The Improvement of National Route N2 Section 33 & 34 between KZN / Mpumalanga Provincial Border and Camden

ROAD
SECTION D (km 34,0 to km 63,3)

BIODIVERSITY ASSESSMENT

Terrestrial Ecological Assessment and Aquatic (Wetland) Assessment

Compiled by
Flori Scientific Services
Johannes O. Maree

FEBRUARY 2017 (Updated August 2021)

PROJECT INFORMATION

PROJECT TITLE: N2 Section 33 (Section D) - Road

STUDY NAME: Biodiversity Impact Assessment

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EXECUTIVE SUMMARY

Background

The South African National Roads Agency Soc Limited (SANRAL) is in the process of planning the proposed upgrade of the National Route N2 Section 33 & 34 between the KZN / Mpumalanga Provincial Border and Camden in the Mpumalanga Province. The entire length of the project is 150 km and the project is divided up into 5 separate projects. This study and report only deals with the road for N2 Section 33, from km 34,0 to km 63,3 (**Section D**).

Location of the study area

The study area for this report is only for the road. This is the National Route N2 Section 33 between Bloemdendal (km 34,0) to just north of Piet Retief (Mkhondo) (km 63,3). The study site is located in the Mkhondo Local Municipality of the Gert Sibande District Municipality, Mpumalanga Province.

TERRESTRIAL ECOLOGY

Vegetation

The study area is situated Paulpietersburg Moist Grassland and KaNgwane Montane Grassland, which are both veldtypes within the Grassland Biome of South Africa. Both veldtypes are threatened ecosystems (veldtypes) with statuses of 'Vulnerable'.

Priority species

No Red Data Species were observed during field investigations.

Protected trees in the study area

No protected trees were observed during field investigations and none are expected to occur.

AQUATIC ECOLOGY

Watercourses in the study area

The main watercourse the study area crosses over is the Assegaai River. A few smaller streams and drainage lines are also present. There are also a few wetland areas along the study route, especially in the area south of Piet Retief (Mkhondo) and north of the Assegaai River. These wetland and moist grassland areas have been highly impacted on and transformed by extensive and highly encroached afforestation.

Drainage areas

The study area is situated within the Primary Drainage Area (PDA) of **W** and the Quaternary Drainage Areas (QDAs) of **W51D** and **W42F**.

The study area is within the Inkomati - Usuthu Water Management Area (WMA 3) and under the jurisdiction of the Inkomati - Usuthu Catchment Management Agency (CMA 3). In terms of the water environment the study area is situated within a single Wetland Vegetation Ecoregion, namely the Mesic Highveld Grassland (Group 5).

Present Ecological State (PES) of watercourses in the study area

Criteria	Identified Watercourses			
	Assegaai River	**Unnamed streams**	**Drainage lines**	**Wetlands**
Category:	D	D	D	D
Integrity (PES):	Low	Low	Low	Low
PES Description	Largely Modified	Largely Modified	Largely Modified	Largely Modified
Recommended EMC	C	C	C	C

EIS of watercourses in the study area

Determinant	Assegaai River	Unnamed streams	Drainage lines	Wetlands
Overall EIS	B	C	D	C
Description	High	Moderate	Low	Moderate

Drivers of ecological change

The main ecological driver (by far) on the water environment in the study area is afforestation. Other drivers include urbanisation, manmade impoundments (farm dams) and cultivation.

Sensitivity analyses

The ecological sensitivity of the study area is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit, whether it is floristic or faunal in nature.

According to the analyses there are no high sensitivity areas or habitats. However, the watercourses must be viewed and approached as sensitive.

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity	Development Go-ahead
Grassland	Medium/Low	Medium/Low	Medium/Low	Go-Slow
Plantations	Low	Low	Low	Go
Watercourses	Medium/High	Medium/High	Medium/High	Go-But

Fatal flaws

There are no fatal flaws.

Priority areas

The study area does not fall within any priority areas, except those of NFEPA wetlands and streams. Priority areas include formal and informal protected areas (nature reserves); important bird areas (IBAs); RAMSAR sites; National fresh water ecosystem priority areas (NFEPA) and National protected areas expansion strategy (NPAES) areas.

Sensitivity maps

The majority of the route of the study area is within highly modified or totally transformed natural environments, primarily due to extensive afforestation. There are no pristine grassland areas within the study area. Even the watercourses are highly encroach upon and modified by plantations to a point of being illegal.

There are a few sensitive areas within the study area, which are all watercourses. The sensitive watercourses (areas) include the Assegaai River, a few small streams and wetlands. Wetlands include seepage wetlands and valley-bottom wetlands. These watercourses, eventhough highly impacted on, need to (by default) be approached as sensitive. Fortunately the nature of the project is such that most of the construction work is on the existing tarred road itself and within the existing road reserve. So there will be little to no increased, or measurable, negative impact on existing sensitive areas or natural grassland areas.

The sensitivity areas of the study area are shown in the figures below:

Sensitivity Map: Southern section

Sensitivity Map: Middle section

Sensitivity Map: Northern section

The entire study area is low sensitivity, except the water crossings. Only the watercourses are high sensitivity. The water crossings will not be negatively impacted on by the proposed upgrades. In fact, there will be a certain amount of positive impacts on the watercourses as culverts, drains and bridges will be cleared and unblocked of present debris, rubbish, etc. creating improved waterflow and general river function.

There are no areas of Medium sensitivity.

Risk Matrix

A risk matrix was assessed and completed and attached as a separate xcel spreadsheet.

All impacts, with the implementation of mitigating measures have a risk rating of LOW. There are no MODERATE or HIGH risk ratings for the project.

The upgrade of water crossing should qualify for a General Authorisation (GA) process.

Conclusions

- The study site is situated within the original extent of Paulpietersburg Moist Grassland and KaNgwane Montane Grassland, within the Grassland Biome.
- Both veldtypes (ecosystems) are threatened with a status of 'Vulnerable'.
- Almost the entire study area is transformed or highly degraded, with the main impact that of afforestation. There are no areas of pristine grassland or habitats in the study site.
- During field investigations no Red Data Listed (RDL) plants were observed in the study site. None are expected to occur.
- Priority Species (Species of conservation concern): *Boophone disticha. Eucomis montana, Hypoxis rigidula.* Other possible priority species occurring the in study area although not observed during field investigations include: *Moraea pubiflora*, *Watsonia latifolia*, *Zantedeschia albomaculata* subsp. *macrocarpa*. *Aloe integra* and *Aloe kniphofioides*
- There are no 'high' sensitive habitats present on site, with the exception of the watercourse crossings. The main (and only large) watercourse crossing is the Assegaai River, which is a perennial small river south of Piet Retief.
- No red data listed (RDL) faunal species were observed to be present and / or breeding with the study area boundaries. It is also highly unlikely that any are or will be present, with the small chance along the main rivers only.
- Site investigations were conducted during the summer and winter months and the findings and availability of field data are sufficient to achieve acceptable findings and outcomes from the assessment.
- Due to the nature of the project (upgrade of an existing road) no further specialist environmental studies are required or recommended.
- There are no obvious fatal flaws in terms of the project on the natural environment.
- Impacts on the existing natural environment related to the project are '**LOW**'
- The levels of change (increase in negative cumulative impacts) arising from the activities of the proposed project are at acceptably low levels for the area and for the project to proceed and not create any related 'fatal flaws'.
- A General Authorisation (GA) process for work on watercourse crossings will be required.
- Taking all findings and recommendations into account the following are the reasonable opinions of the specialist, namely:

- That the entire project, along with related construction activities, should be authorised. The project and related activities may proceed to the next phase.
- The levels of impact and change to the natural environment along and within the study area are low to minimal. In fact, the upgrades of the road, along with storm water culverts and watercourse crossings, will have numerous positive impacts, such as preventing the impeding and impounding of water flow, siltation, and erosion. In other words, the levels of change are well within any acceptable means and expected outcomes. There is no need to drastically alter any project plans or cease / prevent any portion or area of the project from taking place.
- The entire project should be authorised. However, all recommended mitigating measures put forward in this report, as well as other specialist reports and legal requirements should be included in the EMPr and must be implemented.

Recommendations

- Recommended mitigating measures as proposed in this study and report must be implemented. These include, but not limited to:
  - The footprint of the project is small in relation to the area and mostly within an already disturbed and altered environment.
  - One main river will be crossed (Assegaai), along with a few small seasonal drainage lines. The long-term impact of the upgrade of the actual watercourse crossings (including storm water culverts) is a positive impact, because it will improve water flow, remove blockages (including within old storm water culverts), stabilise stream banks, reduce existing erosion of stream banks and riparian areas.
  - Minimal riparian vegetation will be lost (need to be removed) as the project involves the upgrade of crossings and not new crossings. The upgrade will also not include the need to remove trees and other riparian vegetation.
  - Any temporary storage, lay-down areas or accommodation facilities to be setup in existing built-up areas or disturbed areas. No temporary storage areas, laydown areas or site offices are allowed within a **100m** of the edge of any river, stream or distinctive drainage line. That

is, a **100m buffer zone** (no-go zone) for these sites are required along all watercourses (rivers, streams, drainage lines).

- Maintain small footprint during construction phase, where possible stay within the road reserve of the N2 National Road.
- An Erosion Plan to be implemented and monitored during the construction phase, especially in the area of watercourses and steep gradients along escarpment edges. The erosion potential is moderate to low. This also to further reduce the potential of siltation of small watercourses. The plan need only be basic, but needs to be monitored.
- All hazardous materials must be stored appropriately to prevent these contaminants from entering the water environment;
- All excess materials brought onto site for construction to be removed after construction and their removal seen as part of the construction phase.
- No open trenches or mounds of soils to be left.
- Rehabilitation plan for disturbed areas to be compiled and implemented as part of the construction phase.

- The most important recommendations arising from the study is the need for 100m buffer zones around watercourses in which no temporary laydown areas, site offices or campsites may be set up. The obvious exception is the actual project related work carried out within these areas such as upgrading of existing crossings, culverts, etc.
- An independent ECO is recommended to monitor operations and ensure that recommended mitigating measures, including buffer zones, are implemented and adhered to.

REPORT REQUIREMENTS

Below are the requirements for specialist reports as per Appendix 6 of the regulations (Gazette No.40772, 7 April 2017). A specialist report prepared in terms of these regulations must contain the following as highlighted in the table below:

Requirement	Page No
(a) details of— (i) the specialist who prepared the report;	xii, 76
(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	76
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	xii
c) an indication of the scope of, and the purpose for which, the report was prepared;	1
(cA) an indication of the quality and age of base data used for the specialist report;	1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	61
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	2
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	4
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Entire Report
(g) an identification of any areas to be avoided, including buffers;	Entire Report
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Not included in this report
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	2
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Entire Report
(k) any mitigation measures for inclusion in the EMPr;	64
(l) any conditions for inclusion in the environmental authorisation;	76
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	76
(n) a reasoned opinion —	
(i) whether the proposed activity, activities or portions thereof should be authorised;	65
(iA) regarding the acceptability of the proposed activity or activities; and	65
(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	65
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	3
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	None
(q) any other information requested by the competent authority.	None

EXPERTISE, EXPERIENCE & DECLARATION OF SPECIALIST

EXPERTISE & EXPERIENCE

- Qualifications & Expertise in: Terrestrial, Aquatic & Avifaunal Assessments.
- 2 Masters degrees (MSc & MBA); 2 Diplomas (Business & Public Speaking); Certificate: SASS5 Macro Invertebrate Monitoring.
- Co-Authored Books: Cut Flowers of the World. 2010 (1st ed) & Cut Flowers of the World. 2020 (2nd ed), Briza, Pretoria.
- Registered with South African Council for Natural Scientific Professions (SACNASP). Registration number: 400077/91.
- SAQA accreditation in training, assessing & service provision (AgriSeta).
- 21 years experience in technical and managerial positions, project management and consultancy.
- 19 years experience in writing of articles, books, training material & presentations.
- 14 years direct experience in EIAs.
- Conducted hundreds of field investigations and speciaist studies / reports for EIAs, including ecological assessments (fauna & flora), aquatic (wetland) assessments and avifauna impact assessments. Project types include power lines, roads, quarries, housing developments, mines and wind farms.

DECLARATION

In terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the 2014 NEMA Environmental Impact Assessment (EIA) Regulations (as amended on 7 April 2017).

I, **Johannes Oren Maree**, do hereby declare that I:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work; have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

CONTENTS

FIGURES

TABLES

PHOTOGRAPHS

ACRONYMS

CBA	Critical Biodiversity Areas
CMA	Catchment Management Agencies
DEA	Department of Environmental Affairs (Old name of DFFE)
DFFE	Department of Forestry, Fisheries and the Environment
DWA	Department of Water Affairs (Old name for DWS)
DWS	Department Water and Sanitation
EIS	Ecological Importance & Sensitivity
EMC	Environmental Management Class
HGM	Hydrogeomorphic
IBA	Important Bird Area(s)
MAP	Mean Annual Precipitation
MBSP	Mpumalanga Biodiversity Sector Plan (2014)
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy
PES	Present Ecological State
PDA	Primary Drainage Area
QDA	Quaternary Drainage Area
REC	Recommended Ecological Category (or Class)
REMC	Recommended Ecological Management Category (or Class)
RVI	Riparian Vegetation Index
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Soc Limited
SWSA	Strategic Water areas of South Africa
WMA	Water Management Areas
WUL	Water Use Licence
WULA	Water Use Licence Application

1 BACKGROUND

1.1 Project overview

The South African National Roads Agency Soc Limited (SANRAL) is in the process of planning the proposed upgrade of the National Route N2 Section 33 & 34 between the KZN / Mpumalanga Provincial Border and Camden in the Mpumalanga Province.

The entire length of the project is 150 km and the project is divided up into 5 separate projects as follows:

A. Project Nra N.002-340-2015/2: The Improvement of National Route N2 Section 34 between Leiden (Km 60.0) and Camden (Km 87.4)

B. Project Nra N.002-340-2016/1: The Improvement of National Route N2 Section 34 from Verzameling (Km 30) to Leiden (Km 60)

C. Project Nra N.002-340-2015/1: The Improvement of National Route N2 Section 34 from Piet Retief (Km 0) to Verzameling (Km 30)

D. Project Nra N.002-330-2016/1: The Improvement of National Route N2 Section 33 between Bloemendal (Km 34,0) to Piet Retief (Km 63.3).

E. Project Nra N.002-330-2015/1: The Improvement of National Route N2 Section 33 between KZN Border (Km 0.0) to Bloemendal (km 34.0).

The major aspects of the entire project include the following:

- The expansion of the existing 2-lane facility to a 4 lane, undivided dual carriageway facility.
- General widening of the existing road surfaced width from 7.4m to 21.0m. Two lanes per direction with 2.5m wide shoulders.
- Increasing road reserve width from 38m to 60m with associated land acquisition towards the left or right of the existing N2,.
- Strengthening the existing pavement.
- Substantial vertical and/or horizontal geometric improvements.
- Rehabilitation and or improvement of the N2 in the town of Piet Retief.
- Possible consolidation of accesses to the N2.
- Replacement or widening of approximately 15 bridges.
- Widening and/or capacity improvement of approximately 13 major culverts.
- Opening of approximately 1 hard rock quarry and 4 borrow pits per section.

Flori Scientific Services cc was appointed as the independent consultancy to conduct the biodiversity assessments, which include a terrestrial ecological assessment and an aquatic (wetland) assessment.

Field investigations were conducted during July and October 2016.

1.2 Purpose for the Study

The purpose of the study is to assess the ecology of the site to determine if any sensitive habitats are present. To investigate the fauna and flora and determine if there are any priority species present. Furthermore, the purpose of the study is to identify any possible fatal flaws, assess impacts, delineated buffer zones (if required), and to recommend mitigating measures aimed at reducing any potential negative impacts the project may have on the natural environment.

1.3 Scope of Work

The scope of work was understood to be as follows:

- Conduct a biodiversity impact assessment for the study site, which includes terrestrial ecology (fauna & flora) and aquatic ecology (watercourses);
- Conduct site visits and investigations;
- Compile a biodiversity report, which addresses potential impacts on the natural environment;
- Determine if there are any fatal flaws, high sensitive areas, no-go zones, etc.;
- Identify and delineate any sensitive areas / habitats, recommend buffers (if required); and
- Provide recommendations and mitigating measures, if and where necessary.

1.4 Quality and Age of Data

The latest data sets were used for the report in terms of background information. Practitioners routinely use the data sets from the sources shown below.
The source and age of data used includes the following:

- Screening Tool: Dept. of Forestry, Fisheries and the Environment (DFFE) – (www.screening.environment.gov.za).
- Threatened ecosystems: South African National Biodiversity Institute (SANBI) - (www.bgis.sanbi.org).

- Protected Areas: Protected Areas Register (PAR): DFFE – (https://portal.environment.gov.za).
- RDL species: Red List of South Africa Plants (latest update) – (www.redlist.sanbi.org).
- Veldtypes and ecosystems: Mucina & Rutherford, 2006, 2010. Updated 2012 & 2018. Source from SANBI on www.bgis.sanbi.org.
- National Wetland Map (Map 5) – SANBI & Water Research Commission (WRC).
- Endangered Wildlife Trust (EWT) – latest data sets – (www.ewt.org.za).
- SANBI data sets – latest updated website data (www. bgis.sanbi.org).
- Mpumalanga Biodiversity Sector Plan (2014).

1.5 Assumptions and Limitations

The assumptions and limitations for the study are as follows:

- All information regarding the proposed project and related activities as provided by the Client are taken to be accurate.
- Site investigations were conducted during July and November 2016. The site visits fall within the wet (summer) and dry (winter) seasons for the region.
- The report was updated in August 2021, to ensure that it adheres to new legislation and guidelines, and to fill in any knowledge gaps where possible. No additional field investigations were conducted for the update.
- During site investigations all areas were easily accessed. There were no areas that could not be investigated or accessed. Permission to private property was obtained prior to visits.
- The study site is very narrow with easy access. The study area consists almost entirely of the existing hard-surface (asphalt) road and road reserve, which are predominantly totally transformed and/or highly degraded environments. The field investigations conducted are therefore sufficient to reach informed conclusions and make informed recommendations for the proposed project. Notwithstanding that site investigations were limited to a few days only and it is therefore possible that some small aspects may have been missed.
- The site investigations and study are deemed adequate for the project and no further specialist environmental studies are considered necessary or recommended.

- Precise buffer zones, regulated zones, etc. or exact GPS positions cannot be made using generalised corridors or kml files on Google Earth. However, buffer zones and delineations drawn are accurate to within a few metres;
- The latest data sets were used as background information and desktop review for the project. The data sets were verified and refined during field investigations (ground-truthing).
- Equipment used: Standard soil augers; hand-held Garmin GPS instrument; EC & pH hand-held meters; IPhone for photographs, MacBook Pro and Epson PC Laptops; Google earth maps, 1:50 000 South African topographical maps.
- Computer packages used: MS Word; MS Excel; Adobe Photoshop, ARC GIS (10.2.2); Google Earth Pro; and Garmin Base Maps

1.6 Duration, Season and relevance to Outcome of Assessment

The site investigations were conducted during both the summer (wet) and winter (dry) seasons. That is, during November 2016 and July 2016, respectively. The duration of the site visits were only two days per season (four days in total). However, the fairly short durations for the site visits were sufficient to collect the necessary information for the assessment and to be able to make informed decisions and come to informed conclusions. This is due to the fact that the Specialist has a good understanding and working knowledge of the ecosystems and veldtypes in which the study site is situated, having conducted numerous assessments for projects in the region. Furthermore, due to the nature of the project, that is, the upgrade of an existing hard-surface national road, which is a totally transformed and highly degraded environment, an extensive investigation is unnecessary. The seasons therefore had little to no significant relevance to the outcome of the assessment, conclusions and recommendations of the study and report, because both summer and winter site visits were conducted and the transformed nature of the project site (study site). The main growing season (wet season) for the study area and region is summer. During site investigations the environments encountered were expected and there were no unusual or unexpected habitats, species (fauna and flora), etc. encountered.

1.7 Consultation Process of the Study

Emails were exchanged and telephone conversations held with the lead EAP (Dr. Jenine Bothma from Chameleon Environmental) regarding the project. Where

necessary Landowners were contacted directly to arrange access to their private properties for site investigations. During site visits landowners did not accompany Specialists to the relevant sites.

2 METHODOLOGY

2.1 Desktop assessment

A literature review was conducted regarding the main vegetation types and fauna of the general region and of the specific study area. The primary guidelines used were those of Mucina & Rutherford (eds) (2006), Low & Rebelo (1996) and Acocks (1988). Background data regarding soils, geology, climate and general ecology were also obtained from existing datasets and relevant organisations. These are useful in determining what species of fauna and flora can be expected or possibly present within the different habitats of the study area.

