MAGATLE FILLING STATION

& ASSOCIATED INFRASTRUCTURE

BIODIVERSITY ASSESSMENT

Ecological Impact Assessment and Wetland Impact Assessment for the Proposed Magatle Filling Station and associated infrastructure in Magatle Village, Limpopo Province

Compiled by

FLORI SCIENTIFIC SERVICES

MAY 2019

1 REPORT INFORMATION

PROJECT TITLE: Magatle Filling Station and Associated Infrastructure

STUDY NAME: Biodiversity Impact Assessment

COMPILED BY: Flori Scientifice Services cc

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REPORT STATUS: Final Draft

REPORT NUMBER: MG/FS_01

2 EXECUTIVE SUMMARY

Background

The project involves the proposed construction of a filling station in the Magatle Village along with associated infrastructure. The infrastructure also includes the possible later construction of a few rooms for overnight accommodation.

Lokisa Environmental Consulting cc was appointed as the lead Environmental Authorised Practitioner (EAP) to conduct and facilitate the EIA process. Flori Scientific Services cc was appointed as the independent consultancy to conduct a specialist biodiversity impact assessment, which includes a terrestrial ecological assessment and a wetland impact assessment of the study site.

Consultation was undertaken with the EAP and consulting engineers to the project.

Field investigations were undertaken on the 8 April 2019.

Location of the study area

The study site is situated within the village of Magatle in the Lepele-Nkumpi Local Municipality (LIM 355) of the Capricorn District Municipality, Limpopo Province. The study site is situated on the old show grounds of the village and is approximately 4,9 ha in area. The western boundary of the site is formed by the D3600, which is the main road that runs through Magatle Village.

TERRESTRIAL ECOLOGY

Vegetation

The vegetation of the study site is moderately to highly degraded and transformed thornveld (Springbokvlakte Thornveld). The site was previously used as the show grounds for Magatle Village and surrounding areas. Therefore, the area was cleared of most bushveld years ago and the grass regularly cut. During site investigations it appeared that the site has stood dormant for a while and some of the grasses, with a few short acacia thorn shrubs, have returned and grown. Most of the site is still cleared of bush and trees. There are a few trees growing on the site that were obviously left on purpose, mostly invasive gumtrees but some of which are protected trees species of Marula (*Sclerocarya birrea*) and Stink Shepherd's tree (*Boscia foetida*). The site is situated within the savanna biome of South Africa.

Priority species

During field investigations no Red Data Listed (RDL) species were observed and none are expected to occur. Two protected trees are present on site, namely marula and stink shepherd's tree.

AQUATIC ECOLOGY

Watercourses in the study area

There are no watercourses in the study area, including distinctive drainage lines, wetlands and freshwater pans (which is a type of wetland). The closest main river is the Nkumpi River, which is approximately 120 m to 200 m east of the study site.

Drainage regions

A summary of the drainage areas and other catchment related information in which the study area is situated is shown in Table 1 below.

Table 1: Drainage areas and catchment areas of the study site

Level	Category
Primary Drainage Area (PDA)	B
Quaternary Drainage Area (QDA)	B51G
Water Management Area (WMA) – Previous / Old	Olifants
Water Management Area (WMA) – New (as of Sept. 2016)	Olifants (WMA 2)
Sub Water Management Area	Middle Olifants
Catchment Management Agency (CMA)	Olifants (CMA 2)
Wetland Vegetation Ecoregion	Central Bushveld (Group 2)
Priority Quaternary Catchment	No
SWSA area	No
NFEPA Rivers in Study Area	No
NFEPA Wetlands in Study Area	No
Fish FEPA	No
Fish FSA	No
Fish Rehab	No
Fish Migratory Catchment	No
Fish Corridor (Mzeke River)	No

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 2).

Table 2: Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity	Development Go-ahead
Degraded Bushveld (Thornveld)	Medium / Low	Medium / Low	Medium / Low	Go-Slow

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.

Priority areas

National 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. The study site is not situated within any priority areas.

Critical Biodiversity Areas (CBAs)

The study area is situated within a critical biodiversity area (CBA). The CBA is delineated as an Optimal Area (CBA 2).

Fatal flaws

There are no fatal flaws and the project may proceed.

Sensitivity Map

No high sensitive areas or 'No-Go' zones were identified during field investigations. All information and data sets are taken into account when determining the sensitivity of the study site, including CBAs, ESAs, priority areas, ideal habitats for priority species (fauna and flora), watercourses, ridges, koppies (rocky outcrops), presence of RDL and ODL species, threat status of the veldtype in which the study site is situated, and the present levels of development, degradation found on site.

According to datasets the delineation of the study area within a CBA has been taken into consideration. But it also needs to be kept in mind that the actual site is mostly degraded and transformed due to the fact that it was historically used as a show grounds for the region. The resulting sensitivity map is shown below (Figure 1).

Figure 1: Sensitivity map

3 REVIEW & APPROVAL

Name	Title	Signature	Date
Johannes Maree	Ecologist & Author (Flori Scientific Services cc)		**27/05/2019**
Elaine Minnaar	Lead EAP (Lokisa Environmental Consulting cc)		

4 ACKNOWLEDGEMENTS

The authors would like to acknowledge and thank Lokisa Environmental Consulting cc and other roleplayers for their assistance with project information and queries related to the project.

Consultation was undertaken with the EAP and consulting engineers to the project.

5 EXPERTISE OF THE SPECIALIST

The expertise and experience of the specialist that conducted the investigations and compiled the report are as follows:

Name of Specialist: Johannes Oren Maree

Position: Ecologist and Wetland Specialist.

- 2 Masters degrees (MSc & MBA).
- Diplomas in both business and public speaking.
- SAQA accreditation and qualifications in training, assessing & service provision (AgriSeta).
- Registerd with the South African Council for Natural Scientific Professions (SACNASP) since 1991. Registration number: 400077/91.
- Member of the Gauteng Wetland Forum & SA Wetland Society.
- 21 years experience in technical and managerial positions.
- 18 years experience in project management and consultancy.
- 18 years experience in writing of articles, books, training material, training & presentations, proposals.
- 13 years direct experience in EIAs.
- Has conducted hundreds of field investigations and compiled hundreds of technical speciaist reports for EIAs, including ecological assessments (fauna & flora), wetland assessments and avifauna impact assessments.
- Specialist studies on both linear and modular projects.
- Types of projects involved in include power lines, roads, quarries, housing developments, industrial develoments, mines, farms and wind farms. That is, both linear and modular projects.

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6 ACRONYMS

CBA	Critical Biodiversity Areas
CMA	Catchment Management Agencies
DEA	Department of Environment Affairs
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)
IUCN	International Union for Conservation of Nature
MAP	Mean Annual Precipitation
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy
PES	Present Ecological State
PDA	Primary Drainage Area
QDA	Quaternary Drainage Area
QDS	Quarter Degree Square
REC	Recommended Ecological Category (or Class)
REMC	Recommended Ecological Management Category (or Class)
RVI	Riparian Vegetation Index
SANBI	South African National Biodiversity Institute
SWSA	Strategic Water areas of South Africa
WMA	Water Management Areas
WUL	Water Use Licence
WULA	Water Use Licence Application

7 BACKGROUND

7.1 Project overview

The project involves the proposed construction of a filling station in the Magatle Village along with associated infrastructure. The infrastructure also includes the possible later construction of a few rooms for overnight accommodation.

Lokisa Environmental Consulting cc was appointed as the lead Environmental Authorised Practitioner (EAP) to conduct and facilitate the EIA process. Flori Scientific Services cc was appointed as the independent consultancy to conduct a specialist biodiversity impact assessment, which includes a terrestrial ecological assessment and a wetland impact assessment of the study site.

Consultation was undertaken with the EAP and consulting engineers to the project. Field investigations were undertaken on the 8 April 2019.

7.2 Purpose of the Study

The project involves the proposed construction of a filling station and associated infrastructure. The purpose of the study is therefore to determine if any terrestrial or aquatic sensitive habitats or red data listed (RDL) fauna and flora species are present. If so, to highlight and assess the potential impacts the project might have on these environments or species and to recommend mitigating measures where and if necessary. The study is also necessary to determine if there are any potential fatal flaws arising from the proposed project. The focus of the study is the natural environment.

7.3 Quality and age of base data

The latest data sets were used for the report in terms of background information for veldtypes, ecosystems, threatened ecosystems, red data listed (RDL) fauna and flora species, priority areas (including protected areas, strategic expansion areas, wetlands, watercourses, etc. The data used is of high quality and was sourced from the same data sets that are nationally used and approved by all consultants and governmental organisations. These include the South African National Biodiversity Institute, which is the standard for all EIAs/ BAs and specialist studies and assessments conducted in South Africa.

The source, data and age of data includes the following:

- Threatened ecosystems: Latest datasets were obtained from the SANBI website (www.bgis.sanbi.org).
- RDL species: Red List of South Africa Plants (latest update) – (www.redlist.sanbi.org).
- Veldtypes and ecosystems: Mucina & Rutherford, 2006, 2010. Updated 2012.
- SANBI data sets – latest updated website data (www. bgis.sanbi.org).
- Plants of Southern Africa: 2012 - (www.posa.sanbi.org).
- Limpopo Conservation Plan (v2) (latest available version).

7.4 Assumptions and Limitations

The assumptions and limitations for the assessment are as follows:

- All information regarding the proposed project and related activities as provided by the Client are taken to be accurate;
- Field investigations were conducted on the 8 April 2019.
- The study site is small and only a single site visit was required to adequately assess the site and the natural environment. Much of the site is disturbed and transformed, which also aided shortened site investigations.
- Summer investigations are deemed to be sufficient for this project;
- Precise buffer zones, regulated zones or exact GPS positions cannot be made using generalised corridors or kml files on Google Earth. However, the buffer zones drawn are accurate to within 2-3m;
- Standard and acceptable methodologies as required and used in South Africa were used.
- The latest data sets were used in terms of obtaining and establishing background information and desktop reviews for the project. The data sets were taken to be accurate, but were verified and refined during field investigations.
- Consultation was undertaken with the EAP and consulting engineers to the project.

8 METHODOLOGY

8.1 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.

8.2 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 listed fauna species
- Sensitive floral habitats;
- Species of conservation concern (priority species), which include red data listed (RDL) fauna and flora species;
- Watercourses, including rivers, natural drainge lines and wetlands.

Digital photographs and GPS reference points of importance where recorded and used throughout the report when and where necessary.

8.3 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%

8.4 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 there are no other viable alternatives.

- 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.

8.5 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 Listed (RDL) 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.

8.6 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 RDL 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 Categories and Go, No-Go criteria used for the floral sensitivity ratings are used for the faunal sensitivity ratings.

8.7 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.

8.8 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.

8.9 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.

9 RECEIVING ENVIRONMENT

9.1 Study Site Location

The study site is situated within the village of Magatle in the Lepele-Nkumpi Local Municipality (LIM 355) of the Capricorn District Municipality, Limpopo Province. The study site is situated on the old show grounds of the village and is approximately 4,9 ha in area. The western boundary of the site is formed by the D3600, which is the main road that runs through Magatle Village (Figure 2 & Figure 3).

9.2 GPS Coordinates of the Main Landmarks

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

- Study Site: 24°27'32.63"S; 29°24'47.60"E.
- Magatle Village: 24°27'12.65"S; 29°24'11.00"E.
- Quarter Degree Square (QDS) 1:50 000 map: 2429AD (Zebediela – East).
- Quaternary Drainage Area (QDA): B51G.

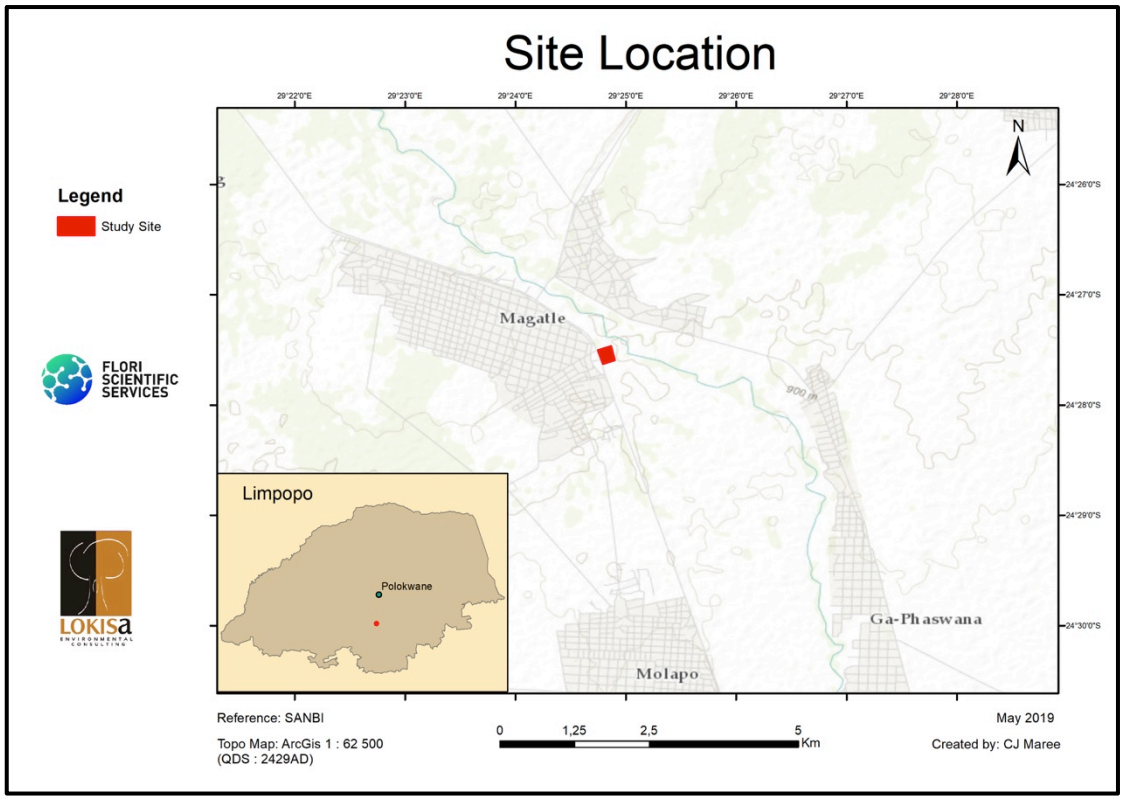

Figure 2: Study Site location

Figure 3: Site location (Google Earth)

9.3 Topography

The topography of the study area and the surrounding area is that of open bushveld on flat to undulating plains. Small hills and shallow, broad valleys are present, with no distinctive ridges, rocky outcrops (koppies) or deep ravines found within the study area. The stud site is flat with no significant gradients or topographic features.

