APPENDIX C -
SPECIALIST IMPACT ASSESSMENTS

APPENDIX C1 -
AGRICULTURAL IMPACT ASSESSMENT

AGRICULTURAL POTENTIAL, LAND CAPABILITY AND SOIL ASSESSMENT FOR THE DEVELOPMENT OF:

CONTRACT NRA R516-010-2020/1F
IMPROVEMENT OF NATIONAL ROAD R516

FROM R511 TO TOOYSPRUIT
LIMPOPO PROVINCE

August 2021

PREPARED BY:
INDEX (PTY) LTD
P.O. BOX 96023
WATERKLOOF VILLAGE
PRETORIA, 0145
index@iafrica.com

SUMMARY

SANRAL propose the improvement of the existing National Route R516 from R511 to Tooyspruit in the Limpopo Province.

There are about 390 ha within a 100 metre corridor of the centre line that may be affected by the proposed construction activities. However, there will be no land cleared of vegetation.

The major land use is livestock grazing or game ranching.

The eastern portion of the route is Central Sandy Bushveld. The soils are shallow sandy soils. West of Leeupoort is Central Sandy Bushveld. These veld types have palatable species if well maintained and offer excellent forage for grazers and browsers. The region has many game farms and hunting is a preferred commercial activity. The grazing capacity for livestock of natural veld is estimated at 8 - 9 ha per large stock unit (LSU).

The soils on the entire route consist of reddish and greyish brown soils that are shallow and rocky Glenrosa, Mispah and rocky Hutton.

None of the land evaluated is sensitive that warrants further investigation in terms of National Environmental Management Act (NEMA) or National Policy on the Preservation of High Potential and Unique Agricultural Land (HUAL).

According to the guidelines of Department of Agriculture, Land Reform and Rural Development (DALRRD) most of the land has a Land Use Capability of Class 6 and below, which is considered as low-moderate capability land. Also, according to the sensitivity tool of the Department of Forestry, Fisheries and the Environment, there is no sensitive land that should be protected.

Impact description

- *There will be no permanent loss of high potential or cultivated land.*
- *The loss of grazing and browsing land is temporary and will at most be for the duration of construction. Mitigation is achieved by keeping the construction period as short as possible and by reducing dust and noise as far as possible.*
- *There will not be permanent loss of farming infrastructure.*
- *Farm stalls and businesses close to road which depend on passing traffic may see lower income duration the period of construction. However, this is only temporary and is only for the duration of construction.*
- *Many of the properties are used for wildlife breeding with hunting, with tourism as focus. Fences are of game standard with many electrified to protect the animals.*

  The hunting season is a particularly sensitive period when people moving along the construction sites must be controlled or at least be communicated to the farmers in order to ensure the safety of workers.

  Some possible impacts of construction on the farmers, albeit temporary, are that theft and vandalism is may increase, noise and dust may impact tourism and hunting and that there could be an increased fire hazard.

  Mitigation is achieved by providing security to farmers, keeping the construction period as short as possible communicate blasting and after-hours construction work with farmers, particularly where tourism and hunting takes place and by making fire breaks or provide fire protection during the period that construction takes place.

The environmental impact of upgrading the road on agriculture is low and only of a temporary nature. Normal operational practices and environmental awareness is required to minimise any impacts.

Table of Contents

1 BACKGROUND

BVi Consulting Engineers Western Cape was appointed by the South African National Roads Agency SOC Ltd (SANRAL) for the improvement of National Route R516. BVi in turn appointed Coastal Environmental Services (Pty) Ltd (CES) as the Environmental Assessment Practitioner (EAP) for the Project.

SANRAL propose the improvement of the existing National Route R516 Section 1 from R511 to Tooyspruit in the Limpopo Province.

The goal of the road improvement on Road R516 is to relieve traffic congestion to an acceptable level of service; improve road geometry and road safety; reconstruct bridges and other structures for hydraulic and traffic capacity improvement; and provide adequate pavement capacity for the 20 year design period.

The study area boundary is as follows (refer to Figure 1):

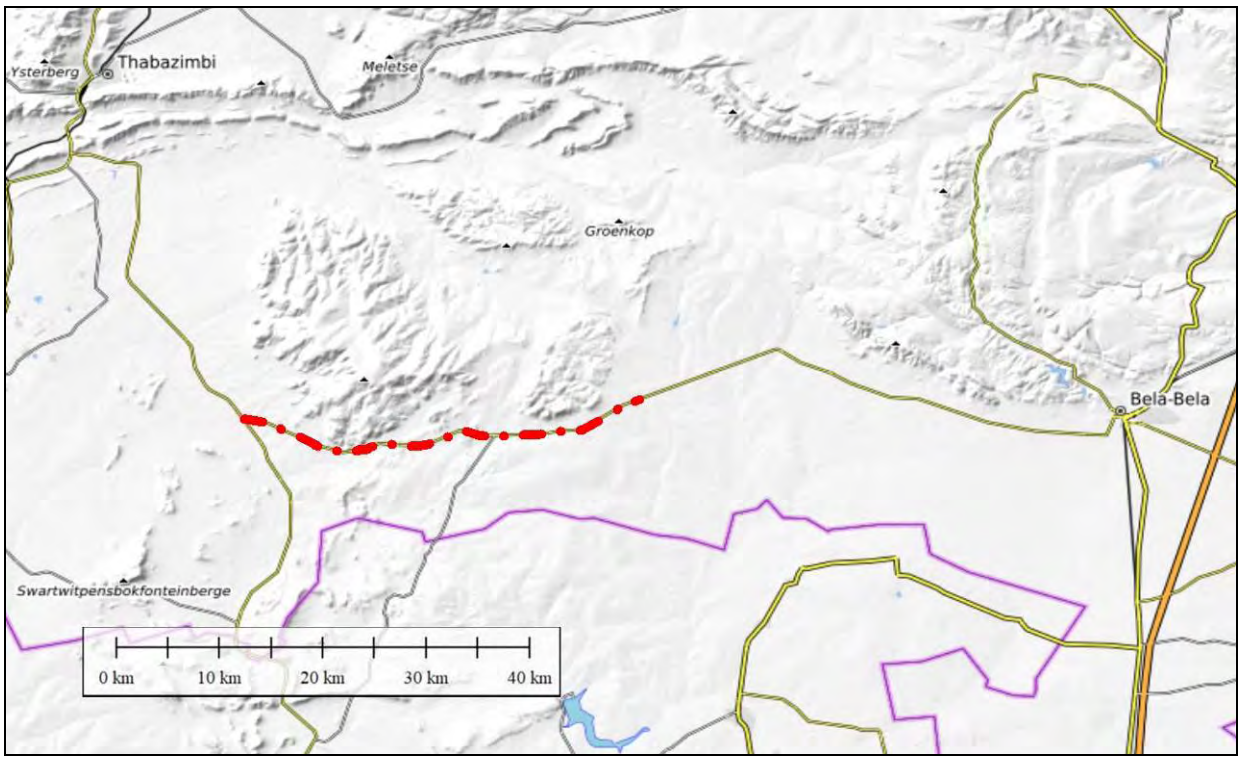


Figure 1. Locality and routes

Scope of Work

The following activities are to be undertaken:

- A agricultural agro-ecosystem assessment, including an assessment of soil characteristics, vegetation composition, water availability, agro-climatic information, land productivity and existing impacts;
- The mapping of present land uses, land capability/potential and any agricultural/agro-ecosystem sensitivities;
- An assessment of the potential impacts of the proposed road upgrade on agriculture and/or agro-ecosystems; and,
- Recommendations to mitigate these potential impacts.

The report should meet the requirements of the General Agricultural Assessment Protocols (GNR 320) (2020), in accordance with NEMA.

2 PROCESS OF THE ASSESSMENT

The present land uses were identified from satellite images dated 2004 to 2021 and then verified by a site visit on 10 August 2021.

The land uses were delineated the following main categories:

1) Housing;
2) Grazing (open veld or pastures);

Permanent loss will only be the land within a servitude registered in favour of SANRAL. The 40 m servitude covers the present fence to fence boundaries.

A file containing the route and the road design was provided by the client as background information.

A buffer of 50 m around all the components was drawn and was used as the boundary of the area that may be impacted on.

Seventeen photographs were taken along route, focussing also where particular features occur that construction may impact.

3 AGRICULTURAL LAND USE

Land uses in agriculture are dynamic and constantly changes depending on the climate and socioeconomic conditions of the farmer of the region and even of the country. Viability of farm enterprises diminished with the increase of production cost and product prices that did not increase at the same rate. Some of the land previously cultivated has as a result reverted back to veld or was planted to pastures.

The following figures indicate the land uses within 50 m of the road servitude:

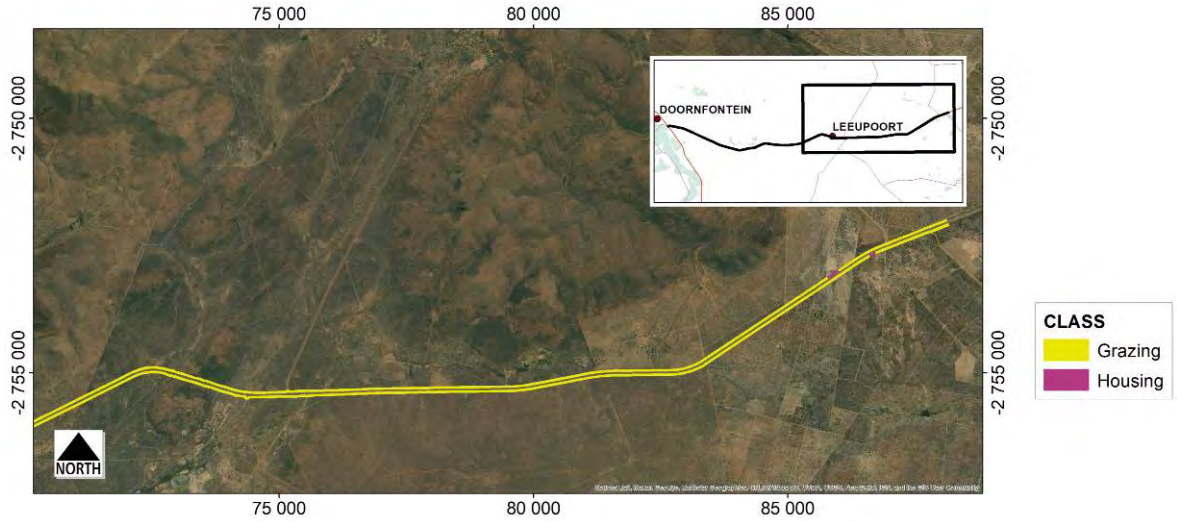


Figure 2. Portion 1

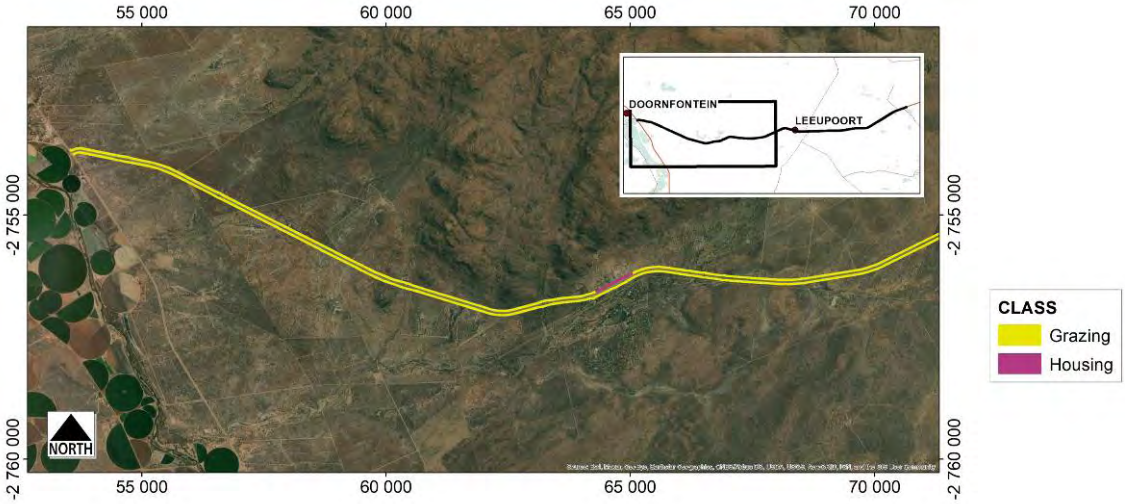


Figure 3. Portion 2

There are about 389,5 ha within the metre corridor that was assessed (see Table 1).

The only farming land use is livestock grazing or game ranching. There are some houses abutting the road servitude. The area impacted on by construction is relatively small. The areas used by housing and grazing land are as follows:

Table 1. Land uses within 100 m of the proposed buffer line

Land use	Within the 40 m road reserve	Buffer area of 50 m outside the road reserve(ha)
Grazing	0	389,5
Housing	0	6,2
TOTAL		**389,7**

4 AGRICULTURAL INFRASTRUCTURE

No farming infrastructure will be lost. There may, however, be inconvenience by the farmers to access their properties – this will need to be managed.

A large number of farms are game fenced and used for hunting. The boundaries are along the road servitude, and will not directly be influenced.

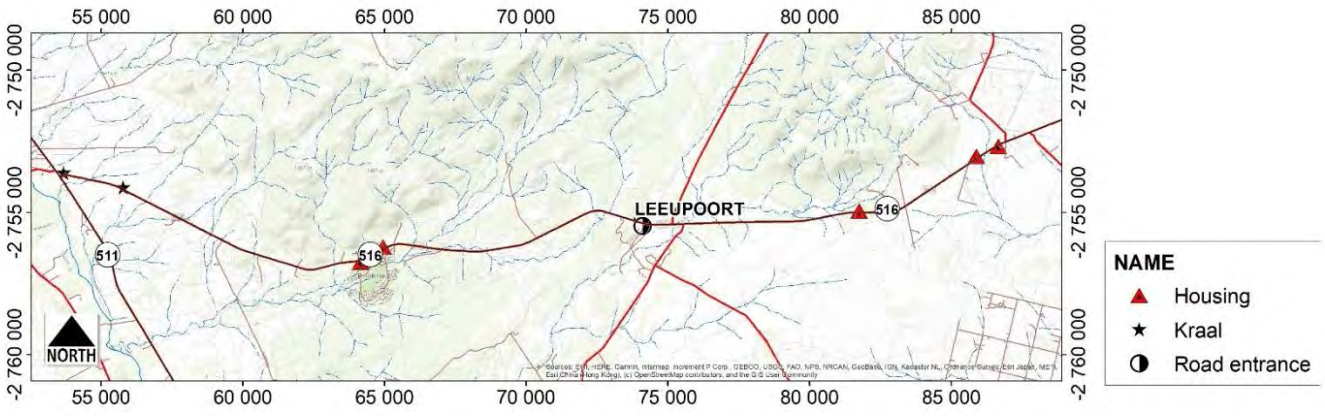


Figure 4. Farming related infrastructure

Photo 1. Kraal and handling facilities

Photo 2. Game standard fencing

5 NATURAL RESOURCES – BASELINE CONDITION

5.1 Climate

The area experiences significant seasonal variation in monthly rainfall. The long term average is 560 to 600 mm per year. The rainy period of the year lasts for 7,8 months, from end September to early May. Most rain falls around January. (Source for weather: weatherspark.com).

The rainfall if coupled with the low water holding capacity of the soil is not sufficient for commercial crop production.

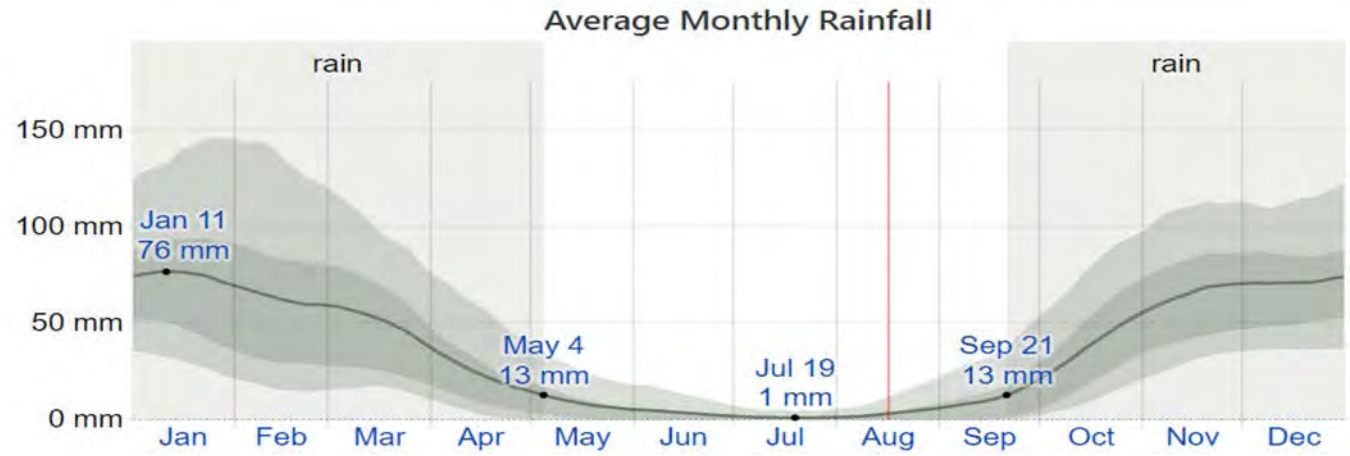


Figure 5. The average rainfall (solid line) with 25th to 75th and 10th to 90th percentile bands

The warm season lasts for 6 months, from mid-September to mid-March, with an average daily high temperature above 28°C. The hottest day of the year is in early January, with an average high of 30°C and low of 19°C.

The cool season lasts for 2 months, from early May to early August, with an average daily high temperature below 23°C. The coldest day of the year is June 25, with an average low of 4°C and high of 21°C.

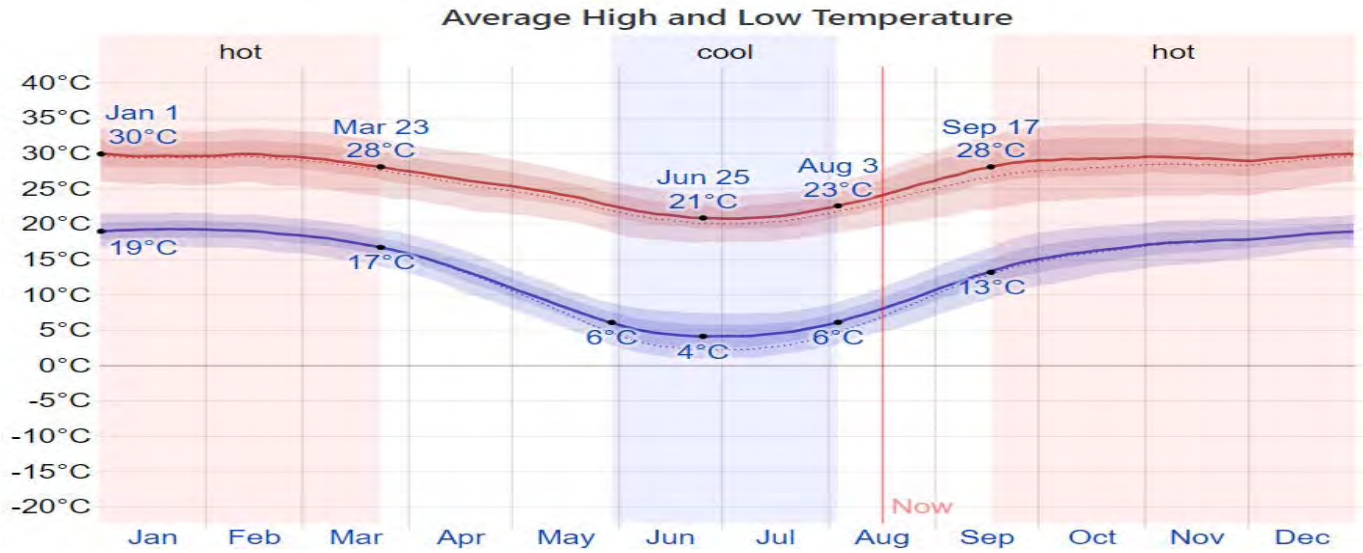


Figure 6. Daily average high and low Temp, with 10th to 90th percentile bands

The average hourly wind speed the site experiences mild seasonal variation over the course of the year,

The windier part of the year lasts for 4 months, from August to December, with average wind speeds of more than 12 m/sec.

