NATIONAL ROUTE
N11 SECTION 13

BIODIVERSITY IMPACT ASSESSMENT

Terrestrial and Aquatic Ecological Assessments for the Proposed Upgrade and Rehabilitation of the National Route N11 Section 13 from Mokopane (km 1,3) to the Groot Sandsloot River (km 24,0) in the Mogalakwena Local Municipality of the Waterberg District Municipality, Limpopo Province

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STUDY NAME: Biodiversity Impact Assessment

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EXECUTIVE SUMMARY

Project Overview

The project involves the upgrade and rehabilitation of the National Route N11 Section 13, from Mokopane (km 1,3) up to the Groot SandSloot River (km 24,0) in the Mogalakwena Local Municipality of the Waterberg District Municipality, Limpopo Province.

The existing road is a single carriageway surfaced road with varying width stretching through areas as that can be classified as urban, semi-urban and rural. Only the area from about Km 16,5 can be regarded as predominantly urban. As part of the project three of the bridges will be rebuilt. These three bridges cross over the Dorps, Rooisloot, and Dithokeng Rivers.

Flori Scientific Services cc was appointed as the independent specialist consultancy to conduct specialist environmental studies for the project.

Field investigations were conducted on 27 January 2023.

Vegetation

The vegetation and natural environment of the study site is altered and degraded. This is to be expected for an environment along an existing road, which predominantly runs through an urban environment. The road reserve is also regularly cut / mowed and oftentimes burnt, which degrades and alters the natural vegetation mix, resulting in very few trees, and shrubs. The herbaceous layer of grasses and herbs is degraded and consists mostly of a few common grass species. There are a number of marula trees scattered along the length of the study site in the road reserve. Some of these trees are close to the road and will probably need to be removed during the construction / upgrade phase of the project.

During site investigations no red data listed (RDL) or orange data listed (ODL) plant species were observed

There are a number of marula trees (*Sclerocarya birrea*) along the study site route. The tree is a protected tree.

Watercourses

The main watercourses in the region of the study site are four rivers / streams that the existing N11 road crosses over. From Mokopane going north these watercourses (rivers / streams) are: Dorps; Rooisloot; Dithokeng; and Groot Sandsloot. There are no wetlands in the study area.

Drainage Regions

Below is a summary of the drainage region / catchment area for the study site.

Level	Category
Primary Drainage Area (PDA)	A
Quaternary Drainage Area (QDA)	A61F & A61G
Water Management Area (WMA) – Previous / Old	Limpopo

Water Management Area (WMA) – New (as of Sept. 2016)	Limpopo (WMA 1)
Sub-Water Management Area	Mogalakwena
Catchment Management Agency (CMA)	Limpopo (CMA 1)
Wetland Vegetation Ecoregion (WetVeg)	Central Bushveld (Group 4)
RAMSAR Site	No
River FEPA	No
Wetland FEPA	No
Fish FEPA	No
Fish FSA	No
Fish Corridor	No
Fish Migratory	No
National Strategic Water Source Area (SWSA)	No
Provincial important Water Source Area (WSA)	No

Priority areas

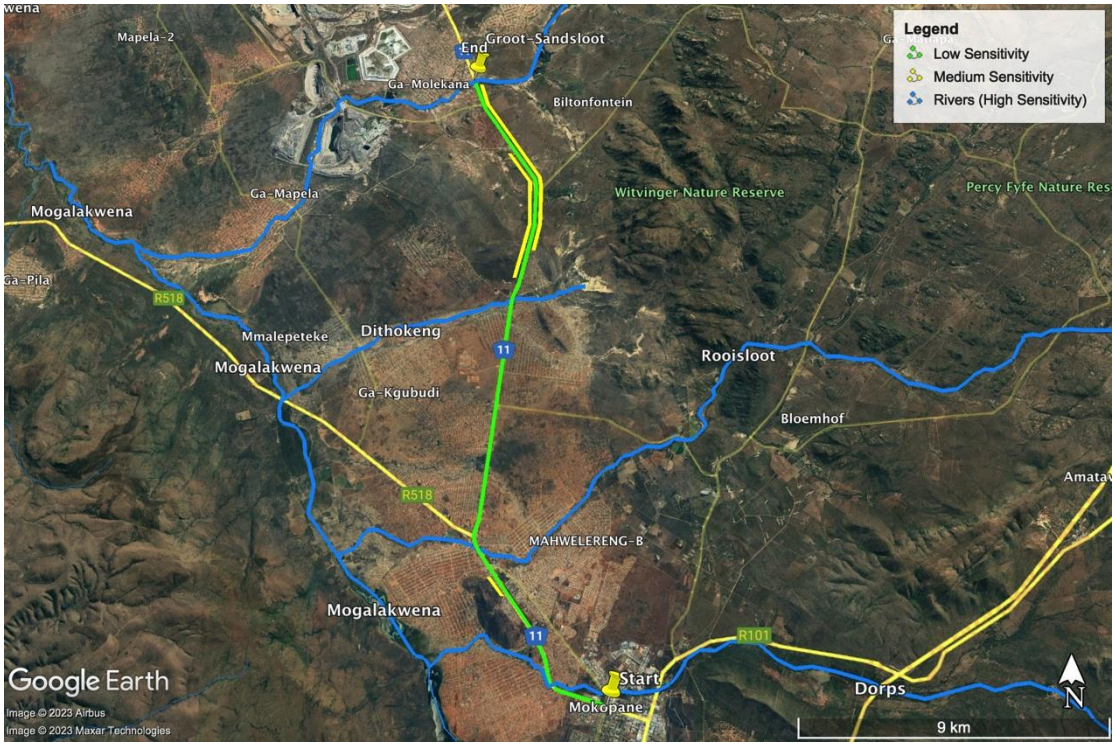
The study site is not within any national priority areas.

Fatal flaws

There are no fatal flaws and the project may proceed.

Sensitivity Maps

The biodiversity sensitivity for the entire study site (road and road reserve) is 'Low'. The rivers have a sensitivity of 'High' and therefore so do the crossings (bridges). There are a few areas markd as 'Medium'. These are areas outside of the study site but adjacent to it and include some open bushveld in the north (which also includes the demarcated Witvinger Nature Reserve); and the inselberg in the south (west of the N11). The second map shows the the area in black and white to better highight the demarcated senstivities of the study site and adjacent areas.



Sensitivity Map

Sensitivity Map (Black and White)

Buffer Zones

No buffer zones are required within the road or road reserve.

However, Buffer zones of 32m wide are recommended along the banks of the four main rivers / stream that the N11 Section 13 crosses over. These buffer zones site outside of the road and road reserve, but should extent all the way up and down along the watercourses. However, in terms of temporary laydown areas or site offices the buffer zone along watercourses is 100m.

Conclusions

The conclusions of the biodiversity study are as follows:

- The study site is within the original extent of Makhado Sweet Bushveld, which is not a threatened veldtype / ecosystem, and has a status of 'Least Concern'. However, most of the study area (road and road reserve) is transformed and altered environments with no pristine bushveld present.
- There are four main river / stream crossings, three of which are earmarked for upgrade.
- The study site (existing road and road reserve) runs through the western edge of the Witvinger Nature Reserve. However, the project will not impact any further on the reserve and will remain within the existing road reserve in this area.
- No red data listed (RDL) and orange data listed (ODL) floral species were observed in the study area and none are expected to occur.
- The study site runs through a CBA (in the north) and two ESAs. The ESAs are the corridors and shallow valleys in which the Dorps and Rooisloot Rivers flow.
- There are no obvious fatal flaws in terms of the natural ecology.
- It is likely that a General Authorisation (GA) process will be required for the project due to the proposed upgrade of the three watercourse crossings (bridges) which will require some work operations within and along the riverbanks.
- Taking all findings and recommendations into account it is the reasonable opinion of the author / specialist that the activity may be authorised. The project and related activities should be allowed to proceed.

Recommendations

The recommendations of the study are as follows:

- All recommended mitigating measures as proposed in this study and report should be implemented if the findings of this report are to remain pertinent. All of the recommended mitigating measures must form part of the conditions of the EMP.
- Some of the recommended mitigating measures are:

- Any temporary storage, lay-down areas or accommodation facilities to be setup in existing built-up areas or disturbed areas. No temporary storage areas, laydown areas or site offices are allowed within a **100m** of the edge of any river, stream or distinctive drainage line.
- No temporary storage areas, laydown areas or site offices are allowed within a **100m** of the edge of any river, stream or distinctive drainage line. That is, a **100m buffer zone** (no-go zone) for these sites are required along all watercourses.
- Ensure small footprint during construction phase
- An Erosion Plan to be implemented and monitored during the construction phase, especially in the area of riverbanks. The erosion potential is moderate to low. This also to further reduce the potential of siltation of the rivers. The plan need only be basic, but needs to be monitored.
- All hazardous materials must be stored appropriately to prevent these contaminants from entering the water environment;
- All excess materials brought onto site for construction to be removed after construction and their removal seen as part of the construction phase.
- No open trenches or mounds of soils to be left. All disturbed areas, including temporary laydown areas to be reshaped / re-contoured to blend in with the surrounding topography.
- Rehabilitation plan for disturbed areas to be compiled and implemented as part of the construction phase.
- No construction vehicles may drive through any streams or simply create new crossings outside of the proposed plans and EMPr conditions, which might include WUL or GA conditions. Existing roads to be used as much as possible, but these roads to be maintained during all phases of the project.
- No concrete or mounds of building sand and other materials may be stored temporary during the construction phase within **32m** of any watercourses, because a heavy rainstorm can wash these materials into the watercourse.
- Temporary access roads (if any) and temporary laydown sites, site office areas, etc. need to be monitored, maintained and rehabilitated at the end of the construction phase as part of the rehabilitation process.
- There are a few scattered marula trees in the study area. The marula is a national protected tree. Some are going to need to be removed and this will require a prior permit application process.
- A General Authorisation (GA) is going to be required for the project.

SPECIALIST EXPERTISE & DECLARATION

Expertise of Specialist

Qualifications & Expertise in: Terrestrial Ecology, Aquatic Ecology and Avifaunal Assessments.

- 2 Masters Degrees (MSc & MBA); 2 Diplomas (Business & Public Speaking).
- Co-Authored two books: Cut Flowers of the World. 2010 (1st ed) & 2020 (2nd ed), Briza, Pretoria.
- SAQA accreditation and qualifications in training, assessing & service provision (AgriSeta).
- Professional Memberships:
    - SA Council of Natural Scientific Professions (Reg. No. 400077/91)
    - South African Wetland Society (Reg. No: 998061)
    - Society of Wetland Scientists
- 21 years' experience in technical and managerial positions, project management and consultancy.
- 19 years' experience in writing of articles, books, training material, training & presentations.
- 14 years direct experience in EIAs.
- Has conducted hundreds of field investigations and compiled hundreds of technical specialist reports for EIAs, including ecological assessments (fauna & flora), wetland assessments and avifauna impact assessments.
- Projects involved in include power lines, roads, quarries, housing developments, mines and wind farms.

Declaration

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

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

- Act as an independent specialist in compiling this report;
- Do not have any financial interests, or stand to gain in any way in the undertaking of this activity, other than remuneration for work performed;
- Do not have, nor will have, any vested interest in the proceeding activity or project;
- 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; and
- Will provide competent authority access to my information regarding the report and investigations, whether such information is favourable to the applicant or not.

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ACRONYMS

CBA	Critical Biodiversity Areas
CMA	Catchment Management Agencies
DEA	Department of Environmental Affairs (Old name for DFFE)
DFFE	Department of Forestry, Fisheries & the Environment
DWS	Department of Water and Sanitation
EIS	Ecological Importance & Sensitivity
EMC	Environmental Management Class
ESA	Ecological Support Area
HGM	Hydrogeomorphic
IBA	Important Bird Area(s)
MAP	Mean Annual Precipitation
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy
ODL	Orange Data Listed
PDA	Primary Drainage Area
QDA	Quaternary Drainage Area
RDL	Red Data Listed
REC	Recommended Ecological Category (or Class)
REMC	Recommended Ecological Management Category (or Class)
SANBI	South African National Biodiversity Institute
SCC	Species of conservation concern
SWSA	Strategic Water areas of South Africa
TOPS	Threatened or Protected Species
WMA	Water Management Areas

1 BACKGROUND

1.1 Project Overview

The project involves the upgrade and rehabilitation of the National Route N11 Section 13, from Mokopane (km 1,3) up to the Groot SandSloot River (km 24,0) in the Mogalakwena Local Municipality of the Waterberg District Municipality, Limpopo Province.

The existing road is a single carriageway surfaced road with varying width stretching through areas as that can be classified as urban, semi-urban and rural. Only the area from about Km 16,5 can be regarded as predominantly urban. As part of the project three of the bridges will be rebuilt. These three bridges cross over the Dorps, Rooisloot, and Dithokeng Rivers.

Flori Scientific Services cc was appointed as the independent specialist consultancy to conduct specialist environmental studies for the project.

Field investigations were conducted on 27 January 2023.

1.2 Purpose for the Study

The purpose of the study is to conduct a biodiversity impact assessment that consists of a terrestrial and an aquatic ecological assessment (biodiversity assessment) to determine the ecological sensitivities and habitats of the study area. To investigate the fauna and flora and determine if there are any priority species present. To investigate the presence of watercourses and, if present, to delineate and assess them. Furthermore, the purpose of the study is to identify any potential fatal flaws, assess impacts, delineated buffer zones (if required), and to recommend mitigating measures aimed at reducing any potential negative impacts the project may have on the natural environment.

1.3 Quality and Age of the Base Data Used

The latest data sets were used for the report in terms of background information.

The source and age of the data used included the following:

- Threatened ecosystems: SANBI (www.bgis.sanbi.org) and NEMBA (G 34809, GoN 1002), 9 December 2011).
- Protected areas: Protected Areas Register (PAR): DFFE – (https://portal.environment.gov.za).
- RDL species: Red List of South Africa Plants (latest update) – (www.redlist.sanbi.org).
- Veldtypes and ecosystems: Mucina & Rutherford, 2006. Updated 2012, 2018.
- SANBI data sets – latest updated website data (www. bgis.sanbi.org).
- Environmental Screening Tool – Dept. of Environmental Affairs (Now DFFE) (www.environment.gov.za).
- National Freshwater Ecosystem Priority Areas (NFEPA) – DWS & SANBI databases.
- National Wetland Map 5 (2018) – CSIR, SANBI (www.bgis.sanbi.org).
- Limpopo Conservation Plan (Version 2).

1.4 Assumptions and Limitations

The assumptions and limitations for the assessment were as follows:

- All information regarding the project as provided by the Client is taken to be accurate.
- This study focuses on the biodiversity (terrestrial and aquatic ecology) of the study site.
- Field investigations were conducted on 27 January 2023, which is during the wet season (summer season) for the region.
- Previous specialist studies been conducted in the region. These along with the current studies allow specialists to collect sufficient and quality data to be able to make well-informed decisions and recommendations for the proposed project. Although the general area is investigated as well, roads create small and narrow footprints, which make it easier to investigate. Therefore, no additional field investigations are required or recommended, including a dry season (winter season) assessment.
- Precise buffer zones or exact GPS positions cannot be made using generalised corridors or KML files on Google Earth. However, the buffer zones, delineations, etc. drawn on maps and obtained in kml files, shapefiles, etc. are accurate to within 2-3m;
- Standard and acceptable methodologies were used, as required and used in South Africa.
- 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 (ground-truthing). This includes the important DEA Screening Tool assessment.
- **NOTE**: Recommendations put forward in the report are based on actual biodiversity and specialist findings, but this does not mean that legal requirements do not still apply. In other words, recommendations do not negate legal requirements as set out in various acts such as NEMA (Act 107 of 1998) and NEMBA (Act 10 of 2004). For example, a buffer zone of 15 m from the edge of a watercourse might be recommended as adequate, but this does not negate the fact that such activities still trigger regulations such as the 32m from a watercourse, as set out in Listed Activities.
- No specific or highly specialised scientific equipment were used except standard soil augers, hand-held Garmin GPS instruments, relevant computer programmes, etc.
- There were no limitations encountered that hindered the project or potentially impacted on any outcomes of the study. All areas of the study site were able to be easily accessed and assessed.

2 METHODOLOGY

2.1 Desktop Assessment

An initial desktop assessment was conducted regarding the main fauna and flora and watercourses of the region and study site. The primary sources used were those mentioned above in Section 1.3. Red data listed (RDL) and other priority species listed by the National Environmental Management: Biodiversity Act (Act No. 10 of 2004), as well as in other authoritative publications were also consulted. 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 taken into account.

2.2 Field surveys

During field surveys cognisance was taken of all environmental features and attributes, namely: Biophysical environment; Regional and site specific vegetation; Habitats ideal for potential red data fauna species; Sensitive floral habitats; Red data listed (RDL) fauna and flora species; Protected fauna and flora species; and Watercourses.

Digital photographs and GPS reference points of importance were recorded and used in the report where applicable.