The average height above sea level of the study area is about 906 m, with a minimum of approximately 904 m and a maximum of approximately 906 m. The average gradient (slope) across the study area is low and averages between 0,3% - 2,0%. The overall downward slope of the study area is flat to very slight and east towards the Nkumpi River.

9.4 Geology and Soils

Rocks are part of the volcano-sedimentary Karoo Supergroup. Most abundant in the area are the mafic volcanics (tholeitic and olivine basalts and nephelinites) of the Letaba Formation, then the mudstones of the Irrigasie Formation and the shale, with sandstone units, of the Ecca Group. Soils are red-yellow apedal, freely drained with high base status and self-mulching, black, vertic clays. The vertic soils, with a fluctuating water table, experience prolonged periods of swelling and shrinking during

wet and dry periods, considerable soil cracking when dry, a loose soil surface, high calcium carbonate content and gilgai micro-relief. Main land types are Ae and Ea (Mucina & Rutherford, 2006). Table 3, below, gives a basic description of the main soils.

The soils in the study site have a medium base status, with a mix of freely drained, structurless (apedal) red soils (www.bgis.sanbi.org) Soils of the study site are predominantly Ae type soils.

Table 3: Description of the Land Types found in the Region

Ae	Red-yellow apedal, freely drained soils (Red, high base status soils, > 300 mm deep, without dunes). Moderately deep (average 500-1200 mm) red, freely drained, apedal (= structureless) soils. Soils occur in areas associated with low to moderate rainfall (300-700 mm per annum) in the interior of South Africa and have a high fertility status. A wide range of texture occurs (usually sandy loam to sandy clay loam).
Ea	One or more of: Vertic, melanic, red structured diagnostic horizons. Dark or red coloured, strongly to very strongly structured soils (topsoil and subsoil) of varying depths, with high clay contents (mostly clay loam to clay texture) and a high fertility status. However, they are often difficult to cultivate, especially the dark clays. The soils have a high water-holding capacity and mostly contain a high percentage of swelling clay minerals, which pose a hazard for construction.

9.5 Climate

The study area is situated in the medium rainfall region of (401mm – 600mm) of South Africa (Figure 4). There are a few high rainfall areas to the northwest and northeast of the site, which are mountainous areas of the Wolkberg Range. Zebiedela has a similar climate to that of the study site and is approximately 21 km northwest of the site.

Zebiedela normally receives about 475 mm of rain per annuum, with most rainfall occuring during summer and very dry winter months. Zebediela's average annual temperature ranges between 10^0C and 30^0C. Summers are warm to hot with temperatures in the low to high 30^0C range and winters are cool in the low 10^0C to 7^0C range at night. Frost in winter is rare but can occasionally occur (www.worldweatheronline.com).

The study site is situated within the temperate interior climatic zone of South Africa (Figure 5).

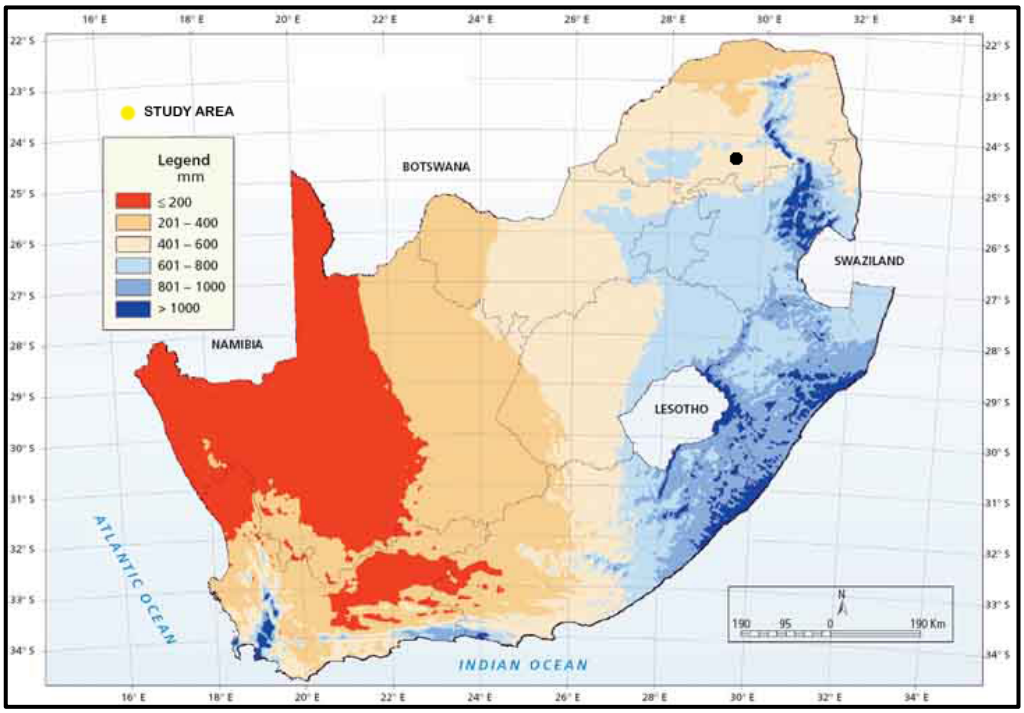

Figure 4: Rainfall averages for South Africa

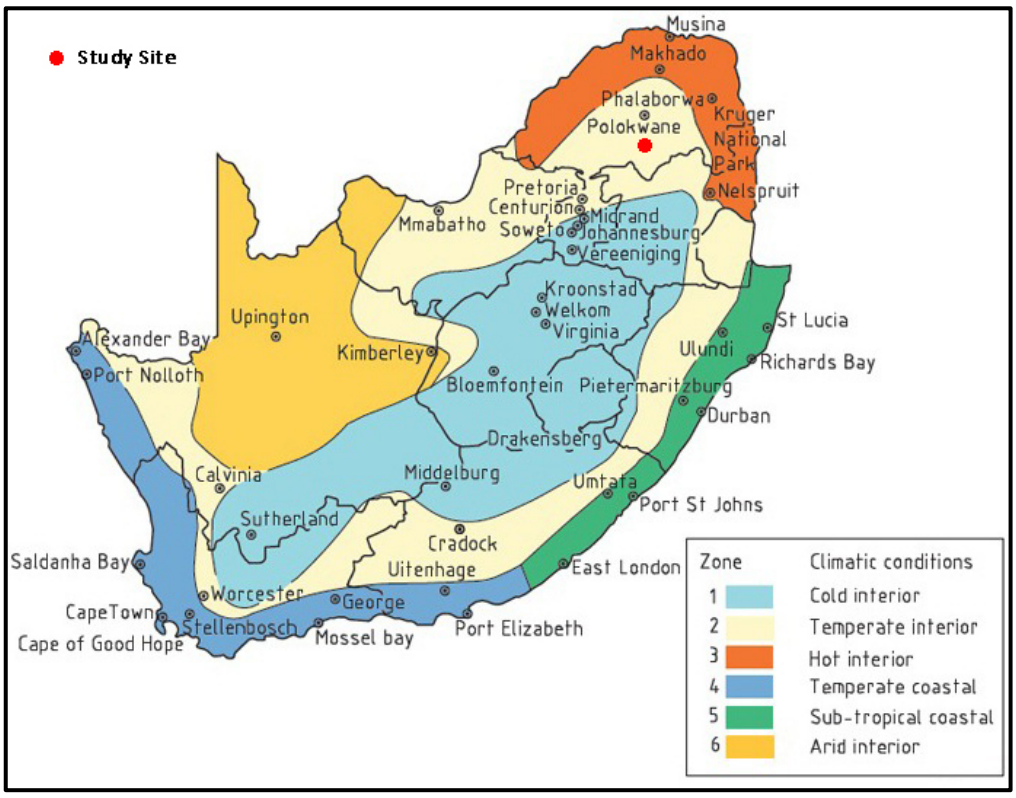

Figure 5: Broad climatic zones of South Africa

10 TERRESTRIAL ECOLOGY

10.1 Vegetation

South Africa is divided up into nine major Biomes. The study area is situated within the Savanna Biome (Figure 6). Savanna (bushveld) vegetation types (veldtypes) tend to have a mix of a lower grassy layer, middle shrub layer and an upper woody layer (trees). The mix and ratio of the three layers varies from veldtype to veldtype within the Savanna Biome.

The Savanna Biome is subdivided into six main bioregions, namely, Central Bushveld; Mopane; Lowveld; Sub-Escarpment Savanna; Eastern Kalahari Bushveld; and Kalahari Duneveld. The study site is situated within the Central Bushveld Bioregion (Figure 7). According to the vegetation classification of Mucina & Rutherford (2006) the study site is situated within the original extent of Springbokvlakte Thornveld (Figure 8). Table 4, below, shows the hierarchy of the vegetation classification of the study area, while a comparison of various veldtype names for the same vegeation unit is shown in Table 5.

Table 4: Vegetation classification of the study site

Category Description	Classification
Biome	Savanna (Bushveld)
Bioregion	Central Bushveld
Vegetation Types	Springbokvlakte Thornveld

Table 5: Comparison of veldtype names

Mucina & Rutherford (2006)	Low & Rebelo (1996)	Acocks (1953)
Springbokvlakte Thornveld	Clay Thorn Bushveld	Springbok Flats Turf Thornveld

