climate change.

Map Category	Description	Sub-Category	Description
Ecological Support Areas (ESA)	important role in supporting the functioning of CBAs and that deliver important ecosystem services.	ESA: Local Corridor	Finer-scale alternative pathways that build resilience into the corridor network by ensuring connectivity between climate change focal areas, reducing reliance on single landscape-scale corridors.
		ESA: Species Specific	Areas required for the persistence of particular species. Although these may be production landscapes, a change in land-use may result in loss of this species from the area. (Only one species-specific ESA was included in the analysis – an over-wintering site for blue cranes).
		ESA: Protected Area Buffers	Areas surrounding protected areas that moderate the impacts of undesirable land-uses that may affect the ecological functioning or tourism potential of Pas. Buffer distances vary according to reserve status: National Parks – 10km; Nature Reserves – 5km and Protected Environments – 1km buffer.
Other Natural Areas (ONA)	Areas that have not been identified as a priority in the current systematic biodiversity plant but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions.		
Moderately or Heavily Modified Areas	Areas in which significant or complete loss of natural habitat and ecological function has taken place due to activities such as ploughing, hardening of surfaces, open-cast mining, cultivation and so on.	Heavily Modified	All areas currently modified to such an extent that any valuable biodiversity and ecological functions have been lost.
		Moderately Modified: Old lands	Old cultivated lands that have been allowed to recover (within the last 80 years), and support some natural vegetation. Although biodiversity pattern and ecological functioning may have been compromised, the areas still play a role in supporting biodiversity and providing ecosystem services.

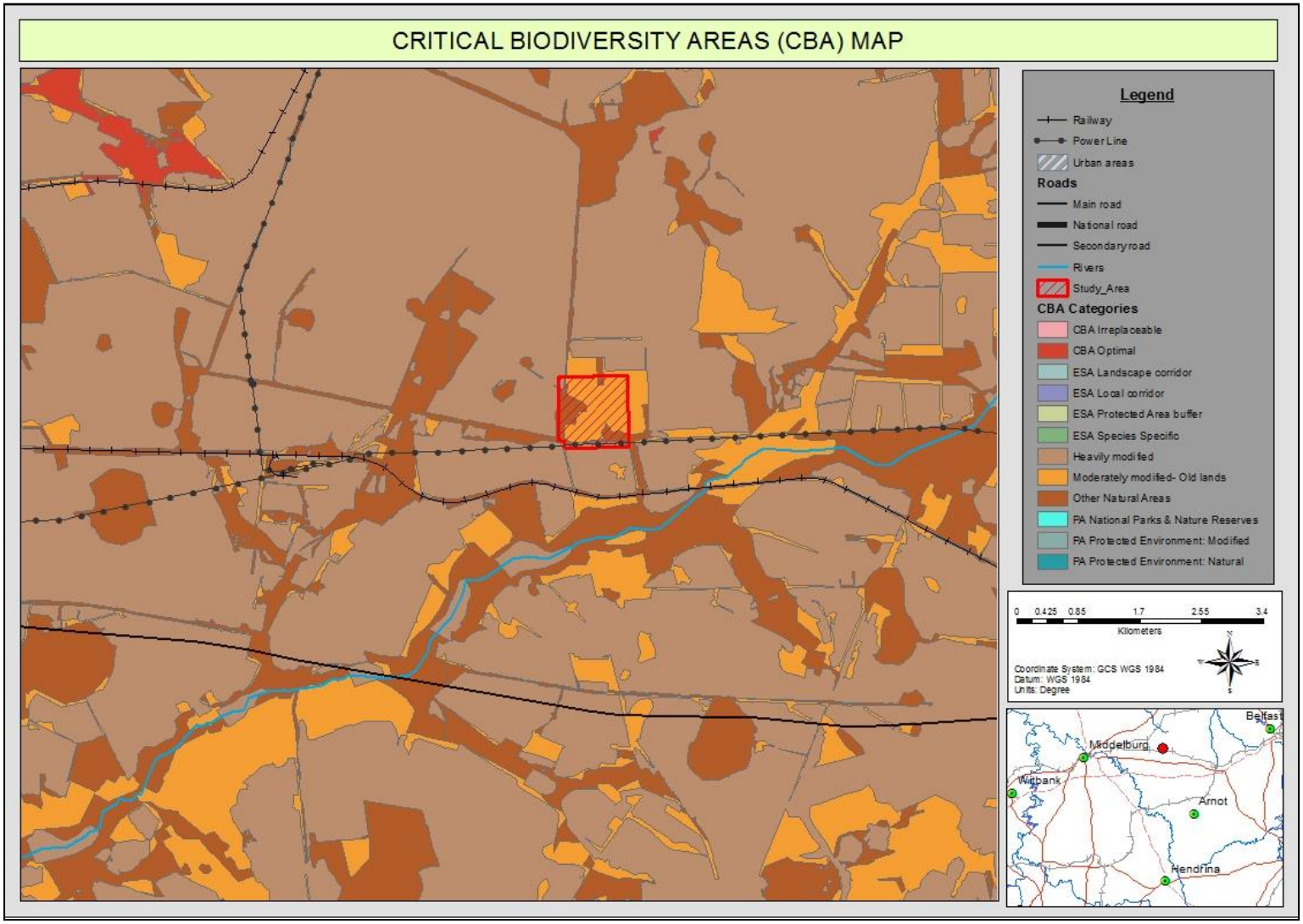


Figure 15: Critical Biodiversity Areas as classified in the Mpumalanga Biodiversity Sector Plan.

5 FAUNA OVERVIEW

5.1 Mammals

Although the potential diversity of mammals within the study area is high with as many as 70 terrestrial mammals, there are several factors which will reduce the actual number of species present. This includes the proximity to coal mines and major roads (i.e. R104, R555 and the N4) in the area.

Listed mammals which may occur in the area include the Rough-haired Golden Mole *Chrysospalax villosus* (Critically Endangered), Serval – *Leptailurus serval* (Near Threatened) White-tailed Mouse - *Mystromys albicaudatus* (Endangered), Brown Hyaena - *Hyaena brunnea* (Near Threatened), Black-footed Cat - *Felis nigripes* (Vulnerable), Honey Badger - Mellivora capensis (Near Threatened) and South African hedgehog *Atelerix frontalis*.

5.2 Reptiles and Amphibians

Of the 28-reptilian species that have been recorded within the 2529D degree grid, 7 species have been recorded within the quarter degree grid (2528 DB). None of these species (recorded within the relevant degree grid) are listed as Red Data species. Of the 28-reptilian species 4 are regarded as region endemic (See below).

Regional Endemic Reptile Species: *Agama aculeate subsp. distanti* (Distant's Ground Agama), *Platysaurus orientalis subsp. orientalis* (Sekhukhune Flat Lizard), *Pseudocordylus melanotus subsp. melanotus* (Common Crag Lizard), *Smaug vandami* (Van Dam's Girdled Lizard), *Lydodactylus nigropunctatus* (Black-spotted Dwarf Gecko), *Lydodactylus ocellatus* (Spotted Dwarf Gecko), *Pachydactylus affinis* (Transvaal Gecko) and *Acontias gracilicauda* (Thin-tailed Legless Skink).

Of the 21-amphibian species that have been recorded within the 2529D degree grid, 14 species have been recorded within the quarter degree grid (2529 DC). Only one of these species (recorded within the relevant quarter degree grid) are listed as a Red Data species, namely Giant Bull Frog – *Pyxicephalus adspersus*. The Giant Bull Frog (*Pyxicephalus adspersus*) is classified as Near Threatened within the Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland (2004). These species prefer and breed in the shallows of temporary rain filled depressions in grassland and dry savannah. The wetland flat systems identified within the north-western corner of the study area may potentially (although likelihood is low) be a suitable habitat for these species. Furthermore, of the 21-amphibian species only one species is regarded as a regional endemic, namely *Amietia delalandii* (Delalande's River Frog)

6 METHODOLOGY

6.1 Data scouring and review

Data sources from the literature were consulted and used where necessary in the study and include the following:

Vegetation:

» Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006, 2012) as well as the National List of Threatened Ecosystems (2011), where relevant.
» Critical Biodiversity Areas (CBAs) for the site and surroundings were extracted (CBA Map for Mpumalanga Province obtained from http://bgis.sanbi.org/fsp/project.asp).
» Information on plant and animal species recorded for the Degree Square (DS) 2529D and Quarter Degree Square (QDS) 2529DC was extracted from the South African Biodiversity Information Facility / SANBI's Integrated Biodiversity Information System (SABIF/SIBIS) database (http://posa.sanbi.org, 5 March, 2018, 10:47am, Grid reference: 2529 & 2529DC), hosted by the South African National Biodiversity Institute (SANBI). This is a considerably larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has probably not been well sampled in the past.
» The International Union for Conservation of Nature (IUCN) conservation status of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2013).
» Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment (NFEPA) (Nel et al. 2011). This includes rivers, wetlands and catchments defined under the study area.

- For reference the following definitions are provided pertaining to wetland, watercourses (streams) and drainage lines etc.
  - **Drainage line**: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial and riparian vegetation may not be present.
  - **Perennial and non-perennial**: Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contain flows for short periods, such as a few hours or days in the case of drainage lines.
  - **Riparian**: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are

saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).

- **Wetland**: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin et al., 1979).
- **Water course**: as per the National Water Act means -
  (a) a river or spring;
  (b) a natural channel in which water flows regularly or intermittently;
  (c) a wetland, lake or dam into which, or from which, water flows; and
  (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Fauna

» Lists of mammals, reptiles and amphibians which are likely to occur in the study area were derived based on distribution records from the literature and various spatial databases (SANBI's SIBIS and BGIS databases).

» Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.

» Apart from the literature sources, additional information on reptiles were extracted from the South African Reptile Conservation Assessment (SARCA) web portal, hosted by the Animal Demography Unit (ADU), http://vmus.adu.org.za

» The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria 2014 (See Figure 13) and where species have not been assessed under these criteria, the Convention on International Trade in Endangered Species (CITES) status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming, the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

6.2 Site Visit

The site was conducted on the 15th to the 17th of March 2018. During the site visit, the different biodiversity features, habitat, and landscape units present at the site were identified and mapped in the field. Specified features visible on the satellite imagery of the site were also marked for field inspection and were verified and assessed during the site visit. A walk-through-survey was done of the study site wherein all plant and animal species observed were recorded. Random plots (4X4m) were taken during the survey wherein all plants were recorded. Active searches for reptiles and amphibians were also conducted. All data samples were accompanied by GPS coordinates and was used in the compilation of the sensitivity map.

6.3 Criteria used to assess the project site

The broad-scale scoping phase ecological sensitivity map of the site was produced by integrating information acquired during the desktop survey including available ecological and biodiversity information available in the literature and various spatial databases (SIBIS, BGIS) as well as the Mpumalanga Provinces' CBAs. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

Table 4: Explanation of sensitivity rating

Sensitivity	Factors contributing to sensitivity	Examples of qualifying features
VERY HIGH	Indigenous natural areas that are highly positive for any of the following: ▪ Presence of threatened species (Critically Endangered, Endangered, Vulnerable) and/or habitat critical for the survival of populations of threatened species. ▪ High conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). ▪ Protected habitats (areas protected according to national/provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas, Lake Areas Development Act)	▪ CBA 1 areas ▪ Remaining areas of vegetation type listed in Draft Ecosystem List of NEM:BA as Critically Endangered, Endangered or Vulnerable. ▪ Protected forest patches. ▪ Confirmed presence of populations of threatened species.