Lists of plant species for the relevant 1:50 000 base map grid references within which the proposed project is situated, were obtained from the database of the South Africa National Biodiversity Institute (SANBI). The lists represent all plant species that have been identified and recorded within the designated grid coordinates. The main aim was to determine if any protected species or Red Data species were know to occur in the study area or in the immediate vicinity of the study area.

Red data and protected species listed by the National Environmental Management: Biodiversity Act (Act No. 10 of 2004), as well as in other authoritative publications were consulted and taken into account. Alien invasive species and their different Categories (1, 2 & 3) as listed by the Conservation of Agricultural Resources Act (Act No. 43 of 1983) and the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) were also consulted.

2.2 Field surveys

During field surveys, cognisance was taken of the following environmental features and attributes:

- Biophysical environment;
- Regional and site specific vegetation;
- Habitats ideal for potential red data fauna species

- Sensitive floral habitats;
- Red data fauna and flora species;
- Fauna and flora species of conservation concern; and
- Water courses and water bodies.

Digital photographs and GPS reference points of importance where recorded.

2.3 Floristic Sensitivity

The methodology used to estimate the floristic sensitivity is aimed at highlighting floristically significant attributes and is based on subjective assessments of floristic attributes. Floristic sensitivity is determined across the spectrum of communities that typify the study area. Phytosociological attributes (species diversity, presence of exotic species, etc.) and physical characteristics (human impacts, size, fragmentation, etc.) are important in assessing the floristic sensitivity of the various communities.

Criteria employed in assessing the floristic sensitivity vary in different areas, depending on location, type of habitat, size, etc. The following factors were considered significant in determining floristic sensitivity:

- Habitat availability, status and suitability for the presence of Red Data species
- Landscape and/or habitat sensitivity
- Current floristic status
- Floristic diversity
- Ecological fragmentation or performance.

Floristic Sensitivity Values are expressed as a percentage of the maximum possible value and placed in a particular class or level, namely:

- High: 80 – 100%
- Medium/high: 60 – 80%
- Medium: 40 – 60%
- Medium/low: 20 – 40%
- Low: 0 – 20%

High Sensitivity Index Values indicate areas that are considered pristine, unaffected by human influences or generally managed in an ecological sustainable manner. Nature reserves and well-managed game farms typify these areas. Low Sensitivity Index Values indicate areas of poor ecological status or importance in terms of

floristic attributes, including areas that have been negatively affected by human impacts or poor management.

Each vegetation unit is subjectively rated on a sensitivity scale of 1 to 10, in terms of the influence that the particular Sensitivity Criterion has on the floristic status of the plant community. Separate Values are multiplied with the respective Criteria Weighting, which emphasizes the importance or triviality that the individual Sensitivity Criteria have on the status of each community.

Ranked Values are then added and expressed as a percentage of the maximum possible value (Floristic Sensitivity Value) and placed in a particular class or level, namely:

- High: 80% – 100%
- Medium/high: 60% – 80%
- Medium: 40% – 60%
- Medium/low: 20% – 40%
- Low: 0% – 20%

2.4 GO, NO - GO Criteria

The sensitivity analyses are also expressed in terms of whether the “Go Ahead” has or has not been given for development in a specific area or ecological unit, with regards to the ecological sensitivity along with mitigating measures. The criteria are directly linked to all the other analyses used in the study and can be expressed as follows:

- GO: Areas of low sensitivity

These would typically be areas where the veld as been totally or mostly transformed.

- GO-SLOW: Areas of medium/low sensitivity

These would typically be areas where large portions of the veld has been transformed and/or is highly infested with alien vegetation and lacks any real faunal component. Few mitigating measures are typically needed, but it is still always wise to approach these areas properly and slowly.

- GO-BUT: Areas of medium and medium/high sensitivity

These are areas that are sensitive and should generally be avoided if possible. But, with the correct implementation of mitigating and management measures can be entered if need be.

- NO-GO: Areas of high sensitivity

These are areas of high sensitivity and should be avoided at all cost. In these areas mitigating measures are typically futile in limiting impacts.

The Precautionary Principle is applied throughout this investigation.

2.5 Floral Assessment – Species of Conservation Concern

Baseline data for the quarter degree grids in which the study area is situated were obtained from the SANBI database and were compared to the Interim Red Data List of South African Plant Species (Raimondo D. *et.al*., 2009) to compile a list of Floral Species of Conservation Concern (which includes all Red Data flora species) that could potentially occur within the study area.

A snapshot investigation of an area presents limitations in terms of locating and identifying Red Data floral species. Therefore, particular emphasis is placed on the identification of habitats deemed suitable for the potential presence of Red Data species by associating available habitat to known habitat types of Red Data floral species. The verification of the presence or absence of these species from the study area is not perceived as part of this investigation as a result of project limitations.

2.6 Faunal Sensitivity

Determining the full faunal component of a study area during a short time scale of a few field trips can be highly limiting. Therefore, the different habitats within the study area and nearby surrounding areas were scrutinised for attributes that are deemed to be suitable for high diversity of fauna, as well as for Red Data species. Special consideration was given to habitats of pristine condition and high sensitivity.

Areas of faunal sensitivity were calculated by considering the following parameters:

- Habitat status – the status or ecological condition of the habitat. A high level of habitat degradation will often reduce the likelihood of the presence of Red Data species.
- Habitat linkage – Movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to surrounding habitats and adequacy of these linkages are evaluated for the ecological functioning of Red Data species within the study area

- Potential presence of Red Data species – Areas that exhibit habitat characteristics suitable for the potential presence of Red Data species are considered sensitive.

The same Index Values, Sensitivity Values and Categories used for the floral sensitivity ratings are used for the faunal sensitivity ratings. The same Go, No-Go criteria and ratings used for the flora component are also used for the faunal component.

2.7 Faunal Assessment – Species of Conservation Concern

Literature was reviewed and relevant experts contacted to determine which faunal species of conservation concern (which include all Red Data species) are present, or likely to be present, in the study area.

A snapshot investigation of an area presents limitations in terms of locating and identifying Red Data fauna species. Particular emphasis was therefore placed on the identification of habitat deemed suitable for the potential presence of Red Data fauna species by associating available habitat to known habitat types of Red Data species. The verification of the presence or absence of these species from the study area is not perceived as part of this investigation as a result of project limitations.

2.8 Biodiversity Impact Assessment

The impact assessment takes into account the nature, scale and duration of the effects on the natural environment and whether such effects are positive (beneficial) or negative (detrimental).

A rating/point system is applied to the potential impact on the affected environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each issue the following criteria are used and points awarded as shown:

- Extent: National - 4; Regional – 3; Local – 2; Site – 1.
- Duration: Permanent – 4; Long term – 3; Medium term – 2; Short term – 1.
- Intensity: Very high – 4; High – 3; Moderate – 2; Low – 1.
- Probability of Occurrence: Definite – 4; Highly probable – 3; Possible – 2; Impossible – 1.

2.9 Criteria for the classification of an impact

Nature

A brief description of the environmental aspect being impacted upon by a particular action or activity is presented.

Extent (Scale)

Considering the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact.

- Site: Within the construction site
- Local: Within a radius of 2 km of the construction site
- Regional: Provincial (and parts of neighbouring provinces)
- National: The whole of South Africa

Duration

Indicates what the lifetime of the impact will be.

- Short-term: The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase.
- Medium-term: The impact will last for the period of the construction phase, where after it will be entirely negated.
- Long-term: The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter.
- Permanent: The only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.

Intensity

Describes whether an impact is destructive or benign.

- Low: Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.
- Medium: Effected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way.

- High: Natural, cultural and social functions and processes are altered to extent that they temporarily cease.
- Very high: Natural, cultural and social functions and processes are altered to extent that they permanently cease.

Probability

Probability is the description of the likelihood of an impact actually occurring.

- Improbable: Likelihood of the impact materialising is very low.
- Possible: The impact may occur.
- Highly probable: Most likely that the impact will occur.
- Definite: Impact will certainly occur.

Significance

Significance is determined through a synthesis of impact characteristics. It is an indication of the importance of the impact in terms of both the physical extent and the time scale and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Using the scoring from the previous section, the significance of impacts is rated as follows:

- Low impact: 4-7 points. No permanent impact of significance. Mitigating measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
- Medium impact: 8-10 points. Mitigation is possible with additional design and construction inputs.
- High impact: 11-13 points. The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
- Very high impact: 14-16 points. The design of the site may be affected. Intensive remediation as needed during construction and/or operational phases. Any activity, which results in a “very high impact”, is likely to be a fatal flaw.

Status

Status gives an indication of the perceived effect of the impact on the area.

- Positive (+): Beneficial impact.
- Negative (-): Harmful or adverse impact.
- Neutral Impact (0): Neither beneficial nor adverse.

It is important to note that the status of an impact is assigned based on the *status quo.* That is, should the project not proceed. Therefore not all negative impacts are equally significant. The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented.

3 RECEIVING ENVIRONMENT

3.1 Study Site Location

The study area for this report is only considered to be Section D of the National Road N2, Section 33. This is the National Route N2 Section 33 between Bloemdendal (km 34,0) to just north of Piet Retief (Mkondo) (km 63,3). The study site is located in the Mkhondo Local Municipality of the Gert Sibande District Municipality in the Mpumalanga Province (Figure 1, Figure 2).

3.2 GPS Coordinates of the Main Landmarks

The GPS coordinates of the main landmarks within the project area are as follows:

- Piet Retief (Mhkondo): 26°59'57.38"S; 30°47'59.66"E.
- Start of route (KM 34,0): 27° 9'17.64"S; 30°58'24.88"E.
- End of route (KM 63,3): 26°58'17.83"S; 30°47'29.96"E.
- 1:50 000 map grid references: 2730BB; 2630DD.

Figure 1: Site location

Figure 2: Site location (Google Earth)

3.3 Topography

The topography of the study area comprises largely of flat to very flat open plains to slight undulating hills and plains. The study area is situated just on top of the escarpment on the start of the plateau of the highveld areas of the Mpumalanga Province. The average height above sea level across the study site varies between 1 300m and 1 200m.

3.4 Geology and Soils

The geology and soils of the study area in the northern section is predominantly that of granite of the Mpuluzi Granite (Randian Erathem), Archaean gneiss giving rise to melanic soils, with intrusions of diabase. Land types Ac, Fa and Ba (Mucina & Rutherfords, 2006). While the geology and soils of the southern section is mostly that of Archaean granite and gneiss partly covered by Karoo Supergroup sediments (Madzaringwe Formation) and intruded by Karoo Dolerite Suite dykes and sills. Dominant land types are Ac, with Fa and Ba of subordinate importance (Mucina & Rutherford, 2006). Table 1 gives a basic description of the land types of the study area.

Table 1: Description of the Land Types found in the Region

Code	Description
Ac	Red-yellow apedal, freely drained soils (Red and yellow, dystrophic and/or mesotrophic). Dominantly (> 40%) red and yellow, freely drained, apedal (= structureless) soils. Normally associated with high rainfall areas, where soils are subjected to moderate (= mesotrophic) to intense (= dystrophic) leaching of nutrients from the soil profile. Soils are thus mostly low in base elements (K, Ca, Mg, Na). A broad range of textures may occur.
Ba & Bb	Plinthic catena: Upland duplex and margalitic soils rare (Dystrophic and/or mesotrophic; red and/or yellow soils). Mainly red (Ba) or yellow (Bb), apedal (= structureless) soils, moderately (mesotrophic) to highly (dystrophic) leached (low to moderate fertility status), with a wide textural range, mostly sandy loam to sandy clay loam. Soils contain a greyish subsoil layer (plinthic) where iron and manganese accumulate in the form of mottles, due to a seasonally fluctuating water table. 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.
Fa	Glenrosa and/or mispah forms (other soils may occur); lime rare or absent in the entire landscape. Generally shallow soils consisting of a topsoil directly underlain by weathered rock (Glenrosa form) or hard rock (Mispah form), sometimes with surface rock and steep slopes. Found in moister areas or areas with acidic parent materials, where little lime exists.

3.5 Climate

The study area is situated within the higher rainfall regions of South Africa (601mm – 800mm per annum) as can be seen from the map below (Figure 3). Summer rainfall with a mean annual precipitation (MAP) of between 600mm+ is common in the region and the study area. Frost is uncommon, but does occur on occasion. The study area runs through Piet Retief and to the immediate south of the town. The climatic conditions are basically those of Piet Retief.

Piet Retief receives on average around 746mm of rainfall annually, with most occurring during the summer months. The town receives the lowest rainfall (approximately 2mm) in June and the highest (approximately 140mm) in December. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Piet Retief range from 19.4°C in June to 26.2°C in January. The region is the coldest during June when the temperatures drop on average to a low of 3,2°C during the night

(www.saexplorer.co.za). The study area is situated within the Temperate Interior Climatic Zone of South Africa (Figure 4).

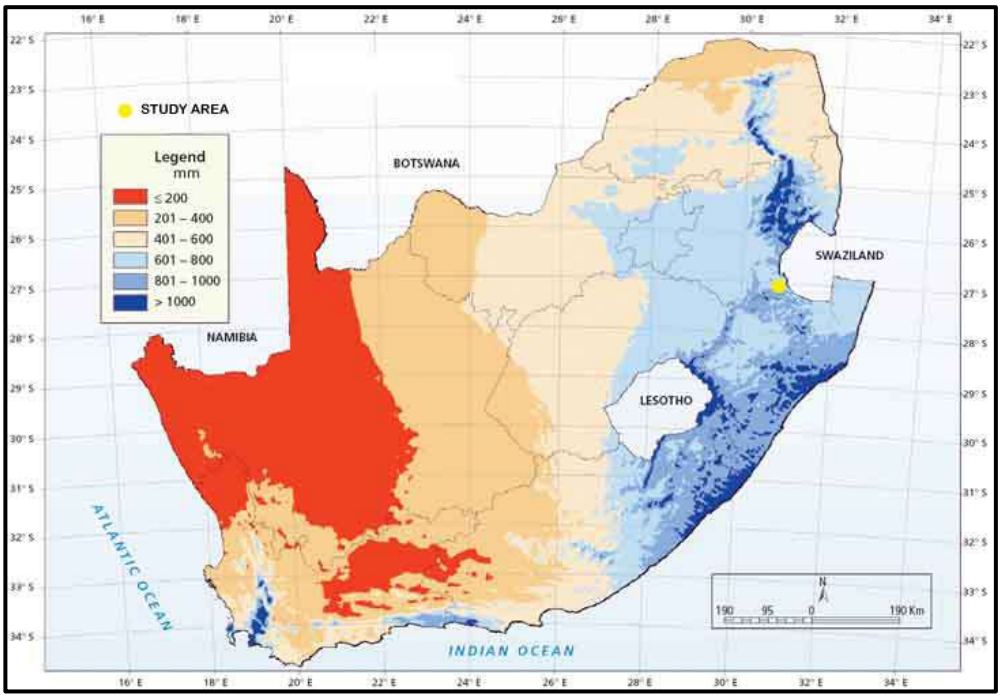


Figure 3: Rainfall averages for South Africa

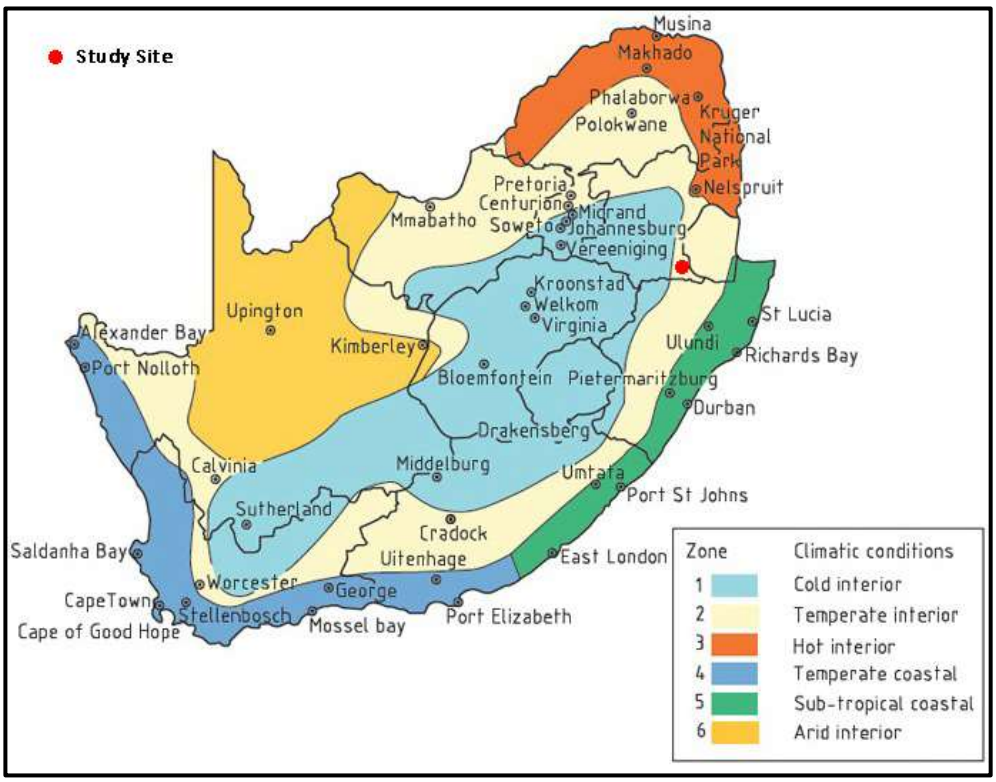


Figure 4: Broad climatic zones of South Africa

3.6 Landcover

The landcover or landuse or the study area is predominantly afforestation (Figure 5). Most of the areas along the study route are either planted, or in the process of being planted. Eucalypt (gum trees) and pine trees are the main species under cultivation, which are considered as alien invasive species in the natural environment of South Africa. Other landuses include open grassland areas that are mainly used for grazing of cattle or sheep. The other main landcover is that of the town of Piet Retief, in the north of the study area. Cultivation in the study area and general area is low.

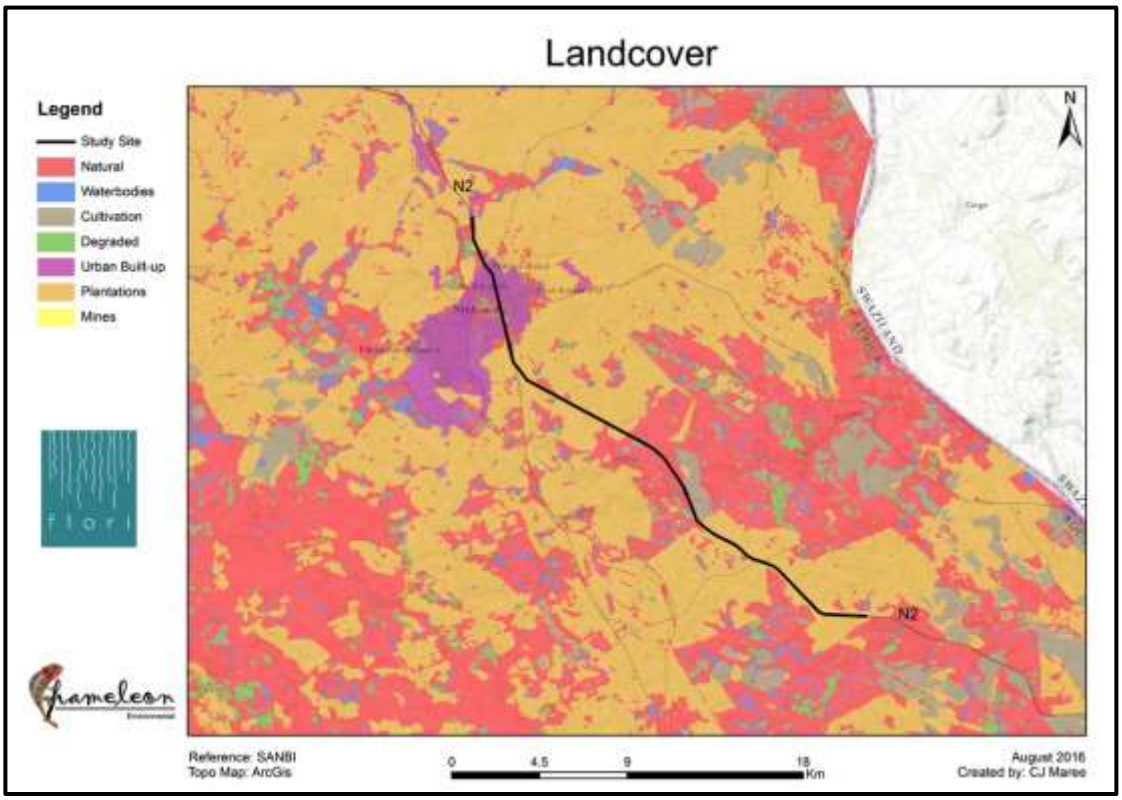


Figure 5: Landcover

4 TERRESTRIAL ECOLOGY

4.1 Vegetation

South Africa is divided up into nine Biomes. The study area is situated within the Grassland Biome (Figure 6). The Grassland Biome can be naturally subdivided into dry and moist grassland regions. Grassland veldtypes with a rainfall of 600mm+ per annum tend to be dominated by sour, andropogonoid grasses. While in veldtypes with an average rainfall of below 600mm per annum, the sweet chloridoid grasses tend to be more common. Dry and moist grassland types are divided primarily on the basis of rainfall, with 500-700mm being the broad boundary. Historically, such as with the classification of veld types by JPH Acocks (1952) and AB Low & AG Rebelo (1998), these grasslands have been divided into sweet grasses (sweetveld) and sour grasses (sourveld) based primarily on agriculutral or grazzing criteria. In high rainfall areas (moist grasslands) sour grasses tend to dominate, while in low rainfall areas the sweet grasses (which are more palatable for livestock) tend to dominante. Grasslands (like any other vegetation type) are also influenced and shaped by numerous environmental factors such as temperature, soils and altitude.