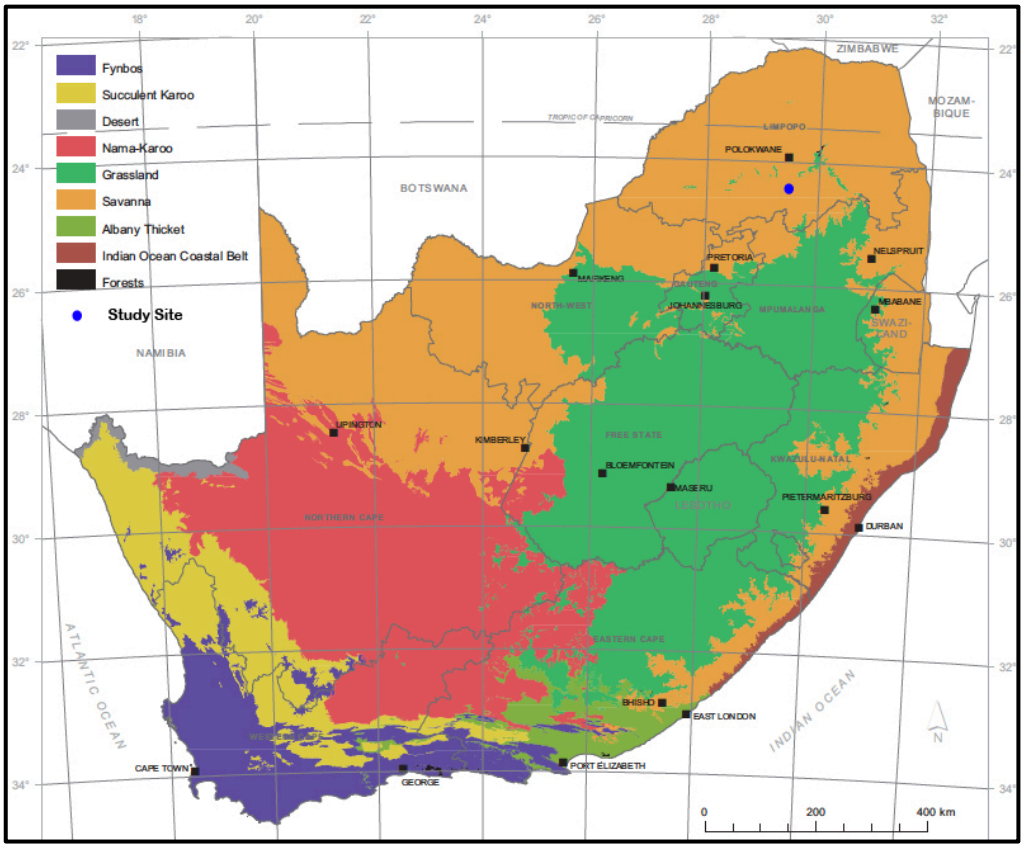

Figure 6: Biomes of South Africa

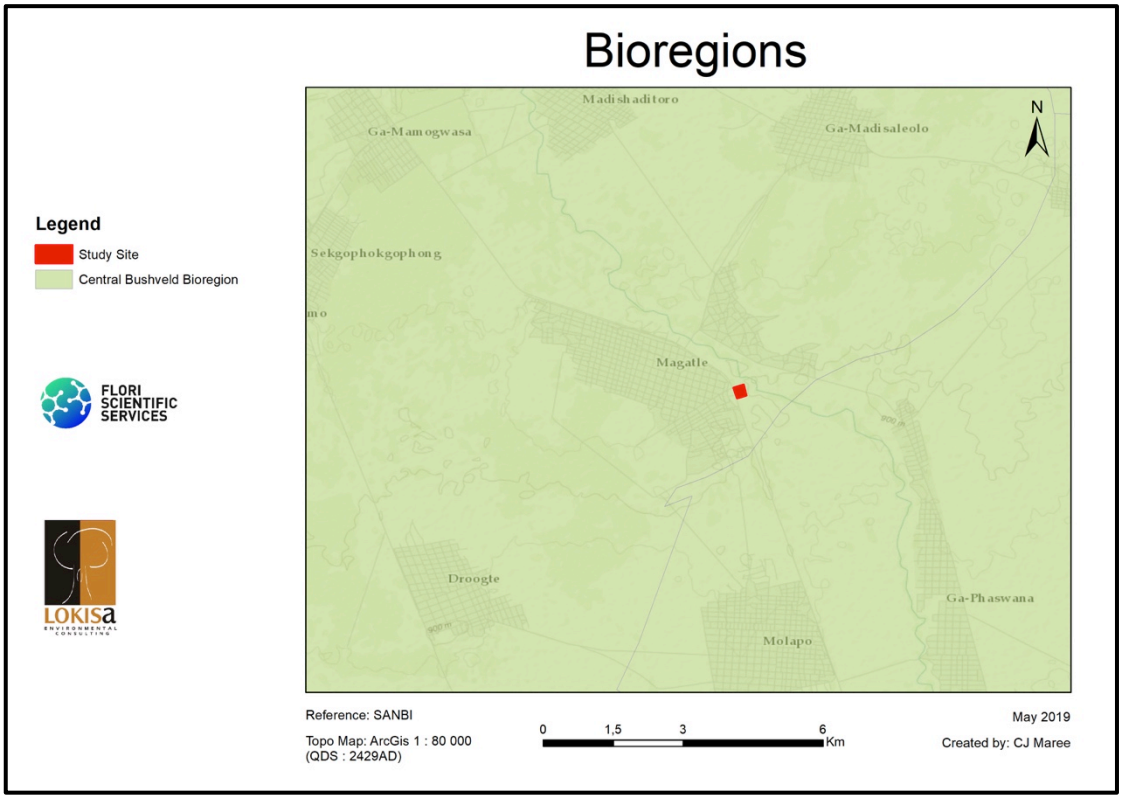

Figure 7: Bioregions

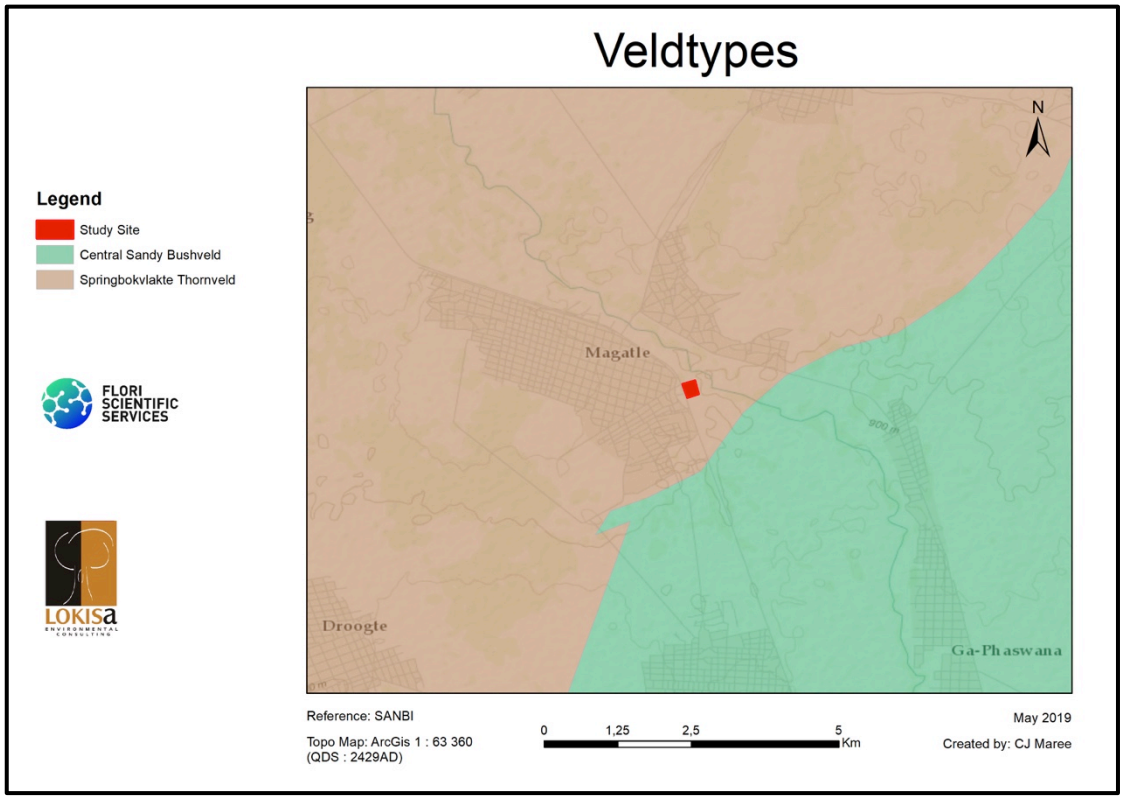

Figure 8: Veldtypes

The veldtype of Springbokvlakte Thornveld is characterised by open to dense, low thorn savanna dominated by *Acacia* species or shrubby grassland with a very low shrub layer. The veldtype is typically found on heavier clay or loam, dark soils and occurs on very flat to slightly undulating plains (Mucina & Rutherford, 2006). However, the soils of the study site (which is not uncommon for the veldtype) are medium base structureless (apedal) red soils with fairly good drainage, unless heaily compacted.

10.1.1 Vegetation of the study area

The vegetation of the study site is moderately to highly degraded and transformed vegetation. The site was previously used as the show grounds for Magatle Village and surrounding areas. Therefore, the area was cleared of most bushveld years ago and the grass regularly cut. During site investigations it appeared that the site has stood dormant for a while and some of the grasses, with a few short acacia thorn shrubs, have returned and grown. Most of the site is still cleared of bush and trees. There are a few trees growing on the site that were obviously left on purpose, mostly invasive gumtrees but some of which are protected trees species of Marula (*Sclerocarya birrea*) and Stink Shepherd's tree (*Boscia foetida*).

The dominant plant species observed during field investigations and known to occur in the immediate area are listed in the appendices.

10.2 Priority Floral Species

No Red Data Listed (RDL) floral species (endangered, threatened or vulnerable) were observed during field investigations. No Orange Data species or species or conservation concern were observed during field investigations either.

Aloe greatheadii is found in the area. It is not a Red Data Listed (RDL) species, but has a status of Least Concern (LC). It is however recommended to lift and relocate any aloe plants found during construction to a nearby area. No permit is required for this activity.

10.3 Conservation status

The conservation status of Springbokvlakte Thornveld is vulnerable (VU), according to the biodiversity conservation plans of the Lepele-Nkumpi Local Municipality (www.bgis.sanbi.org). However, according to Mucina & Rutherford (2010) the veldtype should have a conservation status of endangered (EN), due to the low percentage of formally conserved areas and the high percentage of urbanisation within the veldtype (Table 6).

Table 6: Veldtype status

Veldtype	Status	Information
Springbokvlakte Thornveld	Vulnerable (VU)	Only about 1% statutorily conserved, mainly in the Mkombo Nature Reserve. Roughly three times this area is conserved in a number of other reserves. At least 49% transformed, including about 45% cultivated and 3% urban and built-up. Dense rural populations in parts of the southern and eastern side of the unit. Very scattered alien plants over wide areas include *Cereus jamacaru*, *Eucalyptus* species, *Lantana camara*, *Melia azedarach*, *Opuntia ficus-indica* and *Sesbania punicea*. Erosion is very low to moderate (Mucina & Rutherford, 2006, 2010).

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 7: 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 (CR)	>60% or BT Index for that specific veldtype	Species loss. Remaining habitat is less than 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.

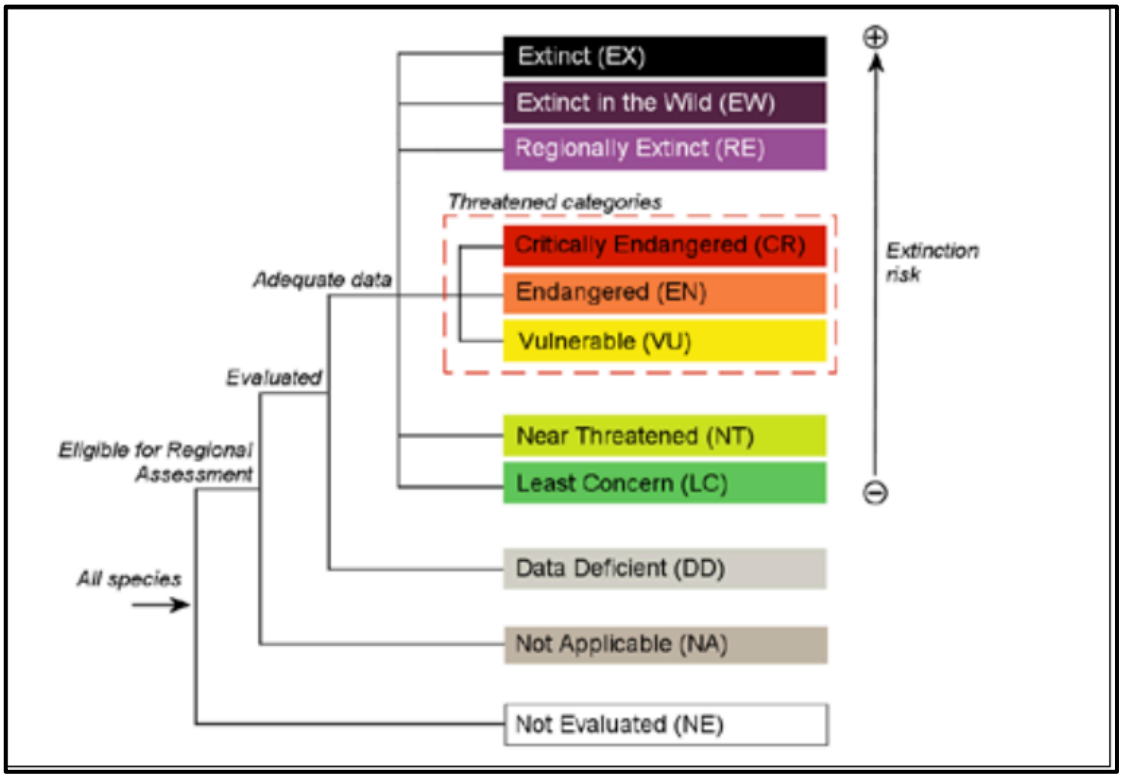

Figure 9: Structure of categories used at the regional level

10.4 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 fully comprehensive, but are representative. The study area is a small area of open grassland bushveld, with few scattered shrubs and thorn trees.

10.5 Alien plants identified in the Study Area

A few alien plant species were identified in the study area and general area. The bushveld and grassland areas of the region are not overly infested with alien species. Herbaceous plants are especially prevalent in disturbed areas. Alien plant species, some of which are invasive, occur scattered throughout the area, especially in disturbed areas and along road verges.

The alien plant species encountered in the study area are recorded, along with their category rating, in Table 8. The categories are as set out in the Conservation Act of Agricultural Resources Act, 1983 (CARA) (Act 43 of 1983).

Invasive alien plant species such as *Cereus jamacaru, Eucalyptus species, Lantana camara, Melia azedarach, Opuntia ficus-indica and Sesbania punicea* are present in the general area, with only a few plants found within the study area itself.

Table 8: Alien plants identified in the study area and immediate vicinity

Botanical Name	Common Name	Category
Acacia mearnsii	Blackwattle	2
Bidens pilosa	Blackjacks	-
Cereus jamacaru	Queen-fo-the-night	1b
Conyza canadensis	Horseweed fleabane	-
Datura ferox	Large thorn-apple	1
Eucalyptus spp & cultivars	Gum trees; Eucalyptus	2
Lantana camara	Lantana	1b
Melia azedarach	Syringa	1b
Opuntia ficus-indica	Prickly pear	1
Sesbania punicea	Sesbania	1b
Solanum elaeagnifolium	Silverleaf bitter apple	1
Tagetes minuta	Khakibos, kahki weed	-

10.6 Protected tree species identified in the study area

Two protected trees are present on the study site. Marula (*Sclerocarya birrea*), which is a national protected tree, and Stink Shepherd's tree (*Boscia foetida*), which is a provincial protected tree.