Sensitivity	Factors contributing to sensitivity	Examples of qualifying features
	May also be positive for the following: ▪ High intrinsic biodiversity value (high species richness and/or turnover, unique ecosystems) ▪ High value ecological goods and services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value) ▪ Low ability to respond to disturbance (low resilience, dominant species very old).	
HIGH	Indigenous natural areas that are positive for any of the following: ▪ High intrinsic biodiversity value (moderate/high species richness and/or turnover). ▪ Presence of habitat highly suitable for threatened species (Critically Endangered, Endangered Vulnerable species). ▪ Moderate ability to respond to disturbance (moderate resilience, dominant species of intermediate age). ▪ Moderate conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk). ▪ Moderate to high value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). May also be positive for the following: ▪ Protected habitats (areas protected according to national/provincial legislation, e.g. National Forests Act, Draft Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)	▪ CBA 2 "critical biodiversity areas". ▪ Habitat where a threatened species could potentially occur (habitat is suitable, but no confirmed records). ▪ Confirmed habitat for species of lower threat status (near threatened, rare). ▪ Habitat containing individuals of extreme age. ▪ Habitat with low ability to recover from disturbance. ▪ Habitat with exceptionally high diversity (richness or turnover). ▪ Habitat with unique species composition and narrow distribution. ▪ Ecosystem providing high value ecosystem goods and services.

Sensitivity	Factors contributing to sensitivity	Examples of qualifying features
MEDIUM-HIGH	Indigenous natural areas that are positive for one or two of the factors listed above, but not a combination of factors.	▪ CBA 2 "corridor areas". ▪ Habitat with high diversity (richness or turnover). ▪ Habitat where a species of lower threat status (e.g. near threatened, rare) could occur (habitat is suitable but no confirmed records).
MEDIUM-LOW	Degraded or disturbed indigenous natural vegetation	
LOW	No natural habitat remaining	

Any natural vegetation within which there are features of conservation concern will be classified into one of the high sensitivity classes (MEDIUM-HIGH, HIGH or VERY HIGH). The difference between these three high classes is based on a combination of factors and can be summarized as follows:

» Areas classified into the VERY HIGH class are vital for the survival of species or ecosystems. They are either known sites for threatened species or are ecosystems that have been identified as being remaining areas of vegetation of critical conservation importance. CBA1 areas would qualify for inclusion into this class.

» Areas classified into the HIGH class are of high biodiversity value, but do not necessarily contain features that would put them into the VERY HIGH class. For example, a site that is known to contain a population of a threatened species would be in the VERY HIGH sensitivity class, but a site where a threatened species could potentially occur (habitat is suitable), but it is not known whether it does occur, is classified into the HIGH sensitivity class. The class also includes any areas that are not specifically identified as having high conservation status but, have high local species richness, unique species composition, low resilience or provide very important inclusion into this class, if there were no other factors that would put them into the highest class.

» Areas classified into the MEDIUM-HIGH sensitivity class are natural vegetation in which there are one or two features that make them of biodiversity value, but not to the extent that they would be classified into one of the other two higher categories. CBA2 "corridor areas" would qualify for inclusion into this class.

6.4 Assessment of impacts to be used during the Basic Assessment

The EIA methodology assists in the evaluation of the overall effect of a proposed activity on the environment. This includes an assessment of the significant direct, indirect, and cumulative impacts. The significance of environmental impacts is to be assessed by means of the criteria of extent (scale), duration, magnitude (severity), probability (certainty) and direction (negative, neutral or positive).

» The **nature**, which includes a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 was assigned as appropriate (with 1 being low and 5 being high).
» The **duration**, wherein it was indicated whether:
  - the lifetime of the impact will be of a very short duration (0 – 1 years) – assigned a score of 1;
  - the lifetime of the impact will be of a short duration (2 – 5 years) – assigned a score of 2;
  - medium-term (5 -15 years) – assigned a score of 3;
  - long term (> 15 years) – assigned a score of 4; or
  - permanent – assigned a score of 5;
» The **magnitude**, quantified on a scale from 0 – 10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
» The **probability** of occurrence, which describes the likelihood of the impact actually occurring. Probability was estimated on a scale of 1 -5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
» The **significance**, was determined through a synthesis of the characteristics described above and can be assessed as **LOW**, **MEDIUM** or **HIGH**; and
» the **status**, which was described as either positive, negative or neutral.
» the degree of which the impact can be reversed,
» the degree to which the impact may cause irreplaceable loss of resources,
» the degree to which the impact can be mitigated.

The significance was calculated by combining the criteria in the following formula:

S=(E+D+M)P where;

» S = Significance weighting
» E = Extent
» D = Duration
» M = Magnitude
» P = Probability

The significance weightings for each potential impact are as follows;

» < 30 points: **LOW** (i.e. where the impact would not have a direct influence on the decision to develop in the area),
» 30 – 60 points: **MEDIUM** (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» > 60 points: **HIGH** (i.e. where the impact must have an influence on the decision process to develop in the area).

7 RESULTS

7.1 Vegetation Survey

As already mentioned extremely little of the study area contained vegetation that resembled Rand Highveld Grassland with most of the study area in a severe degraded and disturbed condition. Mainly due to historical cultivation activities as well as afforestation activities (plantations and woodlots). The previous disturbed areas as well as the surrounding areas contain a vegetation cover comprising of numerous weeds, alien plants as well as pioneer and sub-climatic species associated with such disturbed areas. Some invasive alien trees have also settled within these areas (apart from the woodlots). Almost 97% (81.52ha) of the study area have been transformed and disturbed. The remaining 2.8% is regarded as slightly disturbed to semi-natural and contain some elements of the natural occurring grassland and occur as isolated patches associated mostly with the wetland habitats. Due to the highly transformed and degraded state of the study area this portion of land provides very limited ecological functions and services including some habitat for a very limited amount of biota (flora and fauna). Very little grazing potential is provided by this area due to the dominance of unpalatable weeds and forbs as well as pioneer grasses.

Three azonal habitats (hydrological systems) were identified within the study area. Two of these hydrological systems appear to be endoreic, namely the Wetland Flat and Depression Wetland. The unchanneled valley-bottom wetland as well as

associated seepages form part of a larger draining system (extending well beyond the study area), flowing largely in a southern direction. The ecological condition of these azonal habitats varies from severely degraded and transformed (Depression, Wetland Flat and some of the Seepages) to mostly disturbed and transformed (Valley-bottom Wetland and remaining seepages). Disturbances within these habitats are mainly due to invasive alien plant invasion, historical ploughing, trampling, roads and afforestation.

A total of 147 different plant species were recorded within the study area of which 54 species were alien plant and weeds (12 were listed invasive alien plants), subsequently contributing 36.7% to the total species composition of the study area. Furthermore, as already mentioned, five conservation worthy species were recorded within the study area including one Red Data Species (Hypoxis hemerocallidea – Declining) and four MNCA protected species, namely *Gladiolus spp., Habenaria galpinii, Eucomis autumnalis and Aloe ecklonis*. All of these species were identified outside of the development footprint and subsequently will not be impacted by the proposed development. All of these species do not have deep rooting systems and can be successfully removed and relocated to a similar habitat if some species were to be encountered with the development area during the walkthrough.

The vegetation habitats that would be affected by the development are described in more below.

A. *Seriphium plumosum – Pollichia campestris* Unit: Transformed mixed forb/grass land on gravelly compacted soils:

This mixed forb/grassland have re-established on formerly transformed cultivation land characterized by a slightly higher grit/gravel content. These soils tend to compact when exposed. The vegetation is characterized by a mixture of dwarf shrubs, forbs and sub-climatic grasses. Weedy species and alien plants contribute approximately 50 - 60% of the total vegetation cover of this unit. This unit is moderate to poor in terms of species diversity with numerous weeds and alien plants contributing to the species diversity.

Habitat and Land use			
Substrate	Moderate to deep Sandy to Sandy-loam soil with some fine gravel and grit present within the soil and on the surface. Soils tend to be prone to soil capping.	**Disturbance**	Past cultivation and ploughing activities. Low to Moderate levels of AIP invasion (e.g. *Acacia mearnsii, Eucalyptus camaldulensis, Verbena brasiliensis*). Dense patch of *Acacia mearnsii and*

			Eucalyptus camaldulensis woodlots are present within this unit with some of the species establishing outside of the woodlots.
Species Richness **(Indigenous)**	40 species	**Conservation value:**	Low Highly disturbed and transformed.
Ecosystem function	Permanent vegetation cover for stabilising, maintaining and nourishing soil as well as for slowing down runoff to increase infiltration into the soil.	**Sensitivity:**	Low
Need for rehabilitation	Clearing of weeds and alien invasive species (12 alien plants, weeds and pioneer species noted.	**Agricultural potential**	Very Low

Vegetation structure		
Layer	**Height (m)**	**Cover (%)**
High shrubs and trees	1.5 - 4	0 – 15
Low Shrubs	0.2 – 1	20 – 55
Grass	0.1 – 0.9	20 – 30
Forbs	0.01 – 1.5	30 - 50
Diagnostic Species, Dominant Species & Constant Species	***Seriphium plumosum*, *Microchloa caffra*, *Pollichia campestris*,** *Heteropogon contortus, Helichrysum nudifolium, Eragrostis racemose, Eragrostis gummiflua, Eragrostis chloromelas, Melinis repens, Verbena brasiliensis.*	

Species	Growth Form	Ecological Status	Average Cover (%)
Agrostis lachnantha	Grass		2
Aristida congesta subsp. congesta	Grass	Weed	6
Berkheya setifera	Forb		1
Bulbine narcissifolia	Geophyte		2
Conyza bonariensis	Forb	Alien Plant	6
Conyza canadensis	Forb	Alien Plant	
Conyza sumatrensis	Forb	Alien Plant	2
Crepis hypchaeridea	Forb	Alien Plant	4

Cyanotis spp.	Forb		0.5
Dicoma anomala	Forb		0.5
Eragrostis chloromelas	Grass		35
Eragrostis curvula	Grass	Weed	5
Eragrostis gummiflua	Grass		15
Eragrostis racemosa	Grass		22
Felicia muricata	Dwarf Shrub		5
Haplocarpha lyrata	Forb		1
Helichrysum acutatum	Forb		0.5
Helichrysum aureonitens	Forb		3
Helichrysum nudifolium	Forb		10
Helichrysum rugolosum	Forb		4
Hermannia depressa	Forb		1
Hermannia transvaalensis	Forb		0.5
Heteropogon contortus	Grass	Weed	25
Hibiscus microcarpus	Forb		0.1
Hypoxis rigidula	Geophyte		0.5
Melenis repens	Grass	Alien Plant	1
Microchloa caffra	Grass		25
Nemesia fruticans	Forb		0.5
Pogonarthria squarrosa	Grass		18
Pollichia campestris	Forb		8
Rhynchosia caribaea	Creeping Forb		3
Richardia brasiliensis	Forb	Alien Plant	12
Selago densiflora	Dwarf Shrub		4
Senecio coronatus	Forb		0.5
Seriphium plumosum	Dwarf Shrub	Weed	55
Tagetes minuta	Forb	Alien Plant	4
Tephrosia rhodesica	Forb		3
Themeda triandra	Grass		5
Trichoneura grandiglumis	Grass		1
Verbena brasiliensis	Forb	Category 1b IAP	8
Cynodon dactylon	Grass	Weed	1

Photo 1: View of the western portion of Vegetation unit 1.

B. *Conyza sumatrensis – Senecio pentactinus* Unit: Transformed mixed forb/grass land on deep sandy soils:

This mixed forb/grassland have re-established on formerly transformed cultivation land characterized by deep, fine textured sandy soils. A relative tall for layer (comprising mostly of *Conyza sumatrensis, Bidens pilosa, Senecio pentactinus, Tagetes minuta and Verbena brasiliensis*), dominate this vegetation unit. Weedy species and alien plants contribute approximately 70 - 80% of the total vegetation cover of this unit. This unit is moderate to poor in terms of species diversity with numerous weeds and alien plants contributing to the species diversity. Most of the proposed development will occur within this vegetation unit.

Habitat and Land use			
Substrate	Relative deep, finely textured sandy soils with little to no gravel/grit.	**Disturbance**	Past cultivation and ploughing activities. Moderate levels of AIP invasion (e.g. *Acacia mearnsii, Eucalyptus camaldulensis, Verbena brasiliensis*). Dense patch of *Acacia mearnsii and Eucalyptus camaldulensis* woodlots are present within this unit with some of the species establishing outside of the woodlots.
Species Richness	47 species	**Conservation value:**	Low Highly disturbed and transformed.

