PROPOSED UPGRADE OF NATIONAL ROAD R36 SECTION 6, FROM MANCHABENI (KM 4,70) TO TZANEEN (KM 33,40), GREATER TZANEEN LOCAL MUNICIPALITY, MOPANI DISTRICT MUNICIPALITY, LIMPOPO PROVINCE

BIODIVERSITY ASSESSMENT

Terrestrial Ecological Assessment (Fauna and Flora) and Aquatic (Wetland) Ecological Assessment for the Proposed Upgrade of National Road R36 Section 6

Compiled by

FLORI SCIENTIFIC SERVICES

JUNE 2021

PROJECT TITLE: Proposed Upgrade of National Road R36 Section 6, from Manchabeni (KM 4,70) to Tzaneen (KM 33,40).

STUDY NAME: Biodiversity Impact Assessment

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EXECUTIVE SUMMARY

Background

The South African Roads Agency (SOC) Ltd (SANRAL) intends to upgrade the existing National Road R36 Section 6 from Manchabeni (km 4,70) to Tzaneen (km 33,40).

The Project description is as follows:

- Widening of the existing road cross section to a new single and dual carriageway cross-section,
- Vertical and horizontal geometric improvements,
- Vertical and horizontal realignments,
- Improvements of minor and major intersections.
- Widening of river bridges and major and minor culverts,
- Clearing of vegetation outside the road reserve for stockpile areas.

Chameleon Environmental was appointed to undertake the Basic Assessment (BA) for the project. Flori Scientific Services cc was appointed by Chameleon as the independent consultancy to conduct a biodiversity assessment, which includes a terrestrial ecological (fauna and flora) assessment and an aquatic (wetland) assessment, for the study site.

Site visits were conducted on 15 April and 12 August 2021.

Location of the study area

The study site is the National Road R36 Section 6, which is situated from Manchabeni (in the south) to Tzaneen (in the north), in the Greater Tzaneen Local Municipality of the Mopani District Municipality, Limpopo Province. The study site consists only of the existing road and road reserve, along with a few bridges and stormwater culverts. The study site is 28,70km in length.

TERRESTRIAL ECOLOGY

Vegetation

The study site is within the original extent of the veldtypes of Tzaneen Sour Bushveld and Granite Lowveld, within the Lowveld Bioregion of the Savanna Biome. Tzaneen Sour Bushveld is a threatened veldtype / ecosystem, with a status of 'Vulnerable'.

The study site is a highly transformed area of existing hard-surfaced road and transformed and highly degraded road reserve. Added to this is that approximately 21km of the 28,7km is within built-up, urban areas. The remaining 2,7km comprises of 1,5km of farmlands and 1,2km of degraded bushveld. In other words, only around 4% of the immediate adjacent area along the length of the study site (R36, Section 6) can be classified as bushveld or natural vegetation. All of this 4% is within badly degraded Tzaneen Sour Bushveld. The only other resemblances of natural vegetation are in the areas of the small streams

and rivers that are crossed. There are no patches or examples of pristine Tzaneen Sour Bushveld or Granite Lowveld present in the study area.

Category Description	Classification
Biome	Savanna
Bioregion	Lowveld
Veldtype	Tzaneen Sour Bushveld and Granite Lowveld

Fauna

No RDL or ODL (or other Species of conservation concern) were observed in the study area during field investigations.

AQUATIC ECOLOGY

Watercourses in the study area

The Letsitele and the Thabina are the only two main perennial rivers crossed by the study site. The Thabina River flows into the Letsitele, which then flows into the Great Letaba River. There are a few small seasonal streams and drainage lines that the study site crosses over. These small watercourses all flow into the three main rivers mentioned above. Some of the small streams / drainage lines have associated valley bottom wetlands. The watercourses in the study area and surrounding areas, especially within the built-up areas, are badly encroached on, with much of the original riparian zones destroyed and the actual quality of the water negatively impacted on.

Drainage areas

Below is a summary of the drainage areas of the study site

Level	Category
Primary Drainage Area (PDA)	B
Quaternary Drainage Area (QDA)	B72E; B81C; B81D
Water Management Area (WMA) – Previous	Luvuvhu & Letaba
Water Management Area (WMA) – New	Olifants (WMA 2)
Sub-Water Management Area	Groot Letaba
Catchment Management Agency (CMA)	Olifants (CMA 2)
Wetland Vegetation Ecoregion	Lowveld (Group 3 & Group 7)
RAMSAR Site	No
Wetland FEPA	No
Fish FEPA	No
Fish FSA	No
Fish Corridor	No

Fish Migratory	No
Priority Quaternary Catchment	No
National Strategic Water Source Area (SWSA)	No
Provincial Important Water Source Area (WSA)	No

Sensitivity analyses

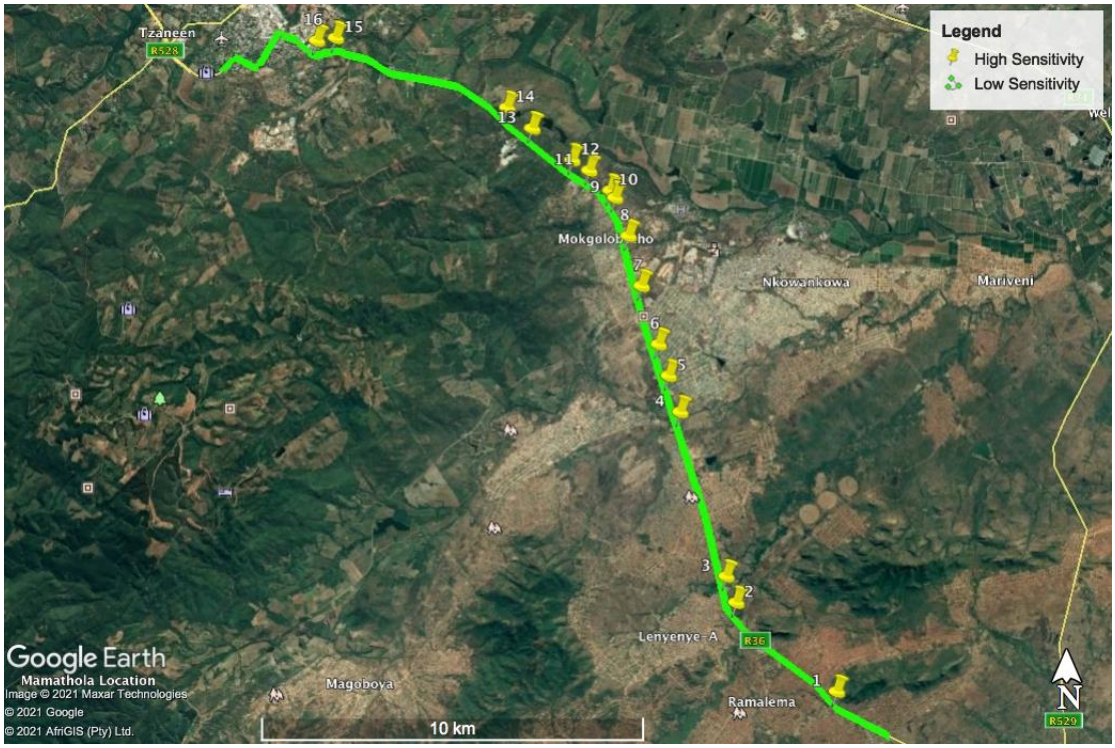
The ecological sensitivity of the study area is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit, whether it is floristic or faunal in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

Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity
Transformed (Road & Road Reserve)	Low	Low	Low
Watercourses	Medium	Medium	Medium (Default: High)
Bushveld (Mostly degraded)	Medium/Low	Medium/Low	Medium/Low

There are no sensitive areas directly within the study site in terms of the road (R36 Section 6) and the road reserve. Most of this is transformed habitat. However, the study site (R36) does pass through a designated CBA area in the north, which needs to be considered as having a sensitivity of 'High'. Other 'High' sensitive areas include the river crossings at three (3) sites, which are the Thabina, Unnamed tributary to the Thabina and Letsitele. Other sensitive areas include watercourse crossings of small seasonal streams, drainage lines and in some cases associated valley bottom wetlands in the area of Tzaneen.

The sensitive areas of the CBA and watercourses are therefore of importance mostly in terms of setting up of temporary laydown areas, site offices and campsite areas.



Sensitivity map

Fatal flaws

There are no fatal flaws.

Priority areas

The northern section of the study area is within and along the edge of the Wolkberg Forest Belt Important Bird area (IBA). The site is not within any other priority areas, except the two rivers crossed (Letsitele and Thabina). Priority areas include formal and informal protected areas (nature reserves); important bird areas (IBAs); RAMSAR sites; national fresh water ecosystem priority areas (NFEPA) and national protected areas expansion strategy (NPAES) focus areas.

Conclusions

- The study site is situated within the original extent of the veldtypes of Granite Lowveld and Tzaneen Sour Bushveld, within the Savanna Biome.
- Tzaneen Sour Bushveld is a threatened veldtype / ecosystem with a status of 'Vulnerable'.
- Most of the study area is transformed or highly degraded. There are no areas of pristine bushveld in the study site.
- The northern half of the study site is within and on the edge of the Wolkberg Forest Belt Important Bird Area (IBA). It is not within any other national priority areas.
- The study site is not within 10km from any protected area (formal and informal).

- Two small perennial rivers (Letsitele and Thabina), as well as a few smaller streams and drainage lines are present.
- During field investigations no Red Data Listed (RDL) or Orange Data Listed (ODL) plants were observed in the study site. None are expected to occur.
- One protected tree species (Marula - *Sclerocarya birrea*) is present in the study site. There are a few scattered trees in the area. It seems unlikely that any of these trees will need to be cut ro removed. A tree permit will need to be obtained prior to the removal of any of these trees.
- The study site is situated within a Critical Biodiversity Area (CBA) and within an Ecological Support Area (ESA). However, the study site itself is mostly transformed, existing road.
- There are no 'high' sensitive habitats present on site, with the exception of the watercourse crossings.
- No red data listed (RDL) faunal species were observed to be present and / or breeding with the study area boundaries. It is also highly unlikely that any are or will be present, with the small chance along the main rivers only.
- Site investigations were conducted during the summer and winter months and the findings and availability of field data are sufficient to achieve acceptable findings and outcomes from the assessment.
- Due to the nature of the project (upgrade of an existing road) no further specialist environmental studies are required or recommended.
- There are no obvious fatal flaws in terms of the project on the natural environment.
- Impacts on the existing natural environment related to the project are '**LOW**'
- The levels of change (increase in negative cumulative impacts) arising from the activities of the proposed project are at acceptably low levels for the area and for the project to proceed and not create any related 'fatal flaws'.
- A General Authorisation (GA) process for work on watercourse crossings will be required.
- Taking all findings and recommendations into account it is the reasonable opinion of the author / specialist that the activity may be authorised. The project and related activities may proceed to the next phase.

Recommendations

- Recommended mitigating measures as proposed in this study and report must be implemented. These include:
    - No protected trees will be removed or destroyed.
    - The footprint of the project is small in relation to the area and mostly within an already disturbed and altered environment.
    - Two main rivers will be crossed (Letsitele & Thabina), along with a few small semi-perennial streams and drainage lines. 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) as the project involves the upgrade and not totally new crossings. The upgrade will also not include little to no need to remove trees and other riparian vegetation.
- Any temporary storage, lay-down areas or accommodation facilities to be setup in existing built-up areas or disturbed areas. No temporary storage areas, laydown areas or site offices are allowed within a **100m** of the edge of any river, stream or distinctive drainage line.
- 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 watercourses and steep gradients along escarpment edges. The erosion potential is moderate to low. This also to further reduce the potential of siltation of small watercourses. The plan need only be basic, but needs to be monitored.
- All hazardous materials must be stored appropriately to prevent these contaminants from entering the water environment;
- All excess materials brought onto site for construction to be removed after construction and their removal seen as part of the construction phase.
- No open trenches or mounds of soils to be left.
- Rehabilitation plan for disturbed areas to be compiled and implemented as part of the construction phase.

- The most important recommendations arising from the study is the need for 100m buffer zones around watercourses in which no temporary laydown areas, site offices or campsites may be set up.
- An independent ECO is recommended to monitor operations and ensure that recommended mitigating measures, including buffer zones, are implemented and adhered to.

EXPERTISE AND EXPERIENCE OF SPECIALIST

EXPERTISE

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 in training, assessing & service provision (AgriSeta).

Registered with South African Council for Natural Scientific Professions (SACNASP). Registration number: 400077/91

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 speciaist reports for EIAs, including ecological assessments (fauna & flora), wetland assessments and avifauna impact assessments. Projects include power lines, roads, quarries, 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 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

BA	Basic Assessment
CBA	Critical Biodiversity Areas
CMA	Catchment Management Agencies
DEA	Department of Environmental Affairs (Old name of DEFF)
DEFF	Department of Environment, Forestry & Fisheries (Old name for DFFE)
DFFE	Department of Forestry, Fisheries and the Environment
DWA	Department of Water Affairs (Old name for DWS)
DWS	Department Water and Sanitation
EAP	Environmental Authorised Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance & Sensitivity
EMC	Environmental Management Class
EMF	Environmental Management Framework
HGM	Hydrogeomorphic
IBA	Important Bird Area(s)
IUCN	International Union for Conservation of Nature
MAP	Mean Annual Precipitation
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy
PES	Present Ecological State
PDA	Primary Drainage Area
QDA	Quaternary Drainage Area
REC	Recommended Ecological Category (or Class)
REMC	Recommended Ecological Management Category (or Class)
RVI	Riparian Vegetation Index
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency (SOC) Limited
SWSA	Strategic Water areas of South Africa
WMA	Water Management Areas
WRC	Water Research Commission
WUL	Water Use Licence
WULA	Water Use Licence Application

1 BACKGROUND

1.1 Project overview

The South African Roads Agency (SOC) Ltd (SANRAL) intends to upgrade the existing National Road R36 Section 6 from Manchabeni (km 4,70) to Tzaneen (km 33,40).

The Project description is as follows:

- Widening of the existing road cross section to a new single and dual carriageway cross-section,
- Vertical and horizontal geometric improvements,
- Vertical and horizontal realignments,
- Improvements of minor and major intersections.
- Widening of river bridges and major and minor culverts,
- Clearing of vegetation outside the road reserve for stockpile areas.

The water uses (crossing streams/rivers or within 500m of a wetland) will be applied for at the Department of Water and Sanitation in accordance with the National Water Act, (Act No. 36 of 1998).

The Basic Assessment (BA) process will be guided by the EIA Regulations, 2014, as amended and environmental management principles and objectives of the National Environmental Management Act, 1998 (Act No. 107 of 1998). The Environment Impact Assessment (EIA) regulations, 2014 came into effect on 8 December 2014 in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998). Activities identified in terms of Regulation R. 983 and may not commence without environmental authorization from the competent authority and in respect of which the investigation, assessment and communication of potential impacts of activities must follow the Basic Assessment procedure as prescribed.

Chameleon Environmental was appointed to undertake the Basic Assessment (BA) for the project. Flori Scientific Services cc was appointed by Chameleon as the independent consultancy to conduct a biodiversity assessment, which includes a terrestrial ecological (fauna and flora) assessment and an aquatic (wetland) assessment, for the study site.

Site visits were conducted on 15 April and 12 August 2021.

1.2 Scope of work

The scope of work was understood to be as follows:

- Conduct a biodiversity impact assessment for the study site, which includes fauna & flora as well as watercourses (aquatic);
- Conduct site visits and investigations;

- Compile a biodiversity report, which addresses potential impacts on the natural environment;
- Determine if there are any fatal flaws, high sensitive areas, no-go zones, etc.;
- Identify and delineate any sensitive areas / habitats, recommend buffers (if required); and
- Provide recommendations and mitigating measures, if and where necessary.

1.3 Quality and age of base data

The latest data sets were used for the report and conclusions reached, in terms of background information and guidelines.

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

- Screening Tool: Dept. Environmental Affairs (DEA) – (www.screening.environment.gov.za).
- Threatened ecosystems: South African National Biodiversity Institute - (www.bgis.sanbi.org).
- Protected areas: Protected Areas Register (PAR): DEFF – (https://portal.environment.gov.za).
- RDL species: Red List of South Africa Plants (latest update) – (www.redlist.sanbi.org).
- Veldtypes and ecosystems: Mucina & Rutherford, 2006, 2010. Updated 2012, 2018.
- National Wetland Map (Map 5) – SANBI & Water Research Commission (WRC).
- Endangered Wildlife Trust (EWT) – latest data sets – (www.ewt.org.za).
- SANBI data sets – latest updated website data (www. bgis.sanbi.org).
- Limpopo Conservation Plan (Version 2).
- Mopani District Bioregional Plan (2016).

1.4 Assumptions and limitations

The assumptions and limitations for the assessment are as follows:

- All information regarding the proposed project and related activities as provided by the Client are taken to be accurate.
- Site investigations were conducted on 15 April and 12 August 2021. The site visits fall within the wet (summer) and dry (winter) seasons for the region.
- During site investigations all areas were easily accessed. There were no areas that could not be investigated or accessed.
- The study site is relatively long, but very narrow with easy access and inspection possible.
- The site investigations and study are deemed adequate for the project and no further specialist environmental studies are necessary or recommended.
- Precise buffer zones, regulated zones, etc. or exact GPS positions cannot be made using generalised corridors or kml files on Google Earth. However, buffer zones and delineations drawn are accurate to within a few metres;
- The latest data sets were used as background information and desktop review for the project. The data sets were verified and refined during field investigations (ground-truthing).

- Equipment used: Standard soil augers; hand-held Garmin GPS instrument; EC & pH hand-held meters; IPhone 7 for photographs, MacBook Pro and Epson PC Laptops; Google earth maps, 1:50 000 South African topographical maps.
- Computer packages used: MS Word; MS Excel; Adobe Photoshop, ARC GIS (10.8); Google Earth; and Garmin Base Maps

1.5 Consultation process for the study

Emails were exchanged and telephone conversations held with the lead EAP (Chameleon Environmental) regarding the project. Information regarding the project was obtained from SANRAL via Chameleon Environmental, including authorisation to conduct the studies and access the necessary areas.