10.7 Fauna

10.7.1 Mammals

No large- or medium-sized mammals were observed during field investigations, with the exception of some common bird species and a few signs of mongoose and field mice. Some rodent species are more than likely to be present, although not observed during field investigations, except for signs such as droppings. Some priority species (including RDL species) are likely to occur in the study area due to the openness of bushveld areas to the south and west (in particular) as well as the presence of the nearby Nkumpi River. However, large and medium-sized mammals will be limited in variety and numbers due to the rural villages (such as Magatle) and the cultivation of lands (farming) in the area. Large free-roaming mammals are non-existent to rare in the region.

10.7.2 Avifuana

A few common species to the area such as doves, bulbuls, swallows, swifts, bee-eaters, francolins *(Pternistis spp*), guineafowl (*Numida meleagris*) and some raptors were observed. The study site is not situated within, or adjacent to, any Important Bird Areas (IBAs). The closest IBA (Wolkberg Forest Belt) is shown in the map below, which is approximately 16 km north of the site (Figure 10). No nesting or breeding birds were observed on the study site. A few nests were observed down at the Nkumpi River in the riparian zone. These were of more common bird species such as weavers. The river and riparian habitat is suited to a number of common bird species. The study site and proposed activities will not have any impact on the river or riparian zone.

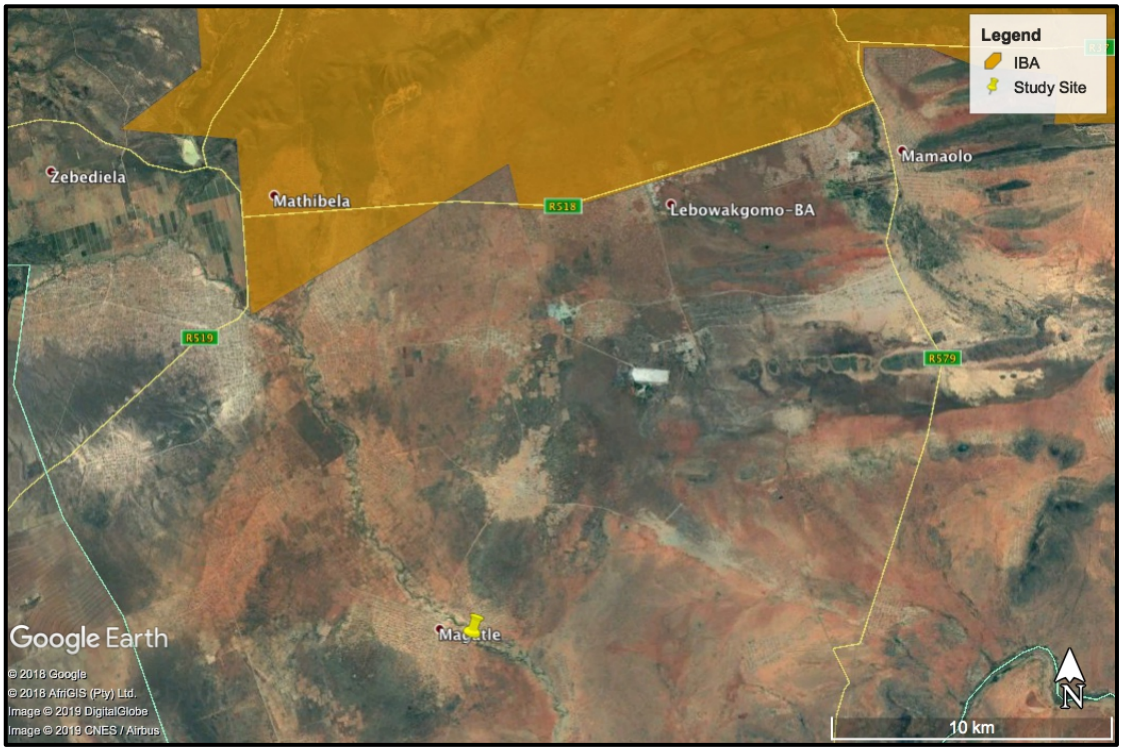

Figure 10: Important Bird Areas (IBAs)

10.7.3 Reptiles

No reptiles were observed during field investigations. 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. Snakes tend to be more mobile and adaptable to various and altered environments. It is likely that some common snake

species will be found on site from time to time, due especially to the nearby Nkumpi River.

10.7.4 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. A few common sheet-web spiders (Linyphiidae) were found on site but no priority species were observed.

10.7.5 Faunal species of conservation concern

During field investigations no faunal species of conservation concern were encountered. The general habitats present in the study area are not ideal for most priority species, including mammals, reptiles and most birds. Priority species, if encountered, will most likely be encountered traversing the area and not so much as breeding on the study site, due to lack of ideal habitat. No active or even old animal burrows were found in the study site. Table 9, below, lists some of the priority faunal species and their likelihood to occur in the study area.

Table 9: Priority Faunal Species likely to occur in the area

Species	Common Name	Red Data Status	Preferred Habitat	Habitat Restrictions	Present in Study area
Frogs					
Pyxicephalus adspersus	Giant bullfrog	Least concern	Grassland; savanna	Temporary floodplains, pans	No
Mammals					
Atelerix frontalis	SA hedgehog	Near threatened	Most, broad	Broad	Not likely
Manis temmincki	Pangolin (Scaly anteater)	Vulnerable	Grassland, savanna	Woody savanna, ants, termites	No
Mellivora capensis	Honey badger (Ratel)	Near threatened	Most, broad	Broad	Not likely
Cloeotis percivali	Short-eared trident bat	Critically endangered	Savanna	Caves and subterranean	No

				habitat	
Pipistrellus rusticus	Rusty bat	Near threatened	Most, broad	Woody savanna, large trees	No
Snakes					
Python natalensis	Rock python	Vulnerable	Ridges, wetlands	Rocky areas; open water	Not likely

The maps below show the Quarter Degree Squares (QDS) that are hotspots for priority butterflies, snakes and lizards in South Africa (Figure 11, Figure 12 & Figure 13). The study site is not within any of these faunal hotspots. The study site is north of a lizard hotspots that are found more towards Groblersdal and Tafelkop areas, where there are more rocky ridges, hills, etc. The study site is not within a lizard hotspot.

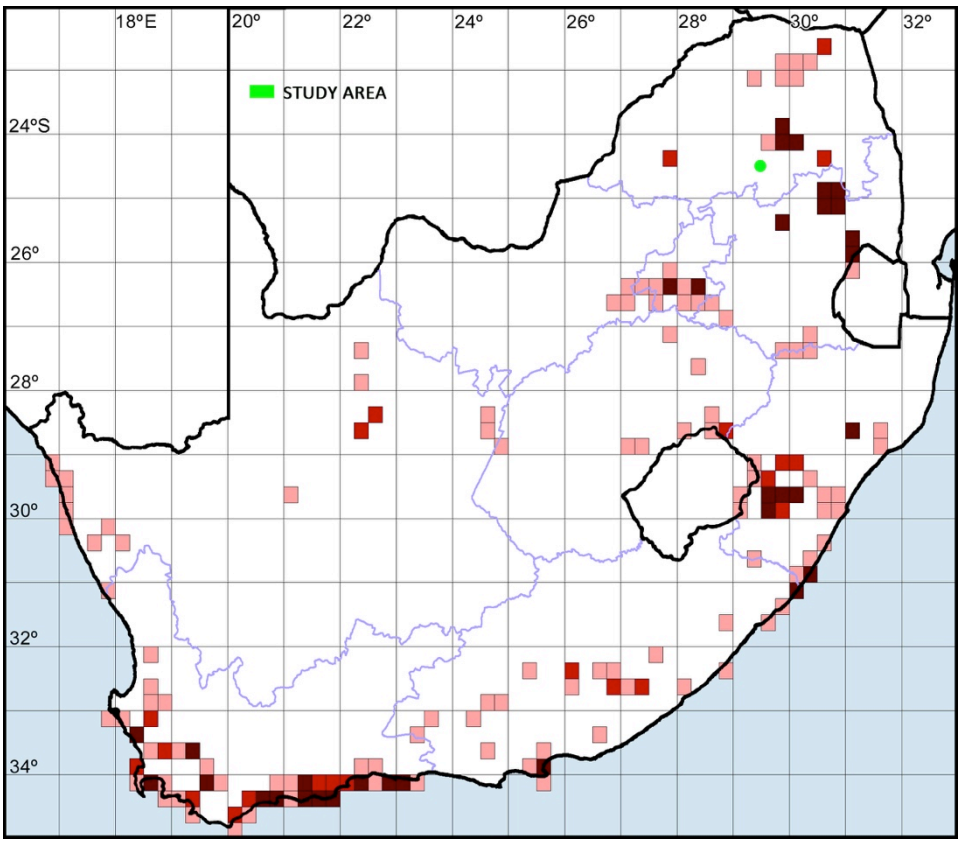

Figure 11: Butterfly Hotspots

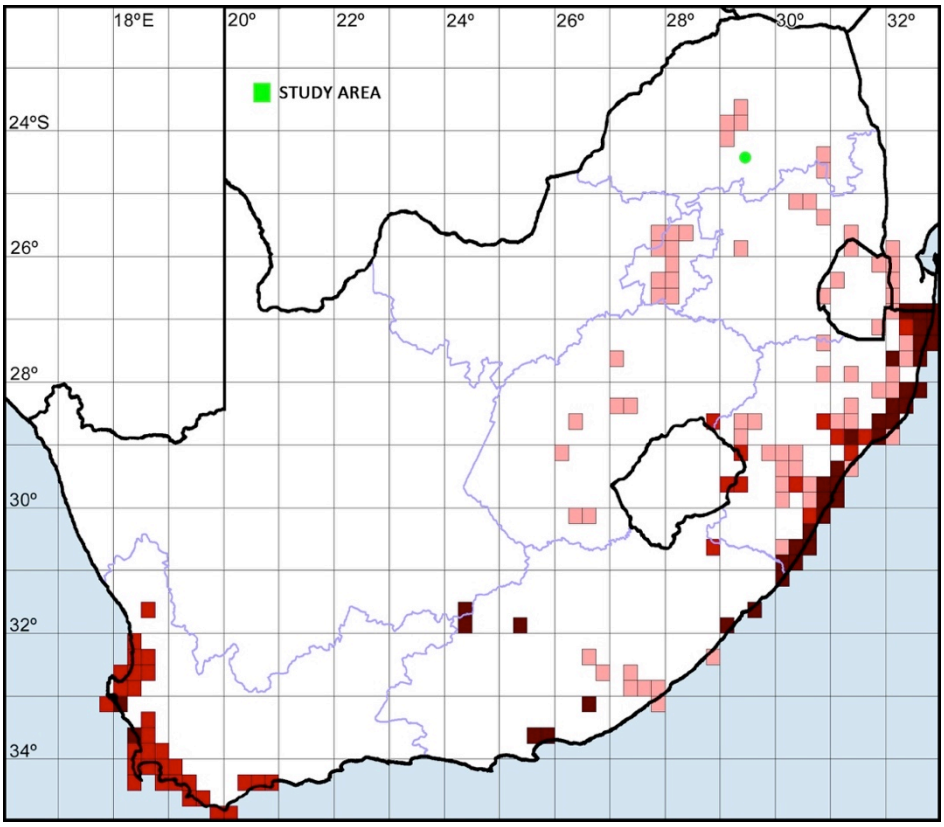

Figure 12: Snake Hotspots

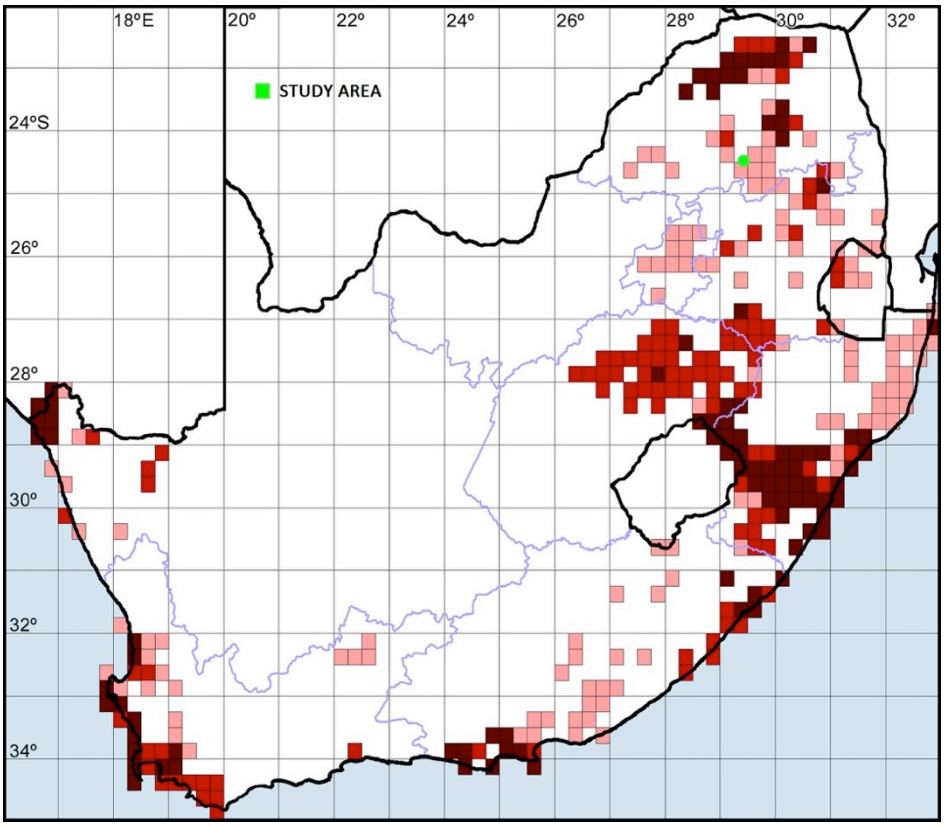

Figure 13: Lizard Hotspot

11 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.