Ecosystem function	Permanent vegetation cover for stabilising, maintaining and nourishing soil as well as for slowing down runoff to increase infiltration into the soil.	**Sensitivity:**	Low
Need for rehabilitation	Clearing of weeds and alien invasive species (27 alien plants, weeds and pioneer species noted.	**Agricultural potential**	Very Low

Vegetation structure		
Layer	**Height (m)**	**Cover (%)**
High shrubs and trees	1.5 - 4	0 – 8
Low Shrubs	0.2 – 1	0 – 15
Grass	0.1 – 0.9	20 – 40
Forbs	0.01 – 1.5	60 – 80
Diagnostic Species, Dominant Species & Constant Species	***Conyza sumatrensis*, *Senecio pentactinus, Tagetes minuta, Eragrostis curvula,*** *Bidens pilosa, Richardia brasiliensis, Senecio inornatus, Verbena brasiliensis*	

Species	Growth Form	Ecological Status	Average Cover (%)
Agrostis lachnantha	Grass		0.5
Aristida bipartita	Grass	Weed	1
Aristida congesta subsp. congesta	Grass	Weed	0.5
Berkheya insigins	Forb	Weed	5
Bidens pilosa	Forb	Alien Plant	12
Bulbine narcissifolia	Geophyte		0.5
Cleome maculata	Forb	Alien Plant	0.5
Commelina africana var. krebsiana	Forb	Weed	4
Conyza bonariensis	Forb	Alien Plant	4
Conyza canadensis	Forb	Alien Plant	12
Conyza sumatrensis	Forb	Alien Plant	55
Ctenium concinnum	Grass		3
Eragrostis chloromelas	Grass		12
Eragrostis curvula	Grass	Weed	25
Eragrostis gummiflua	Grass		8
Felicia muricata	Dwarf Shrub		1
Helichrysum nudifolium	Forb		6

Helichrysum ruderale	Forb		0.1
Hibiscus pusillus	Forb		0.1
Hibiscus trionum	Forb	Alien Plant	0.5
Hyparrhenia hirta	Grass		3
Nemesia fruticans	Forb		0.5
Oenothera biennis	Forb	Alien Plant	0.5
Oxygonum dregeanum	Forb		0.5
Plantago lanceolata	Forb	Alien Plant	2
Pogonarthria squarrosa	Grass		9
Pollichia campestris	Forb		0.5
Richardia brasiliensis	Forb	Alien Plant	15
Selago densiflora	Dwarf Shrub		1
Senecio consanguineus	Forb	Weed	3
Senecio inornatus	Forb		18
Senecio pentactinus	Forb	Weed	55
Seriphium plumosum	Dwarf Shrub	Weed	3
Solanum nigrum	Forb	Alien Plant	0.5
Striga asiatica	Hemi-parasitic Forb		0.5
Tagetes minuta	Forb	Alien Plant	20
Tragopogon dubius	Forb	Alien Plant	0.1
Tricholaena monachne	Forb		0.5
Urelytrum agropyroides	Grass		1
Verbena brasiliensis	Forb	Category 1b IAP	25
Vernonia poskeana	Forb		2
Eucalyptus camaldulensis	Tree	Category 2 IAP	8
Acacia dealbata	Tree	Category 2 IAP	1
Cynodon dactylon	Grass	Weed	2
Schkuhria pinnata	Forb	Alien Plant	1
Agave americana	Succulent Herb	Alien Plant	0.1
Cosmos bipinnatus	Forb	Alien Plant	2

Photo 2: View of the western portion of Vegetation unit 2.

C. *Leersia hexandra – Kylinga erecta* var*. erecta* Unit: Permanent saturated wetland zone:

The vegetation of this unit can be described as moisture loving graminoids adapted to extended periods of soil saturation with occasional seasonal inundation (normally for short periods of time following sufficient precipitation). This vegetation unit is mostly associated with the wetland flat and valley-bottom wetland. Disturbances within the wetlands themselves as well as within the catchment has resulted in the significant alteration of the hydrological and morphological character of these wetland areas, subsequently resulting in an alteration/transformation of the species composition of these areas leaving some locations exposed to invasion with alien plants. Sedges and hydrophytic grasses dominate this unit with some forbs present, especially in disturbed areas. Weedy species and alien plants contribute approximately 15 - 25% of the total vegetation cover of this unit. This unit is poor in terms of species diversity with numerous weeds and alien plants contributing to the species diversity. This vegetation unit is excluded from the development footprint and will not be impacted.

Habitat and Land use			
Substrate	Greyish loamy soils, may locally become more clayey. Most of these habitats tend to become saturated with water, temporary after sufficient rainfall. Wetlands predominantly surface water fed. Input from runoff (diffuse	**Disturbance**	Severe catchment alteration, Trampling, Alterations to morphology, Moderate levels of alien plant invasion (e.g. *Verbena brasiliensis, V.*

	flow from the slopes as well as contained flow within the higher lying drainage channels) and precipitation. Wetlands may contain a lower permeability layer overlying an aquifer (impermeable strata) and subsequently groundwater seepage may also contribute to the water input.		*bonariensis, Persicaria lapathifolia*).
Species Richness	29 species	**Conservation value:**	Medium Provide relative valuable ecosystem functions and services.
Ecosystem function	Vegetation for stabilisation of soils, accumulated and slows down runoff from higher lying areas, maximises infiltration of runoff into soils and filtering of runoff before it seeps further into lower-lying river systems, creates unique habitat for flora and fauna	**Sensitivity:**	Medium - High
Need for rehabilitation	Clearing of weeds and alien invasive species (7 alien plants, weeds and pioneer species noted.	**Agricultural potential**	Very Low

Vegetation structure		
Layer	**Height (m)**	**Cover (%)**
High shrubs and trees	1.5 - 4	0
Low Shrubs	0.2 – 1	0 - 3
Grass	0.1 – 0.9	70 - 90
Forbs	0.01 – 1.5	10 - 30
Diagnostic Species, Dominant Species & Constant Species	***Leersia hexandra*, *Kylinga erecta var. erecta, Eleocharis acutangular, Persicaria lapathifolia,*** *Typha capensis, Imperata cylindrica, Agrostis lachnantha, Runanculus meyeri*	

Species	Growth Form	Wetland Indicator Status	Ecological Status	Average Cover (%)
Kylinga erecta var. erecta	Sedge	Obligate Wetland		35

Cycnium tubulosum	Forb	Facultative Wetland		0.5
Sabaea leiostyla	Forb	Facultative Wetland		0.1
Typha capensis	Bulrush	Obligate Wetland		15
Ranunculus meyeri	Forb	Obligate Wetland		10
Ranunculus multifidus	Forb	Obligate Wetland		3
Andropogon eucomus	Grass	Obligate Wetland		3
Hemarthria altissima	Grass	Obligate Wetland		5
Setaria sphacelata var. sericea	Grass	Facultative Wetland		8
Imperata cylindrica	Grass	Obligate Wetland		12
Panicum shinzii	Grass	Facultative Wetland	Weed	4
Agrostis lachnantha	Grass	Facultative Wetland		12
Leersia hexandra	Grass	Obligate Wetland		60
Arundinella nepalensis	Grass	Obligate Wetland		8
Acroceras macrum	Grass	Obligate Wetland		4
Eragrostis planiculmis	Grass	Obligate Wetland		3
Brachiaria spp.	Grass	Obligate Wetland		4
Eleocharis acutangula	Sedge	Obligate Wetland		25
Eleocharis spp. (limosa?)	Sedge	Obligate Wetland		2
Juncus effusus	Rush	Obligate Wetland		8
Paspalum scrobiculatum	Grass	Obligate Wetland		3
Cyperus esculentis	Sedge	Facultative	Alien Plant	1
Panicum spp. (subflabellatum or dregeanum?)	Grass	Obligate Wetland		2
Plantago major	Forb	Facultative Wetland	Alien Plant	6
Persicaria lapathifolia	Forb	Obligate Wetland	Alien Plant	25
Cyperus denudatus	Sedge	Obligate Wetland		7
Verbena bonariensis	Forb	Opportunistic Wetland	Category 1b IAP	8
Cynodon dactylon	Grass	Facultative	Weed	0.5
Paspalum urvillei	Grass	Obligate Wetland	Alien Plant	2
Bergia pentheriana	Forb	Obligate Wetland		1

Photo 3: View of the western portion of Vegetation unit 3.

D. *Agrostis lachnantha – Juncus oxycarpus* Unit: Seasonal to temporary saturated wetland zone:

This vegetation unit comprise two hydrological zones (temporary and seasonal saturated zones) and can be described as a mixture of moisture loving graminoids accompanied by high base cover of forbs (mainly weeds and alien plants). The boundaries between these two zones are difficult to distinguished based on vegetation composition as these units share most species. Slight differences in terms of the dominant species and constant species as well as percentage cover of some of the species provide some distinction. As these zones are relatively similar in species composition, disturbances as well as functions and services provided it was decided to provide a collective description. Disturbances within these wetland zones include historical ploughing, afforestation, high density weed and alien plant invasion and some trampling. The degree in disturbance within these zones differ with the pan wetland (containing both zones) being severely altered and degraded, to an extent where most of this wetland's functions and services have been lost. Weedy species and alien plants contribute approximately 20 - 30% of the total vegetation cover of these zones. The temporary and seasonally wet zones is poor in terms of species diversity with numerous weeds and alien plants contributing to the species diversity. One Red Data Species (*Hypoxis hemerocallidea* – Declining) and four Mpumalanga Nature Conservation Act (Act 10 of 1998) (MPNCA) Protected species (*Eucomis autumnalis, Habenaria galpinii, Gladiolus* spp. and *Aloe ecklonis*) have been recorded within this unit. None of these species occurred within the development footprint and will subsequently not be impacted by the proposed development. If such species were to be identified within the development area,

these species may not be disturbed/destroyed or relocated without the necessary permits obtained from the relevant authority (Mpumalanga Tourism and Parks Agency). Most of these wetland zones are excluded from the development footprint and will not be impacted apart from the depression wetland located along the central portion of the western boundary of the study area. Access road option B will slightly impact on this wetland. It is suggested that either this option is slightly re-aligned to join the existing road some 70m north of this point or to reject this option and to regard option A as the preferred option.

Habitat and Land use			
Substrate	Greyish loamy soils, may locally become more clayey in the subsurface soil layers or contain plinthic horizons with indications of wetness (Mottles). Most of these habitats tend to become soil saturated during the rainy season or after sufficient precipitation have occurred. Saturation may remain for a short period of time (for temporary zone) or throughout extended periods of time during the wet season. Wetlands predominantly surface water fed. Input from runoff (diffuse flow from the slopes as well as contained flow within the higher lying drainage channels) and precipitation. Wetlands may contain a lower permeability layer overlying an aquifer (impermeable strata) and subsequently groundwater seepage may also contribute to the water input.	**Disturbance**	Severe catchment alteration, historical ploughing, afforestation, trampling, alterations to morphology, moderate to high levels of alien plant invasion (e.g. *Verbena brasiliensis, V. bonariensis, Eucalyptus camaldulensis, Acacia mearnsii, Campuloclinium macrocephalum, Circium vulgare, Conyza sumatrensis, Paspalum urvillei, Plantago major*).
Species Richness	86 species Approximately 54 species for seasonal saturated zone and 73 species for the temporary saturated zone.	**Conservation value:**	Medium Provide relative valuable ecosystem functions and services.
Ecosystem function	Vegetation for stabilisation of soils, accumulated and slows down runoff from higher lying areas, maximises infiltration of runoff into soils and filtering of runoff before it seeps further into lower-lying river	**Sensitivity:**	Medium

	systems, creates unique habitat for flora and fauna.		
Need for rehabilitation	Clearing of weeds and alien invasive species (33 alien plants, weeds and pioneer species noted.	**Agricultural potential**	Very Low