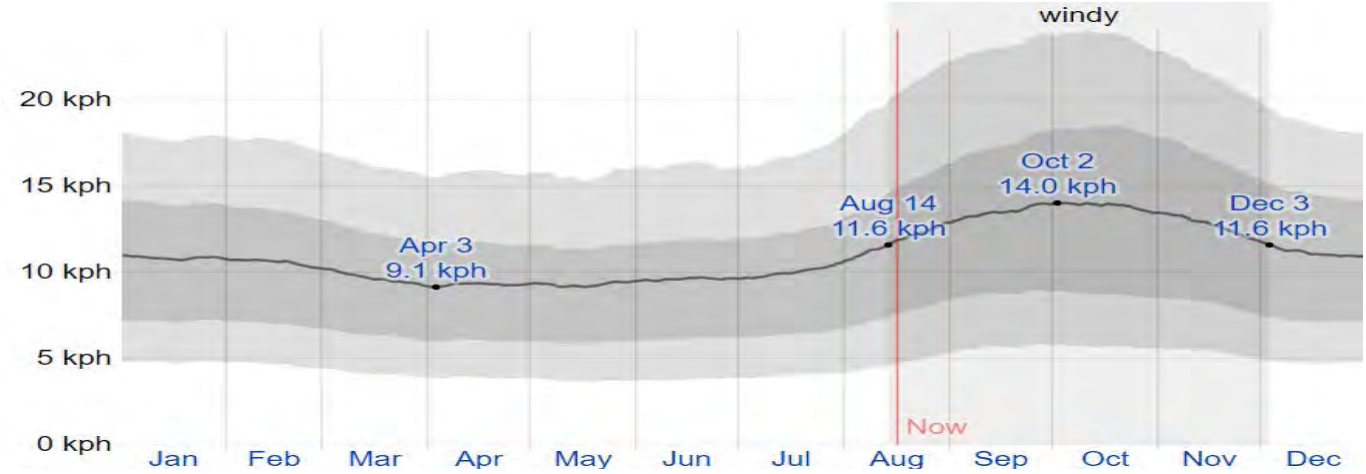


Figure 7. Average wing speed

5.2 Vegetation

The eastern portion of the route is Central Sandy Bushveld. The soils are shallow sandy soils. West of Leeupoort is Central Sandy Bushveld. Both have primarily *Burkea africana*, *Vachellia tortilis* trees with *Terminalia, Ziziphus, Euclia* and *Commiphora*. Grasses are *Eragrostis* spp, *Hyperelia, Panicum maximum* and *Themeda triandra*. These are palatable species if well maintained.

Both these biomes offer excellent forage for grazers and browsers. The region has many game farms and hunting is a preferred commercial activity.

Photo 3. *Terminalia* trees on rocky soils

Photo 4. Mixed Bushveld with *Panicum maximum* grass

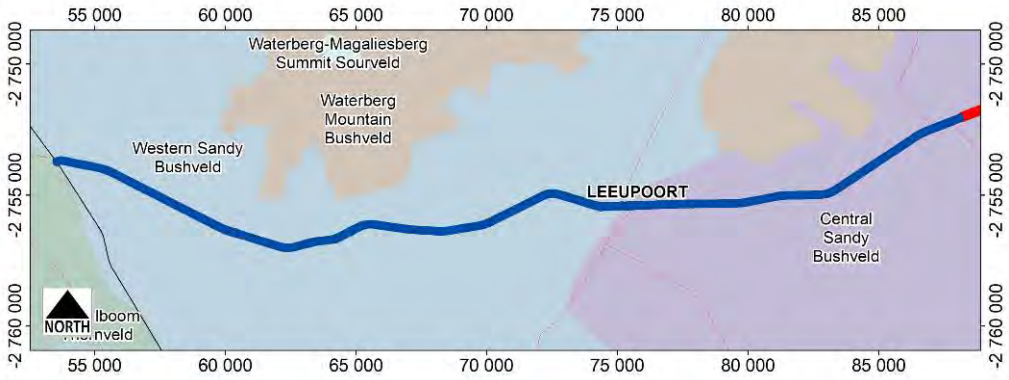


Figure 8. Biomes of vegetation along the route

Growing season

The growing season commences in November when precipitation exceeds 50% of transpiration. This lasts until the beginning of April. The dry season lasts for 8 months of the year. The winter period is dry with little vegetative growth (source: Grieser, J, 2006).

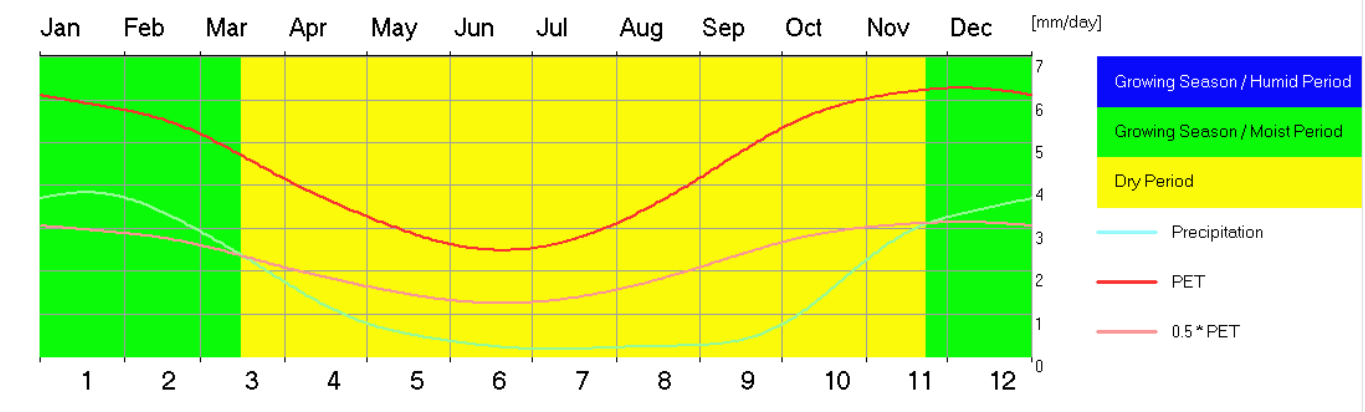


Figure 9. Growing season of vegetation at Rooiberg

Grazing capacity

The grazing capacity for livestock of natural veld, according to the DALRRD, is estimated at 8 - 9 hectares per large stock unit (LSU).

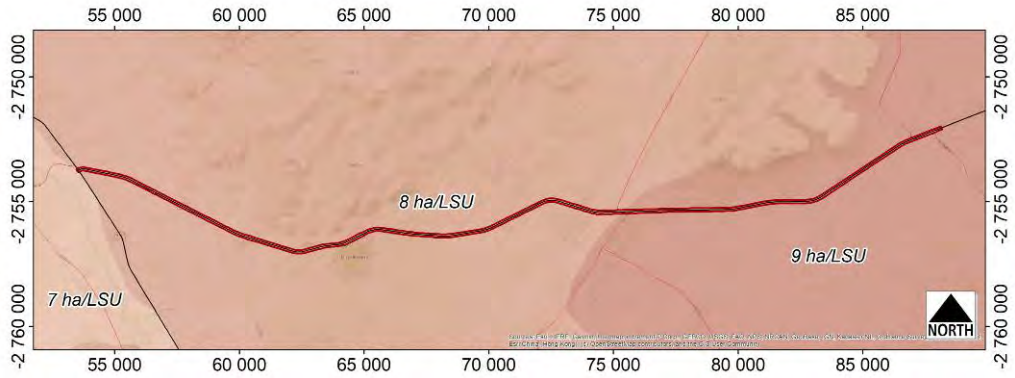


Figure 10. Grazing capacity of land in the study area

5.3 Soil

The soils along the entire route have reddish and greyish brown in colour and are shallow and rocky. There is no arable land.

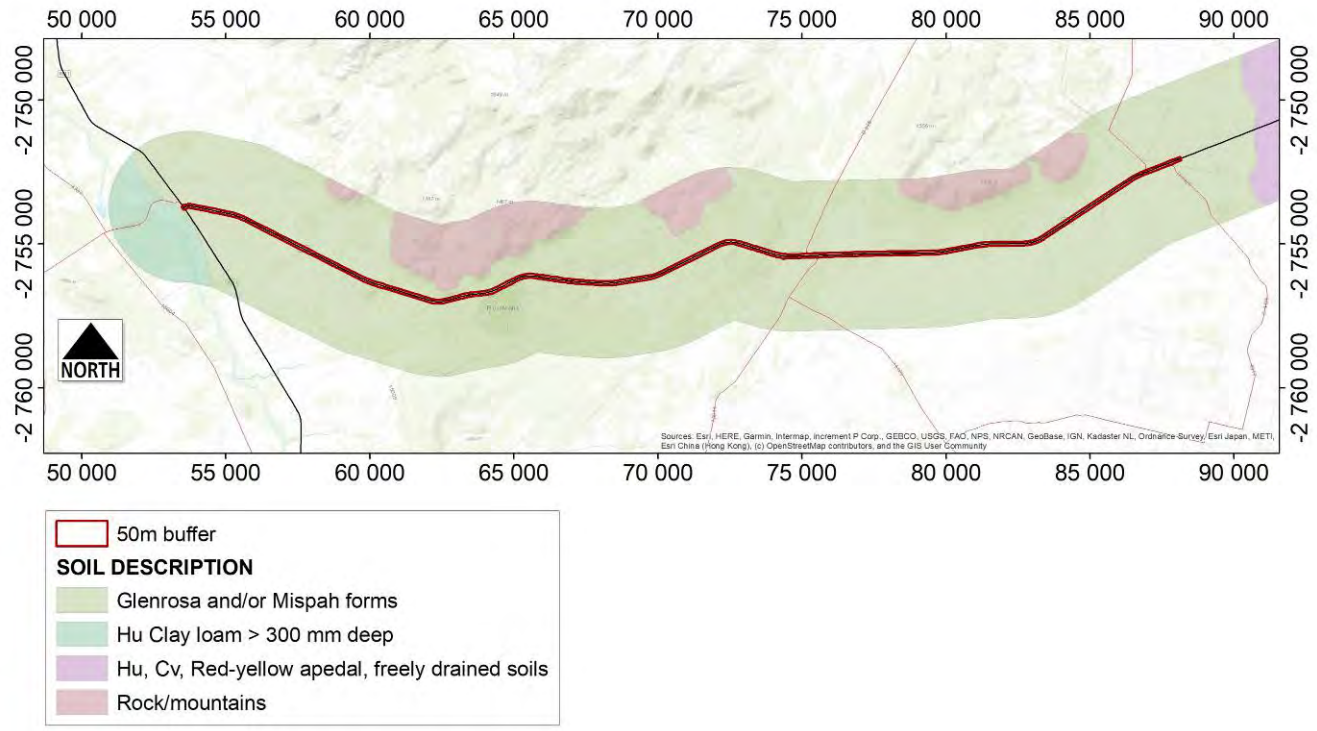


Figure 11. Soil Map

The road reserve is the only land that is permanently disturbed.

6 LAND CAPABILITY

6.1 Defining High potential land

The potential of land is defined in terms of a viable farming unit as described in *Conservation of Agricultural Resources Act* (CARA) and *National Policy of the Preservation of High Potential Land* (HUAL) and in other legislation and guidelines that are used by the Department of Agriculture Land Reform and Rural Development.

However, land and soil properties are often the only criterion that is used to determine if land is arable instead of financial viability of the property as a farming unit.

Norms and standards in terms of CARA and HUAL

National policy on the protection of high potential and unique agricultural land published by Department of Agriculture in 2006 relates to subdivision of land and a change in land use, states that *Protection of high potential agricultural land for food security remains the primary responsibility of the Department of Agriculture*.

High potential cropping land means land best suited to, and capable of, consistently producing acceptable levels of goods and services for a wide range of agricultural enterprises in a sustainable manner, taking into consideration expenditure of energy and economic resources; and includes:

- Land capability classes i to iii;
- Unique agricultural land;
- Irrigated land; and
- Land suitable for irrigation and/or where irrigation water is available.

Essentially, HUAL's objective is to protect high potential land from being exploited for non-farming purposes.

No high potential land was found.

6.2 Capability – DALRRD

In 2014 the Directorate: Land Use and Soil Management embarked on a process to refine the 2002 national land capability data set.

The new methodology is based on a spatial evaluation modelling approach wherein the key modelling issues include the delineation of geographic units.

These results are made available on request from the Department. It consists of a dataset that evaluated soil properties, land characteristics and climate, which then culminates into 12 land use capability classes.

The main deciding criterion in the case of this site is the soil potential (or capability).

Figure 16 indicates the soil capability and the land use capability from this dataset.

The capability description is provided here because it is the dataset used by the Ecological Sensitivity Tool of the Department of Forestry, Fisheries and the Environment (DFFE) in determining what the impact will be if the land is withdrawn from agriculture.

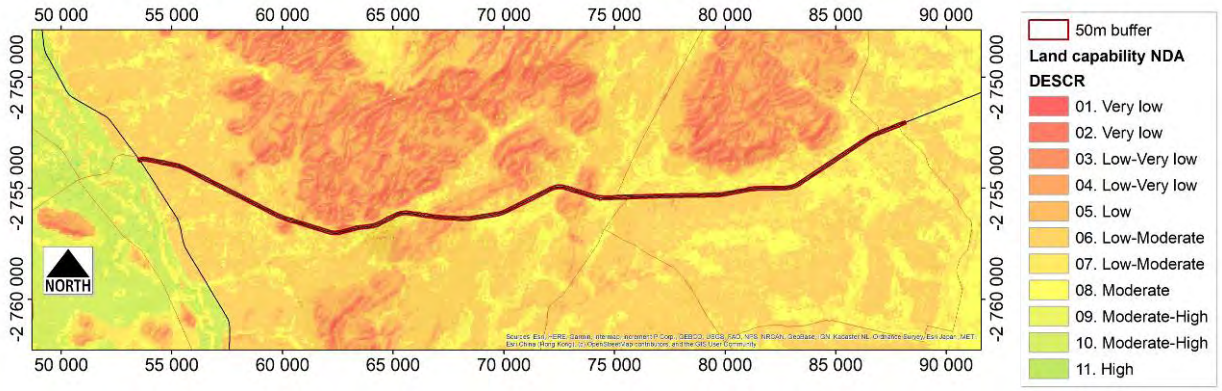


Figure 12. Land use capability

Most of the land consists of Class 6 and below, which is low-moderate capability land. According to the guidelines of DALRRD, Classes 8 to 12 should be protected.

The conclusions of the analyses are the following:

- No moderate or high capability land occurs within the 100 m along the centre line,
- Because the road reserve is the only land that is permanently disturbed, land capability outside the road reserve have very little value in the impact assessment.

7 ECOLOGICAL SENSITIVITY

The DFFE published Notice 648 of the National Environmental Management Act in May 2019 that describes the minimum criteria when applying for environmental authorisation. The notice relates specifically to energy generation projects. Nevertheless, it is more broadly applied to also include other developments.

This protocol provides the criteria for the assessment and reporting of impacts on agricultural resources for activities requiring environmental authorisation. The assessment requirements of this protocol are associated with a level of environmental sensitivity determined by the national web-based environmental screening tool. It is based on the most recent land capability evaluation as provided by the DALRRD (see Section 6).

The sensitivity analysis is a general description because it is based on very broad information.

Figure 17 indicates the result of the screening tool.

The site according to the screening tool has mostly a medium or low sensitivity. The result of the Screening Tool is provided in the addenda.

The detailed assessment performed by Index found the following:

1) The soil is mostly shallow and rocky soils (Glenrosa, Mispah and rocky Hutton).
2) The road reserve is expropriated land and not available to farming. It will, therefore automatically have very low sensitivity.
3) Because the Sensitivity screening tool is based on a broader raster-based dataset it may include paved and compacted land into the category of sensitive farming land.
4) None of the land indicated as sensitive that warrants further investigation in terms of NEMA or HUAL.

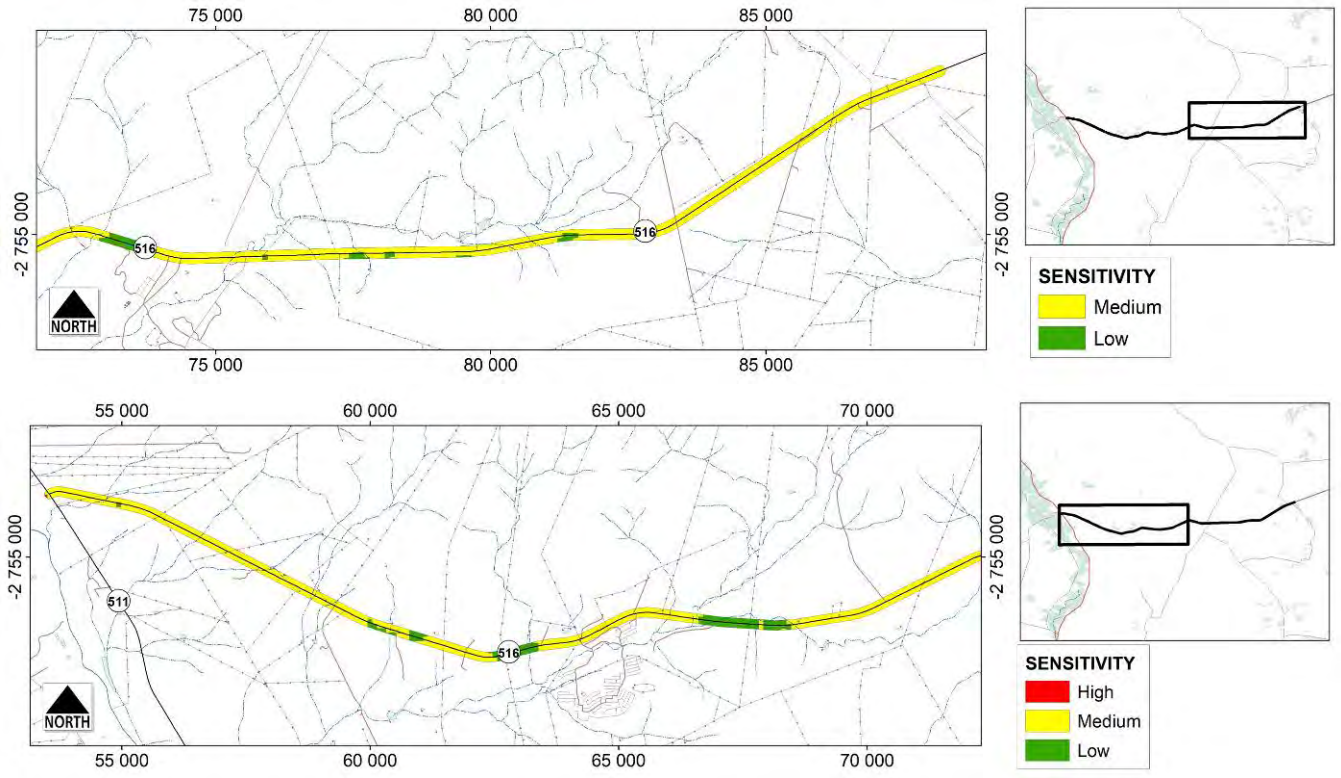


Figure 13. Agricultural sensitivity according to the Screening Tool

8 IMPACT ASSESSMENT

8.1 Assumptions

The land uses on which the impact is based are as follows:

Table 2. Land uses (area in hectare or as indicated)

Land use	Within the 40 m road reserve	Buffer area of 50 m outside the road reserve(ha)
Grazing	0	389,5
Housing	0	6,2
TOTAL		**389,7**

- No land will permanently be lost due to the construction. All activities are within the road reserve. In the event that the boundary at intersections needs to be broadened, the area will be so small that it will have little or no impact on farming viability.
- Grazing land may temporary be lost within the 50 buffer along the road reserve. The duration will be for the period that that construction takes place, and only for that portion of the road.

8.2 Rating criteria

The following rating was used to indicate impacts:

Extent

- Local - extend to the site and its immediate surroundings,
- Regional - impact on the region but within the province,
- National - impact on an interprovincial scale,
- International - impact outside of South Africa.

Magnitude

Degree to which impact may cause irreplaceable loss of resources.

- Low - natural and social functions and processes are not affected or minimally affected,
- Medium - affected environment is notably altered; natural and social functions and processes continue albeit in a modified way,
- High - natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

Duration

- Short term - 0-5 years,
- Medium term - 5-11 years,
- Long term - impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention,
- Permanent - mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Probability

- Almost certain - the event is expected to occur in most circumstances,
- Likely - the event will probably occur in most circumstances,

- Moderate - the event should occur at some time,
- Unlikely - the event could occur at some time,
- Rare/Remote - the event may occur only in exceptional circumstances.

Significance

Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-

- 0 – Impact will not affect the environment. No mitigation necessary,
- 1 – No impact after mitigation,
- 2 – Residual impact after mitigation,
- 3 – Impact cannot be mitigated.

8.3 Impact description

8.3.1 Permanent loss of high potential agricultural land

There will be no permanent loss of high potential land

Mitigation

No loss is foreseen and no mitigation is necessary.

8.3.2 Loss of cultivated land

There will be no loss of cultivated land.

Mitigation

No loss is foreseen and no mitigation is necessary.

8.3.3 Loss of grazing and browsing land

Permanent loss

There will be no loss of grazing or browsing land.

Mitigation

No loss is foreseen and no mitigation is necessary.

Provide easy and free access to properties.

Temporary loss

The loss of grazing land is temporary and will at most for the duration of construction. Grazing land will not be disturbed, but animals stay clear of disturbance and noise. Human impacted is less on livestock that it is on wildlife. The effect on hunting due to construction will be dealt with under later sections.

The temporary impacts are as follows:

- Extent: Site
- Magnitude: Low
- Duration: Short
- Probability: Possible
- Reversibility: Completely
- Significance on local community: Low

- Significance on regional level: None

Mitigation

1) Keep the construction period as short as possible,
2) Employ dust reducing practices to protect adjoining grazing land.
3) Especially blasting can be damaging for wildlife farmers. Game may have to be moved away from areas and periods where blasting may occur.