Mucina and Rutherford (eds) (2006) subdivided the Grassland Biome into four main bioregions. Namely, Dry Highveld Grasslands; Drakensberg Grasslands; Meisic Highveld Grasslands; and Sub-Escarpment Grasslands. These subdivisions of the Grassland Biome are based on gradients of altitude (height above sea-level) and moisture (rainfall). Altitude has a strong influence on climatic variables and an increase in altitude usually corresponds with an increase in rainfall and a decrease in temperature.

Grassland vegetation types are dominated by a single, lower layer of grasses, with the occurance of a middle layer of shrub and upper layer of trees being rare to absent, except in a few localised habitats such as koppies (rocky outcrops) and rocky ridges. The study area occurs within the Mesic Highveld Grassland Bioregion (Figure 7).

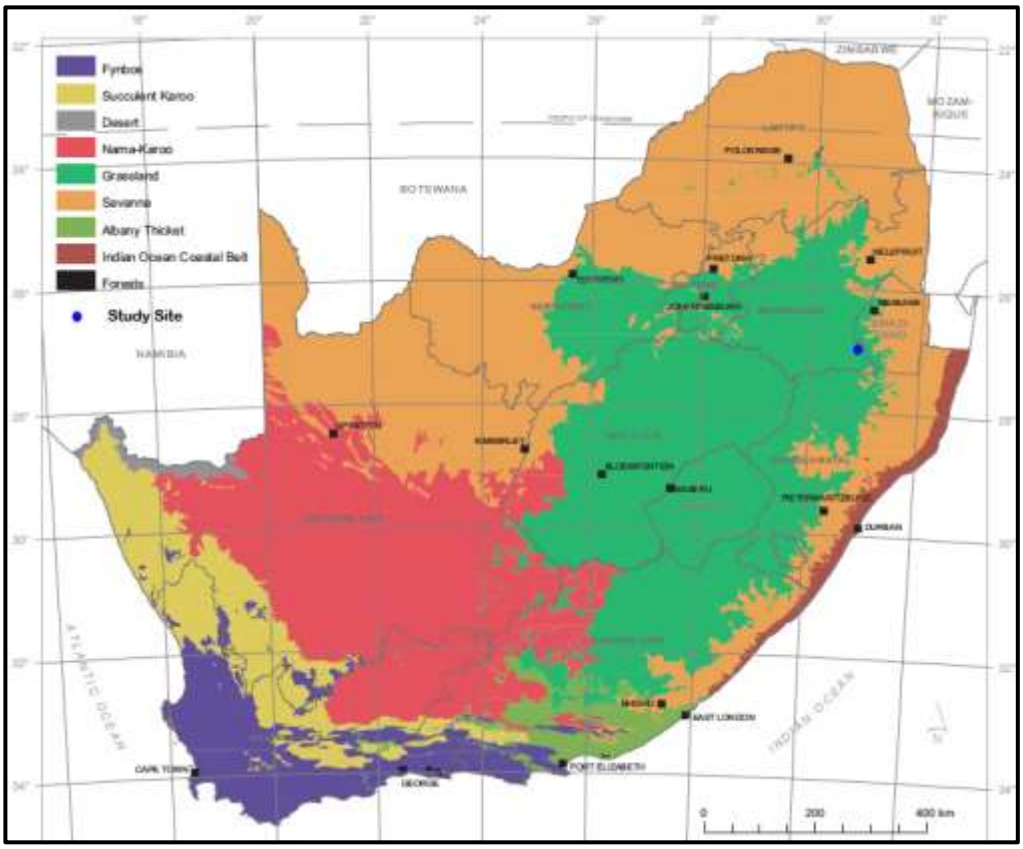


Figure 6: Biomes of South Africa

The study area is situated within two main veldtypes. Namely, **Paulpietersburg Moist Grassland** and **KaNgwane Montane Grassland** (Figure 8). Table 2 shows the hierarchy of the vegetation, while Table 3 gives other classification names used for the same veldtypes. The study area is situated within high-lying, high rainfall, sour grasslands of Mpumalanga Province. Low & Rebelo (1996) make little distinction between the two veldtypes. The southern third of the study site is transitional between the Highveld and the Escarpment and contains elements of both. The vegetation structure in this area is comprised mostly of a short, closed grassland layer with many forbs, and a few scattered shrubs on the rocky outcrops and ridges, with little to no indigenous upper layer of trees. The northern half of the study area is characterised more by tall, closed grassland, rich in forbs and dominated by the grass species of *Tristachya leucothrix*, *Themeda triandra* and *Hyparrhenia hirta*

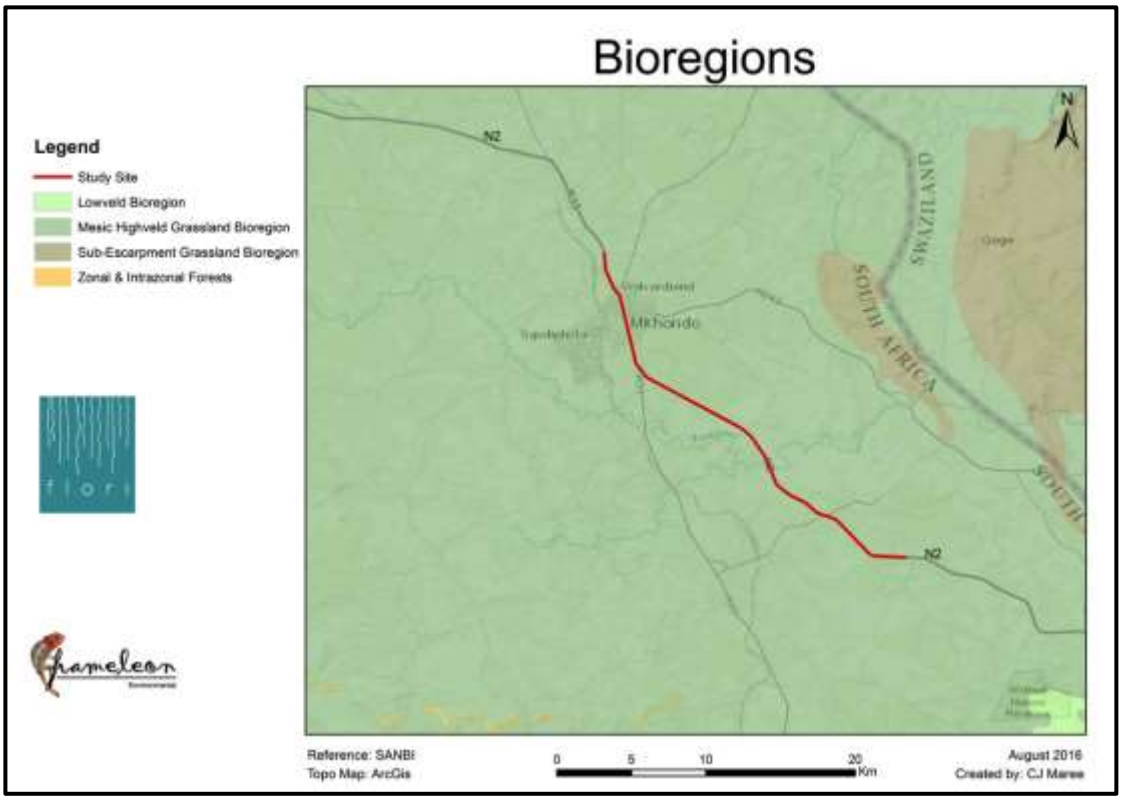


Figure 7: Bioregions

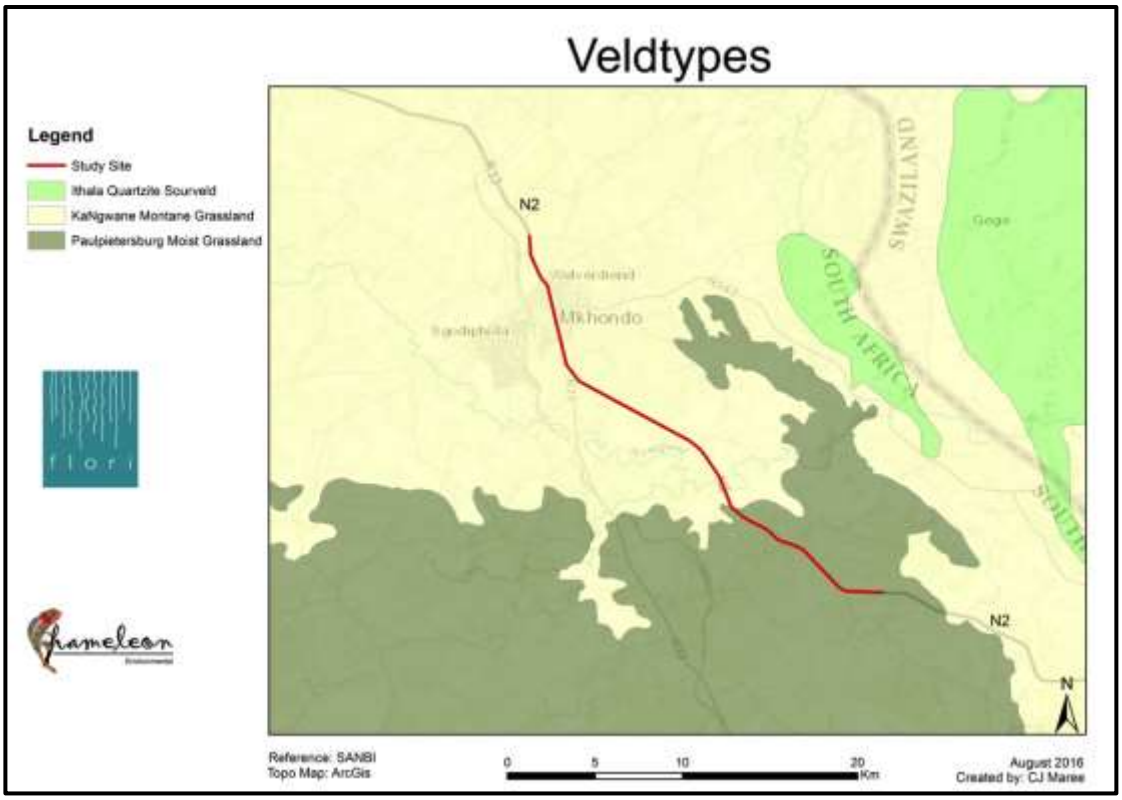


Figure 8: Veld types

Table 2: Vegetation classification of the study site

Category Description	Classification
Biome	Grassland
Bioregion	Mesic Highveld Grassland
Vegetation Types	Paulpietersburg Moist Grassland; KaNgwane Montane Grassland

Table 3: Comparison of veldtype names

Mucina & Rutherford (2006)	Low & Rebelo (1996)	Acocks (1953)
Paulpietersburg Moist Grassland	North-eastern Mountain Grassland	Northern Tall Grassland
KaNgwane Montane Grassland	North-eastern Mountain Grassland	Piet Retief Sourveld

4.1.1 Vegetation of the study area

The vegetation all along the study area is highly negatively impacted on and generally transformed, or moderately to mostly modified. No pristine grassland areas exist within or immediately adjacent to the study area. This is because most of the study area is the N2 National Route road itself and the road reserve, which is routinely mowed or burnt. The predominant landuse in the area is also afforestation, which totally transforms the natural environment.

4.1.2 Priority Floral Species

No Red Data species (endangered, threatened or vulnerable) were observed during field investigations. According to the SANBI database a few Red Data species have been recorded in the region of the QDS quadrants. It is possible that a few plants might be present along the roadside in the damper, less disturbed grassy areas. None were observed during field investigations, but care should still be taken during the project. Any plants found should be lifted and planted nearby in a similar looking habitat (Table 4). The summaries of priority floral species per grid reference are tabled below (Table 4). Due to the regular cutting of the grass in the study area, as well as the grazing of free-roaming cattle, the species richness is much lower than in pristine grassland.

Priority species (that are not Red Data Species) that were observed during field investigations include: *Boophone disticha. Eucomis montana* and *Hypoxis rigidula.*

Other possible priority species occurring the in study area although not observed during field investigations include: *Moraea pubiflora*, *Watsonia latifolia*, *Zantedeschia albomaculata* subsp. *macrocarpa*. *Aloe integra* and *Aloe kniphofioides*

Table 4: Priority Floral Species per 1:50 000 Grid Reference

Grid reference & Priority Category	No. of species	Name of species
2730BB		
Critically endangered (CR)	0	-
Endangered (EN)	0	-
Vulnerable (VU)	1	*Aloe kniphofioides*
Near threatened (NT)	1	*Merwilla plumbea*
2630DD		
Critically endangered (CR)	0	-
Endangered (EN)	0	-
Vulnerable (VU)	0	-
Near threatened (NT)	0	-

4.2 Conservation status

Both of the grassland veldtypes in which the study area is situated are vulnerable (VU). Afforestation is the largest negative impact on the grasslands of the study area (Table 5). According to the maps from SANBI the study area is within vulnerable veldtypes or ecosystems (Figure 10). Both veldtypes are considered threatened (Figure 11). Figure 9 and Table 6 give explanations as to the categories and status levels.

Table 5: Veldtype status

Veldtype	Status	Description of status
Paulpietersburg Moist Grassland	VU	Only very small portion statutorily conserved in Witbad, Vryheid Mountain, Paardeplaats and Phongola Bush Nature Reserves. Some private reserves protect small patches (Rooikraal, Mhlongamvula, Kombewaria). About 33% already transformed by plantations or cultivated land. Heavy livestock grazing and altered fire regimes

		have greatly reduced the area of grasslands of high conservation value. Aliens such as species of *Acacia*, *Eucalyptus* and *Pinus* are of major concern in places (Mucina & Rutherford, 2006, 2010).
KaNgwane Montane Grassland	VU	The conservation target is 27% with only 0,4% protected within any formally proclaimed nature reserves (Malalotja, Nooitgedacht Dam and Songimvelo). A number of private conservation areas protect small patches of this unit. It is well suited for afforestation and at least 30% has already been converted to plantations of alien trees. A further 6% is under cultivation (Mucina & Rutherford, 2006, 2010).

Table 6 below gives a basic description of each of the status categories, while Figure 9 shows the categories in a hierarchical format (IUCN Redlist, 2010).

A general overview map of the threatened ecosystems of South Africa is shown below in Figure 10. From the map in Figure 10 it can be seen that the study area is situated within threatened ecosystems or veldtypes. The map in Figure 10 is taken from SANBI's website (www.bgis.sanbi).

The Biodiversity Act (Act 10 of 2004) provides for listing of threatened or protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or protected. The main purpose for the listing of threatened ecosystems is an attempt to reduce the rate of ecosystem and species destruction and habitat loss, leading to extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems (SANBI).

Table 6: Ecosystem Status: Simplified explanation of categories used

STATUS	% Transformed	Effect on Ecosystem
Least Threatened (LT)	0-20% (<20% loss)	No significant disruption of ecosystem functions
Vulnerable (VU)	20-40% (>20% loss)	Can result in some ecosystem functions being altered
Endangered (EN)	40-60% (>40% loss)	Partial loss of ecosystem functions
Critically Endangered	>60% or BT Index for	Species loss. Remaining habitat is less than

(CR)	that specific veldtype	is required to represent 75% of species diversity

Source: South African National Spatial Biodiversity Assessment Technical Report. Volume 1: Terrestrial Component. 2004. SANBI. Mucina & Rutherford (eds) (2010).

Note: BT stands for the Biodiversity Threshold and is an index value that differs for each veldtype. In other words, because the composition, recovery rate, etc. differs for each veldtype there will be a different threshold (in this case percentage transformed) at which species become extinct and ecosystems breakdown. That is, at which point the veldtype is critically endangered. For the grassland vegetation units discussed the index value (BT) is broadly given as 60% and greater.