Vegetation structure		
Layer	**Height (m)**	**Cover (%)**
High shrubs and trees	1.5 - 4	0
Low Shrubs	0.2 – 1	0 - 3
Grass	0.1 – 0.9	50 - 70
Forbs	0.01 – 1.5	30 - 50
Diagnostic Species, Dominant Species & Constant Species	***Agrostis lachnantha*, *Juncus oxycarpus*, *Andropogon eucomus*, *Aristida junciformis*, *Eragrostis curvula*, *Kylinga erecta var. erecta*, *Persicaria lapathifolia*,** *Arundinella nepalensis, Eragrostis gummiflua, Helichrysum aureonitens, Imperata cylindrica, Microchloa caffra, Paspalum urvillei, Runanculus meyeri.*	

Species	**Growth Form**	**Wetland Indicator Status**	**Ecological Status**	**Average Cover (%)**	
				Seasonal	**Temporary**
Acacia mearnsii	Tree	Facultative Upland	Category 2 IAP		8
Agrostis lachnantha	Grass	Facultative Wetland		60	40
Aloe ecklonis	Succulent Herb	Facultative	MPNCA		0.5
Andropogon eucomus	Grass	Obligate Wetland		18	7
Aristida bipartita	Grass	Facultative		2	1
Aristida junciformis	Grass	Facultative		10	25
Arundinella nepalensis	Grass	Obligate Wetland		18	5
Berkheya insigins	Forb	Facultative			8
Buchnera reducta	Forb	Obligate Wetland		2	2
Campuloclinium macrocephalum	Forb	Facultative	Category 1b IAP	0.1	
Chironia purpurascens	Forb	Facultative Wetland			1
Circium vulgare	Forb	Opportunistic Wetland	Category 1b IAP	1	1
Commelina africana var. krebsiana	Forb	Facultative	W	7	4
Conyza bonariensis	Forb	Facultative Upland	AP		1
Conyza sumatrensis	Forb	Facultative Upland	AP	5	8

Cynodon dactylon	Grass	Facultative	W	2	8
Cyperus denudatus	Sedge	Obligate Wetland		2	
Cyperus esculentis	Sedge	Facultative	AP	4	6
Cyperus rigidifolius	Sedge	Facultative	W		2
Cyperus rotundus	Sedge	Facultative Wetland	AP	2	3
Cysnium tubulosum	Hemi-parasitic Forb	Facultative Wetland			1
Denekia capensis	Forb	Facultative Wetland			0.5
Digitaria argyrograpta	Grass	Facultative Upland		5	
Eragrostis chloromelas	Grass	Facultative Upland			4
Eragrostis curvula	Grass	Facultative Upland	W	12	20
Eragrostis gummiflua	Grass	Facultative Wetland		7	15
Eragrostis plana	Grass	Facultative	W	3	6
Eragrostis planiculmis	Grass	Obligate Wetland		6	
Eucalyptus camaldulensis	Tree	Facultative Upland	Category 2 IAP	3	1
Eucomis autumnalis	Geophyte	Facultative	MPNCA		0.5
Festuca scabra	Grass	Facultative			1
Gomphrena celosioides	Forb	Opportunistic Wetland	AP		0.5
Habenaria galpinii	Geophyte	Facultative	MPNCA		1
Haplocarpha lyrata	Forb	Facultative Wetland			0.5
Helichrysum aureonitens	Forb	Facultative Wetland		5	15
Helichrysum coriaceum	Forb	Facultative			1
Helichryum nudifolium	Forb	Facultative	W	3	4
Hermannia depressa	Forb	Facultative			0.5
Hyparrhenia dregeana	Grass	Facultative Wetland		1	1
Hyparrhenia hirta	Grass	Facultative Upland			2
Hypochaeris radicata	Forb	Opportunistic Wetland	AP	0.5	3
Hypoxis filiformis	Geophyte	Facultative Wetland		0.5	
Hypoxis hemerocallidea	Geophyte	Facultative	Declining		0.5
Iridaceae spp. (Gladiolus)	Geophyte	Obligate Wetland	MPNCA	0.5	
Imperata cylindrica	Grass	Obligate Wetland		15	5
Jamesbrittenia aurantiaca	Forb	Facultative			0.5
Juncus dregeanus	Rush	Obligate Wetland		6	5
Juncus efFacultative Uplandsus	Rush	Obligate Wetland		4	
Juncus oxycarpus	Rush	Obligate Wetland		12	18
Kylinga erecta var. erecta	Sedge	Obligate Wetland		25	6
Ledebouria cooperi	Geophyte	Facultative		0.5	1
Lobelia flaccida	Forb	Facultative Wetland			0.5

Microchloa caffra	Grass	Facultative Upland		7	10
Monocymbium ceresiiforme	Grass	Facultative		2	4
Monopsis decipiens	Forb	Obligate Wetland			0.5
Nidorella anomala	Forb	Facultative			1
Nidorella podocephala	Forb	Obligate Wetland		0.5	
Oenothera rosea	Forb	Facultative Wetland	AP		0.5
Oxygonum dregyanum	Forb	Facultative		0.5	2
Panicum ecklonii	Grass	Facultative			1
Panicum schinzii	Grass	Facultative Wetland	W	1	
Paspalum scrobiculatum	Grass	Obligate Wetland		5	
Paspalum urvillei	Grass	Facultative Wetland	AP	7	12
Persicaria lapathifolia	Forb	Obligate Wetland	AP	1	
Persicaria limbata	Forb	Obligate Wetland	AP	0.5	0.5
Plantago lanceolata	Forb	Facultative	AP		3
Plantago major	Forb	Facultative Wetland	AP	3	1
Pseudognaphalium luteo album	Forb	Facultative	AP		1
Ranunculus meyeri	Forb	Obligate Wetland		12	3
Richardia brasiliensis	Forb	Opportunistic Wetland	AP	1	4
Sabaea leiostyla	Forb	Facultative Wetland		0.5	0.5
Sabea grandis	Forb	Facultative Wetland			0.5
Senecio consanguineus	Forb	Facultative Upland	W		0.5
Senecio inornatus	Forb	Facultative Wetland		3	
Senecio pentactinus	Forb	Facultative Upland	W	5	8
Seriphium plumosum	Dwarf Shrub	Facultative	W		8
Setaria sphacelata var. sericea	Grass	Facultative Wetland		5	1
Sporobolus africanus	Grass	Facultative	W		0.5
Striga asiatica	Hemi-parasitic Forb	Facultative Wetland			0.5
Tagetes minuta	Forb	Opportunistic Wetland	AP	1	2
Themeda triandra	Grass	Facultative			2
Verbena bonariensis	Forb	Opportunistic Wetland	Category 1b IAP	15	15
Verbena brasiliensis	Forb	Opportunistic Wetland	Category 1b IAP	4	2
Vernonia poskeana	Forb	Facultative Upland		2	2
Vernonia spp. (glabra?)	Forb	Opportunistic Wetland	W	0.5	
Wahlenbergia virgata	Forb	Facultative Wetland		0.5	1

Photo 4: View of the western portion of Vegetation unit 4.

7.2 Faunal Survey (Amphibians, Reptiles and Mammals)

The study area was investigated during the vegetation survey for signs or the presence (observations) of amphibians, reptiles, and mammals as well as other noteworthy faunal species. Disturbances such as the transformation of natural veld, historical cultivation, human presence and the fractured nature of the landscape has contributed to an extremely low faunal biodiversity, especially in terms of mammals, consisting of highly adaptable and/or secretive species. Such species typically have a wide geographical distribution as well as habitat prevalence and are capable of either, adapting to an environmental (habitat) change or are highly mobile and are capable of moving between different habitat types.

The eastern portion of the study area, especially the valley-bottom wetland and seepage areas as well as fringing grassland is expected to contain a somewhat higher diversity due to the fact that this habitat is least disturbed and contain some connectivity downstream. Such wetland systems form important corridors of movement for species especially where the surrounding upland areas have been transformed for agricultural purposes.

Species and signs of such sighted during the survey on and in the vicinity of the study area were:

Mammals:

» Numerous small rodent burrows were noted throughout Vegetation Unit 2 with a preference of the units finely textured sandy soil. Species that will inhabit such a disturbed habitat is likely to be a "generalist" or a species that is highly adaptable to such environmental pressures. The most likely candidates include:

Crocidura mariquensis (Swamp musk shrew), *Myosorex varius* (Forest Shrew) *Rhabdomys pumilio* (Four-striped grass mouse) and *Mastomys natalensis* (Multimammate Mouse).

» Highly adaptable and mobile species such as Steenbok (*Raphicerus campestris*), Yellow Mongoose (*Cynictis penicillata*), Cape porcupine (*Hystrix africaeaustralis*), and Scrub Hare (*Lepus saxatilis*) may occasionally utilize the study area.
» A few tremitarias were noted although not abundant throughout the study area and may provide some food source and habitat for species such as Aardvark (*Orycteropus afer*) and Lesser Dwarf Shrew (*Suncus varilla*).
» Within the Wetland Flat signs of rodent activity was noted and likely belonged to South African Vlei Rat (*Otomys irroratus*)

In general, the impact associated with the development on mammals can be regarded as low.

Reptiles and Amphibians:

» No reptile activity was noted during the survey.
» No amphibian activity was noted during the survey within the study area. However, the following species were noted within a wetland outside of the study area and have a likelihood to occur within the seasonally inundated portions of the valley-bottom wetland within the study area (may temporary inhabit wet areas during rainy season and move downstream to permanent inundated area during drier periods): *Strongylopus fasciatus* (Striped Stream Frog) and *Hyperolius marmoratus* (Painted Reed Frog).

In general, the impact associated with the development on amphibians and reptiles can be regarded as low.

7.3 Ecological Sensitivity Analysis

The relevant sensitivities of the vegetation units and ecological features as determined by this study are presented in Figure 16, with summaries on the sensitivity issues for every vegetation association presented after that. All areas re completely transformed such as cultivated areas, exotic woodlots and areas containing infrastructure and old building ruins are regarded as low sensitive.

A. MEDIUM-HIGH SENSITIVITY

a. Vegetation Unit 3: *Leersia hexandra – Kylinga erecta var. erecta* Unit (Permanent saturated wetland zone)

Conservation status	» Medium » Mostly slightly disturbed to semi-natural wet grassland. Provide relative valuable ecosystem functions and services (albeit in an altered form).
Ecosystem function	» Vegetation as stabilisation of soils, » Accumulated and slows down runoff from higher lying areas, » Maximises infiltration of runoff into soils and filtering of runoff before it seeps further into lower-lying river systems, » Creates unique habitat for flora and fauna.
Stability	» High where the vegetation layer is dense, » Medium to low if soils become bare.
Reversibility of degradation	» Habitat will be difficult to recreate after significant modification, rehabilitation of vegetation and ecosystem functionality after disturbance will be problematic and slow.
Rating	» ***Medium-High sensitivity (These areas should preferably be regarded as No-Go Areas)***

b. Vegetation Unit 4: *Agrostis lachnantha – Juncus oxycarpus* Unit (Seasonal and Temporary saturated wetland zones)

Conservation status	» Medium » Mostly disturbed to highly disturbed wet grassland. Has lost some of its functionality but still however provide some valuable ecosystem functions and services (albeit in an altered and limited form form). » 5 Conservation worthy species: o *Hypoxis hemerocallidea* (Declining) o *Aloe ecklonis* (Provincially Protected – MPNCA) o *Eucomis autumnalis* (Provincially Protected – MPNCA) o *Habenaria galpinii* (Provincially Protected – MPNCA) o *Gladiolus* spp. (Provincially Protected – MPNCA)
Ecosystem function	» Vegetation as stabilisation of soils, » Accumulated and slows down runoff from higher lying areas, » Maximises infiltration of runoff into soils and filtering of runoff before it seeps further into lower-lying river systems.