2 METHODOLOGY

2.1 Desktop assessment

A literature review was conducted regarding the main vegetation types and fauna of the general region and of the specific study area. The primary guidelines and datasets used were from Mucina & Rutherford (eds) (2006, 2010, updated 2012); the South African National Biodiversity Institute (SANBI: www.bgis.sanbi.org); and Endangered Wildlife Trust (www.ewt.org.za). Background data regarding soils, geology, climate and general ecology were also obtained from existing datasets and relevant organisations. Specialist studies that were conducted in the area on similar or different projects were also previewed, if and where available.

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

2.2 Field surveys

Site investigations of the study site and surrounding areas were conducted on 15 April and 31 May 2021.

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

- Biophysical environment, including regional and site-specific vegetation.
- Habitats ideal for potential red data listed fauna and flora species;

- Watercourses.

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

2.3 Floral Sensitivity

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

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

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

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

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

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

Each vegetation unit is subjectively rated on a sensitivity scale of 1 to 10, in terms of the influence that the particular Sensitivity Criterion has on the floristic status of the plant community. Separate Values are

multiplied with the respective Criteria Weighting, which emphasizes the importance or triviality that the individual Sensitivity Criteria have on the status of each community.

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

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

2.4 Faunal Sensitivity

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

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

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

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

2.5 Present Ecological State

The Present Ecological State (PES) is the current (present) ecological condition (state) in which the watercourses are 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 PES of watercourses are found in Table 1. The scores for the various attributes are found in Table 2. 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 provides guidelines for determining the category of the Present Ecological Status (PES) based on the total score determined during assessments. This 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	Overgrazing, over fishing, over harvesting of plant material, etc.

Table 2: Scoring guidelines for habitat assessment

Scoring guidelines per criteria	
Natural / unmodified	5
Mostly natural	4
Moderately modified	3
Largely modified	2
Seriously modified	1
Critically modified (totally transformed)	0

Table 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 were deemed to be Low. Category rating of C was deemed to be Medium, while Category ratings of B & A were deemed to be High.

2.6 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.

Table 4: EIS Categories and Descriptions

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

2.7 Impact Assessment

2.7.1 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

2.7.2 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 below in 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 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.

3 RECEIVING ENVIRONMENT

3.1 Study Site Location

The study site is the National Road R36 Section 6, which is situated from Manchabeni (in the south) to Tzaneen (in the north), in the Greater Tzaneen Local Municipality of the Mopani District Municipality, Limpopo Province (Figure 1, Figure 2). The study site consists only of the existing road and road reserve, along with a few bridges and stormwater culverts. The study site is 28,70km in length.

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

- Starting Point (KM 4,70): 23°59'52.07"S; 30°19'18.99"E.
- End Point (KM 33,40): 23°50'28.84"S; 30° 9'0.74"E.
- Tzaneen: 23°50'0.23"S; 30° 9'59.64"E.
- Manchabeni: 23°59'33.54"S; 30°19'24.28"E.
- Quarter Degree Square (QDS): 2330CC, 2330CD.
- Quaternary Drainage Area (QDA): B72E, B81C, B81D.

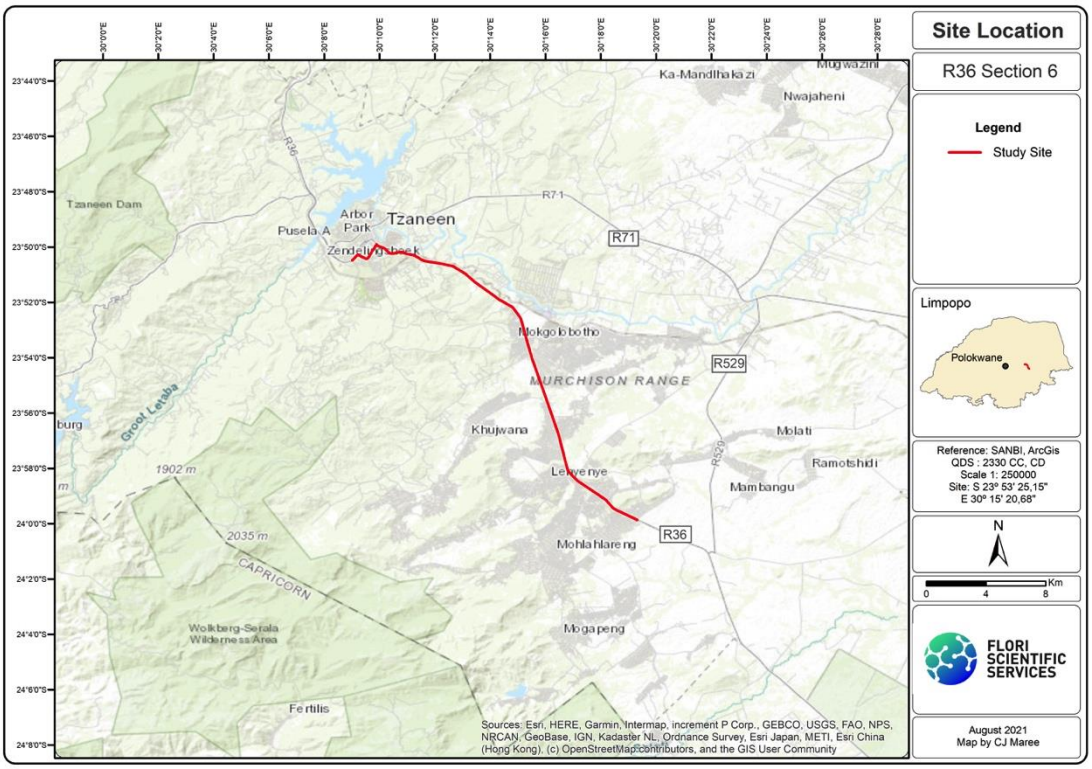


Figure 1: Study Site Location

Figure 2: Study Site (R36 Section 6)

3.2 Topography

The topography of the region is mountainous areas with undulating hills, valleys and flat to undulating plains, sometimes ontop of small plateaus. The average height above sea level for the study site is approximately 629m, with maximum and minimum elevations of 767m and 541m, respectively. The highest point is in the Town of Tzaneen, near the end of the Road Section 6, while the lowest point is where the site (Road R36) crosses over the Letsitele River. The study site is situated mostly at the bottom of the escarpment, with Tzaneen situated on the edge or lower foothills of the escarpment.

3.3 Climate

The study site is within a summer rainfall region of the country. The study site is situated along the edges of the two high rainfall regions (601mm – 1 000mm, and >1000mm) on top of and along the escarpment; and within medium rainfall region (401mm – 600mm) on the lower foothills (Figure 3). The site is within the Hot Interior Climatic Zone of South Africa (Figure 4). The summers are hot to very hot and humid (sub-tropical in the area of Tzaneen), while the winter nights and early mornings can be cool to mild. Frost is uncommon. The average annual rainfall for Tzaneen is approximately 881mm. The average temperatures for Tzaneen are maximums in the high twenties / low thirties and minimums in the low teens, Degrees Celsius (en.climate-data.org).

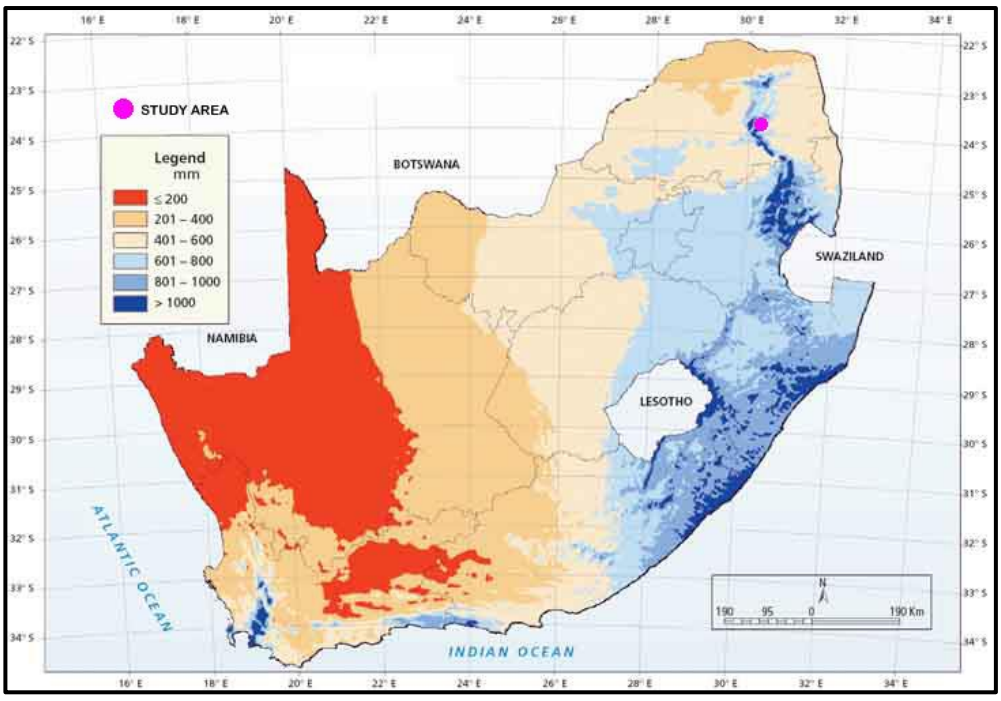


Figure 3: Rainfall Regions of South Africa

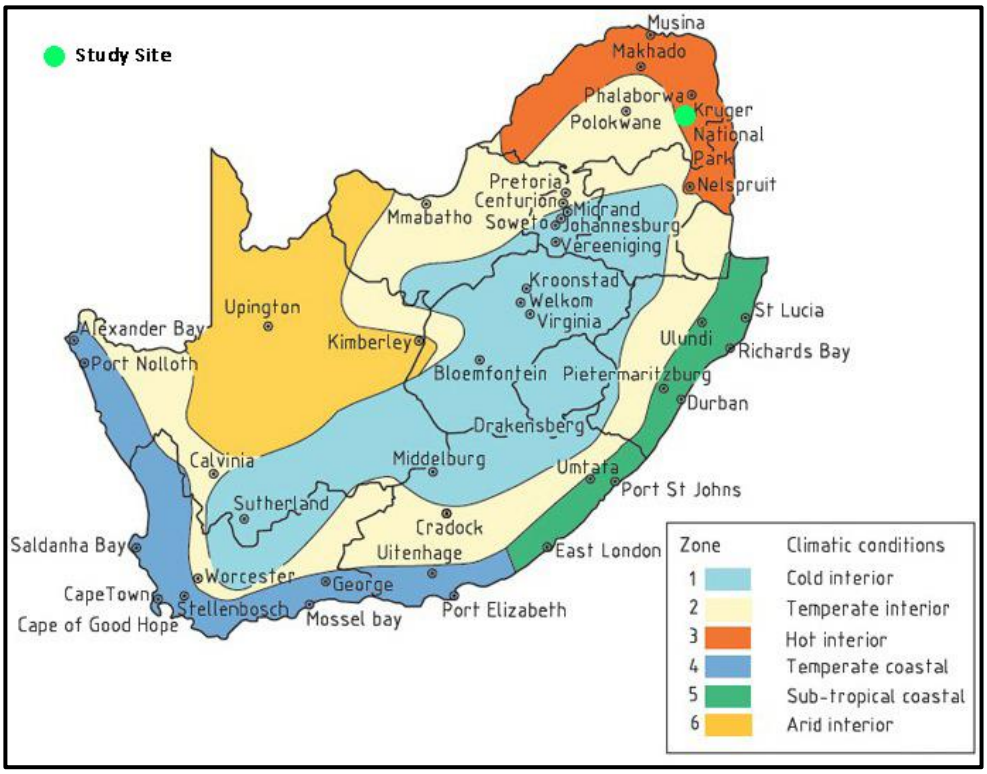


Figure 4: Broad Climatic Zones of South Africa

3.4 Landuse

The landuses and/or landcover of the study site are the existing national road (R36) and road reserve. The dominant landcovers of the area are high-density townships in the south; the Town of Tzaneen in the north; and some open bushveld in the areas between. Other landuses in the area include forestry, mining and high-intensity commercial farming (mostly crop cultivation and orchards).

4 TERRESTRIAL ECOLOGY

4.1 Vegetation

South Africa is divided up into nine major Biomes. The study site and the surrounding area are within the Savanna Biome (Figure 5). Mucina & Rutherford (2006) divide the Bushveld into six main bioregions, namely, Central Bushveld, Mopane, Lowveld, Sub-Escarpment Savanna, Eastern Kalahari Bushveld and Kalahari Duneveld. The study site is within the Lowveld Bioregion and within the original extent of the veldtypes of **Granite Lowveld and Tzaneen Sour Bushveld** (Figure 6).

The vegetation hierarchy of the study site is shown below in Table 6.

Table 6: Vegetation hierarchy of the study area

Category Description	Classification
Biome	Savanna (Bushveld)
Bioregion	Lowveld
Veldtype	Granite Lowveld, Tzaneen Sour Bushveld

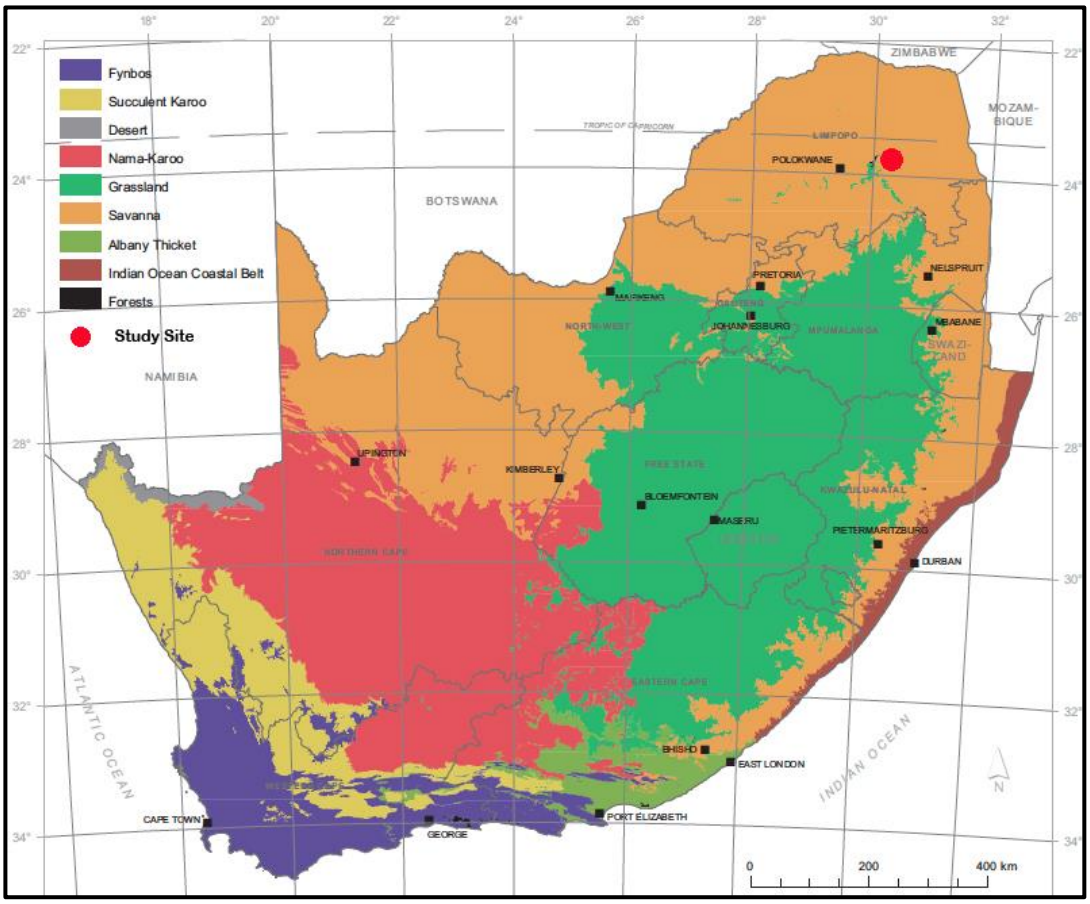


Figure 5: Biomes of South Africa

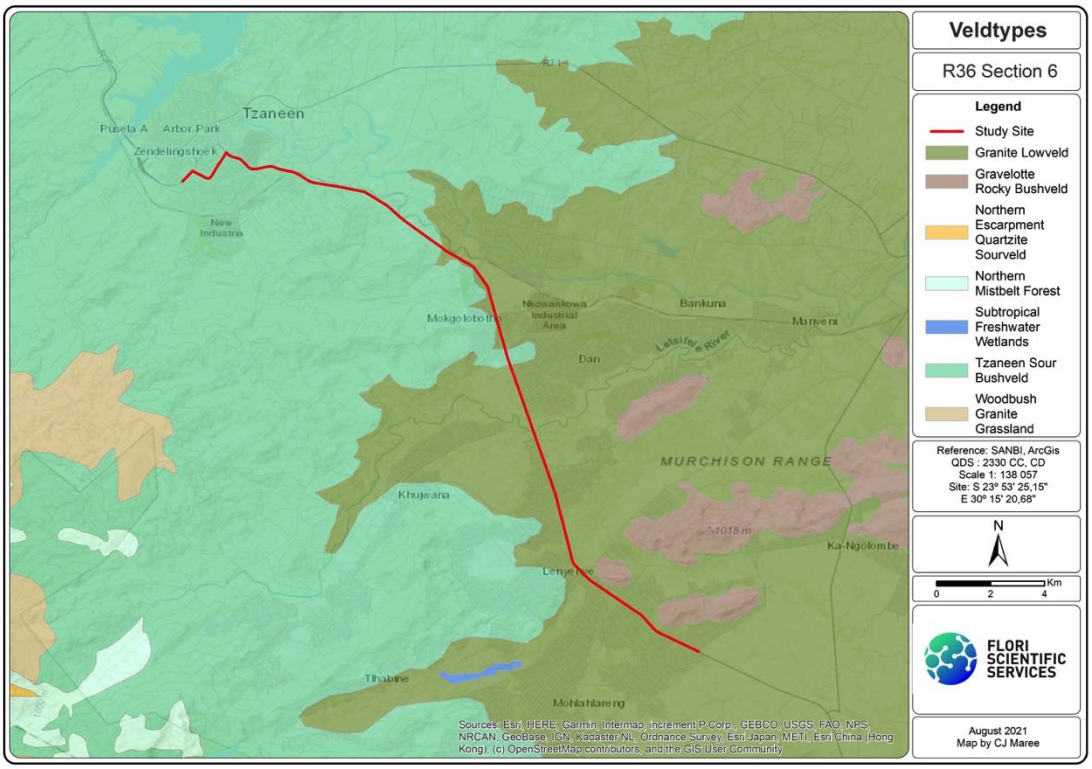


Figure 6: Veldtypes

Granite Lowveld is characterised by tall shrubland with few trees to moderately dense low woodland on the deep sandy uplands with *Terminalia sericea* (Silver Cluster-leaf), *Combretum zeyheri* (Bushwillow) and *Combretum apiculatum* and ground layer including *Pogonarthria squarrosa*, *Tricholaena monachne* and *Eragrostis rigidior*. Dense thicket to open savanna in the bottomlands with *Vachellia (Acacia) nigrescens*, *Dichrostachys cinerea*, *Grewia bicolor* in the woody layer. The dense herbaceous layer contains the dominant *Digitaria eriantha*, *Panicum maximum* and *Aristida congesta* on fine-textured soils, while brackish bottomlands support *Sporobolus nitens*, *Urochloa mosambicensis* and *Chloris virgata*. At seep lines, where convex topography changes to concave, a dense fringe of *Terminalia sericea* occurs, with *Eragrostis gummiflua* in the undergrowth (Mucina & Rutherford, 2006).