11.1 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 14).

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 14: Classification of wetlands

11.2 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*."

11.3 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 permitted development and buffer zones.

11.4 Watercourses in the study area

There are no watercourses in the study area, including distinctive drainage lines, wetlands and freshwater pans (which is a type of wetland). The closest main river is the Nkumpi River, which is approximately 120 m to 200 m east of the study site (Figure 15).

Figure 15: Main rivers in the area

11.5 Classification of watercourses in the study area

Watercourses identified in the study area are classified according to 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 found in the Classification System for Wetlands – SANBI Series 22 (Ollis *et. al.* 2013) (Table 10). This in addition to the classification system used for wetlands (Figure 14). There are no wetlands in the study area therefore the classification system shown in Figure 14 was not used.

The Nkumpi River is not within the study site and will not be impacted on by the proposed project. However, due to the relative closeness of the river to the site it was assessed and classified as shown in Table 11, below.

Table 10: 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 • Bench	River	• Mountain headwater stream • Mountain stream • Transitional stream • Upper foothill • Lower foothill • Lowland • Rejuvenated foothill • Upland floodplain
			Channeled 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 11: Classification of watercourses in or nearby the study site

Name	LEVEL 1 System	LEVEL 2 Regional setting (Ecoregion)	LEVEL 3 Landscape Unit	LEVEL 4 HGM Unit	
				HGM Type	Landform
Nkumpi River	Inland	Central Bushveld (Group 2)	Plain	River	Lowland

11.6 Delineated watercourses

There are no watercourses within the study area. However, the nearby Nkumpi River was delineated as shown in the figure below (Figure 16). The proposed project will have no negative or positive impacts on the river, but the river was highlighted for the sake of transparency and investigations into the broader surrounding areas of the study site. The outer edges of the river and riparian zone have been delineated, as per the figure below (Figure 16). Between the study area and the river are existing negative impacts in the form of cultivated lands (farm lands).

Figure 16: Delineated watercourses

11.7 Drainage areas

South Africa is geographically divided up into a number of naturally occurring Primary Drainage Areas (PDAs) and Quaternary Drainage Areas (QDAs) (Figure 17). The different areas are demarcated into Water Management Areas (WMAs) and fall under the authority of different Catchment Management Agencies (CMAs). Until fairly recently there were 19 WMAs and 9 CMAs. Figure 18 shows the extent of the old (or previous) Water Management Areas (WMAs). As of September 2016, these were revised and there are now officially only 9 WMAs, which correspond directly in demarcation to the 9 CMAs (Figure 19) (Government Gazette, 16 September 2016. No.1056, pg.169-172).

The study area is situated within the Primary Drainage Area (PDA) of B and the Quaternary Drainage Area (QDA) of B51G (Figure 20). The study area is within the Olifants Water Management Area (WMA 2) and under the jurisdiction of the Olifants Catchment Management Agency (CMA 2) (Figure 19).

The table below gives a summary of the catchment areas and management areas for the study site (Table 12).

Table 12: Summary of Catchment areas for the study site

Level	Category
Primary Drainage Area (PDA)	B
Quaternary Drainage Area (QDA)	B51G
Water Management Area (WMA) – Previous / Old	Olifants
Water Management Area (WMA) – New (as of Sept. 2016)	Olifants (WMA 2)
Sub Water Management Area	Middle Olifants
Catchment Management Agency (CMA)	Olifants (CMA 2)
Wetland Vegetation Ecoregion	Central Bushveld (Group 2)
Priority Quaternary Catchment	No
SWSA area	No
NFEPA Rivers in Study Area	No
NFEPA Wetlands in Study Area	No
Fish FEPA	No
Fish FSA	No
Fish Rehab	No
Fish Migratory Catchment	No
Fish Corridor (Mzeke River)	No