Stability	» High where the vegetation layer is dense, » Medium to low if soils become bare.
Reversibility of degradation	» Habitat will be difficult to recreate after significant modification, rehabilitation of vegetation and ecosystem functionality after disturbance will be problematic and slow.
Rating	» ***Medium-High sensitivity (These areas should preferably be regarded as No-Go Areas)***

B. LOW SENSITIVITY

a. Vegetation Unit 1: *Seriphium plumosum – Pollichia campestris* Unit (Transformed mixed forb/grass land on gravelly compacted soils)

Conservation status	» Low » Highly degraded and transformed grassland re-established on historically ploughed land and old woodlot areas.
Ecosystem function	» Permanent vegetation cover for stabilising, maintaining and nourishing soil as well as for slowing down runoff to increase infiltration into the soil. » Vegetation as grazing (very low potential).
Stability	» Medium to high if vegetation cover is maintained; » Clearing and monitoring of weeds and invasive species will be necessary.
Reversibility of degradation	» Possible, will require intervention such as over sowing, » Clearing of invasives is needed to improve ecosystem functionality
Rating	» ***Low sensitivity***

b. Vegetation Unit 2: *Conyza sumatrensis – Senecio pentactinus* Unit (Transformed mixed forb/grass land on deep sandy soils)

Conservation status	» Low » Highly degraded and transformed grassland re-established on historically ploughed land and old woodlot areas.

Ecosystem function	» Permanent vegetation cover for stabilising, maintaining and nourishing soil as well as for slowing down runoff to increase infiltration into the soil. » Vegetation as grazing (very low potential).
Stability	» Medium to high if vegetation cover is maintained; » Clearing and monitoring of weeds and invasive species will be necessary.
Reversibility of degradation	» Possible, will require intervention such as over sowing, » Clearing of invasives is needed to improve ecosystem functionality.
Rating	» ***Low sensitivity***

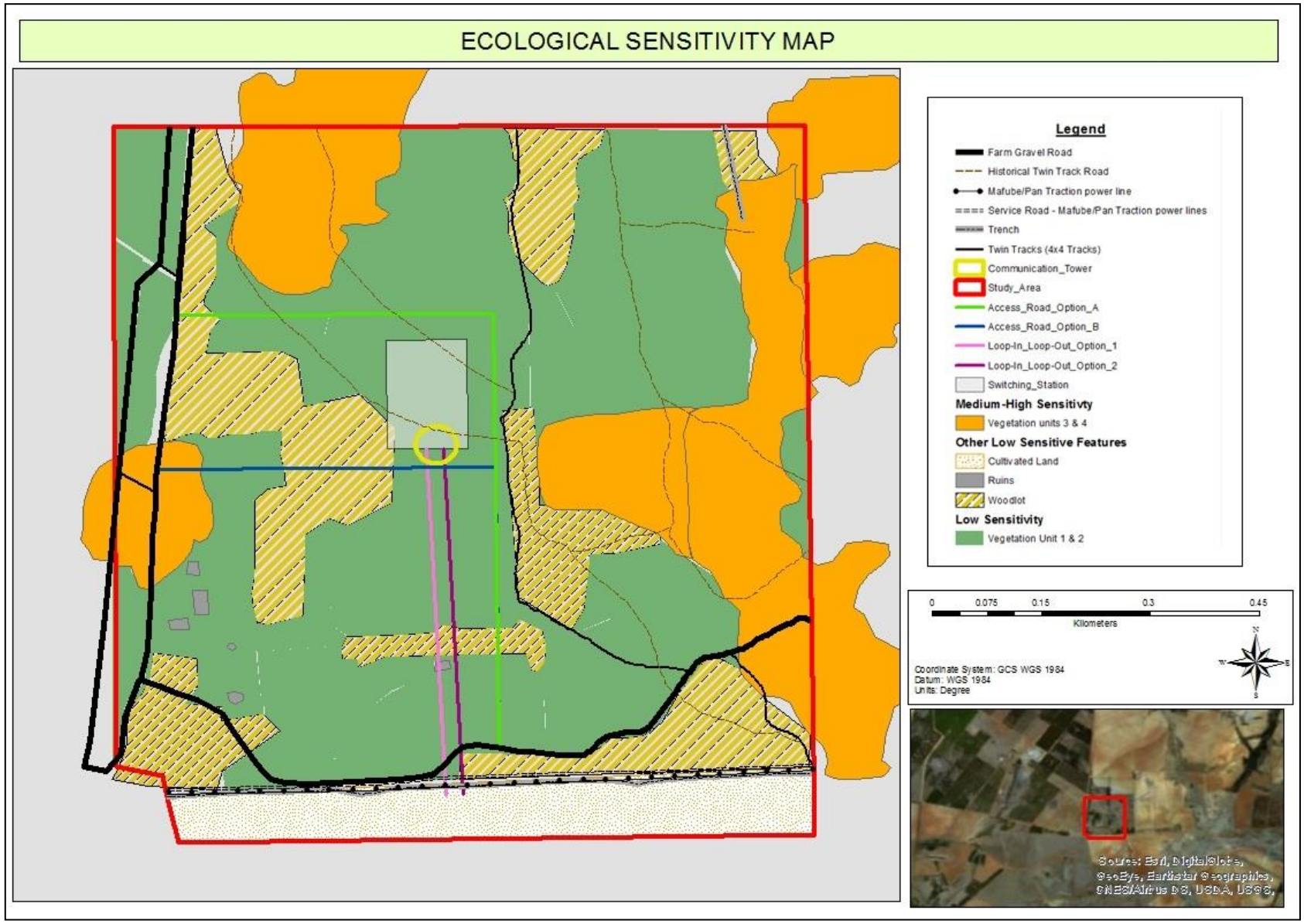


Figure 16: Ecological Sensitivity for the study area.

8 IMPACT ASSESSMENT

8.1 Identification of Potential Impacts

ASSUMPTIONS

The following is assumed and/or known:

- » A thorough ecological investigation of all footprint areas will be conducted to detect, and relocate where possible; all plant species of conservation concern by a suitably qualified botanist prior to commencement of construction.
  - Such investigation must be carried out at a time when the maximum amount of species is actively growing and thus visible.
- » Prior to development and after construction the development footprint will be routinely cleared of all alien invasive plants if detected.
- » The construction phase itself will be associated with clearing of vegetation within the development footprint only.
- » All removal of vegetation for construction purposes will be done mechanically, with the use of herbicides restricted to larger woody species.
- » A continuous vegetation layer is the most important aspect of ecosystem functionality within and beyond the project site.
  - A weakened or absent vegetation layer not only exposes the soil surface, but also lacks the binding and absorption capacity that creates the buffering functionality of vegetation to prevent or lessen erosion as a result of floods.

Potential ecological impacts resulting from the proposed development would stem from a variety of different activities and risk factors associated with the construction and operation phases of the project including the following:

- » Human presence and uncontrolled access to the site may result in negative impacts on fauna and flora through poaching of fauna and uncontrolled collection of plants for traditional medicine or other purpose.

Construction Phase

- » Site clearing and exploration activities for site establishment.
- » Vegetation clearing would also lead to the loss of vegetation communities and habitats for fauna and potentially the loss of faunal species, habitats and ecosystems. On a larger and cumulative scale (if numerous and uncontrolled developments are allowed to occur in the future) the loss of these vegetation communities and habitats may potentially lead to a change in the ability of this vegetation type and associated features to fulfil its ecological responsibilities (functions). The above impact is however regarded as very low. It is expected that the impact will be mostly local

(concentrated within the proposed development areas and within the immediate surrounding areas).

- » Soil compaction and increased erosion risk would occur due to the loss of plant cover and soil disturbance created during the construction phase.
- » Invasion by alien plants may be attributed to excessive disturbance to vegetation, creating a window of opportunity for the establishment of these alien invasive species. In addition, regenerative material of alien invasive species may be introduced to the site by machinery traversing through areas with such plants or materials that may contain regenerative materials of such species.
- » Presence and operation of construction machinery on site. This will create a physical impact as well as generate noise, potential pollution and other forms of disturbance at the site.
- » Increased human presence can lead to poaching, illegal plant harvesting and other forms of disturbance such as fire.

Operation Phase

- » The project will require maintenance and if this is not done appropriately, it could impact adjacent intact areas through impacts such as erosion and the invasion of alien plant species.

Cumulative Impacts

- » Invasion of exotics and invasive species into the broader area may potentially be exacerbated.

The following impacts are identified as the major impacts that are likely to be associated with the development and which are assess for the development.

Impacts on vegetation

The most likely and significant impact will be on the vegetation. The proposed development will lead to the general loss of vegetation within the development footprint area.

Direct and Indirect Faunal impacts

Faunal species will primarily be affected by the overall loss of habitat. Increased levels of noise, pollution, disturbance and human presence may be detrimental to fauna. Sensitive and shy fauna would move away from the area, while some slow-moving species and species confined and dependant on specified habitats would not be able to avoid the construction activities and might be killed. Some mammals and reptiles may be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. This impact is likely to occur during the construction-phase and would also potentially occur with resident fauna within the facility after

construction. Disturbance of faunal species can be maintained to a minimum and low significance by implementing effective mitigation measures.

Alien Plant Invasion

Major factors contributing to invasion by alien invader plants includes habitat disturbance and associated destruction of indigenous vegetation. Consequences of this may include:

- » further loss and displacement of indigenous vegetation;
- » change in vegetation structure leading to change in various habitat characteristics;
- » change in plant species composition;
- » change in soil chemistry properties;
- » loss of sensitive habitats;
- » loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
- » fragmentation of sensitive habitats;
- » change in flammability of vegetation, depending on alien species;
- » hydrological impacts due to increased transpiration and runoff; and
- » impairment of wetland function.

Although the potential severity of this impact may be high, it can be easily mitigated through regular alien control.

Soil erosion and associated degradation of ecosystems

Soil erosion is a frequent risk due to vegetation clearance and disturbance associated with the construction phase of the development and may continue occurring throughout the operational phase. Hard impenetrable surfaces will generate an increase in runoff during intense rainfall events and may exaggerate the effects of erosion.

With effective mitigation measures in place including regular monitoring the occurrence, spread and potential cumulative effects of erosion may be limited to an absolute minimum.

Impacts on wetlands (only applicable for Access Road Option B)

Construction will lead to some local, direct loss of or damage to the depression wetland if this option is selected to be the preferred option. However, this depression wetland is already in a severely degraded and transformed condition, retaining very little ecological functioning and as such the significance of this impact

on this habitat is regarded as moderate. Physical alteration to the depression wetland can have an impact on the functioning the wetlands. Consequences may include:

- increased loss of soil;
- loss of/or disturbance to indigenous wetland vegetation;
- fragmentation of sensitive habitats;
- impairment of wetland function;
- change in channel morphology.

It is expected that no direct impacts to wetlands will occur due to the remaining development footprint and access road option A.

Impacts on Formal Biodiversity Areas (as classified within the Mpumalanga Biodiversity Sector Plan - MBSP)

As the study area is largely situated within areas identified within the MBSP as Moderately Modified (Old Lands) as well as Other Natural Areas which has been assessed as being highly disturbed during the survey, this impact will not be assessed as no Critical or Ecological Support Areas will be impacted.

Cumulative impacts due to other developments within the region.

There are similar infrastructure within a 10km radius from the project site. These include:

- Mafube 13kV Substation situated ~7,9km south-east of the study area;
- Nitens 132kV Substation~7,8 km north of the study area
- 132kV Mafube/Pan Traction power line which traverses the southern boundary of the project site;
- 132kV Nitens Trac-Pan Traction power line ~4km west of the study area;
- 132kV Kleindam Traction/Nitens Traction power line ~7,9km south-east of the study area
- 132kV Arnot Traction/Mafube power line ~7,3km north of the study area;
- 275kV Arnot Simplon power line ~7,9km south-east of the study area;
- 400kV Arnot Merensky power line ~7,9km south-east of the study area; and
- 132 kV Derwent Trac-Pan Traction ~10km east of the study area.

Due to the location of the project and associated infrastructure within an already degraded and transformed habitat cumulative contribution will be negligible and as such assessment of this impact is deemed unnecessary. Extremely little natural

occurring, indigenous vegetation persists within the study area and provide such a limited form of resources for biological cycles and diversity that a loss of this area will not result in any change and degrade of the larger ecological environment.

8.2 Assessment of Impacts

The major impacts (identified above) that, may potentially or likely will occur, are assessed below, during the construction and operational phase as well as before and after mitigation. Due to the fact that impacts associated with the decommission phase will be very similar to that of the construction phase, the decommissioning phase will be dealt together with the construction phase.