8.3.4 Loss of farming infrastructure

There are some houses, cattle handling facilities and farm entrances that may be impacted on (see Section 4). These instances occur close to, but outside the road servitude and the structures themselves will remain unaffected by construction.

Permanent loss

There will be no loss of farming infrastructure.

Mitigation

No loss is foreseen and no mitigation is necessary.

Temporary loss

Access to properties may inconvenience farmers for the duration that construction takes place.

The impact of constructing the lines is as follows:

- Extent: Local
- Magnitude: Low
- Duration: Short
- Probability: Possible
- Reversibility: Completely
- Significance on local community: Moderate
- Significance on regional level: Low

Mitigation

1) Construction should be done with care to minimise damage to infrastructure.

8.3.5 Biological

Some possible environmental impacts of the development are the following:

- Dust that is created by large trucks could reduce growth and palatability of plant; and
- Noise could impact on tourism and hunting opportunities of game farms, especially during the hunting season.

8.3.6 Socio-economic

There are some businesses close to road and which depend on passing traffic may see declining income for the duration of construction. The reason being that access to their businesses may prove difficult and could discourage patrons to do business. However, this is temporary.

Permanent loss

These business premises will not be lost permanently.

Mitigation

No loss is foreseen and no mitigation is necessary.

Temporary loss

A loss of income can occur due to access that is compromised. This may last for the duration of construction.

The impact of constructing the road is as follows:

- Extent: Local
- Magnitude: Low
- Duration: Short
- Probability: Possible
- Reversibility: Completely
- Significance on local community: Moderate
- Significance on regional level: Low

Mitigation

Keep the construction period as short as possible and suppress dust. Ensure good access to businesses along the route and to the entrances of properties.

8.3.7 Farming operations

Many of the properties are used for wildlife breeding or production. Fences are of game standard with many electrified to protect the animals.

The hunting season is a particularly sensitive period when people movement along the construction sites must be controlled or at least be discussed with the farmers in order to ensure safety of workers and animals.

Game farmers often express their fear that construction would disrupt their operations. Some possible impacts of construction, albeit temporary, on the farmers are as follows:

- Theft and vandalism is likely to increase during construction;
- Noise and dust will impact on tourism and hunting opportunities of game farms; and
- Increased fire hazard emanating from the construction site or camps.

Mitigation

- Theft and vandalism can be reduced by providing security to farmers;
- Discuss blasting and after-hours construction work with farmers, particularly where tourism and hunting takes place; and
- National Veld and Forest Fire Bill (B122B of 1998) provides guidelines on the prevention of fires and for making fire breaks. Construction contractors should ensure adequate fire protection.

8.4 Summary of impacts

The impacts ratings are as follows:

Score	Significance	Description of Rating
2 – 10	Low Significance	No specific management action required
10 – 20	Medium-low significance	Administrative management actions required
20 – 40	Medium significance	Management and monitoring action plans required
40 – 60	Medium-high significance	Specific management and monitoring plans required
60 – 80	High significance	Detailed plans required, potential red flag impact

Table 3. Impact assessment

POTENTIAL ENVIRONMENTAL	Before mitigation								After mitigation								
	Extent	Probability	Reversibility	Irreplaceable	Duration	Magnitude	**TOTAL (SP)**	**Significance**	Extent	Probability	Reversibility	Irreplaceable	Duration	Magnitude	**TOTAL (SP)**	**Significance**	**DISCUSSION / MITIGATION**
LOSS OF HIGH POTENTIAL AND CULTIVATED LAND																	
Permanent loss	1	1	1	1	1	1	**5**	**L**	1	1	1	1	1	1	**5**	**L**	No permanent loss of high potential land. No mitigation is necessary.
LOSS OF GRAZING LAND																	
Permanent loss	1	1	1	1	1	1	**5**	**L**	1	1	1	1	1	1	**5**	**L**	No permanent loss of grazing land. No mitigation necessary.
Temporary loss	1	3	1	1	1	1	**7**	**L**	1	2	1	1	1	1	**6**	**L**	Loss of grazing land is for the duration of construction. Grazing land will not be disturbed, but animals stay clear of disturbance and noise. **Mitigation** 1) Keep the construction period as short as possible. 2) Reduce or suppress dust. 3) Game may have to be moved away from areas and periods where blasting may occur.
LOSS OF AGRICULTURAL PRODUCTION																	
Permanent	1	1	1	1	1	1	**5**	**L**	1	1	1	1	1	1	**5**	**L**	There will be no permanent loss of high potential land. No mitigation is necessary.
Temporary loss	1	1	1	1	1	1	**5**	**L**	1	1	1	1	1	1	**5**	**L**	Construction is confined to the road reserve. There will be no loss of production. No mitigation is necessary.
LOSS OF AGRICULTURAL INFRASTRUCTURE																	
Direct loss	1	1	1	1	1	1	**5**	**L**	1	1	1	1	1	1	**5**	**L**	No loss of farming infrastructure. **Mitigation** Construction should be done is a way to minimise damage to infrastructure.
BIOLOGICAL																	
Loss of production due to dust	1	2	1	1	1	1	**6**	**L**	1	1	1	1	1	1	**5**	**L**	Dust has an impact on livestock. Noise will impact tourism and hunting opportunities of game farms.

POTENTIAL ENVIRONMENTAL	Before mitigation								After mitigation								
	Extent	Probability	Reversibility	Irreplaceable	Duration	Magnitude	**TOTAL (SP)**	**Significance**	Extent	Probability	Reversibility	Irreplaceable	Duration	Magnitude	**TOTAL (SP)**	**Significance**	**DISCUSSION / MITIGATION**
SOCIO-ECONOMIC																	
Permanent impact	1	1	1	1	1	1	**5**	**L**	1	1	1	1	1	1	**5**	**L**	No permanent loss of infrastructure. No mitigation is necessary.
Temporary impact	1	3	1	1	1	2	**14**	**ML**	1	2	1	1	1	1	**6**	**L**	Farm stalls and businesses close to road which depend on passing traffic may see lower income for the duration of construction. **Mitigation** Keep the construction period as short as possible. Ensure access to these businesses and to the entrances of properties.
FARMING OPERATIONS																	
Direct impact	1	3	1	3	1	2	**18**	**ML**	1	2	1	1	1	1	**6**	**L**	Theft and vandalism is likely to increase. Noise may have an impact on tourism and hunting of game farms. There could be an increased fire hazard by construction site or camps. **Mitigation** 1) Provide security to farmers to reduce theft and vandalism; 2) Keep the construction period as short as possible; 3) Discuss blasting and after-hours construction work with farmers, particularly where tourism and hunting takes place; and 4) Manage fire risk.

9 CONCLUSIONS

The major land use is livestock grazing or game ranching.

The land along the proposed route has a capability rating of low. The road reserve is the only land that is permanently disturbed and this is not used for farming purposes.

A site assessment found that the delineation according to the sensitivity tool is accurate. There is no sensitive land that should be protected. Consequently, the development will not impact the land capability of farming land.

Impact description

- There will be no permanent loss of high potential or cultivated land.
- The loss of grazing land is temporary and will at most for the duration of construction. Mitigation is achieved by keep the construction period as short as possible and reducing dust and noise as far as possible.
- There will not be permanent loss farming infrastructure.
- Farm stalls and businesses close to the road, depend on passing traffic and may see lower income duration the period of construction. However, this is only temporary.
- Many of the properties are used for wildlife breeding with hunting. Fences are of game standard with many electrified.

  The hunting season is a particularly sensitive period of the year, when people moving along the construction sites must be controlled or at least such actions communicated to the farmers in order to ensure the safety of workers.

  Some possible impacts of construction on the farmers, albeit temporary, are that theft and vandalism is likely to increase, noise and dust may impact tourism and hunting and that there could be an increased fire hazard.

  Mitigation is achieved by providing security to farmers, keeping the construction period as short as possible communicate blasting and after-hours construction work with farmers, particularly where tourism and hunting takes place and by making fire breaks or provide fire protection during the period that construction takes place.

The environmental impact of upgrading the road on agriculture is low and only of a temporary nature. Normal operational practices and environmental awareness is required to minimise any impacts.

10 REFERENCES

1) Grondklassifikasie Werkgroep, 1991. Grondklassifikasie, 'n Taksonomiese sisteem vir Suid Afrika, Departement van Landbou-ontwikkeling, Pretoria.
2) South African Atlas of Agrohydrology and Climatology. Water Research Commission, Pretoria
3) Criteria for high potential agricultural land in South Africa, Department of Agriculture, Directorate Land Use and Soil Management, 2002.
4) Soil Management, Agricultural Research Council, 2005.
5) GIS Layers, Environmental Potential Atlas, Department of Environment Affairs, 2002.
6) Quickbird and Bing Satellite Imagery, 2014

11 ADDENDA

11.1 Firebreaks

National Veld and Forest Fire Bill (B122B of 1998)

The requirement to prepare firebreaks

- Landowners are required to prepare firebreaks on their side of the boundary where there is a reasonable risk of veld fire (section 12(1)).
- How do we know what a reasonable risk is?
- The courts use the "reasonable person test":
  - if a reasonable person in the position of the landowner would foresee that by not preparing a firebreak, a veld fire could start or spread across his or her land, causing harm to someone else,
  - and therefore would prepare one,
  - then the landowner should also prepare one.

Preparing firebreaks

- Firebreaks can be prepared in a number of ways, for example, by grading, ploughing, disking, hoeing or burning.
- However, any soil disturbance is subject to the Conservation of Agricultural Resources Act. Owners should ensure that firebreaks are positioned and prepared in such a way as to cause the least disturbance to soil and biodiversity.
- Section 16 allows the owner to damage, destroy or remove any protected plants in making a firebreak, despite what the National Forests Act or any other law says. But the owner must transplant protected plants if possible or position the firebreak to avoid protected plants.
- The National Environmental Management Act requires biodiversity to be protected, so remind landowners of this when advising them about firebreaks.
- The Act sets out a procedure for burning firebreaks.
- Neighbours can agree to reposition a firebreak on a common boundary.

Requirements for firebreaks

- The Act doesn't specify requirements for firebreaks.
- This is because requirements will vary from one situation to the next. For example, on the Cape Peninsula, firebreak requirements would be different to what is needed in the eastern Free State.
- Local practice and local issues must determine what the requirements are.
- The Act states that the owner must pay attention to weather, climate, terrain and vegetation in deciding on how to prepare the break.
- The break must:
  - be wide enough and long enough to have a reasonable chance of stopping the veld fire
  - not cause soil erosion
  - be reasonably free of inflammable material (section 13).

Co-ordination with other legislation

- Burning of firebreaks must co-ordinate with other legislation and regulations.

- Conservation of Agricultural Resources Act (CARA):
  - Regulation 12 contains provisions dealing with prevention and control of veld fires, preventing land users from burning or grazing burnt veld without written permission from the executive officer
  - Rules for burning veld (firebreaks and controlled burns) must not contradict the procedure set out in CARA.
- Atmospheric Pollution Prevention Act:
  - Although the Act does not apply to smoke caused by veld fires, it may apply to smoke caused by management practices such as burning firebreaks and controlled burns.
  - If occupiers of premises make representation to the local authority regarding smoke that is causing a nuisance, the authority is obliged to serve an abatement notice.
  - Failure to comply with the notice (i.e. failure to abate or stop) constitutes an offence.

11.2 Photos

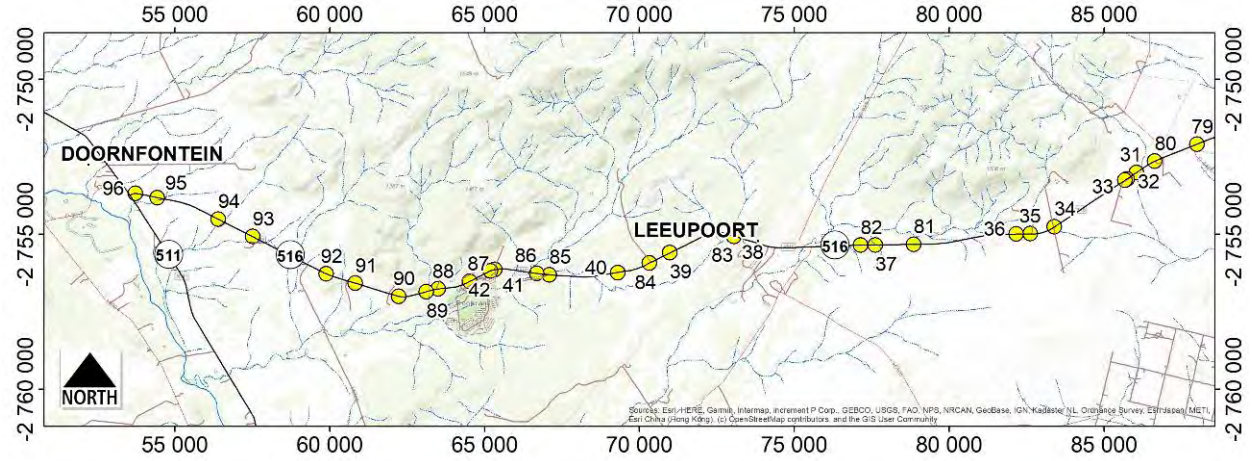


Figure 14. Photo positions


82


83


84


85


86


87


88


89


90


91


92


93


94


95


96

SCREENING REPORT FOR AN ENVIRONMENTAL AUTHORIZATION AS REQUIRED BY THE 2014 EIA REGULATIONS – PROPOSED SITE ENVIRONMENTAL SENSITIVITY

EIA Reference number: SANRAL

Project name: R516

Project title: Section 2

Date screening report generated: 16/08/2021 10:41:37

Applicant: Index

Compiler: Dr A Gouws

Compiler signature: .....

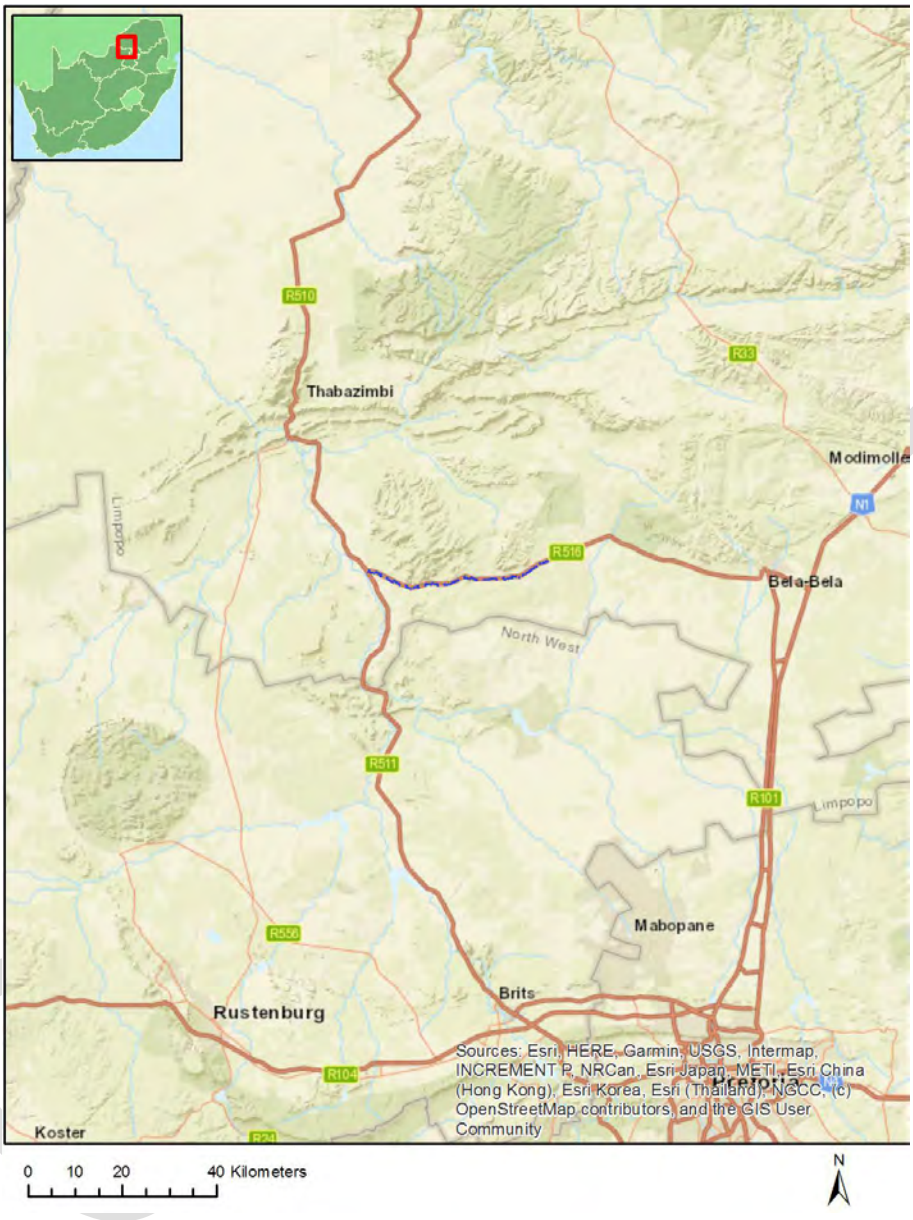
Application Category: Agriculture_Forestry_Fisheries|Animal Production

Table of Contents

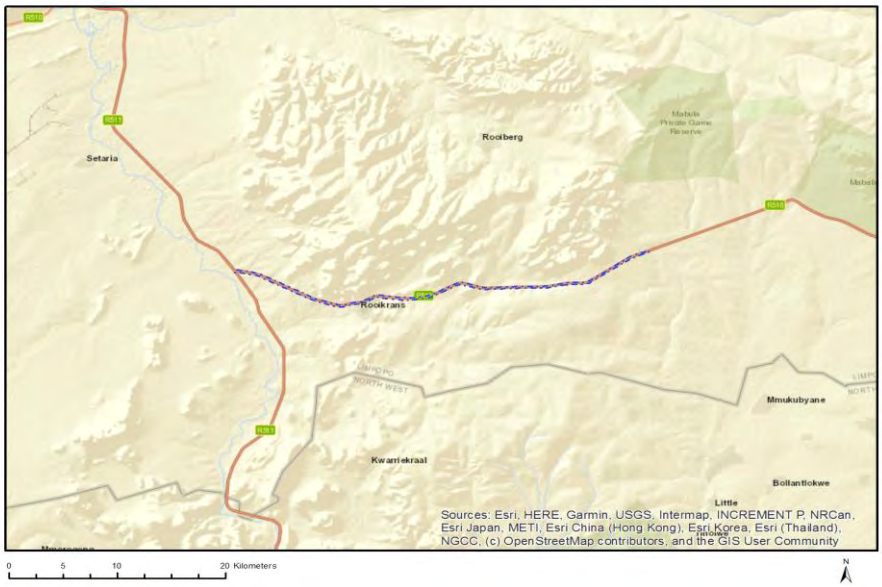
Proposed Project Location

Orientation map 1: General location

General Orientation: R516



Map of proposed site and relevant area(s)



Cadastral details of the proposed site

Property details:

No	Farm Name	Farm/ Erf No	Portion	Latitude	Longitude	Property Type
1	LEEUPOORT VAKANSIEDORP	126	0	24°54'36.78S	27°38'42.28E	Erven
2	LEEUPOORT VAKANSIEDORP	1	0	24°54'53.09S	27°38'7.32E	Erven
3	LEEUPOORT VAKANSIEDORP	123	0	24°54'49.02S	27°38'16.59E	Erven
4	LEEUPOORT VAKANSIEDORP	124	0	24°54'43.5S	27°38'27.93E	Erven
5	LEEUPOORT VAKANSIEDORP	125	0	24°54'40.63S	27°38'35.05E	Erven
6	LEEUPOORT VAKANSIEDORP	2	0	24°54'52.55S	27°38'10.05E	Erven
7	LEEUPOORT VAKANSIEDORP	1482	0	24°54'33.23S	27°38'36.34E	Erven
8	LEEUPOORT VAKANSIEDORP	1527	0	24°54'35.18S	27°38'33.37E	Erven
9	LEEUPOORT VAKANSIEDORP	1529	0	24°54'35.59S	27°38'32.43E	Erven
10	LEEUPOORT VAKANSIEDORP	1534	0	24°54'34.77S	27°38'32.86E	Erven
11	LEEUPOORT VAKANSIEDORP	1575	0	24°54'36.49S	27°38'29.15E	Erven
12	LEEUPOORT VAKANSIEDORP	1581	0	24°54'37.28S	27°38'28.93E	Erven
13	LEEUPOORT VAKANSIEDORP	1483	0	24°54'33.69S	27°38'36.6E	Erven
14	LEEUPOORT VAKANSIEDORP	1495	0	24°54'33.77S	27°38'35.25E	Erven
15	LEEUPOORT VAKANSIEDORP	1526	0	24°54'35.01S	27°38'33.9E	Erven