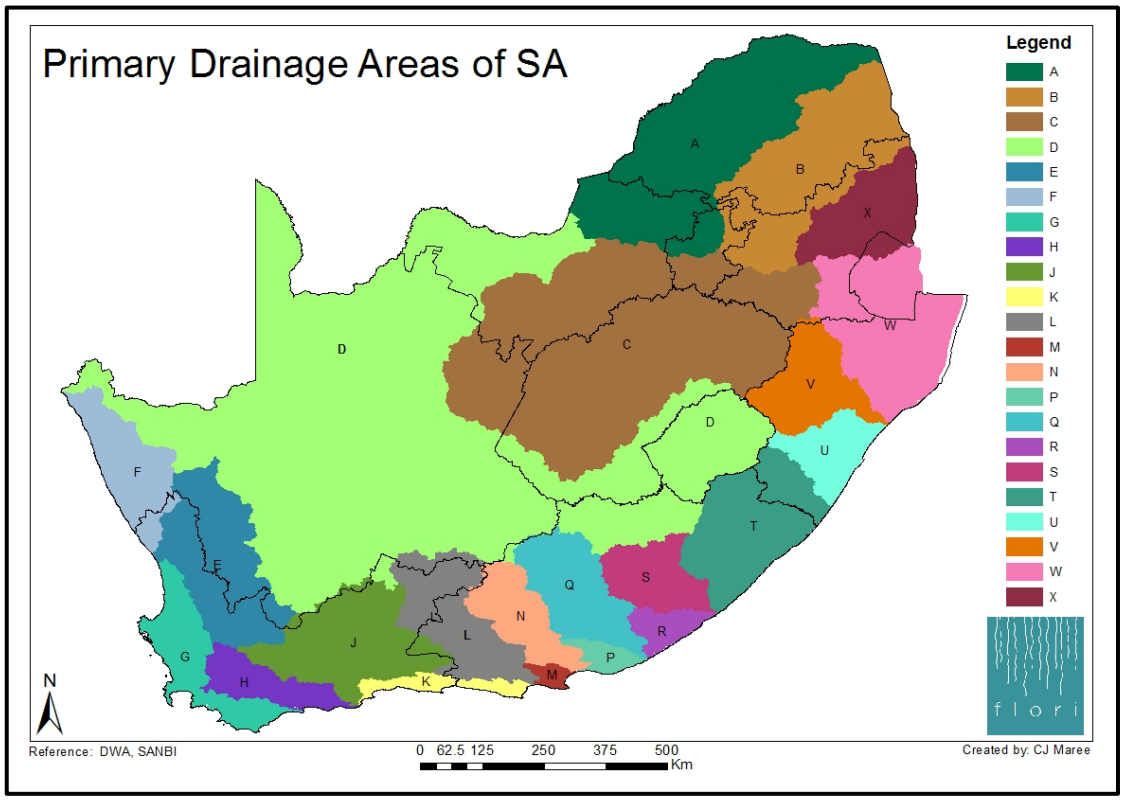

Figure 17: Primary drainage areas of South Africa

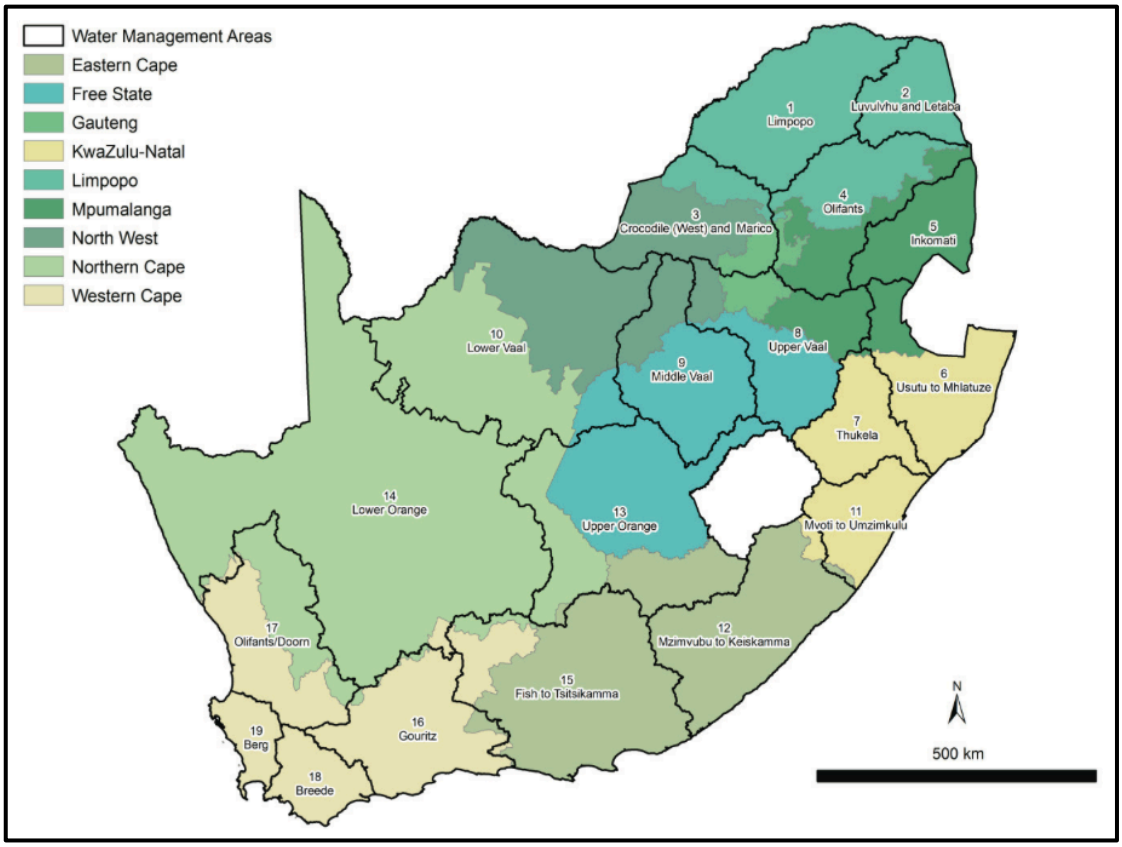

Figure 18: Old WMAs of South Africa

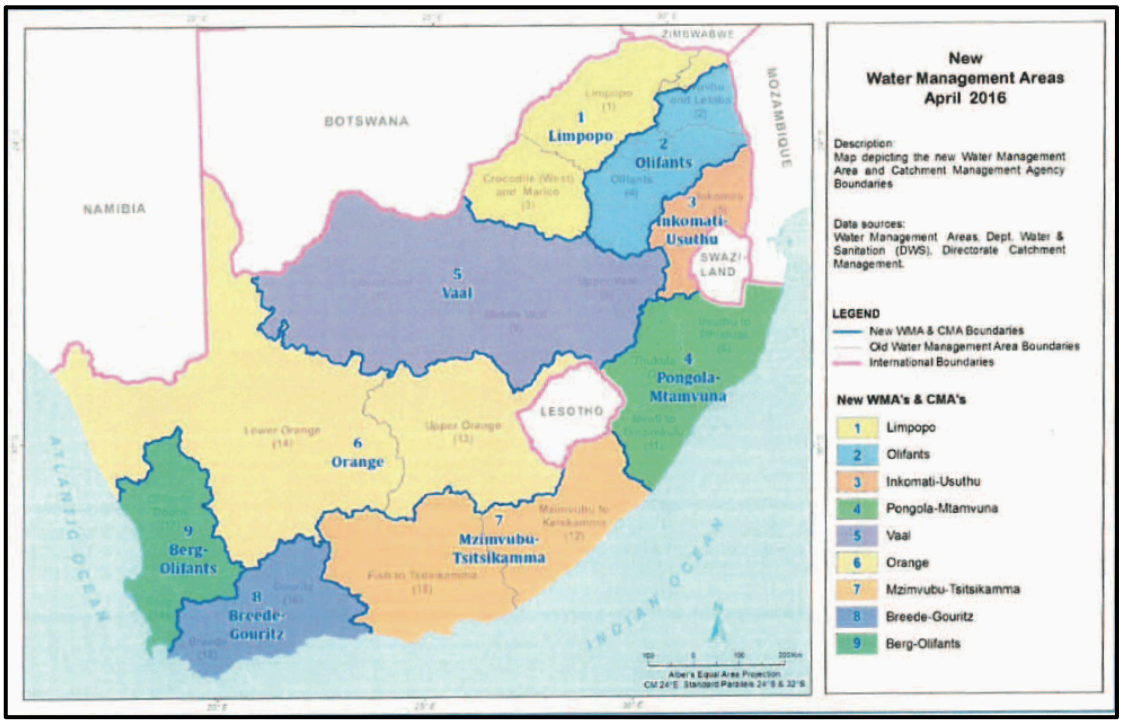

Figure 19: New WMAs & CMAs of South Africa

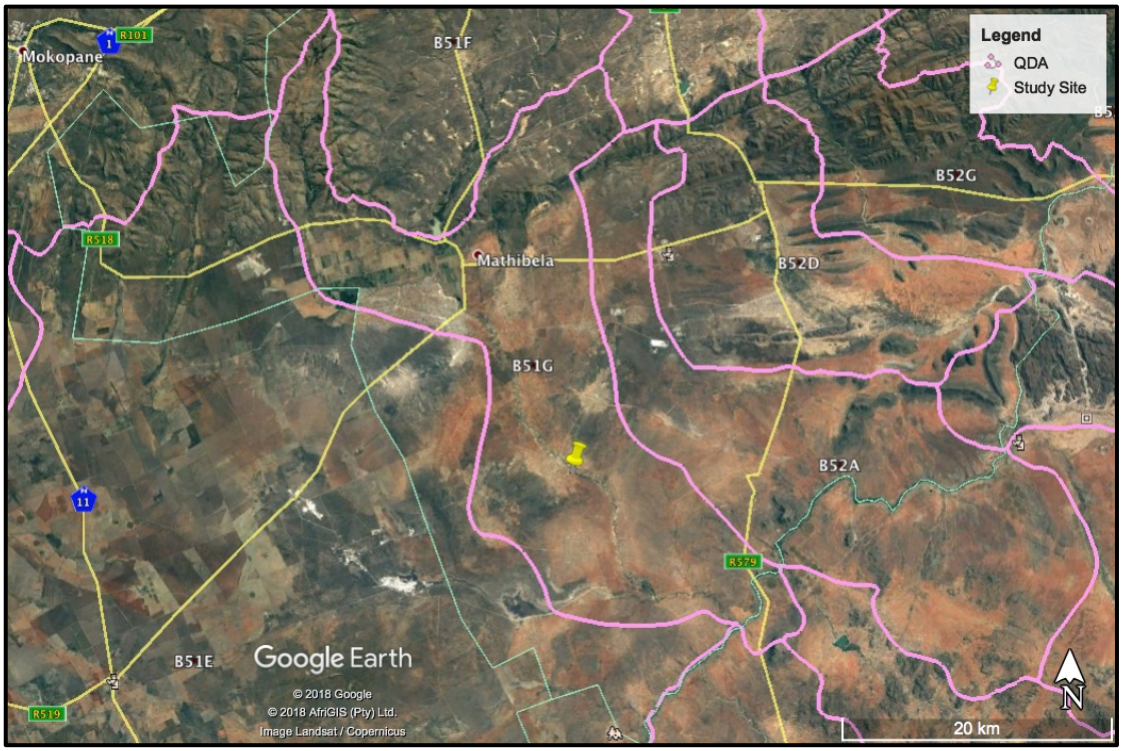

Figure 20: Quaternary Drainage Areas (QDAs)

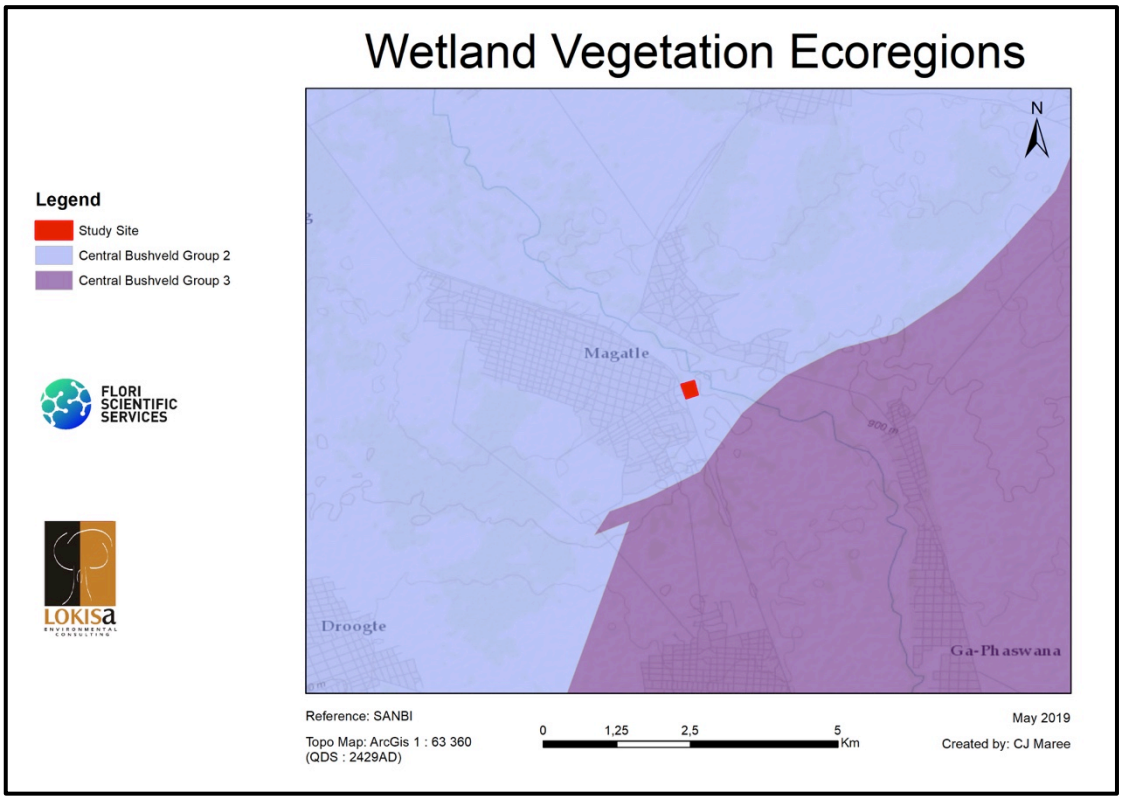

Figure 21: Wetland vegetation ecoregions

11.8 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.

The study area is not situated within any Strategic Water Source Areas of South Africa (SWSA), neither is it surrounded by SWSA areas (Figure 22).

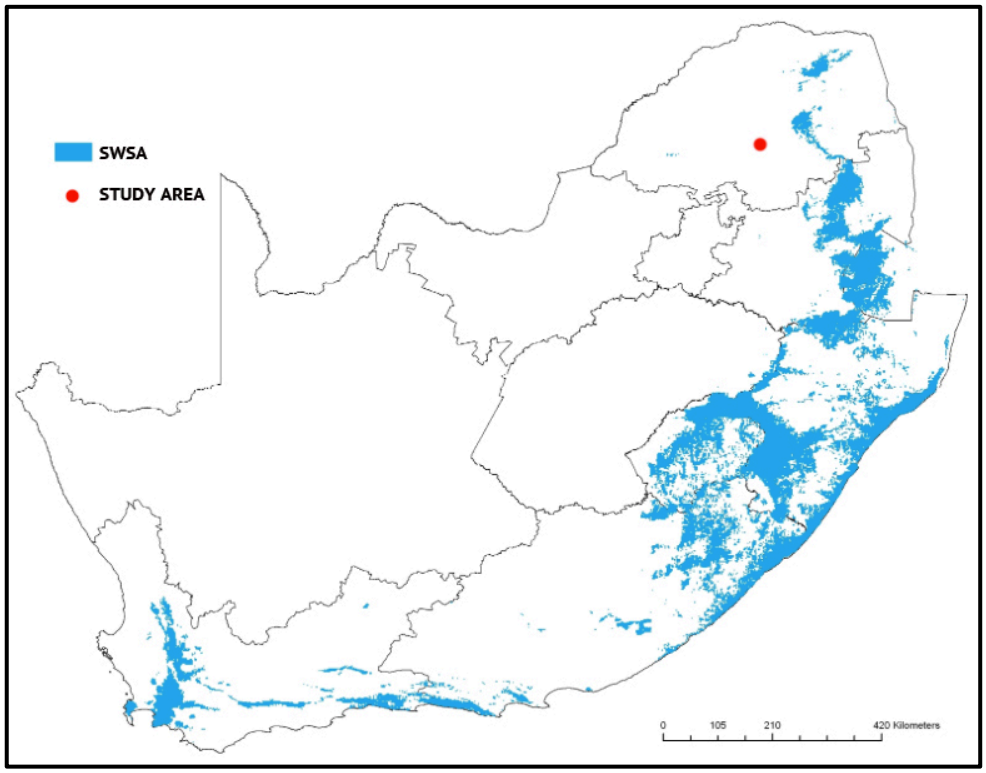

Figure 22: Strategic Water Areas of South Africa (SWSA)

11.9 Methodology: Present Ecological State

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 13 shows the criteria used for assessing the habitat integrity (PES) of wetlands and other watercourses, along with Table 14 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 13: 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 14: 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 15 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 15: 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 D, E & F are deemed to be Low. Category ratings of C are deemed to be Medium, while category ratings of A & B are deemed to be High.

11.10 PES of watercourses in the study area

There are no watercourses in the study area, but the PES of the Nkumpi River was nonetheless calculated, as shown in the table below (Table 16). The PES of a river may differ from area to area along its course. The PES shown in Table 16, below, is for the river in the general area of the study site.

An environmental management class (EMC) of category C is recommended for the river in the region. However, it is understood that this is not the responsibility or requirement of the project or client as the proposed project will not have any impacts on the river.

Table 16: PES of Nkumpi River

Criteria	Identified Watercourses
	Unnamed Stream
HYDROLOGY	
Flow modification	3
Permanent inundation	3
WATER QUALITY	
Water Quality Modification	2
Sediment Load Modification	2
GEOMORPHOLOGY	

Canalisation	2
Topographic Alteration	2
BIOTA	
Terrestrial Encroachment	1
Indigenous Vegetation Removal	1
Invasive Plant Encroachment	3
Alien Fauna	3
Over utilisation of Biota	1
Total:	23
Average:	2,1
Category:	**D**
Integrity (PES):	**Low**
PES Description	**Largely Modified**
Recommended EMC	**C**

11.11 Methodology: Ecological Importance and Sensitivity

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 17). 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.

Table 17: 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

11.12 EIS of watercourses in the study area

The EIS value of the nearby Nkumpi River was determined using the above methodology. The calculations and categories are shown below (Table 18).

Table 18: EIS and EMC values of watercourses

Determinant	Nkumpi River	Confidence
PRIMARY DETERMINANTS		
1. Rare & Endangered Species	1	4
2. Populations of Unique Species	2	4
3. Species/taxon Richness	2	4
4. Diversity of Habitat Types or Features	2	4
5 Migration route/breeding and feeding site for wetland species	1	3
6. Sensitivity to Changes in the Natural Hydrological Regime	2	3
7. Sensitivity to Water Quality Changes	2	3
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	1	3
MODIFYING DETERMINANTS		
9. Protected Status	0	4
10. Ecological Integrity	2	4
TOTAL	15	-
AVERAGE	1,5	-

Overall EIS	**C**	**-**
Description	**Moderate**	**-**

11.13 Drivers of ecological change on the watercourses

The main drivers of ecological change on the watercourse/s and water ecosystems in the region and the study area are:

- Cultivation;
- Over utilisation of resources at site and upstream; and
- Urbanisation.

There are no major impacts on the water ecosystem directly within the study area. The project and related activities should not have any impact (negative or positive) on the main watercourses in the area, or on the water environment in general.

12 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 threatened ecosystems, ideal habitat for priority species (including Red Data species), etc.

The natural environment within the study area is uniform and consists of only one natural habitat, namely open degraded bushveld (thornveld). There are no significant rocky outcrops or rocky ridges within the study area that proposed activities of the project will impact on. There are also no aquatic habitats in the study area, including streams and wetlands. The floral and faunal sensitivity analyses are shown in the tables below (Table 19 & Table 20).

12.1 Floristic Sensitivity Analysis

Table 19: Floristic sensitivity analysis

Criteria	Distinctive habitats in the study area
	Degraded Bushveld (Thornveld)
Red Data Species	5
Habitat Sensitivity	3
Floristic Status	4
Floristic Diversity	3
Ecological Fragmentation	5
Sensitivity Index	40%
Sensitivity Level	Medium / Low
Development Go Ahead	Go-Slow

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.

12.2 Faunal Sensitivity Analysis

Table 20: Faunal sensitivity analysis

Criteria	Distinctive habitats in the study area
	Degraded Bushveld (Thornveld)
Red Data Species	2
Habitat Sensitivity	3
Faunal Status	3
Faunal Diversity	2
Ecological Fragmentation	5
Sensitivity Index	30%
Sensitivity Level	Medium / Low
Development Go Ahead	Go-Slow

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.

12.3 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 21).

Table 21: Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity	Development Go-ahead
Degraded Bushveld (Thornveld)	Medium / Low	Medium / Low	Medium / Low	Go-Slow

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.