Construction and Decommissioning Phase Impacts: Switching Station, Power Lines and associated infractructure (excluding access roads)

Impact 1: Impacts on vegetation

Impact Nature: Impacts on vegetation would occur due to vegetation clearance associated with the construction of the facility and associated infrastructure and will be maintained through the operational phase. The most likely consequences include: » local loss of habitat (to an extent as a natural ground covering will be maintained where possible); » very small and local disturbance to processes maintaining local biodiversity and ecosystem goods and services;		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Probable (3)	Probable (3)
Significance	Low (21)	Low (15)
Status	Slightly Negative	Slightly Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Very slight loss of resources	Very slight loss of resources
Can impacts be mitigated?	To some extent. Areas of vegetation will be replaced with infrastructure and hard surfaces. The only recommended mitigation is to ensure that all activities occur within the development footprint with no disturbance of vegetation outside of the development boundary.	

Mitigation	» Pre-construction walk-through of the final development footprint for species of conservation concern that would be affected and that can be translocated. » Since all of the identified conservation worthy species with the study area are geophytes and succulents with relative shallow rooting systems (e.g *Hypoxis hemerocallidea, Gladiolus spp., Habenaria galpinii, Eucomis autumnalis and Aloe ecklonis*), the potential for successful translocation is high. Before construction commences individuals of listed species within the development footprint that would be affected, should be counted and marked and translocated, where deemed necessary by the ecologist conducting the pre-construction walk-through survey, and according to the recommended rations. Permits from the relevant provincial authorities, i.e. the Mpumalanga Tourism and Parks Agency, will be required to relocate and/or disturb listed plant species. » Any individuals of protected species affected by and observed within the development footprint during construction should be translocated under the supervision of the ECO and/or Contractor's Environmental Officer (EO). » Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared. » All construction vehicles should adhere to clearly defined and demarcated roads. No driving outside of the development boundary. » Rehabilitation of disturbed areas is important: Disturbed areas containing no infrastructure and hard surfaces should be allowed to rehabilitated with natural vegetation as soon as possible to avoid the potential of erosion and invasion with alien plants. The area should be monitored on a weekly basis throughout the construction phase and on a monthly basis thereafter and to the point where the area has been rehabilitated to a satisfactory level.	
Cumulative Impacts	Cumulative impacts on vegetation are likely to be very low given the fact that most habitats are already in a highly disturbed and transformed condition and given the limited expected footprint of the facility.	
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)

Magnitude	Minor (1)	Small (0)
Probability	Very Improbable (1)	Very Improbable (1)
Significance	Low (6)	Low (5)
Status	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources	No loss	No loss
Residual Impacts	Some loss of vegetation is inevitable and cannot be avoided.	

Impact 2: Faunal Impacts due to construction activities.

Impact Nature: Construction activities such as the operation of heavy machinery and the presence of construction personnel at the site could result in direct (e.g. road mortalities) and indirect impacts as a result of noise and dust pollution on terrestrial fauna at the site during construction. The most likely consequences include: » reduction in area of occupancy of some of the affected species.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Short-term (2)
Magnitude	Minor (2)	Small (1)
Probability	Probable (3)	Probable (3)
Significance	Low (18)	Low (12)
Status	Slightly Negative	Slightly Negative
Reversibility	Medium	High
Irreplaceable loss of resources	Slight loss of resources	No
Can impacts be mitigated?	Noise and disturbance during the construction phase cannot be avoided but would be transient in nature and with appropriate mitigation; no long-term impacts from the construction phase can be expected if the development is strictly maintained within the pre-determined footprint area.	

Mitigation	» Site access should be controlled and no unauthorised persons should be allowed onto the site. » Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated construction site. » Fires should not be allowed on site. » A firebreak should be maintained around the development boundary to avoid potential fires occurring within the facility from spreading into the surrounding grasslands, subsequently posing a threat to faunal species occurring within the surrounding environment. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. » All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises. » Construction vehicles limited to a minimal footprint on site	
Cumulative Impacts	The construction of the infrastructure would contribute to cumulative disturbance and habitat loss for fauna, but the contribution would be very small and is not considered significant.	
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small (0)	Small (0)
Probability	Improbable (2)	Very Improbable (1)
Significance	Low (10)	Low (5)
Status	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources	No loss	No loss

Residual Impacts	Residual impacts would be very low with a very slight loss of natural habitat for faunal species.

Impact 3: *Potential increased erosion risk during construction*.

Impact Nature: During construction, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Short-term (2)
Magnitude	Low (4)	Small (1)
Probability	Probable (3)	Probable (3)
Significance	Low (24)	Low (12)
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Slight loss of resources	No
Can impacts be mitigated?	Yes	
Mitigation	» Any erosion problems observed should be rectified immediately and monitored thereafter to ensure that they do not re-occur. » All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential. » Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened). » Roads and other disturbed areas should be regularly monitored for erosion problems and problem areas should receive follow-up monitoring by the EO to assess the success of the remediation. » Topsoil should be removed and stored separately and should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas. » Practical phased development and vegetation clearing should be practiced so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time.	
Cumulative Impacts	Cumulative impacts within the surrounding environment are low due to the general low erosion potential of the area	

	as described by Mucina and Rutherford (2016). Erosion features will thus be local with a low potential to spread beyond the development footprint.	
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Short duration (2)
Magnitude	Minor (2)	Small (1)
Probability	Very Improbable (1)	Very Improbable (1)
Significance	Low (7)	Low (4)
Status	Slightly Negative	Neutral
Reversibility	High	High
Irreplaceable loss of resources	Limited loss of resources	No loss
Residual Impacts	With appropriate avoidance and mitigation residual impacts will be very low and may be limited to very limited and local area containing some erosion features with little potential to spread beyond the point of origin.	

Construction and Decommissioning Phase Impacts: Access Roads

Impact 1: Impacts on vegetation

Impact Nature: Construction may potentially lead to some direct or indirect loss of or damage to some wetland portions. This wetland however, has already been altered and transformed, subsequently loosing much of its functions and services.

Impacts include

- » increased loss of soil;
- » loss of/or disturbance to indigenous wetland vegetation;
- » fragmentation of sensitive habitats;
- » impairment of wetland function;
- » change in channel morphology.

The potential for these impacts to occur can furthermore be eluded with diligent and effective mitigation measures in place.

	Alternative A		**Alternative B**	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)

Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)	Minor (2)	Small (0)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	Low (21)	Low (15)	Low (21)	Low (15)
Status	Slightly Negative	Slightly Negative	Slightly Negative	Slightly Negative
Reversibility	Moderate	High	Moderate	High
Irreplaceable loss of resources	Very slight loss of resources	Very slight loss of resources	Very slight loss of resources	Very slight loss of resources
Can impacts be mitigated?	To some extent. Areas of vegetation will be replaced with hard surfaces. The only recommended mitigation is to ensure that all activities occur within the development footprint with no disturbance of vegetation outside of the development boundary.			
Mitigation	» Pre-construction walk-through of the final development footprint for species of conservation concern that would be affected and that can be translocated. » Since all of the identified conservation worthy species with the study area are geophytes and succulents with relative shallow rooting systems (e.g *Hypoxis hemerocallidea, Gladiolus spp., Habenaria galpinii, Eucomis autumnalis and Aloe ecklonis*), the potential for successful translocation is high. Before construction commences individuals of listed species within the development footprint that would be affected, should be counted and marked and translocated, where deemed necessary by the ecologist conducting the pre-construction walk-through survey, and according to the recommended rations. Permits from the relevant provincial authorities, i.e. the Mpumalanga Tourism and Parks Agency, will be required to relocate and/or disturb listed plant species. » Any individuals of protected species affected by and observed within the development footprint during construction should be translocated under the supervision of the ECO and/or Contractor's Environmental Officer (EO). » Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.			

	» All construction vehicles should adhere to clearly defined and demarcated roads. No driving outside of the development boundary. » Rehabilitation of disturbed areas is important: Disturbed areas containing no infrastructure and hard surfaces should be allowed to rehabilitated with natural vegetation as soon as possible to avoid the potential of erosion and invasion with alien plants. The area should be monitored on a weekly basis throughout the construction phase and on a monthly basis thereafter and to the point where the area has been rehabilitated to a satisfactory level.	
Cumulative Impacts	Cumulative impacts on vegetation are likely to be very low given the fact that most habitats are already in a highly disturbed and transformed condition and given the limited expected footprint of the facility.	
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (1)	Small (0)
Probability	Very Improbable (1)	Very Improbable (1)
Significance	Low (6)	Low (5)
Status	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources	No loss	No loss
Residual Impacts	Some loss of vegetation is inevitable and cannot be avoided.	

Impact 2: Faunal Impacts due to construction activities.

Impact Nature: Construction activities such as the operation of heavy machinery and the presence of construction personnel at the site could result in direct (e.g. road mortalities) and indirect impacts as a result of noise and dust pollution on terrestrial fauna at the site during construction.

The most likely consequences include:
reduction in area of occupancy of some of the affected species.

	Alternative A		**Alternative B**	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**

Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)	Minor (2)	Small (0)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	Low (21)	Low (15)	Low (21)	Low (15)
Status	Slightly Negative	Slightly Negative	Slightly Negative	Slightly Negative
Reversibility	Moderate	High	Moderate	High
Irreplaceable loss of resources	Very slight loss of resources	Very slight loss of resources	Very slight loss of resources	Very slight loss of resources
Can impacts be mitigated?	Noise and disturbance during the construction phase cannot be avoided but would be transient in nature and with appropriate mitigation; no long-term impacts from the construction phase can be expected if the development is strictly maintained within the pre-determined footprint area.			
Mitigation	» Site access should be controlled and no unauthorised persons should be allowed onto the site. » Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated construction site. » Fires should not be allowed on site. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. » All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises. » Construction vehicles limited to a minimal footprint on site			
Cumulative Impacts	The construction of the infrastructure would contribute to cumulative disturbance and habitat loss for fauna, but the contribution would be very small and is not considered significant.			
Extent	Local (1)		Local (1)	

Duration	Long-term (4)	Long-term (4)
Magnitude	Small (0)	Small (0)
Probability	Improbable (2)	Very Improbable (1)
Significance	Low (10)	Low (5)
Status	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources	No loss	No loss
Residual Impacts	Residual impacts would be very low with a very slight loss of natural habitat for faunal species.	

Impact 3: *Potential increased erosion risk during construction*.

Impact Nature: During construction, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion.				
	Alternative A		**Alternative B**	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Medium-term (3)	Short-term (2)	Medium-term (3)	Short-term (2)
Magnitude	Low (4)	Small (1)	Low (4)	Small (1)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	Low (24)	Low (12)	Low (24)	Low (12)
Status	Negative	Negative	Negative	Negative
Reversibility	Moderate	High	Moderate	High
Irreplaceable loss of resources	Slight loss of resources	No	Slight loss of resources	No
Can impacts be mitigated?	Yes			
Mitigation	» Roads and other disturbed areas should be regularly monitored for erosion problems and problem areas should receive follow-up monitoring by the EO to assess the success of the remediation. » Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened).			

	» Topsoil should be removed and stored separately and should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas. » Construction of gabions and other stabilisation features to prevent erosion, where deemed necessary. » Practical phased development and vegetation clearing should be practiced so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time.	
Cumulative Impacts	Cumulative impacts within the surrounding environment are low due to the general low erosion potential of the area as described by Mucina and Rutherford (2016). Erosion features will thus be local with a low potential to spread beyond the development footprint.	
Extent	Local (1)	**Extent**
Duration	Long-term (4)	**Duration**
Magnitude	Minor (2)	**Magnitude**
Probability	Very Improbable (1)	**Probability**
Significance	Low (7)	**Significance**
Status	Slightly Negative	**Status**
Reversibility	High	**Reversibility**
Irreplaceable loss of resources	Limited loss of resources	**Irreplaceable loss of resources**
Residual Impacts	With appropriate avoidance and mitigation residual impacts will be very low and may be limited to very limited and local area containing some erosion features with little potential to spread beyond the point of origin.	