94	VLAKFONTEIN	535	0	24°52'30.91S	27°48'25.55E	Farm Portion
95	RIETFONTEIN	536	4	24°54'27.18S	27°45'13.12E	Farm Portion
96	RIETFONTEIN	536	0	24°52'51.29S	27°46'40.99E	Farm Portion
97	ROOYKRANS	538	2	24°53'34.46S	27°39'51.96E	Farm Portion
98	LEEUWPOORT	554	0	24°54'50.16S	27°43'16.33E	Farm Portion
99	ETOSHA	671	0	24°52'30.63S	27°52'46.07E	Farm Portion
100	DOORNFONTEIN	498	2	24°53'30.03S	27°32'23.23E	Farm Portion
101	HARTEBEESTVLEY	510	0	24°51'5.65S	27°42'45.16E	Farm Portion
102	MORGENZON	533	23	24°53'46.19S	27°50'9.89E	Farm Portion
103	MORGENZON	533	28	24°52'39.59S	27°50'1.61E	Farm Portion
104	WEIHOEK	540	9	24°55'52.76S	27°37'7.73E	Farm Portion
105	RIETFONTEIN	541	9	24°55'13.68S	27°35'50.35E	Farm Portion
106	MORGENZON	533	27	24°52'27.96S	27°50'42.55E	Farm Portion
107	RIETFONTEIN	536	7	24°54'9.06S	27°45'2.83E	Farm Portion
108	WEIKRANS	539	1	24°54'50.16S	27°38'31.87E	Farm Portion
109	WEIHOEK	540	14	24°54'55.71S	27°37'36.47E	Farm Portion
110	RIETFONTEIN	541	8	24°53'43.52S	27°34'2.04E	Farm Portion
111	DRIE JONGELINGS GELUK	562	0	24°54'56.15S	27°34'40.52E	Farm Portion
112	MOTSWIRI	678	0	24°52'41.23S	27°51'26.83E	Farm Portion
113	LEEUPOORT VAKANSIEDORP	1606	0	24°54'37.21S	27°38'33.08E	Public Place

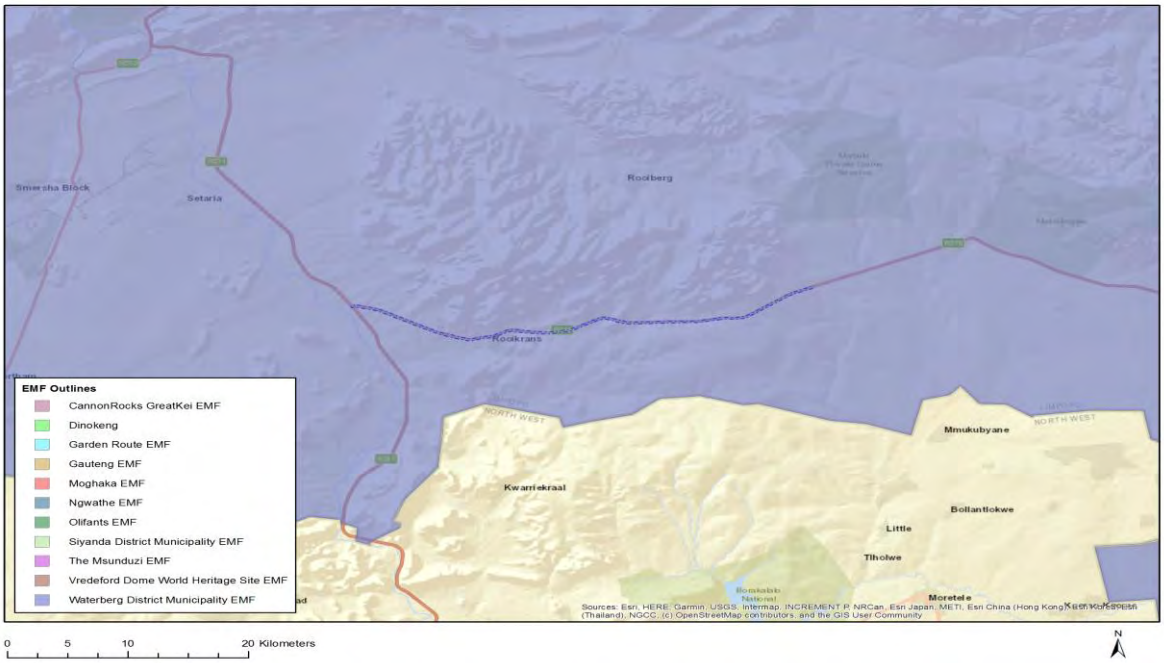
Development footprint[1] vertices:
No development footprint(s) specified.

Wind and Solar developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed area

No	EIA Reference No	Classification	Status of application	Distance from proposed area (km)
1	14/12/16/3/3/1/969	Solar PV	Approved	1.9

[1] "development footprint", means the area within the site on which the development will take place and incudes all ancillary developments for example roads, power lines, boundary walls, paving etc. which require vegetation clearance or which will be disturbed and for which the application has been submitted.

Environmental Management Frameworks relevant to the application



Environmental Management Framework	LINK
Waterberg District Municipality EMF	https://screening.environment.gov.za/ScreeningDownloads/EMF/WDEMF_Final_EMF_Report.pdf

Environmental screening results and assessment outcomes

The following sections contain a summary of any development incentives, restrictions, exclusions or prohibitions that apply to the proposed development site as well as the most environmental sensitive features on the site based on the site sensitivity screening results for the application classification that was selected. The application classification selected for this report is: **Agriculture_Forestry_Fisheries|Animal Production**.

Relevant development incentives, restrictions, exclusions or prohibitions

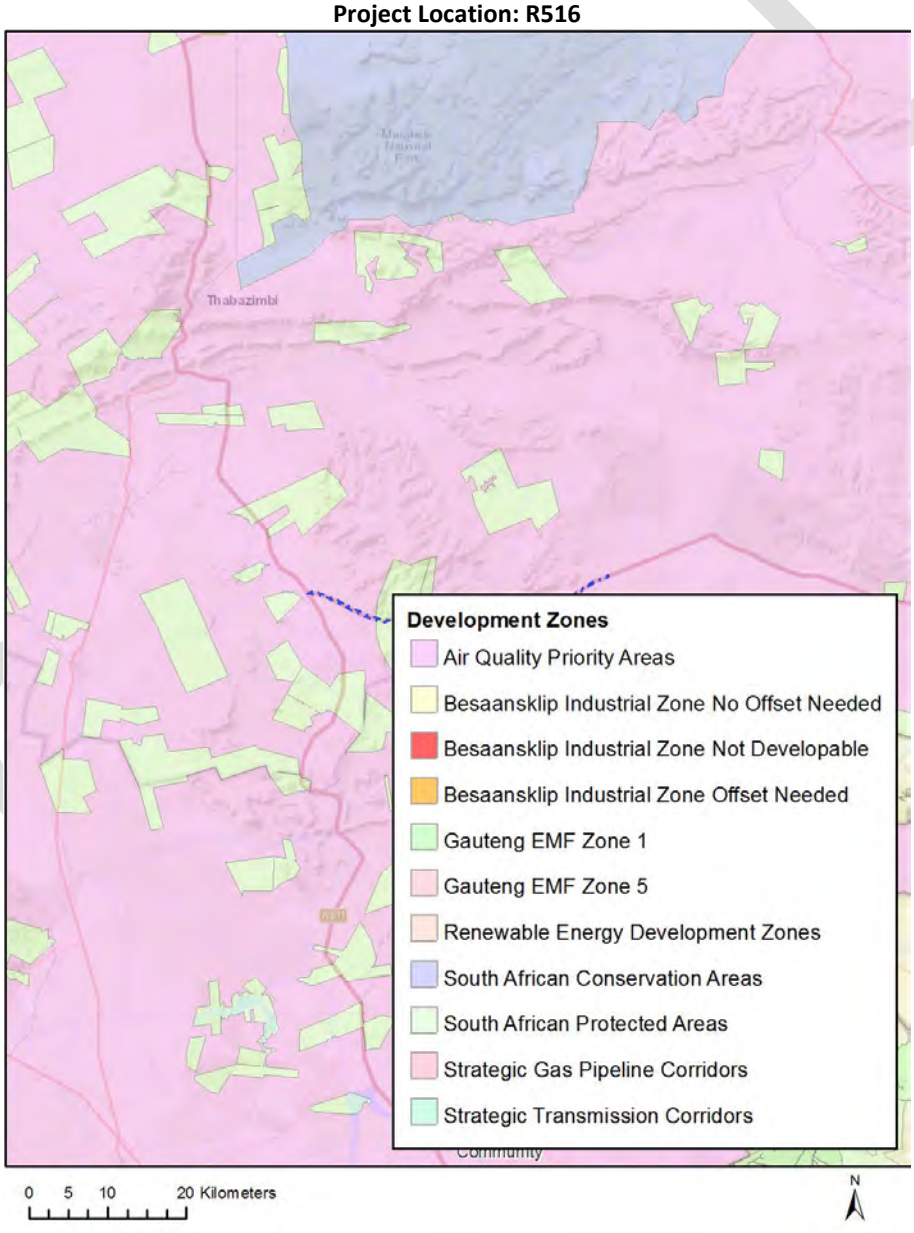
The following development incentives, restrictions, exclusions or prohibitions and their implications that apply to this site are indicated below.

Incentive, restriction or prohibition	Implication

Air Quality-Waterberg-Bojanala Priority Area	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/gg39489_nn1207a.pdf
South African Protected Areas	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/SAPAD_OR_2021_Q1_Metadata.pdf

Map indicating proposed development footprint within applicable development incentive, restriction, exclusion or prohibition zones

Project Location: R516



Proposed Development Area Environmental Sensitivity

The following summary of the development site environmental sensitivities is identified. Only the highest environmental sensitivity is indicated. The footprint environmental sensitivities for the proposed development footprint as identified, are indicative only and must be verified on site by a suitably qualified person before the specialist assessments identified below can be confirmed.

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Agriculture Theme	X			
Animal Species Theme			X	
Aquatic Biodiversity Theme	X			
Archaeological and Cultural Heritage Theme				X
Civil Aviation Theme		X		
Defence Theme				X
Paleontology Theme			X	
Plant Species Theme				X
Terrestrial Biodiversity Theme	X			

Specialist assessments identified

Based on the selected classification, and the environmental sensitivities of the proposed development footprint, the following list of specialist assessments have been identified for inclusion in the assessment report. It is the responsibility of the EAP to confirm this list and to motivate in the assessment report, the reason for not including any of the identified specialist study including the provision of photographic evidence of the site situation.

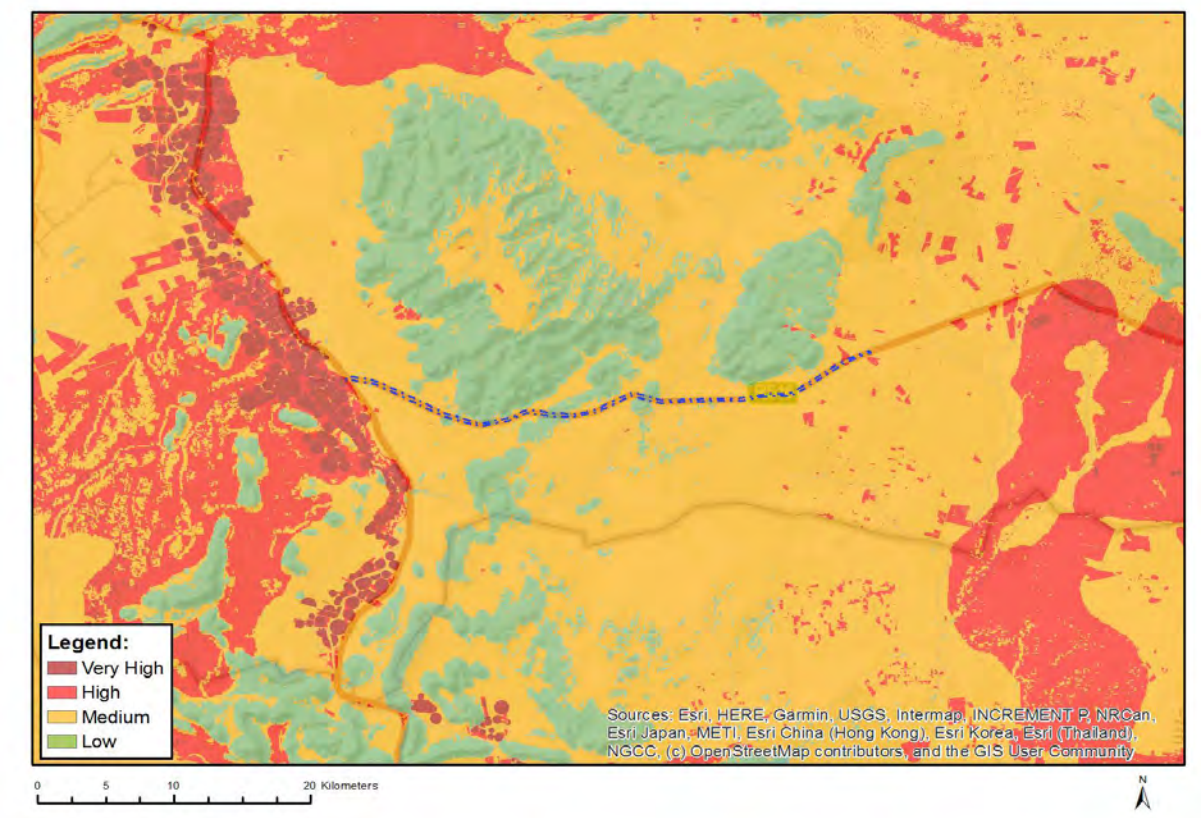
No	Specialist assessment	Assessment Protocol
1	Landscape/Visual Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
2	Archaeological and Cultural Heritage Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
3	Palaeontology Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
4	Terrestrial Biodiversity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Terrestrial_Biodiversity_Assessment_Protocols.pdf

5	Aquatic Biodiversity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Aquatic_Biodiversity_Assessment_Protocols.pdf
6	Hydrology Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
7	Traffic Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
8	Socio-Economic Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
9	Ambient Air Quality Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
10	Plant Species Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Plant_Species_Assessment_Protocols.pdf
11	Animal Species Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Animal_Species_Assessment_Protocols.pdf

Results of the environmental sensitivity of the proposed area.

The following section represents the results of the screening for environmental sensitivity of the proposed site for relevant environmental themes associated with the project classification. It is the duty of the EAP to ensure that the environmental themes provided by the screening tool are comprehensive and complete for the project. Refer to the disclaimer.

MAP OF RELATIVE AGRICULTURE THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;09. Moderate-High/10. Moderate-High
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
Low	Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
Medium	Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
Very High	Pivot Irrigation;Land capability;09. Moderate-High/10. Moderate-High
Very High	Pivot Irrigation;Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate

APPENDIX C2 -
AQUATIC AND WETLAND IMPACT ASSESSMENT

ENVIRONMENTAL IMPACT ASSESSMENT (BAR) FOR THE PROPOSED NATIONAL ROAD R516 SECTION 1 - R511 TO TOOYSPRUIT IMPROVEMENT, NEAR BELA BELA, IN THE LIMPOPO PROVINCE

AQUATIC IMPACT ASSESSMENT

FOR

BVI (PTY) LTD

BY

EnviroSci (Pty) Ltd

Dr Brian Colloty

1 Rossini Rd
Pari Park
Gqeberha
6070

DATE

20 January 2022

REVISION FINAL DRAFT

Executive Summary

BVI (Pty) Ltd appointed EnviroSci (Pty) Ltd to conduct an assessment of the proposed road improvements along the R516, near Bela Bela. This was based on a detailed 4 day site visit conducted, first in July 2021, and again in October 2021, this due to project description related changes that needed assessment.

The focus of this report was the Road Section 1 between the R511 and Tooyspruit (KM0.00 – KM36.67), which will see improvements to the road with general roadworks, the inclusion of temporary bypass/s, the widening / extension of several culverts and bridges and the installation of a new major culverts as required.. A detailed description of all the road upgrade components is provided later in this report.

This assessment thus included the delineation of any natural waterbodies within the study area in question, as well as assessing the potential consequences of the proposed activities on the surrounding watercourses and wetlands.

The surveys adhered to the assessment criteria contained in the DWAF 2005/2008 delineation manuals, the National Wetland Classification System and the requisite habitat integrity methods to determine the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the observed aquatic systems. Note the PES rating scale is also used to show the Ecological Category of the system being assessed.

The PROTOCOL FOR SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR THE ENVIRONMENTAL IMPACTS ON AQUATIC BIODIVERSITY (Government Gazette 43110, 20 March 2020), superseding the Appendix 6 NEMA requirements, was also adhered to. The Department of Environmental Affairs Screening Tool, which is also discussed in greater detail in this report.

The proposed works occurs within the A24C, A24B and A23H catchment associated with watercourses typical of the Bushveld Basin Ecoregion. The mainstem watercourses within or in close proximity to the road included the Crocodile, Sleepfontein and Lepenya rivers.

Overall, these watercourses are largely in a stable state, with impacts being limited to the road itself, inclusive of the typical maintenance activities (mowing and clearing of trees), while the areas beyond the road servitude have been modified by livestock production, creation of a large number of farm dams, and clearing of bush for farming and or access tracks.

The National Wetland Inventory v5.2 spatial data (NWI / NSBA, 2018), indicated the potential presence of the following wetland /aquatic features within 500m of the road section:

- Channelled Valley Bottom Wetlands associated with the Crocodile River floodplain
- Seeps along the Sleepfontein River

This resulted in the portions of the road sections, receiving a Very High Aquatic sensitivity rating in the DFFE Screening Tool, thus requiring the submission of an Aquatic Biodiversity Specialist Assessment and not an Aquatic Biodiversity Compliance Statement.

This assessment thus focused on identifying and delineating at a finer scale the aquatic systems associated with any of the smaller watercourses as well as the mainstem systems crossed by the Road Section. Only four small wetlands (depression and valley bottom systems) were found in close proximity to the proposed works, while the remaining areas affected are associated with riparian vegetation (non-wetland specific vegetation units).

Rivers and streams that still contained water during the time of the survey, had the following species: *Phragmites mauritianum* colonising the moist areas , while the dominant grass layer included *Cynodon*

dactylon, *Melinis repens, Hyperthelia dissoluta* (yellow thatching grass), and *Eragrostis* species. *Commelina benghalensis* dominated the herbaceous layer. Species such as *Albuca, Convolvulus sagittatus* subsp *sagitatus, Dipcadi viride, Senecio consonguineus* (starvation Senecio) and *Merremia palmata* were also noted. Saplings of the trees *Diospyros lycioides* and *Searsia lancea* were recorded.

The Tooyspruit contained water at the time of the site visit and hydrophyllic grasses such as *Imperata cylindrica* and *Miscanthus junceus* as well as the sedges *Cyperus sexiangularis* and *Schoenoplectus muricinux* were recorded. Forbs species included *Lobelia erinus, Berkhyea radula* and *Pelargonium luridum*. The invasive species recorded were *Persicaria lapathifolia* and *Verbena brasiliensis*. The provincially protected *Scadoxus puniceus* was recorded in the westbound servitude.

Different to the other watercourses and wetland areas, a small depression was observed and was colonised by a *Schoenoplectus muriciux*. However, no other wetland species were recorded, and terrestrial grasses dominated (e.g. *Melinis repens, Setaria incrassata* and *Cynodon dactylon*).

The remaining dry perennial watercourses contained species are typical of the regional vegetation type, namely the Western Sandy Bushveld (SVcb16) and Central Sandy Bushveld (SVcb12) vegetation types as indicated in the Vegmap of South Africa (2018).

The National Freshwater Ecosystems Priority Areas (NFEPA) (Nel *et al*., 2011), also earmarked sub-quaternaries, based either on the presence of important biota (e.g. rare or endemic fish species) or conversely the degree of riverine degradation, i.e. the greater the catchment degradation the lower the priority to conserve the catchment. The important catchments areas are then classified as Freshwater Ecosystems Priority Areas (FEPAs). The FEPAs and Fish Sanctuaries are sub-quaternary catchments that are required to meet biodiversity targets for threatened and near threatened fish species indigenous to South Africa. Only the last remaining 100m of the western portion of the road section falls within a Phase 2 FEPA.

The Present Ecological State scores (PES) for the road section were rated as follows (DWS, 2014)

Subquaternary Catchment Number	Present Ecological State	Catchment Ecological Importance	Catchment Ecological Sensitivity
596	D (Largely Modified)	Moderate	High
600	D (Largely Modified)	Moderate	High
607	C (Moderately Modified)	Moderate	High

The river/stream reaches observed would seem to uphold the findings of the past DWS assessment and the PES / EIS ratings were also D (largely Modified) and Moderate respectively in this assessment. The Moderate EIS was due to intact vegetation was found upstream/downstream of the road crossings sites, substantiated by the fact that these riverine reaches still formed part of Critical Biodiversity Area Type 1 and 2 and Ecological Support Areas (Limpopo Conservation Plan), while containing several, protected species (although mostly terrestrial).

The pan / depression (> 0.5 ha) received a PES score of D, and EIS score of Low. The score was due to the effect of grazing / trampling and or the road maintenance activities that occurred adjacent the road servitude.

The PES and EIS scores were then translated in the respective sensitivity ratings of the various aquatic systems (High to Moderate), and used to prepare a sensitivity map, that will be used in guiding any of the works required. The remaining secondary aquatic systems (highly ephemeral, with no to limited aquatic habitat) were considered Moderately Sensitive.