2.3 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 of watercourses found in the study area is 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). The criteria used for assessing the habitat integrity or present ecological state (PES) of watercourses can be found below in Table 1, along with Table 2, which describes 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 watercourse.

Table 3 gives a short description of each category. The approach is based on the assumption that extensive degradation of any of the attributes may determine the PES of the watercourse (DWA, 2005).

Table 1: 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	Over-grazing, over-fishing, over-harvesting of plant material, etc.

Table 2: Scoring Guidelines for Habitat Assessment Criteria

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 3: Wetland Integrity Categories

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

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

2.4 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 4).

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 / watercourse / wetland in

terms of EIS, PES and function, and the desire to with realistic recommendations and mitigating actions to return the system to a certain level of functionality and original state. The determination of the Environmental Importance and Sensitivity (EIS) of the watercourses identified in the study area are shown below (Table 4).

Table 4: EIS Categories and Descriptions

EIS Categories	Median Range	Category
Watercourses that are considered ecologically important and sensitive on a **national or international** level. The biodiversity of these watercourses 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
Watercourses that are considered to be ecologically important and sensitive. The biodiversity of these watercourses 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
Watercourses that are considered to be ecologically important and sensitive on a **provincial or local** scale. The biodiversity of these watercourses 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
Watercourses that are not ecologically important and sensitive on any scale. The biodiversity of these watercourses 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

2.5 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 and habitats 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 RDL species;
- Landscape and/or habitat sensitivity;
- Current floristic status, including diversity; and
- Ecological fragmentation.

2.6 Faunal Sensitivity

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

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

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

2.7 Rating Scale for Floral and Faunal Sensitivity

Floristic and/or Faunal 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 or even 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 unit is subjectively rated on a scale of **1 to 10 (Sensitivity Values)** in terms of the influence that the particular Sensitivity Criterion has on the floristic or faunal status of the plant or animal community / habitat.

2.8 Faunal Assessment – Species of Conservation Concern

Literature was reviewed and relevant experts contacted to determine which faunal species of conservation concern (which include Red Data Listed (RDL) 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 RDL fauna species. Particular emphasis was therefore placed on the identification of habitat deemed suitable for the potential presence of RDL fauna species by associating available habitat to known habitat types of RDL species. The verification of the presence or absence of these species from the study area is not perceived as a complete or fundamental part of site investigation as a result of project limitations.

2.9 Fauna Red Data Sensitivity Index Score (RDSIS)

Field investigations limited to a few days can seldom, if ever, be comprehensive in terms of identifying all faunal species, let alone Red Data Listed (RDL) Species and/or priority species. Included is the reality that many faunal species are highly mobile and might be moving in and out of an area, which makes observing these species sometimes incidental and fortunate, depending largely on time and chance. Added to this are the species that are primarily nocturnal in nature.

For the above reasons, the Red Data Sensitivity Index Scoring (RDSIS) method for fauna is widely used by specialists involved in EIAs, specialist studies, etc. The RDSIS methodology provides a calculated indication for the potential of certain red data or priority species occurring in the study area. The index is based on historical data, present presence of ideal habitat and food sources, general inferences on the landuses of the region and the Specialist's knowledge and experience.

2.9.1 Probability of Occurrence (POC)

Known distribution range (D), habitat suitability of the site (H) and availability of food sources (F) on site is determined for each of the species. Each of these variables is expressed a percentage (where 100% is a perfect score). The average of these scores provides a POC score for each species.

The POC is calculated as follows:

POC = (D+H+F) / 3

The POC value is then categorised as follows:

- 0-20% = Low
- 21-40% = Low / Medium
- 41-60% = Medium
- 60-80% = Medium/High
- 81-100% = High

2.9.2 Total Species Score (TSS)

Species with a POC score of more than 60% (Medium/High) are considered when applying the RDSIS. A weighting factor is assigned to the different IUCN categories providing species with a higher conservation status, a higher score. This weighting factor is then multiplied with the POC to calculate the total species score (TSS) for each species.

The weighting assigned to each category rating is as follows:

Status Category	Abbreviation	Weighting
Data deficient	DD	0,2
Rare	RA	0,5
Near Threatened	NT	0,7
Vulnerable	VU	1,2

Endangered	EN	1,7
Critically Endangered	CR	2,0

The TSS is calculated as follows:

TSS = (IUCN weighting x POC) where POC is > 60%.

2.9.3 Average Total Species & Average Threatened Taxa Score

The average of the Total Species (TSS) potentially occurring on the site is calculated. The average of all the Threatened Taxa (TT) (Near threatened, Vulnerable, Endangered and Critically Endangered) TSS scores are also calculated. The average of these two scores (Av.TSS and Av.TT) is then calculated in order to add more weight to threatened taxa with POC higher than 60%.

The average is calculated as follows:

Average = (Avg. TSS [TSS / Tot. Species] + Av.TT [TT TTS / No. of species]) / 2

2.9.4 Red Data Sensitivity Index Score (RDSIS)

The average score obtained above and the sum of the percentage of species with a POC of >60% of the total number of Red Data Listed species listed for the area is then calculated. The average of these two scores, expressed as a percentage, gives the RDSIS for the area investigated.

The RDSIS is calculated as follows:

RDSIS = (Average + [Spp. with POC >60% / Total No. Spp*100]) / 2

The RDSIS Category ratings are categorised as follows:

RDSIS Score	Category Rating
0 – 20%	LOW
21 – 40%	LOW / MEDIUM
41 – 60%	MEDIUM
61 – 80%	MEDIUM / HIGH
81 – 100%	HIGH

2.10 Impact Assessment

2.10.1 Scoring Method

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 scoring method (rating 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 in the table below (Table 5)

Table 5: Scoring Method for Impact Assessment

Magnitude (Intensity)	**Duration**
10 - Very high/unknown	5 - Permanent
8 - High	4 - Long-term (Impact ceases after operational life of the activity
6 - Moderate	3 - Medium-term (5-15 years)
4 - Low	2 - Short-term (0-5 years)
2 - Minor	1 - Immediate
0 - None	0 - None
Scale (Extent)	**Probability**
5 – International	5 – Definite / Unknown
4 – National	4 – Highly probable
3 – Regional	3 – Medium probability
2 – Local	2 – Low probability
1 - Site only	1 – Improbable
0 – None	0 – None

Once the above factors had been ranked for each impact, the overall risk (environmental significance) of each impact will be assessed using the following formula:

Significance (SP) = [Magnitude (M) + Duration (D) + Scale(S)] x Probability (P).

The maximum value is 100 significance points (SP). Environmental impacts will be rated as either that of High, Moderate or Low significance on the following basis:

- SP ≥60: Indicates **high** environmental significance;
- SP 31 ≥ 59: Indicates **moderate** environmental significance;
- SP ≤ 30: Indicates **low** environmental significance.

2.10.2 Criteria for the classification of an impact

Scale (Extent)

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 the country
- International: Impact is across countries

Duration

Indicates what the lifetime of the impact will be.

- Immediate: The impact will either disappear with mitigation or will be mitigated through natural process in a time span shorter than the construction phase.
- Short-term: The impact will either disappear with mitigation or will be mitigated through natural process within 0 – 5 years.
- Medium-term: The impact will either disappear with mitigation or will be mitigated through natural process within 5 – 15 years.
- 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. Impact ceases after the operational life of the activity.
- 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.

Magnitude (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 / Unknown: 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.
- Low probability / possible: The impact may occur.
- Medium probability: It is more than likely that the impact will occur.
- Highly probable: High likelihood that the impact will occur.
- Definite / Unknown: The impact will definitely (most certainly) occur, or is unknown and therefore needs to be afforded a high probability score.

Significance

Significance (environmental significance) constitutes the overall risk and 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.

Status

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

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

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

3 RECEIVING ENVIRONMENT

3.1 Study Site Location

The study site (project site) is the existing National Route N11 Section 13, which is from Mokopane (Potgietersrus) (km 1,3) to the Groot Sandsloot River (km 24,0) in the Mogalakwena Local Municipality of the Waterberg District Municipality, Limpopo Province. The study area is the existing road and the road reserve and includes bridges along the route.

Below are some of the main coordinates for the project:

- Start of N11 Section 13: 24°10'37.95"S; 29° 0'6.36"E.
- End of N11 Section 13: 23°59'31.91"S; 28°57'33.84"E.
- Mokopane: 24°10'47.80"S; 29° 0'25.85"E.
- Quarter Degree Square (QDS): 2429AA; 2428BB; 2328DD.
- Quaternary Drainage Area (QDA): A61F, A61G.

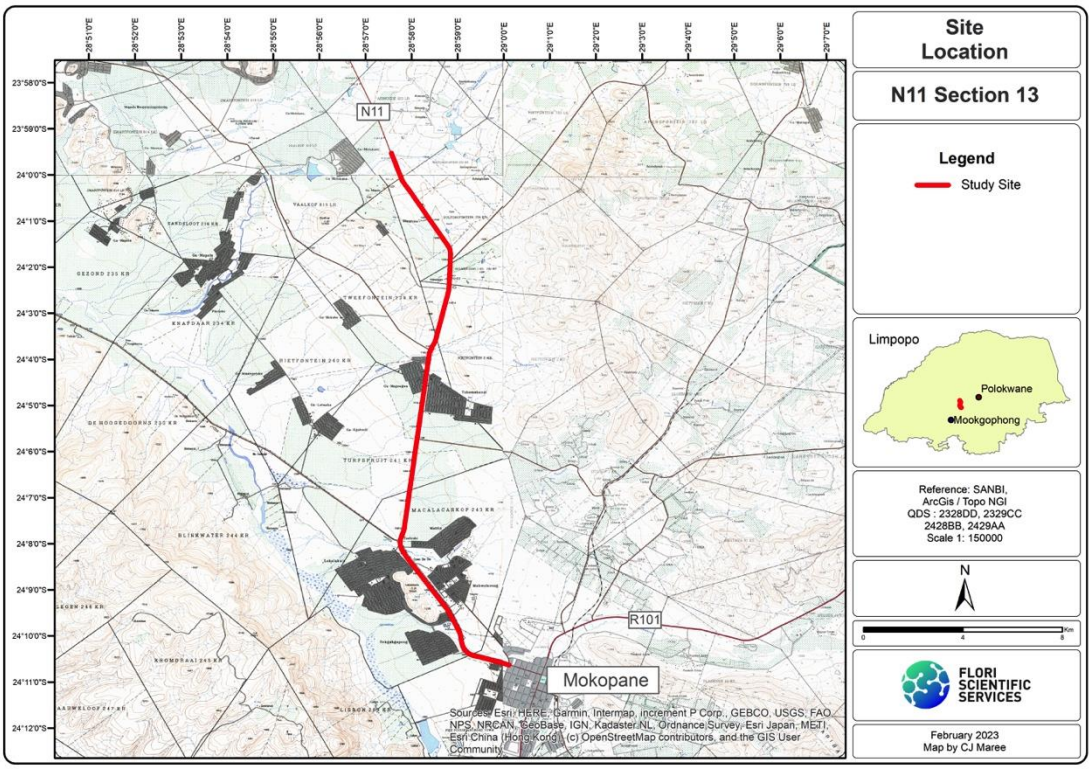


Figure 1: Study Site location

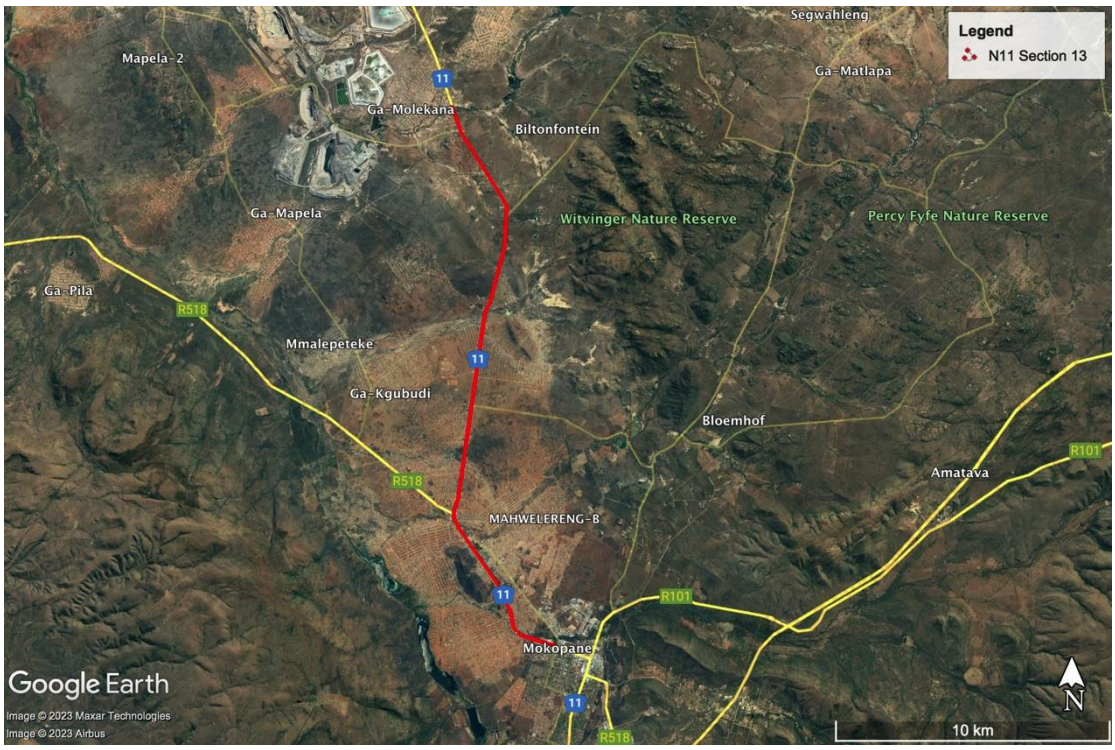


Figure 2: Study Site Location (Google Earth)

3.2 Topography

The topography of the study area is open flat to undulating low hills with shallow, valleys in which small seasonal and semi-perennial streams are typically found. The topography of the site and surroundings has been modified to an extent typical of the construction of roads and urban areas. The average height above sea level across the study site is 1 132m, with a maximum and minimum elevation of approximately 1 221m and 1 078m, respectively. The average gradient (slope) is low at about 1,4%, with maximum slopes of 5,1% - 4,0%.

3.3 Geology and Soils

The geology and soils of the study site and surrounding areas vary quite a bit over the length of the route. In general the area is underlain by the gneisses and migmatites of the Hout River Gneiss (Randian Erathem) and the potassium-deficient gneisses of the Goudplaats Gneiss (Swazian Erathem). Sandstones and mudstones of the Matlabas Subgroup (Mokolian Waterberg Group) are also found. Soils include deep, greyish sands, eutrophic plinthic catenas, red-yellow apedal freely drained soils with high base status, clayey in bottomlands. Land types mainly Bd, Bc, Ae and Ia (Mucina & Rutherford, 2010). Short descriptions of the prominent landtypes of the study area are shown below (Table 6).

Table 6: Description of land types found in the region

Land Type	Description
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).
Bc & Bd	Plinthic catena: Upland duplex and margalitic soils rare (Eutrophic; red and/or yellow soils). Mainly red (Bc) or yellow (Bd), apedal (= structureless) soils, which are eutrophic (= high base status). They have a moderate to high fertility status and a wide textural range, mostly sandy loam to sandy clay loam. Soils contain a greyish subsoil layer (plinthic) where iron and manganese accumulate in the form of mottles, due to a seasonally fluctuating water table. With time these mottles may harden (or even cement) to form concretions. These plinthic layers will cause restricted water infiltration and root penetration. In drier areas, however, they may help to hold water in the soil that plants can use.
Ia	Miscellaneous land classes (Undifferentiated deep deposits). Usually deep pedologically youthful soils, which occur mostly along river courses, valley bottoms and in lower lying areas. Soils are usually weakly structured, with a great variety of colour (often mottled) and often, several layers have been deposited (usually by water) with different soil textures.

3.4 Climate

The study site is situated within the medium rainfall zone of 401mm – 600mm per annum (Figure 3) and in the Temperate Interior Climatic Zone of South Africa (Figure 4).

The study site is within a summer rainfall region of South Africa, with very dry winters. The site is situated within and nearby to the Town of Mokopane (Potgietersrus).

Mokopane has an average annual rainfall of around 495mm, with most of the percipitation in the summer months of December to February (en.climate-data.org). The summers are warm to hot, while the winters are moderate to cold, but seldom very cold or with severe frost. The cool winter mornings usually become warm and pleasant later during the day.