Impact 4: *Potential Impacts on depression wetland (This impact is only applicable for the access road option B)*.

Impact Nature: Construction may potentially lead to some direct or indirect loss of or damage to some wetland portions. This wetland however, has already been altered and transformed, subsequently loosing much of its functions and services. Impacts include

- increased loss of soil;
- loss of/or disturbance to indigenous wetland vegetation;
- fragmentation of sensitive habitats;
- impairment of wetland function;
- change in channel morphology.

The potential for these impacts to occur can furthermore be eluded with diligent and effective mitigation measures in place.

	Alternative A		**Alternative B**	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Extent	N/A	N/A	Local (1)	Local (1)
Duration	N/A	N/A	Permanent (5)	Medium-term (2)
Magnitude	N/A	N/A	Low (3)	Minor (2)
Probability	N/A	N/A	Highly Probable (4)	Probable (3)
Significance	N/A	N/A	Medium (36)	Low (15)
Status	N/A	N/A	Negative	Slightly Negative
Reversibility	N/A	N/A	Low	High
Irreplaceable loss of resources	N/A	N/A	Very small loss of resources	Very small loss of resources
Can impacts be mitigated?	To a limited extent.			
Mitigation	» Any areas disturbed during the construction phase should be encouraged to rehabilitate as quickly and effectively as possible. » Natural indigenous species applicable to the specific habitat should be used and the area should be monitored on a monthly basis by the Environmental Officer (EO) to ensure effective rehabilitation and to			

	avoid erosion and the invasion with weeds and alien invasive species. » No unnecessary vegetation clearance may be allowed. » Any eroded areas observed should be rehabilitated as soon as possible.
Cumulative Impacts	There will be no cumulative impact as this depression is endorheic and has no connection to other wetland habitats. Furthermore, due to the severe degraded state of this depression this wetland and its associated vegetation and ecosystem services and functions (in its current state) do not contribute to the general conservation status of similar habitat types. As such an assessment of this impact is not necessary.
Residual Impacts	A limited area will be altered although both access road alternatives are located within a largely disturbed area with limited ecological functioning and as such the residual impact on functions and services will be very limited.

Operation Phase Impacts

Impact 1: Increased alien plant invasion during operation

Impact Nature: The disturbed and bare ground that is likely to be present at the site after construction will leave the site vulnerable to alien plant invasion for some time, and pose a potential threat to surrounding grasslands and wetlands.		
	Without Mitigation	**With Mitigation**
Extent	Local – Regional (3)	Local (1)
Duration	Long-term (4)	Very short-term (1)
Magnitude	Moderate (5)	Minor (2)
Probability	Highly Probable (4)	Improbable (2)
Significance	Medium (48)	Low (8)
Status	Negative	Slightly Negative
Reversibility	No	High
Irreplaceable loss of resources	Potential loss of resources	No
Can impacts be mitigated?	Yes, to a large extent	

Mitigation	» A site-specific eradication and management programme for alien invasive plants should be included in the Operation Environmental Management Programme (OEMPr). » Regular monitoring by the EO for alien plants at the site should occur and could be conducted simultaneously with erosion monitoring. » When alien plants are detected, these should be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur. » Clearing methods should aim to keep disturbance to a minimum. » No planting or importing any listed invasive alien plant species (all Category 1a, 1b and 2 invasive species) to the site for landscaping, rehabilitation or any other purpose.	
Cumulative Impacts	Cumulative impacts within the surrounding environment due to the spread and settlement of alien invasive species beyond the initial disturbed area will lead to the replacement of natural indigenous vegetation and subsequently in natural grazing land etc.	
Extent	Local - Regional (2)	Local (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Moderate (6)	Small (0)
Probability	Probable (3)	Improbable (2)
Significance	Medium (36)	Low (6)
Status	Negative	Slightly Negative to Neutral
Reversibility	Moderate	High
Irreplaceable loss of resources	Yes	No
Residual Impacts	With appropriate mitigation such as regular monitoring and eradication residual impacts will be very low will likely comprise of few alien plants establishing for short periods of time between monitoring and eradication phases.	

Impact 2: Faunal Impacts due to operation.

Impact Nature: The operation and presence of the project may lead to disturbance or persecution of fauna within or adjacent to the project.

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Minor (1)	Small (0)
Probability	Probable (3)	Improbable (2)
Significance	Low (15)	Low (8)
Status	Slightly Negative	Slightly Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Some aspects such as those relating to human activity can be mitigated, but habitat loss cannot be mitigated	
Mitigation	» No unauthorised persons should be allowed onto the site. » Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. » All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.	
Cumulative Impacts	The development would contribute to cumulative habitat loss for fauna, but the contribution would be very small and is not considered significant.	
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Small (1)	Small (0)
Probability	Improbable (2)	Very Improbable (1)
Significance	Low (12)	Low (4)
Status	Negative	Neutral
Reversibility	High	High

Irreplaceable loss of resources	Yes	No
Residual Impacts	Some habitat loss is an inevitable consequence of the development and cannot be fully mitigated.	

Impact 3: Increased erosion risk during operation.

Impact Nature: Increased erosion risk as a result of soil disturbance and loss of vegetation cover as well as increased runoff generated from hard impenetrable surfaces.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Very Short term (1)
Magnitude	Minor (1)	Small (0)
Probability	Probable (3)	Improbable (2)
Significance	Low (15)	Low (4)
Status	Negative	Slightly Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Slight loss of resources	No
Can impacts be mitigated?	Yes	
Mitigation	» All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. » Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. » All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. » All cleared areas should be revegetated, preferably with indigenous perennial grasses (no invasive plants may be used).	
Cumulative Impacts	Cumulative impacts within the surrounding environment are low due to the general low erosion potential of the area as described by Mucina and Rutherford (2016). Erosion	

	features will thus be local with a low potential to spread beyond the development footprint.	
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Very short-term (1)
Magnitude	Minor (2)	Small (0)
Probability	Very Improbable (1)	Very Improbable (1)
Significance	Low (7)	Low (2)
Status	Slightly Negative	Slightly Negative
Reversibility	High	High
Irreplaceable loss of resources	Limited loss of resources	Limited loss of resources
Residual Impacts	If erosion at the site is controlled, then there will be no residual impact.	

9 DISCUSSION AND CONCLUSION

» The extent of the development footprint area in this study is very limited and furthermore restricted to an area already that is already in a severe degraded and transformed condition. Given the limited footprint of the development and the characteristics of the receiving environment, there are not likely to be any significant impacts resulting from the construction and operation of the infrastructure.

» During the study it was found that the majority of the study area can be regarded as **Low** Sensitive, with regards to fauna and flora, with the exception of the wetland habitat types which is regarded as **Medium-High** Sensitive. Most of these Medium-High wetland habitats falls outside of the development footprint and will not be impacted by the development with the exception of a small depression wetland located in the central portion of the western boundary of the study area. A portion of this wetland will be impacted by the access road if access road option B is selected as the final route position. However, this wetland can be avoided through a route adjustment or through the selection of access road option A as the final position. From an ecological perspective the latter option is the preferred option and subsequently route option A is the preferred option.

» Five species of conservation concern were recorded within the study area. However, none of these species occurred within the development footprint and will not be impacted through the proposed development. The identified species are as follows
- Red Data Species: *Hypoxis hemerocallidea* (Declining)
- Protected according to Schedule 11 of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) (MNCA): *Aloe ecklonis, Eucomis autumnalis, Habenaria galpinii, Gladiolus* spp.

» Most of these protected species form populations of variable size within the seasonal and temporary zones of the wetland, especially the wetland flat and valley-bottom wetland.

» A summary of pre- and post mitigation impact significance ratings for the different impacts and risks factors identified for the proposed development are provided below.

Table 5: Summary of pre and post mitigation impact significance ratings.

Construction & Operational Phase					
Switching Station, Power Lines and associated Infrastructure					
Phase	**Impact**	**Significance Pre-Mitigation**		**Significance Post Mitigation**	
Construction & Decommissioning	Impacts on vegetation.	Low (21)		Low (15)	
	Direct faunal impacts during construction	Low (18)		Low (12)	
	Potential erosion risk during construction	Low (24)		Low (12)	
Access Roads					
Phase	**Impact**	**Alternative A**		**Alternative B**	
		Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Construction & Decommissioning	Impacts on vegetation.	Low (21)	Low (15)	Low (21)	Low (15)
	Direct faunal impacts during construction	Low (21)	Low (15)	Low (21)	Low (15)
	Potential Impacts on depression wetland wetlands (This impact is only applicable for the access road option B).	N/A	N/A	Medium (36)	Low (15)
	Potential erosion risk during construction	Low (24)	Low (12)	Low (24)	Low (12)
Switching Station, Power Lines, Access Roads and associated Infrastructure					
Phase	**Impact**	**Significance Pre-Mitigation**		**Significance Post Mitigation**	
Operation	Faunal Impacts due to operation	Low (15)		Low (8)	
	Increased erosion risk during operation.	Low (15)		Low (4)	
	Potential increased alien plant invasion during operation	Medium (48)		Low (8)	

» With regards to potential cumulative impacts relating to the proposed development:

- Due to the location of the facility and associated infrastructure within an already degraded and transformed habitat cumulative contribution will be negligible.

General recommendations:

» As already mentioned a portion of a small depression wetland will be impacted by the access road if access road option B is selected as the final route position. However, this wetland can be avoided through a route adjustment or through the selection of access road option A as the final

position. From on ecological perspective the latter option is the preferred option and subsequently route option A is the preferred option.

» Pre-construction walk-through of the final development footprint for species of conservation concern that would be affected and that can be translocated.

» Since all of the identified conservation worthy species with the study area are geophytes and succulents with relative shallow rooting systems (e.g *Hypoxis hemerocallidea, Gladiolus spp., Habenaria galpinii, Eucomis autumnalis and Aloe ecklonis*), the potential for successful translocation is high. Before construction commences individuals of listed species within the development footprint that would be affected, should be counted and marked and translocated, where deemed necessary by the ecologist conducting the pre-construction walk-through survey, and according to the recommended rations. Permits from the relevant provincial authorities, i.e. the Mpumalanga Tourism and Parks Agency, will be required to relocate and/or disturb listed plant species.

» Any individuals of protected species affected by and observed within the development footprint during construction should be translocated under the supervision of the ECO and/or Contractor's Environmental Officer (EO).

The following mitigation measures are recommended:

» Regarding vegetation and protected plant species:

- Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
- All construction vehicles should adhere to clearly defined and demarcated roads. No driving outside of the development boundary.
- Rehabilitation of disturbed areas are important: Disturbed areas containing no infrastructure and hard surfaces should be allowed to rehabilitated with natural vegetation as soon as possible to avoid the potential of erosion and invasion with alien plants. The area should be monitored (responsibility of EO) on a weekly basis throughout the construction phase and on a monthly basis thereafter and to the point where the area has rehabilitated to a satisfactory level.
- See comments above (general recommendations) relating to pre-construtions walk-through and search and rescue of conservation worthy plant species that may occur within the development footprint.

» Regarding fauna:

- Site access should be controlled and no unauthorized persons should be allowed onto the site.

- Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated construction site.
- Fires should not be allowed on site.
- A firebreak should be maintained around the development boundary to avoid potential fires occurring within the facility from spreading into the surrounding grasslands, subsequently posing a threat to faunal species occurring within the surrounding environment.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.
- Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location.

» Regarding the depression wetland (only applicable for access road option B)
- Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible.
- Natural indigenous species applicable to the specific habitat should be used and the area should be monitored on a monthly basis by the Environmental Officer (EO) to ensure effective rehabilitation and to avoid erosion and the invasion with weeds and alien invasive species.
- No unnecessary vegetation clearance may be allowed.
- Any eroded areas observed should be rehabilitated as soon as possible.

» Regarding the potential increased erosion risk
- Any erosion problems observed should be rectified immediately and monitored thereafter to ensure that they do not re-occur.
- All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential.
- Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened).