According to the final analysis there are no high sensitivity areas, high sensitivity habitats, or 'No-Go' zones. The floristic sensitiviy is low, but is heightened slighty due to the presence of marula and shepherd's trees on site, as well as the closeness of the Nkumpi River. Faunally, the site is not sensitive and has no distinctive ideal faunal habitats.

12.4 National Priority areas

National 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. The study site is not situated within any priority areas (Figure 23).

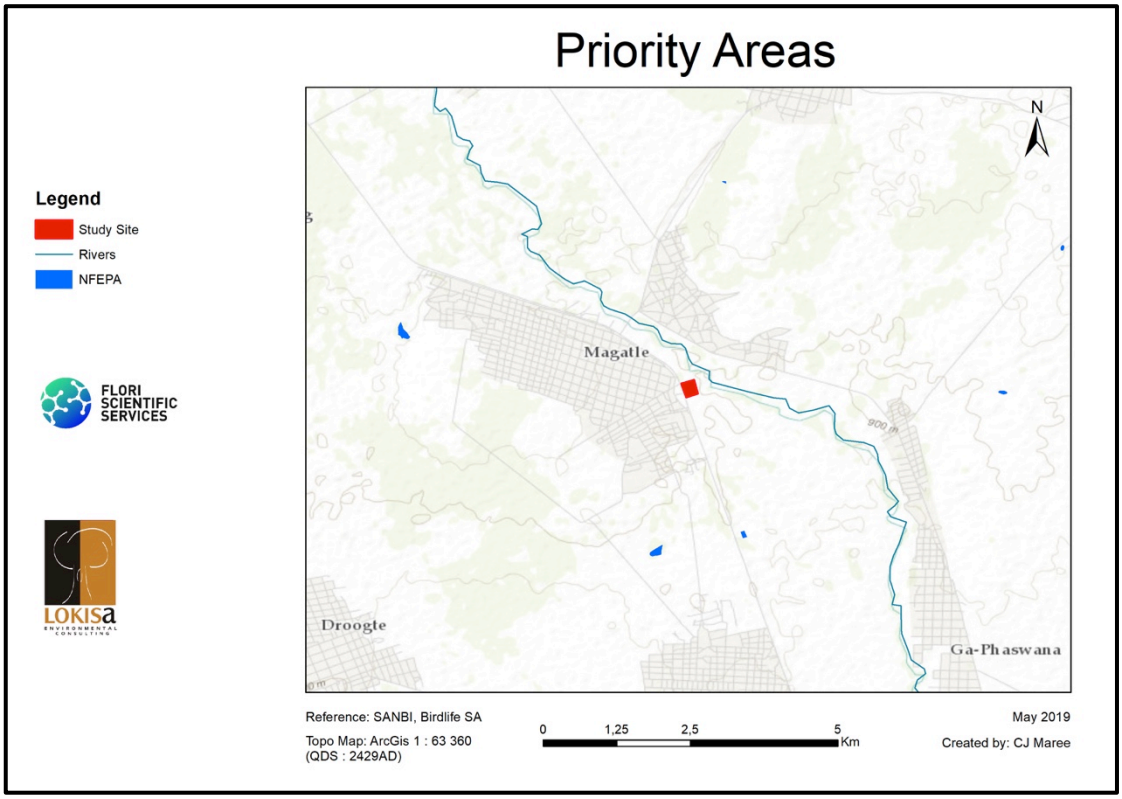

Figure 23: Priority Areas

12.5 Limpopo Conservation Plan (V.2)

The study area is situated within a critical biodiversity area (CBA). The CBA is delineated as an Optimal Area (CBA 2) (Figure 24).

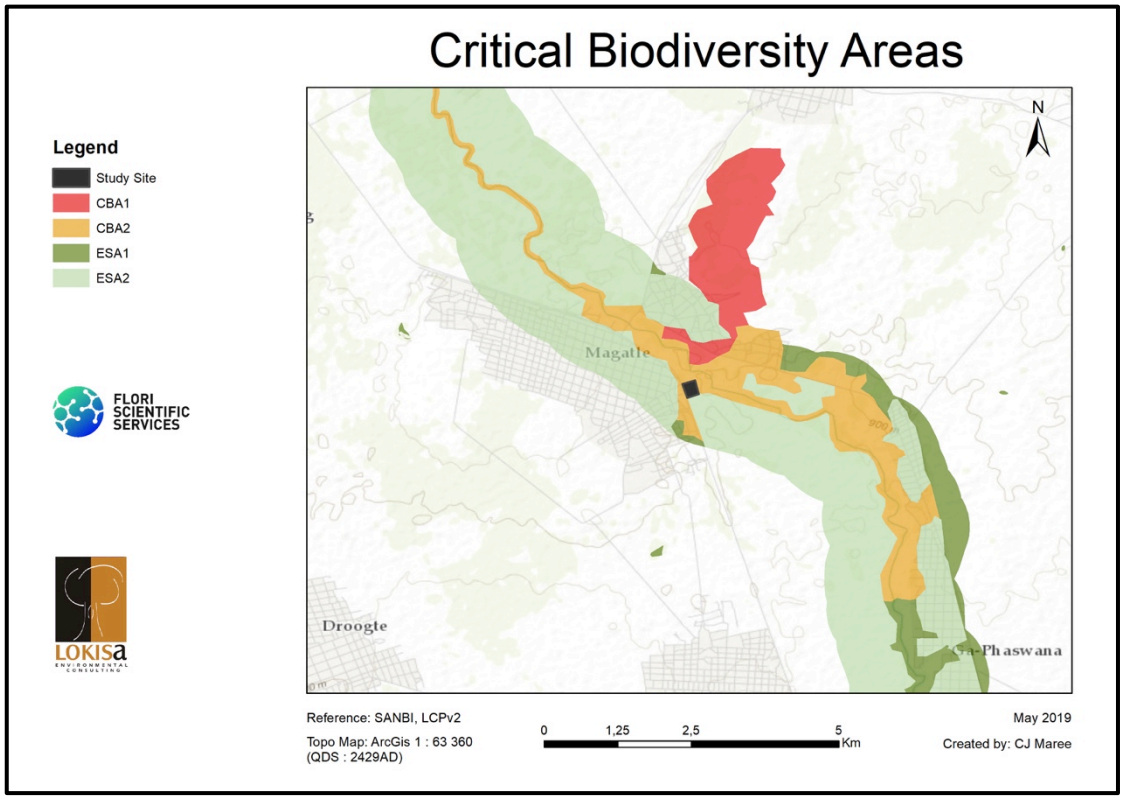

Figure 24: CBAs & ESAs

According to the Limpopo Provincial Gazette, Vol. 26, No. 2966, dated 4 January 2019, CBAs and ESAs have the following criteria:

- Critical Biodiversity Areas (CBAs) are sites that are required to meet each ecosystem's biodiversity target, and need to be maintained in the appropriate condition for their category. CBA 1 can be considered irreplaceable in that there is little choice in terms of areas available to meet targets. Those areas falling within CBA 2 are considered optimal. Although they represent areas where there are other spatial options for achieving targets, the selected sites are the ones that best achieve targets of the systematic biodiversity plan.
- Ecological Support Areas (ESAs) are areas that are important for maintaining the ecological processes on which CBAs depend. This category has also been split into ESA1 and ESA2 on the basis of land cover. ESA1 areas are in a largely natural state, and are important for supporting CBAs, while ESA2 areas are no longer intact but potentially retain significant importance from an ecological process perspective (e.g. agricultural land maintaining landscape connectivity).

Criteria used to determine critical biodiversity areas include the following, namely:

- Red list plant habitat;
- Orange listed plant habitat;
- Red listed bird habitat; and
- Prime vegetation.
- Threatened vegetation units (veldtypes).

During site investigations no red listed (RDL) or orange listed (ODL) plant and animal species were observed. The area is also not an important bird area. There are two protected tree species on site, but these do not have RDL threat status.
The statuses of both marula and stink shepherd's trees are that of 'least concern' (LC) (redlist.sanbi.org).

12.6 Sensitive areas identified during field investigations

No high sensitive areas or 'No-Go' zones were identified during field investigations. All of the above information and data sets are taken into account when determining the sensitivity of the study site, including CBAs, ESAs, priority areas, ideal habitats for priority species (fauna and flora), watercourses, ridges, koppies (rocky outcrops), presence of RDL and ODL species, threat status of the veldtype in which the study site is situated, etc.
According to datasets the delineation of the study area within a CBA has been taken into consideration. But it also needs to be kept in mind that the actual site is mostly degraded and transformed due to the fact that it was historically used as a show grounds for the region. The few protected trees on site have also been taken into consideration. The proposed project should have no impact on these trees and recommendations are that they should not be removed at all, but nurtured and protected.
If (as an absolute last resort) some of the trees need to be removed, then a tree permit application through National and Provincial Departments will first need to be done. The position and gps coordinates of the protected trees are shown below (Figure 26 & Table 22).

Figure 25: Sensitivity map of the study area

Figure 26: Protected trees on site

Table 22: Coordinates of protected trees

Number of trees	Coordinates
1	24°27'36.36"S; 29°24'48.97"E
2	24°27'33.61"S; 29°24'48.80"E
3	24°27'33.44"S; 29°24'50.01"E
4	24°27'33.99"S; 29°24'51.93"E
5	24°27'33.47"S; 29°24'51.23"E
6	24°27'33.06"S; 29°24'50.92"E
7	24°27'32.73"S; 29°24'51.21"E
8	24°27'31.50"S; 29°24'49.73"E
9	24°27'30.81"S; 29°24'49.01"E

13 THE GO, NO-GO OPTION

13.1 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.

13.2 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 still need to be implemented.

14 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 (cumulative effects) of the negative impacts. The rated impacts of the proposed project before and after the implementation of mitigating measures are shown in the table below (Table 23). The impact assessments focus primarily on the construction phase of the project.

14.1 Existing Impacts

Existing negative impacts on the study area are high. Existing negative impacts include the degradation and transformation of the site over the years due to use as a show ground. Other negative impacts include movement of people through the area; the fact that the site is basically in a urban area (Magatle Village); cultivated lands and other farm lands; and other associated anthropogenic impacts such as general litter.

14.2 Potential Impacts

The potential impacts of the proposed project and related activities on the entire property are low-level to medium-level negative impacts for the medium- to long-term. Potential negative impacts include loss of vegetation to build the filling station; increased human activity in the area in the form of people and vehicles and other related potential negative impacts such as oil spills, rubbish, etc.
There are no potential positive impacts arising from the project.

14.3 Assessment of total potential impacts

The calculated total potential impacts that the proposed development project may have on the natural environment, with specific recommended mitigating measures, are summarised in the table below (Table 23).

Besides the direct impacts project, a number of other general impacts in the study area can occur during the construction phase that need to be taken into account. The significances of these are highlighted in the table below (Table 24).

Table 23: Rating matrix: Grassland

Potential Impact on Habitat BEFORE Mitigating & Management Measures	
Criteria	**Rating**
Extent – Local	2
Duration – Long term	3
Intensity – Moderate	2
Probability of occurrence – Highly probable	3
Total	**10**
Rated as a **MEDIUM** negative impact before the implementation of mitigating and management measures	
Impact AFTER Mitigating and Management Measures	
Criteria	**Rating**
Extent - Site	1
Duration – Long term	3
Intensity - Moderate	2
Probability of occurrence – Possible	2
Total	**8**
Rated as a **MEDIUM** negative impact after the successful implementation of all mitigating and management measures.	
Cumulative Effect	**Low**
The study site and proposed project is very localised. The cumulative effect on existing negative impacts will be low, with little significant negative impact on bushveld (thornveld). After construction and rehabilitation the limited grasslands in the study area will recover quickly (short-term) resulting in little measurable cumulative effect arising from the project itself. Most potential negative impacts will be related anthropogenic activities such as increased movement of people and vehicles in the area, as well as rubbish, etc. These can and should be strictly controlled, hereby limiting the cumulative effect. The total impacts of the project are calculated to be medium to medium / low. This 'higher' impact rating is because the site (although having low sensitivity) is within a demarcated CBA area and a threatened veldtype. Although the study site is not within representative Springbokvlakte Thornveld but is mostly transformed and degraded.	
Main mitigating measures reducing intensity are: • All temporary construction facilities, lay-down areas, and storage of materials to be confined to within the study site only.	

- Not temporary facilities or storage of materials within 100 m of any watercourses.
- No trees to be cut down and removed unless within the actual development zone.
- Only existing roads to be used as access roads during the construction phase.
- The nearby Nkumpi River is a 'no-go' zones in terms of movement of people, vehicles and materials.
- No water for construction purposed may be taken from out of the Nkumpi River unless the relevant permits have been obtained.
- There are protected trees on site, which must be left. However, if as a last resort some of them need to be removed a tree permit application process will first need to be done.
- No trees may be removed on the study site unless first authorised by the ECO and/or ecologist. There are some alien tree species, but need to first be confirmed by the ECO and/or ecologist.
- No movement of construction vehicles allowed outside the boundaries of the study area especially along the northern and western boundaries. The western boundary is closer to the river and riparian area and the northern boundary has a sand road that is badly eroded and heavy vehicles will cause more erosion that during a rain downpour leads to increased siltation into the Nkumpi River.
- Rehabilitation of denuded and disturbed areas resulting from construction is required.
- The site must be inspected on a regular basis during construction to ensure there are no erosion problems, etc.