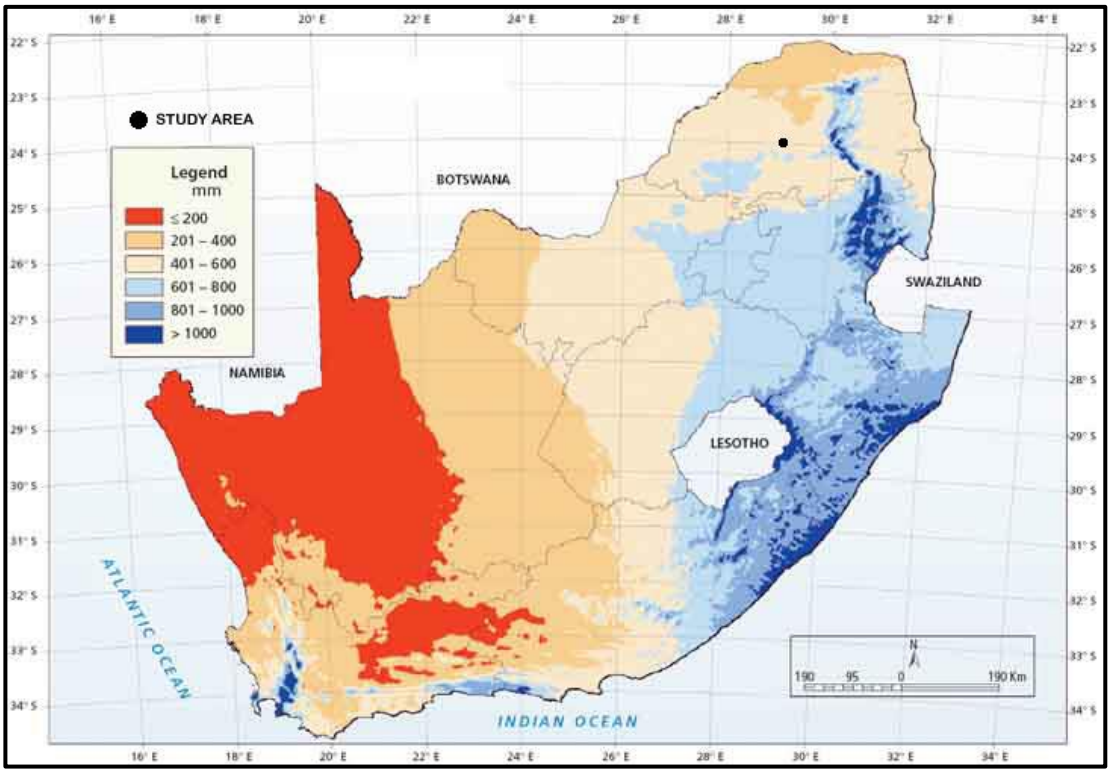


Figure 3: Rainfall zones of South Africa

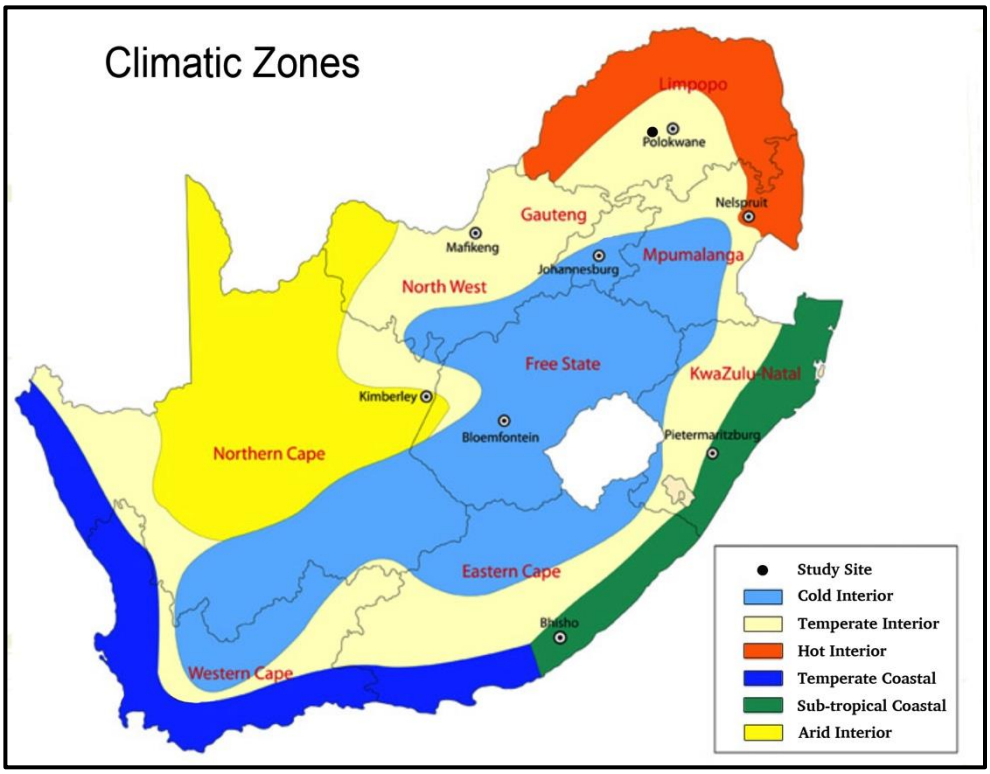


Figure 4: Climatic zones of South Africa

3.5 Landcover

The landcover of the study site is that of the existing single carriageway surfaced road and road reserve. The first +/-15km of the road (N11) runs through urban, built-up areas. The last 8-9km is more open, rural area.

3.6 Vegetation

3.6.1 General vegetation

South Africa is divided up into nine major biomes. The study area is situated within the Savanna Biome (Figure 5). 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 study site is within the vedltype commonly known as **Makhado Sweet Bushveld**. The veldtype / ecosystem is not threatened and has a status of 'Least Concern' (Skowno, 2019).

Table 7, below, shows the hierarchy and classifications of the vegetation of the study area.

Table 7: Vegetation classification of the study site

Category Description	Classification
Biome	Savanna
Bioregion	Central Bushveld

Vegetation Types	Eastern Highveld Grassland
Status	Least Concern – Not threatened

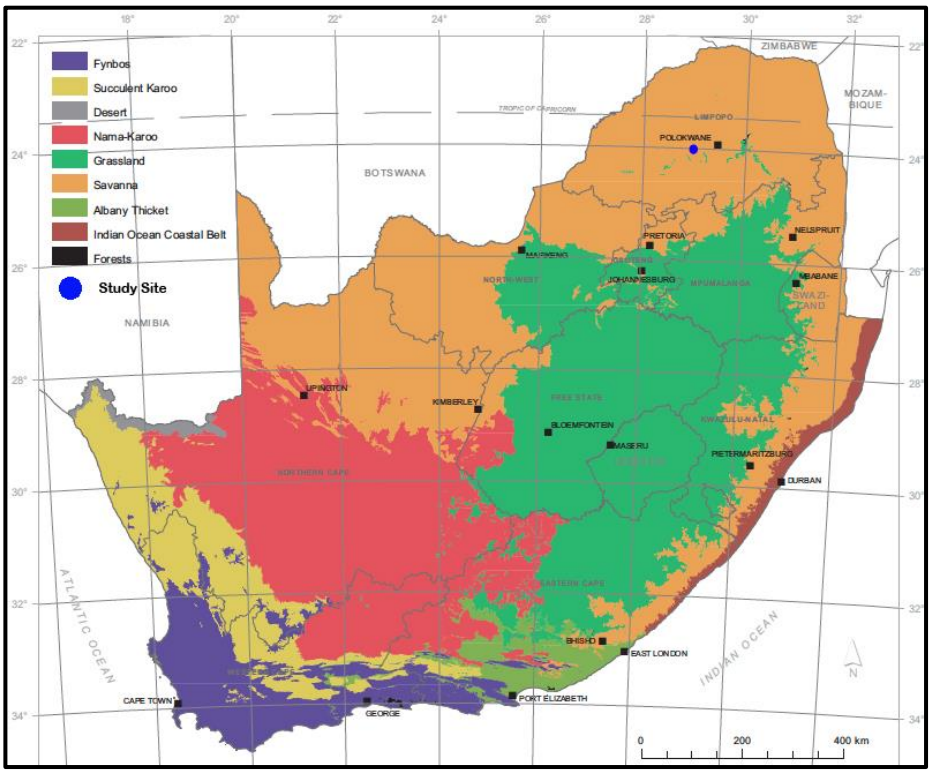


Figure 5: Biomes of South Africa

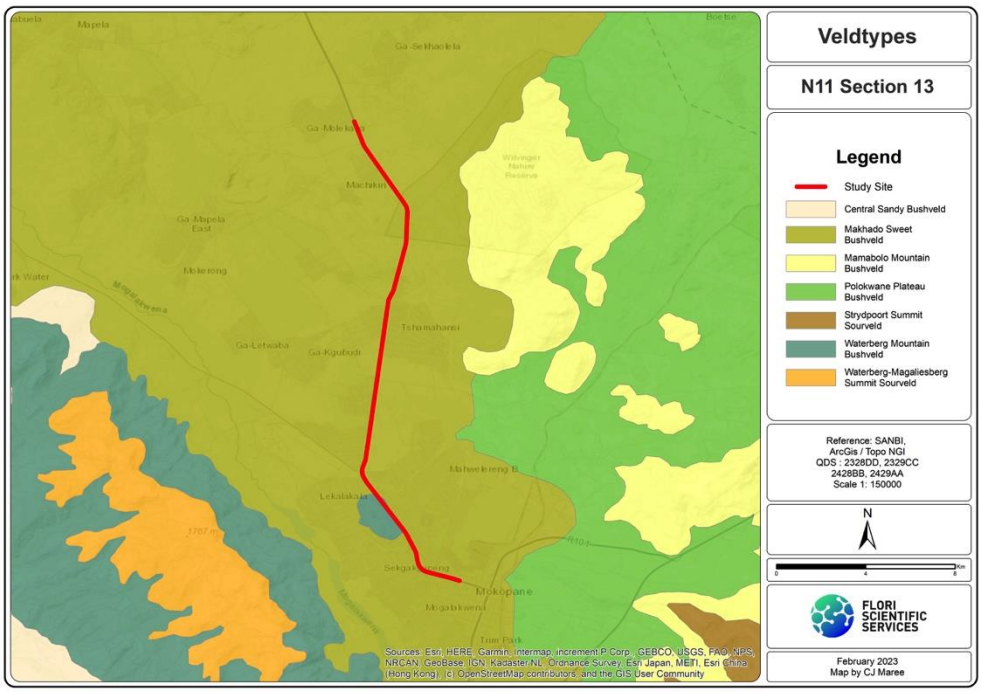


Figure 6: Veldtypes

Makhado Sweet Bushveld characterised by slightly to moderately undulating plains sloping generally down to the north, with some hills in the southwest. The veldtype has a short and shrubby bushveld with a poorly developed grass layer (Mucina & Rutherford, 2010).

3.6.2 Vegetation of the Study Area

The vegetation and natural environment of the study site is altered and degraded. This is to be expected for an environment along an existing road, which predominantly runs through an urban environment. The road reserve is also regularly cut / mowed and oftentimes burnt, which degrades and alters the natural vegetation mix, resulting in very few trees, and shrubs. The herbaceous layer of grasses and herbs is degraded and consists mostly of a few common grass species. There are a number of marula trees scattered along the length of the study site in the road reserve. Some of these trees are close to the road and will probably need to be removed during the construction / upgrade phase of the project.

During site investigations no red data listed (RDL) or orange data listed (ODL) plant species were observed. The only priority species observed is the marula, which is a national protected tree.

A list of floral species observed during field investigations is found in the appendices.

Table 8: Photos of the Vegetation in the Study Area

	Study Site (N11 Section 13) near the start on the outskirts of Mokopane central

	Study Site showing the lack of vegetation in the road reserve and the damaged and wash away edges of the road shoulder
	Study Site (N11 Sec 13) highlighting lack of vegetation in the road reserve, including trees and general bushveld
	Study site in the northern section where it is still a bit more rural. Here lack of bushveld (trees and shrubs) in the road reserve is evident. Some degraded Makhado Sweet Bushveld is seen along the road, outside of the fenced road reseve

	Study Site near the Witvinger Nature Reserve. Only grass and some common herbaceous plants are found growing in the road reserve. The large trees along the road in the background are alien gum trees

3.7 Priority Floral Species

During field investigations no red data listed (RDL) (Critically endangered, endangered or vulnerable) species were observed within the proposed project area. No orange data listed (ODL) plant species were observed either.

The only priority species in the study area that would be impacted is the marula (*Sclerocarya birrea*). There are approximately 41 trees within the study area, of which some will need to be removed and others will not need to be impacted on at all.

3.8 Protected Trees

There is one species of national protected tree within the study area, namely marula (*Sclerocarya birrea*). There are no provincially protected trees. The marula trees are scattered along the length of the study site within the road reserve. Removal of any of these trees will require a tree permit application and process through DFFE.

	Large marula tree growing close to the existing N11 Section 13. This tree will most likely need to be removed.
	A few small / medium marula trees growing along the outer edge of the road reserve. These trees might not need to be removed.

3.9 Conservation status

The conservation status of the veldtype in which the study site is situated is not threatened and has a status of 'Least Concern' (bgis.sanbi.org.za, NEMBA (G 34809, Government Notice 1002), 2011. Skowno, 2019) (Table 9).

Table 9: Veldtype status

Veldtype	Status	Info
Makhado Sweet Bushveld	Least Concern (LC)	About 1% statutorily conserved, mainly in the Bellevue Nature Reserve. Some 27% transformed, mainly by cultivation, with some urban and built-up areas. The southwestern half of the unit has densely populated rural communities (Mucina & Rutherford, 2010).

Table 10 below, gives a basic description of the status categories. 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 10: 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.

Figure 7 uses the term 'Least Concern' which is similar to that of 'Least Threatened'.

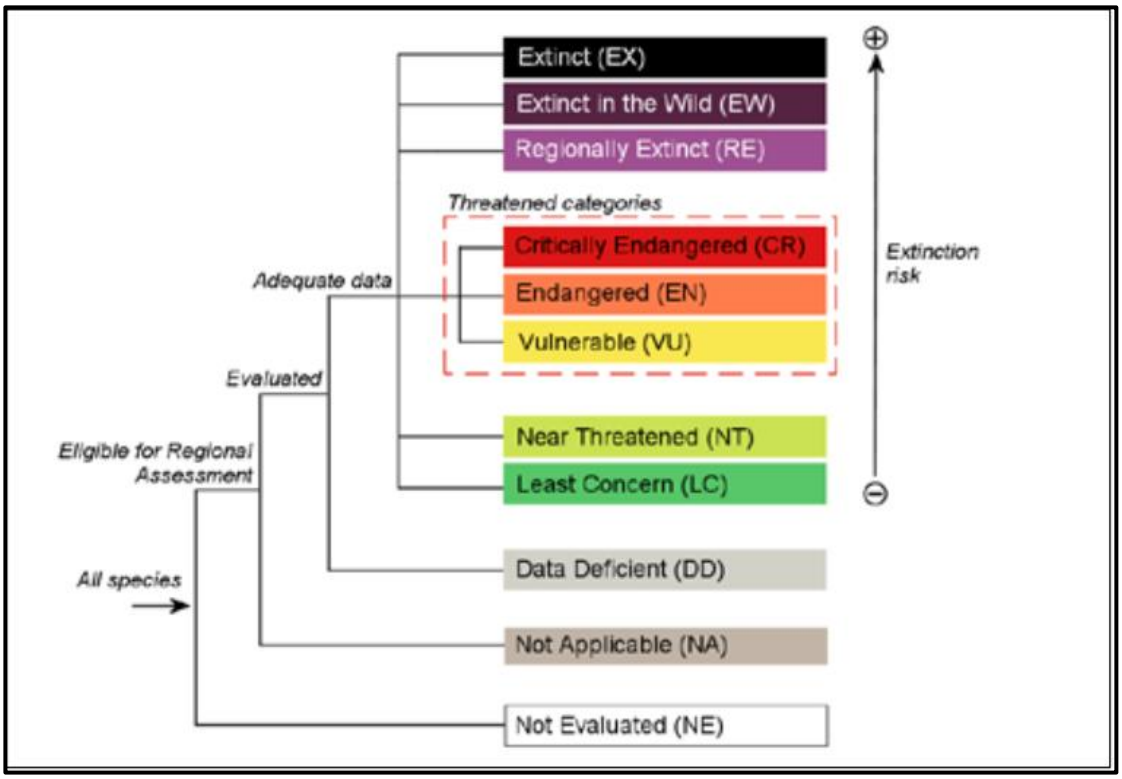


Figure 7: Structure of categories used at the regional level

3.10 Watercourses in the study area

The main watercourses in the region of the study site are four rivers / streams that the existing N11 road crosses over. From Mokopane going north these watercourses (rivers / streams) are: Dorps; Rooisloot; Dithokeng; and Groot Sandsloot (Figure 8).

The GPS locations of these four crossings are shown below in Table 11.

Figure 9, below, is the latest National Wetland Map (Map 5, 2018), which shows the extent of the wetlands in the area. The Rooisloot and Groot Sandsloot Rivers are shown in Map 5 as 'Valley Bottom Wetlands'. However, these are actually better defined as small rivers or streams that have associated wetlands elements.

There are no true wetlands along the length of the study site. There are a number of stormwater culverts under the road which are common, to allow for the free flow of surface stormwater of a downpour. These are not watercourses and have therefore not been delineated.