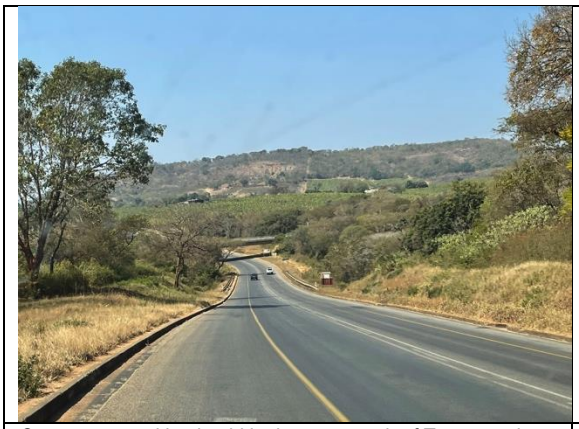
Tzaneen Sour Bushveld is characterised by deciduous, tall open bushveld (parkland) with a well-developed, tall grass layer, occurring on low to high mountains with undulating plains mainly at the base of, and on the lower to middle slopes of, the northeastern escarpment (Mucina & Rutherford, 2006).

The study site is a highly transformed area of existing hard-surfaced road and transformed and highly degraded road reserve. Added to this is that approximately 21km of the 28,7km is within built-up, urban areas. The remaining 2,7km comprises of 1,5km of farmlands and 1,2km of degraded bushveld. In other words, only around 4% of the immediate adjacent area along the length of the study site (R36, Section 6) can be classified as bushveld or natural vegetation. All of this 4% is within badly degraded Tzaneen

Sour Bushveld. The only other resemblances of natural vegetation are in the areas of the small streams and rivers that are crossed. There are no patches or examples of pristine Tzaneen Sour Bushveld or Granite Lowveld present in the study area.

The list of dominant and other plant species observed on site are listed in the Appendices.

Table 7: Environment within and along the study site (R36 Section 6)

	
Some trees and bushveld in the area south of Tzaneen along the study site route (R36)	Banana Plantation next to R36 near and south of Tzaneen.
	
Study Site (R36) in the area of Sasekani showing cleared road reserve and some open degraded Granite Lowveld within built up (township / urban areas)	Study Site (R36) at Manchabeni showing transformed environment with bare road reserves and scattered bushveld trees in urban yards and along road reserve edges

4.2 Priority Floral Species

No Red Data Listed (RDL) species (endangered, threatened or vulnerable) were observed during field investigations. None are expected to occur. No Orange Data Listed (ODL) species were observed either with none expected to occur. A few marula trees (*Sclerocarya birrea*), which are nationally protected trees, where observed within the road reserve of the study area.

4.3 Threat Status

Granite Lowveld is not a threatened veldtype / ecosystem, while Tzaneen Sour Bushveld is, with a status of vulnerable (Table 8).

Table 8: Veldtype status

Veldtype	Status	Description
Granite Lowveld	Least Threatened (LT) / Least Concern (LC)	Some 17% statutorily conserved in the Kruger National Park. About the same amount conserved in private reserves mainly the Selati, Klaserie, Timbavati, Mala Mala, Sabi Sand and Manyeleti Reserves. More than 20% already transformed, mainly by cultivation and by settlements / townships (Mucina & Rutherford, 2006, 2010)
Tzaneen Sour Bushveld	Vulnerable (VU)	Only a little over 1% statutorily conserved, almost all in the Lekgalameetse Nature Reserve, and about 2% conserved in private reserves such as the Selati Game Reserve and Wolkberg (Serala) Wilderness Area. About 41% transformed mainly by cultivation (29%) and plantations (9%). The higher-lying parts of this unit have been heavily afforested with tree plantations while the lower-lying areas are under agricultural and horticultural crops. Scattered alien plants include *Solanum mauritianum*, *Melia azedarach* and *Caesalpinia deca- petala*. The subtropical climate is conducive to the spread of *Chromolaena odorata*, *Lantana camara* and *Psidium guajava*. Erosion is very variable—from very low to high in some areas (Mucina & Rutherford, 2006, 2010)

Table 9 below gives a basic description of each of the status categories, while Figure 7 shows the categories in a hierarchical format (IUCN Redlist, 2010).

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

Table 9: Ecosystem Status: Simplified explanation of categories used

STATUS	% Transformed	Effect on Ecosystem
Least Threatened (LT)	0-20% (<20% loss)	No significant disruption of ecosystem functions
Vulnerable (VU)	20-40% (>20% loss)	Can result in some ecosystem functions being altered
Endangered (EN)	40-60% (>40% loss)	Partial loss of ecosystem functions
Critically Endangered (CR)	>60% or BT Index for that specific veldtype	Species loss. Remaining habitat is less than is required to represent 75% of species diversity

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

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

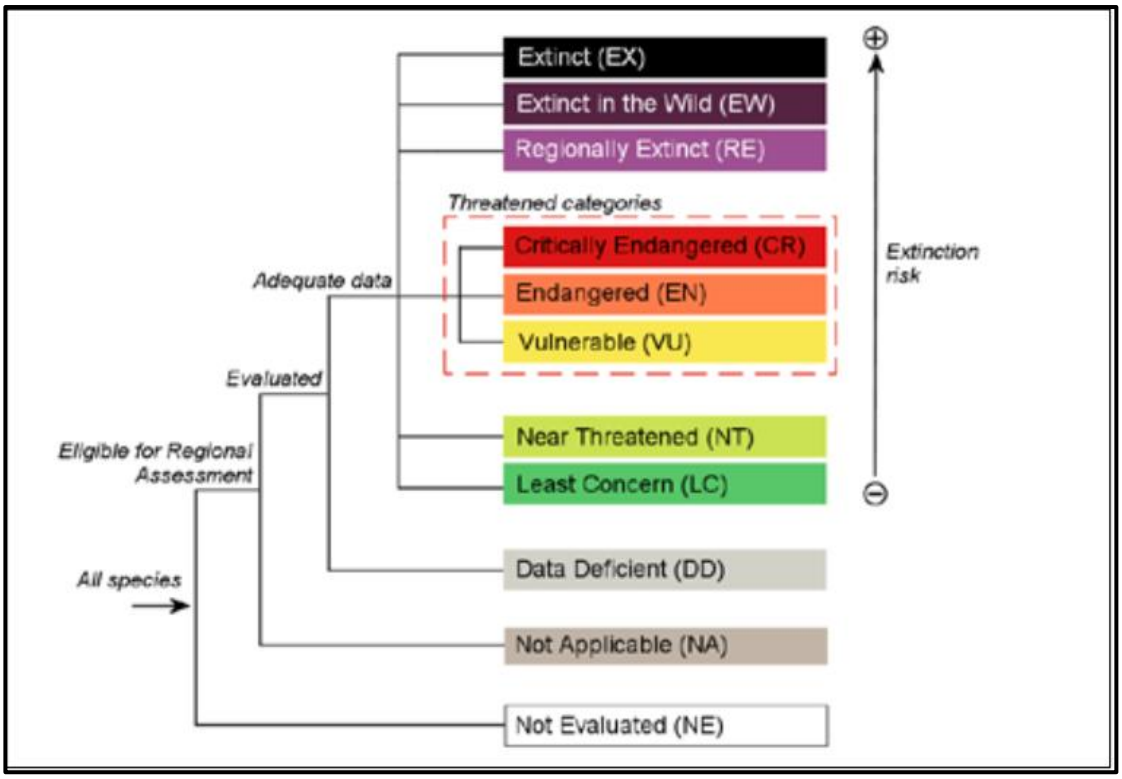


Figure 7: Structure of categories used at the regional level

4.4 Fauna

The region of the study area has high levels of urban development around Tzaneen in the north and the southern half of the site in the area of Manchabeni and other townships. The agricultural farmlands, orchards and forest plantations in the area further have a negative impact on the presence of wild fauna. The more open, mountainous areas south of Tzaneen and west of the study site (R36) create the best habitat for the presence of wild faunal species. However, it is realised that various faunal species such as monkeys are attracted to farmlands and orchards. Free roaming wild fauna will be present in the general area, especially in the northern half of the study site, south of Tzaneen and north of Letsitele River, in the less urban and populated areas. There are also a number of protected areas (PA) in the greater region, which adds to the potential for free roaming wild animals passing through or wandering into the study site (Figure 8).

However, the nature of the proposed project will have low to very low levels of negative impact on the wild fauna of the region. Keeping in mind that roads are generally renowned for numerous deaths of wild animals crossing them (road kills).

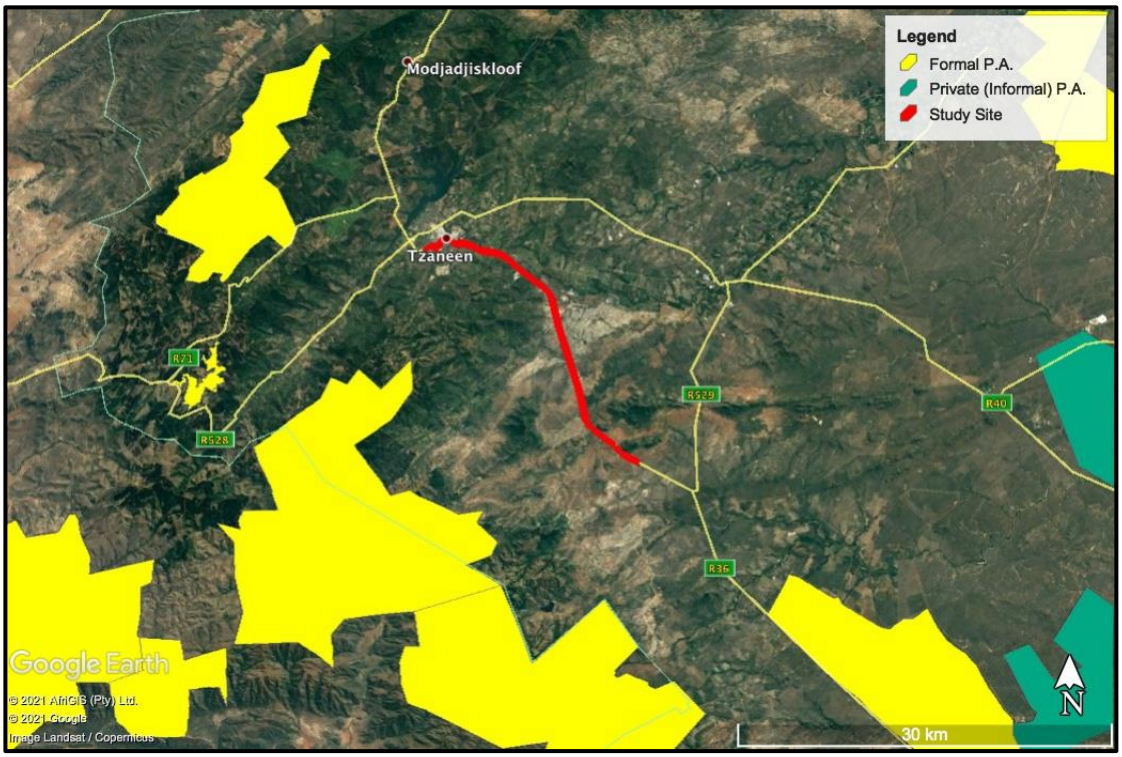


Figure 8: Formal and Informal (Private) Protected Areas in the Greater Region

4.4.1 Mammals

No large- or medium-sized mammals were observed during field investigations, A few small burrows were found outside of the main study area (road and road reserve), which appear to be used by small field mouse, scrub hare and mongoose. There are many common species of wild animals and mammals present in the area of the Wolkberg Mountains and other surrounding bushveld areas ,moiuntains and nature reserve. It is highly likely that occasional some of these mammals, especially the smaller species will traverse the study site.

Gunning's Golden Mole, *Amblysomus gunning,* (*Endangered*) is *endemic* to Limpopo. However, the mole is not found within the study area, but is known only to occur in the Grootbosch Forest and the Agatha Forest Reserve (Mopani District Bioregional Plan, 2016).

4.4.2 Avifuana

The northern section of the study site is within and along the Wolkberg Forest Belt Important Bird Area (IBA) (Figure 9). Priority / threatened species such as the Bush Blackcap (*Lioptilus nigricapillus*) and Crowned Eagle (*Stephanoaetus coronatus*) are found in the Wolkberg IBA. There are also a number of

formal and informal protected areas in a greater region (Figure 8). The Blue Swallow (*Hirundo atrocaerulea*) (*Vulnerable*) and Cape Parrot (*Poicephalus robustus*) (*Critically Endangered*) are *endemic* to South Africa, but not present in the area of the study site. All of these factors add to the presence of birds flying through the study area, keeping in mind that many species, including priority species such as eagles, vultures, storks and cranes, are highly mobile and often travel far distances to forage. Although roads do pose an ongoing threat to birds, the project will have little to no cumulative negative impact on birds.

A few common bird species were observed within the study area during field investigations, which included laughing dove (*Streptopelia senegalensis*), cape turtle dove (*Streptopelia capicola*), hadeda ibis (*Bostrychia hagedash*) and dark-capped bulbul (*Pycnonotus tricolor*).

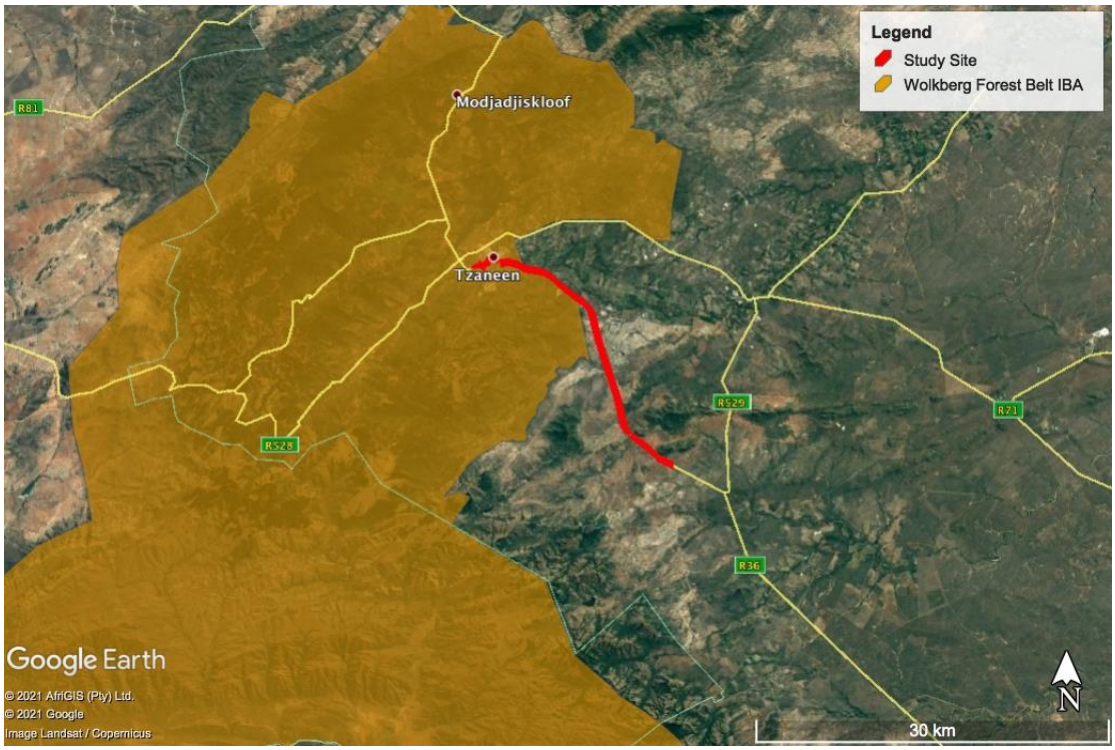


Figure 9: Important Bird Area (IBA) near the Study Site

4.4.3 Reptiles

A few common lizard species such as plated lizards were observed during field investigations. None were observed directly within the study area. No other reptiles such as snakes or tortoises were observed during field investigations. It is obvious that a number of common snake species are present in the general area. However, no priority species are expected to be present in the study area, including Southern African Python (*Python natalensis*), which is also known as African Rock Python. Even though the site is within the distribution range of the python. Some species most likely to present in the greater region and surrounding areas include common brown house (*Lamprophis capensis*), red-lipped herald

(*Crotaphopeltis hotamboeia*), rinkhals (*Hemachatus haemachatus*), cobra species (Including the dangerous Mozambique spitting cobra (*Naja mossambica*)) and other common bushveld snakes. The study site is not within a priority snake hotspot (Figure 10).

The site is within a lizard quarter degree square (QDS) hotspot (Figure 11). However, the presence of these lizards will be more within the nearby Wolkberg Mountains and not within the actual study site.

4.4.4 Amphibians

No amphibians were observed during field investigations. A number of common species are likely to occur in the small streams in the area. The Forest Rain Frog (*Breviceps sylvestris*) (*Endangered*) is endemic to the Limpopo Province and is found in the Blouberg, Soutpansberg, Wolkberg and Drakensberg ranges. The Wolkberg complex is west of the study site, but the frog requires forest habitat and is not found in the study area.

4.4.5 Invertebrates

The map below shows the hotspots for priority butterflies and species-rich areas for South Africa (Figure 12). The study area is not within any of these known hotspots.