The following direct impacts were then assessed, which are aligned with those contained in the Biodiversity Assessment Protocol and included in the table below:

Biodiversity Assessment Protocol Impacts found applicable to this project	**Impacts assessed in this report below**
Fragmentation (physical loss of ecological connectivity and or CBAs)	Impact 1 & 2
Changes in numbers and density of species	Impact 1 & 2
Faunal and vegetation communities inhabiting the site	Impact 1 & 2
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Impact 3
Streamflow regulation	Impact 3
Erosion control	Impact 4
Water quality changes (increase in sediment, organic loads, chemicals or eutrophication	Impact 5
Cumulative Impacts	Impact 6

Impact 1: Loss of Very High Sensitivity systems, through physical disturbance although the proposed layout will avoid any of these systems identified in the DFFE Screening Tool (Figure 2).

Impact 2: Impact on wetlands & watercourses (Very High, High & Moderate Sensitivity), through physical disturbance related to the improvement / widening of the 6 river bridges and eight culverts and replacement of 2 major culverts, as well as the replacement of minor culverts. Works will also include provision/upgrading of erosion protection and stormwater management.

Impact 3: Impact on all riparian and wetland systems through the possible increase in surface water runoff on riparian form and function through hydrological changes

Impact 4: Increase in sedimentation and erosion impacts during the operational phase

Impact 5: Risks on the aquatic environment due to water quality impacts mostly during the construction phase

Impact 6: Cumulative impacts

In summary, the proposed road section for the facility would not have a direct impact on the following:

- Any Very High sensitivity areas identified by the DFFE Screening Tool as these areas will be avoided or are already impacted by the proposed activities that will be upgraded and in most cases provide an improvement in flows and or erosion protection.
- Any functioning aquatic environments that received a Very High sensitivity rating as indicated in Figure 8.

Therefore, based on the results of this report, the significance of the remaining impacts assessed for the aquatic systems after mitigation would be LOW. Thus, no objection to the authorisation of any of the proposed activities is made at this point based on the summary of works provided.

This report also indicates the watercourses and wetlands within 500m of the development area. Any activities within these areas, the buffers or 500m from the wetland boundary will require a Water Use license under Section 21 c and i of the National Water Act (Act 36 of 1998). It is however assumed that as impacts will be LOW, a General Authorisation process can be followed – substantiated by the attached DWS Risk Assessment Matrix..

As the proposed activities have the potential to create erosion, the following recommendations are reiterated:

- Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment, and suitable dust and erosion control mitigation measures should be included in the EMP to mitigate.

- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination / leaks outside of any delineated waterbodies and their buffers. Washing and cleaning of equipment should also be done in berms or bunds, to trap any cement / hazardous substances and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel.

- It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas along aquatic features, using selected species detailed in this report.

- All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.

- It is further recommended that a comprehensive rehabilitation plan be implemented from the project onset within watercourse areas to ensure a net benefit to the aquatic environment. This should from part of the suggested walk down as part of the final EMP preparation preconstruction.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTO PLATES

ACRONYMS

BAR	Basic Assessment Report
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DWS	Department of Water and Sanitation formerly the Department of Water Affairs
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
GIS	Geographic Information System
NFEPA	National Freshwater Ecosystem Priority Atlas (Nel, *et al*. 2011).
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SQ	Subquaternary catchment
WUL	Water Use License
WULA	Water Use License Application

COMPLIANCE WITH THE PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON AQUATIC BIODIVERSITY ISSUED 20 MARCH 2020, REPLACING REQUIREMENTS OF APPENDIX 6 – GN R326 EIA REGULATIONS OF 7 APRIL 2017

DFFE Screening Tool Summary			
Requirement	**Completed / Assessed**	**Date**	**Comments**
Desktop and satellite imagery analysis	Yes	18 October 2021	
Preliminary On-site inspection	Yes	July and October 2021	Two sites visits were conducted
Additional information			**Results**
1:50 000 topocadastral maps	Yes	18 October 2021	Cadastre and indicated features unchanged
Google Earth	Yes	18 October 2021	Used as the basis of GIS mapping and road section verification
National Wetland Inventory Spatial Data	Yes	18 October 2021	Natural and artificial systems present
National Vegetation Spatial Data	Yes	18 October 2021	Western Sandy and Central Sandy Bushveld (SVcb 12 & 16)
Threatened Ecosystems Spatial Data	Yes	18 October 2021	None
Conservation Plans (WCBSP, ECBCP, NCBSP etc)	Yes	18 October 2021	Limpopo Biodiversity Spatial Plan - CBA 1, 2 and ESA
National Freshwater Ecosystem Priority AREA (NFEPA)	Yes	18 October 2021	NFEPA
Strategic Water Resource Area	Yes	18 October 2021	Crocodile River Valley Groundwater
Free flowing Rivers	Yes	18 October 2021	None
Wetland Clusters	No	18 October 2021	None
Critical Biodiversity Area (CBA)	Yes	18 October 2021	Yes
Ecological Support Area (ESA)	Yes	18 October 2021	Yes
Ecological Importance and Sensitivity of Site (EIS)	Yes	18 October 2021	Moderate
Description of ecosystem processes (movement of surface water, recharge/discharge & sediment transport etc)	Yes	18 October 2021	Ephemeral systems with and without riparian zones

Historic Reference Condition and Present Ecological State (PES) of rivers (instream, riparian, floodplain), wetlands or estuaries and possible changes to channel and flow regime (surface & groundwater)	Yes	18 October 2021	PES = C to D Reference Condition B	
Review of Screening Tool results	**Present**	**Confirmed / Disputed (if disputed photographic evidence must be included into assessment)**	**Aquatic Biodiversity Specialist Assessment Protocol Required (Y/N or N/A)**	**Aquatic Biodiversity Compliance Statement Protocol required (Y / N or N/A)**
Very High Aquatic Habitat	No	Confirmed, but the road alignment / servitude already exists	YES	N/A
Low Aquatic Habitat	Yes	Confirmed	N/A	N/A
ASSESSMENT AND REPORTING OF IMPACTS ON AQUATIC BIODIVERSITY PROTOCOL REQUIREMENTS				
Aquatic Biodiversity Specialist Assessment Protocol	YES	**Aquatic Biodiversity Compliance Statement Protocol**		**NO**
Reason	VERY HIGH aquatic habitats	*Reason*		
Proposed Site (Site Sensitivity)	Moderate only within the footprint	Proposed Site (Site Sensitivity)		
Preferred Site (Site Sensitivity)	Not Assessed as the alignment already exists	Preferred Site (Site Sensitivity) - NA		
ANTICIPATED IMPACT AND IF REQUIRING ASSESSMENT IN THE SPECIALIST ASSESSMENT	**(Y/N)**	**AQUATIC BIODIVERSITY COMPLIANCE STATEMENT REQUIREMENTS**		**(Y/N**
Aquatic features		**Aquatic features**		
Alteration in baseflow (increase or Reduction of overall flows)	No	Proposed development footprint assessed		Yes
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Yes	LOW site sensitivity confirmed		Yes

Change in hydrogeomorphic typing (Unchannelled valley bottom wetland to Channelled Valley Bottom Wetland)	No	Confirm whether or not the proposed development will have an impact on the aquatic features	Impacts will still occur
Water quality changes (increase in sediment, organic loads, chemicals or eutrophication	Yes		
Fragmentation (physical loss of ecological connectivity and or CBA road sections)	Yes		
Loss or degradation of unique characters or features (waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, pans/ depressions)	No		
Ecosystem regulating and supporting services			
Flood attenuation	No		
Streamflow regulation	Yes		
Sediment trapping	No		
Phosphate assimilation	No		
Nitrate assimilation	No		
Toxicant assimilation	No		
Erosion control	Yes		
Carbon storage	No		
Ecosystem Community Composition			
Changes in numbers and density of species	Yes		
Integrity (condition, viability, predator prey ratios, dispersal rates)	Yes		
Faunal and vegetation communities inhabiting the site	Yes		
Estuary function (where applicable)			
Size of estuary	N/A		
Availability of sediment	N/A		
Wave action in mouth	N/A		
Protection of mouth	N/A		
Beach slope	N/A		

volume of Mean Annual Runoff	N/A		
Extent of saline intrusion (especially where relevant to Permanently Open Systems	N/A		
REPORTING REQUIRMENTS ADDRESSED OR INCLUDED IN THE ASSESSMENT / COMPLIANCE STATEMENT (REPLACING SECTION 6 OF NEMA REGUALTIONS (REPORTING REQUIREMENTS			
Details of SACNASP author included (Registration number, field of expertise and CV	YES	Details of SACNASP author included (Registration number, field of expertise and CV attached in appendix 1.	
Signed statement of independence	YES	Signed statement of independence	
Statement of duration, date and season of site inspection, methods and models use, as well as equipment	YES	A baseline profile description of biodiversity and ecosystems of the site	
Description of assumptions and limitations (uncertainties & knowledge gaps)	YES	The methodology used to verify the sensitivities of the aquatic biodiversity features on the site including the equipment and modelling used where relevant.	
Local of No-Go areas for construction and operation	YES	In the vase of linear activity, confirmation from the aquatic biodiversity specialist that in their opinion, based on the mitigation and remedial measures proposed the land cane be returned to the current state within two years of completion of the construction phase.	
Additional environmental impacts	YES	Proposed impact management actions and impact management outcomes or any monitoring requirements for inclusion in the EMPr.	
Direct, indirect and cumulative impacts assessed	YES	Description of assumptions and limitations (uncertainties & knowledge gaps).	
Degree to which impacts and risks can be mitigated	YES	Any conditions to which approval is subject	
Degree to which impact or risks can be reversed	YES	Signed copy of assessment must be appended to the BAR or EIA	
Degree to which impact or risks can cause the loss of irreplaceable resources	YES		
Inclusion of a suitable construction and operational buffer using accepted methodologies	YES		
Proposed impact management actions and impact management outcomes for inclusion in the EMPr	YES		

Motivation for using High Sensitive Areas versus available Low Biodiversity Sensitive Areas	YES	
Substantiated statement based on the findings of the specialist assessment, regarding the acceptability or no of the proposed development and if the proposed development should receive approval or not	YES	
Any conditions to which approval is subject	YES	
Signed copy of assessment must be appended to the BAR or EIA	YES	

SPECIALIST DECLARATION

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

R516 Section 1 upgrade

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address: Department of Environmental Affairs Attention: Chief Director: Integrated Environmental Authorisations Private Bag X447

Pretoria

0001

Physical address:

Department of Environmental Affairs

Attention: Chief Director: Integrated Environmental Authorisations

Environment House

473 Steve Biko Road

Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:

Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	EnviroSci (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	Dr Brian Colloty			
Specialist Qualifications:	Ph.D			
Professional affiliation/registration:	SACNASP Pr Sci Nat 400268/07 Ecological			
Physical address:	1 Rossini Rd Pari Park Port Elizabeth 6070			
Postal address:	1 Rossini Rd Pari Park Port Elizabeth 6070			
Postal code:	6070	Cell:	0834983299	
Telephone:	0413662077	Fax:	-	
E-mail:	b.colloty@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, _____Brian Colloty_____, declare that –

- I act as the independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations and all other applicable legislation.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.

- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

EnviroSci (Pty) Ltd

Name of Company:

20 January 2022

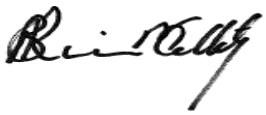
Date

SPECIALIST REPORT DETAILS

Report prepared by: Dr. Brian Colloty Pr.Sci.Nat. (Ecology) / Member SAEIES.

Expertise / Field of Study: BSc (Hons) Zoology, MSc Botany (Rivers), Ph.D Botany Conservation Importance rating (Estuaries) and interior wetland / riverine assessment consultant from 1996 to present.

I, **Dr. Brian Michael Colloty** declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs and or Department of Water and Sanitation.



Signed: …… Date:…20 January 2022……

Appendix 1 of this report contains a detailed CV

1. Introduction

BVI (Pty) Ltd appointed EnviroSci (Pty) Ltd to conduct an assessment of the proposed road improvements along the R516, near Bela Bela (Figure 1). This was based on a detailed 4 day site visit conducted, first in July 2021, and again in October 2021, this due to project description related changes that needed assessment.

The focus of this repot was the Road Section 1 between the R511 and Tooyspruit (KM0.00 – KM36.67), which will see improvements to the road with general roadworks, the inclusion of temporary bypass/s, the widening / extension of several culverts and bridges and the installation of a new major culverts as required.. A detailed description of all the road upgrade components is provided later in this report

This assessment included the delineation of any natural waterbodies within the study area in question, as well as assessing the potential consequences of the proposed activities on the surrounding watercourses and wetlands.

The surveys adhered to the assessment criteria contained in the DWAF 2005/2008 delineation manuals, the National Wetland Classification System and the requisite habitat integrity methods to determine the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the observed aquatic systems. Note the PES rating scale is also used to show the Ecological Category of the system being assessed.

The PROTOCOL FOR SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR THE ENVIRONMENTAL IMPACTS ON AQUATIC BIODIVERSITY (Government Gazette 43110, 20 March 2020), superseding the Appendix 6 NEMA requirements, was also adhered to as portions of the study area were highlighted by the Screening Tool as Very High Sensitivity Aquatic Environments (Figure 2).

Several important national, provincial and municipal scale conservation plans were also reviewed, with the results of those studies being included in this report. Most conservation plans are produced at a high level, so it is therefore important to verify the actual status of the study area during this initial phase, prior to the final development plan being produced.

1.2 Aims and objectives

The aim of this report is to provide the applicant with the requisite delineation of any natural waterbodies, while providing the competent authority with the relevant information to make an informed decision.

Certain aspects of the development may also trigger the need for a Section 21 c & i, Water Use License Applications (WULAs) (or General Authorisation [GA] applications) such as river or water course crossings or any activities within 500m of a wetland boundary. These applications must be submitted to the Department of Water and Sanitation (DWS) and information contained in this report must be used in the supporting documentation.

Information with regard to the state and function of the observed water bodies, suitable no-go buffers and assessment of the potential impacts are also provided.

1.3 Assumptions and Limitation

To obtain a comprehensive understanding of the dynamics of both the flora and fauna of the aquatic communities, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. No baseline long-term monitoring was undertaken as part of this assessment. However, a concerted effort was made to assess as much of the potential development area and the study area, as well as make use of any available literature, species distribution data and aerial photography. Furthermore, based on the previous assessments undertaken and the current state/management of the road servitude, this was not foreseen as a huge limiting factor. The level of investigation undertaken is sufficient to inform this assessment.

It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

A further assumption is that water will be sourced from the Local Municipality and not illegally abstracted from any surrounding watercourses, particularly if dust suppression is required.

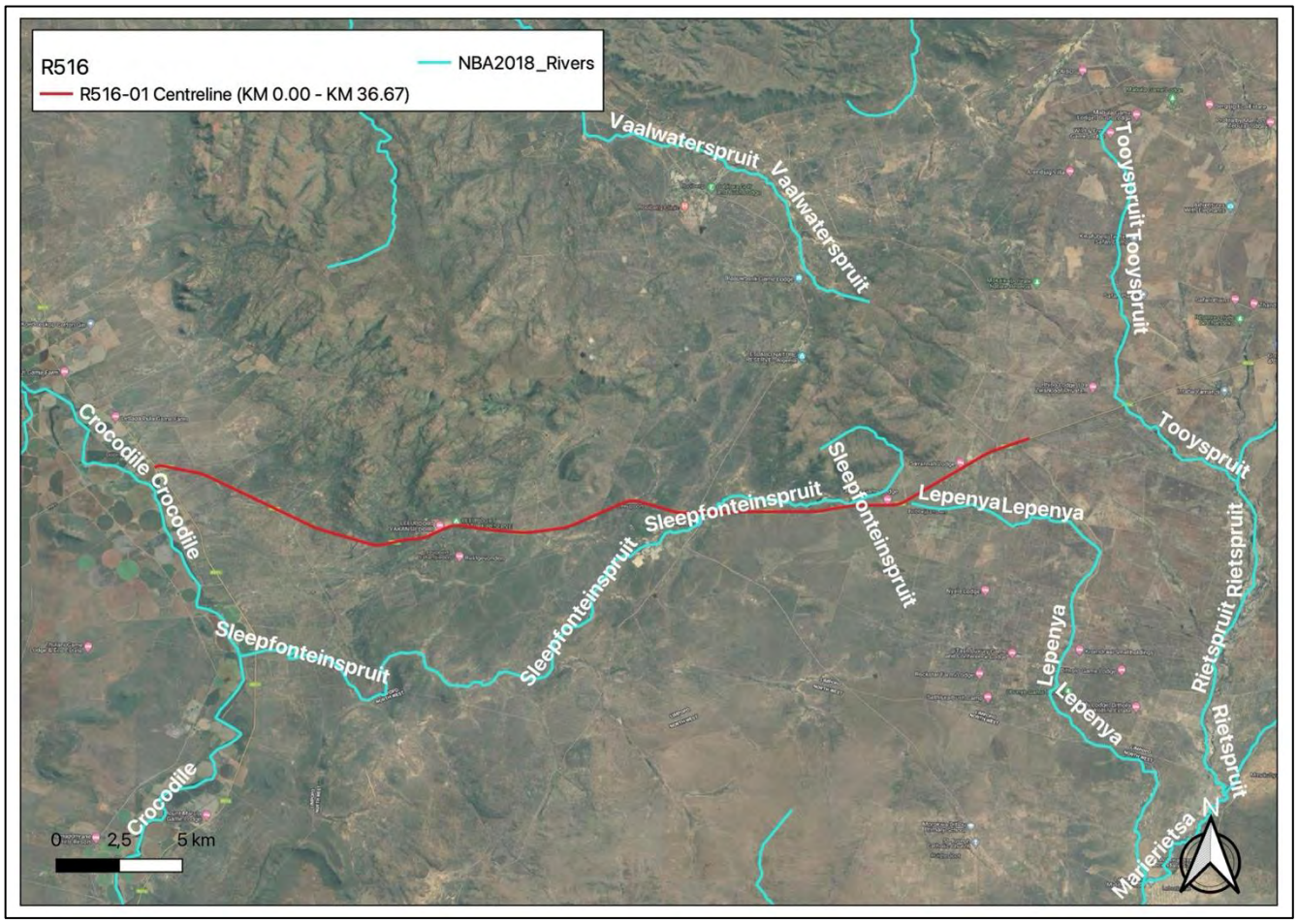


Figure 1: The study area found along Section 1 of the R516 near Bela Bela

Figure 2: Screen clip of the Very High Sensitivity aquatic systems as indicated by the DFFE Screening Tool results Accessed December 2021, where the proposed alignment traverses a Strategic Groundwater System (Crocodile) for this portion of the assessment

2. Terms of Reference

The following scope of work was used as the basis of this study to fulfil the above requirements as provided by the EAP:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with the Specialist Assessment Protocol 20 March 2020, as amended.
- Adherence to all appropriate best practice guidelines, relevant legislation and authority requirements;
- Provide a thorough overview of all applicable legislation, guidelines;
- Cumulative impact identification and assessment as a result of other developments in the area (including; a cumulative environmental impact table(s) and statement, review of the specialist reports undertaken for other Renewable Energy developments and an indication of how the recommendations, mitigation measures and conclusion of the studies have been considered);
- Identification of sensitive areas to be avoided (including providing shapefiles/kmls);
- Assessment of the significance of the proposed development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
    - Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
    - Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity.
    - Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.
- Comparative assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures in order to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (e.g. permits, licenses etc) and specialist comment if the proposed development should be authorised.

3. Project Description

The following information was provided by the client:

Project component	R516 Section 1: R511 – Tooyspruit (KM 0.00-KM36.67)
General roadworks	• Rehabilitating the existing road pavement; • Realignment of four sub-standard vertical curves to comply with the requirements for a 120km/h design speed. Earthworks are required at two of these curves with the existing cutting extended to a maximum of 2.5 m. • Widening of the current road cross section to 3.7 m lanes and 3.0 m surfaced shoulders; • Addition of turning lanes at seven (7) intersections; • Proposed addition of public transport facilities (two bus stops) and sidewalks on both sides of the R516 near the Raphuti intersection (± km 11.5); • Temporary widening of the existing road to accommodate two way traffic during construction; • Realignment of a 600 m section of Road D928 (Assen) to ensure it is situated opposite Road D928 (Rooiberg); • Relocation or protection of trees that are too close to the road surface and pose a safety risk to motorists; and • Removal of vegetation in excess of 1 hectare outside the road reserve for possible stockpile areas..
Drainage, culverts and bridges	• The widening of six (6) river bridges and eight (8) major culverts; • The replacement of two (2) major culverts; • Minor structural repair and erosion protection works at an additional one (1) bridge and four (4) major culverts; and • The widening and/or replacing minor culverts.
	Water Use License Applications will be lodged with the DHSWS.
Material sourcing	No mining component

4. Methodology

This study followed the approaches of several national guidelines regarded for aquatic assessment and wetland assessments. These have been modified by the author, to provide a relevant mechanism of assessing the present state of the study area systems applicable to the specific environment and in a clear and objective manner, assess the potential impacts associated with the proposed development area based on information collected over a number of years for this and other proposed projects.