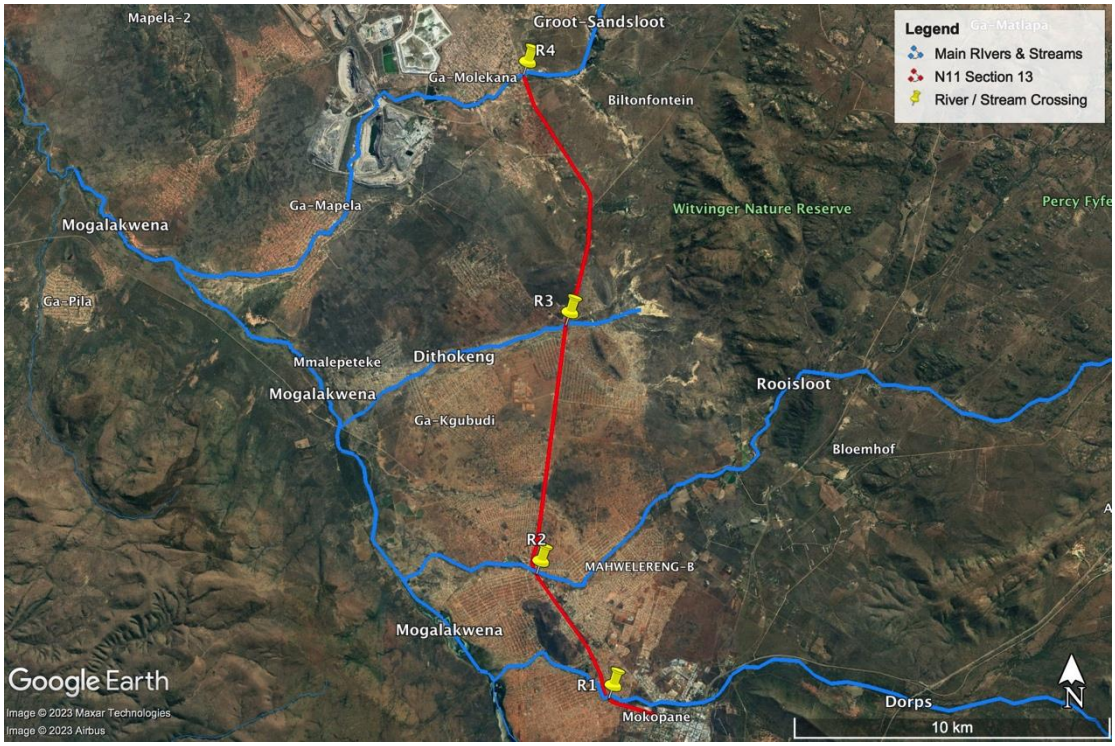


Figure 8: Main Watercourses in the Region

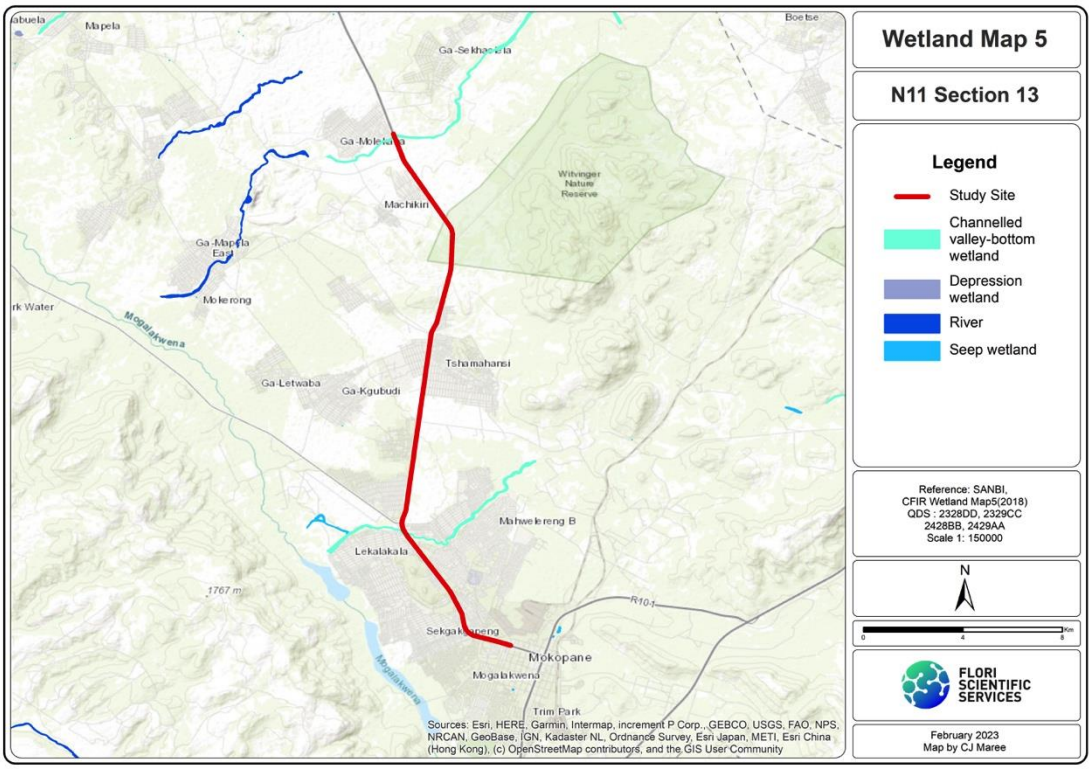


Figure 9: National Wetland Map (Map 5, 2018)

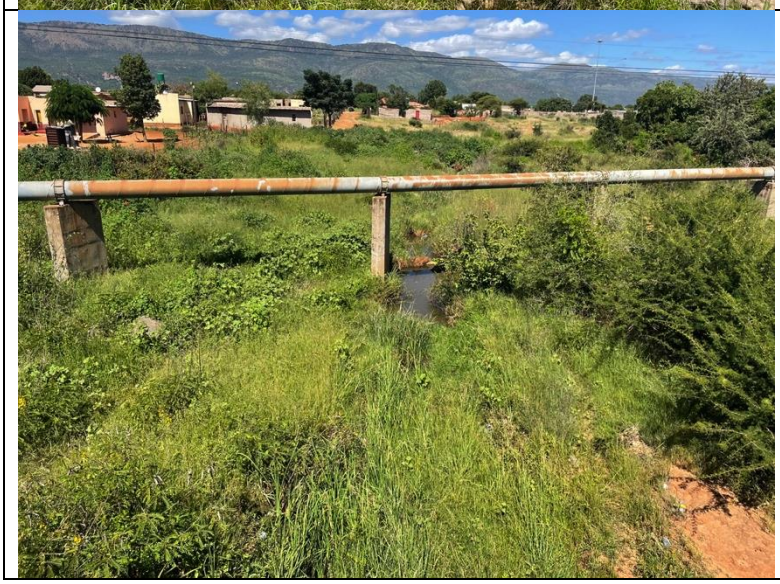
Table 11: Main Watercourse crossings

Map ID Number	Coordinates	Type of Watercourse

R1	24°10'20.93"S; 28°59'11.89"E	River / Stream
R2	24° 8'11.98"S; 28°57'49.81"E	River / Stream
R3	24° 3'54.26"S; 28°58'22.96"E	River / Stream
R4	23°59'35.02"S; 28°57'35.06"E	River / Stream

Table 12: Photos of watercourses in the study area

	Dorps River Bridge on the N11 (See R1 in Figure 8)
	Dorps River showing the small highly polluted narrow main channel and high levels of alien plant infestation. Most of the vegetation in picture is alien. During the time of the site visit the water was grey and smelly due to very high levels of raw sewage contamination

	Rooisloot Bridge on the N11 (see R2 in Figure 8)
	Upstream of the Rooisloot with a narrow main channel. Notice the weir across the stream in the top of the picture
	Downstream of the Rooisloot. The stream is small with a fairly wide floodplain. The riparian vegetation is badly degraded with removal of resources by locals and infestation by alien invasive plants. The water was also polluted by did not have raw sewage running in it as in the case of the Dorps River (at the time of the site visit)

	Dithokeng Bridge on the N11 (see R3 in Figure 8)
	The Dithokeng upstream of the N11. The flow was very low and stagnant during the site investigation, which was conducted after a lengthy period of above average rainfall. The stream has no distinctive riparian zone and moderately levels of alien plant infestation, compared to the Dorps and Rooisloot.
	The Dithokeng immediately downstream of the N11. The flow was stagnant with small areas of ponding. The dominant small trees / shrubs in and along the river were indigenous, local thorn trees.

	Groot Sandsloot Bridge on the N11 (see R4 in Figure 8)
	Groot Sandsloot upstream of the bridge. The level of alien weed infestation is moderate to low and the water quality is much better than those of the first two river crossings. The stream is more rural with less built-up areas along its' course upstream.
	Groot Sandsloot downstream of the bridge. The river has been badly altered by in-stream sand mining. The bulrushes and water ponding in the middle of the picture is the result of sand mining and not a natural feature

	Large flat area with heavy soils creating ideal conditions for thicker grass growth. This entire area has historically been heavily ploughed, cultivated and farmed. The area is not a watercourse as such. Present impacts include construction of houses and buildings in the area, and continued cultivation of the soils. There are a number of stormwater culverts under the road to facilitate free movement of surface water and avoid ponding. Looking east (See Figure 10)
	Houses being constructed in the flat area. Looking west.

There is a large, very flat open plain near Mozombane Village. The area is between the Rooisloot and Dithokeng Streams (Figure 10). The area has heavier soils than surrounding areas and therefore surface stormwater remains longer in the area, creating ideal conditions for heavier plant growth. The area has historically been heavily and continually ploughed and cultivated because of these properties. Presently there are still numerous cultivated lands as well as large-scale development of houses and other structures in this area. This may lead to flooding during periods of high rainfall. There are numerous stormwater culverts under the N11 road to facilitate the free movement of surface stormwater and to prevent ponding. The area is not seen as a watercourse and was therefore not delineated.

Figure 10: Large flat area with heavy soils near Mozombane Village

3.11 Classification of Watercourses in the Study Area

The classifications of the watercourses in the study area and general area are shown below, in Table 13. Identified watercourses are classified along different hydrogeomorphic (HGM) types or units, up to Level 4, in terms of various levels as refined for South Africa by Kleynhans, *et. al*. (2005) and as used in the Classification System for Wetlands user manual – SANBI Series 22 (Ollis *et. al.* 2013) (Table 14).

Table 13: Classification of watercourses in the study area

Delineated systems	Level 1 System	Level 2 Regional Setting (Ecoregion)	Level 3 Landscape Unit	Level 4 HGM Unit
Dorps	Inland	Central Bushveld (Group 4)	Plain	River (Lowland)
Rooisloot	Inland	Central Bushveld (Group 4)	Plain	River (Lowland)
Dithokeng	Inland	Central Bushveld (Group 4)	Plain	River (Lowland)
Groot Sandsloot	Inland	Central Bushveld (Group 4)	Plain	River (Lowland)

Table 14: 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	• Valley floor	River	• Mountain headwater stream

	DWS and/or NFEPA	• Slope • Plain • Bench		• 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	

3.12 Drainage Regions

South Africa is geographically divided up into a number of naturally occurring Primary Drainage Areas (PDAs) and Quaternary Drainage Areas (QDAs) (Figure 11). The different areas are demarcated into Water Management Areas (WMAs) and Catchment Management Agencies (CMAs). Previously there were 19 WMAs and 9 CMAs, but as of September 2016, these were revised and there are now officially only nine WMAs, which correspond directly in demarcation to the nine new CMAs (Government Gazette, 16 September 2016. No.1056, pg. 169-172) (Figure 12).

The study area is situated within the Primary Drainage Area (PDA) of **A** and the Quaternary Drainage Areas (QDAs) of **A61F & A61G** (Figure 13).

Table 15, below, gives a summary of the catchment and drainage area information for the study site.

Table 15: Summary of Catchment Area information

Level	Category
Primary Drainage Area (PDA)	A
Quaternary Drainage Area (QDA)	A61F & A61G
Water Management Area (WMA) – Previous / Old	Limpopo

Water Management Area (WMA) – New (as of Sept. 2016)	Limpopo (WMA 1)
Sub-Water Management Area	Mogalakwena
Catchment Management Agency (CMA)	Limpopo (CMA 1)
Wetland Vegetation Ecoregion (WetVeg)	Central Bushveld (Group 4)
RAMSAR Site	No
River FEPA	No
Wetland FEPA	No
Fish FEPA	No
Fish FSA	No
Fish Corridor	No
Fish Migratory	No
National Strategic Water Source Area (SWSA)	No
Provincial important Water Source Area (WSA)	No