Wolkberg Zulu Butterfly (*Alaena margaritacea*) (Critically Endangered) is endemic to Limpopo where a small one colony can be found near Haenertsburg. The butterfly is not found within the region of the study site.

Invertebrates such as spiders and scorpions 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). 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.

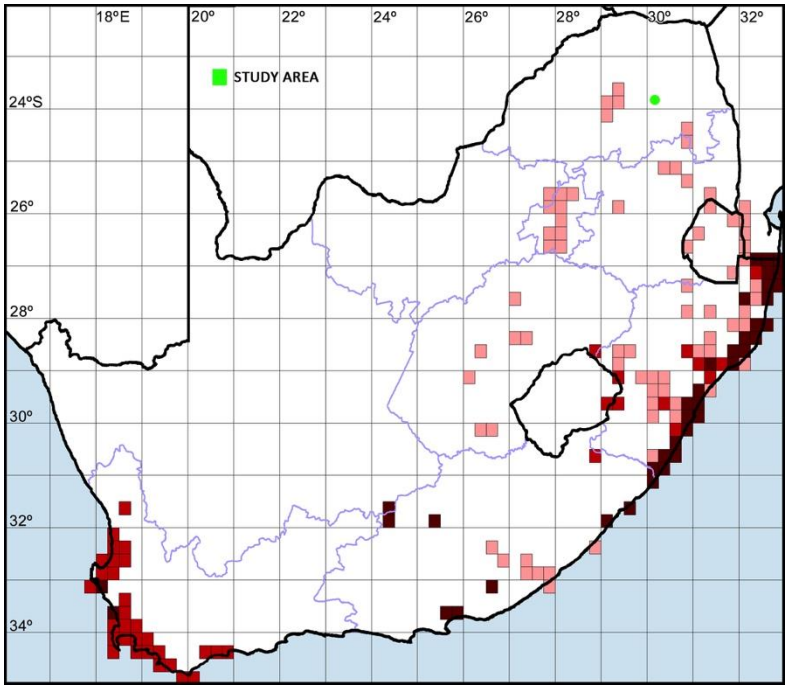


Figure 10: Snake hotspots

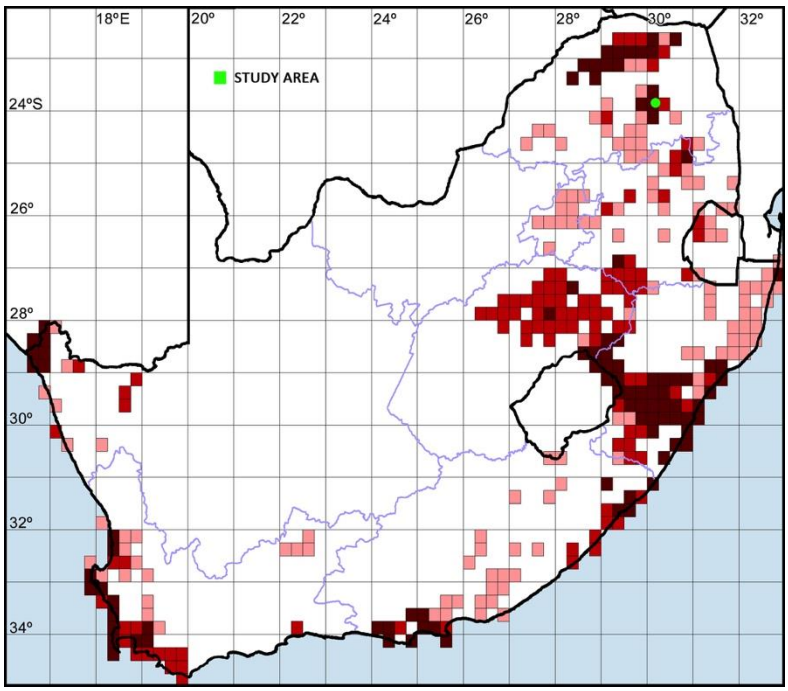


Figure 11: Lizard hotspots

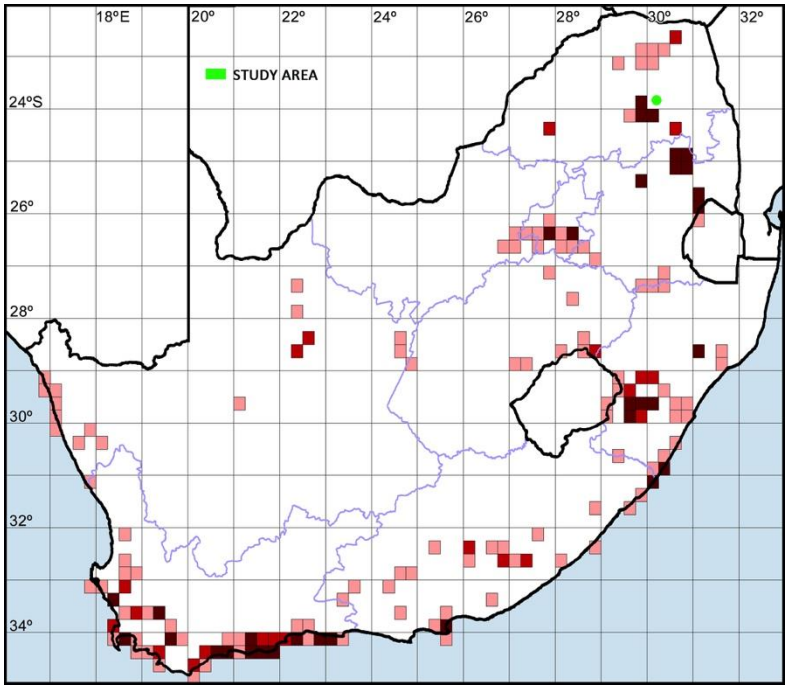


Figure 12: Butterfly hotspots

4.4.6 Faunal Species of Conservation Concern

During field investigations no faunal species of conservation concern were encountered in the study area itself. There are no ideal habitats present in the study site, although there are some moderate habitats outside of the study area, with the most obvious being some of the small streams and nearby mountains and rocky hills. Table 10, below, highlights some of the priority species and their likelihood to occur in the study area and immediate surroundings. The nature of the proposed project will have a positive impact on all of the species mentioned below and will not negatively impact them at all. Furthermore, the project will not lead to the destruction and clearance of any natural bushveld or large trees.

Table 10: 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	Unlikely
Manis temmincki	Pangolin (Scaly anteater)	Vulnerable	Grassland, savanna	Woody savanna, ants, termites	Unlikely
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	Rusty bat	Near threatened	Most, broad	Woody savanna,	No

rusticus				large trees	
Snakes					
Python natalensis	Southern African python	Vulnerable	Ridges, wetlands	Rocky areas; open water	No

5 AQUATIC ECOLOGY

The aquatic ecology focuses on the surface water in the environment and looks at all watercourses and other open waterbodies within the study area. Watercourses include rivers, streams and wetlands. Wetlands include marshes, seeps and pans (freshwater and saltwater). Manmade systems such as farm dams and artificial wetlands (if present) are also investigated and discussed in the aquatic ecology. Although rivers, streams and wetlands are all watercourses, the legal implications differ in terms of development guidelines, buffer zones, etc.

According to the National Water Act (36 of 1998) a 'watercourse' means:

a. A river or spring;
b. A natural channel in which water flows regularly or intermittently;
c. A wetland, lake or dam into which or from which water flows; and
d. Any collection of water, which the Minister may, by notice in the Gazette declare to be a watercourse.

The reference to a watercourse includes, where relevant, its beds and banks.

The official definitions of the different types of watercourses, including that of a riparian zone can be found in the Appendices.

During site investigations the following indicators are typically used to determine whether an area needed to be defined as a wetland or not, namely: Terrain unit indicator; Soil form indicator; Soil wetness indicator; and Vegetation indicator.

5.1 Watercourses in the study area

The Letsitele and the Thabina are the only two main perennial rivers crossed by the study site (National Road R36 Section 6) (Figure 13). The Great Letaba River is north of the study site. All of the rivers flow in an easterly direction and eventually into the Letaba River. The Thabina River flows into the Letsitele, which then flows into the Great Letaba River (Figure 13). There are a few small seasonal streams and drainage lines that the study site crosses over. These small watercourses all flow into the three main rivers mentioned above. Some of the small streams / drainage lines have associated valley bottom wetlands. The watercourses in the study area and surrounding areas, especially within the built-up areas, are badly encroached on, with much of the original riparian zones destroyed and the actual quality of the water negatively impacted on.

Photographs of some of the main watercourses crossed are shown in Table 11

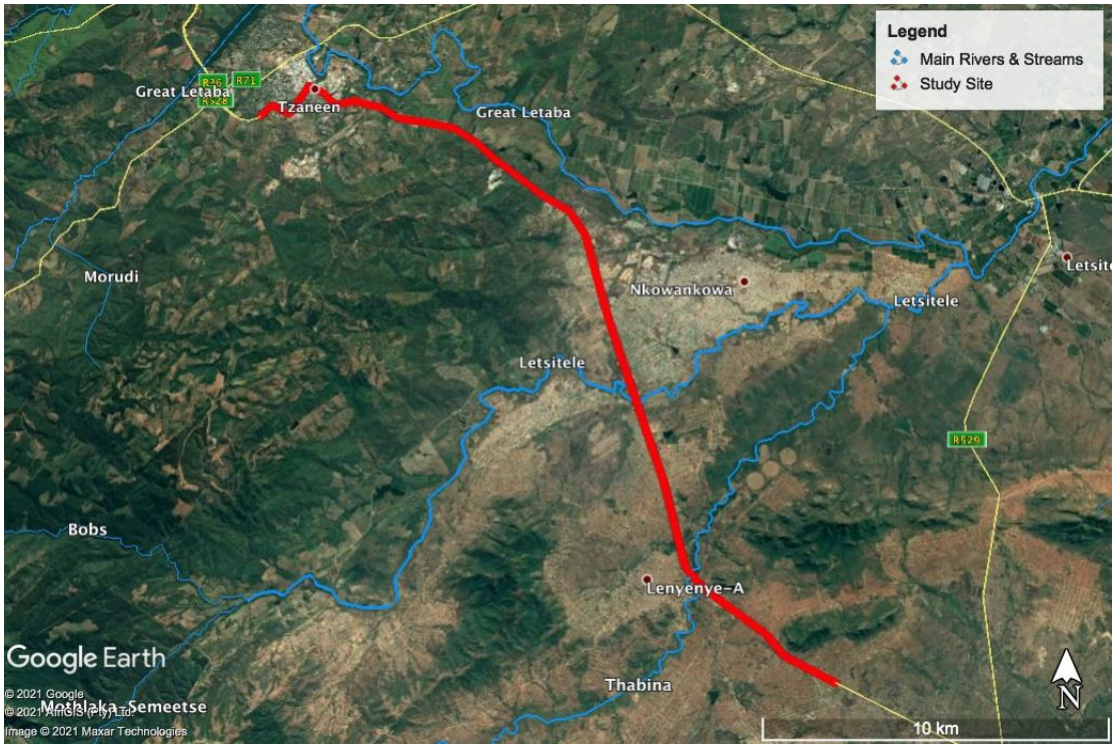
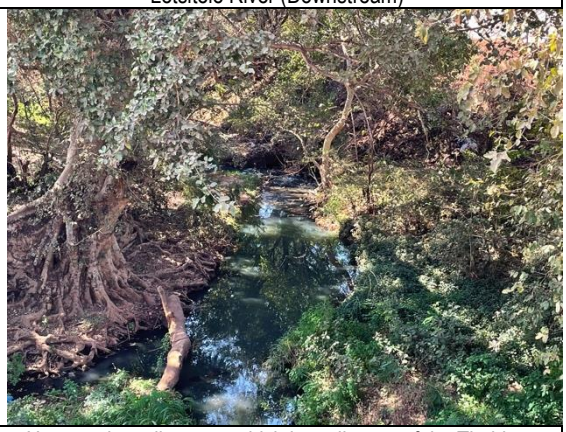


Figure 13: Main Rivers and Streams in the Greater Area of the Study Site

Table 11: Watercourses over which the study site (R36) crosses

	
Thabina River (Upstream)	Thabina River (Downstream). A road was graded within the riparian and stream bank edge. The main channel is on the left of photo
	

Letsitele River (Upstream)	Letsitele River (Downstream)
	
Small stream crossing on the outskirts of Tzaneen	Unnamed small stream which is a tributary of the Thabina River, situated just north of the Thabina River
	
Small unnamed stream crossing just on the outskirts of Tzaneen	Stormwater open canal system within road reserve along study site route

The latest national wetland map (Map 5, 2018) demarcates wetlands and other NFEPA watercourses such as rivers. The wetland map of the area shows the Letsitele and Thabina Rivers (Figure 14). The Thabina River and unnamed tributary are demarcated as Valley bottom wetlands. These are however not true valley bottom wetlands and should be designated as rivers. Photos of the Thabina River in the area of the road crossing are shown above in Table 11. The areas where the study site (R36) cross over the Thabina River and the small unnamed tributary are shown below (Figure 15).

There are a few small valley bottom wetland areas that the study site (R36) does cross, but these are more in the north close to and around the Town of Tzaneen. There are also a few small seasonal drainage lines that the site crosses as well. The normal stormwater road culverts are not actual watercourses and have not been highlighted as they do not need to adhere to the same conditions as a river or stream crossing, and are not considered as watercourses.

Figure 16 below, shows the locations of the main crossings of rivers, streams and small (but significant) drainage lines.

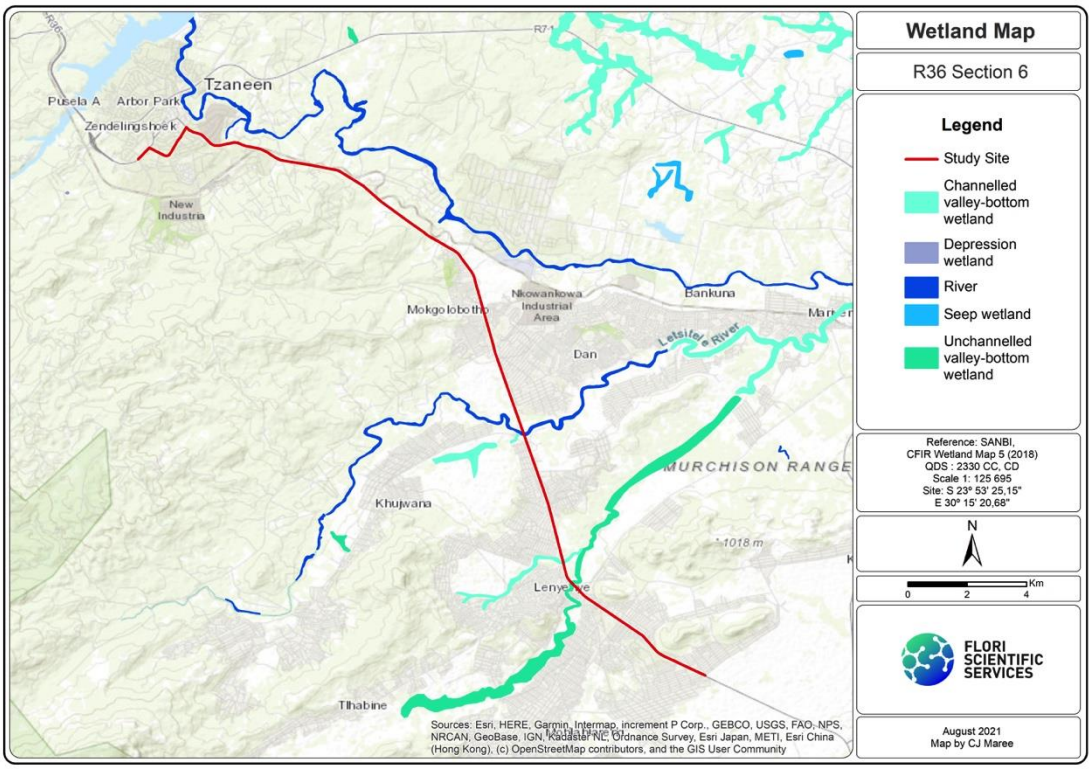


Figure 14: National Wetland Map 5 (2018)