- Roads and other disturbed areas should be regularly monitored for erosion problems and problem areas should receive follow-up monitoring by the EO to assess the success of the remediation.
- Topsoil should be removed and stored separately and should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.
- Practical phased development and vegetation clearing should be practiced so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time.
- All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk

» Regarding the potential of invasion by alien plants:

- A site-specific eradication and management program for alien invasive plants should be included in the Operation Environmental Management Program (OEMPr).
- Regular monitoring by the EO for alien plants at the site should occur and could be conducted simultaneously with erosion monitoring.
- When alien plants are detected, these should be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur.
- Clearing methods should themselves aim to keep disturbance to a minimum.
- No planting or importing any listed invasive alien plant species (all Category 1a, 1b and 2 invasive species) to the site for landscaping, rehabilitation or any other purpose.

From an ecological perspective no objective or motives were identified which would hinder the development of the Switching Station and associated infrastructure on the affected properties. The development will be appropriate and acceptable from an ecological perspective and will not cause detrimental impacts to the ecological features located within the affected properties. Therefore, it is the opinion that the development may be authorised, constructed and operated.

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11 APPENDICES:

Appendix 1. List of Mammals

List of Mammals which were noted within the 2528D Degree grid as wel as within the 2528DB Quarter Degree Grid (in bold). This list has been extracted from the Animal Demography Unit (2016). MammalMAP Virtual Museum.

Colours Relate as follow:
Threatened Status: Critically (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient (DDD)

» Mpumalanga Nature Conservation Act (Act No. 10 of 1998) - Schedule 2: Protected Game, and

» Mpumalanga Nature Conservation Act (Act No. 10 of 1998) - Schedule 4: Protected Wild Animals.

* Take note of the following addition abbreviations: Least Concern (LC), Not Listed (NL)

Genus	Species	Subspecies	Common name	Red list category
Cryptomys	*hottentotus*		Southern African Mole-rat	LC
Aepyceros	***melampus***		**Impala**	**LC**
Alcelaphus	***buselaphus***		**Hartebeest**	**NL**
Alcelaphus	*caama*		Red Hartebeest	LC
Antidorcas	***marsupialis***		**Springbok**	**LC**
Connochaetes	***taurinus***		**Blue Wildebeest**	**NL**
Connochaetes	***taurinus***	***taurinus***		**LC**
Damaliscus	***pygargus***	***phillipsi***	**Blesbok**	**LC**
Hippotragus	*niger*		Sable Antelope	NL
Kobus	***ellipsiprymnus***		**Waterbuck**	**NL**
Oreotragus	***oreotragus***		**Klipspringer**	**LC**
Oryx	***gazella***		**Gemsbok**	**LC**
Sylvicapra	*grimmia*		Bush Duiker	LC
Tragelaphus	*oryx*		Common Eland	LC
Tragelaphus	*strepsiceros*		Greater Kudu	LC
Canis	*mesomelas*		Black-backed Jackal	LC

Genus	Species	Subspecies	Common name	Red list category
Vulpes	***chama***		**Cape Fox**	**LC**
Chrysospalax	*villosus*		Rough-haired Golden Mole	CR
Equus	***quagga***		**Plains Zebra**	**NL**
Caracal	***caracal***		**Caracal**	**LC**
Felis	*nigripes*		Black-footed Cat	LC
Leptailurus	***serval***		**Serval**	**NT**
Panthera	***pardus***		**Leopard**	**LC**
Giraffa	*camelopardalis*	*giraffa*	The South African Giraffe	LC
Graphiurus	***murinus***		**Forest African Dormouse**	**LC**
Graphiurus	*platyops*		Flat-headed African Dormouse	DDD
Cynictis	*penicillata*		Yellow Mongoose	LC
Herpestes	*sanguineus*		Slender Mongoose	LC
Hyaena	***brunnea***		**Brown Hyena**	**NT**
Hystrix	*africaeaustralis*		Cape Porcupine	LC
Elephantulus	*brachyrhynchus*		Short-snouted Elephant Shrew	DDD
Elephantulus	***myurus***		**Eastern Rock Elephant Shrew**	**LC**
Sauromys	***petrophilus***		**Roberts's Flat-headed Bat**	**LC**
Acomys			**Spiny Mice**	**NL**
Acomys	***spinosissimus***		**Southern African Spiny Mouse**	**LC**
Aethomys			**Veld rats**	**NL**
Aethomys	***ineptus***		**Tete Veld Aethomys**	**LC**
Aethomys	***namaquensis***		**Namaqua Rock Mouse**	**LC**
Gerbilliscus	***brantsii***		**Highveld Gerbil**	**LC**
Gerbilliscus	***leucogaster***		**Bushveld Gerbil**	**DDD**
Lemniscomys	***rosalia***		**Single-Striped Lemniscomys**	**DDD**
Mastomys			**Multimammate Mice**	**NL**
Mastomys	***coucha***		**Southern African Mastomys**	**LC**
Mus	***minutoides***		**Southern African Pygmy Mouse**	**LC**
Otomys			**Vlei Rats**	**NL**
Otomys	*angoniensis*		Angoni Vlei Rat	LC
Otomys	***auratus***		**Southern African Vlei Rat**	**NL**
Rhabdomys	***pumilio***		**Xeric Four-striped Grass Rat**	**LC**
Tatera				**NL**
Thallomys	*paedulcus*		Acacia Thallomys	LC
Aonyx	***capensis***		**African Clawless Otter**	**LC**

Genus	Species	Subspecies	Common name	Red list category
Mellivora	***capensis***		**Honey Badger**	**NT**
Dendromus			**African Climbing Mice**	**NL**
Dendromus	***melanotis***		**Gray African Climbing Mouse**	**LC**
Dendromus	***mystacalis***		**Chestnut African Climbing Mouse**	**LC**
Steatomys			**Fat Mice**	**NL**
Steatomys	***pratensis***		**Common African Fat Mouse**	**LC**
Procavia	***capensis***		**Rock Hyrax**	**LC**
Crocidura			Shrews	NL
Crocidura	***cyanea***		**Reddish-gray Musk Shrew**	**DDD**
Crocidura	*maquassiensis*		Makwassie Musk Shrew	VU
Crocidura	***mariquensis***		**Swamp Musk Shrew**	**DDD**
Suncus	***infinitesimus***		**Least Dwarf Shrew**	**DDD**
Phacochoerus	***africanus***		**Common Wart-hog**	**LC**
Potamochoerus	***porcus***		**Red River Hog**	**NL**
Myotis	*welwitschii*		Welwitsch's Myotis	NT
Neoromicia				NL
Neoromicia	*capensis*		Cape Serotine	LC
Pipistrellus	*rusticus*		Rusty Pipistrelle	NT
Scotophilus	*dinganii*		Yellow-bellied House Bat	LC

Appendix 2. List of Reptiles.

List of reptiles which are known from the broad area (3124 Degree Grids) according to the SARCA database. All species that have been noted within the Quarter Degree Grids of the study site (3124 BB) are indicated in **green**. All species listed as red data species, highlighted in red.

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
Agamidae	Acanthocercus	atricollis	atricollis	Southern Tree Agama	LC	
Agamidae	Agama	aculeata	distanti	Distant's Ground Agama	LC	Yes
Agamidae	Agama	atra		Southern Rock Agama	LC	
Colubridae	Crotaphopeltis	hotamboeia		Red-lipped Snake	LC	
Colubridae	Dasypeltis	scabra		Rhombic Egg-eater	LC	
Colubridae	Dispholidus	typus	typus	Boomslang	LC	
Colubridae	Philothamnus	semivariegatus		Spotted Bush Snake	LC	
Colubridae	Thelotornis	capensis	capensis	Southern Twig Snake	LC	
Cordylidae	Cordylus	vittifer		Common Girdled Lizard	LC	
Cordylidae	Smaug	vandami		Van Dam's Girdled Lizard	LC	Yes
Elapidae	Elapsoidea	sundevallii	media	Highveld Garter Snake	Not listed	
Elapidae	Hemachatus	haemachatus		Rinkhals	LC	
Elapidae	Naja	annulifera		Snouted Cobra	LC	
Elapidae	Naja	mossambica		Mozambique Spitting Cobra	LC	
Gekkonidae	Lygodactylus	capensis	capensis	Common Dwarf Gecko	LC	
Gekkonidae	Pachydactylus	affinis		Transvaal Gecko	LC	Yes
Gerrhosauridae	Gerrhosaurus	flavigularis		Yellow-throated Plated Lizard	LC	
Lacertidae	Ichnotropis	capensis		Ornate Rough-scaled Lizard	LC	
Lacertidae	Nucras	holubi		Holub's Sandveld Lizard	LC	
Lacertidae	Pedioplanis	lineoocellata	lineoocellata	Spotted Sand Lizard	LC	
Lamprophiidae	Aparallactus	capensis		Black-headed Centipede-eater	LC	
Lamprophiidae	Atractaspis	bibronii		Bibron's Stiletto Snake	LC	
Lamprophiidae	Boaedon	capensis		Brown House Snake	LC	
Lamprophiidae	Lamprophis	aurora		Aurora House Snake	LC	Yes

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
Lamprophiidae	Lycodonomorphus	rufulus		Brown Water Snake	LC	
Lamprophiidae	Lycophidion	capense	capense	Cape Wolf Snake	LC	
Lamprophiidae	Prosymna	sundevallii		Sundevall's Shovel-snout	LC	
Lamprophiidae	Psammophis	brevirostris		Short-snouted Grass Snake	LC	
Lamprophiidae	Psammophylax	tritaeniatus		Striped Grass Snake	LC	
Lamprophiidae	Pseudaspis	cana		Mole Snake	LC	
Pelomedusidae	Pelomedusa	subrufa		Central Marsh Terrapin	LC	
Scincidae	Mochlus	sundevallii	sundevallii	Sundevall's Writhing Skink	LC	
Scincidae	Panaspis	wahlbergii		Wahlberg's Snake-eyed Skink	LC	
Scincidae	Trachylepis	capensis		Cape Skink	LC	
Scincidae	Trachylepis	punctatissima		Speckled Rock Skink	LC	
Scincidae	Trachylepis	varia		Variable Skink	LC	
Testudinidae	Kinixys	lobatsiana		Lobatse Hinged Tortoise	LC	
Varanidae	Varanus	albigularis	albigularis	Rock Monitor	LC	
Viperidae	Bitis	arietans	arietans	Puff Adder	LC	
Viperidae	Causus	rhombeatus		Rhombic Night Adder	LC	

Appendix 3. List of Amphibians.

List of amphibians which are known from the broad area (3124 Degree Grid) according to the SARCA database. All species that have been noted within the Quarter Degree Grids of the study site (3124BB) are indicated in **green**. All species listed as red data species, highlighted in red.

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Bufonidae	Poyntonophrynus	fenoulheti	Northern Pygmy Toad	LC	
Bufonidae	Schismaderma	carens	Red Toad	LC	
Bufonidae	Sclerophrys	capensis	Raucous Toad	LC	
Bufonidae	Sclerophrys	gutturalis	Guttural Toad	LC	
Hyperoliidae	Kassina	senegalensis	Bubbling Kassina	LC	
Microhylidae	Phrynomantis	bifasciatus	Banded Rubber Frog	LC	
Phrynobatrachidae	Phrynobatrachus	natalensis	Snoring Puddle Frog	LC	
Pipidae	Xenopus	laevis	Common Platanna	LC	
Ptychadenidae	Ptychadena	anchietae	Plain Grass Frog	LC	
Ptychadenidae	Ptychadena	porosissima	Striped Grass Frog	LC	
Pyxicephalidae	Amietia	delalandii	Delalande's River Frog	LC	Yes
Pyxicephalidae	Cacosternum	boettgeri	Common Caco	LC	
Pyxicephalidae	Pyxicephalus	adspersus	Giant Bull Frog	NT	
Pyxicephalidae	Strongylopus	fasciatus	Striped Stream Frog	LC	
Pyxicephalidae	Tomopterna	cryptotis	Tremelo Sand Frog	LC	
Pyxicephalidae	Tomopterna	natalensis	Natal Sand Frog	LC	