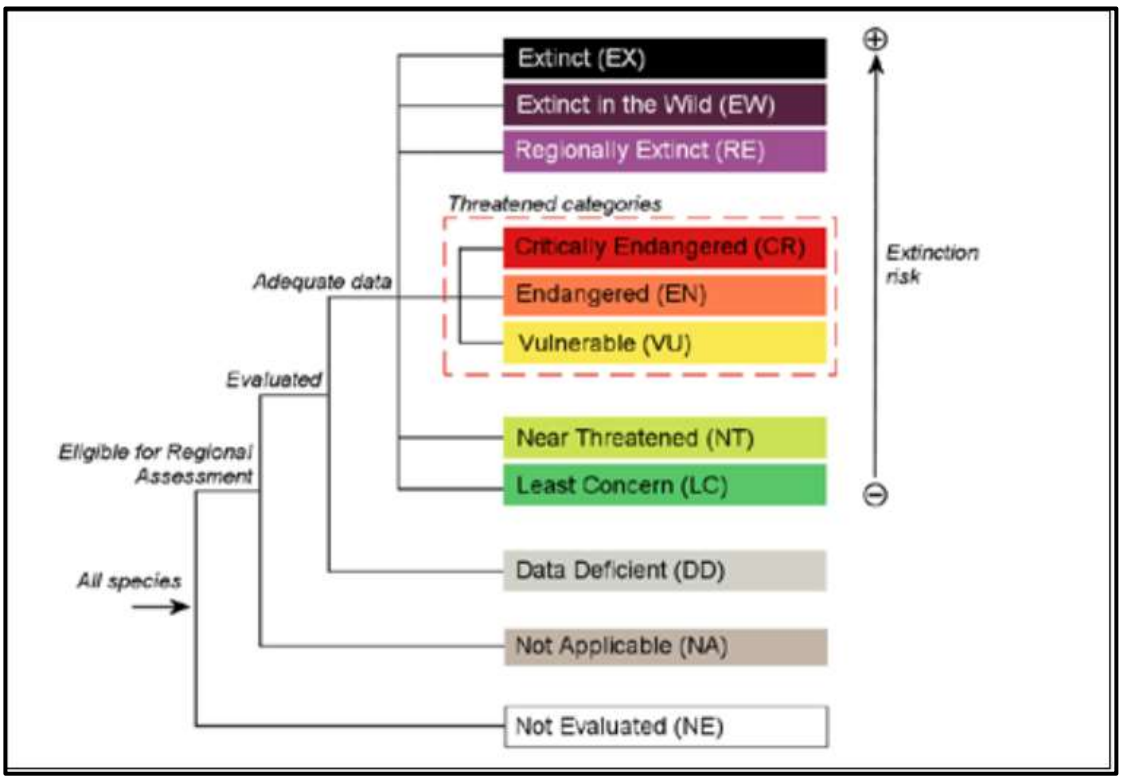


Figure 9: Structure of categories used at the regional level

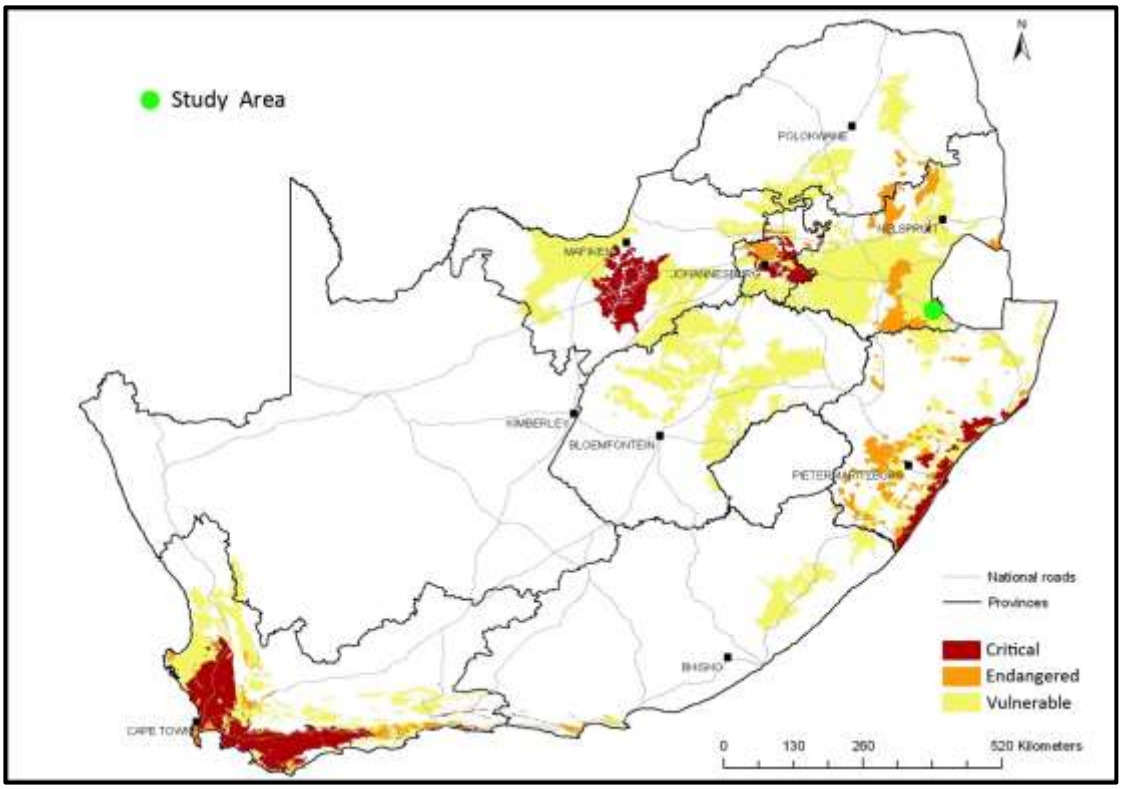


Figure 10: Threatened ecosystems of South Africa

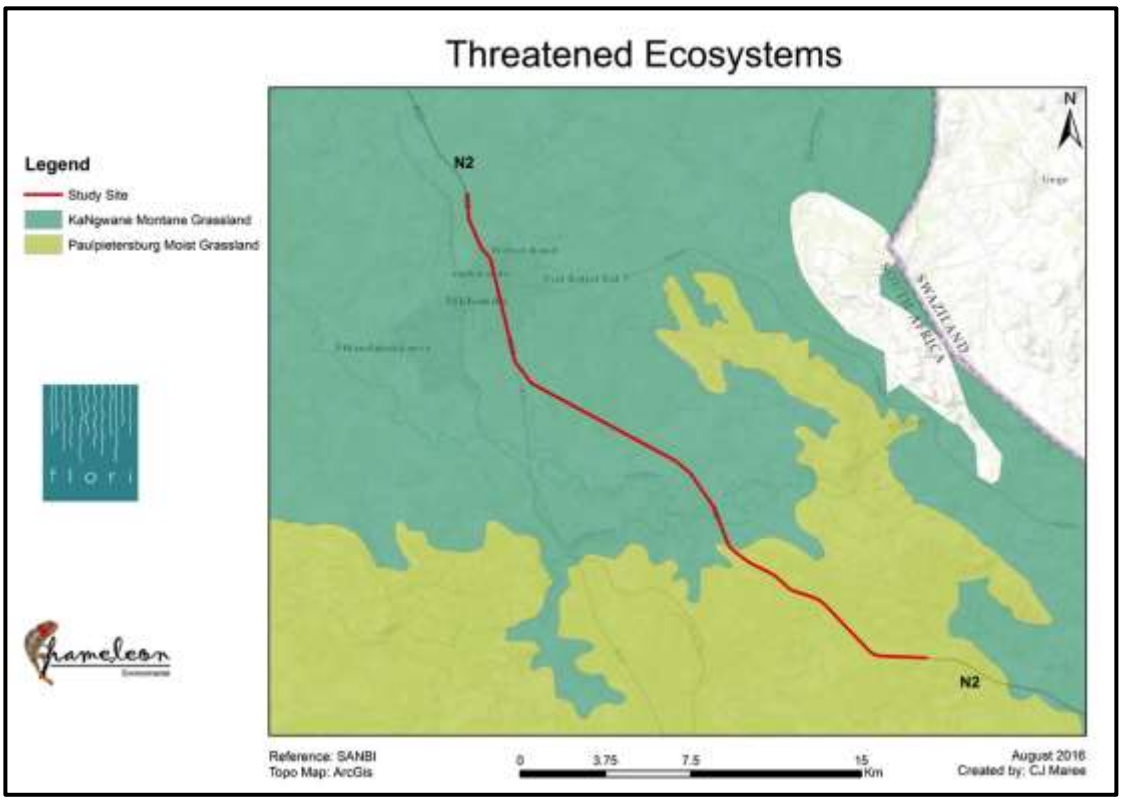


Figure 11: Threatened ecosystems of the region

4.3 Plants identified during field investigations

The dominant plant species identified during field investigations are listed in the appendices. Field investigations were limited to a few days only and plant lists can therefore not be considered comprehensive.

4.3.1 Alien plants identified in the Study Area

There are a number of alien plants in the study area. The herbaceous plants are especially prevalent in disturbed areas and rehabilitated mining areas. Tree species present tend to be mainly blackwattle (*Acacia mearnsii*) and gum trees (*Eucalyptus* spp.), with indigenous trees been rare to absent. Alien plant species, some of which are invasive, occur scattered throughout the area, especially in disturbed areas, rehabilitated mine areas and along road curbs. The alien plant species encountered in the study area are recorded, along with their category rating, in Table 7. The categories are as set out in the Conservation Act of Agricultural Resources Act, 1983 (CARA) (Act 43 of 1983).

Table 7: Alien plants identified in the study area

Botanical Name	Common Name	Category
Acacia mearnsii	Blackwattle	2
Argemone ochroleuca	White-flowered Mexican poppy	1
Bidens pilosa	Blackjacks	-
Caesalpinia decapetala	Mauritius thorn	1
Chromolaena odorata	Triffid weed	1
Conyza canadensis	Horseweed fleabane	-
Datura ferox	Large thorn-apple	1
Eucalyptus spp & cultivars	Gum trees; Eucalyptus	2
Guilleminea densa	Mat weed	-
Melia azedarach	Syringa	3
Malva verticillata	Mallow	-
Onopordum acanthium	Scotch thistle	-
Oxalis corniculata	Sorrel	-
Pinus pinaster	Pine	2
Populus x canescens	Grey poplar	2
Solanum elaeagnifolium	Silverleaf bitter apple	1
Tagetes minuta	Khakibos, kahki weed	-
Tarazacum officinale	Common dandelion	-
Verbena bonariensis	Vervain	-

Xanthium strumarium	Large cocklebur	-

4.4 Protected tree species identified in the study area

No protected tree species were found in the study area during field investigations.

4.5 Fauna

Field observations were limited to a few days, which always limits the observation and identification of fauna in the field. Due to the transformed nature of the study area the species richness will be low. Ideal habitats for most large or priority faunal species are rare to non-existent, with the exception of the pans, wetlands and streams. However, even these are under pressure with lack of adequate bufferzones and corridors and none are in a pristine condition. Extensive afforestation using alien invasive species has drastically transformed the natural habitat of the area. The large plantations tend to be fairly sterile with very low faunal species richness.

4.5.1 Mammals

No large- or medium-sized mammals were observed during field investigations.

4.5.2 Avifuana

A few locally common bird species were observed during field investigations such as laughing dove, cape turtle dove, pied crow and black-capped bulbul, hadeda ibis and the jackal buzzard. The study area is within a region that is home to a number of priority bird species. Most of these species are dependent on good quality grassland and wetland areas. Black-shouldered kite (which is a priority species) was observed. Many stork and crane species, most of which are under threat, occur in the greater region of the study area. Another important Red Data Species under threat in the region (due mainly as a result of afforestation) is the blue swallow.

Due to its' nature the project will have little to no negative impact on any priority bird species. However, care should still be taken to avoid contact with large bird species such as cranes, storks and owls as they are obviously very mobile and can from time to time come into contact with contractors.

4.5.3 Reptiles

No reptiles were observed during field investigations. The maps below show the hotspots for priority snake and lizard species for South Africa (Figure 12 & Figure 13). The study area is not within a snake hotspot, although it is possible that rock python (*Python natalensis*) could occur although rarely. The study area is also not within an area known to be a hotspot. Further south is an area, but this is more along the escarpment and rocky ridges and plateaus not found within the study area (Figure 13). Lizards tend to prefer rocky habitats and there are no rocky outcrops (koppies), rocky ridges or areas of large rock sheets within the study area. The likelihood is rare that any priority lizard species will be present in the study area.

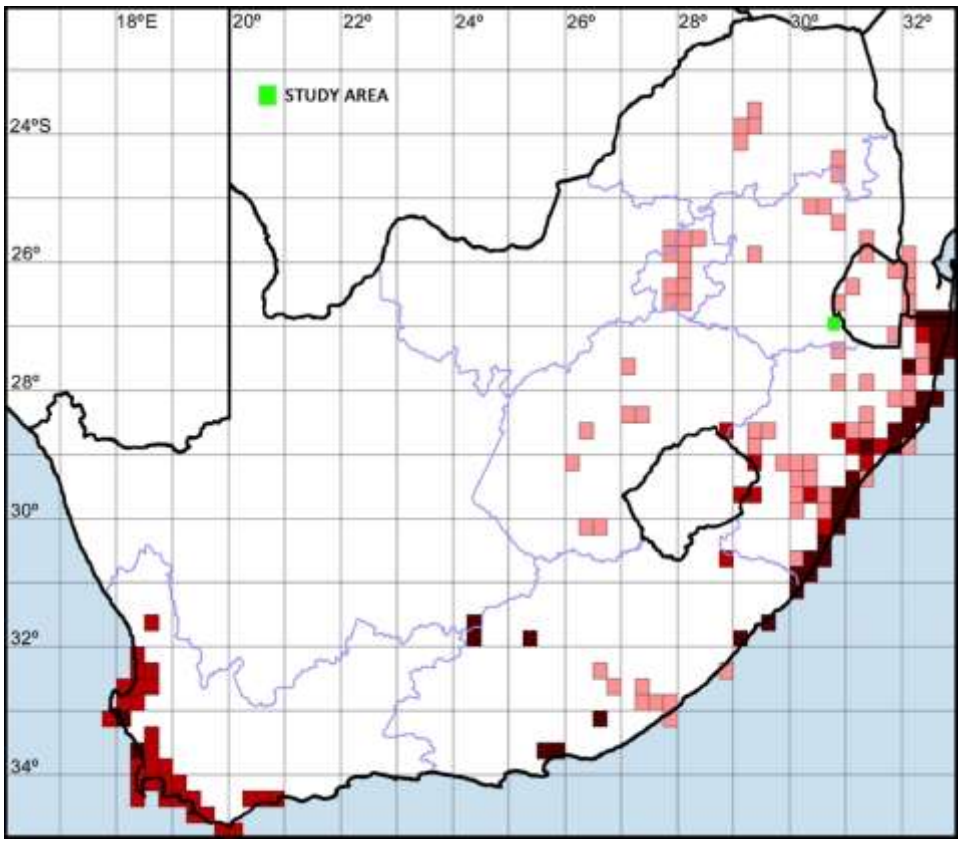


Figure 12: Snake hotspots

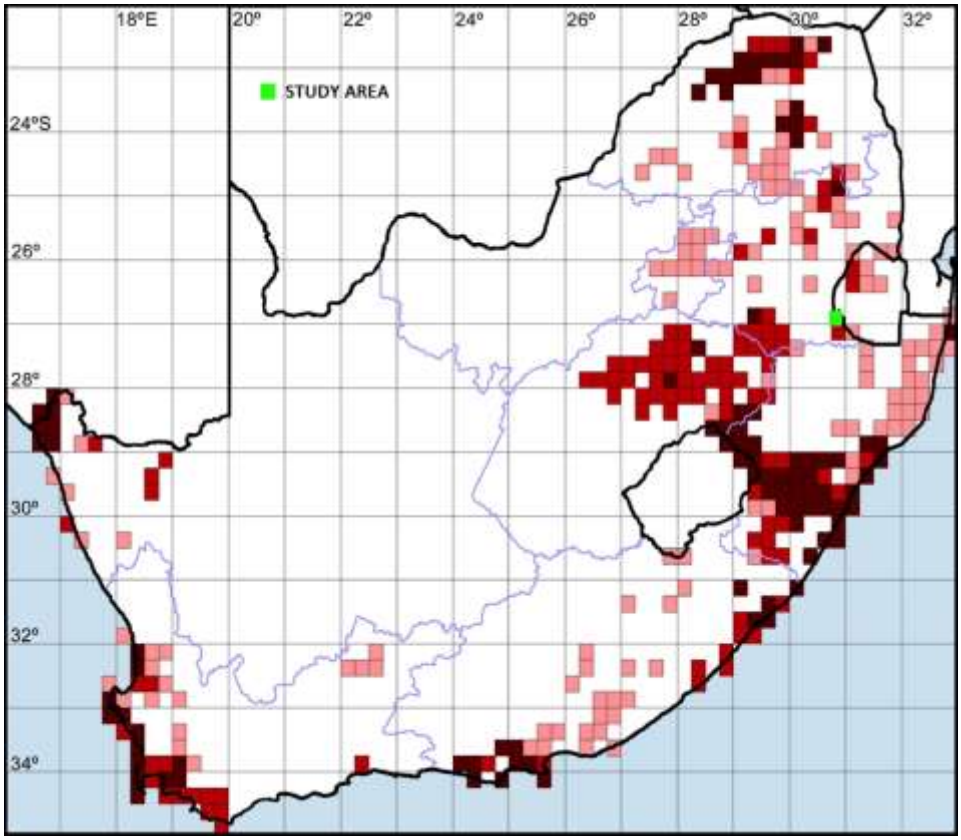


Figure 13: Lizard hotspots

4.5.4 Invertebrates

Invertebrates such as spiders, scorpions and butterflies are important faunal groups, but are difficult to fully assess in a short time period. During field investigations specific attention was given to priority species such as Mygalomorphae arachnids (Trapdoor and Baboon spiders) and red data butterflies. Fortunately, the nature and scope of the project is such that it will have very little negative impact, if any, on these species. No priority species were observed.

The map below shows the hotspots for priority butterflies and species-rich areas for South Africa (Figure 14). The study area is not within any of these known hotspots. The most likely red data butterfly to potentially occur in the region is the Marsh sylph (*Metisella meninx*), which is vulnerable (VU). The Marsh Sylph is endemic to the wet vleis of highland grasslands in northern KwaZulu-Natal, Mpumalanga, Gauteng and the northern part of the Orange Free State.

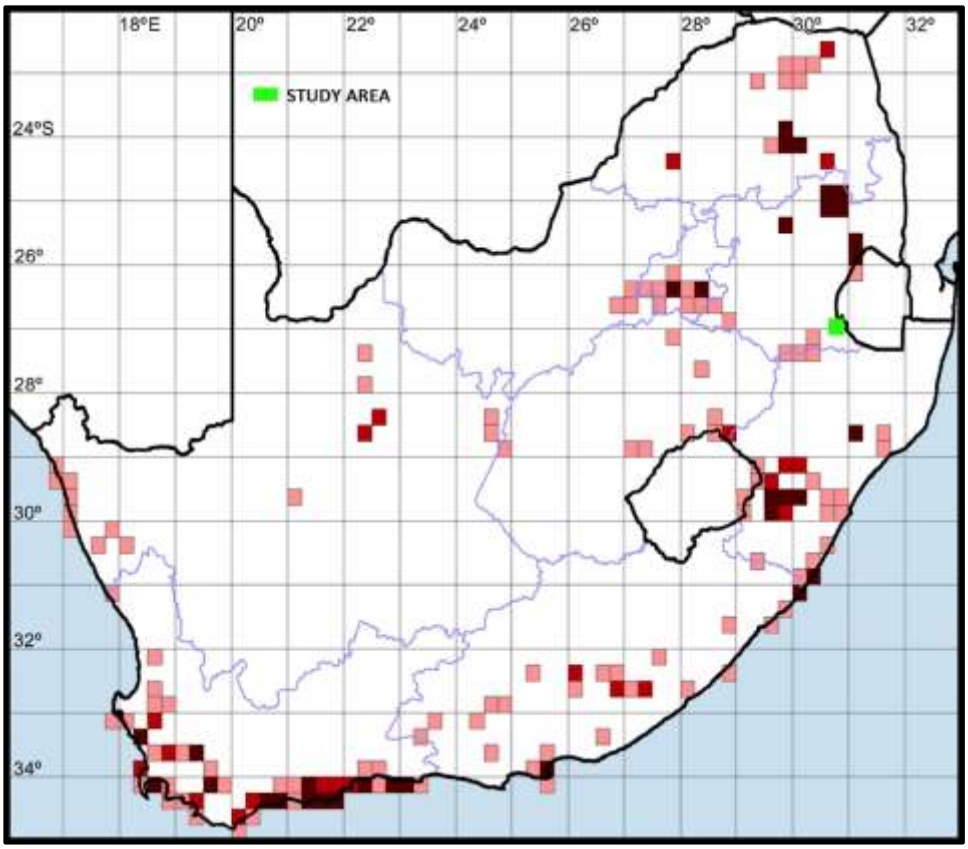


Figure 14: Butterfly hotspots

4.5.5 Faunal species of conservation concern

Most of the habitats present in the study area and surrounding areas are not pristine and are not ideal for most potentially occurring Red Data faunal species, with the exception of a few watercourses, some moist grassland areas and some open grassland areas. Care should still be taken to avoid impacting on or interacting with, any animals encountered.

The table below highlights the faunal species of conservation concern (which includes Red Data species) that potentially might occur in the study area and surrounding areas from time to time (Table 8).

Table 8: Red Data Faunal Species likely to occur in the area

Scientific Name	Common Name	Conservation Status	Preferred Habitat	Habitat Restrictions
Birds				
Anthropoides paradiseus	Blue crane	VU	Grasslands, cultivated lands	Grasslands, moist areas

Asio capensis	Marsh owl	LC	Grasslands, wetlands, vleis	Grassy Wetlands
Balearica regulorum	Grey crowned crane	EN	Grasslands, cultivated lands	Grasslands, moist areas
Bugeranus carunculatus	Wattled crane	EN	Grasslands, cultivated lands	Grasslands, moist areas
Ciconia nigra	Black stork	NT	Broad, open waterbodies	Cliff ledges for breeding
Hirundo atrocaerulea	Blue swallow	VU	Highveld or upland grassland	Grassland, old animal burrows
Phoenicopterus minor	Lesser flamingo	NT	Broad, pans	Pans or shallow water areas, food
Phoenicopterus roseus	Greater flamingo	LC	Broad, pans	Pans or shallow water areas, food
Tyto capensis	Grass owl	LC	Grasslands, wetlands.	Wetland areas
Butterflies				
Metisella meninx	Marsh sylph	VU	Wetlands, moist grassy areas	Wetlands, Montane
Frogs				
Pyxicephalus adspersus	Giant bulfrog	LC	Grassland, Savanna	Temporary floodplains, pans
Mammals				
Atelerix frontalis	SA hedgehog	NT	Most, broad	None
Snakes				
Python natalensis	Rock python	VU	Ridges, wetlands	Rocky areas, open water

5 AQUATIC ECOLOGY

The aquatic ecology focuses on the open waterbodies within the study area. These watercourses include wetlands, rivers, streams, pans, lakes and manmade dams. In reality a pan is actually a type of wetland and must be approached as such. The focus is to delineate watercourses and limit any impact the project might have on these watercourses.

5.1 Wetlands

'Wetland' is a broad term and for the purposes of this study it is defined according the parameters as set out by the Department of Water & Sanitation (DWS) in their guideline (A practical field procedure for identification and delineation of wetlands and riparian areas, 2005). The classification of wetlands (which is a type of watercourse) is summarised below (Figure 15).

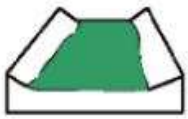
According to the DWS document and the National Water Act (NWA) a wetland is defined as, "*land which is transitional between terrestrial and aquatic systems where the water table is usually at or near surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil*."

Furthermore, the guidelines stipulate that wetlands must have one or more of the following defining attributes:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation;
- The presence, at least occasionally, of water loving plants (hydrophytes); and
- A high water table that results in saturation at or near surface, leading to anaerobic conditions developing in the top 50cm of the soil.

During the site investigations the following indicators were used to determine whether an area needed to be defined as a wetland or not, namely:

- Terrain unit indicator;
- Soil form indicator;
- Soil wetness indicator; and
- Vegetation indicator.