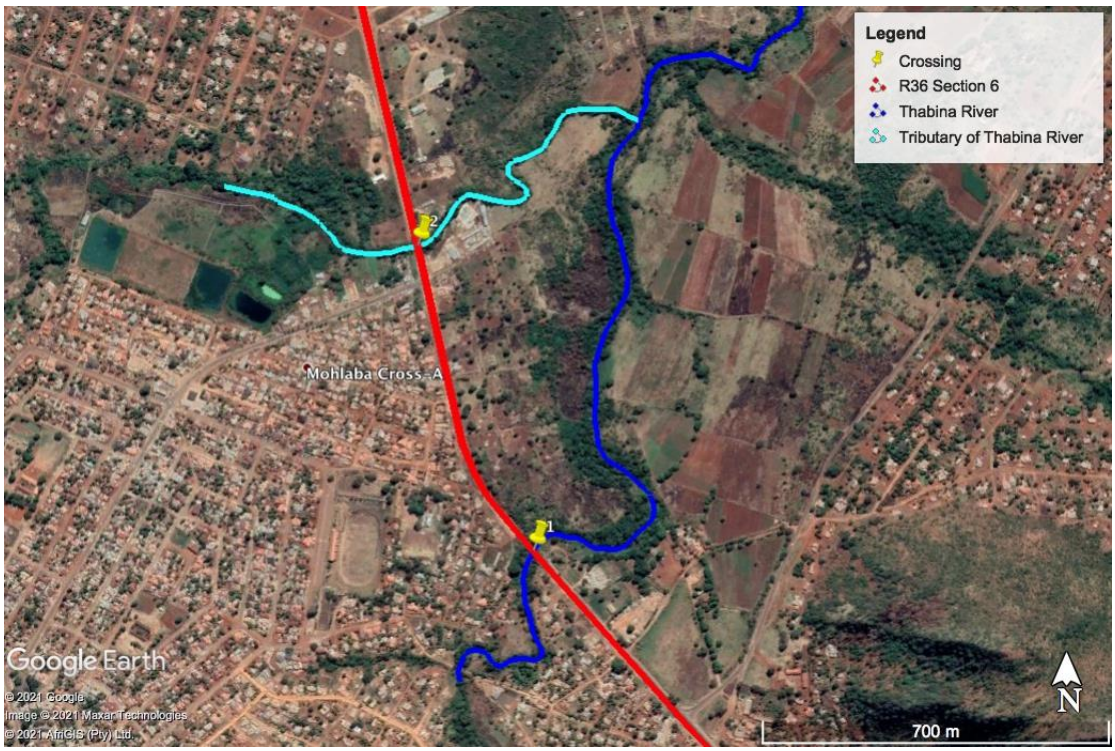


Figure 15: Thabina and Tributary Road Crossings

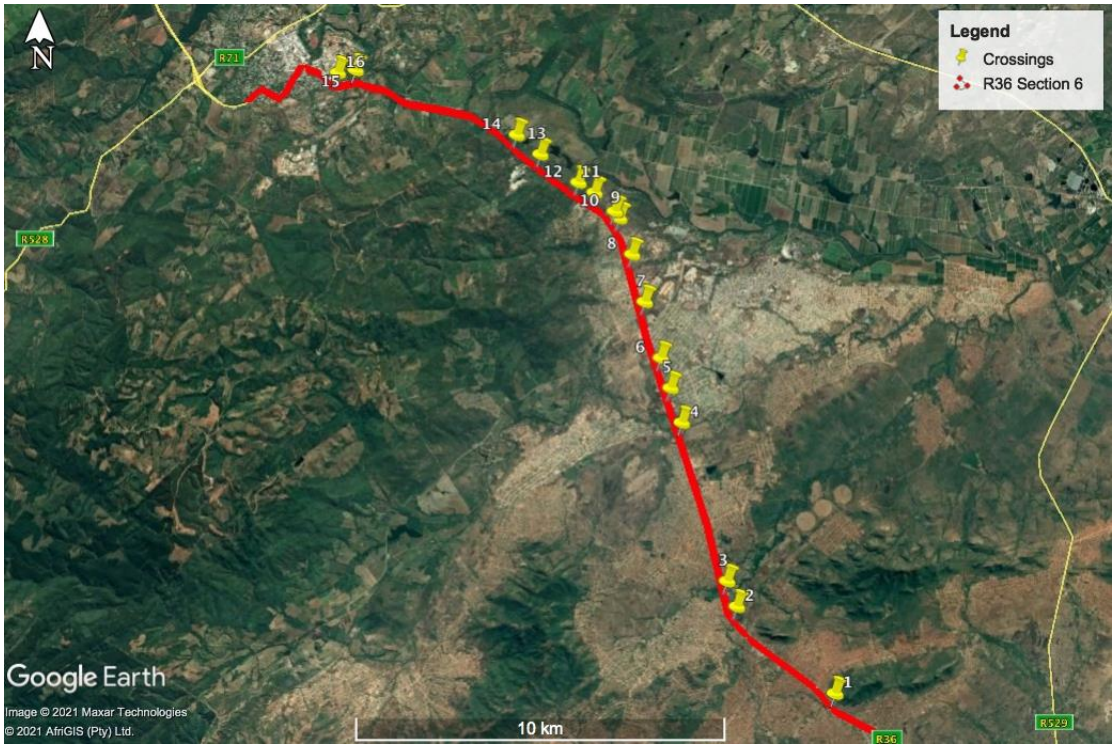


Figure 16: Main watercourse crossings along route

Table 12: Locations of Watercourse Crossings

Point Number	GPS Location
1	23°59'25.99"S; 30°18'26.41"E
2	23°58'11.00"S; 30°16'53.45"E
3	23°57'48.73"S; 30°16'44.19"E
4	23°55'28.88"S; 30°16'1.33"E
5	23°54'58.05"S; 30°15'50.58"E
6	23°54'31.27"S; 30°15'41.10"E
7	23°53'41.62"S; 30°15'25.05"E
8	23°52'59.15"S; 30°15'12.97"E
9	23°52'26.74"S; 30°15'0.50"E
10	23°52'20.61"S; 30°14'56.10"E
11	23°52'3.66"S; 30°14'36.47"E
12	23°51'54.62"S; 30°14'20.75"E
13	23°51'28.25"S; 30°13'43.52"E
14	23°51'10.41"S; 30°13'20.33"E
15	23°50'11.45"S; 30°10'41.51"E
16	23°50'13.92"S; 30°10'24.15"E

5.2 Classification of watercourses

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 used in the Classification System for Wetlands user manual – SANBI Series 22 (Ollis *et. al.* 2013). See Table 13, below. Watercourses found on site, or within a 500m radius if the watercourse is a wetland, are assessed in terms of their Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS).

Table 13: Classification System for Watercourses (Levels 1 – 4)

LEVEL 1 System	LEVEL 2 Regional setting (Ecoregion)	LEVEL 3 Landscape Unit	LEVEL 4 HGM Unit	
			HGM Type	Landform
Inland	SA Ecoregions according to DWS and/or NFEPA	• Valley floor • Slope • Plain • Bench	River	• Mountain headwater stream • Mountain stream • Transitional stream • Upper foothill • Lower foothill • Lowland • Rejuvenated foothill • Upland floodplain
			Channeled valley bottom wetland	
			Unchannelled valley bottom wetland	
			Floodplain Wetland	
			Depression	• Exorheic • Endorheic • Dammed
			Seep	• With channel outflow (connected) • Without channel outflow (disconnected)
			Wetland flat	

Table 14: Classification of Watercourses

Delineated systems	Level 1 System	Level 2 Regional Setting (Ecoregion)	Level 3 Landscape Unit	Level 4 HGM Unit
Letsitele River	Inland	Lowveld (Group 3 & 7)	Valley Floor / Plain	Lowland
Thabina River	Inland	Lowveld (Group 3 & 7)	Valley Floor / Plain	Lowland

Small season Streams / Drainage Lines	Inland	Lowveld (Group 3 & 7)	Valley Floor / Plain	Lowland

5.3 Drainage areas

South Africa can be naturally divided up into a number of geographically occurring Primary Drainage Areas (PDAs) (Figure 17). The PDAs can be further divided into a number of Quaternary Drainage Areas (QDAs). The different areas are demarcated into Water Management Areas (WMAs) and Catchment Management Agencies (CMAs). Previously there were 19 WMAs and 9 CMAs. As of September 2016, the WMAs were revised and there are now officially only 9 WMAs, which correspond directly in demarcation and area to the 9 CMAs (Government Gazette, 16 September 2016. No.1056, pg.169-172) (Figure 18).

The study area is situated within the Primary Drainage Area (PDA) of **B** and in the Quaternary Drainage Areas (QDAs) of **B72E, B81C AND B81D** (Figure 19 & Figure 20). The study site is within the Lowveld Wetland Vegetation Ecoregions of Group 3 and Group 7 (Figure 21). A summary of the catchment areas is shown in Table 15, below.

Table 15: Summary of Catchment Areas

Level	Category
Primary Drainage Area (PDA)	B
Quaternary Drainage Area (QDA)	B72E; B81C; B81D
Water Management Area (WMA) – Previous	Luvuvhu & Letaba
Water Management Area (WMA) – New	Olifants (WMA 2)
Sub-Water Management Area	Groot Letaba
Catchment Management Agency (CMA)	Olifants (CMA 2)
Wetland Vegetation Ecoregion	Lowveld (Group 3 & Group 7)
RAMSAR Site	No
Wetland FEPA	No
Fish FEPA	No
Fish FSA	No
Fish Corridor	No
Fish Migratory	No
Priority Quaternary Catchment	No
National Strategic Water Source Area (SWSA)	No
Provincial Important Water Source Area (WSA)	No

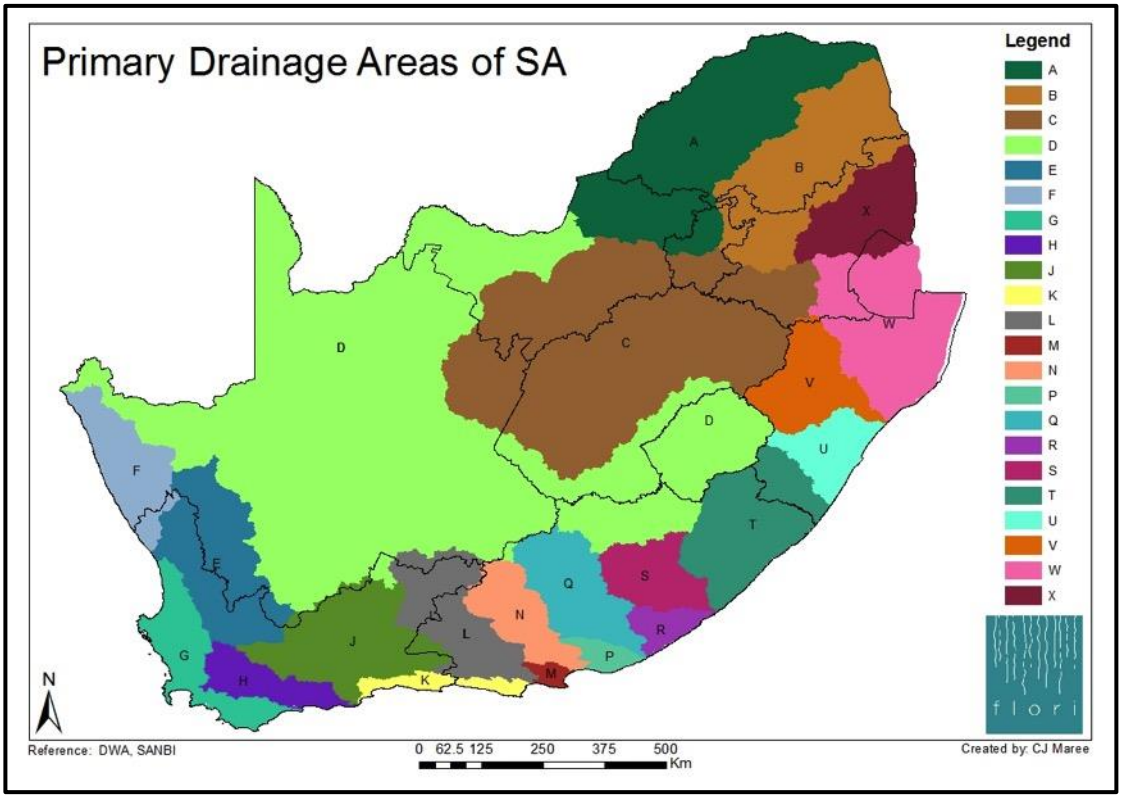


Figure 17: Primary drainage areas of South Africa

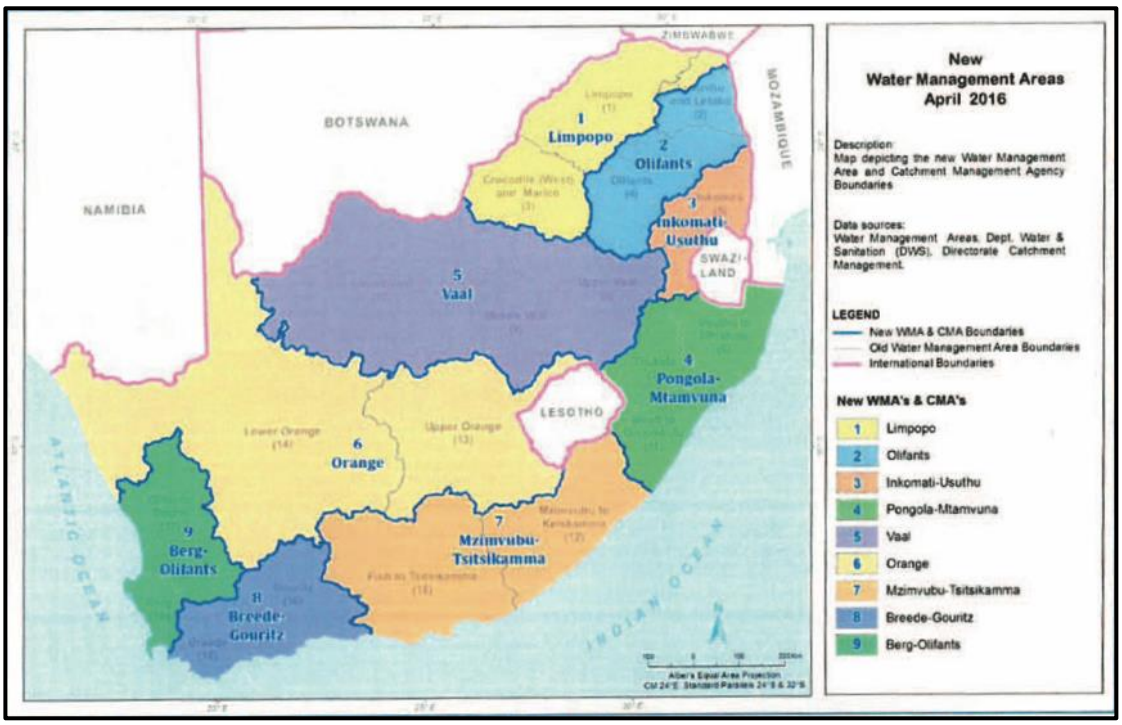


Figure 18: WMAs and CMAs of South Africa

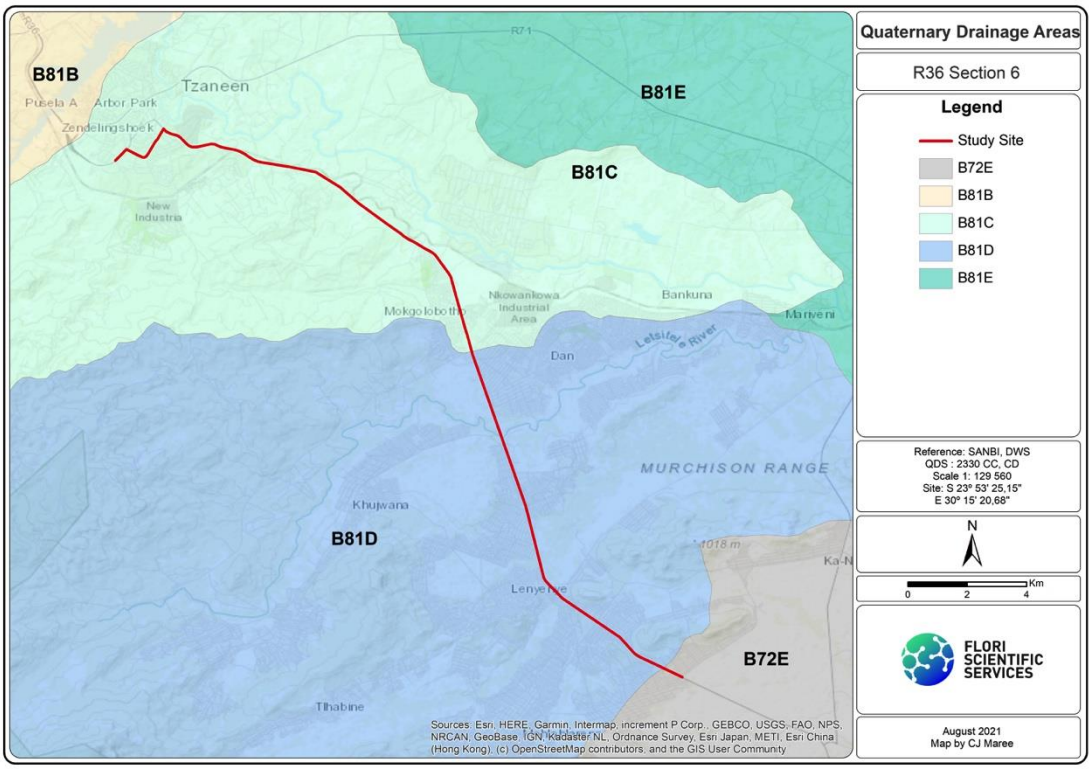


Figure 19: Quaternary Drainage Areas (QDAs)

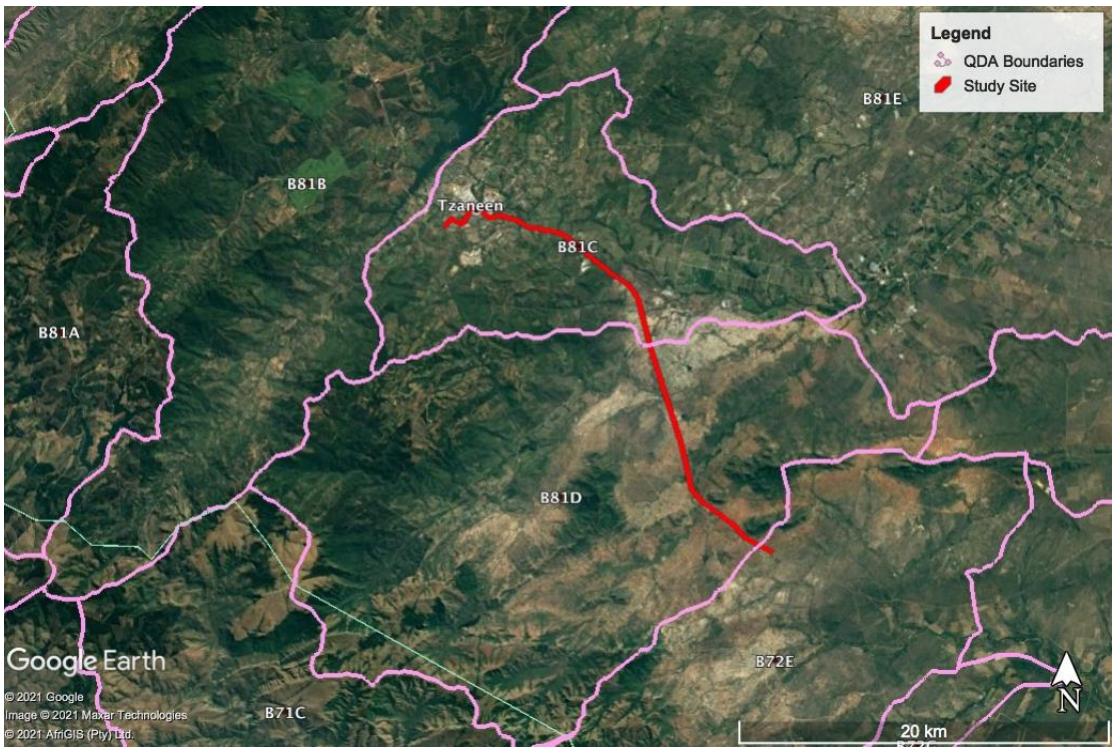


Figure 20: Quaternary Drainage Areas (Google Earth)