Current water resource classification systems make use of the Hydrogeomorphic (HGM) approach, and for this reason, the National Wetland Classification System (NWCS) approach will be used in this study, a system that also differentiates between riverine and wetland aquatic systems.

4.1 Waterbody Classification Systems

Since the late 1960's, wetland classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith *et al*., 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects. **Coupled to this was the inclusion of other criteria within the classification systems to differentiate between river, riparian and wetland systems, as well as natural versus artificial waterbodies.**

The South African National Biodiversity Institute (SANBI) in collaboration with several specialists and stakeholders developed the newly revised and now accepted National Wetland Classification Systems (NWCS) (Ollis *et al*., 2013). This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, with including structural features at the finer or lower levels of classification (Ollis *et al*., 2013).

Wetlands develop in a response to elevated water tables, linked either to rivers, groundwater flows or seepage from aquifers (Parsons, 2004). These water levels or flows then interact with localised geology and soil forms, which then determines the form and function of the respective wetlands. Water is thus the common driving force, in the formation of wetlands (DWAF, 2005). It is significant that the HGM approach has now been included in the wetland classifications as the HGM approach has been adopted throughout the water resources management realm with regards to the determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) and WET-Health assessments for aquatic environments. All these systems are then easily integrated using the HGM approach in line with the Eco-classification process of river and wetland reserve determinations used by the Department of Water and Sanitation (DWS). The Ecological Reserve of a wetland or river is used by DWS to assess the water resource allocations when assessing WULAs.

The NWCS process is provided in more detail in the methods section of the report, but some of the terms and definitions used in this document are present below:

Definition Box

Present Ecological State is a term for the current ecological condition of the resource. This is assessed relative to the deviation from the Reference State. Reference State/Condition is the 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 is determined per component - for rivers and wetlands this would be for the drivers: flow, water quality and geomorphology; and the biotic response indicators: fish, macroinvertebrates, riparian vegetation and diatoms. PES categories for every component would be integrated into an overall PES for the river reach or wetland being investigated. This integrated PES is called the EcoStatus of the reach or wetland.

EcoStatus is the overall PES or current state of the resource. It represents the totality of the features and characteristics of a river and its riparian areas or wetland that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. The EcoStatus value is an integrated ecological state made up of a combination of various PES findings from component EcoStatus assessments (such as for invertebrates, fish, riparian vegetation, geomorphology, hydrology and water quality).

Reserve: The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.

Reserve requirements: The quality, quantity and reliability of water needed to satisfy the requirements of basic human needs and the Ecological Reserve (inclusive of instream requirements).

Ecological Reserve determination study: The study undertaken to determine Ecological Reserve requirements.

Licensing applications: Water users are required (by legislation) to apply for licenses prior to extracting water resources from a water catchment.

Ecological Water Requirements: This is the quality and quantity of water flowing through a natural stream course that is needed to sustain instream functions and ecosystem integrity at an acceptable level as determined during an EWR study. These then form part of the conditions for managing achievable water quantity and quality conditions as stipulated in the Reserve Template

Water allocation process (compulsory licensing): This is a process where all existing and new water users are requested to reapply for their licenses, particularly in stressed catchments where there is an over-allocation of water or an inequitable distribution of entitlements.

Ecoregions are geographic regions that have been delineated in a top-down manner on the basis of physical/abiotic factors. • NOTE: For purposes of the classification system, the 'Level I Ecoregions' for South Africa, Lesotho and Swaziland (Kleynhans *et al.* 2005), which have been specifically developed by the Department of Water Affairs & Forestry (DWAF) for rivers but are used for the management of inland aquatic ecosystems more generally, are applied at Level 2A of the classification system. These Ecoregions are based on physiography, climate, geology, soils and potential natural vegetation.

4.2 Wetland Definition

Although the National Wetland Classification System (NWCS) (Ollis *et al*., 2013) is used to classify wetland types it is still necessary to understand the definition of a wetland. Terminology currently strives to characterise a wetland not only on its structure (visible form), but also to relate this to the function and value of any given wetland.

The Ramsar Convention definition of a wetland is widely accepted as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" (Davis 1994). South Africa is a signatory to the Ramsar Convention and therefore its extremely broad definition of wetlands has been adopted for the proposed NWCS, with a few modifications.

Whereas the Ramsar Convention included marine water to a depth of six metres, the definition used for the NWCS extends to a depth of ten metres at low tide, as this is recognised as the seaward boundary of the shallow photic zone (Lombard *et al*., 2005). An additional minor adaptation of the definition is the removal of the term 'fen' as fens are considered a type of peatland. The adapted definition for the NWCS is, therefore, as follows (Ollis *et al*., 2013):

WETLAND: an area of marsh, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed ten metres.

This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten metres. The only legislated definition of wetlands in South Africa, however, is contained within the National Water Act (Act No. 36 of 1998) (NWA), where wetlands are defined as "land which is transitional between terrestrial and aquatic systems, where the water table is usually at, or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports, or would support, vegetation adapted to life in saturated soil." This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition. It should be noted that the NWA definition is not concerned with marine systems and clearly distinguishes wetlands from estuaries, classifying the latter as a watercourse (Ollis *et al*., 2013). Table 1 below provides a comparison of the various wetlands included within the main sources of wetland definitions used in South Africa.

Although a subset of Ramsar-defined wetlands was used as a starting point for the compilation of the first version of the National Wetland Inventory (i.e. "wetlands", as defined by the NWA, together with open waterbodies), it is understood that subsequent versions of the Inventory include the full suite of Ramsar-defined wetlands in order to ensure that South Africa meets its wetland inventory obligations as a signatory to the Convention (Ollis *et al.*, 2013).

Wetlands must therefore have one or more of the following attributes to meet the above definition (DWAF, 2005):

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

The site surveys included sampling (soil auguring) and species identification to ascertain the presence of any of the listed attributes.

It should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e. those associated with the drainage lines and rivers.

Table 1: Comparison of ecosystems considered to be 'wetlands' as defined by the proposed NWCS, the NWA and ecosystems included in DWAF's (2005) delineation manual.

Ecosystem	NWCS "wetland"	National Water Act wetland	DWAF (2005) delineation manual
Marine	YES	NO	NO
Estuarine	YES	NO	NO
Waterbodies deeper than 2 m (i.e. limnetic habitats often described as lakes or dams)	YES	NO	NO
Rivers, channels and canals[1]	YES	NO[1]	NO
Inland aquatic ecosystems that are not river channels and are less than 2 m deep	YES	YES	YES
Riparian[2] areas that are permanently / periodically inundated or saturated with water within 50 cm of the surface	YES	YES	YES[3]
Riparian [3] areas that are not permanently / periodically inundated or saturated with water within 50 cm of the surface	NO	NO	YES[3]

Where:

[1] Although river channels and canals would generally not be regarded as wetlands in terms of the National Water Act, they are included as a 'watercourse' in terms of the Act.

[2] According to the National Water Act and Ramsar, riparian areas are those areas that are saturated or flooded for prolonged periods and would be considered riparian wetlands, as opposed to non –wetland riparian areas that are only periodically inundated and the riparian vegetation persists due to having deep root systems drawing on water many meters below the surface.

[3] The delineation of 'riparian areas' (including both wetland and non-wetland components) is treated separately to the delineation of wetlands in DWAF's (2005) delineation manual.

4.3 National Wetland Classification System method

During this study, due to the nature of the wetlands and watercourses observed, it was determined that the newly accepted NWCS be adopted. This classification approach has integrated aspects of the HGM approach used in the WET-Health system as well as the widely accepted eco-classification approach used for rivers.

The NWCS (Ollis *et al*., 2013) as stated previously, uses hydrological and geomorphological traits to distinguish the primary wetland units, i.e. direct factors that influence wetland function. Other wetland assessment techniques, such as the DWAF (2005) delineation method, only infer wetland function based on abiotic and biotic descriptors (size, soils & vegetation) stemming from the Cowardin approach (Ollis *et al.,* 2013).

The classification system used in this study is thus based on Ollis *et al*. (2013) and is summarised below:

The NWCS has a six-tiered hierarchical structure, with four spatially nested primary levels of classification (Figure 3). The hierarchical system firstly distinguishes between Marine, Estuarine and Inland ecosystems (**Level 1**), based on the degree of connectivity the particular system has with the open ocean (greater than 10 m in depth). Level 2 then categorises the regional wetland setting using a combination of biophysical attributes at the landscape level, which operate at a broad bioregional scale.

This is opposed to specific attributes such as soils and vegetation. **Level 2** has adopted the following systems:

- Inshore bioregions (marine)
- Biogeographic zones (estuaries)
- Ecoregions (Inland)

Level 3 of the NWCS assess the topographical position of inland wetlands as this factor broadly defines certain hydrological characteristics of the inland systems. Four landscape units based on topographical position are used in distinguishing between Inland systems at this level. No subsystems are recognised for Marine systems, but

estuaries are grouped according to their periodicity of connection with the marine environment, as this would affect the biotic characteristics of the estuary.

Level 4 classifies the hydrogeomorphic (HGM) units discussed earlier. The HGM units are defined as follows:

- Landform – shape and localised setting of wetland
- Hydrological characteristics – natural of water movement into, through and out of the wetland
- Hydrodynamics – the direction and strength of flow through the wetland

These factors characterise the geomorphological processes within the wetland, such as erosion and deposition, as well as the biogeochemical processes.

Level 5 of the assessment pertains to the classification of the tidal regime within the marine and estuarine environments, while the hydrological and inundation depth classes are determined for inland wetlands. Classes are based on frequency and depth of inundation, which are used to determine the functional unit of the wetlands and are considered secondary discriminators within the NWCS.

Level 6 uses six descriptors to characterise the wetland types based on biophysical features. As with Level 5, these are non-hierarchal in relation to each other and are applied in any order, dependent on the availability of information. The descriptors include:

- Geology;
- Natural vs. Artificial;
- Vegetation cover type;
- Substratum;
- Salinity; and
- Acidity or Alkalinity.

It should be noted that where sub-categories exist within the above descriptors, hierarchical systems are employed, and these are thus nested in relation to each other.

The HGM unit (Level 4) is the **focal point of the NWCS**, with the upper levels (Figure 4 – Inland systems only) providing means to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, while the lower levels provide more descriptive detail on the particular wetland type characteristics of a particular HGM unit. Therefore Level 1 – 5 deals with functional aspects, while Level 6 classifies wetlands on structural aspects.

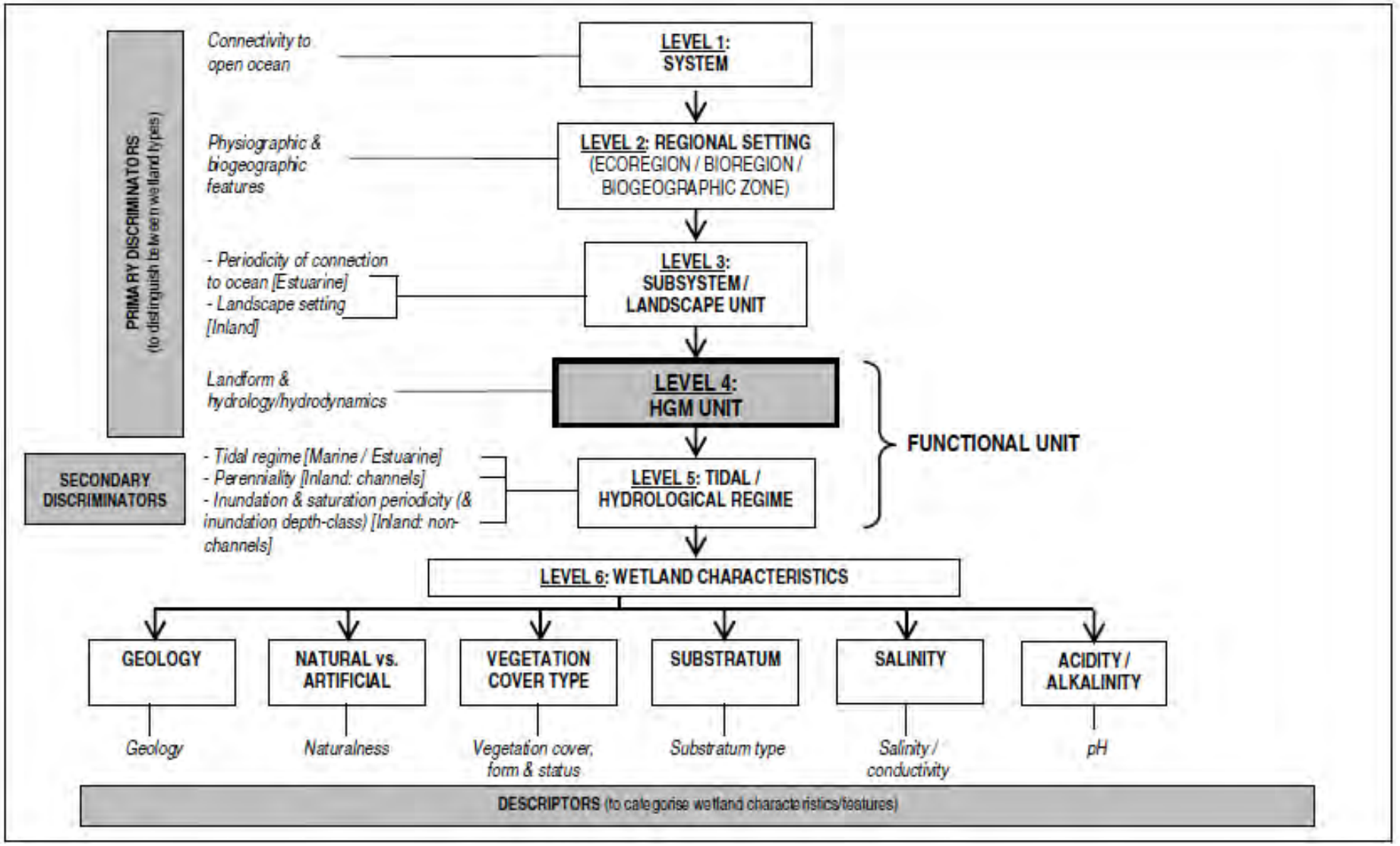


Figure 3: Basic structure of the NWCS, showing how 'primary discriminators' are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with 'secondary discriminators' applied at Level 5 to classify the tidal/hydrological regime, and 'descriptors' applied at Level 6 to categorise the characteristics of wetlands classified up to Level 5 (From Ollis *et al.*, 2013).

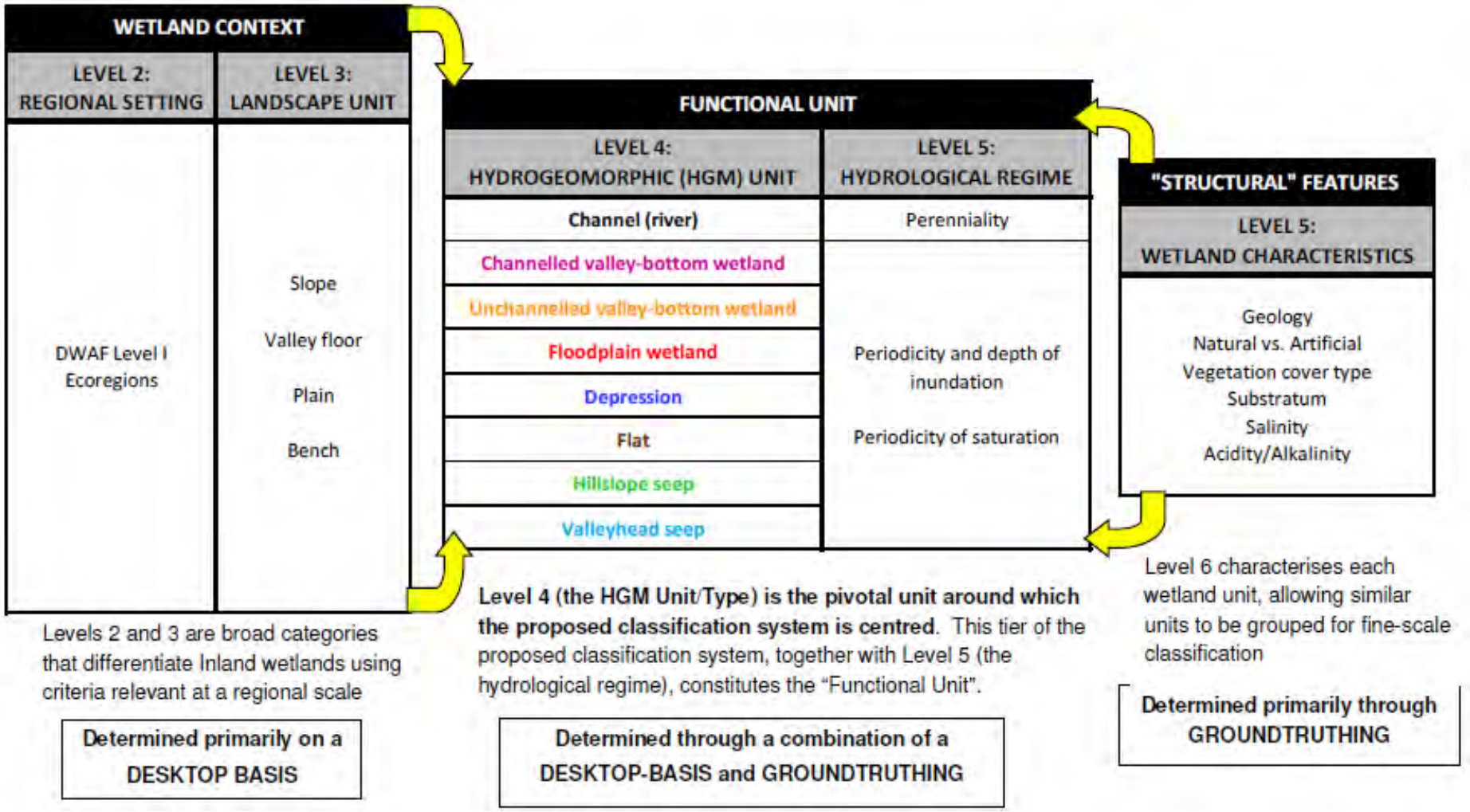


Figure 4: Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis *et al.*, 2013).

4.4 Waterbody Condition

To assess the PES or condition of the observed wetlands, a modified Wetland Index of Habitat Integrity (DWAF, 2007) was used. The Wetland Index of Habitat Integrity (WETLAND-IHI) is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The output scores from the WETLAND-IHI model are presented in the standard DWAF A-F ecological categories (Table 2) and provide a score of the PES of the habitat integrity of the wetland system being examined. The author has included additional criteria into the model-based system to include additional wetland types. This system is preferred when compared to systems such as WET-Health – wetland management series (WRC 2009), as WET-Health (Level 1) was developed with wetland rehabilitation in mind and is not always suitable for impact assessments. This coupled size and functioning of the wetlands in the study area, indicated that a complex study approach was not warranted, i.e. conduct a Wet-Health Level 2 and WET-Ecosystems Services study required for an impact assessment.

Table 2: Description of A – F ecological categories based on Kleynhans *et al*., (2005)

ECOLOGICAL CATEGORY	ECOLOGICAL DESCRIPTION	MANAGEMENT PERSPECTIVE
A	Unmodified, natural.	Protected systems; relatively untouched by human hands; no discharges or impoundments allowed
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	Some human-related disturbance, but mostly of low impact potential
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	**Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation**
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	**Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality**
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	

The WETLAND-IHI model is composed of four modules. The “Hydrology”, “Geomorphology” and “Water Quality” modules all assess the contemporary driving processes behind wetland formation and maintenance. The last module, “Vegetation Alteration”, provides an indication of the intensity of human land use activities on the wetland surface itself and how these may have modified the condition of the wetland. The integration of the scores from these 4 modules provides an overall PES score for the wetland system being examined. The WETLAND-IHI model is an MS Excel-based model, and the data required for the assessment are generated during a site visit.

Additional data may be obtained from remotely sensed imagery (aerial photos; maps and/or satellite imagery) to assist with the assessment. The interface of the WETLAND-IHI has been developed in a format which is similar to DWA’s River EcoStatus models which are currently used for the assessment of PES in riverine environments.

4.5 Aquatic Ecosystem Importance and Function

South Africa is a Contracting Party to the Ramsar Convention on Wetlands, signed in Ramsar, Iran, in 1971, and has thus committed itself to this intergovernmental treaty, which provides the framework for the national protection of wetlands and the resources they could provide. Wetland conservation is now driven by the South African National Biodiversity Institute, a requirement under the National Environmental Management: Biodiversity Act (No 10 of 2004).

Wetlands are among the most valuable and productive ecosystems on earth, providing important opportunities for sustainable development (Davies and Day, 1998). However, wetlands in South Africa are still rapidly being lost or degraded through direct human induced pressures (Nel *et al.,* 2004).

The most common attributes or goods and services provided by wetlands include:

- Improve water quality;
- Impede flow and reduce the occurrence of floods;
- Reeds and sedges used in construction and traditional crafts;
- Bulbs and tubers, a source of food and natural medicine;
- Store water and maintain base flow of rivers;
- Trap sediments; and
- Reduce the number of water-borne diseases.

In terms of this study, the wetlands provide ecological (environmental) value to the area acting as refugia for various wetland associated plants, butterflies and birds.