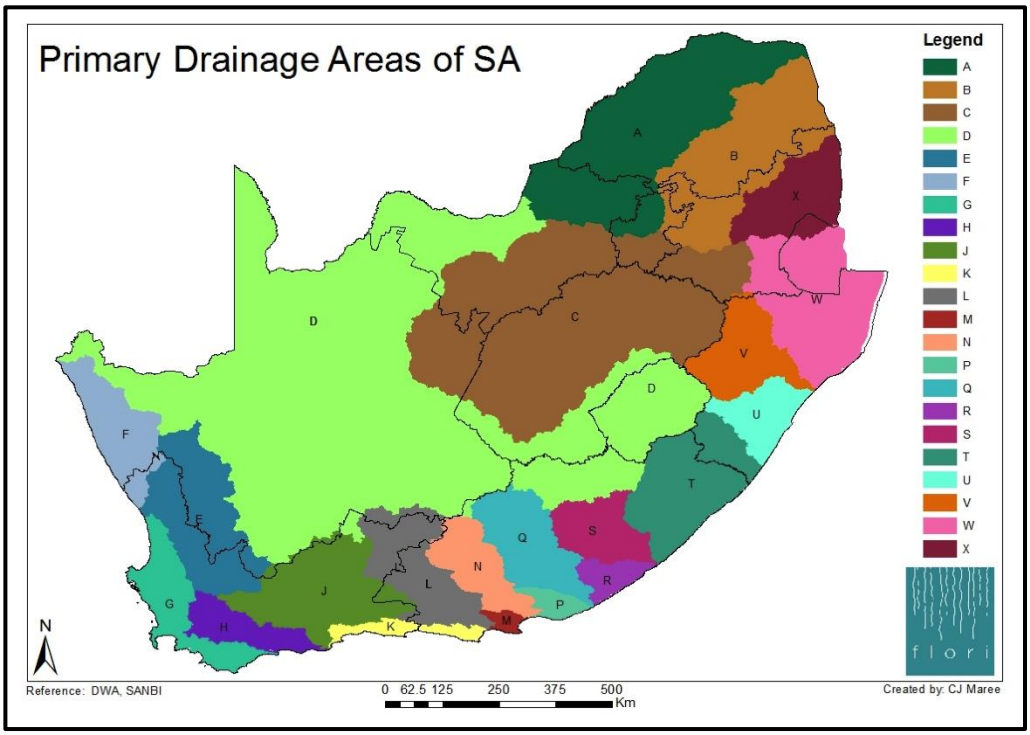


Figure 11: Primary Drainage Areas (PDAs) of South Africa

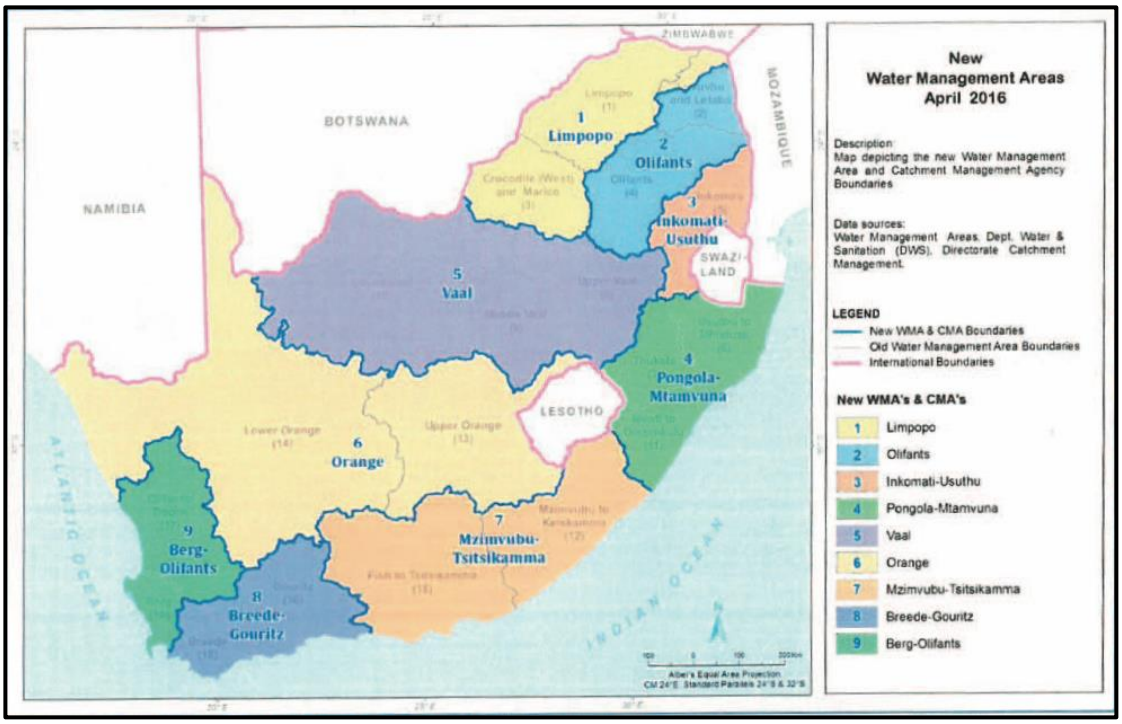


Figure 12: New Water Management Areas (WMAs) of South Africa

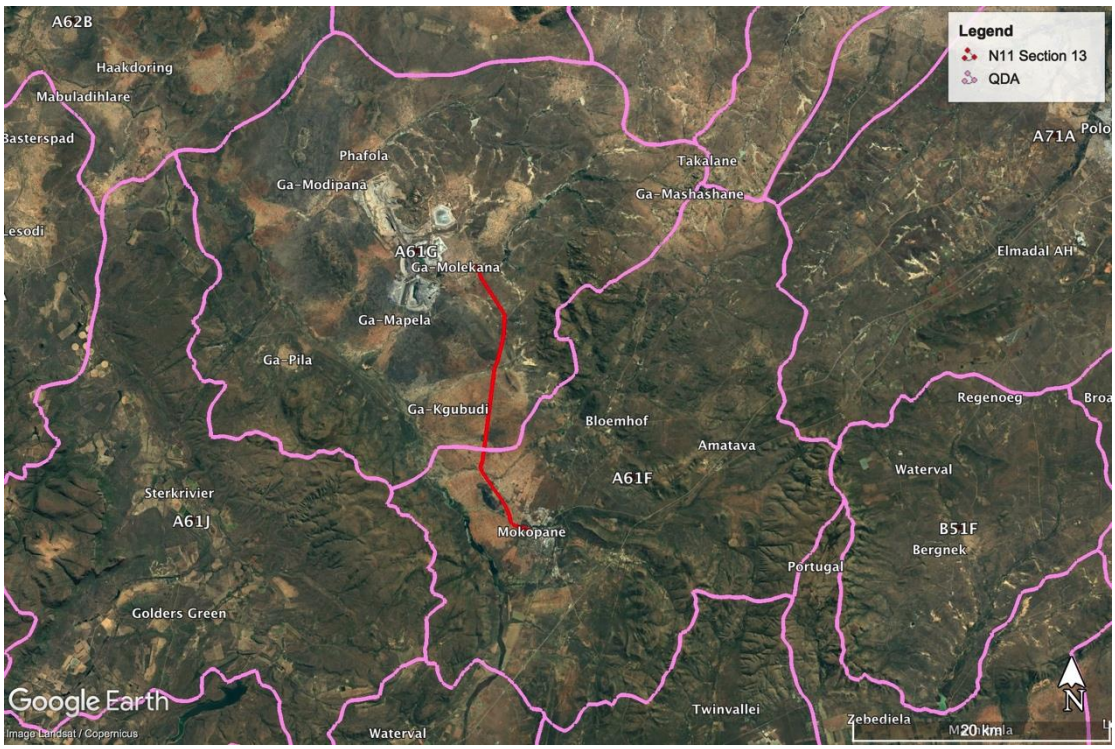


Figure 13: Quaternary Drainage Areas (QDAs)

The study site is not situated within a catchment that is an important or designated Fish FEPA area or Fish Corridor catchment. There are two tertiary catchment areas in which the power line route is situated, with most of the study site in the catchment around the Olifants River and a small section in the north around the Koringspruit.

3.13 Strategic Water Source Areas of South Africa

The southern tip of the study site is within the Nyl & Dorps River Valley Strategic Water Source Area. This is a national SWSA in terms of groundwater.

However, it is clear that in this area the proposed project will have absolutely no impact on groundwater.

A Water Source Area (WSA) is a water catchment or aquifer system that either supplies a relatively large volume of water for its size, or is the primary source of water for a town, city or industrial activity. Strategic Water Source Areas (SWSAs) are defined as areas of land that either: (a) supply a disproportionate (i.e. relatively large) volume of mean annual surface water runoff (i.e. water in streams, rivers and wetlands) in relation to their size and so are considered nationally important; or (b) have relatively high groundwater recharge and groundwater forms a nationally important resource (has high levels of use or settlements depend on it); or (c) areas that meet both criteria (a) and (b). A SWSA is one where the water that is supplied is considered to be of national importance for water security, but there are others, which are considered to be sub-nationally important (WRC, 2019).

According to SANBI, a Strategic Water Source Areas of South Africa (SWSA) are those areas that supply a disproportionate amount of mean annual runoff in relation to the size of the geographical region. These areas are important because they have the potential to contribute significantly to overall water quality and supply, 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 (SANBI).

3.14 Present Ecological State of Watercourses

All watercourses identified within the study area were assessed to determine their Present Ecological State (PES) (Table 16). The assessment criteria and structure are based on the modified Habitat Integrity approach of Kleynhans (1996, 1999). The PES is calculated by looking at the hydrology, geomorphology, water quality and biota of each watercourse. Of importance is the overall PES of the system (Table 16).

The first two watercourses (Dorp and Rooisloot) are in very bad condition (Seriously Modified – Category E). The PES qualities of the watercourses improve as one moves north and more into the rural areas where there are less direct negative anthropogenic impacts on them.

Table 16: PES of Watercourses in the study area

Criteria	Identified Watercourses			
	Dorps River	Rooisloot	Dithokeng	Groot Sandsloot
HYDROLOGY				
Flow modification	1	1	3	3
Permanent inundation	2	2	3	3
WATER QUALITY				
Water Quality Modification	1	2	3	3

Sediment Load Modification	2	2	2	2
GEOMORPHOLOGY				
Canalisation	2	2	3	3
Topographic Alteration	2	2	2	2
BIOTA				
Terrestrial Encroachment	1	1	2	3
Indigenous Vegetation Removal	1	1	2	3
Invasive Plant Encroachment	1	2	3	3
Alien Fauna	3	3	3	3
Over utilisation of Biota	2	2	3	3
Total:	18	20	29	31
Average:	1,6	1,8	2,6	2,8
Category:	**E**	**E**	**C**	**C**
Description	**Seriously Modified**	**Seriously Modified**	**Moderately Modified**	**Moderately Modified**
Description summary	The losses of natural habitats and basic ecosystem functions are extensive.	The losses of natural habitats and basic ecosystem functions are extensive.	The losses of natural habitats and basic ecosystem functions are extensive.	The losses of natural habitats and basic ecosystem functions are extensive.
Recommended EMC	**C**	**C**	**C**	**C**

3.15 Ecological Importance & Sensitivity of Watercourses in the Study Area

The Ecological Importance and Sensitivity (EIS) ratings of the watercourses were determined as shown in the table below (Table 17). The Dorps River is ecologically important and has an overall EIS rating of High (Category B). The level of EIS of a watercourse is not directly linked to its PES.

Table 17: EIS of watercourses in the study area

Determinants	Dorps	Rooisloot, Dithokeng	Groot Sandsloot	Confidence
PRIMARY DETERMINANTS				
1. Rare & Endangered Species	2	1	1	4
2. Populations of Unique Species	2	1	1	4
3. Species/taxon Richness	2	2	2	4
4. Diversity of Habitat Types or Features	2	1	1	4
5 Migration route/breeding and feeding site for wetland species	2	1	1	3

6. Sensitivity to Changes in the Natural Hydrological Regime	3	1	1	3
7. Sensitivity to Water Quality Changes	3	1	1	3
8. Flood Storage, Energy Dissipation & Particulate / Element Removal	3	1	1	3
MODIFYING DETERMINANTS				
9. Protected Status	0	0	0	4
10. Ecological Integrity	2	1	1	4
TOTAL	20	10	10	-
AVERAGE	2,0	1,0	1,0	-
EIS Category	**B**	**C**	**C**	**-**
Description	**High**	**Moderate**	**Moderate**	**-**
	Ecologically important and sensitive. The biodiversity of these watercourses may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	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.	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.	

3.16 Fauna

3.16.1 Mammals

No large- or medium-sized mammals were observed during field investigations. There are potentially a number of common species of wild animals, including mammals, present in the greater area, but most are small species with rodents been the dominant group present. The area with the largest potential presence of mammals (and other fauna) is the nearby Witvinger Nature Reserve.

3.16.2 Avifuana

The study area is not situated within an Important Bird Area (IBA). The closest IBA is the Waterberg System that includes the Waterberg Mountains and Nylsvley. The Waterberg IBA is located at varying distances of between 10km and 17km west of the study site (Figure 14). A number of birds common to the region were seen during field investigations included: laughing dove (*Streptopelia senegalensis*), cape turtle dove (*Streptopelia capicola*), hadeda ibis (*Bostrychia hagedash*), dark-capped bulbul (*Pycnonotus*

tricolor), Cattle egret (*Bubulcus ibis*), Levaillant's cisticola (*Cisticola tinniens*), rattling cisticola (*Cisticola chiniana*), etc.

During field investigations two avifaunal species of conservation concern (SCC) were observed in the general area, namely, black-shouldered kite (*Elanus caerleus*) and amur falcon (*Falco amurensis*). Both species are not threatened and the project will have no measurable impact on them.

No waterbirds were observed at the watercourses along or near to the study site (N11 road) during site investigations.

Figure 14: Important Bird Areas (IBAs)

3.16.3 Reptiles and Amphibians

A few common frog species are likely to occur in the rivers in the north of the study site. Frogs are very susceptible to polluted water and riparian zones. The Dorps and Rooisloot Rivers have high levels of polluted water and degraded environments, which greatly reduces the presence of abundant species and numbers. Typically the endangered species are the most susceptible to loss of ideal habitat and the presence of good quality water. It is unlikely that any red data listed (RDL) amphibian species will be present in the study area.

No snakes or lizards were observed along the road and road reserve during field investigations. However, it is more than likely that some common snake and lizard species will be present in the study area. Lizards tend to prefer rocky habitats such as rocky hills (koppies), rocky ridges and rock sheets. However, there are very few such rocky habitats present in the study area. The most ideal habitat and likelihood for

numerous lizards and even snakes is the isolated mountain (inselberg) just west of the N11 in the area of Mosate. The project will have no impact on this mountain and habitat.

3.16.4 Invertebrates

Invertebrates such as spiders, scorpions and butterflies are important faunal groups, but are very difficult to properly 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. The nature and scope of the project is such that it will have low to negligible negative impact on these species should they occur. No priority species were observed.

Recorded butterfly fauna for Limpopo Provinces fall into: 5 families, 17 subfamilies, 127 genera, 361 species and 8 additional subspecies (369 taxa). Shared endemic genera: 8. Exclusive endemism: 10 species and 8 subspecies (18 taxa). Shared endemism: 31 species and 7 subspecies (38 taxa). Proposed Red List taxa: 9 (all endemic to LP) (SA Red Data Book: Butterflies, SANBI Series 13).

The species of conservation concern for Limpopo are:

Nymphalidae: *Telchinia induna salmontana, Dingana clara, Dingana jerinae, Pseudonympha swanepoeli.*

Lycaenidae: *Alaena margaritacea, Aloeides stevensoni, Anthene juanitae, Erikssonia acraeina, Lepidochrysops lotana*

The Wolkberg mountain range is the main hotspot in the Province for butterflies and include priority species such as: *Aloeides stevensoni Dingana clara Lepidochrysops lotana.*

The likelihood for RDL butterfly species to occur in the study area is shown in Table 18, below.

Table 18: RDL butterfly species for the Limpopo Province

Scientific Name	Common name	Local Status	Present in study area
Alaena margaritacea	Wolkberg zulu	CR	No
Aloeides stevensoni	Stevenson's copper	VU	No
Anthene juanitae	Juanita's hairtail	VU	No
Dingana clara	Wolkberg widow	Vu	No
Dingana jerinae	Jerine's widow	VU	No
Erikssonia acraeina	Erikson's copper	CR	No
Lepidochrysops lotana	Lotana blue	CR	No
Pseudonympha swanepoeli	Swanepoel's brown	CR	No
Telchinia induna salmontana	Induna acraea	VU	No

CR= Critically Endangered**, EN=** Endangered**, NT =** Near Threatened**, VU=** Vulnerable**.**

3.16.5 Faunal species of conservation concern

During field investigations no faunal species of conservation concern were encountered. This can also be due to the limited time available for site investigations. There are no ideal habitats within the study area. However, it must be assumed that on occasion free roaming fauna will cross over the study area, and most likely in the north where the area is more rural and open.

Table 19: 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	Threatened	Grassland; savanna	Temporary floodplains, pans	No
Mammals					
Atelerix frontalis	SA hedgehog	Near threatened	Most, broad	Broad	Possible
Manis temmincki	Pangolin (Scaly anteater)	Vulnerable	Grassland, savanna	Woody savanna, ants, termites	No
Mellivora capensis	Honey badger (Ratel)	Near threatened	Most, broad	Broad	Unlikely
Cloeotis percivali	Short-eared trident bat	Critically endangered	Savanna	Caves and subterranean habitat	No
Pipistrellus rusticus	Rusty bat	Near threatened	Most, broad	Woody savanna, large trees	No
Snakes					
Python natalensis	Southern African python	Vulnerable	Ridges, wetlands	Rocky areas; open water	Unlikely

The maps below show the Quarter Degree Squares (QDS) that are hotspots for priority faunal species / SCC such as butterflies, snakes and lizards in South Africa (Figure 15, Figure 16, Figure 17).