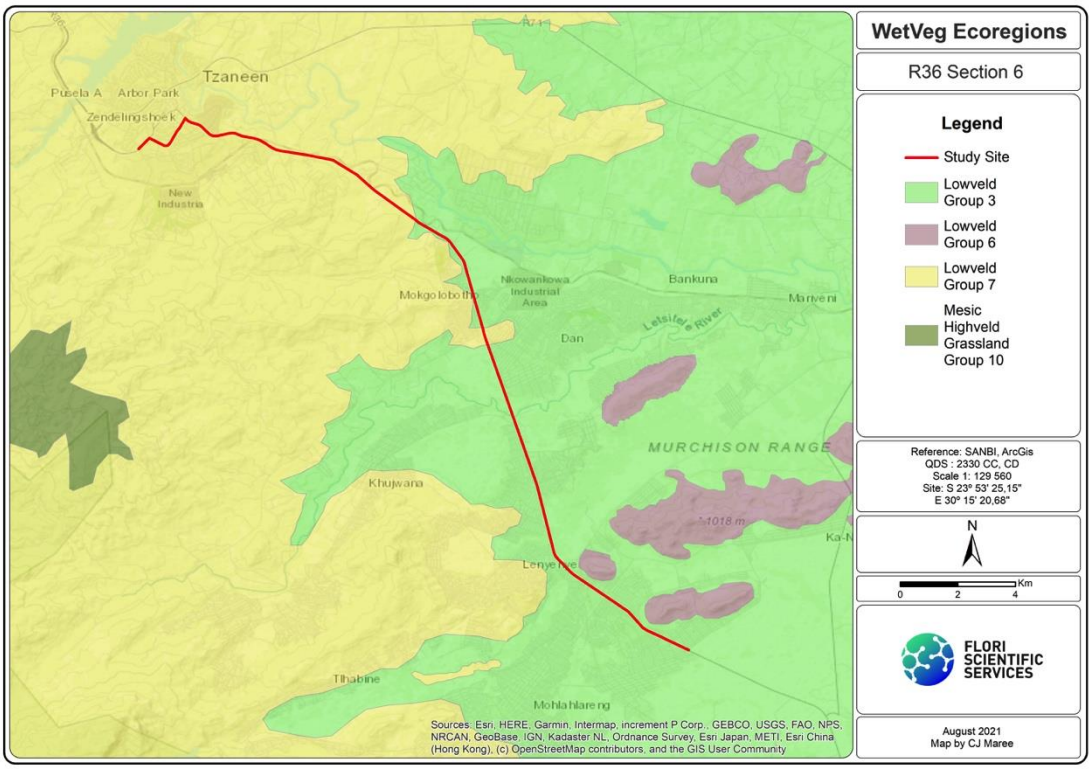


Figure 21: Wetland Vegetation Ecoregion

The study site is situated within two smaller local catchment areas (Figure 22 & Figure 23). The southern catchment area (Within QDA B81D) feeds into the Letsitele River and the northern catchment area (Within B81C) feeds into the Great Letaba River. None of the two local catchment areas are important in terms of Fish FEPA, Fish Corridors or Fish Migratory, as shown in Table 15.

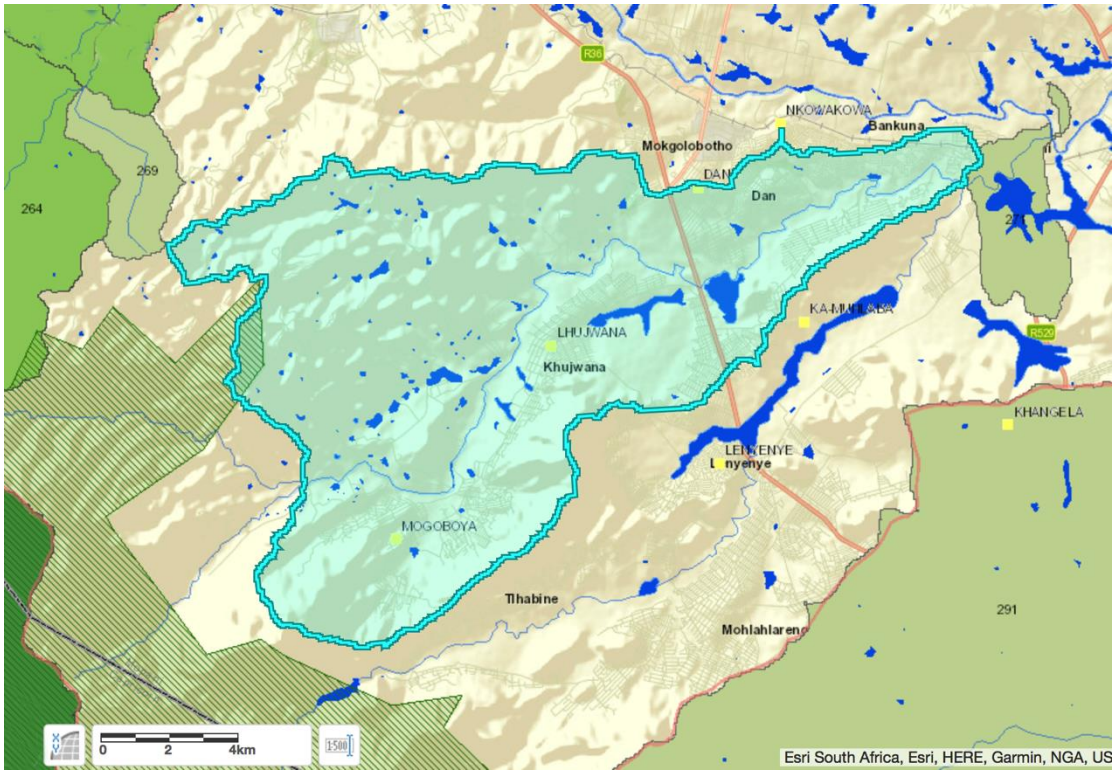


Figure 22: Local catchment area for southern section of study site (Shaded blue-green area)

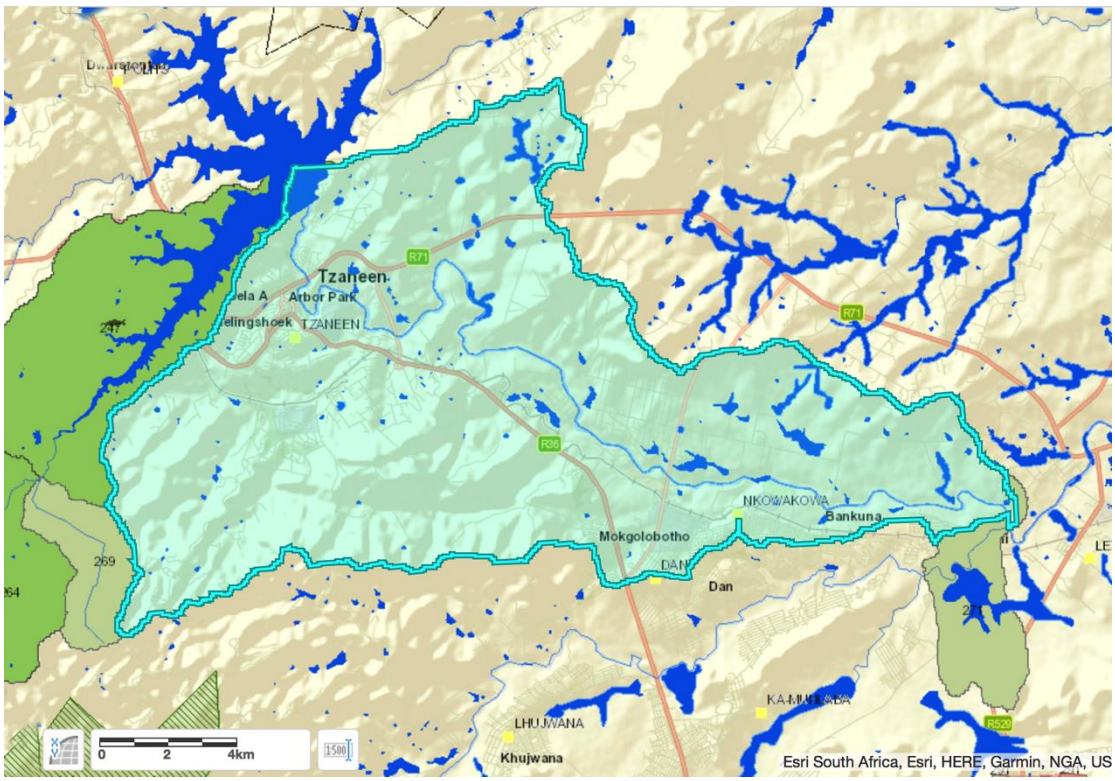


Figure 23: Local catchment area for northern section of study site (Shaded blue-green area)

5.4 Present Ecological State of Watercourses in the Study Area

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 importance is the overall PES of the aquatic ecosystem (Table 16).

The overall PES of the various watercourses (Rivers, streams and associated wetlands) are the same. The ecological states of the Letsitele and Thabina in the area of the study site are both **Category D** (Largely Modified). The few small seasonal drainage lines in the area that feed into the two larger rivers have a similar overall PES of **Category D** (Largely Modified). They are slightly more negatively impacted on, especially in the built-up areas. The two larger watercourses (Letsitele and Thabina) are also heavily impacted on upstream by afforestation.

Table 16: PES Assessment

Criteria	Identified Watercourses		
	Letsitele	**Thabina**	**Drainage Lines**
HYDROLOGY			
Flow modification	2	2	2
Permanent inundation	3	3	2
WATER QUALITY			
Water Quality Modification	2	2	2
Sediment Load Modification	2	2	2
GEOMORPHOLOGY			
Canalisation	3	3	2
Topographic Alteration	2	2	2
BIOTA			
Terrestrial Encroachment	2	2	2
Indigenous Vegetation Removal	2	2	2
Invasive Plant Encroachment	3	3	3
Alien Fauna	3	3	3
Over utilisation of Biota	2	2	2
Total:	26	26	24
Average:	2,4	2,4	2,2
Category:	**D**	**D**	**D**
Description	**Largely Modified**	**Largely Modified**	**Largely Modified**
	A large loss of natural habitats and basic ecosystem functions has occurred.		
Recommended EMC	**C**	**C**	**C**

5.5 Ecological Importance & Sensitivity of Watercourses

The Ecological Importance and Sensitivity (EIS) ratings of the watercourses identified were determined as shown in the table below (Table 17). Both of the main watercourses crossed by the R36 have an EIS rating of **Category C** (Moderate). The other small seasonal drainage lines crossed have a rating of **Category D** (Low). The small tributary of the Thabina River is just north of the Thabina and the R36 crosses it in the area of Mohlaba Cross-A. This small tributary is seen as forming part of the Thabina and also has a EIS rating of **Category C** (Moderate).

Table 17: EIS of watercourses in the study area

Determinants	Letsitele	Thabina & Tributary	Drainage lines, etc.	Confidence
PRIMARY DETERMINANTS				
1. Rare & Endangered Species	0	0	0	4
2. Populations of Unique Species	2	1	1	4
3. Species/taxon Richness	2	2	1	4
4. Diversity of Habitat Types or Features	2	2	1	4
5 Migration route/breeding and feeding site for wetland species	1	0	0	3
6. Sensitivity to Changes in the Natural Hydrological Regime	1	1	0	3
7. Sensitivity to Water Quality Changes	1	1	1	3
8. Flood Storage, Energy Dissipation & Particulate / Element Removal	1	1	0	3
MODIFYING DETERMINANTS				
9. Protected Status	0	0	0	4
10. Ecological Integrity	2	2	1	4
TOTAL	12	10	5	-
AVERAGE	1,2	1,0	0,5	-
EIS Category	**C**	**C**	**D**	**-**
Description	**Moderate**	**Moderate**	**Low**	**-**
	Important on a local scale	Important on a local scale	Fairly insignificant in moderating the quantity and quality of water of major rivers	

6 SENSITIVITY ASSESSMENT

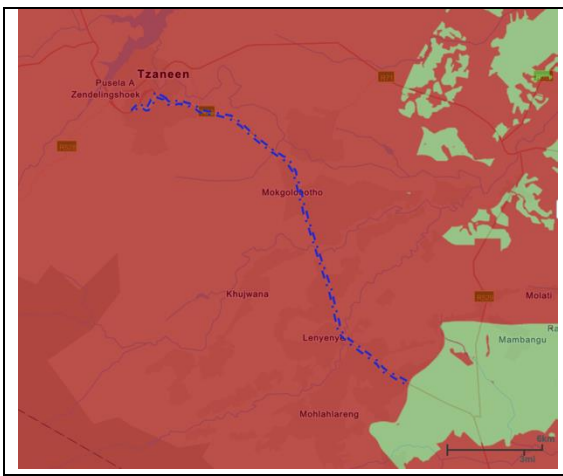
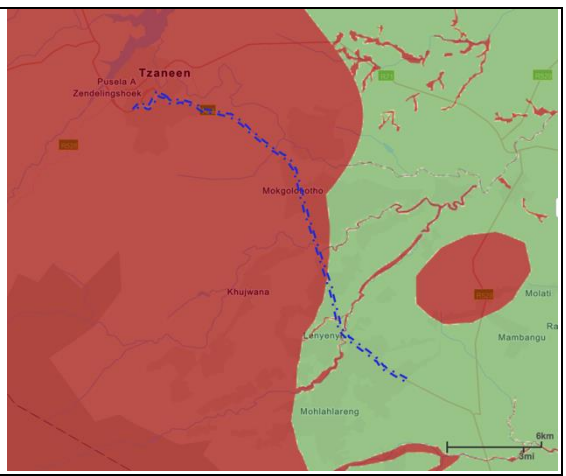
6.1 Desktop Screening Tool Assessment

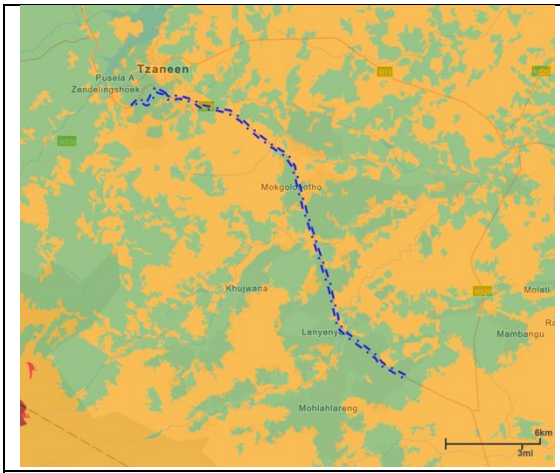
The Department of Forestry, Fisheries and the Environment (DFFE) (Previously DEFF and DEA) has development a desktop screening tool that is to be used as a guideline in an initial desktop assessment of a project site (www.screening.environment.gov.za). The screening tool incorporates most datasets produced by DWS, DFFE, SANBI and Provincial Conservation Plans. The screening tool is a desktop guideline that needs to be verified during site investigations (ground truthing). Depending on the levels of sensitivity shown in the screening assessment certain criteria in terms of assessments, studies, etc. can be required by governmental authorities. According to the screening tool (accessed August 2021) the various sensitivities for the study site and immediate surroundings are as follows:

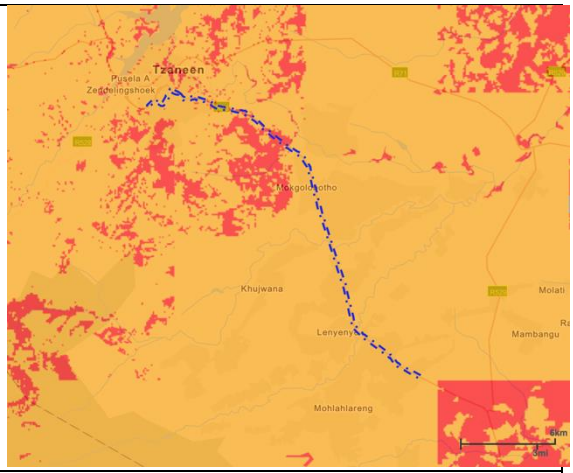
- Terrestrial biodiversity theme: Very High Sensitivity.
- Aquatic biodiversity theme: Very High & Low Sensitivity.
- Plant species theme: Medium & Low Sensitivity.
- Animal species theme: High & Medium Sensitivity.

Screenshots of the maps of the different themes area shown below (Table 18).

Table 18: Maps from Screening Tool

	
Terrestrial Biodiversity Theme	Aquatic Biodiversity Theme





Plant Species Theme	Animal Species Theme
Blue Dotted Area: Study Site; Dark Red – Very High; Red - High; Yellow – Medium; Green - Low	

During site investigations the sensitivities as shown in the above desktop screening tool results were assessed to determine if they are accurate. Firstly it is important to keep in mind that the study site itself is a transformed environment. The terrestrial and aquatic biodiversity themes are disputed. The screening tool is too general and over-reaching. For example, the high levels of township and built-up (totally transformed areas) have not been delineated as such, and which have a Terrestrial and Aquatic sensitivity of 'Low'. It is unclear why the Aquatic theme sensitivity is 'High'. A possible explanation may be that this is part of a strategic water source area (SWSA). However, the project and study site will not have any negative impact on the flow or channeling of any stormwater run-off. During site investigations the Plant and Animal sensitivities were verified to be overall accurate and acceptable. The areas of 'High' sensitivity in the Animal theme are mountainous terrain, mostly to the west of the study site, in the area that extends into the sensitive Wolkberg Mountains.

6.2 Ecological Sensitivity Assessment

The sensitivity assessment identifies those areas and habitats within the study site that have a high conservation value and that may be sensitive to disturbance. All watercourses, including seasonal streams and drainage lines are, by default, viewed as sensitive, even if they are badly degraded. However, note that the initial assessment shows the actual ecological sensitivity and state. Areas or habitats have a higher conservation value (or sensitivity) based on their threatened ecosystem / veldtype status, ideal habitat for priority species (including Red Data species), species-richness, distinctive habitats, etc. Demarcated priority areas such as nature reserves also have a higher ecological sensitivity, even if not within a threatened ecosystem.