In the past, wetland conservation has focused on biodiversity as a means of substantiating the protection of wetland habitat. However not all wetlands provide such motivation for their protection, thus wetland managers and conservationists began assessing the importance of wetland function within an ecosystem.

Table 3 below summarises the importance of wetland function when related to ecosystem services or ecoservices (Kotze *et al*., 2008). One such example is emergent reed bed wetlands that function as transformers converting inorganic nutrients into organic compounds (Mitsch and Gosselink, 2000).

Table 3: Summary of direct and indirect ecoservices provided by wetlands from Kotze *et al*., 2008

Ecosystem services supplied by wetlands	Indirect benefits	Hydro-geochemical benefits		Flood attenuation
				Stream flow regulation
			Water quality enhancement benefits	Sediment trapping
				Phosphate assimilation
				Nitrate assimilation
				Toxicant assimilation
				Erosion control
				Carbon storage
		Biodiversity maintenance		
	Direct benefits	*Provision of water for human use*		
		Provision of harvestable resources[2]		
		Provision of cultivated foods		
		Cultural significance		
		Tourism and recreation		
		Education and research		

Conservation importance of the individual wetlands was based on the following criteria:

- Habitat uniqueness;
- Species of conservation concern;
- Habitat fragmentation or rather, continuity or intactness with regards to ecological road sections; and
- Ecosystem service (social and ecological).

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetlands were found in a near natural state (high PES). Should any of the habitats be found modified the conservation importance would rate as MEDIUM, unless a Species of Conservation Concern (SCC) was observed, in which case it would receive a HIGH rating. Any system that was highly modified (low PES) or had none of the above criteria, received a LOW conservation importance rating. Wetlands with HIGH and MEDIUM ratings should thus be excluded from development with incorporation into a suitable open space system, with the maximum possible buffer being applied. Natural wetlands or wetlands that resemble some form of the past landscape but receive a LOW conservation importance rating could be included into stormwater management features and should not be developed to retain the function of any ecological road sections.

4.6 Relevant Wetland Legislation and Policy

Locally the South African Constitution, seven (7) Acts and two (2) international treaties allow for the protection of wetlands and rivers. These systems are protected from destruction or pollution by the following:

- Section 24 of The Constitution of the Republic of South Africa, 1996;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- The Ramsar Convention, 1971 including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000);
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983); and
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- Nature and Environmental Conservation Ordinance, 1974 (No. 19 of 1974)
- National Forest Act, 1998 (No. 84 of 1998)
- National Heritage Resources Act, 1999 (No. 25 of 1999)

NEMA and the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) would also apply to this project. These Acts have categorised many invasive plants together with associated obligations on the landowner.

4.7 Provincial Legislation and Policy

Currently there are no formalised riverine or wetland buffer distances provided by the provincial authorities and as such the buffer model as described Macfarlane & Bredin (2017) for wetlands, rivers and estuaries was used.

These buffer models are based on the condition of the waterbody, the state of the remainder of the site, coupled to the type of development, as wells as the proposed alteration of hydrological flows. Based then on the information known for the site the buffer model provided the following:

Rivers

- Construction period: 48 m
- Operation period: 42 m
- Final: 48 m

Wetlands (Pans)

- Construction period: 47 m
- Operation period: 43 m
- Final: 47 m

However as works will need to be carried out within the servitude and will affect all of the watercourses intersected, no buffers have been included into the final sensitivity, however any ancillary works, (batching) camps and stockpiles must be excluded from any of these areas inclusive of the respective buffers shown above.

5. Description of the affected environment

The proposed works occurs within the A24C, A24B and A23H catchment associated with watercourses typical of the Bushveld Basin Ecoregion. The mainstem watercourses within or in close proximity to the road included the Crocodile, Sleepfontein and Lepenya rivers (Figure 5).

Overall, these watercourses are largely in a stable state, with impacts being limited to the road itself, inclusive of the typical maintenance activities (mowing and clearing of trees), while the areas beyond the road servitude have been modified by livestock production, creation of a large number of farm dams, and clearing of bush for farming and or access tracks.

The National Wetland Inventory v5.2 spatial data (NWI / NSBA, 2018), indicated the potential presence of the following wetland /aquatic features within 500m of the road section (Figure 6):

- Channelled Valley Bottom Wetlands associated with the Crocodile River floodplain
- Seeps along the Sleepfontein River

This resulted in the portions of the road sections, receiving a Very High Aquatic sensitivity rating in the DFFE Screening Tool, thus requiring the submission of an Aquatic Biodiversity Specialist Assessment and not an Aquatic Biodiversity Compliance Statement.

This assessment thus focused on identifying and delineating at a finer scale the aquatic systems associated with any of the smaller watercourses as well as the mainstem systems crossed by the Road Section. Only four small wetlands (depression and valley bottom systems) were found in close proximity to the proposed works, while the remaining areas affected are associated with riparian vegetation (non-wetland specific vegetation units).

Rivers and streams that still contained water during the time of the survey, had the following species dominanted by a grass layer that included *Cynodon dactylon*, *Melinis repens, Hyperthelia dissoluta* (yellow thatching grass), and *Eragrostis* species. *Commelina benghalensis* dominated the herbaceous layer. Species such as *Albuca, Convolvulus sagittatus* subsp *sagitatus, Dipcadi viride, Senecio consonguineus* (starvation Senecio) and *Merremia palmata* were also noted. Saplings of the trees *Diospyros lycioides* and *Searsia lancea* were recorded.

This was also confirmed for the proposed bypass at C3408, site where little to no actual aquatic vegetation withn the watercourse observed.

Different to the other watercourses and wetland areas, a small depression was also observed and was colonised by a *Schoenoplectus muriciux*. However, no other wetland species were recorded, and terrestrial grasses dominated (e.g. *Melinis repens, Setaria incrassata* and *Cynodon dactylon*.

The remaining dry perennial watercourses contained species are typical of the regional vegetation type, namely the Western Sandy Bushveld (SVcb16) and Central Sandy Bushveld (SVcb12) vegetation types as indicated in the Vegmap of South Africa (2018) (Plate 1 -4).

The National Freshwater Ecosystems Priority Areas (NFEPA) (Nel *et al*., 2011), also earmarked sub-quaternaries, based either on the presence of important biota (e.g. rare or endemic fish species) or conversely the degree of riverine degradation, i.e. the greater the catchment degradation the lower the priority to conserve the catchment. The important catchments areas are then classified as Freshwater Ecosystems Priority Areas (FEPAs). The FEPAs and Fish Sanctuaries are sub-quaternary catchments that are required to meet biodiversity targets for threatened and near threatened fish species indigenous to South Africa. Only the last remaining 100m of the western portion of the road section falls within a Phase 2 FEPA (Figure 7).

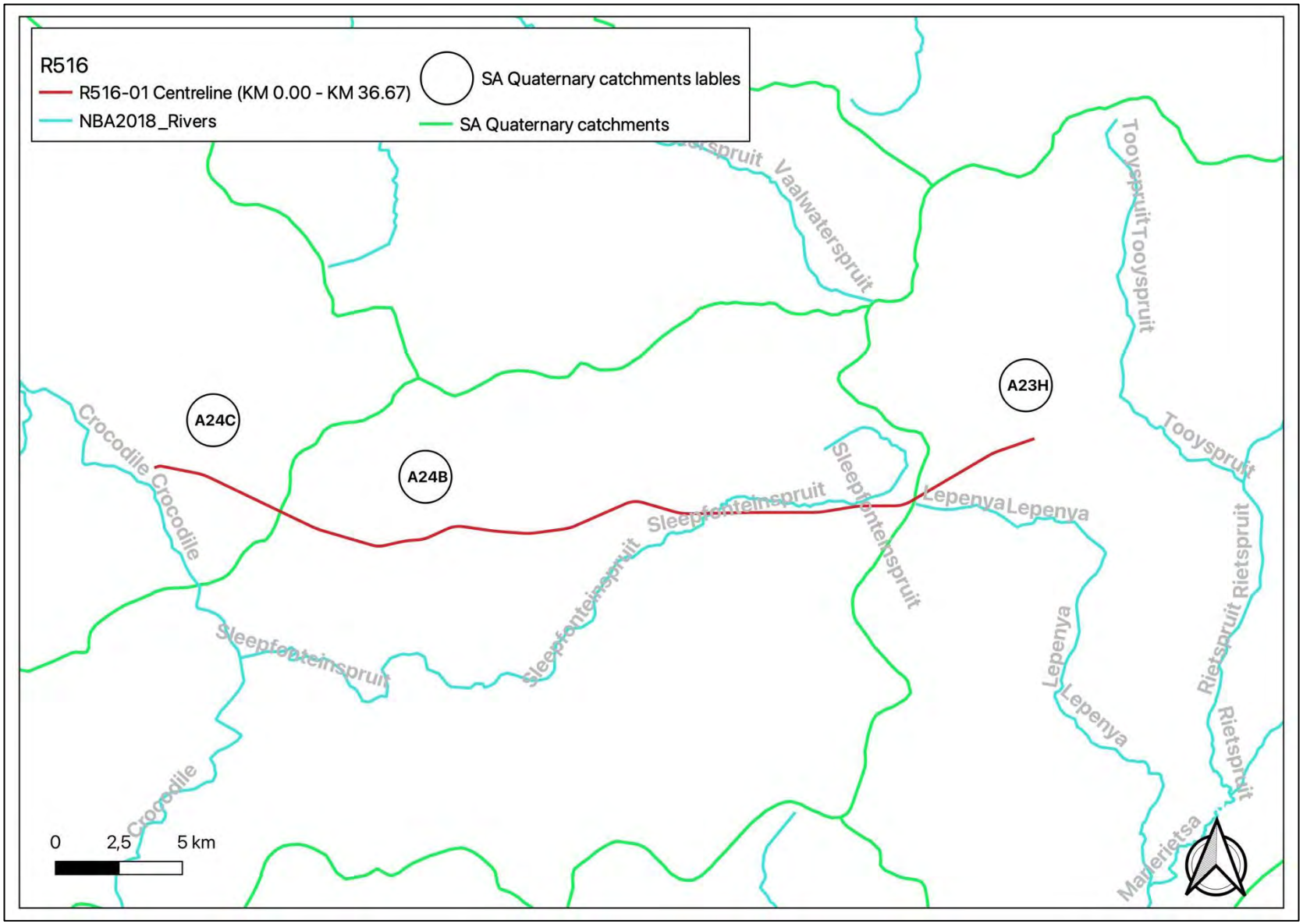


Figure 5: Project locality map indicating the various quaternary catchment boundaries (green line) in relation to the grid road section (Source DWS and NGI).

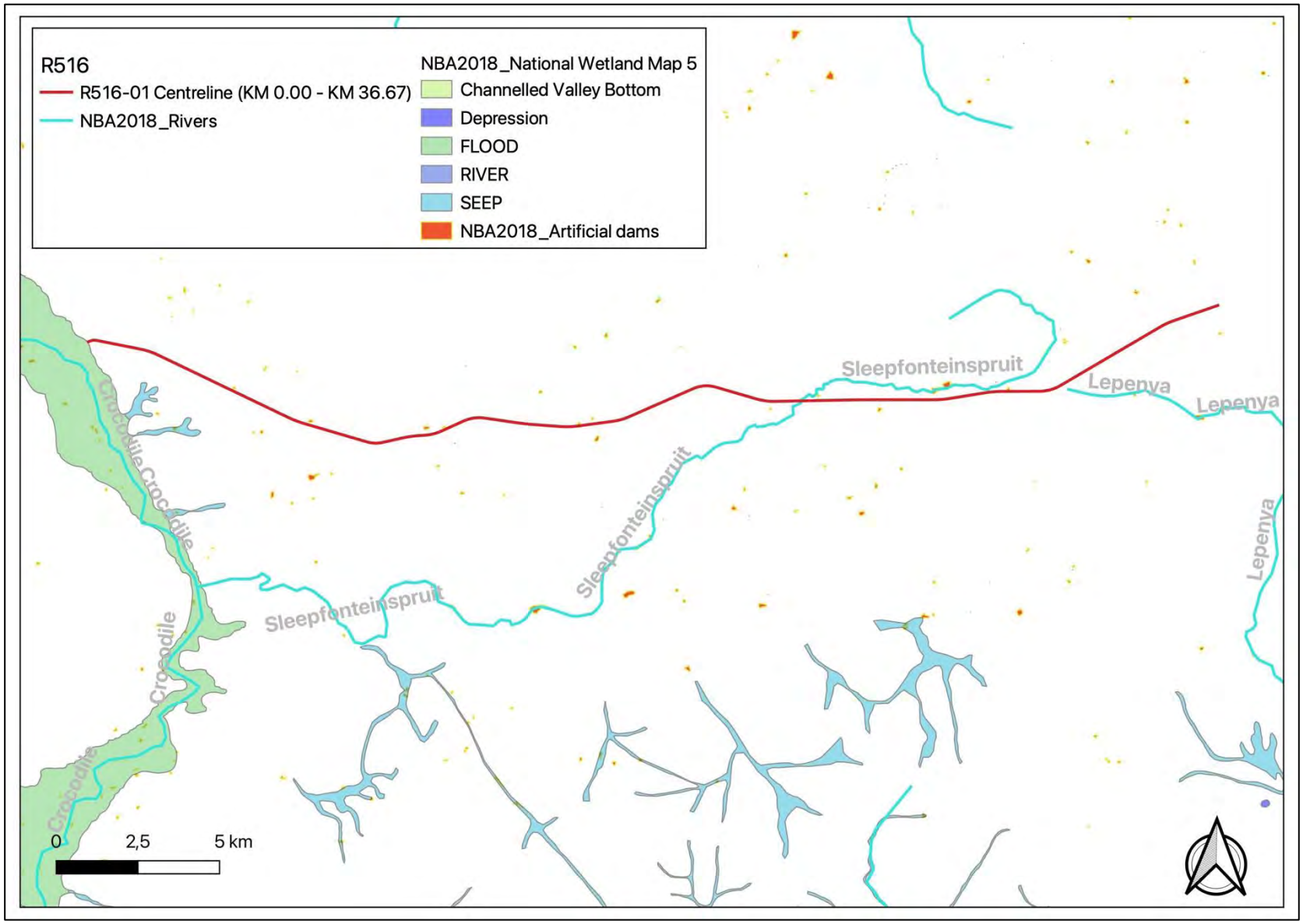


Figure 6: The various waterbodies identified in the National Wetland Inventory V5.2 (2018)

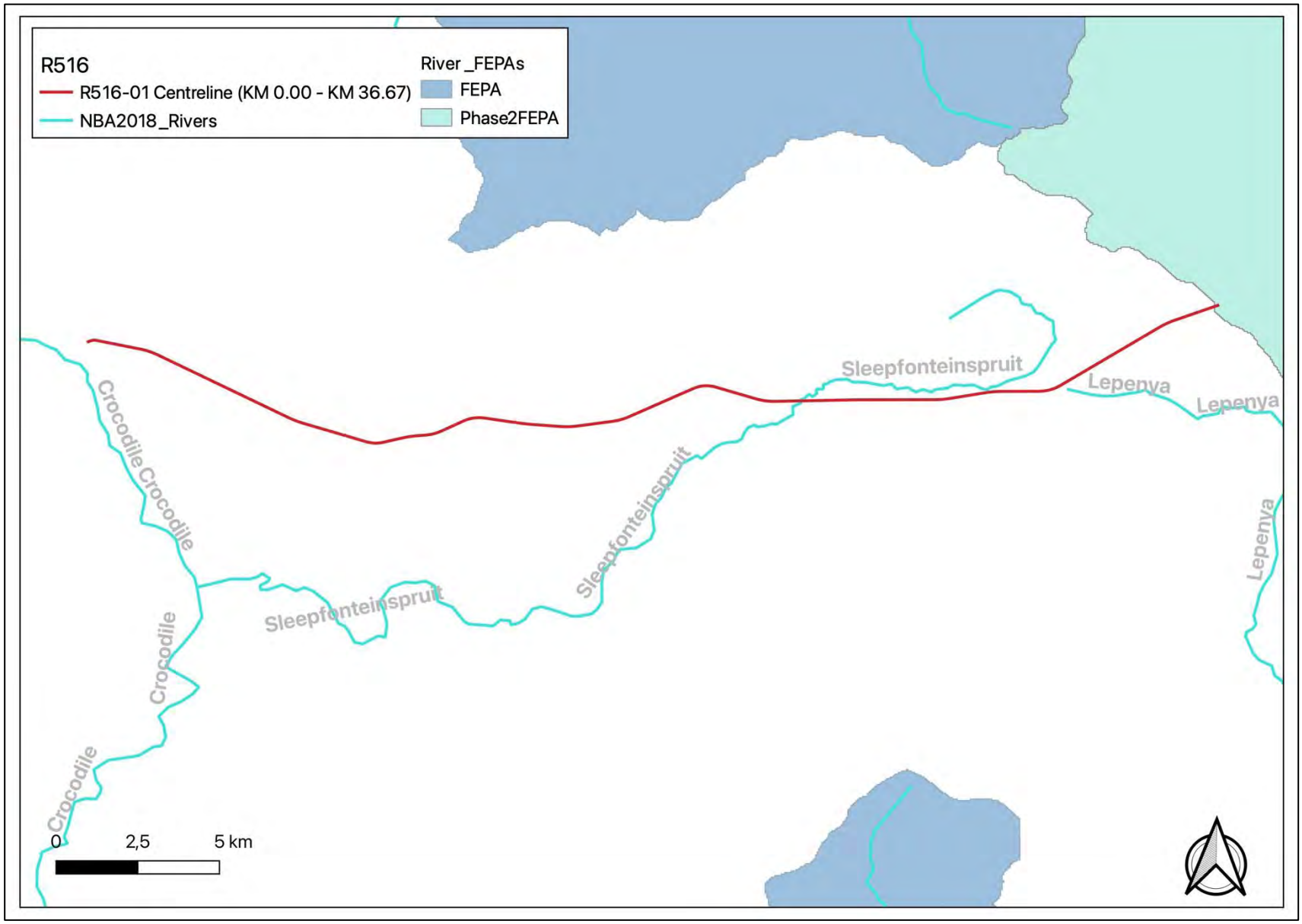


Figure 7: The respective sub quaternary catchments rated in terms of Freshwater Ecosystem Priority Areas (FEPAs) in relation to the study area

6. Present Ecological State, conservation importance and final sensitivity rating

The Present Ecological State scores (PES) for the road section were rated as follows (DWS, 2014)

Subquaternary Catchment Number	Present Ecological State	Catchment Ecological Importance	Catchment Ecological Sensitivity
596	D (Largely Modified)	Moderate	High
600	D (Largely Modified)	Moderate	High
607	C (Moderately Modified)	Moderate	High

The river/stream reaches observed would seem to uphold the findings of the past DWS assessment and the PES / EIS ratings were also D (largely Modified) and Moderate respectively in this assessment. The Moderate EIS was due to intact vegetation was found upstream/downstream of the road crossings sites, substantiated by the fact that these riverine reaches still formed part of Critical Biodiversity Area Type 1 and 2 and Ecological Support Areas (Limpopo Conservation Plan), while containing several, protected species (although mostly terrestrial) (Figure 8). The pan / depression (> 0.5 ha) received a PES score of D, and EIS score of Low. The score was due to the effect of grazing / trampling and or the road maintenance activities that occurred within the road servitude.

The PES and EIS scores were then translated in the respective sensitivity ratings of the various aquatic systems (High to Moderate), and used to prepare a sensitivity map, that will be used in guiding any of the works required. The remaining secondary aquatic systems (highly ephemeral, with no to limited aquatic habitat) were considered Moderately Sensitive.

To reiterate, no buffers are shown, as the works will be required within the areas, and could not be avoided, but guidance is provided to minimise any additional impacts up and downstream of the works sites in the impact section below.