Hydrogeomorphic types		Description	Source of water maintaining the wetland[1]	
			Surface	Sub-surface
Floodplain		Valley bottom areas with a well defined stream channel, gently sloped and characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*
Valley bottom with a channel		Valley bottom areas with a well defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/ ***
Valley bottom without a channel		Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	***	*/ ***
Hillslope seepage linked to a stream channel		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well defined stream channel connecting the area directly to a stream channel.	*	***
Isolated Hillslope seepage		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel.	*	***
Depression (includes Pans)		A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/ ***	*/ ***

[1] Precipitation is an important water source and evapotranspiration an important output in all of the above settings

Water source: * Contribution usually small

*** Contribution usually large

*/ *** Contribution may be small or important depending on the local circumstances

*/ *** Contribution may be small or important depending on the local circumstances.

 Wetland

Figure 15: Classification of wetlands

5.2 Riparian zones

Riparian vegetation is typically zonal vegetation closely associated with the course of a river or stream and found in the alluvial soils of the floodplain. According to the National Water Act (NWA) riparian habitat is defined as including "*The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or*

flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas."

It is important to note that the NWA states that the riparian zone has a floral composition distinct from those of adjacent areas. The NWA also defines riparian zones as areas that "c*ommonly reflect the high-energy conditions associated with the water flowing in a water channel, whereas wetlands display more diffuse flow and are lower energy environments*."

5.3 Rivers and streams

A stream or river is a watercourse that is characterised by a very distinct channel. Most, but not all streams and rivers have an associated floodplain and / or riparian zone. Although wetlands and rivers are both watercourses, the legal implications differ in terms of development, buffer zones, etc.

5.4 Watercourses in the study area

The main watercourse the study area crosses over is the Assegaai River. A few smaller streams and drainage lines are also present. There are also a few wetland areas along the study route, especially in the area south of Piet Retief and north of the Assegaai River. These wetland and moist grassland areas have been highly impacted on and transformed by extensive and highly encroached afforestation.

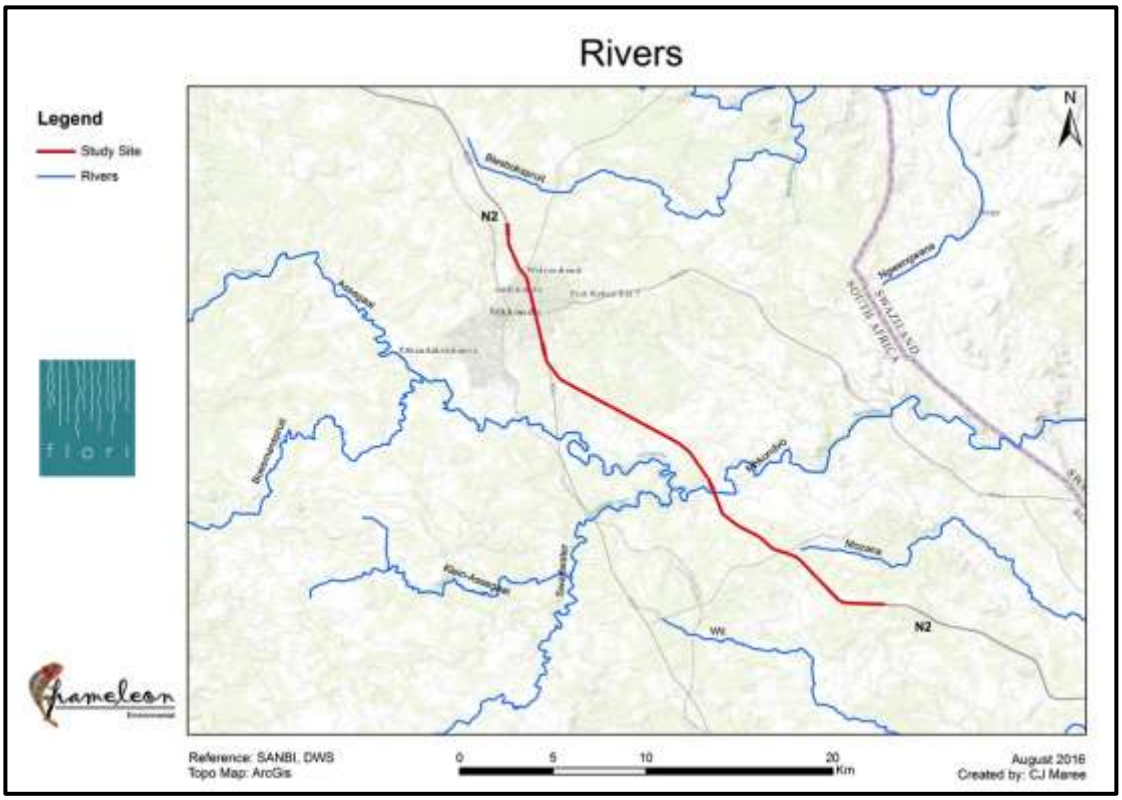


Figure 16: Main Rivers in the region

5.5 Classification of watercourses in the study area

The watercourses of the study area were classified along different hydrogeomorphic (HGM) types or units, up to Level 4, in terms of various levels as refined for South Africa by Kleynhans, *et. al*. (2005) and used in the Classification System for Wetlands user manual – SANBI Series 22 (Ollis *et. al.* 2013). See tables below (Table 9 & Table 10). This in addition to the classification system used above for wetlands (Figure 15).

Table 9: Classification levels 1 - 4

LEVEL 1 System	**LEVEL 2 Regional setting (Ecoregion)**	**LEVEL 3 Landscape Unit**	**LEVEL 4 HGM Unit**	
			HGM Type	Landform
Inland	SA Ecoregions according to DWS and/or NFEPA	• Valley floor • Slope • Plain	River	• Mountain headwater stream • Mountain stream • Transitional stream

		• Bench		• Upper foothill • Lower foothill • Lowland • Rejuvenated foothill • Upland floodplain
			Channelled valley bottom wetland	
			Unchannelled valley bottom wetland	
			Floodplain Wetland	
			Depression	• Exorheic • Endorheic • Dammed
			Seep	• With channel outflow (connected) • Without channel outflow (disconnected)
			Wetland flat	

Table 10: HGM Level 4: Watercourses in study area

Delineated systems	Level 1 System	Level 2 Regional Setting (Ecoregion)	Level 3 Landscape Unit	Level 4 HGM Unit
Assegaai River	Inland	Mesic Highveld Grassland Group 5	Plain	River (Lowland)
Unnamed Streams / Drainage lines	Inland	Mesic Highveld Grassland Group 5	Plain	River (Lowland)
Wetlands	Inland	Mesic Highveld Grassland Group 5	Plain	Channelled & Unchannelled valley bottoms

5.6 Delineated Watercourses

The maps below show the extent of the delineated watercourses (Figure 18 to Figure 24). Some watercourses, especially in terms of associated wetland areas are impossible to delineate accurately due to the ploughing and planting of plantations in the area that often go straight through these wetland areas or encroach significantly on them. The wetland areas are typical of the moist grassland / wetland areas found in the Mpumalanga Highveld, where there is usually no permanent zone (permanent open bodies of surface water). Numerous specialists don't refer to these wetlands as 'true wetlands' but as moist grassland areas, such as Acocks (1958).

The GPS positions (with ID numbers) are given in the table below (Table 11).

The positions of the water crossings, as shown with Blue Pins, are highlighted below in Figure 17

Table 11: GPS Coordinates of watercourse crossings

PIN ID	Figure No.	Latitude	Longitude
646	17	27° 6'38.26"S	30°53'44.60"E
647	18	27° 6'5.68"S	30°53'31.81"E
648	19	27° 4'25.71"S	30°52'6.75"E
649	20	27° 4'8.30"S	30°51'34.14"E
650	20	27° 4'1.65"S	30°51'21.80"E
651	20	27° 3'55.70"S	30°51'10.88"E
652	21	27° 3'18.08"S	30°50'0.94"E
653	21	27° 3'15.32"S	30°49'55.85"E
654	22	27° 1'39.94"S	30°48'30.73"E
655	23	27° 0'42.58"S	30°48'16.87"E

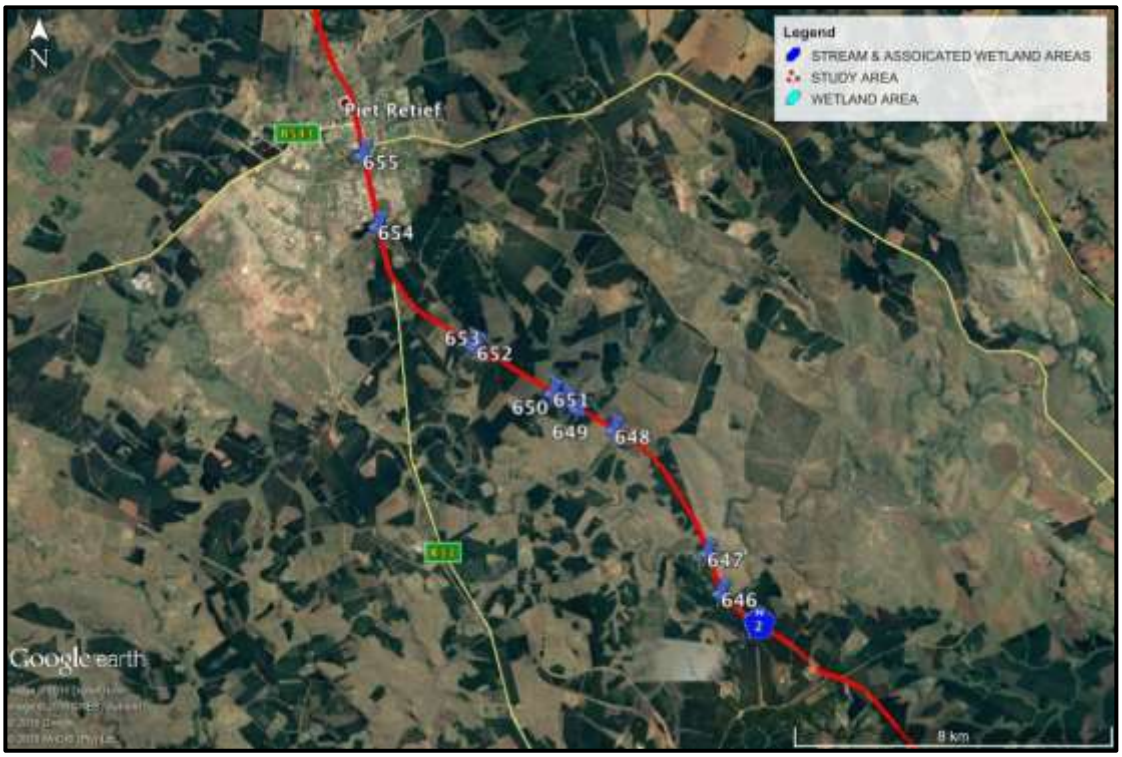


Figure 17: Locations of water crossings along study route

Figure 18: Drainage line (ID No. 646)

Figure 19: Assegaai River crossing (ID No. 647)

Figure 20: Drainage line and associated erosion gullies (ID No. 648)

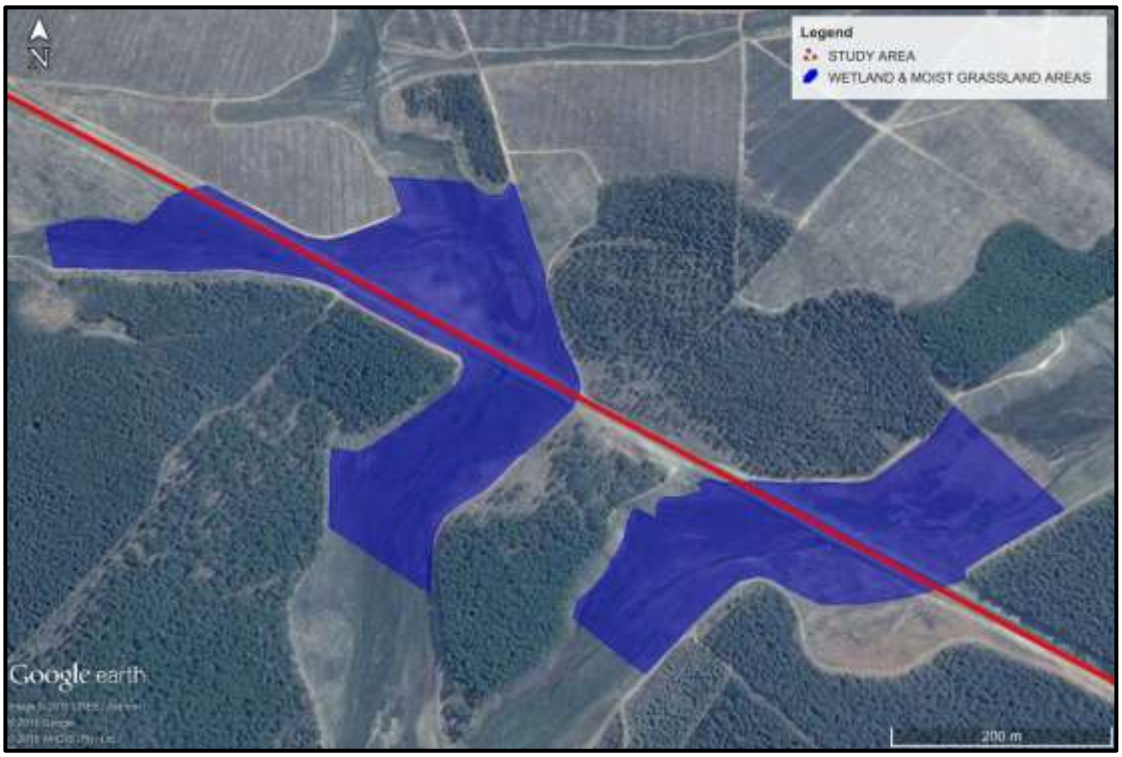


Figure 21: Wetland areas and associated moist grassland areas (ID No. 649, 650 & 651)

Figure 22: Wetland & stream (ID No. 652 & 653)

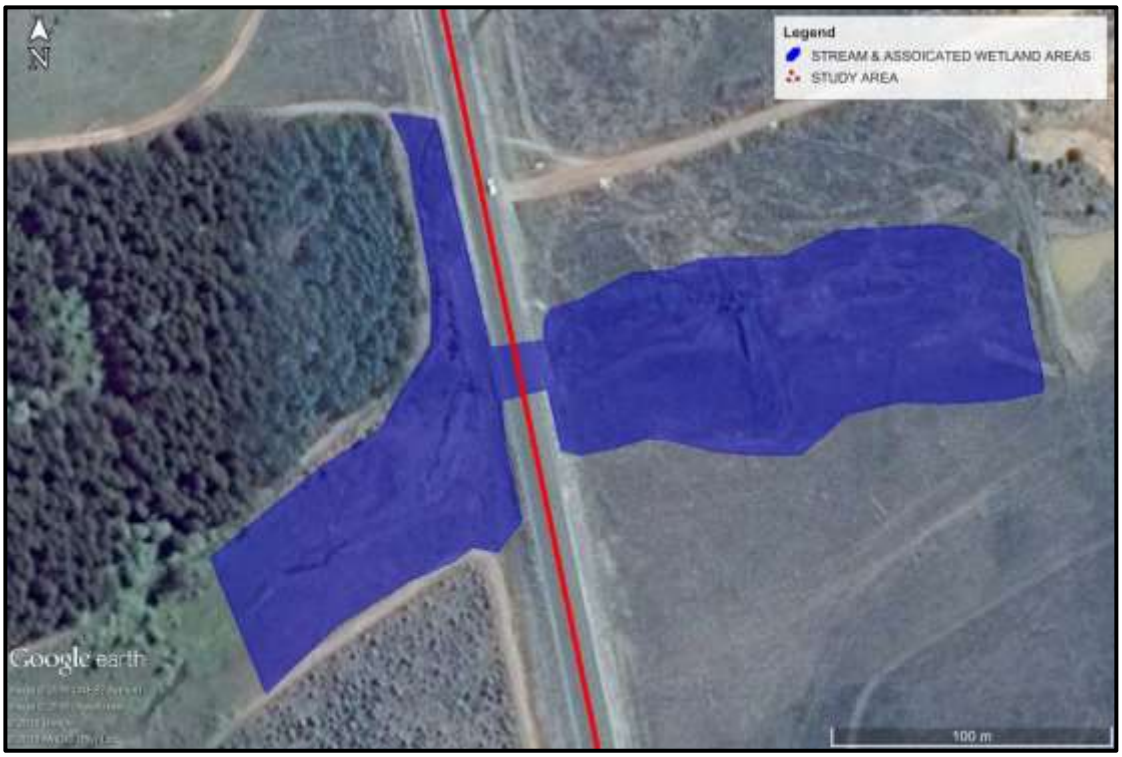


Figure 23: Stream & associated wetland area (ID No. 654)

Figure 24: Stream & Associated wetland linked to town dam (on left) (ID No. 655)

5.7 Drainage areas

South Africa is geographically divided up into a number of naturally occurring Primary Drainage Areas (PDA) and Quaternary Drainage Areas (QDA) (Figure 25). The different areas fall under the authority of different Water Management Areas (WMA) and Catchment Management Agencies (CMA) (Figure 26 & Figure 27). Until fairly recently there were 19 WMAs and 9 CMAs. As of September 2016, these were revised and there are now officially only nine WMAs, which correspond directly in demarcation to the nine new CMAs (Government Gazette, 16 September 2016. No.1056, pg. 169-172).

The study area is situated within the Primary Drainage Area (PDA) **W** and the Quaternary Drainage Areas (QDA) of **W51D** and **W42F** (Figure 28).

The study area is within the Inkomati - Usuthu Water Management Area (WMA 3) and under the jurisdiction of the Inkomati - Usuthu Catchment Management Agency (CMA 3) and the Vaal Catchment Management Agency (CMA 5) (Figure 27). In terms of the water environment the study area is situated within a single Wetland Vegetation Ecoregion, namely the Mesic Highveld Grassland Group 5 (Figure 29).