The natural environment within the study area is relatively homogenous and consists almost entirely of transformed and highly degraded environments, which is to be expected, as it is an existing public road and road reserve, which is regularly cleared and graded. The other habitats present are watercourses and degraded bushveld. The sensitivities of the habitats are first assessed separately in terms of fauna

and flora (Table 19 & Table 20) and then combined into a combined ecological sensitivity analysis (Table 21).

Table 19: Floristic sensitivity analysis

Criteria	Distinctive habitats in the study area		
	Transformed (Road & Road Reserve)	Watercourses	Bushveld (Mostly degraded)
Red Data Species	1	4	2
Habitat Sensitivity	1	8	3
Floristic Status	1	6	3
Floristic Diversity	1	6	3
Ecological Fragmentation	1	7	4
Sensitivity Index	10%	62%	30%
Sensitivity Level	**Low**	**Medium**	**Medium/Low**

Low: 0-20%; Medium/Low: 20-40%; Medium: 40-60%; Medium/High: 60-80%; High: 80-100%

Table 20: Faunal sensitivity analysis

Criteria	Distinctive habitats in the study area		
	Transformed (Road & Road Reserve)	Watercourses	Bushveld (Mostly degraded)
Red Data Species	1	4	2
Habitat Sensitivity	1	8	3
Faunal Status	1	5	3
Faunal Diversity	1	5	3
Ecological Fragmentation	1	7	4
Sensitivity Index	10%	58%	30%
Sensitivity Level	**Low**	**Medium**	**Medium/Low**

Low: 0-20%; Medium/Low: 20-40%; Medium: 40-60%; Medium/High: 60-80%; High: 80-100%

The ecological sensitivity of the study site is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit, whether it is floristic or faunal in nature (Table 21).

Table 21: Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity
Transformed (Road & Road Reserve)	Low	Low	Low
Watercourses	Medium	Medium	Medium (Default: High)

Bushveld (Mostly degraded)	Medium/Low	Medium/Low	Medium/Low

According to the analyses there are no actual high sensitivity areas or habitats. However, regardless of their actual (on the ground) rating, watercourses are by default viewed as sensitive (high). Therefore, the only sensitive habitat present in the study site is the watercourses. As seen from the PES assessments these watercourses have mostly high negative impacts in the area of the study site.

6.3 Priority Areas

The northern section of the study site is within / along the edge of the Wolkberg Forest Belt Important Bird Area. The site is not within any other priority areas. However, it does cross over the Letsitele and Thabina Rivers, which are NFEPA Watercourses. The proposed project will have no impacts on the IBA, but will have low to minimal impacts on watercourse crossings, but only during the short period of the construction phase.

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

According to the official Protected Areas Register (PAR) there are no protected areas within a 10km radius of the outer boundaries of the study site (www.portal.environment.gov.za).

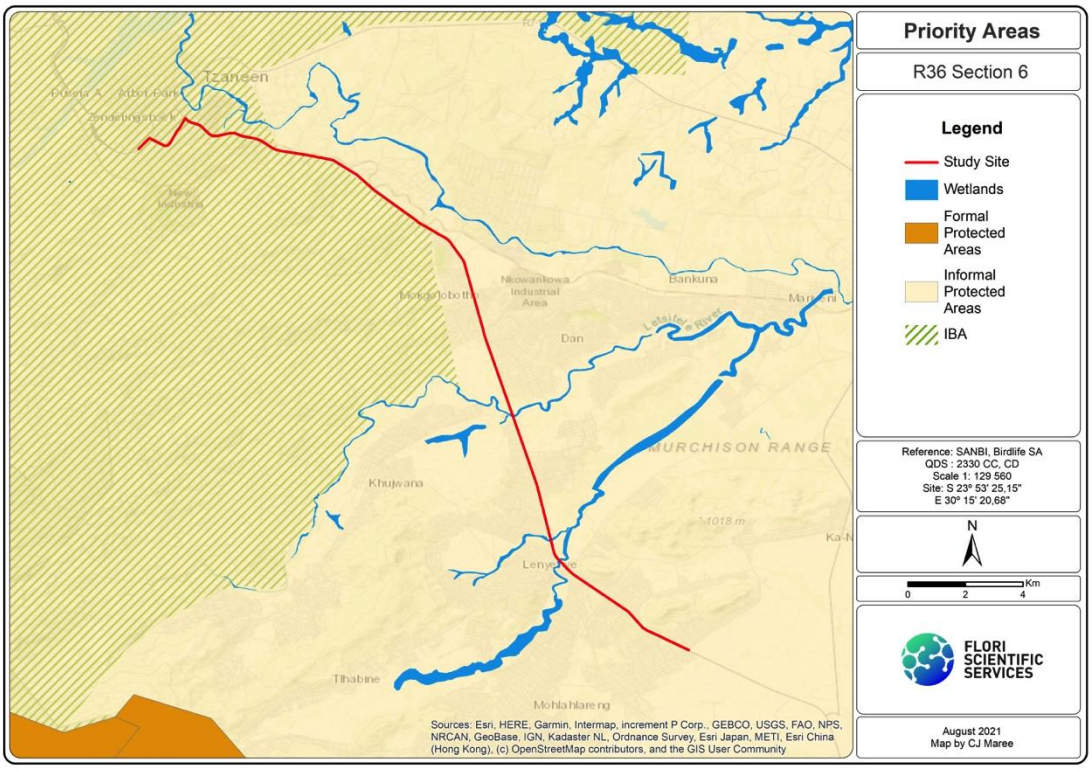


Figure 24: Priority Areas

6.4 Critical Biodiversity Areas and Ecological Support Areas

According to the Limpopo Conservation Plan (Version 2), the study site crosses through designated CBA areas and ESA areas (Figure 25). Due to the nature of the proposed project of the upgrade of an existing road within an existing, mostly cleared, road reserve, the project will have no impact on any IBA or ESA designated areas.

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).

According to the Limpopo Biodiversity Conservation Plan (version 2) 40% of the province is designated as Critical Biodiversity Areas (CBAs). These CBAs have been split into CBA 1 and CBA 2 on the basis of selection frequency and the underlying characteristics of the biodiversity features, which are being protected (i.e. location fixed features such as sites for CR species and flexible ones such as Least Cost Corridors). The majority of the CBAs in the province are CBA 1 (22 %), which can be considered "irreplaceable" in that there is little choice in terms of areas available to meet targets. If CBA 1 areas are not maintained in a natural state then targets cannot be achieved. CBA 2's are considered "optimal" as there is significant design involved in their identification, make up 18 % of the province. CBA 2's represent areas where there are spatial options for achieving targets and the selected sites are the ones that best achieve targets within the landscape design objectives of the plan (LBCP, v2).

According to the Limpopo Biodiversity Conservation Plan (version 2) an additional 23% of the province is designated as Ecological Support Area (ESA). This category has also been split on the basis of land-cover into ESA 1 (16%) and ESA 2 (7%), with ESA 1 being in a largely natural state while ESA 2 areas are no longer intact but potentially retain significant importance from a process perspective (e.g. maintaining landscape connectivity) (LBCP, v2).

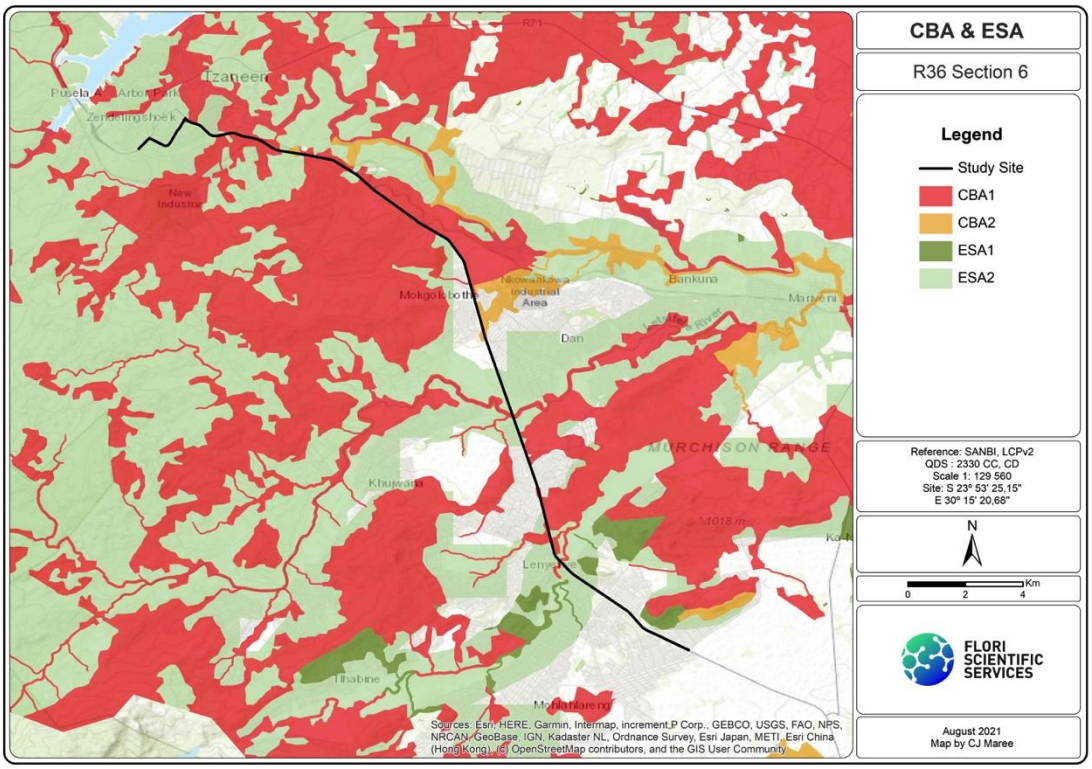


Figure 25: CBAs and ESAs

6.5 Sensitive areas identified during field investigations

There are no sensitive areas directly within the study site in terms of the road (R36 Section 6) and the road reserve. Most of this is transformed habitat. However, the study site (R36) does pass through a designated CBA area in the north, which needs to be considered as having a sensitivity of 'High'. Other 'High' sensitive areas include the river crossings at three (3) sites, which are the Thabina, Unnamed tributary to the Thabina and Letsitele. Other sensitive areas include watercourse crossings of small seasonal streams, drainage lines and in some cases associated valley bottom wetlands in the area of Tzaneen (see Figure 16).

The sensitive areas of the CBA and watercourses are therefore of importance mostly in terms of setting up of temporary laydown areas, site offices and campsite areas.

The entire study site therefore has a sensitivity rating of 'Low' except for the watercourse crossings that have a rating of 'High' (Figure 26). The location points of the 'high' sensitive areas (yellow pins in figure) are found in Table 12.

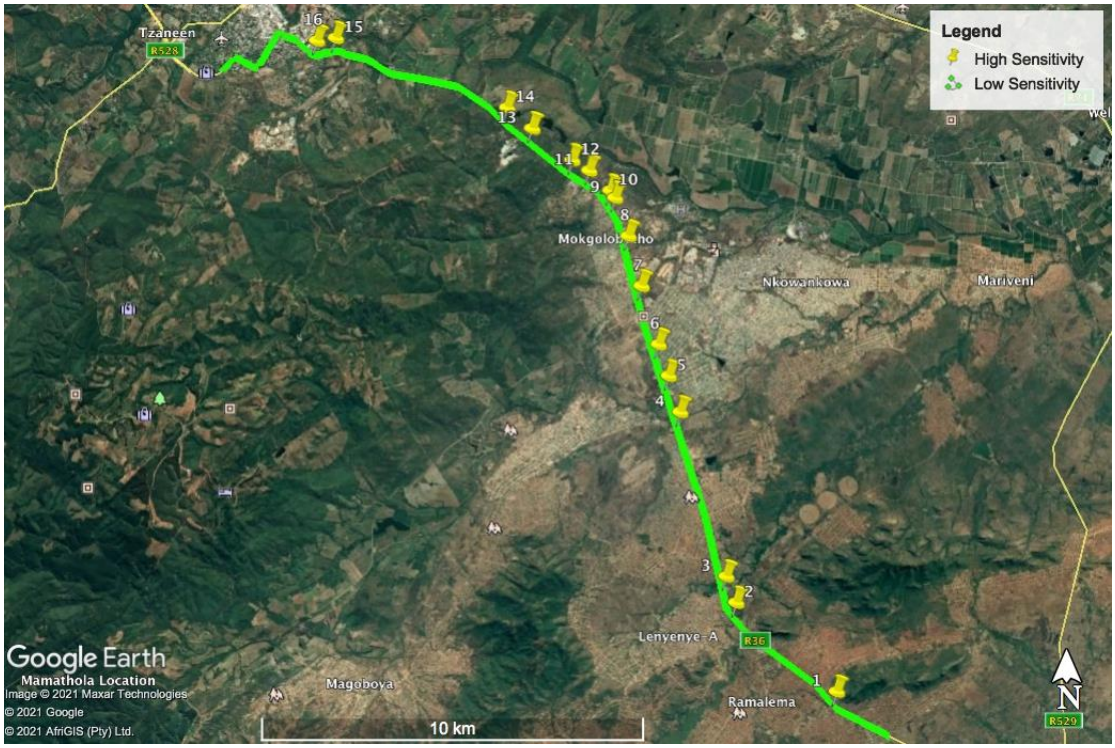


Figure 26: Sensitivity map

7 THE GO, NO-GO OPTION

7.1 Potential Fatal Flaws

Taking all aspects and investigations into consideration, as well as mitigating measures and existing procedures for the upgrade of national roads, there are no obvious environmental fatal flaws and the project may proceed.

7.2 Classification criteria

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

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

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

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

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

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

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

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

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

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

8 IMPACT ASSESSMENT

8.1 Existing Impacts

Existing negative impacts on the study area and surrounding natural environments are high to very high. The biggest existing impacts are high-density urban / dwellings areas; existing infrastructure (roads, power lines); agricultural farmlands (orchards, cultivated crops); mining; and afforestation. The study site itself is an existing impact consisting of a hard-surfaced (asphalt) national road and road reserve. The road reserve is routinely scrapped bare of vegetation and burnt. The burning of vegetation along the road reserve and nearby bushveld areas is common during the dry winter months. Upstream afforestation and farming practices have a negative impact on the waterflow and quality of small streams and rivers, along with urban development along these watercourses.

8.2 Potential Impacts

The project and related activities will have low to minimal negative impacts on the environment, and mostly for a short duration during the construction phase. The project activities are predominantly within the existing road and road reserve areas, where cumulative impacts are limited. Additional potential negative (short-term) impacts include temporary lay-down areas for materials, machinery, site office, etc. These temporary laydown areas must be setup up within disturbed areas and rehabilitated on completion of construction activities.

In terms of the natural environment there are positive impacts arising from the proposed project. The upgrading of stormwater culverts and bridges will improve waterflow, correct erosion along stream banks, remove some blockages and alien vegetation such as trees.

8.3 Assessment of potential impacts

The calculated potential impacts on the natural environment, along with required and necessary mitigating measures are found in the table below (Table 22).

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

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

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

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

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

8.4 Cumulative Impacts

Cumulative impacts can be defined as impacts or effects on the environment which are caused by the combined effects of past, current and future activities. Cumulative impacts are the sum total of the overall impacts arising from the project (under the control of the developer), other activities (that may be under the control of others, including other developers, local communities, government and landowners) and other background pressures and trends which may be unregulated. Cumulative impacts in the end is the sum total of existing impacts and the addition of any new impacts arising from the project. The proposed project will have very few additional / cumulative impacts on the natural environment.

The cumulative impacts on the study site may include:

- Some loss of vegetation during construction phase;
- Some loss of trees and shrubs in the area of watecourse crossings;
- Some potential damage to natural envrionment from the setup and use of temporary lay down areas.

All of these potential impacts can be rehabilitated and off set, with little to no measurable addition to the overall cumulative impact on the natural environment.

8.5 Levels of acceptable change

The cumulative negative impacts will most likely remain neutral. Small negative impacts will be corrected (rehabilitated) and off set with the positive impacts of upgrading culverts, bridges and road surfaces along with improved and upgraded stormwater management systems and existing erosion

along road surface edges. Therefore, the levels of change (increase in negative cumulative impacts) arising from the activities of the proposed project are at acceptably low levels for the area and for the project to proceed and not create any related 'fatal flaws'.

Table 22: 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)**	**Long-term (4)**	**Minor (2)**	**None (0)**	**0**	**None**
Mitigating Measures	**Construction Phase** i. Impacts on the existing natural environment related to the project are '**LOW**' No protected trees will be removed or destroyed. The footprint of the project is small in relation to the area and mostly within an already disturbed and altered environment. Two main rivers will be crossed (Letsitele & Thabina), along with a few small semi-perennial streams and drainage lines. 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) as the project involves the upgrade and not totally new crossings. The upgrade will also not include little to no need to remove trees and other riparian vegetation. ii. 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. iii. 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. iv. Ensure small footprint during construction phase v. An Erosion Plan to be implemented and monitored during the construction phase, especially in the area of watercourses and steep gradients along escarpment edges. The erosion potential is moderate to low. This also to further reduce the potential of siltation of small watercourses. The plan need only be basic, but needs to be monitored. vi. All hazardous materials must be stored appropriately to prevent these contaminants from entering the water environment; vii. All excess materials brought onto site for construction to be removed after construction and their removal seen as part of the construction phase. viii. No open trenches or mounds of soils to be left. ix. Rehabilitation plan for disturbed areas to be compiled and implemented as part of the construction phase. x. 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. xii. 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. xiii. 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. xiv. An independent ECO is required for the duration of the construction phase. xv. There are a few scattered marula trees in the study area. The marula is a national protected tree. It appears that there should be no need to remove of cut any of these trees during the project. However, should any of these trees need to be removed then a tree permit will need to be required prior to any such operations. xvi. A General Authorisation (GA) is going to be required for the project. A Water Use Licence Application (WULA) process should not be required. **Operational Phase** i. Monitoring, rehabilitation, general maintenance may form part of the routine maintenance programme for the road. **Rehabilitation of Temporary Laydown areas** i. 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	i. There are a few protected trees (all marula trees) scattered throughout the study site. It is unlikely that any of these should need to be cut or removed. ii. There are no RDL or ODL (Priority) species on site. iii. There are no habitats with 'High' sensitivity present within the study site. With the exception of the main river and stream crossings. iv. Minimal natural vegetation will need to be removed. v. Any vegetation areas damaged outside of the site during the construction phase (establishment phase) must be rehabilitated during the construction phase. vi. 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. vii. 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	i. 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. ii. Care must be taken not to interact directly with any wild life encountered. iii. 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)						

	iv. 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	i. All mitigating measures in the impact assessment have reference to siltation and erosion. ii. 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. iii. 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	i. The biggest initial impact on the natural environment within the study site will be at watercourse crossings. 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. ii. 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. iii. 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 iv. A site-specific stormwater management plan is required.						
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	i. 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. ii. Care must be taken with heavy machinery used on the project. All access roads used and temporary laydown areas, must be monitored and maintained.						