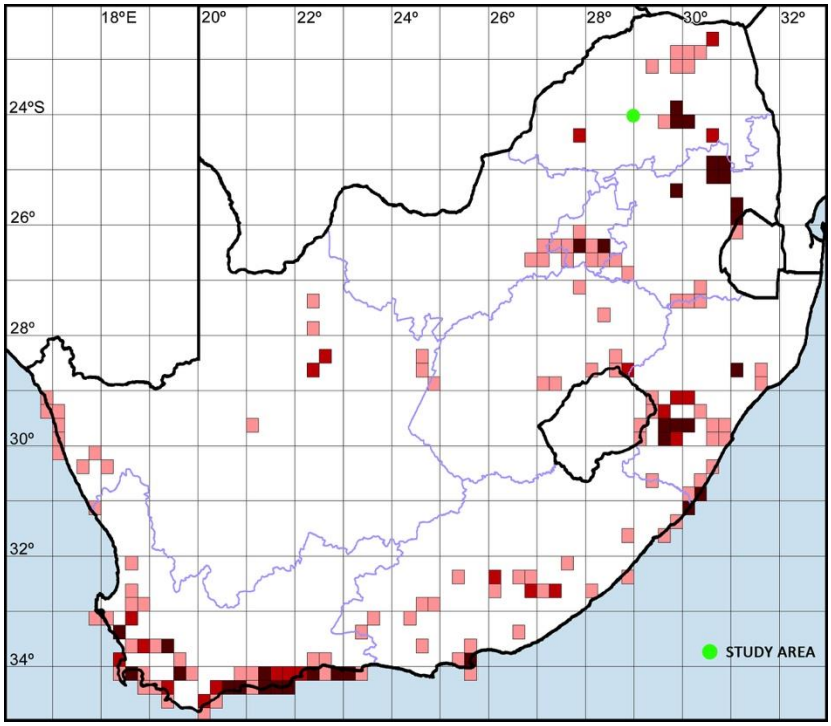


Figure 15: Butterfly hotspots

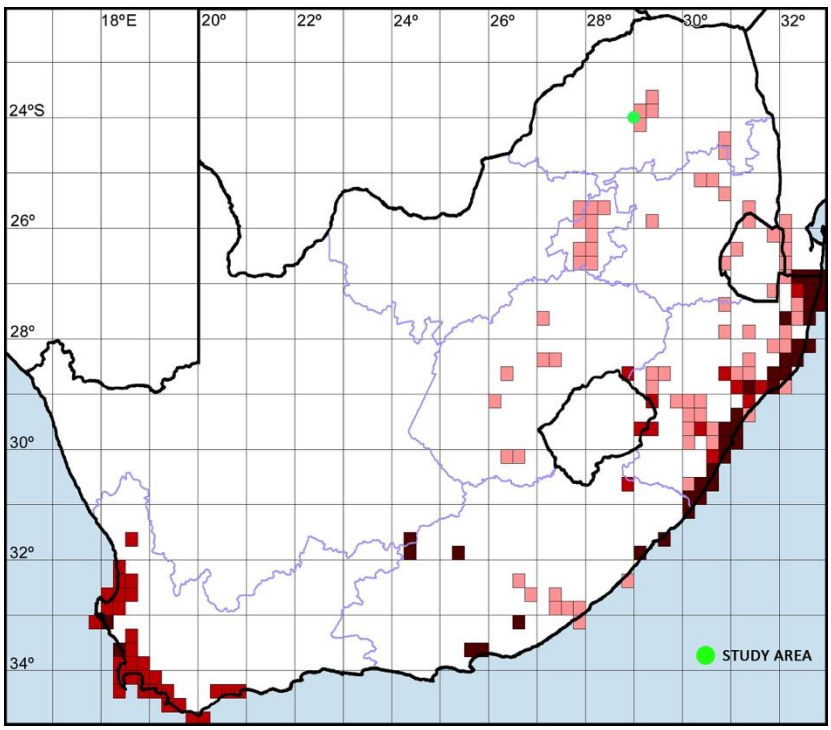


Figure 16: Snake hotspots

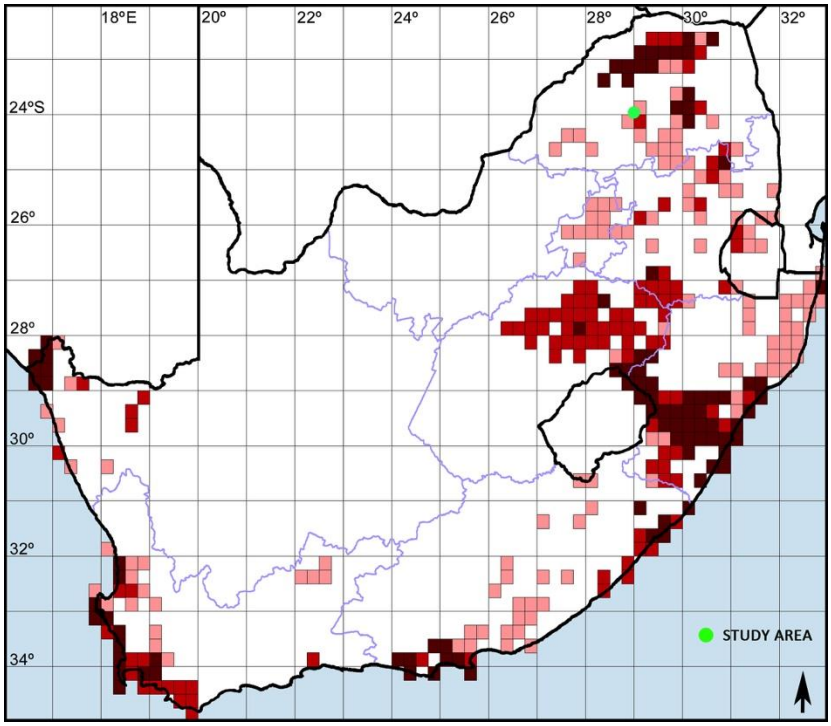


Figure 17: Lizard hotspots

4 SENSITIVITY ASSESSMENT

4.1 DEA Screening Tool Assessment

The Department of Forestry, Fisheries and Environment (DFFE) (Previously DEA) has developed a desktop screening tool that is to be used as a guideline in an initial desktop assessment of a project site (www.screening.environment.gov.za). The screening tool is a guideline tool that needs to be verified during site investigations (ground truthing). Depending on the levels of sensitivity shown in the screening assessment certain criteria in terms of assessments, studies, etc. may be required by the competent authorities. According to the screening tool (accessed August 2022) the various sensitivities for the study site and immediate surroundings are as follows:

- Terrestrial biodiversity combined theme sensitivity: Low (southern section); Very High (northern section).
- Aquatic biodiversity combined theme sensitivity: Low; Small section at Mokopane (Very High).
- Plant species theme sensitivity: Low.
- Animal species theme sensitivity: Medium.

During site investigations, the sensitivities, were assessed and ground-truthed. The site investigations do not agree with most of the sensitivities shown in the desktop screening assessment. Much of the data in the screening tool appears to be outdated. The sensitivities of the study area were all found to be 'Low'. However, on a slightly broader scale the sensitivities were found to be mostly 'Low' with the watercourses

being 'Medium' and some of the open bushveld areas in the north also 'Medium'. The only 'Very High' sensitivity is the isolated mountain (inselberg) in the vicinity of the study site (west of the N11).

4.2 Ecological Sensitivity

The sensitivity assessment identifies those areas and habitats within the study area and nearby areas that have a high conservation value and that may be sensitive to disturbance or transformation. All watercourses (rivers, streams, drainage lines and wetlands) are, by default, considered sensitive (High Sensitivity), even if in a poor or degraded condition. Areas or habitats have a higher conservation value (or sensitivity) based on their threatened ecosystem status, ideal habitat for priority species, potential or real presence of RDL fauna and flora species, etc.

The study area and assessment area consist of three broad habitats, namely, Altered (which is the altered and badly degraded road reserve and road); bushveld; and watercourses.

The floral and faunal sensitivity analyses are shown in the tables below (Table 20 & Table 21).

Table 20: Floristic sensitivity analysis

Criteria	Habitats		
	Altered (Road Reserve)	Bushveld	Watercourses
Red Data Species	1	3	4
Habitat Sensitivity	1	5	7
Floristic Status	2	5	5
Floristic Diversity	2	5	5
Ecological Fragmentation	3	5	6
Sensitivity Index	18%	46%	54%
Sensitivity Level	Low	Medium	Medium

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

Table 21: Faunal sensitivity analysis

Criteria	Habitats		
	Altered (Road Reserve)	Bushveld	Watercourses
Red Data Species	2	3	4
Habitat Sensitivity	1	5	7
Faunal Status	2	5	5
Faunal Diversity	2	5	5
Ecological Fragmentation	3	5	6
Sensitivity Index	20%	46%	54%
Sensitivity Level	Low	Medium	Medium

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

4.3 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 22).

The table below gives the true sensitivity of the different habitats. However, watercourses are, by default, viewed and approached as having a sensitivy of 'High'.

Table 22: Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity
Altered (Road Reserve)	Low	Low	Low
Grassland	Medium	Medium	Medium
Watercourse	Medium	Medium	Medium

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

4.4 National Priority Areas

The Study Site runs through the western edge of the Witvinger Nature Reserve, which is a priority area (Figure 18). The Rooisloot River is demarcated as a NFEPA priority area.

National priority areas include formal and informal (private) protected areas (nature reserves); important bird areas (IBAs); RAMSAR sites; National fresh water ecosystem priority areas (NFEPA) and National protected areas expansion strategy focus areas (NPAES).

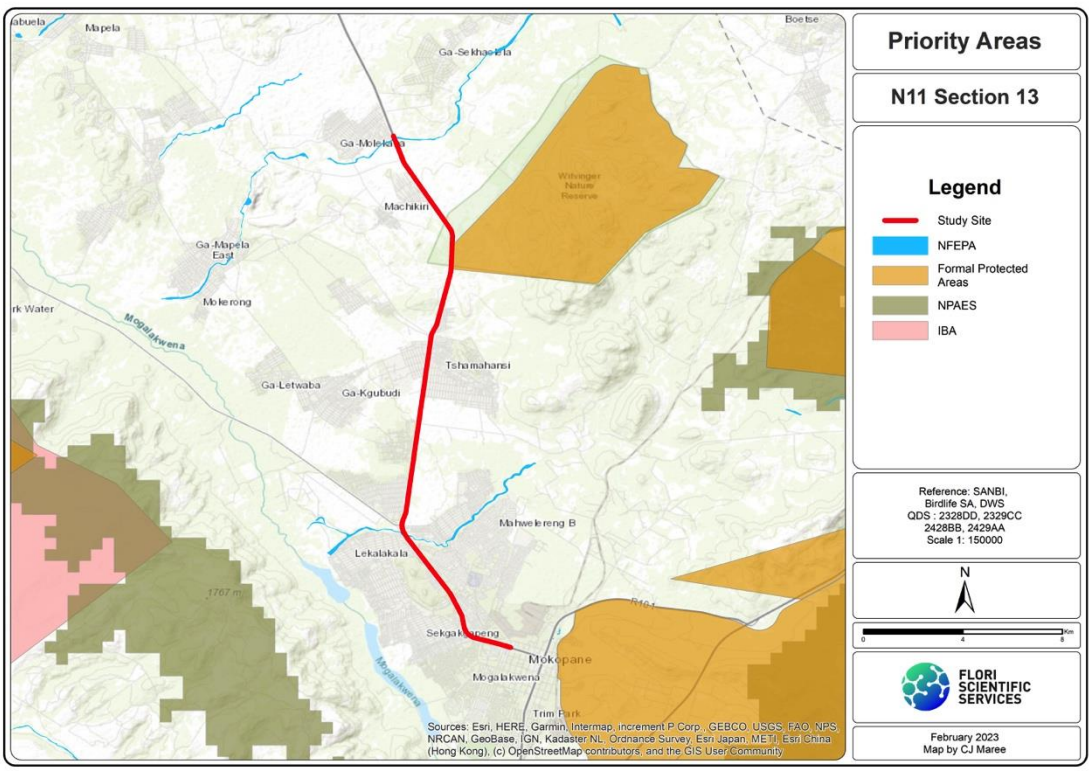


Figure 18: Priority Areas

4.5 Critical Biodiversity Areas & Ecological Support Areas

According to the Limpopo Conservation Plan (Version 2) the study area runs through some critical biodiversity areas (CBAs) and ecological support areas (ESAs) (Figure 19). The CBA is some open

bushveld and buffer area around the Witvinger Nature Reserve. The ESAs are the corridors and shallow valleys in which the Dorps and Rooisloot Rivers flow. The inselberg (isolated mountain) just west of the N11 and between the two previously named rivers is also a demarcated ESA.

Critical biodiversity areas (CBAs) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI, 2007). These form the key outputs of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision-making tools. CBAs are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services (SANBI).

Ecological Support Areas (ESAs) are areas that are often seen as buffer areas for CBAs as well as corridors and connective areas between CBAs and/or other priority areas. ESAs are also often designated buffer and support areas along rivers and streams.

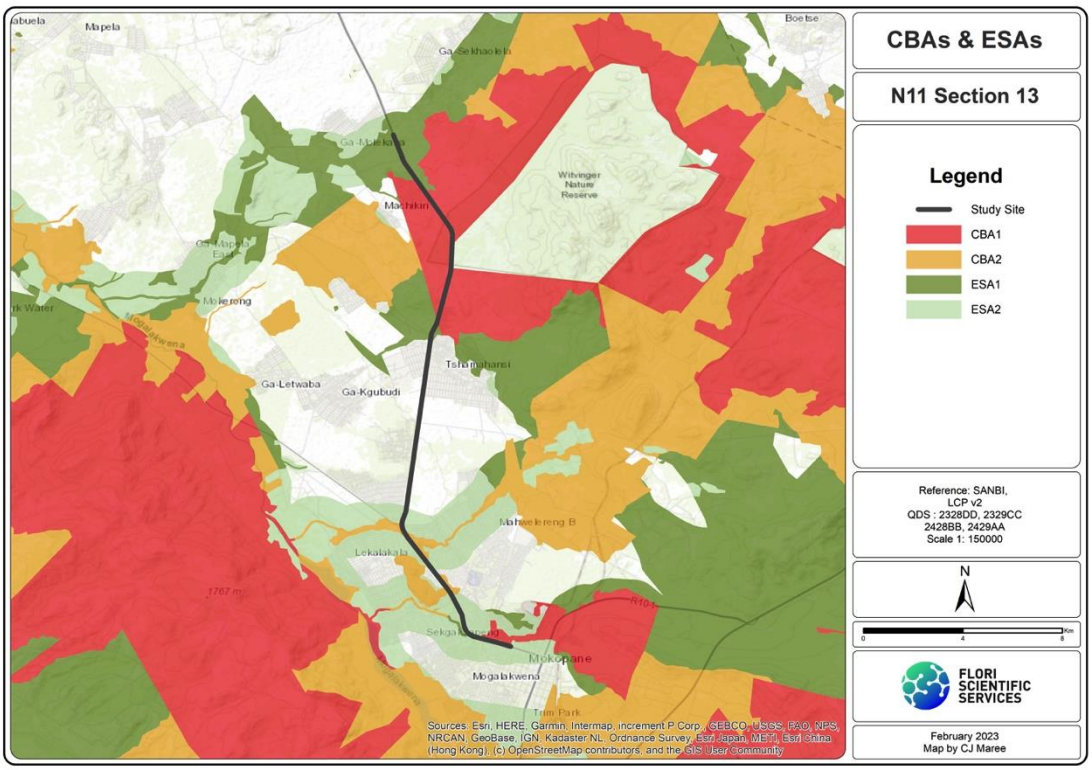


Figure 19: CBAs & ESAs

4.6 Sensitivity mapping of the study area

All relevant datasets, DEA screening desktop assessment and field investigations were taken into account in determining the sensitivity mapping of the study site.

A summary of the sensitivities of the Study Area is as follows:

- The site is within the original extent of veldtype (ecosystem) of Makhado Sweet Bushveld, which is not a threatened veldtype / ecosystem and has a status of 'Least Concern'. However, the vegetation / ecosystem of the study area itself is almost entirely transformed and altered by the existing road and the road reserve.
- According to the DEA Screening Tool overall terrestrial biodiversity sensitivity is Low (southern section); Very High (northern section). Site invesetigations confirm (verify) the southern section as being 'Low' but dispute the northern section as 'Very High'. Field investigations show the area to be at most 'Medium'. Although the actual study site is in reality 'Low'.
- There are no highly sensitive habitats, or no-go zones, present in the study site (existing road and road reserve) itself, with the exception of the watercourses.
- There are no protected areas.
- The study area runs through a CBA and ESAs.
- The environment of the exisitng road and road reserve are transformed and altered. The adjacent environment is a mix of transformed and degraded bushveld. There are no areas of pristine bushveld in or immediate along side the study site.

The biodiversity sensitivity for the entire study site (road and road reserve) is 'Low'. The rivers have a sensitivity of 'High' and therefore so do the crossings (bridges). There are a few areas markd as 'Medium'. These are areas outside of the study site but adjacent to it and include some open bushveld in the north (which also includes the demarcated Witvinger Nature Reserve); and the inselberg in the south (west of the N11) (Figure 20).

Figure 21 shows the area in black and white to better highight the demarcated senstivities of the study site and adjacent areas.

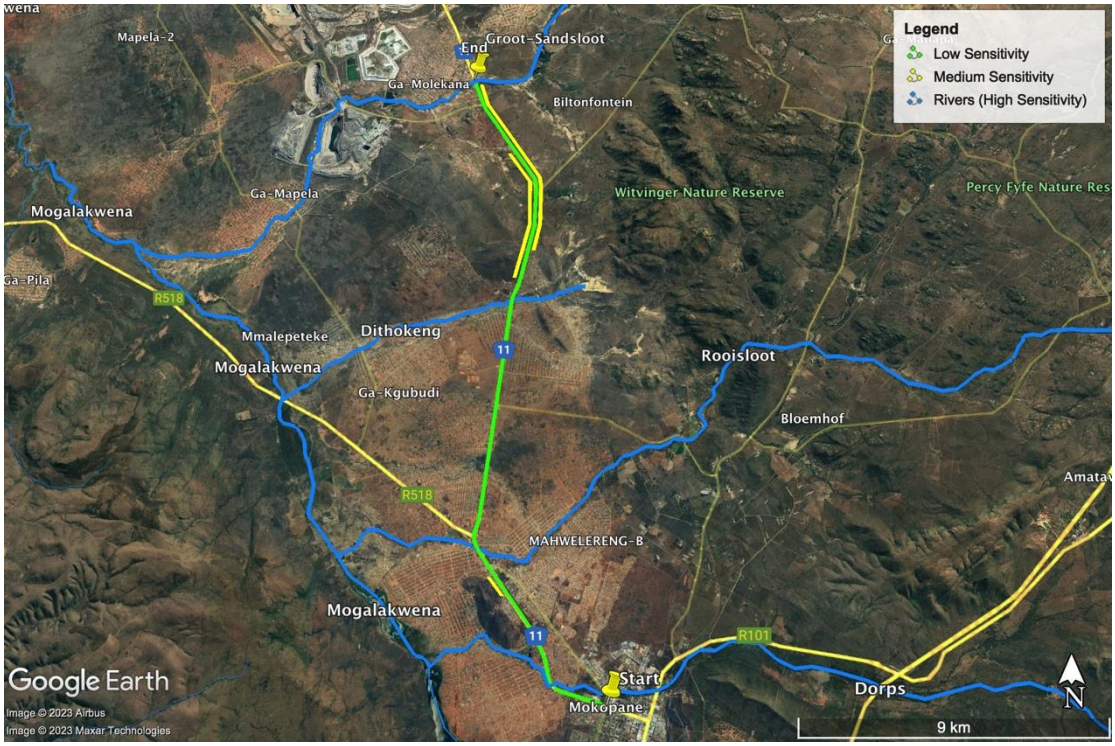


Figure 20: Sensitivity Map

Figure 21: Sensitivity Map (B&W)

4.7 Buffer Zones

No buffer zones are required within the road or road reserve.

However, Buffer zones of 32m wide are recommended and have been delineated along the banks and riparian edges of the four main rivers / stream that the N11 Section 13 crosses over. These buffer zones sit outside of the road and road reserve, but should extent all the way up and down along the watercourses. However, in terms of temporary laydown areas or site offices the buffer zone along watercourses is 100m.