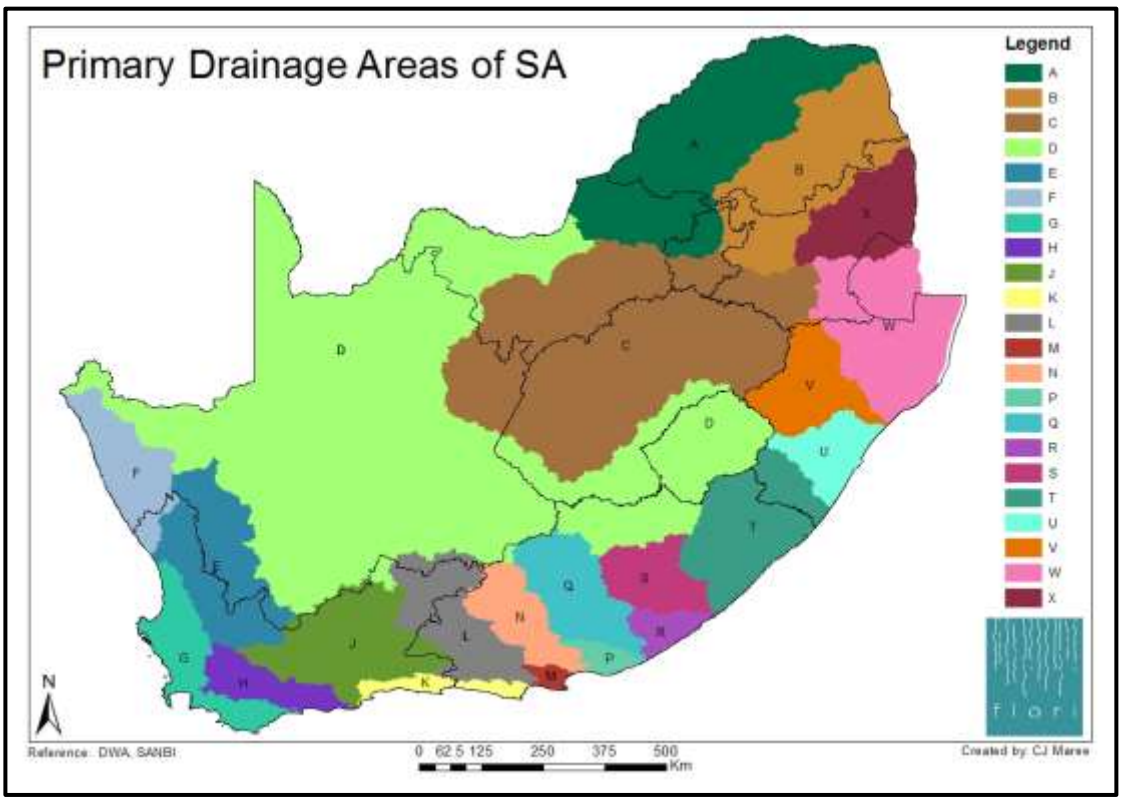


Figure 25: Primary Drainage Areas (PDA) of South Africa

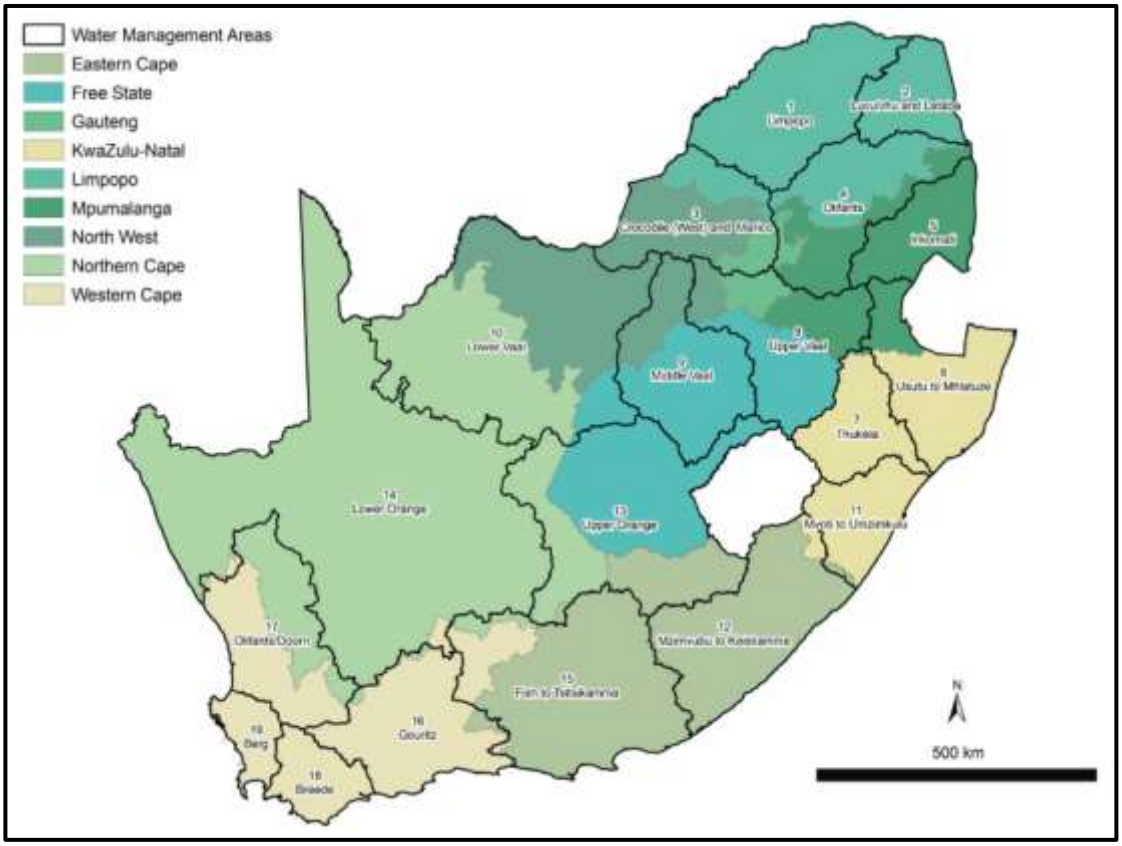


Figure 26: Old Water Management Areas (WMAs) of South Africa

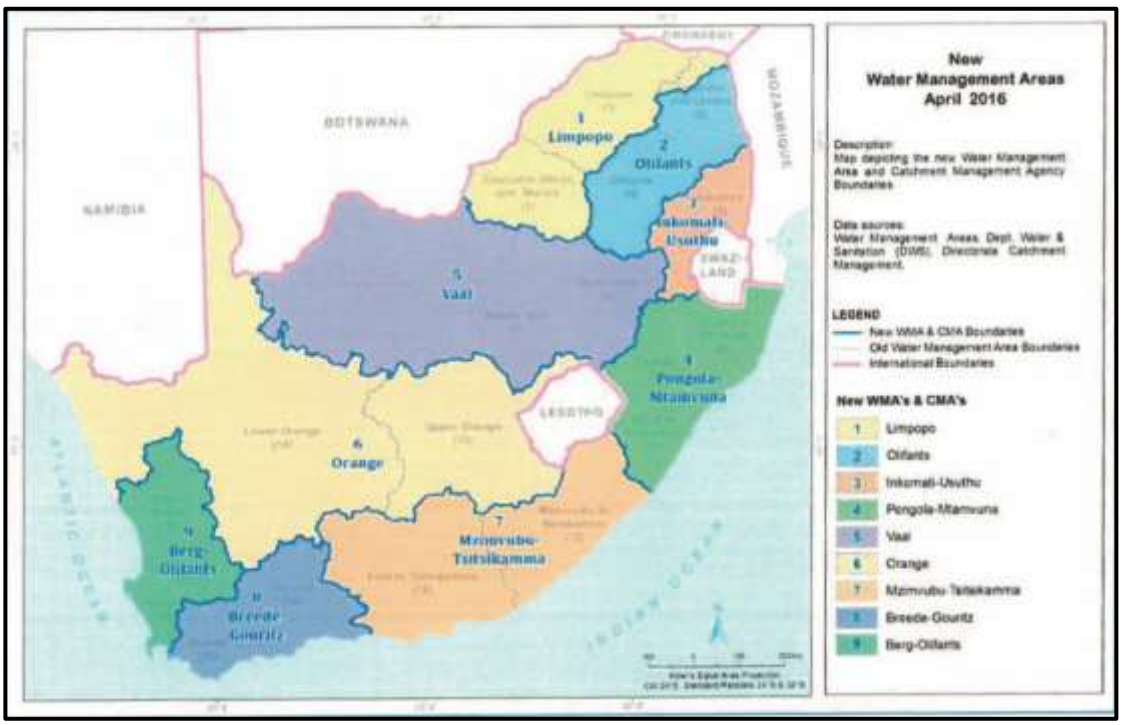


Figure 27: New WMAs & CMAs of South Africa

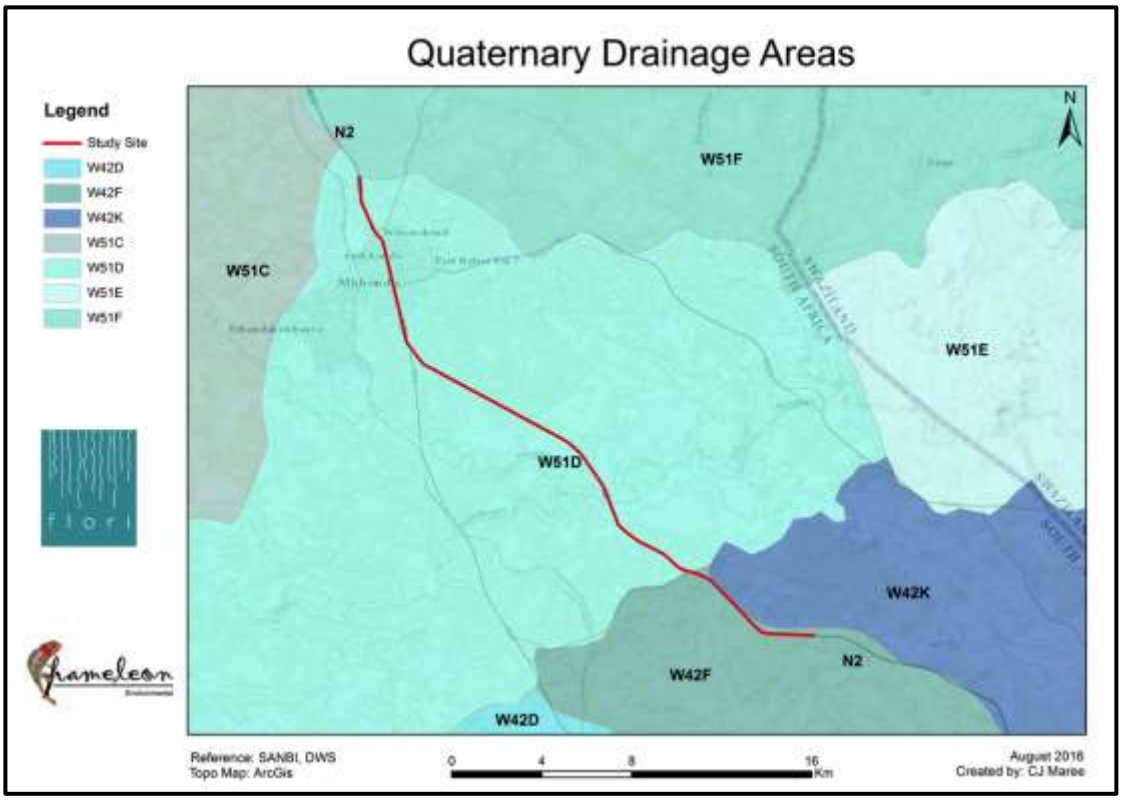


Figure 28: Quaternary drainage areas (QDAs)

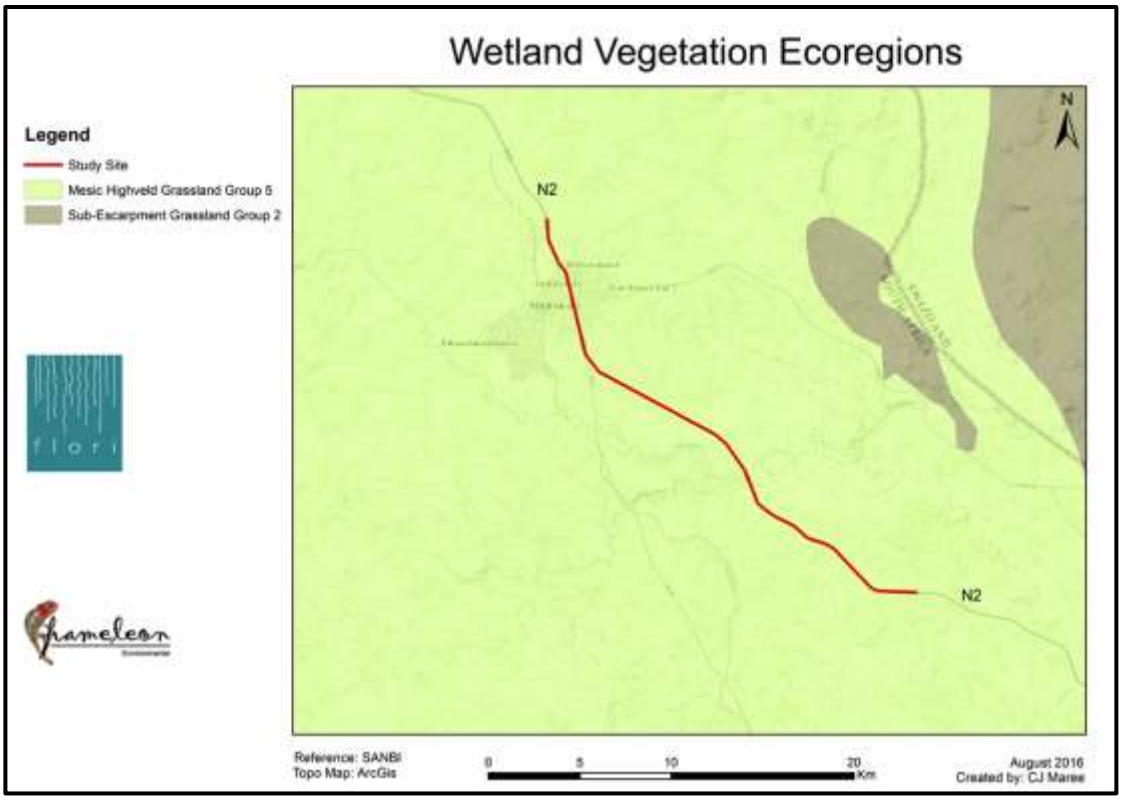


Figure 29: Wetland Vegetation Ecoregions

5.8 Strategic water source areas (SWSA) of South Africa

The Strategic Water Source Areas of South Africa (SWSA) are those areas that supply a disproportionate amount of mean annual runoff compared to the actual size of the geographical area. These areas are important because they have the potential to contribute significantly to the overall water quality and supply of the country, supporting growth and development needs that are often a far distance away. These areas make up 8% of the land area across South Africa, Lesotho and Swaziland but provide 50% of the water in these countries.

At a national level, Strategic Water Source Areas form the foundational ecological infrastructure on which a great deal of built infrastructure for water services depends. The study area is situated on the northern edge of Strategic Water Source Areas of South Africa (SWSA), in the area of the escarpment (Figure 30). At completion the proposed project will have no measurable negative impact on the quality or quantity of the water environment of the region.

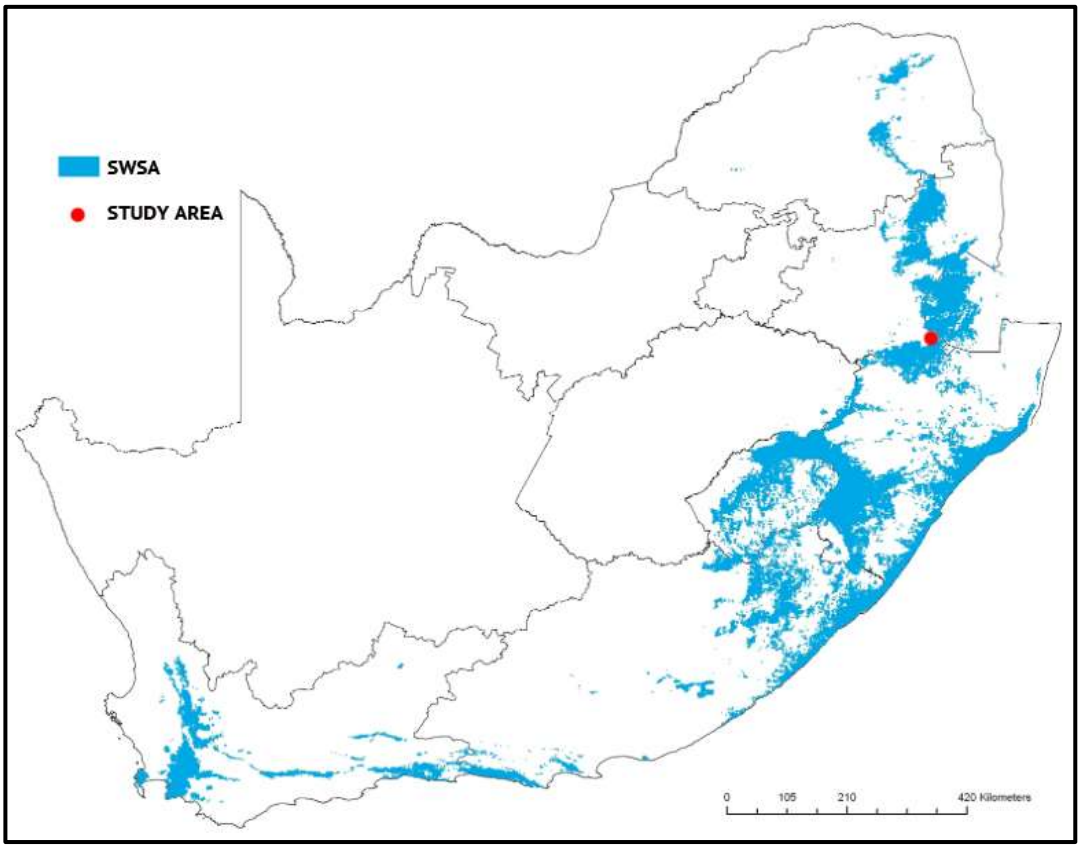


Figure 30: SWSA of South Africa

5.9 Methodology (PES)

The Present Ecological State (PES) is the current (present) ecological condition (state) in which the watercourse is found, prior to any further developments or impacts from the proposed project. The PES ratings of watercourses found in the study area are just as important to determine, as are the potential impacts of the proposed development. The PES of a watercourse is assessed relative to the deviation from the Reference State (also known as the Reference Condition).

The reference state is the original, natural or pre-impacted condition of the system. The reference state is not a static condition, but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES Method (DWA, 2005) was used to establish the present state (integrity) of the unnamed drainage line in the study area. The methodology is based on the modified Habitat Integrity approach of Kleynhans (1996, 1999).

Table 12 shows the criteria used for assessing the habitat integrity (PES) of wetlands and other watercourses, along with Table 13 describing the allocation of scores to the various attributes. These criteria were selected based on the assumption that anthropogenic modification of the criteria and attributes listed under each selected criterion can generally be regarded as the primary causes of the ecological integrity of a wetland.

Table 12: Habitat assessment criteria

Rating Criteria	Relevance
Hydrology	
Flow modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural lands. Changes in flow regime (timing, duration, frequency), volumes, and velocity, which affect inundation of wetland habitats resulting in floristic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.
Permanent inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.
Water quality	
Water Quality Modification	From point or diffuse sources. Measured directly

	by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment Load Modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats.
Geomorphology & Hydraulics	
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities, which reduce or changes wetland habitat directly in inundation patterns.
Biota	
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.
Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.
Invasive Plant Encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).
Alien Fauna	Presence of alien fauna affecting faunal community structure.
Over utilisation of Biota	Overgrazing, over fishing, over harvesting of plant material, etc.

Table 13: Scoring guidelines for habitat assessment

Scoring guidelines per criteria	
Natural / unmodified	5
Mostly natural	4
Moderately modified	3

Largely modified	2
Seriously modified	1
Critically modified (totally transformed)	0

Table 14 provides guidelines for the determination of the Present Ecological Status Category (PESC), based on the mean score determined for the assessments. This approach is based on the assumption that extensive degradation of any of the wetland attributes may determine the PESC (DWA, 2005).

Table 14: Wetland integrity categories

Category	Mean Score	Description
A	>4	Unmodified, natural condition.
B	>3 to 4	Largely natural with few modifications, but with some loss of natural habitats.
C	>2,5 to 3	Moderately modified, but with some loss of natural habitats.
D	2 to 2,5	Largely modified. A large loss of natural habitats and basic ecosystem functions has occurred.
E	>0	Seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
F	0	Critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.

The integrity of watercourses with a category rating of F,E & D were deemed to be Low. Category rating of C was deemed to be Medium, while Category ratings of B & A were deemed to be High.

5.10 PES of watercourses in the study area

All of the watercourses identified during field investigations in the study area were assessed (Table 15). The small streams and drainage lines are in reality and functionality the same. They have therefore been assessed as a group. The assessment criteria and structure is based on the modified Habitat Integrity approach of Kleynhans (1996, 1999). The PES is calculated by looking at the hydrology, geomorphology, water quality and biota of each watercourse. Of importance is the overall PES of the system.

Table 15: PES of watercourses in the study area

Criteria	Identified Watercourses			
	Assegaai River	Unnamed streams	Drainage lines	Wetlands
HYDROLOGY				
Flow modification	2	2	2	2
Permanent inundation	2	1	1	1
WATER QUALITY				
Water Quality Modification	2	2	2	2
Sediment Load Modification	2	2	2	2
GEOMORPHOLOGY				
Canalisation	2	2	2	2
Topographic Alteration	2	2	2	2
BIOTA				
Terrestrial Encroachment	2	2	2	2
Indigenous Vegetation Removal	2	2	2	2
Invasive Plant Encroachment	3	3	3	3
Alien Fauna	3	3	3	3
Over utilisation of Biota	1	1	1	1
Total:	22	22	22	22
Average:	2,0	2,0	2,0	2,0
Category:	**D**	**D**	**D**	**D**
Integrity (PES):	**Low**	**Low**	**Low**	**Low**
PES Description	**Largely Modified**	**Largely Modified**	**Largely Modified**	**Largely Modified**
Recommended EMC	**C**	**C**	**C**	**C**

5.11 Methodology (EIS)

Ecological importance and sensitivity (EIS) looks at the importance of the wetland, watercourse or water ecosystem in terms of biodiversity and maintenance. The determination is not just based on the identified watercourse in isolation, but also its' importance in terms of supplying and maintaining services to the larger catchment and water systems up and downstream.

The ecological sensitivity (ES) part of the EIS looks at how sensitive the system is to changes in services and environmental conditions. The Recommended Environmental Management Class (REMC) is the recommended state to which the watercourse should be returned to or maintained at. The EIS categories and descriptions are outlined in the table below (Table 16).