9 CONCLUSIONS & RECOMMENDATIONS

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

Conclusions

- The study site is situated within the original extent of the veldtypes of Granite Lowveld and Tzaneen Sour Bushveld, within the Savanna Biome.
- Tzaneen Sour Bushveld is a threatened veldtype / ecosystem with a status of 'Vulnerable'.
- Most of the study area is transformed or highly degraded. There are no areas of pristine bushveld in the study site.
- The northern half of the study site is within and on the edge of the Wolkberg Forest Belt Important Bird Area (IBA). It is not within any other national priority areas.
- The study site is not within 10km from any protected area (formal and informal).
- Two small perennial rivers (Letsitele and Thabina), as well as a few smaller streams and drainage lines are present.
- During field investigations no Red Data Listed (RDL) or Orange Data Listed (ODL) plants were observed in the study site. None are expected to occur.
- One protected tree species (Marula - *Sclerocarya birrea*) is present in the study site. There are a few scattered trees in the area. It seems unlikely that any of these trees will need to be cut ro removed. A tree permit will need to be obtained prior to the removal of any of these trees.
- The study site is situated within a Critical Biodiversity Area (CBA) and within an Ecological Support Area (ESA). However, the study site itself is mostly transformed, existing road.
- There are no 'high' sensitive habitats present on site, with the exception of the watercourse crossings.
- No red data listed (RDL) faunal species were observed to be present and / or breeding with the study area boundaries. It is also highly unlikely that any are or will be present, with the small chance along the main rivers only.
- Site investigations were conducted during the summer and winter months and the findings and availability of field data are sufficient to achieve acceptable findings and outcomes from the assessment.
- Due to the nature of the project (upgrade of an existing road) no further specialist environmental studies are required or recommended.
- There are no obvious fatal flaws in terms of the project on the natural environment.
- Impacts on the existing natural environment related to the project are '**LOW**'
- The levels of change (increase in negative cumulative impacts) arising from the activities of the proposed project are at acceptably low levels for the area and for the project to proceed and not create any related 'fatal flaws'.
- A General Authorisation (GA) process for work on watercourse crossings will be required.

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

Recommendations

- Recommended mitigating measures as proposed in this study and report must be implemented. These include:
    - No protected trees will be removed or destroyed.
    - The footprint of the project is small in relation to the area and mostly within an already disturbed and altered environment.
    - Two main rivers will be crossed (Letsitele & Thabina), along with a few small semi-perennial streams and drainage lines. 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) as the project involves the upgrade and not totally new crossings. The upgrade will also not include little to no need to remove trees and other riparian vegetation.
    - Any temporary storage, lay-down areas or accommodation facilities to be setup in existing built-up areas or disturbed areas. No temporary storage areas, laydown areas or site offices are allowed within a **100m** of the edge of any river, stream or distinctive drainage line.
    - 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 watercourses and steep gradients along escarpment edges. The erosion potential is moderate to low. This also to further reduce the potential of siltation of small watercourses. The plan need only be basic, but needs to be monitored.
    - All hazardous materials must be stored appropriately to prevent these contaminants from entering the water environment;
    - All excess materials brought onto site for construction to be removed after construction and their removal seen as part of the construction phase.
    - No open trenches or mounds of soils to be left.
    - Rehabilitation plan for disturbed areas to be compiled and implemented as part of the construction phase.
- The most important recommendations arising from the study is the need for 100m buffer zones around watercourses in which no temporary laydown areas, site offices or campsites may be set up.
- An independent ECO is recommended to monitor operations and ensure that recommended mitigating measures, including buffer zones, are implemented and adhered to.

10 APPENDICES

10.1 Photographs

More photographs are found within the body of the report.

Start of Section 6 (KM 4,70) in Manchabeni

R36 Section 6 (Study Site) within the built-up urban townships. Notice the lack of trees, and other vegetation in the road reserve

Another example of the study site showing lack of trees and other bushveld vegetation in the road reserve and township areas

A few mature indigenous trees in the study site (road reserve). It is likely (and preferable) that these trees are not disturbed

River crossing – Letsitele River (Largest of the crossings)

River Crossing – Thabina River (second largest of the crossings)

	
R36 Section 6 (Study Site) in the Town of Tzaneen	End of the study site (KM 33,40)

10.2 List of floral species

Trees

Vachellia (*Acacia*) *nigrescens*, Vachellia (*Acacia*) *nilotica,* Vachellia (*Acacia*) *gerrardii, Sclerocarya birrea* subsp. *caffra, Combretum apiculatum, Ficus stuhlmannii. Terminalia sericea.*

None.

Shrubs

Combretum hereroense, Dichrostachys cinerea, Euclea divinorum.

Herbaceous and other plants

Achyranthes aspera, *Aspilia mossambicensis*, *Becium filamentosum*, *Commelina benghalensis*, *Commelina erecta*, *Cucumis africanus*, *Evolvulus alsinoides*, *Hermbstaedtia odorata*, *Hibiscus praeteritus, Indigofera filipes, Indigofera sanguinea, Kohautia virgata.*

Graminoids (Grasses)

Brachiaria nigropedata, *Digitaria eriantha*, *Eragrostis rigidior*, *Melinis repens* (d), *Aristida congesta*, *Chloris mossambicensis*, *Enneapogon cenchroides*, *Heteropogon contortus*, *Leptochloa eleusine*

Alien plants

A number of alien plants are present in the general area including: jacaranda, lantana, and guava.

Protected Trees

Sclerocarya birrea subsp. *caffra*

10.3 Granite Lowveld

Below is the list of the dominant plant species found in the veldtype of Granite Lowveld, as taken from Mucina & Rutherford (2006, 2010).

Tall Trees: Vachellia (*Acacia*) *nigrescens* (d), *Sclerocarya birrea* subsp. *caffra* (d). Small Trees: Vachellia (*Acacia*) *nilotica* (d), *Albizia harveyi* (d), *Combretum apiculatum* (d), *Combretum imberbe* (d), *Combretum zeyheri* (d), *Ficus stuhlmannii* (d), *Peltophorum africanum* (d), *Pterocarpus rotundifolius* (d),

Terminalia sericea (d), Vachellia (*Acacia*) *exuvialis*, Vachellia (*Acacia*) *gerrardii*, *Bolusanthus speciosus*, *Cassia abbreviata* subsp. *beareana*, *Combretum collinum* subsp. *suluense*, *Dalbergia melanoxylon*, *Gymnosporia glaucophylla*, *Lannea schweinfurthii* var. *stuhlmannii*, *Pavetta schumanniana*, *Plectroniella armata*, *Terminalia prunioides*. Tall Shrubs: *Combretum hereroense* (d), *Dichrostachys cinerea* (d), *Euclea divinorum* (d), *Strychnos madagascariensis* (d), *Gardenia volkensii*, *Hibiscus micranthus*, *Tephrosia polystachya*. Low Shrubs: *Abutilon austro-africanum*, *Agathisanthemum bojeri*, *Aptosimum lineare*, *Barleria elegans*, *Clerodendrum ternatum*, *Commiphora africana*, *Gossypium herbaceum* subsp. *africanum*, *Pavonia burchellii*. Woody Climber: *Sphedamnocarpus pruriens* subsp. *pruriens*. Herbaceous Climber: *Rhynchosia totta*. Graminoids: *Brachiaria nigropedata* (d), *Digitaria eriantha* subsp. *eriantha* (d), *Eragrostis rigidior* (d), *Melinis repens* (d), *Panicum maximum* (d), *Pogonarthria squarrosa* (d), *Aristida congesta*, *Bulbostylis hispidula*, *Chloris mossambicensis*, *Enneapogon cenchroides*, *Heteropogon contortus*, *Leptochloa eleusine*, *Perotis patens*, *Schmidtia pappo- phoroides*, *Sehima galpinii*, *Tricholaena monachne*, *Urochloa mosambicensis*. Herbs: *Achyranthes aspera*, *Aspilia mossambicensis*, *Becium filamentosum*, *Chamaecrista absus*, *Commelina benghalensis*, *C. erecta*, *Cucumis africanus*, *Evolvulus alsinoides*, *Heliotropium strigosum*, *Hermbstaedtia odorata*, *Hibiscus praeteritus, Indigofera filipes, Indigofera sanguinea, Kohautia virgata, Kyphocarpa angustifolia, Leucas glabrata, Ocimum gratissimum, Phyllanthus maderaspatensis, Pupalia lappacea, Vahlia capensis subsp. vulgaris, Waltheria indica. Succulent Herbs: Orbea rogersii, Stapelia leendertziae.*

(d) = Dominant.

10.4 Tzaneen Sour Bushveld

Below is the list of the dominant plant species found in the veldtype Tzaneen Sour Bushveld, as taken from Mucina & Rutherford (2006, 2010).

Tall Trees: *Pterocarpus angolensis*, *Sclerocarya birrea* subsp. *caffra*. Small Trees: Vachellia (*Acacia*) *polyacantha* (d), *Albizia versicolor* (d), *Ficus sansibarica* (d), *Parinari curatellifolia* (d), *Piliostigma thonningii* (d), *Pterocarpus rotundifolius* (d), *Trichilia emetica* (d), Vachellia (*Acacia*) *davyi*, Vachellia (*Acacia*) *sieberiana* var. *woodii*, *Antidesma venosum*, *Catha edulis*, *Faurea rochetiana*, *Faurea saligna*, *Ficus burkei, Ficus petersii, Heteropyxis natalensis, Peltophorum africanum, Terminalia sericea, Vernonia colorata. Tall Shrubs: Olea europaea subsp. africana, Pseudarthria hookeri var. hookeri, Rhus pentheri, Triumfetta pilosa var. tomentosa. Low Shrubs: Agathisanthemum bojeri, Barleria elegans, Dicliptera clinopodia, Flemingia grahamiana, Indigofera filipes, Polygala producta. Woody Climbers: Bauhinia galpinii, Pterolobium stellatum. Graminoids: Cymbopogon caesius (d), Cymbopogon nardus (d), Hyparrhenia cymbaria (d), Hyparrhenia poecilotricha (d), Hyperthelia dissoluta (d), Alloteropsis semialata subsp. semialata, Andropogon schirensis, Bothriochloa bladhii, Monocymbium ceresiiforme, Paspalum scrobiculatum, Schizachyrium sanguineum, Themeda triandra. Herb: Waltheria indica.*

(d) = Dominant.

10.5 Ecosystems of the Local Municipality

Below is a summary of the main ecosystems of the Local Municipality in which the study area is situated, as taken from SANBI website (www.bgis.sanbi.org.za)

Biomes

Biomes		
Name	**Size (ha)**	**Size (%)**
Forests	9274,9 ha	2,86%
Grassland Biome	34506,9 ha	10,64%
Savanna Biome	280477,4 ha	86,5%
3 biomes in the municipality covering 324259,1 ha (100 %)		

Veldtypes

Vegetation Types		
Name	**Size (ha)**	**Size (%)**
Granite Lowveld	133302,7 ha	41,11%
Gravelotte Rocky Bushveld	9257,4 ha	2,85%
Mamabolo Mountain Bushveld	6219,2 ha	1,92%
Northern Escarpment Quartzite Sourveld	4039,3 ha	1,25%
Northern Mistbelt Forest	12627,8 ha	3,89%
Ohrigstad Mountain Bushveld	99,1 ha	0,03%
Polokwane Plateau Bushveld	618,6 ha	0,19%
Subtropical Freshwater Wetlands	78,8 ha	0,02%
Tsende Mopaneveld	27380,2 ha	8,44%
Tzaneen Sour Bushveld	100866,5 ha	31,11%
Woodbush Granite Grassland	29769,7 ha	9,18%
11 vegetation types in the municipality covering 324259,1 ha (100 %)		

Threatened Veldtypes (Ecosystems)

Threatened EcoSystems (Critically Endangered)		
Name	**Size (ha)**	**Size (%)**
Woodbush Granite Grassland	7267,8 ha	2,24%
1 Critically Endangered Threatened EcoSystems in the municipality covering 7267,8 ha (2,24 %)		

Threatened EcoSystems (Endangered)
There are no Endangered Threatened EcoSystems in the municipality.

Threatened EcoSystems (Vulnerable)		
Name	**Size (ha)**	**Size (%)**
Tzaneen Sour Bushveld	50910,4 ha	15,7%
1 Vulnerable Threatened EcoSystems in the municipality covering 50910,4 ha (15,7 %)		

10.6 Listing of Threatened or Protected Species (TOPS)

Species can be listed as threatened or protected (TOPS) in terms of Section 56 of the National Environmental Management: Biodiversity Act (NEMBA) of 2004

Restricted activities involving TOPS species may not be carried out without a permit; and can be prohibited. Restricted activities include:

i. Hunt / catch / capture / kill

ii. Gather / collect / pluck

iii. Pick parts of / cut / chop off / uproot / damage / destroy

iv. Import into RSA / introduce from the sea

v. Export (re- export) from RSA

vi. Possess / exercise physical control

vii. Grow / breed / propagate

viii. Convey / move/ translocate

ix. Sell / trade in / buy / receive / give / donate/ accept as a gift / acquire / dispose of

x. Any other prescribed activity

Note: Does not include activities relating to habitat loss

Table 23: TOPS Plant Species for Limpopo Province

Name	Habitat	Status
Bowiea volubilis subsp. volubilis	Low and medium altitudes, usually along mountain ranges and in thickly vegetated river valleys, often under bush clumps and in boulder screes. Tolerates wet and dry conditions, growing predominantly in summer rainfall areas with an annual rainfall of 200-800 mm.	VU
Brackenridgea zanguebarica	In South Africa: stony, light grey and shallow sandy loam in woodland, 655m, also on the southern aspect of dry mountain bushveld.	CR
Dioscorea sylvatica	Wooded and relatively mesic places, such as the moister bushveld areas, coastal bush and wooded mountain kloofs.	VU
Drimia sanguinea	Open veld and scrubby woodland in a variety of soil types.	NT
Encephalartos brevifoliolatus	Short grassland in open protea savanna.	CR
Encephalartos cupidus	Grassland, on steep, rocky slopes or cliffs and sometimes near seepage areas bordering gallery forests.	CR
Encephalartos dolomiticus	Grassland, in shallow soils on dolomite ridges.	CR
Encephalartos dyerianus	Open grassland and shrubland on the slopes of low granite hills.	CR
Encephalartos eugene-maraisii	Sandstone hills and rocky ridges in open grassland and savanna.	EN
Encephalartos hirsutus	Exposed quartzite cliffs in mountain bushveld.	CR
Encephalartos inopinus	Shallow soils on steep, rocky slopes and gorges, restricted to dolomite.	CR
Encephalartos nubimontanus	Steep cliffs in low open woodland.	CR
Encephalartos transvenosus	Tall grassveld and mixed bushveld, mainly on steep rocky slopes facing southeast in the mistbelt zone.	LC
Euphorbia groenewaldii	Gentle, northwest-facing slopes of small granite hills and ridges between bands of schist or in gritty red sandy loam soil, 1100-1500 m.	CR
Harpagophytum procumbens	Well drained sandy habitats in open savanna and woodlands.	LC
Harpagophytum zeyheri subsp. *zeyheri*	On Kalahari sand in dry open woodland.	LC
Mondia whitei	Mainly swamp forest in South Africa and occasionally in riverine and coastal forest, further north it is found in Afromontane forest. It is currently restricted to lower elevations, although historically it was recorded in higher altitude midlands forest.	EN
Prunus africana	Evergreen forests near the coast, inland mistbelt forests and afromontane forests up to 2100 m	VU

Siphonochilus aethiopicus	T all open or closed woodland, wooded grassland or bushveld.	CR
Warburgia salutaris	Variable, including coastal, riverine, dune and montane forest as well as open woodland and thickets.	EN

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

10.7 Priority Bird species for Limpopo Province

Scientific Name	Common Name
Anthropoides paradiseus	Blue crane
Areotis kori	Kori bustard
Aquila rapax	Tawny eagle
Bucorvus leadbeateri	Southern ground hornbill
Buphagus africanus	Yellow-billed oxpecker
Buphagus erythrorhynchus	Red-billed oxpecker
Certhilauda chuana	Short-clawed lark
Cinonia nigra	Black stork
Falco naumanni	Lesser kestrel
Gyps africanus	White-backed vulture
Gyps coprotheres	Cape vulture
Polemaetus bellicosus	Martial eagle
Pterocles gutturalis	Yellow throated sandgrouse
Scotopelia peli	Pel's fishing-owl
Stephanoaetus coronatus	Crowned eagle
Terathopius ecaudatus	Bateleur eagle
Torgos trachelliotos	Lappet-faced vulture
Trigonoceps occipitalis	White-headed vulture

10.8 Definitions

10.8.1 Rivers and Streams

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

10.8.2 Wetlands

'Wetland' is a broad term and for the purposes of this study it is defined according to the parameters as set out by the Department of Water & Sanitation (DWS) in their guideline (A practical field procedure for identification and delineation of wetlands and riparian areas, 2005). The classification of wetlands (which is a type of watercourse) is summarised below (Figure 27).

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

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

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation;

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

During site investigations the following indicators are typically used to determine whether an area needed to be defined as a wetland or not, namely: Terrain unit indicator; Soil form indicator; Soil wetness indicator; and Vegetation indicator.

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

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

Water source: * Contribution usually small

*** Contribution usually large

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

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

Wetland

Figure 27: Classification of wetlands

10.8.3 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*."

10.9 Conditions for inclusion in the Environmental Authorisation (EA)

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

10.10 Monitoring requirements

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

No special or specific monitoring requirements are required or recommended.

10.11 Short CV of Specialist

Name: Johannes Oren Maree

QUALIFICATIONS

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

FURTHER TRAINING AND DEVELOPMENT

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

PUBLICATIONS

- Co-Authored Book: Cut Flowers of the World. 2010. Briza, Pretoria.

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

PROFESSIONAL MEMBERSHIPS

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

PROFESSIONAL CAREER

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

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

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

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

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

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

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