Table 24: 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	Low	Low
Access roads (damage, blocking)	Low	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	Medium	Low
Impact on flora	Low	Low

Impact on fauna	Low	Low
Impact on wetlands	Low	Low
Impact on watercourses	Low	Low
Importation of alien vegetation	Low	Low
Impact of herbicides	Low	Low
Impact on conservation areas	Low	Low

14.4 Cumulative impacts

There will be slight negative impacts on the degraded bushveld (thornveld) of the study site, as well as some potential low-level fringe impacts that typically occur with projects such as this. The study site and proposed project is very localised, which is positive in terms of the potential footprint of negative impacts. The cumulative effect on existing negative impacts on the natural environment arising from project related activities will be low.

14.5 Project go-ahead

As discussed in the report the potential levels of negative impacts on the natural environment are low to medium. Impacts and project related activities will be localised. A number of mitigating measures have been recommended that will assist in containing and reducing potential negative impacts on the natural environment.

There are no fatal flaws and no ‘no-go’ zones. The study site is also not within a pristine habitat, although within a demarcated CBA and threatened veldtype.

It is the professional opinion of the specialist that the project may proceed. That is, that the potential impacts on the natural environment are low and within acceptable levels and that the project should be authorised.

15 MITIGATION OF IMPACTS

The following mitigating measures are recommended to help reduce the potential negative impacts of the project on the natural environment. The implementation of recommended mitigating measures are necessary if the conclusions and assessments of the report are to remain pertinent. The main mitigating measures have been mentioned in Section 10: Impact Assessment, above. The mitigating measures below also include, obvious and best practice measures.

15.1 Construction Phase

- Only existing roads to be used by vehicles during construction. Roads to be rehabilitated after construction by contractors.
- 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.
- No temporary laydown areas or site offices, etc. may be established within 100m of any watercourses, with particular reference to the Nkumpi River.
- Proper rubbish/waste bins to be provided. These to be emptied weekly and the waste to be removed to an official waste disposal site.
- Areas denuded during construction phase to be rehabilitated with locally indigenous grass species. It is also recommended, but not obligatory for the contractor / client to plant locally indigenous trees such as bush willows (*Combretum* species) along the outer boundary of the site to add buffers and even improve the environment.
- Stormwater management plans to be compiled and implemented. Special attention to be given to areas along the northern and western boundaries of the site. It is in these areas that there is a slight down gradient and polluted water can potential flow from here into the Nkumpi River catchment.
- All watercourses are ‘no-go’ zones in terms of movement of people, vehicles and materials.
- No water may be extracted from the Nkumpi River for construction use, unless the client and the contractor have acquired the relevant permits.
- No vehicles, especially cement trucks may be washed down by the river.

- No construction vehicles may go within 100 m of the Nkumpi River and its riparian area.
- No trees to be cut down and removed unless within the actual development zone.
- There are protected trees on site. Therefore, any trees that need to be removed must first be discussed and authorised by the ECO and/or ecologist.
- Although not a priority species, all aloes found in the study area must be lifted and transplanted in a similar nearby habitat. No permit is required for this activity.

15.2 Operation Phase and Maintenance Phase

- Mechanical control of alien plants around disturbed areas 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 keeping out alien invasives. After first year weed control can form part of the routine maintenace programme.
- No chemical control (herbicides) of alien plants to be used within 100m of any watercourses.
- Inspection of access gravel roads to take place routinely and any erosion to be corrected.
- Stormwater systems to be check on a regular basis to ensure working properly and there are no leaks, blockages, erosion, siltation, etc.

16 APPENDICES

16.1 List of floral species identified on site and surrounding area

Trees & Shrubs

Acacia karroo, Acacia mellifera, Acacia nilotica, Acacia tortilis, Combretum apiculatum, Dichrostachys cinerea, Terminalia sericea, Peltophorum africanum, Searsia leptodictya, Grewia bicolor, Grewia monticola, Ziziphus mucronata, Euclea undulata, Dichrostachys cinerea, Diospyros lycioides, Grewia flava, Tarchonanthus camphoratus. Rhynchosia minima.

Grasses

Aristida bipartita, Dichanthium annulatum, Ischaemum afrum, Setaria incrassata, Aristida canescens, Brachiaria eruciformis.

Herbaceous Plants

Aspilia mossambicensis, Indigastrum parviflorum, Nidorella hottentotica, Orthosiphon suffrutescens, Senecio apiifolius

(d) = Dominant species

Also see Table 8, for listed alien invasive species.

Aquatic plants

None on site.

Red Data Listed (RDL) species present

None.

Protected Trees

Boscia foetdia, Sclerocarya birrea.

Note: Recent name changes are *Acacia* = *Vachellia*.
However, the name change was politically biased and did not follow proper scientific taxonomic nomenclature and is therefore not recognised by the author.

16.2 Photographs

Photo 1: Study site. Looking north with D3600 road on the left boundary

Photo 2: Study site. Looking south. Tall trees in photo are alien gum trees

Photo 3: Study site. Showing scars from historically cultivation of the area

Photo 4: Old buildings used for the show grounds. The tree in front is a marula tree

Photo 5: Close up of some buildings on the study site

Photo 6: Small vehicle track / footpath just north of study site heading towards the Nkumpi River. Rainy during taking of photo. Notice surface water flow and erosion on hard surface

Photo 7: Footpath near Nkumpi River that crosses over a small low water bridge

Photo 8: Nkumpi River. A fairly large perennial river

Photo 9: A stink shepherd's tree (pale trunk) directly in front of a marula tree photographed on site

17 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.

18 SHORT CV OF SPECIALIST

NAME: JOHANNES OREN MAREE

1. Education

Institution (Date from – Date to)	Qualification Obtained
Rand Afrikaans University (1984-1986)	B.Sc
Rand Afrikaans University (1987)	B.Sc (Hons.)
Rand Afrikaans University (1988)	M.Sc
Damelin College (1998)	Dip. Small Business Management
Oxford Brookes University (England) (1998-2000)	MBA

2. Membership of Professional Bodies

Registered with the SA Council of Natural Scientific Professions (SACNASP) Registration no. 400077/91.

3. Other Skills

- Diploma Public Speaking & Communications – Ambassador College (USA)
- SAQA accreditation and qualifications in training, assessing & service provision (AgriSeta)
- Co-Authored book: Cut Flowers of the World. 2010. Briza, Pretoria.

4. Experience

- Twenty five (25) years experience in botanical and ecological fields, including horticulture, floriculture and environmental
- Twelve (12) years experience in project management and consultancy
- Experience in environmental impact assessments for both linear developments and nodal developments
- Experience in Wetland identification, delineation and assessment.
- Extensive experience in biodiversity assessments in terms of fauna and flora
- Involved in numerous bird-monitoring programmes for projects related to mining, wind farms (wind turbine energy) and Eskom power lines
- Experience in field investigations and report writing

5. Professional Career

Date	Since 2000 to present
Organisation	People Texture Environmental Consultants
Location	Modimolle (Nylstroom), Limpopo Province.
Position	Member / Director. Specialist.
Description of Duties	Conduct specialist studies related to EIA projects. Specialist studies and consultancy includes ecological studies; wetland assessments; avifaunal impact assessments; Water Use Licence and other water related studies. Specialist environmental consultant, Environmental Control Officer (ECO). Specialist work involving field investigations and report writing.

Date	1997 - 2000
Organisation	Sunbird Flowers (Pty) Ltd
Location	Tarlton, Gauteng
Position	Technical Manager
Description of duties	Consulted on and managed projects in the agricultural & floricultural industries, with specific emphasis on high-yield agriculture. 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 (ie. Cut flower and vegetable production) including setting up of business plans, marketing, training and business costing. Conducted "turn-key" projects in most agriculture related fields. This included – Tunnel and greenhouse production; Hydroponics; vegetables, cut flowers; field crops.
Date	1993 - 1997
Organisation	Flori Horticultural Services
Location	Johannesburg, Gauteng
Position	Member / Owner
Description of duties	Duties were the exact same as when worked for Sunbird Flowers fulltime from 1997 – 2000. That is, Consulted on and managed projects in the agricultural & floricultural industries, with specific emphasis on high-yield agriculture. 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 (ie. Cut flower and vegetable production) including setting up of business plans, marketing, training and business costing. Did "turn-key" projects in most agriculture related fields. This included – Tunnel and greenhouse production; Hydroponics; vegetables, cut flowers; field crops.
Date	1989 - 1997
Organisation	Department of Environmental Affairs and Tourism
Location	National Department, Pretoria
Position	Environmental & Conservation Officer
Description of duties	Involved in environmental policies related to Nature Reserves in SA and conservation in general. Involved in auditing of nature reserves in SA. Involved in various environmental sensitive projects at the time. Eg. Richard's Bay Minerals (RBM) wanting to mine sand dunes along north coast of KZN (near St.Lucia). Involved in the very early stages of setting up of Vredefort Dome World Heritage Site. Main lead in Heritage Programme, which aimed to encourage farmers to preserve areas or features of natural significance on their farms.

6. Other relevant information

A list of some Specialist Studies completed (not exhaustive).

Project Title	Study conducted	Date of study	Client
Rehabilitation of Kelland Wetland, Johannesburg	Wetland Assessment; Rehabilitation Programme	March 2019	Eco Assessments Ecological & Environmental Consultants
Mariepskop Cellphone Mast	Ecological Assessment & Wetland Assessment	Sept 2018	Vodacom
Grootpan – Brakfontein 132kv Powerline	Environmental Control Officer	Aug 2018 – Jan 2019	ESKOM
Feasibility Master Plan for Ekurhuleni Metro Municipality waterbodies	Biodiversity, Strategic planning	Mar. 2015 – Mar. 2016	Ekurhuleni Metro Municipality
Platinum Zone Strategic Environmental Assessment North West Province	Biodiversity, Strategic assessment, Planning	Feb 2014 – Nov. 2014	Eskom & Motla Consulting Engineers
Construction of an 88KV powerline from the Middleburg-Uitkyk 88kV powerline to the Aerorand Substation	Wetland Assessment	March 2014	ESKOM
Upgrade of an existing 88kV powerline to a 132kV powerline between Marathon, Paardekop and Kiepersol Substations.	Wetland, Ecological and Avifauna Impact Assessments	March 2014	Wandima Environmental Consultants
Construction of an 132kV underground cable between Delmas DS and Delmas SAR Substations	Wetland Assessment	Feb 2014	ESKOM
Construction of a 132kV powerline between Vesel and Mokalaka Substations	Wetland, Ecological and Avifauna Impact Assessments	February 2014	Wandima Environmental Consultants
The proposed development of the Musina Ring Road N1-29	Wetland Assessment	Dec 2013	Chameleon Environmental Consultants
The partial reconstruction of national route R71 Section 1 from Km 34 to Km 39 between Polokwane and Tzaneen at Moria	Wetland & Ecological Assessments	Nov 2013	Chameleon Environmental Consultants
Township Development: Delineation of wetlands and other watercourses found on The Remainder and Portion 1 of	Wetland Assessments	Nov 2013	Rob Fowler & Associates

Holding 41, Barbeque Downs and Agricultural Holdings			
Township Development: Delineation of wetlands and other watercourses found on the premises of President Park Extension 42	Wetland Assessments	Nov 2013	Rob Fowler & Associates
Development of a sand-washing facility on Eenzaamheid Farm, near Witbank.	Wetland & Biodiversity Assessments	Nov 2013	Kego Mining (Pty) Ltd
Township Development: Lilyfield Phase 2. Delineation of watercourses on the premises of Noordwyk Ext. 85	Wetland Assessment	Sept 2013	George Chantler & Associates
Rerouting of the Twin Rivers, Mogase and Vaalkop T-off sections of powerlines. Construction of a switching station. Dismantling of old existing powerline sections	Wetland Assessment	August 2013	Shumani Environmental Consultants
Construction of a Chickadee 132kV Loop-Out powerline from the Pelly-Warmbad Backbone to the Rust de Winter Substation	Ecological Assessment	July 2013	ESKOM

19 DECLARATION

DECLARATION OF INDEPENDENCE

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

- Act as an independent ecologist, wetland specialist and environmental specialist in compiling this report;
- Do not have any financial interests, or stand to gain in any way whatsoever in the undertaking of this activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- Do not have, nor will have, any vested interest in the proposed activity proceeding;
- Have no, neither will engage in, conflicting interests in the undertaking of this activity;
- Undertake to disclose, to the competent authority, any material information that has, or may have, the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2014; and
- Will provide the competent authority with access to all information at my disposal regarding the investigations, studies and application, whether such information is favourable to the applicant or not.

The South African Council for Natural Scientific Profession (SACNASP) certifies that in terms of Section 20(3)(a) of the Natural Scientific Professions Act, 2003 (Act 27 of 2003), that Mr. J.O. Maree is registered as a Professional Natural Scientist.
Reg. No: 400077/91

Private Bag X5401; Silverton; Pretoria; 0127
Tel: (012) 841 - 1057

SIGNATURE: _____

NAME OF COMPANY: **Flori Scientific Services cc**

DATE: __24 May 2019 ____