A high REMC relates to ensuring a high degree of sustainability and a low risk of ecosystem failure occurring. A low REMC would ensure marginal sustainability, but with a higher risk of ecosystem failure. The REMC is based on the results obtained from assessing the ecosystem or watercourse in terms of EIS, PES and function. The ideal would be that with realistic recommendations and mitigating actions, to return the system to a certain level of functionality and original state. The determination of the Environmental Importance and Sensitivity (EIS) of the identified watercourses in the study area are shown below (Table 17).

Table 16: EIS Categories and Descriptions

EIS Categories	Median Range	Category
Wetlands that are considered ecologically important and sensitive on a **national or international** level. The biodiversity of these wetlands is usually very sensitive to flow & habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	Very high 3 - 4	A
Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	High 2 - 3	B
Wetland that are considered to be ecologically important and sensitive on a **provincial or local** scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	Moderate 1 - 2	C
Wetlands that are not ecologically important and sensitive on any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	Low 0 - 1	D

5.12 EIS of watercourses in the study area

The EIS values of the watercourses were determined using the above methodology. The calculations and categories are shown below (Table 17).

Table 17: EIS and EMC values of watercourses

Determinant	Assegaai River	Unnamed streams	Drainage lines	Wetlands	Confi-dence
PRIMARY DETERMINANTS					
1. Rare & Endangered Species	3	1,5	1	1,5	4
2. Populations of Unique Species	2	1	1	1	4
3. Species/taxon Richness	2	1,5	1	1,5	4
4. Diversity of Habitat Types or Features	2	1	1	1	4
5 Migration route/breeding and feeding site for wetland species	3	1	1	1	3
6. Sensitivity to Changes in the Natural Hydrological Regime	3	2	1	2	3
7. Sensitivity to Water Quality Changes	3	1	1	1	3
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	3	2	1	2	3
MODIFYING DETERMINANTS					
9. Protected Status	1	1	1	1	4
10. Ecological Integrity	3	2	1	2	4
TOTAL	25	14	10	14	-
AVERAGE	2,5	1,4	1,0	1,4	-
Overall EIS	**B**	**C**	**D**	**C**	**-**
Description	**High**	**Moderate**	**Low**	**Moderate**	**-**

5.13 Drivers of ecological change on the watercourses

The main drivers of ecological change on the watercourses and water ecosystems in the study area are:

- Afforestation;
- Impoundment by means of in-channel farm dams; and
- Over-utilisation of natural resources.

Although roads do have an impact on watercourses, especially in terms of impeding waterflow, their impact in the study area is not a major driver of ecological change at all. The most significant driver, probably more than all the others combined is afforestation, which is having a massive negative impact on the water environment of the study area.

6 SENSITIVITY ASSESSMENT

The sensitivity assessment identifies those areas and habitats within the study site that have a high conservation value and that may be sensitive to disturbance. All watercourses, including seasonal streams and drainage lines are always deemed to be sensitive, even if they are badly degraded. Areas or habitats have a higher conservation value (or sensitivity) based on their threatened ecosystem status, ideal habitat for priority species (including Red Data species), species-richness, distinctive habitats, etc.

The natural environment within the study area is uniform and consists of only two natural habitats, namely grassland and watercourses. The watercourses are similar to one another in nature. Most of the natural habitat along the route of the study area has been totally transformed due to cultivation and mining. Such areas are not viewed as sensitive at all. Pristine grassland areas would be viewed in this area as sensitive, but none occur. The floral and faunal sensitivity analyses are shown in the tables below (Table 18 & Table 19).

6.1 Floristic Sensitivity Analysis

Table 18: Floristic sensitivity analysis

Criteria	Distinctive habitats in the study area		
	Grassland	Plantations	Watercourses
Red Data Species	2	1	5
Habitat Sensitivity	2	1	7
Floristic Status	3	1	7
Floristic Diversity	3	1	6
Ecological Fragmentation	5	1	8
Sensitivity Index	30%	10%	66%
Sensitivity Level	Medium/Low	Low	Medium/High
Development Go Ahead	Go-Slow	Go	Go-But

6.2 Faunal Sensitivity Analysis

Table 19: Faunal sensitivity analysis

Criteria	Distinctive habitats in the study area		
	Grassland	Plantations	Watercourses
Red Data Species	2	4	5
Habitat Sensitivity	2	1	7
Faunal Status	3	1	7
Faunal Diversity	3	1	7
Ecological Fragmentation	5	1	8
Sensitivity Index	30%	16%	68%
Sensitivity Level	Medium/Low	Low	Medium/High
Development Go Ahead	Go-Slow	Go	Go-But

6.3 Ecological Sensitivity Analysis

The ecological sensitivity of the study area is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit, whether it is floristic or faunal in nature (Table 20).

Table 20: Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity	Development Go-ahead
Grassland	Medium/Low	Medium/Low	Medium/Low	Go-Slow
Plantations	Low	Low	Low	Go
Watercourses	Medium/High	Medium/High	Medium/High	Go-But

According to the analyses there are no high sensitivity areas or habitats. However, all watercourses, by default, must be viewed and approached as sensitive.

6.4 Screening Tool Desktop Assessment

The Department of Forestry, Fisheries and the Environment (DFFE) (Previously DEFF and DEA) has development a desktop screening tool that is to be used as a **guideline** in an initial desktop screening (assessment) of a project site (www.screening.environment.gov.za). The screening tool incorporates most datasets produced by DWS, DFFE, SANBI and Provincial Conservation Plans. However, it is

important to keep in mind that the screening tool is a broad, desktop guideline that needs to be verified during site investigations (ground truthing). Depending on the levels of sensitivity shown in the screening assessment certain criteria in terms of assessments, studies, etc. can be required by relevant authorities. According to the screening tool (accessed August 2021) the various sensitivities for the study site and immediate surroundings are as follows:

- Terrestrial biodiversity theme: Very High Sensitivity.
- Aquatic biodiversity theme: Low (northern section) & Very High (southern section) Sensitivity.
- Plant species theme: Mix of Low & Medium Sensitivity.
- Animal species theme: Mix of Medium & High Sensitivity.

During site investigations the accuracy of the DEA Screening Tool was verified (ground-truthed). The demarcations of all of the Themes are inaccurate, broad, basic and outdated. For example, many areas shown as having high aquatic sensitivities have no actual aquatic ecosystems within them. Furthermore, large areas shown as having very high biodiversity sensitivities are totally transformed areas consisting of active and historical agricultural lands and alien tree plantations (afforestation).
Finally, it is important to stress that the project involves the upgrade of an existing hard-surfaced road and related infrastructure. Therefore, the main project and related activities will only take place within a transformed, highly degraded, 'Low' sensitivity environment.

6.5 Priority areas

The study area does not fall within any priority areas, except those of NFEPA wetlands and streams. Priority areas include formal and informal protected areas (nature reserves); important bird areas (IBAs); RAMSAR sites; National fresh water ecosystem priority areas (NFEPA) and National protected areas expansion strategy (NPAES) areas (Figure 31).

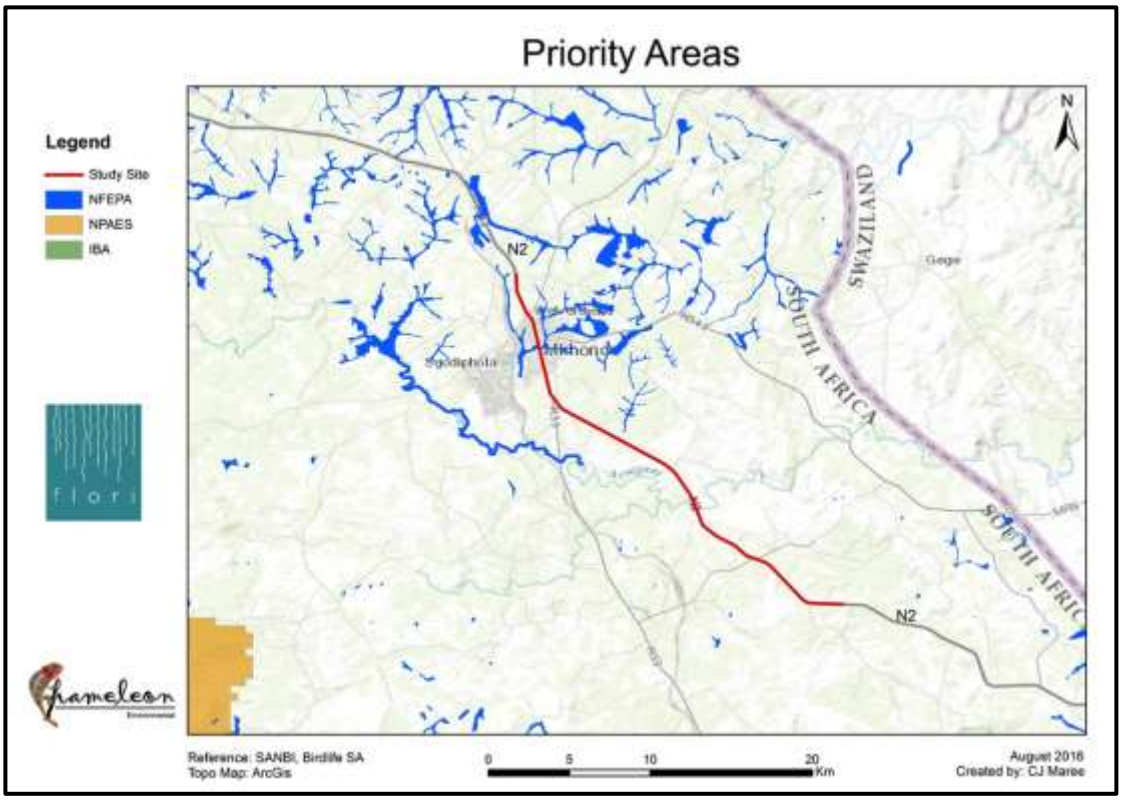


Figure 31: Priority areas

6.6 Mpumalanga Biodiversity Sector Plan

The Mpumalanga Biodiversity Sector Plan (MBSP, 2014) was developed by updating and revising the earlier Mpumalanga Biodiversity Conservation Plan (MBCP, 2006). The revised MBSP 2014 plan incorporates significant technical improvements, including more recent landcover data and better biodiversity data. It is important to note that the MBSP (2014) replaces the earlier MBCP (2006) and should be used as the official reference for biodiversity priority areas to be taken into account in land-use planning and decision-making in the Mpumalanga Province (MBSP, 2014).

Figure 32 highlights the extent of the Critical Biodiversity Areas (CBA) that the study area potentially impacts on, or is situated within. Table 21, as taken directly from the MBSP (2014) handbook, gives descriptions of the different categories used in the MBSP map in Figure 32.

The study area is a long, narrow, linear study area of 33,4km, but only about 150m wide. The study area passes through a few CBA Irreplaceable areas (Figure 32). These areas are grassland and watercourses that have been threatened almost exclusively by transformation of the natural environments by afforestation. The

proposed upgrade of the N2 National Route in this area will have little to no additional negative impact on these threatened environments. Although CBAs are very important in terms of guiding development and protecting the environment, they are not necessary fatal flaws or 'No-Go' Areas.

Table 21: Description of categories for the MBSP (2014) maps

MAP CATEGORY	DESCRIPTION	SUB-CATEGORY	DESCRIPTION
Protected Areas	Areas that are formally protected by law and recognised 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 Reserve, 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 (CBA)	All areas required to meet biodiversity pattern and process targets; Critically Endangered ecosystems, critical linkages (corridor pinch-points) to maintain connectivity; CBAs are areas of high biodiversity value that must be maintained in a natural state.	CBA: Irreplaceable	This category includes: (1) Areas required to meet targets and with irreplaceability 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.
Ecological Support Areas (ESA)	Areas that are not essential for meeting targets, but that play an important role in supporting the functioning of CBAs and that deliver important ecosystem services	ESA: Landscape Corridor	The best option to support landscape-scale ecological processes, especially allowing for adaptation to the impacts of climate change.
		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 distance varies according to reserve status: National Parks — 10 km; Nature Reserves — 5 km buffer; Protected Environments — 1 km buffer.
Other Natural Areas (ONA)	Areas that have not been identified as a priority in the current systematic biodiversity plan 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 may still play a role in supporting biodiversity and providing ecosystem services.

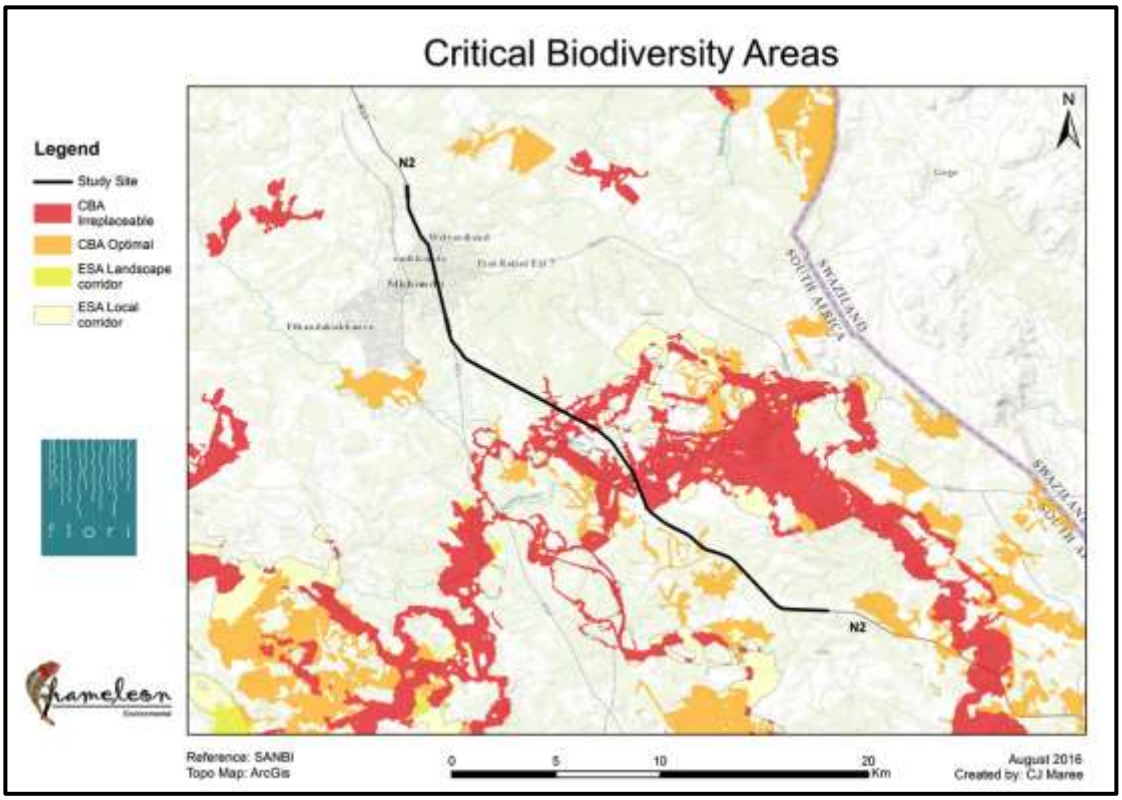


Figure 32: CBAs

6.7 Sensitive areas identified during field investigations

The majority of the route of the study area is within highly modified or totally transformed natural environments, primarily by afforestation. There are no pristine grassland areas within the study area. Even the watercourses are highly encroach upon and modified by plantations to a point of being illegal.

There are a few sensitive areas within the study area, which are all watercourses. The sensitive watercourses (areas) include the Assegaai River, a few small streams and wetlands. Wetlands include seepage wetlands and valley-bottom wetlands. These watercourses, eventhough highly impacted on, need to (by default) be approached as sensitive. Fortunately the nature of the project is such that most of the construction work is on the existing tarred road itself and within the existing road reserve. So there will be little to no increased, or measurable, negative impact on existing sensitive areas or natural grassland areas. The sensitivity areas of the study area are shown in the figures below (Figure 33 to Figure 35). The study area is determined and calculated to have a rating of Low sensitivity. The water crossings are not sensitive in reality, but as all watercourses are, by default, approached as sensitive as shown in the sensitivity map as having a rating of High sensitivity.

Figure 33: Sensitivity Map: Southern section of study area

Figure 34: Sensitivity map: Middle section of study area

Figure 35: Sensitivity map: Northern section of study area

The entire study area is low sensitivity, except the water crossings. Only the watercourses are high sensitivity. The water crossings will not be negatively impacted on by the proposed upgrades. In fact, there will be a certain amount of positive impacts on the watercourses as culverts, drains and bridges will be cleared and unblocked of present debris, rubbish, etc. creating improved waterflow and general river function.

There are no areas of Medium sensitivity.

7 THE GO, NO-GO OPTION

7.1 Classification criteria

The term ‘fatal flaw’ is used in the pre-application planning and screening phases of a project to evaluate whether or not an impact would have a ‘no-go’ implication for the project. In the scoping and impact assessment stages, this term is not used. Rather impacts are described in terms of their potential significance.

A potential fatal flaw (or flaws) from a biodiversity perspective is seen as an impact that could have a "no-go" implication for the project. A ‘no-go’ situation could arise if residual negative impacts (i.e. those impacts that still remain after implementation of all practical mitigatory procedures/actions) associated with the proposed project were to:

a) Conflict with international conventions, treaties or protocols (e.g. irreversible impact on a World Heritage Site or Ramsar Site);

b) Conflict with relevant laws (e.g. clearly inconsistent with NEMA principles, or regulations in terms of the Biodiversity Act, etc.);

c) Make it impossible to meet national or regional biodiversity conservation objectives or targets in terms of the National Biodiversity Strategy and Action Plan (BSAP) or other relevant plans and strategies (e.g. transformation of a ‘critically endangered’ ecosystem);

d) Lead to loss of areas protected for biodiversity conservation;

e) Lead to the loss of fixed, or the sole option for flexible, national or regional corridors for persistence of ecological or evolutionary processes;

f) Result in loss of ecosystem services that would have a significant negative effect on lives (e.g. loss of a wetland on which local communities rely for water);

g) Exceed legislated standards (e.g. water quality), resulting in the necessary licences/approvals not being issued by the authorities (eg. WULA);

h) Be considered by the majority of key stakeholders to be unacceptable in terms of biodiversity value or cultural ecosystem services.

7.2 Potential Fatal Flaws for the Project

There are no fatal flaws and the project may go ahead. There are no ‘No-Go’ areas within the study site. However, mitigating measures need to be implemented and care must be taken specifically in the areas of watercourse crossings.

8 IMPACT ASSESSMENT

8.1 Impact Assessment

The impacts of the activities related to the proposed project were rated. There are existing and potential impacts and mitigating measures are recommended to help reduce the sum of any potentially new (additional) impacts that might arise from the project. The rated impacts of the proposed project before and after the implementation of mitigating measures are shown in the table below (Table 22).

Table 23, below, shows the level of some general impacts potentially arising from the proposed project.