Technically buffer zones are 'No-go zones' but these must be regulated because work on the road and bridges crossing over the watercourses have to be worked on. Therefore, these buffer zones / regulated zones must be regulated and controlled in terms of who and what is allowed in and through them.

The following are not allowed in the buffer zones: Portable toilets, laydown areas, general movement of contractors and vehicles.

Work on the road and bridges in the buffer zones are allowed, but the footprint must be kept to a minimum and movement of contractors, vehicles and materials must be controlled. No new crossings, even temporary ones, are allowed.

The delineated watercourses and buffer zones are shown for the four rivers / streams in the figures below.

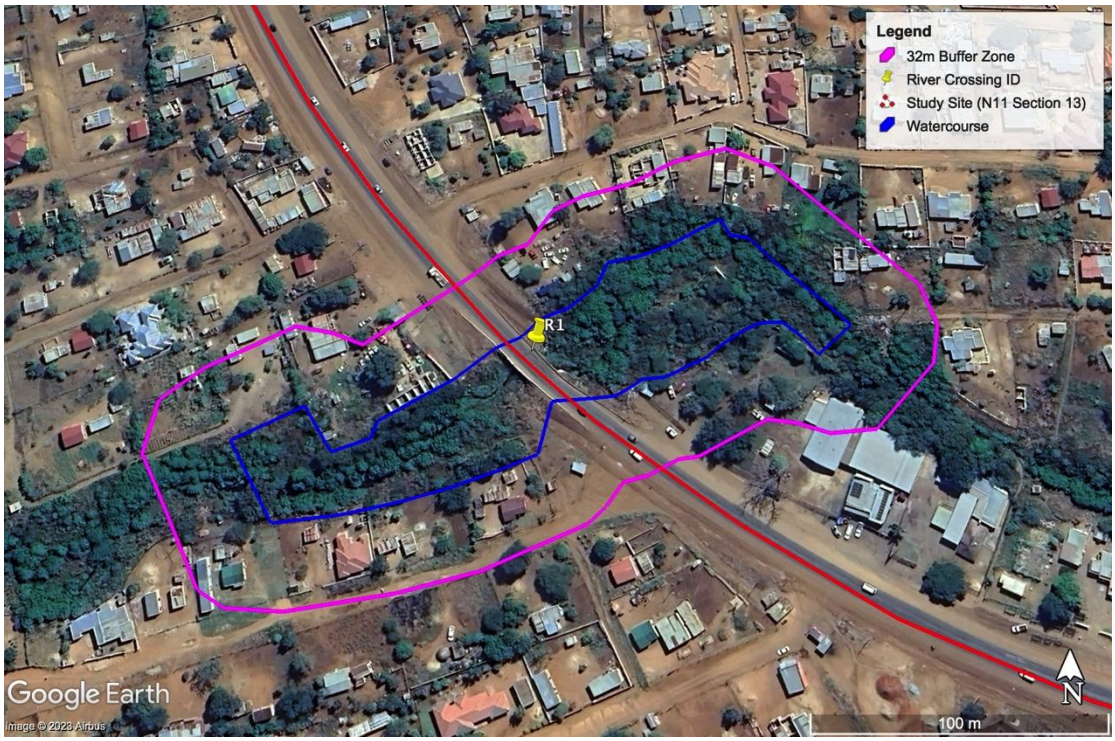


Figure 22: Crossing at R1 (Dorps River)

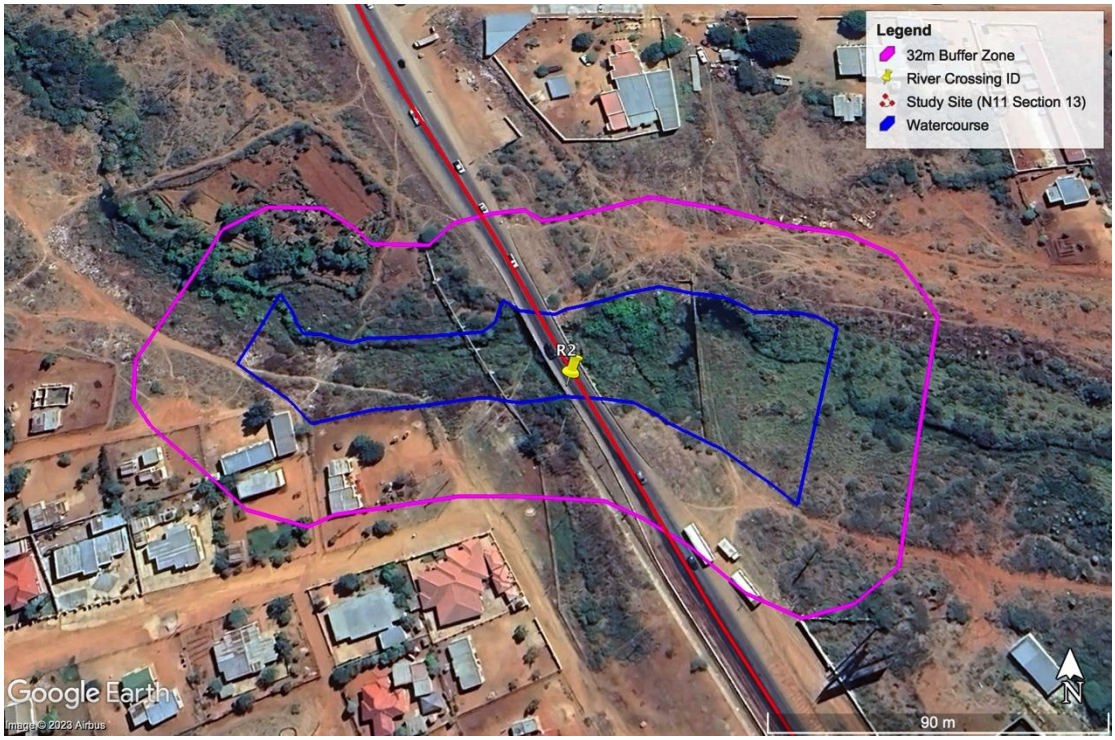


Figure 23: Crossing at R2 (Rooisloot)

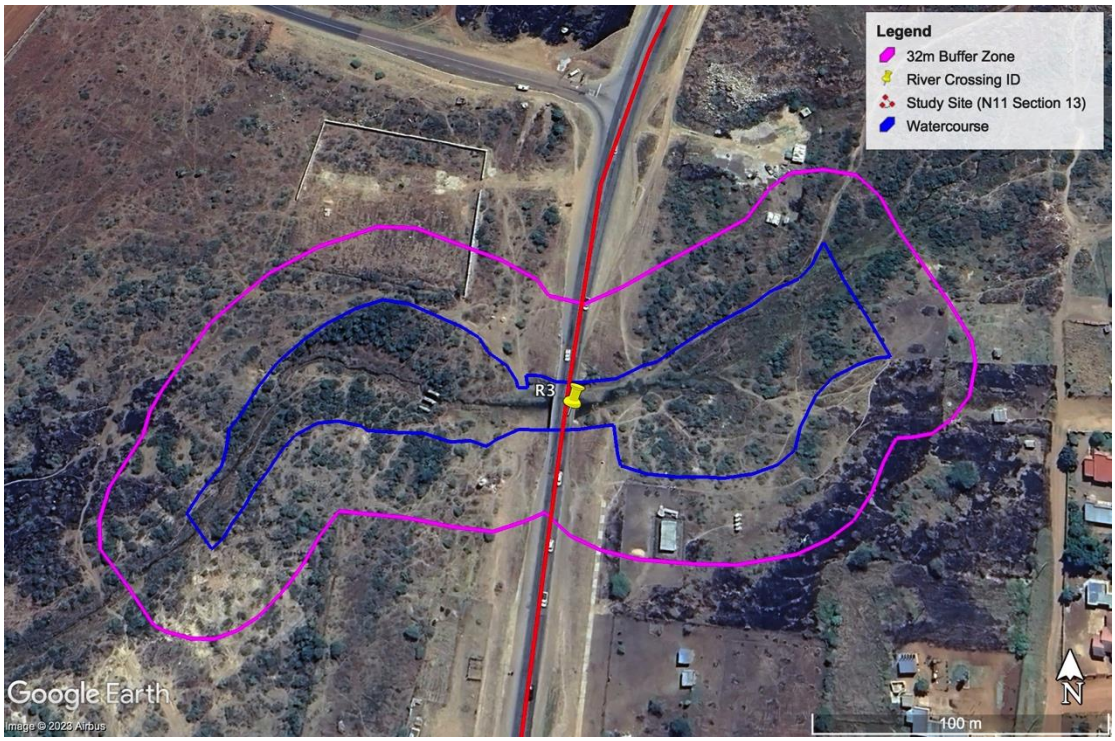


Figure 24: Crossing at R3 (Dithokeng)

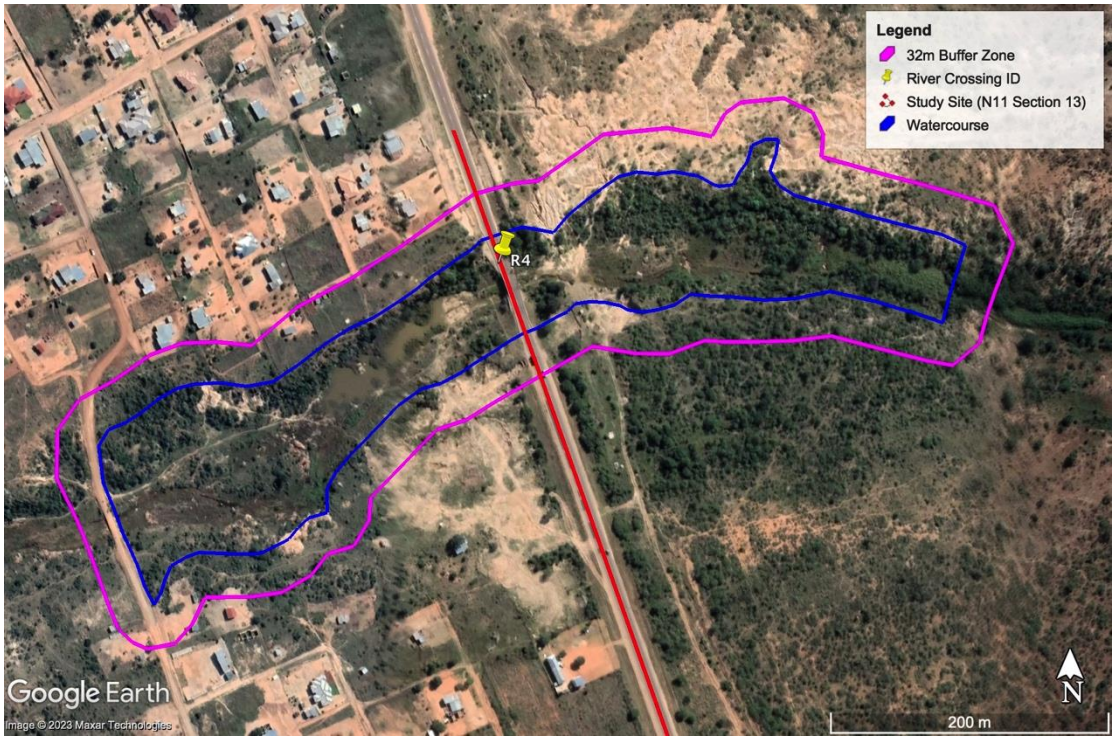


Figure 25: Crossing at R4 (Groot Sandsloot)

5 THE GO, NO-GO OPTION

5.1 Potential fatal flaws

There are no obvious fatal flaws in terms of the ecological biodiversity and the project may proceed. However, mitigating measures should be implemented.

5.2 Classification criteria

The term '**fatal flaw**' is used 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 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.

6 IMPACT ASSESSMENT

The impacts of the activities related to the proposed project were rated. There are existing impacts and potential negative impacts arising from the proposed project. A number of mitigating measures are recommended to help reduce the sum of the negative impacts (cumulative effect) on the natural environment in which the project is based. The impact assessment focuses mainly on the construction phase of the project, but does also consider the long-term impact the project may have on the natural environment. The operation phase is only considered in terms of ongoing, routine maintenance after clean-up and rehabilitation at the end of the construction phase. Recommendations and mitigating measures for the operational phase should be included in the routine maintenance programme / schedules.

6.1 Existing Impacts

Numerous existing negative impacts are in the study area and all are common to those found in urban environments along side main roads. The impacts include loss of vegetation, loss of habitat, degradation and pollution of watercourses, etc.

6.2 Potential Impacts

The potential negative impacts arising from the proposed project are low to very low. The N11 Section 13 is an existing national route, which, like all roads, has long-lasting impacts including initial loss of vegetation and a collision threat to free roaming wildlife. However, roads have a very narrow and linear footprint, which reduces the overall negative impact. The project proposed project (which is the upgrade and rehabilitation of the road and some bridges) would have little to no measurable negative long-term impacts on the existing environment.

During the construction phase, potential negative impacts include erosion, siltation, damaging or altering of stream banks, loss of some vegetation along the road shoulder when the road is widened, and general low negative fringe impacts during the construction phase. Short-term fringe impacts will be the impact of traffic and some noise and dust to local residents.

The upgrade and rehabilitation of some of the bridges will have a positive impact on improving the flow of the watercourse, by removing various obstacles such as sediment, debris, alien plants, etc.

6.3 Assessment of potential impacts

The assessment of potential impacts on the natural environment arising from the project and related activities is shown below in Table 23.

The scoring method used in the impact assessment is as follows:

- **SP = [extent (E) + duration (D) + magnitude (M)] x probability (P).**

The maximum value is 100 significance points (SP). Environmental impacts will be rated as either that of High, Moderate or Low significance on the following basis:

- SP ≥60: **High**; SP 31 ≥ 59: M**oderate**; SP ≤ 30: **Low**.

Further explanation of the assessment methodology is found in the section on methodology

6.4 Cumulative Effect

The cumulative effect speaks to the total sum of negative impacts on the natural environment. The cumulative effect looks at the sum of the existing impacts and the new, additional impacts arising from the proposed project and related activities. In general the overall cumulative impact will be 'Low' to 'Non-measurable'.

Table 23: Assessment of Potential Impacts

Potential Impacts arising from Project	Phase of Project	Impact Rating (Significance: (Total) <30 (Low); 31-59 (Moderate); >60 (High)					
		Extent	Duration	Magnitude	Probability	Total	Significance
Total Impact of Proposed Project	**Construction Phase: Pre-mitigation**	**Local (2)**	**Short-term (2)**	**Low (4)**	**Medium (3)**	**24**	**Low**
	Construction Phase: Post mitigation	**Site (1)**	**Short-term (2)**	**Minor (2)**	**Low (2)**	**10**	**Low**
	Operational Phase Pre-mitigation	**Local (2)**	**Long-term (4)**	**Low (4)**	**Medium (3)**	**24**	**Low**
	Operational Phase Post mitigation	**Local (2)**	**Long-term (4)**	**Minor (2)**	**Low (2)**	**16**	**Low**
Cumulative Effect of Project on the local Ecology	After construction and during operational phase	**Local (2)**	**Short-term (2)**	**Minor (2)**	**Improbable (1)**	**6**	**Low / None**

Mitigating Measures	**Construction Phase** 1. Impacts on the existing natural environment related to the project are '**LOW**' The footprint of the project is small in relation to the area and mostly within an already disturbed and altered environment. Some protected trees (Marula) will need to be removed. Four main rivers / streams will be crossed. The long-term impact of the upgrade of the actual watercourse crossings is a positive impact, because it will improve water flow, remove blockages, stabilise stream banks, reduce existing erosion of stream banks and riparian areas. Minimal riparian vegetation will be lost (need to be removed) at the three watercourse crossings (bridges) that are going to be upgraded. No significant vegetation will be lost by the widening of the road. 2. Any temporary storage, lay-down areas or accommodation facilities to be setup in existing built-up areas or disturbed areas. No temporary storage areas, laydown areas or site offices are allowed within a **100m** of the edge of any river, stream or distinctive drainage line. 3. No temporary storage areas, laydown areas or site offices are allowed within a **100m** of the edge of any river, stream or distinctive drainage line. That is, a **100m buffer zone** (no-go zone) for these sites are required along all watercourses. 4. Ensure small footprint during construction phase 5. An Erosion Plan to be implemented and monitored during the construction phase, especially in the area of riverbanks. The erosion potential is moderate to low. This also to further reduce the potential of siltation of the rivers. The plan need only be basic, but needs to be monitored. 6. All hazardous materials must be stored appropriately to prevent these contaminants from entering the water environment; 7. All excess materials brought onto site for construction to be removed after construction and their removal seen as part of the construction phase. 8. No open trenches or mounds of soils to be left. All disturbed areas, including temporary laydown areas to be reshaped / re-contoured to blend in with the surrounding topography. 9. Rehabilitation plan for disturbed areas to be compiled and implemented as part of the construction phase. 10. No construction vehicles may drive through any streams or simply create new crossings outside of the proposed plans and EMPr conditions, which might include WUL or GA conditions. Existing roads to be used as much as possible, but these roads to be maintained during all phases of the project. 11. No concrete or mounds of building sand and other materials may be stored temporary during the construction phase within **32m** of any watercourses, because a heavy rainstorm can wash these materials into the watercourse. 12. Temporary access roads (if any) and temporary laydown sites, site office areas, etc. need to be monitored, maintained and rehabilitated at the end of the construction phase as part of the rehabilitation process. 13. An independent ECO is required for the duration of the construction phase. 14. There are a few scattered marula trees in the study area. The marula is a national protected tree. Some are going to need to be removed and this will require a prior permit application process. 15. A General Authorisation (GA) is going to be required for the project. **Operational Phase** 1. Monitoring, rehabilitation, general maintenance for the project may form part of the routine maintenance programme for the road. **Rehabilitation of Temporary Laydown areas** 1. Site-specific rehabilitation plan must be compiled and implemented as part of the construction phase of the project. It may not be left until a later date or fall under the operational phase of the project.

Individual Impacts

		Extent	Duration	Magnitude	Probability	Total	Significance
1. Loss of natural vegetation	**Construction Phase: Pre-mitigation**	**Site (1)**	**Long-term (4)**	**Moderate (6)**	**Medium (3)**	**33**	**Low**
	Construction Phase: Post mitigation	**Site (1)**	**Long-term (4)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**

	Operational Phase	**Site (1)**	**Long-term (4)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**
Mitigating Measures	1. There are approximately 41 protected trees (all marula trees) scattered throughout the study site (along the road in the road reserve). Some of these trees are going to have to be removed. 2. There are no RDL or ODL (Priority) species in the study site. 3. There are no habitats with 'High' sensitivity present within the study site. With the exception of the main river and stream crossings. 4. Minimal natural vegetation will need to be removed / lost. 5. Any vegetation areas damaged outside of the site during the construction phase (establishment phase) must be rehabilitated as part of the construction phase. 6. A site-specific rehabilitation must be compiled and implemented as the final stage of the construction phase of the project. Attention must be given to temporary laydown areas, etc. As well as watercourse crossings. 7. A basic weed control programme should be implemented. This programme may form part of routine road maintenance and inspections.						
2. Loss or impact on wildlife	**Construction Phase: Pre-mitigation**	**Site (1)**	**Shot-term (2)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**
	Construction Phase: Post mitigation	**Site (1)**	**Shot-term (2)**	**Minor (2)**	**Low (2)**	**10**	**Low**
	Operational Phase	**Site (1)**	**Immediate (1)**	**Minor (2)**	**Improbable (1)**	**4**	**Low**
Mitigating Measures	1. It is fully understood and appreciated that roads create ongoing hazards to free roaming wild animals. However, the impact assessment focuses on the impacts of the project itself. 2. Care must be taken not to interact directly with any wild life encountered. 3. Under no circumstances may any wildlife be interfered with, hunted, disturbed. Relevant specialists must first be contacted to consult on how to approach and deal with any dangerous animals found on site (such as snakes) 4. Litter (especially food waste) must be properly dealt with to avoid attracting wild animals such as snakes, rats, mice, jackals, etc.						
3. Siltation and erosion	**Construction Phase: Pre-mitigation**	**Local (2)**	**Shot-term (2)**	**Moderate (6)**	**Medium (3)**	**30**	**Moderate**
	Construction Phase: Post mitigation	**Site (1)**	**Shot-term (2)**	**Minor (2)**	**Low (2)**	**10**	**Low**
	Operational Phase	**Site (1)**	**Immediate (1)**	**Minor (2)**	**Improbable (1)**	**4**	**Low**
Mitigating Measures	1. All mitigating measures in the impact assessment have reference to siltation and erosion. 2. Carefully monitoring of construction (especially in the areas of watercourses and steep contours) is essential to locate and mitigate any erosion observed speedily. Investigations must be conducted after every rain downpour. Any problems need to be rectified immediately to avoid problem escalating and the potential siltation of watercourses. 3. It is assumed that standard engineering plans and designs have stormwater management systems, which will greatly assist in reducing and improving erosion and by extension siltation of watercourses.						
6. Impact on watercourses	**Construction Phase: Pre-mitigation**	**Site (1)**	**Long-term (4)**	**Moderate (6)**	**Medium (3)**	**33**	**Moderate**
	Construction Phase: Post mitigation	**Site (1)**	**Long-term (4)**	**Minor (2)**	**Medium (3)**	**21**	**Low**
	Operational Phase	**Site (1)**	**Immediate (1)**	**Minor (2)**	**Improbable (1)**	**4**	**Low**
Mitigating Measures	1. The biggest initial negative impact on the natural environment within the study site will be at watercourse crossings where the bridges are going to be rebuilt / upgraded. However, this negative impact will only last during the construction phase, after which the upgrade of these crossings will be a **positive impact** on the natural environment in general and watercourses in particular.						

	2. No project or project-related activities (outside of the actual upgrade activities) may take place within 32m from the edge of stream banks. In other words, a **32m buffer zone** is required along all watercourses encountered in the study site. 3. No temporary storage areas, laydown areas or site offices are allowed within a **100m** of the edge of any river, stream or distinctive drainage line. That is, a **100m buffer zone** (no-go zone) for these sites are required along all watercourses						
7. Fringe impacts arising from construction phase	**Construction Phase: Pre-mitigation**	**Site (1)**	**Shot-term (2)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**
	Construction Phase: Post mitigation	**Site (1)**	**Shot-term (2)**	**Minor (2)**	**Low (2)**	**10**	**Low**
	Operational Phase	**Site (1)**	**Immediate (1)**	**Minor (2)**	**Improbable (1)**	**4**	**Low**
Mitigating Measures	1. Due to the nature of the project the potential for any significant fringe benefits can and will exist. Management must ensure that all fringe impacts are recorded, discussed and dealt with on a regular basis. These may include potential problems such rubbish, movement of workers and heavy machinery into private lands, etc. 2. Care must be taken with heavy machinery used on the project. All access roads used and temporary laydown areas must be monitored and maintained. 3. Dust suppression will be required along the entire study site route as there are a lot of nearby dwellings.						

7 CONCLUSIONS & RECOMMENDATIONS

Conclusions

The conclusions of the biodiversity study are as follows:

- The study site is within the original extent of Makhado Sweet Bushveld, which is not a threatened veldtype / ecosystem, and has a status of 'Least Concern'. However, most of the study area (road and road reserve) is transformed and altered environments with no pristine bushveld present.
- There are four main river / stream crossings, three of which are earmarked for upgrade.
- The study site (existing road and road reserve) runs through the western edge of the Witvinger Nature Reserve. However, the project will not impact any further on the reserve and will remain within the existing road reserve in this area.
- No red data listed (RDL) and orange data listed (ODL) floral species were observed in the study area and none are expected to occur.
- The study site runs through a CBA (in the north) and two ESAs. The ESAs are the corridors and shallow valleys in which the Dorps and Rooisloot Rivers flow.
- There are no obvious fatal flaws in terms of the natural ecology.
- It is likely that a General Authorisation (GA) process will be required for the project due to the proposed upgrade of the three watercourse crossings (bridges) which will require some work operations within and along the riverbanks.

- Taking all findings and recommendations into account it is the reasonable opinion of the author / specialist that the activity may be authorised. The project and related activities should be allowed to proceed.

Recommendations

The recommendations of the study are as follows:

- All recommended mitigating measures as proposed in this study and report should be implemented if the findings of this report are to remain pertinent. All of the recommended mitigating measures must form part of the conditions of the EMP.
- Some of the recommended mitigating measures are:
    - Any temporary storage, lay-down areas or accommodation facilities to be setup in existing built-up areas or disturbed areas. No temporary storage areas, laydown areas or site offices are allowed within a **100m** of the edge of any river, stream or distinctive drainage line.
    - No temporary storage areas, laydown areas or site offices are allowed within a **100m** of the edge of any river, stream or distinctive drainage line. That is, a **100m buffer zone** (no-go zone) for these sites are required along all watercourses.
    - Ensure small footprint during construction phase
    - An Erosion Plan to be implemented and monitored during the construction phase, especially in the area of riverbanks. The erosion potential is moderate to low. This also to further reduce the potential of siltation of the rivers. The plan need only be basic, but needs to be monitored.
    - All hazardous materials must be stored appropriately to prevent these contaminants from entering the water environment;
    - All excess materials brought onto site for construction to be removed after construction and their removal seen as part of the construction phase.
    - No open trenches or mounds of soils to be left. All disturbed areas, including temporary laydown areas to be reshaped / re-contoured to blend in with the surrounding topography.
    - Rehabilitation plan for disturbed areas to be compiled and implemented as part of the construction phase.
    - No construction vehicles may drive through any streams or simply create new crossings outside of the proposed plans and EMPr conditions, which might include WUL or GA conditions. Existing roads to be used as much as possible, but these roads to be maintained during all phases of the project.
    - No concrete or mounds of building sand and other materials may be stored temporary during the construction phase within **32m** of any watercourses, because a heavy rainstorm can wash these materials into the watercourse.

- Temporary access roads (if any) and temporary laydown sites, site office areas, etc. need to be monitored, maintained and rehabilitated at the end of the construction phase as part of the rehabilitation process.
- There are a few scattered marula trees in the study area. The marula is a national protected tree. Some are going to need to be removed and this will require a prior permit application process.
- A General Authorisation (GA) is going to be required for the project.

8 APPENDICES

8.1 List of floral species identified on site

Trees and Shrubs

Senegalia (*Acacia*) *erubescens*, *Vachellia (Acacia) gerrardii*, *Senegalia* (*Acacia*) *mellifera*, *Vachellia (Acacia) rehmanniana*, *Combretum apiculatum*, *Terminalia sericea*. *Commiphora pyracanthoides*, *Dichrostachys cinerea*, *Grewia flava*,

Herbaceous Plants

Chamaecrista absus, *Corbichonia decumbens*, *Heliotropium steudneri*, *Hemizygia elliottii*, *Hermbstaedtia odorata*, *Leucas sexdentata*, *Osteospermum muricatum*.

Grasses

Anthephora pubescens, *Aristida stipitata* subsp. *graciliflora*, *Cenchrus ciliaris*, *Enneapogon scoparius*, *Brachiaria nigropedata*, *Eragrostis trichophora*, *Panicum coloratum*,

Protected Trees

Marula (*Sclerocarya birrea*)

RDL or ODL

None.

8.2 Alien plants identified in the Study Area

A number of common alien plant species are present in the study area. The alien species encountered in the study area are recorded, along with their category rating below, in Table 24. The categories are as set out in the Conservation Act of Agricultural Resources Act, 1983 (CARA) (Act 43 of 1983).

Table 24: Alien plants

Botanical Name	Common Name	Category
Acacia mearnsii	Blackwattle	1
Argemone ochroleuca	White-flowered Mexican poppy	1
Bidens pilosa	Blackjacks	-
Eucalyptus sp	Gum trees	2
Melia azedarach	Syringa	3 (proposed 1b)
Ricinus communis	Castor oil plant	2
Senna pendula	Senna	1b
Solanum mauritainum	Bug weed	1b
Tagetes minuta	Khakibos, kahki weed	-
Verbena bonariensis	Vervain	-
Xanthium strumarium	Large cocklebur	-

8.3 Makhado Sweet Bushveld

Below is the list of floral species commonly found in the veldtype (Mucina & Rutherford, 2010).

Small Trees: *Senegalia* (*Acacia*) *erubescens* (d), *Vachellia (Acacia) gerrardii* (d), *Senegalia* (*Acacia*) *mellifera* subsp. *detinens* (d), *Vachellia (Acacia) rehmanniana* (d), *Boscia albitrunca* (d), *Combretum*

apiculatum (d), *Vachellia (Acacia) tortilis* subsp. *heteracantha*, *Terminalia sericea*. Tall Shrubs: *Commiphora pyracanthoides*, *Dichrostachys cinerea*, *Grewia flava*, *Hibiscus calyphyllus*, *Lycium shawii*, *Rhigozum obovatum*. Low Shrubs: *Barleria lancifolia*, *Hirpicium bechuanense*, *Indigofera poliotes*, *Melhania rehmannii*, *Pechuel-Loeschea leubnitziae*. Graminoids: *Anthephora pubescens* (d), *Aristida stipitata* subsp. *graciliflora* (d), *Cenchrus ciliaris* (d), *Enneapogon scoparius* (d), *Brachiaria nigropedata*, *Eragrostis trichophora*, *Panicum coloratum*, *P. maximum*, *Schmidtia pappophoroides*, *Urochloa mosambicensis*. Herbs: *Chamaecrista absus*, *Corbichonia decumbens*, *Geigeria acaulis*, *Harpagophytum procumbens* subsp. *transvaalense*, *Heliotropium steudneri*, *Hemizygia elliottii*, *Hermbstaedtia odorata*, *Leucas sexdentata*, *Osteospermum muricatum*, *Tephrosia purpurea* subsp. *leptostachya*.
(d) = Dominant.

8.4 Definitions

8.4.1 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).

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 50 cm of the soil.

8.4.2 Valley Bottom Wetlands

Valley-bottom wetlands are mostly flat wetland areas located along a valley floor, often connected to an upstream or adjoining river channel. Although valley-bottom wetlands are generally sites of sediment accumulation or temporary storage, as in the case of floodplain wetlands, the process of river-derived deposition is not nearly as important in these systems as it is in floodplain wetlands. As such, there tend to be few (if any) depositional features present within a valley-bottom wetland that can be ascribed to current riverine processes, although erosional features relating to riverine processes may be present. Valley-bottom wetlands are not formed by the process of flooding and large-scale sediment movement (Ollis, *et. al*. 2013. SANBI Biodiversity Series 22).

Channelled valley-bottom wetlands must be considered as wetland ecosystems that are distinct from, but sometimes associated with, the adjacent river channel itself, which must be classified as a 'river'. Remember that some river channels, especially in the more arid parts of South Africa, are vegetated Channelled valley-bottom wetlands are characterised by their location on valley floors, the absence of characteristic floodplain features and the presence of a river channel flowing through the wetland (Ollis, *et. al*. 2013. SANBI Biodiversity Series 22).

Unchannelled valley-bottom wetlands are without a river channel running through it. Unchannelled valley-bottom wetlands are characterised by their location on valley floors, an absence of distinct channel banks, and the prevalence of diffuse flows. These wetlands are generally formed when a river channel loses confinement and spreads out over a wider area, causing the concentrated flow associated with the river channel to change to diffuse flow (i.e. the river becomes an unchannelled valley-bottom wetland). This is typically due to a change in gradient brought about by a change in base level at the downstream edge of the wetland (for example, where an erosion-resistant dolerite dyke is present) and the resulting accumulation of sediment. In some cases, an unchannelled valley-bottom wetland could occur at the downstream end of a seep, where a slope grades into a valley near the head of a drainage line (Ollis, *et. al*. 2013. SANBI Biodiversity Series 22).

8.4.3 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*."

Figure 26, below, shows the basic classification of wetlands.

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 26: Basic classification of wetlands

8.5 Buffer Zones vs Regulated Zones

A buffer zone implies or talks to a zone or area in which "nothing" should be done, or no activities are allowed to take place. A regulated zone (or area), has certain legal implications, under which certain or regulated activities may or may not take place.

The following areas / zones and regulations are relevant:

- The 32m in the NEMA listed activities. This is 32m from the 1:1 year flood line or first flood bank of the active stream area. This is not 32 metres from the 1:100 year flood line or 32 metres from

the 500m zone of the delineated wetland as determined by DWS. Experts keep on using definitions in the NEMA to support or define things or issues in the NWA or vice versa. This should not be done).

- The 1:100 flood line, or the riparian area (which ever is the furthest) as defined by the GN509 in terms of the NWA; or
- The wetland area and 500m from the wetland area as defined by GN509 in terms of the NWA. This 500m area is not a buffer zone, but a zone of observation to determine the presence of nearby wetlands that might required buffering.

These areas are the "Extent" or "regulated area" of a watercourse. In other words areas in which the applicable legislation applies. Before any activity can take place as defined by the legislation the activity must be authorised in terms of that legislation. The term is "Regulated Area".

This means an activity may take place within a regulated area. Only if after the necessary environmental evaluation processes have been followed and it has been determined that the impacts are acceptable or the mitigating actions implemented will address any unacceptable impacts.

8.6 Short CV of Specialist

QUALIFICATIONS

2000 MBA, Oxford Brookes University (England)
1998 Diploma in Small Business Management (Damelin College)
1988 MSc (Rand Afrikaans University)
1987 BSc (Hons.) (Rand Afrikaans University)
1986 BSc (Rand Afrikaans University)

FURTHER TRAINING AND DEVELOPMENT

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

PUBLICATIONS

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

PROFESSIONAL MEMBERSHIPS

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

PROFESSIONAL EXPERIENCE

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

- Conduct specialist studies and reasearch for EIA projects.
- Specialist studies and consultancy includes

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

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

- Consulted on and managed projects in the agricultural & floricultural industries, 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

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

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

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