Table 22: Impact assessment

N2 NATIONAL ROUTE FOR N2 SECTION 33 & 34 (SECTION D)		
SECTION D (N2-33: KM 34,0 to KM 63,3)		
GRASSLAND		
Impact Rating	**Mitigating Measures**	**Sensitivity**
Before Mitigation: Medium Total = 9 Extent: (Local) 2 Duration: (Short-term) 1 Intensity: (High) 3 Probability: (Highly probable) 3 With Mitigation: Low Total = 7 Extent: (Site) 1 Duration: (Short-term) 1 Intensity: (Moderate) 2 Probability: (Highly probable) 3	**Construction Phase** All temporary facilities (i.e. storage, accommodation, portable toilets, etc.) to be setup in existing built-up areas or disturbed areas only. No temporary facilities to be setup within 100m of any watercourses, including wetlands. Ensure small footprint during construction phase. Use existing roads and road reserve for haul vehicles, contract vehicles, etc. If possible no new access roads to be constructed. Dust suppression along gravel roads to be implemented. Erosion to be continually monitored and rectified during construction phase, not only after construction. All excess materials brought onto site for construction to be removed after construction. No open trenches or mounds of soils to be left. Rehabilitation plan for disturbed areas to be compiled and implemented. Re-seeding of bare areas with local indigenous grasses to be part of the rehabilitation plan. No exotic species to be used for rehabilitation. No open fires allowed at all during the construction phase by contractors. The study area is within and surrounded by plantations, which are extremely susceptible to large, run-away fires. **Operation Phase & Maintenance Phase** Erosion plan to be compiled and implemented. Stormwater management plan to be compiled and implemented.	LOW

WATERCOURSES		
Impact Rating	**Mitigating Measures**	**Sensitivity**
Before Mitigation: Medium Extent: Local: 2 Duration: Long-term: 3 Intensity: Moderate: 2 Probability: Highly probable: 2 Total: 9 After Mitigation: Low Extent: Site: 1 Duration: Long-term: 1 Intensity: Moderate: 2 Probability: Possible: 2 Total: 6	**Construction Phase** All temporary facilities (i.e. storage, accommodation, portable toilets, etc.) to be setup in existing built-up areas or disturbed areas only. No temporary facilities to be setup within 100m of any watercourses, including wetlands. Ensure small footprint during construction phase. Erosion around bridges and stormwater culverts to be monitored continually during the construction phase and rectified continually (if occurring directly as a result of the construction activities). Erosion control not to be left until after construction only. Avoid and minimise the unnecessary removal of any indigenous vegetation. Full rehabilitation plans for water crossings, including stream banks, to be compiled and implemented. **Operation Phase & Maintenance Phase** Erosion plan to be compiled and implemented. Stormwater management plan to be compiled and implemented.	MEDIUM
CULTIVATED LANDS AND PLANTATIONS		
Impact Rating	**Mitigating Measures**	**Sensitivity**
Before Mitigation: Medium Extent: Local: 2 Duration: Medium-term: 2 Intensity: Moderate: 2 Probability: Highly probable: 3 Total: 9 After Mitigation: Low Extent: Site: 1 Duration: Medium-term: 2 Intensity: Low: 1 Probability: Possible: 2 Total: 6	**Construction Phase** Access roads to and through farmlands / plantations to be limited and controlled. No movement of heavy vehicles through farmlands / plantations directly after rains to limit damage to lands and farm roads. All farm roads and plantation roads used by contractors during construction to be rehabilitated. Erosion along farm roads and plantation roads to be continually monitored and repaired. Especially after rain downpours. Ensure small footprint during construction phase. Dust suppression along gravel roads to be implemented. Erosion plan to be implemented and monitored. Any farm roads / private roads / plantation roads used during construction to be rehabilitated after construction. Any fences, gates, etc. damaged during construction to be repaired. **Operation Phase & Maintenance Phase** N/a	LOW

Table 23: General impacts of the project in the study area

Issue	Significance rating before and after mitigation	
	Before	After
Farming Related & Other Issues		
Access to properties	Medium	Low
Access roads (damage, blocking)	Medium	Low
Loss of agricultural potential	Low	Low
Loss of cultivation potential	Low	Low
Loss of grazing potential	Low	Low
Impact on airstrips	Low	Low
Impacts on seasonal activities	Low	Low
Natural Environment		
Erosion	Low	Low
Impact on flora	Low	Low
Impact on fauna	Low	Low
Impact on wetlands	Medium	Low
Impact on watercourses	Medium	Low
Importation of alien vegetation	Low	Low
Impact of herbicides	Low	Low
Impact on conservation areas	Low	Low

8.2 Levels of Acceptable Changes

The cumulative negative impacts will most likely remain neutral. Small negative impacts will be corrected (rehabilitated) and off set with the positive impacts of upgrading culverts, bridges and road surfaces along with improved and upgraded stormwater management systems and existing erosion along road surface edges. Therefore, the levels of change (increase in negative cumulative impacts) arising from the activities of the proposed project are at acceptably low levels for the area and for the project to proceed and not create or result in any related 'fatal flaws'.

9 MITIGATION OF IMPACTS

The following general mitigating measures are recommended to help reduce the potential negative impacts of the project on the natural environment. The mitigating measures as laid out in the Impact Assessment (Chapter 10) also need to be implemented and many are similar or the same as those highlighted below. The implementation of all recommended mitigating measures are necessary if the conclusions and assessments of the report are to remain pertinent.

9.1 Construction & Operation Phase

- No temporary accommodation or temporary storage facilities may be setup within 100m of the any river, stream, drainage line, wetland or farm dam.
- No temporary facilities (including portable toilets) to be positioned within a 50m bufferzone of the edge of any watercourses.
- Only existing roads to be used by vehicles during construction as far as possible. Especially in terms of crossing over watercourses.
- No vehicles may drive through wetland areas and no new service road may be made through wetland areas.
- Upgrade activities close to watercourses to be carefully monitored in terms of erosion and possible resulting siltation of watercourses. Weekly inspection of work areas around watercourses to be conducted. Any signs of new erosion and siltation to be rectified immediately.
- Disturbed surface areas in the construction phase to be rehabilitated. No open trenches to be left. No mounds of soils created during construction to be left.
- All construction material, equipment and any foreign objects brought into the area by contractors to be removed immediately after completion of the construction phase.
- Proper rubbish/waste bins to be provided. These to be emptied weekly and the waste to be removed to an official waste disposal site.

9.2 Maintenance phase (to be implemented in defect liability period for 1 year)

- Mechanical control of alien plants around disturbed areas caused by construction need to be implemented within three months of completion of construction. Thereafter every six months. Mechanical control to be of such a nature as to allow local, indigenous grasses and other pioneers to colonise the previously disturbed areas, thereby assisting in keeping out invasive weed species.
- No chemical control (herbicides) of alien plants to be used within 100m of any watercourses.
- Areas around foundations, culverts, gabions, etc. need to be check before and after the summer rainy season for signs of soil erosion due to stormwater run-off. Such sites need to be modified and rehabilitated to prevent ongoing erosion. These sites need to be monitored more closely than other sites which show no or minimal signs of erosion.
- Inspection of road shoulders in areas of steep topography to be inspected after the summer rainy season for signs of erosion and rehabilitated and rectified as required.

10 CONCLUSIONS AND RECOMMENDATIONS

The following are the conclusions of the study, along with recommendations.

10.1 Conclusions

- The study site is situated within the original extent of Paulpietersburg Moist Grassland and KaNgwane Montane Grassland, within the Grassland Biome.
- Both veldtypes (ecosystems) are threatened with a status of 'Vulnerable'.
- Almost the entire study area is transformed or highly degraded, with the main impact that of afforestation. There are no areas of pristine grassland or habitats in the study site.
- During field investigations no Red Data Listed (RDL) plants were observed in the study site. None are expected to occur.
- Priority Species (Species of conservation concern): *Boophone disticha. Eucomis montana, Hypoxis rigidula.* Other possible priority species occurring

the in study area although not observed during field investigations include: *Moraea pubiflora*, *Watsonia latifolia*, *Zantedeschia albomaculata* subsp. *macrocarpa*. *Aloe integra* and *Aloe kniphofioides*

- There are no 'high' sensitive habitats present on site, with the exception of the watercourse crossings. The main (and only large) watercourse crossing is the Assegaai River, which is a perennial small river south of Piet Retief.
- No red data listed (RDL) faunal species were observed to be present and / or breeding with the study area boundaries. It is also highly unlikely that any are or will be present, with the small chance along the main rivers only.
- Site investigations were conducted during the summer and winter months and the findings and availability of field data are sufficient to achieve acceptable findings and outcomes from the assessment.
- Due to the nature of the project (upgrade of an existing road) no further specialist environmental studies are required or recommended.
- There are no obvious fatal flaws in terms of the project on the natural environment.
- Impacts on the existing natural environment related to the project are '**LOW**'
- The levels of change (increase in negative cumulative impacts) arising from the activities of the proposed project are at acceptably low levels for the area and for the project to proceed and not create any related 'fatal flaws'.
- A General Authorisation (GA) process for work on watercourse crossings will be required.
- Taking all findings and recommendations into account the following are the reasonable opinions of the specialist, namely:
    - That the entire project, along with related construction activities, should be authorised. The project and related activities may proceed to the next phase.
    - The levels of impact and change to the natural environment along and within the study area are low to minimal. In fact, the upgrades of the road, along with storm water culverts and watercourse crossings, will have numerous positive impacts, such as preventing the impeding and impounding of water flow, siltation, and erosion. In other words, the levels of change are well within any acceptable means and expected outcomes. There is no need to drastically alter any project plans or cease / prevent any portion or area of the project from taking place.

- The entire project should be authorised. However, all recommended mitigating measures put forward in this report, as well as other specialist reports and legal requirements should be included in the EMPr and must be implemented.

10.2 Recommendations

- Recommended mitigating measures as proposed in this study and report must be implemented. These include, but not limited to:
  - The footprint of the project is small in relation to the area and mostly within an already disturbed and altered environment.
  - One main river will be crossed (Assegaai), along with a few small seasonal drainage lines. The long-term impact of the upgrade of the actual watercourse crossings (including storm water culverts) is a positive impact, because it will improve water flow, remove blockages (including within old storm water culverts), stabilise stream banks, reduce existing erosion of stream banks and riparian areas.
  - Minimal riparian vegetation will be lost (need to be removed) as the project involves the upgrade of crossings and not new crossings. The upgrade will also not include the need to remove trees and other riparian vegetation.
  - Any temporary storage, lay-down areas or accommodation facilities to be setup in existing built-up areas or disturbed areas. No temporary storage areas, laydown areas or site offices are allowed within a **100m** of the edge of any river, stream or distinctive drainage line. That is, a **100m buffer zone** (no-go zone) for these sites are required along all watercourses (rivers, streams, drainage lines).
  - Maintain small footprint during construction phase, where possible stay within the road reserve of the N2 National Road.
  - An Erosion Plan to be implemented and monitored during the construction phase, especially in the area of watercourses and steep gradients along escarpment edges. The erosion potential is moderate to low. This also to further reduce the potential of siltation of small watercourses. The plan need only be basic, but needs to be monitored.
  - All hazardous materials must be stored appropriately to prevent these contaminants from entering the water environment;

  - All excess materials brought onto site for construction to be removed after construction and their removal seen as part of the construction phase.
  - No open trenches or mounds of soils to be left.
  - Rehabilitation plan for disturbed areas to be compiled and implemented as part of the construction phase.
- The most important recommendations arising from the study is the need for 100m buffer zones around watercourses in which no temporary laydown areas, site offices or campsites may be set up. The obvious exception is the actual project related work carried out within these areas such as upgrading of existing crossings, culverts, etc.
- An independent ECO is recommended to monitor operations and ensure that recommended mitigating measures, including buffer zones, are implemented and adhered to.

11 APPENDICES

11.1 Risk Matrix

Risk matrix [attached as a separate excel spreadsheet]

All impacts, with the implementation of mitigating measures have a risk rating of LOW. There are no MODERATE or HIGH risk ratings for the project.

The upgrade of water crossing should qualify for a General Authorisation (GA) process.

11.2 List of floral species identified on site

Trees

Acacia caffra, Acacia karroo, Acacia mearnsii, Eucalyptus spp.*, Melia azedarach, Pinus pinaster*, Populus x canescens**

* = Alien species.

Shrubs & Herbaceous plants

Acalypha peduncularis, Alepidea setifera, Argyrolobium speciosum, Aster harveyanus, Berkheya radula, Berkheya setifera, Boophone disticha, *Centella asiatica, Chascanum latifolium, Cheilanthes hirta, Crinum bulbispermum, Diospyros lycioides* subsp. *lycioides, Eucomis montana, Euryops laxus, Haemanthus humilis, Haplocarpha scaposa, Helichrysum adenocarpum, Helichrysum cephaloideum, Helichrysum nudifolium Helichrysum rugulosum*, *Hypoxis rigidula, Ipomoea oblongata, Leucosidea sericea, Oxalis corniculata*, Parinari capensis*, Searesia (=*Rhus*) *magalismontanum*, *Senecio coronatus*. *Senecio panduriformis, Vernonia natalensis, Veronia oligocephala.*

Grasses

Alloteropsis semialata, Andropogon schirensis, Aristida aequiglumis, Aristida congesta, *Aristida junciformis*, *Brachiaria serrata*, *Cynodon dactylon*, *Digitaria monodactyla*, *Diheteropogon amplectens*, *Diheteropogon filifolius*, *Elionurus muticus*, *Eragrostis chloromelas*, *Eragrostis curvula*, *Eragrostis plana*, *Eragrostis racemosa*, *Eragrostis sclerantha*, *Heteropogon contortus*, *Loudetia simplex*, *Microchloa caffra*, *Monocymbium ceresiiforme*, *Panicum natalense, Pennisetum thunbergii, Rendlia altera*, *Setaria sphacelata*, *Sporobolus africanus*, *Sporobolus pectinatus*, *Themeda triandra*, *Trachypogon spicatus*, *Tristachya leucothrix*, *Tristachya rehmannii.*

Aquatic species

Aponogeton junceus, *Ceratophyllum demersum*, *Cyperus congestus, Cyperus cyperoides, Cyperus obtusiflorus*, *Lagarosiphon major*, *Phragmites australis, Marsilea capensis, Schoenoplectus corymbosus, Typha capensis*

Red Data species present

None.

Priority Species (Species of conservation concern)

Boophone disticha. Eucomis montana, Hypoxis rigidula.

Other possible priority species occurring the in study area although not observed during field investigations include:

Moraea pubiflora, *Watsonia latifolia*, *Zantedeschia albomaculata* subsp. *macrocarpa*. *Aloe integra* and *Aloe kniphofioides*

11.3 Grass Seed Mixes for Rehabilitation

The information below is a guideline and may need to be adjusted slightly depending on the availability of seed species and volumes. No alien plant species should be used for rehabilitation purposes, including grasses. Tef (*Eragrostis tef*) is often used for roadside rehabilitation, but it is not indigenous to the Mpumalanga Province or South Africa for that matter. All the grass species below are indigenous to the study area and establish and grow well in disturbed areas.

Table 24: Summer grass mix and application rate

Grass Species	Common Name	Application Rate
Eragrostis curvula	Weeping love grass	8 kg / ha
Setaria sphacelata var. *torta*	Creeping bristle grass	8 kg / ha
Cynodon dactylon	Couch grass	4 kg / ha
Aristida congesta	Spreading three-awn grass	7 kg / ha
Total	**-**	**27 kg / ha**

Table 25: Winter grass mix and application rate

Grass Species	Common Name	Application Rate
Eragrostis curvula	Weeping love grass	10 kg / ha
Aristida congesta	Spreading three-awn grass	10 kg / ha

Cynodon dactylon	Couch grass	10 kg / ha
Total	**-**	**30 kg / ha**

The contractor may determine the type of fertiliser or soil-improvement material to be added. The fertiliser may be applied in liquid form during seeding, or as a granular preplant fertiliser prior to planting during soil preparation. Fertilisers should ideally have a higher percentage of Nitrogen (N) and Phosphorus (P) than that of Potassium (K). No micro-elements or foliar feeds should be necessary.

11.4 Photographs

Photo 1: Study area showing the typical burnt grass areas along the road reserves and extensive plantations, which totally transform the natural environment

Photo 2: Assegaai River, which is the largest watercourse encountered. Notice the extensive plantations that encroch on the watercourse

Photo 3: Assegaai River, downstream. The trees along the riparian zone are all alien invasive blackwattle (*Acacia meaernsii*)

Photo 4: The study area and adjacent areas showing routine burning to create firebreaks as well as indiscriminate burning by locals. Photo taken July 2016

Photo 5: N2 National Route (Study area) looking north highlighting afforestation in the area and region. Open grassland area is moist grassland and wetland areas.

Photo 6: Veldfires in study area encountered during July 2016 field investigations. These annual fires change the plant and animal community makeup of the area

Photo 7: Wetland / moist grassland areas that are usually left open between the blocks of plantations.

Photo 8: N2 National Route (Study Area) running through the town of Piet Retief

Photo 9: Small stream and manmade dam on the southern edge of Piet Retief

Photo 10: Markers showing KM 63,4, which is the northern end of Section D. Notice the invasive pine trees in the background

11.5 Conditions for inclusion in the Environmental Authorisation (EA)

The mitigation measures in the report are to be included in the EMPr for the project that will be approved together with the BAR. The EMPr for the project must therefore be strictly implemented by the applicant. There are no additional or special conditions required.

11.6 Monitoring requirements

Environmental monitoring by an independent ECO, as required by law, industry standards, etc. should take place. Part of the monitoring must include the mitigating measures as per this report as well as the conditions of the EMPr.

Special attention must be given to watercourse crossings. Upstream and downstream monitoring, over a minimum distance of 100m each way, must be conducted.

11.7 Short CV of Specialist

Name: Johannes Oren Maree

QUALIFICATIONS

2000 MBA, Oxford Brookes University (England)

1998 Diploma in Small Business Management (Damelin College)

1988 MSc (Rand Afrikaans University)
1987 BSc (Hons.) (Rand Afrikaans University)
1986 BSc (Rand Afrikaans University)

FURTHER TRAINING AND DEVELOPMENT

- Diploma in Public Speaking & Communications Ambassador College (USA)
- SAQA Accreditation and Qualifications in Training, Assessing & Service Provision (AgriSeta)
- SASS 5 Training Course

PUBLICATIONS

- Co-Authored Book: Cut Flowers of the World. 2010. Briza, Pretoria.
- Co-Authored Book: Cut Flowers of the World, 2ed. 2020. Briza, Pretoria.
- 100s of articles for popular magazines such as Farmer's Weekly & SA Landscape

PROFESSIONAL MEMBERSHIPS

- SA Council of Natural Scientific Professions (SACNASP)
  - Reg. No. 400077/91
- South African Wetland Society
  - Reg. No: 998061
- Society of Wetland Scientists

PROFESSIONAL CAREER

Position: **Director / Owner**
Employer: Flori Scientific Services
Period: 2000 to current
Scope of Work Done:

- Conduct specialist studies and reasearch for EIA projects.
- Specialist studies and consultancy includes
- Ecological studies
- Aquatic and Wetland assessments
- Avifaunal impact assessments
- Risk Matrices for water use licences
- Specialist Environmental Consultant
- Environmental Control Officer (ECO) work
- Specialist work involves field investigations and report writing.

Position: **Technical Manager**
Employer: Sunbird Flowers (Pty) Ltd
Period: 1997 - 2000
Scope of Work Done:

- Consulted on and managed projects in the agricultural & floricultural industries.
- Managed existing and new projects.
- Involved in all aspects of project management from managing, planning; costing; marketing; budgeting, technical and training.
- Assisted emerging rural farmers in most aspects of agriculture

(i.e. Cut flower and vegetable production) including setting up of business plans, marketing, training and costings.

- Conducted "turn-key" projects in most agriculture related fields. This included – Tunnel and greenhouse production; Hydroponics; vegetables, cut flowers; field crops.

12 REFERENCES

- Acocks, J.P.H. 1988. 3rd ed. Veld types of South Africa. Memoirs of the Botanical Survey of South Africa 57: 1-146.
- Branch, B. 1998. Field Guide to Snakes and other Reptiles of Southern Africa. 3d ed. Struik, Cape Town.
- Bromilow, C. 2010. Problem plants and alien weeds of South Africa. Briza, Pretoria.
- Carruthers, V. 2001. Frogs and Frogging in Southern Africa. Struik, Cape Town.
- Gerber, A., Cilliers, CJ., van Ginkel, C. & Glen, R. 2004. Easy identification of Aquatic plants. Dept. of Water Affairs, Pretoria.
- Low, A.B. & G. Rebelo (eds). 1998. Vegetation of South Africa, Lesotho and Swaziland. Dept. Environmental Affairs and Tourism, Pretoria.
- Manning, J. 2009. Field Guide to Wild Flowers of South Africa. Struik, Cape Town.
- Mpumalanga Biodiversity. Sector Plan Handbook (MBSP). 2014. Compiled by Lötter M.c., cadman, M.J. and Lechmere-Oertel R.G. Mpumalanga Tourism & Parks Agency, Mbombela (nelspruit).
- Mucina, L. & M.C. Rutherford (eds). 2006. The vegetation of South Africa, Lesotho and Swaziland. SANBI, Pretoria.
- Palgrave, K.C. 1983. Trees of Southern Africa. 2ed. Struik, Cape Town.
- Picker, M., Griffiths, C. & Weaving, A. 2004. Field guide to Insects of South Africa. Struik Nature, Cape Town.
- Raimondo D., L. von Staden, W. Fonden, JE Victor, NA. Helme, RC. Turner, DA. Kamundi, PA. Manyama (eds). 2009. Red List of South African Plants. Strelitzia 25. SANBI. Pretoria.
- SANBI. South African National Biodiversity website. www.sanbi.org.
- Schmidt, E., M. Lötter & W. McCleland. 2002. Trees and shrubs of Mpumalanga and Kruger National Park. Jacana, Johannesburg.
- South African National Biodiversity Institute (SANBI). Threatened ecosystems of South African Biomes. Draft 2009. www.sanbi.org or www.bgis.sanbi.org.
- Stuart, C. & T. Stuart. 2001. Field Guide to Mammals of Southern Africa. Struik, Cape Town.
- The Plants of Southern Africa (POSA) database. SANBI website. http://posa.sanbi.org or www.sanbi.org

- van Wyk, A-E. & S. Malan. 1988. Field guide to the wild flowers of the Witwatersrand and Pretoria region. Struik, Cape Town.
- van Wyk, E. & F. van Oudtshoorn. 2009. Guide to Grasses of Southern Africa. 2nd ed. Briza, Pretoria.
- Woodhall, S. 2005. Field Guide to Butterflies of South Africa. Struik, Cape Town.