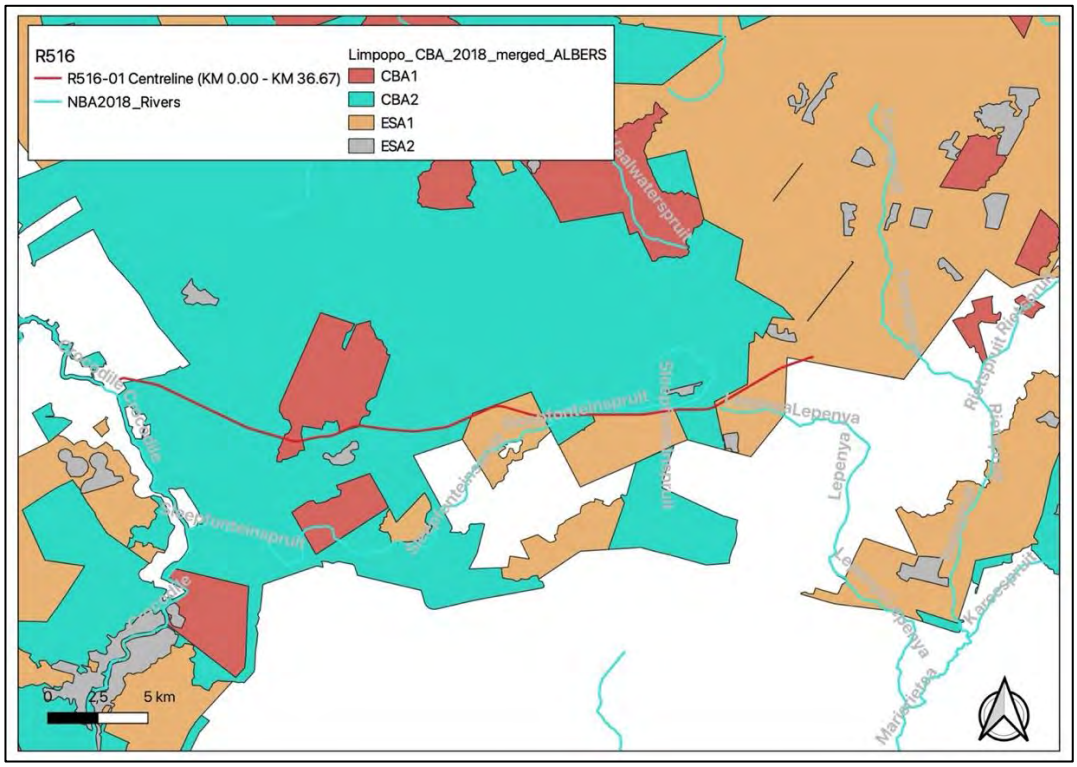


Figure 8: Critical Biodiversity Areas as per the Limpopo Provincial spatial data (2018)

In summary the following aquatic systems were thus observed together with their respective sensitivity ratings based on information collected during this assessment:

Hydrogeomorphic Type and setting	Ecosystem functionality	Sensitivity (Refer to Figure 9)	Comment
Pan	Endorheic systems, although it could not be determined if it was natural of man-made through past excavations. These types of system are however important as refugia between river catchments	Very High	No development will occur within this system
Channelled Valley Bottom Wetlands	Important in preventing erosion of landscape during high volume flows, source of hydrological flows during low rainfall periods, and provide important habitat	High	No development will occur within this system
Mainstem watercourses with riparian zone	Important in preventing erosion of landscape during high volume flows, while providing habitat corridors though the landscape	High	Works should only occur within disturbed areas and if vegetation clearing is unavoidable then a detailed rehabilitation/revegetation plan must be developed
Minor drainage lines	Source of hydrological connectivity with the greater catchment	Moderate	Works within these areas is acceptable, but soils and topography should be reinstated to nature conditions and levels posts construction.

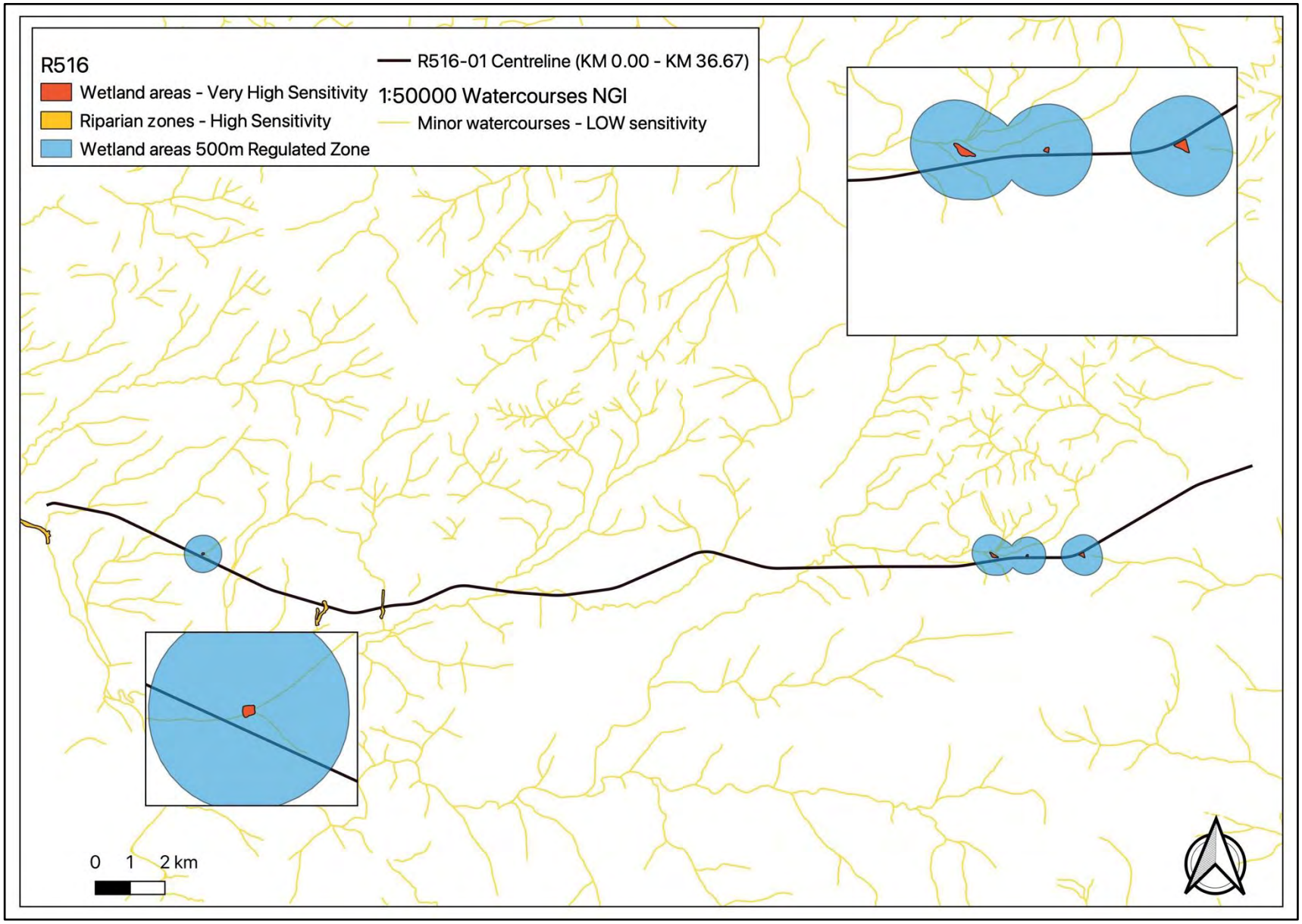


Figure 9: Delineated wetlands and watercourses in relation to the activities, with sensitivity ratings and the 500m regulated WULA zone shown in the respective insets

Plate 1: A view of a minor culvert, typically associated with stormwater management and not directly associated with a watercourse or drainage line

Plate 2: Minor watercourse, with little to no obligate aquatic habitat

Plate 3: Major culvert along watercourse with no obligate aquatic habitat, that also indicates the typical maintenance (mowing activities) that further reduces the potential for any high sensitivity habitat from occurring.

Plate 4: A view a mainstem watercourse, a tributary of the Sleepfontein River, showing a high level of degradation and clearing of any riparian vegetation within road servitude

7. Permit requirements

Based on an assessment of the proposed activities and the following WULs/ GA's could be required based on the following thresholds as listed in the following Government Notices, however ultimately the Department of Water and Sanitation (DWS) will determine if a GA or full WULA will be required:

- **DWS Notice 538 of 2016, 2 September in GG 40243**– Section 21 a & b, Abstraction and Storage of water.
- **Government Notice 509 in GG 40229 of 26 August 2016 –** Section 21 c & i, Impeding or diverting the flow of water in a watercourse and/ or altering the bed, banks, course or characteristics of a watercourse. **Note in the absence of any defined riparian zones for some of the watercourses the 100m regulated zone will apply, coupled to the 500m regulated zone around the observed wetland areas.**

	Water Use Activity	**Applicable to this development proposal**
S21(a)	Taking water from a water resource	Yes if not sourced from the local Water Board or a municipal supply.
S21(b)	Storing water	Not likely, especially if temporary reservoirs (tanks) are used
S21(c)	Impeding or diverting the flow of water in a watercourse	Yes – works will occur in several watercourses as well as activities within 500m of a wetland boundary.
S21(d)	Engaging in a stream flow reduction activity	Not applicable
S21(e)	Engaging in a controlled activity	Not applicable
S21(f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit	Not applicable
S21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource	Not applicable if only portable toilets are used that serviced regularly by an appointed provider.
S21(h)	Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process	Not applicable
S21(i)	Altering the bed, banks, course or characteristics of a watercourse	Yes – works will occur in several watercourses as well as activities within 500m of a wetland boundary.
S21(j)	Removing, discharging or disposing of water found underground for the continuation of an activity or for the safety of persons	Not applicable
S21(k)	Using water for recreational purposes	Not applicable

8. Impact assessment

The following direct impacts were then assessed, which are aligned with those contained in the Biodiversity Assessment Protocol and include in the table below and assessed against the road sections, noting that the proposed alternatives cross the same systems just either upstream or downstream of each other, and based on the assumptions and mitigation proposed, the impacts for each road section would thus be the same:

Biodiversity Assessment Protocol Impacts found applicable to this project	**Impacts assessed in this report below**
Fragmentation (physical loss of ecological connectivity and or CBA road sections)	Impact 1 & 2
Changes in numbers and density of species	Impact 1 & 2
Faunal and vegetation communities inhabiting the site	Impact 1 & 2
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Impact 3
Streamflow regulation	Impact 3
Erosion control	Impact 4
Water quality changes (increase in sediment, organic loads, chemicals or eutrophication	Impact 5
Cumulative Impacts	Impact 6

Impact 1: Loss of Very High Sensitivity systems, through physical disturbance although the proposed layout will avoid any of these systems identified in the DFFE Screening Tool (Figure 2).

Impact 2: Impact on wetlands & watercourses (Very High, High & Moderate Sensitivity), through physical disturbance related to the improvement / widening of the 6 bridges and eight culverts and replacement of 2 major culverts, as well as the replacement of minor culverts. Works will also include provision/upgrading of erosion protection and stormwater management.

Impact 3: Impact on all riparian and wetland systems through the possible increase in surface water runoff on riparian form and function through hydrological changes

Impact 4: Increase in sedimentation and erosion impacts during the operational phase

Impact 5: Risks on the aquatic environment due to water quality impacts mostly during the construction phase

Impact 6: Cumulative impacts

The impacts were assessed as follows:

Nature: Impact 1 - Loss of Very High Sensitivity systems, through physical disturbance although the proposed layout will avoid any of these systems identified in the DFFE Screening Tool (Figure 2).

The physical removal of the riparian zones and disturbance of any watercourses or wetlands is unlikely as most of these systems are located beyond the current road servitude. Should any loss occur this could also result in additional habitat fragmentation resulting in a loss of connectivity between aquatic systems. These disturbances will be the greatest during the construction / operational phase.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**Medium (45)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:

- The engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) generated by any runoff.
- Any laydown areas / stockpiles must make provision for stormwater management with the provision of suitable erosion protection features and or culverts. During the construction and operational /decommissioning phase, these must be monitored for erosion issues and if any erosion control is required.
- Where possible culvert bases for any road crossings if needed, must be placed as close as possible with natural levels in mind so that these don't from additional steps / barriers.
- Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment.
- It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas within aquatic environment, using selected species detailed in this report.
- All alien plant re-growth must be monitored, and should it occur these plants should be eradicated. The scale of the operation does however not warrant the need of a Landscape Architect and / or Landscape Contractor.

Cumulative impacts:

When compared to the surrounding landscape (roads and infrastructure - operational), this impact would be negligible as they have shown limited impacts have occurred when compared to other land use activities within

the region, especially when coupled to the maintenance activities that need to take place within the road servitude.

Residual impacts:

Possible impact on the remaining catchment due to changes in run-off characteristics in the development area is unlikely.

Nature: Impact 2: - Impact on wetlands & watercourses (Very High, High & Moderate Sensitivity), through physical disturbance related to the improvement / widening of the 6 bridges and eight culverts and replacement of 2 major culverts, as well as the replacement of minor culverts. Works will also include provision/upgrading of erosion protection and stormwater management.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**Medium (45)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:

A pre-construction walkthrough with an aquatic specialists is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. This will assist in minimising the overall impact, ensuring that the final structures, especially temporary works are adequately provided for with regard rehabilitation / revegetation.

The following is also reiterated:

- The engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) generated by any runoff.
- Any laydown areas / stockpiles must make provision for stormwater management with the provision of suitable erosion protection features and or culverts. During the construction and operational /decommissioning phase, these must be monitored for erosion issues and if any erosion control is required.
- Where possible culvert bases for any road crossings if needed, must be placed as close as possible with natural levels in mind so that these don't from additional steps / barriers.
- Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment.
- It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations

with regards to the re-vegetation of the newly completed / disturbed areas within aquatic environment, using selected species detailed in this report.

- All alien plant re-growth must be monitored, and should it occur these plants should be eradicated. The scale of the operation does however not warrant the need of a Landscape Architect and / or Landscape Contractor.

Cumulative impacts:

When compared to the surrounding landscape (roads and infrastructure - operational), this impact would be negligible as they have shown limited impacts have occurred when compared to other land use activities within the region, especially when coupled to the maintenance activities that need to take place within the road servitude.

Residual impacts:

Possible impact on the remaining catchment due to changes in run-off characteristics in the development area is unlikely.

Nature: Impact 3 - Impact on all riparian and wetland systems through the possible increase in surface water runoff on riparian form and function through hydrological changes.

Increase in hard surface areas, such as the road surface area, and will require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within the riparian systems, which are currently ephemeral, i.e. riparian systems species composition changes, which then results in habitat change / loss.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (2)
Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

- A pre-construction walkthrough with an aquatic specialists is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout.
- The stormwater management plan must be developed post EA, detailing the structures and actions that must be installed to prevent the increase of surface water flows directly into any natural systems.
- Stormwater systems must be inspected on an annual basis to ensure these are functional.
- Effective stormwater management must include measures to slow, spread and deplete the energy of concentrated flows thorough effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed areas

Cumulative impacts:

When compared to the surrounding landscape (roads and infrastructure - operational), this impact would be negligible as they have shown limited impacts have occurred when compared to other land use activities within the region, especially when coupled to the maintenance activities that need to take place within the road servitude.

Residual impacts:

Possible impact on the remaining catchment due to changes in run-off characteristics in the development area is unlikely.

Nature: Impact 4 - Increase in sedimentation and erosion within the development footprint (operational water quality impact)

An increase in hard surface areas, through and increase in road surface area, that require stormwater management increases runoff from a site through the concentration of surface water flows. These higher volume flows, with increased velocity can result in downstream erosion and sedimentation if not managed.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (1)
Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:

- The stormwater management plan must be developed post EA, detailing the structures and actions that must be installed to prevent the increase of surface water flows directly into any natural systems.
- Stormwater systems must be inspected on an annual basis to ensure these are functional.
- Effective stormwater management must include measures to slow, spread and deplete the energy of concentrated flows thorough effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed areas
- Transmission lines – Any areas disturbed during the operations of the transmission line, including the access tracks must be inspected on a annual basis for signs of erosion or scour. Where these are identified efforts to stabilise the areas *(with reno mattresses, Gabions, Vegetation other suitable intervention) should be immediately implemented and monitored.

Cumulative impacts:

Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, the unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited

downstream will be washed via extreme high flows away from the road servitude. This would be considered a Medium impact as most of the systems are stable within the region.

Residual impacts:

Possible impact on the remaining catchment due to changes in run-off characteristics in the development area is unlikely.

Nature: Impact 5 – Impact on localised surface water quality

During both construction and to a limited degree the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities, as well as maintenance activities, could be washed downslope via the aquatic systems.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (1)
Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes (high)	

Mitigation:

- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination. Washing and cleaning of equipment should also be done in berms or bunds, in order to trap any cement and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel. It is therefore suggested that all construction camps, lay down areas, batching plants or areas and any stores should be more 45 m from a watercourse and wetland. Chemicals used for construction must be stored safely on site and surrounded by bunds. Chemical storage containers must be regularly inspected so that any leaks are detected early;
- Occurrences of erosion and sedimentation must be monitoring during construction and addressed as soon as possible to avoid losing this material into the drainage lines.
- Littering and contamination of water sources during construction must be prevented by effective construction camp management;
- Emergency plans must be in place in case of spillages onto road surfaces and water courses;
- No stockpiling should take place within a water course;
- All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
- Stockpiles must be located away from river channels;
- The construction camp and necessary ablution facilities meant for construction workers must be beyond the 48 m buffer for very high sensitivity systems described previously

Cumulative impacts: None as no direct connection between the development area and Orange River remains
Residual impacts: Residual impacts will be negligible after appropriate mitigation.

Nature: Impact 6 – Cumulative Impacts

In the assessment of this project, no similar projects of this nature were available for consideration, however it was assumed that any of the regional road networks will require upgrading and or maintenance at some point.

However, the worse-case scenario has been assessed below, i.e. only the minimum of mitigation be implemented by the other projects such as stormwater management, and that flows within other systems will not be impacted upon, i.e. best practice with regard roadworks will be implemented.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (1)	Low (1)
Probability	Probable (3)	Probable (3)
Significance	**Low (18)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes (high)	
All mitigation measures provided in the forgoing impact assessment tables should be implemented.		

Residual impacts:

Residual impacts will be negligible after appropriate mitigation.

9. Conclusion and Recommendations

In summary, the proposed road section for the facility would not have a direct impact on the following:

- Any Very High sensitivity areas identified by the DFFE Screening Tool as these areas will be avoided or are already impacted by the proposed activities that will be upgraded and in most cases provide an improvement in flows and or erosion protection.
- Any functioning aquatic environments that received a Very High sensitivity rating as indicated in Figure 9.

Therefore, based on the results of this report, the significance of the remaining impacts assessed for the aquatic systems after mitigation would be LOW. Thus, no objection to the authorisation of any of the proposed activities is made at this point based on the summary of works provided.

This report also indicates the watercourses and wetlands within 500m of the development area. Any activities within these areas, the buffers or 500m from the wetland boundary will require a Water Use license under Section 21 c and i of the National Water Act (Act 36 of 1998). It is however assumed that as impacts will be LOW, a General Authorisation process can be followed – substantiated by the attached DWS Risk Assessment Matrix..

As the proposed activities have the potential to create erosion, the following recommendations are reiterated:

- Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment, and suitable dust and erosion control mitigation measures should be included in the EMP to mitigate.
- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination / leaks outside of any delineated waterbodies and their buffers. Washing and cleaning of equipment should also be done in berms or bunds, to trap any cement / hazardous substances and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel.
- It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas along aquatic features, using selected species detailed in this report.
- All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.
- It is further recommended that a comprehensive rehabilitation plan be implemented from the project onset within watercourse areas to ensure a net benefit to the aquatic environment. This should from part of the suggested walk down as part of the final EMP preparation preconstruction.

10. References

Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998.

Agricultural Resources Act, 1983 (Act No. 43 of 1983).

Berliner D. and Desmet P. 2007. Eastern Cape Biodiversity Conservation Plan: Technical Report. Department of Water Affairs and Forestry Project No 2005-012, Pretoria. 1 August 2007.

Department of Water Affairs and Forestry - DWAF (2005). A practical field procedure for identification and delineation of wetland and riparian areas Edition 1. Department of Water Affairs and Forestry, Pretoria. Updated with amendments in 2007.

Germishuizen, G. and Meyer, N.L. (eds) (2003). Plants of southern Africa: an annotated checklist. Strelitzia 14, South African National Biodiversity Institute, Pretoria.

Holness, S & Oosthuysen, E. 2016. Northern Cape Critical Biodiversity Area map, SANBI BGIS.

Kleynhans C.J., Thirion C. and Moolman J. (2005). A Level 1 Ecoregion Classification System for South Africa, Lesotho and Swaziland. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria.

Macfarlane, D.M. & Bredin, I.P. 2017. Buffer Zone Guidelines for Rivers, Wetlands and Estuaries Buffer Zone Guidelines for Rivers, Wetlands and Estuaries. WRC Report No TT 715/1/17 Water Research Commission, Pretoria.

Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), as amended.

National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.

National Water Act, 1998 (Act No. 36 of 1998), as amended

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Pool-Stanvliet, R., Duffell-Canham, A., Pence, G. & Smart, R. 2017. The Western Cape Biodiversity Spatial Plan Handbook. Stellenbosch: CapeNature.

11. Appendix 1 - Specialist CV

CURRICULUM VITAE

- **Dr Brian Michael Colloty**
- **7212215031083**

1 Rossini Rd

Pari Park

Port Elizabeth, 6070

brianc@envirosci.co.za

083 498 3299

Profession: Ecologist & Environmental Assessment Practitioner (Pr. Sci. Nat. 400268/07)

Member of the South African Wetland Society

Specialisation: Ecology and conservation importance rating of inland habitats, wetlands, rivers & estuaries

Years experience: 25 years

SKILLS BASE AND CORE COMPETENCIES

- 25 years experience in environmental sensitivity and conservation assessment of aquatic and terrestrial systems inclusive of Index of Habitat Integrity (IHI), WET Tools, Riparian Vegetation Response Assessment Index (VEGRAI) for Reserve Determinations, estuarine and wetland delineation throughout Africa. Experience also includes biodiversity and ecological assessments with regard sensitive fauna and flora, within the marine, coastal and inland environments. Countries include Mozambique, Kenya, Namibia, Central African Republic, Zambia, Eritrea, Mauritius, Madagascar, Angola, Ghana, Guinea-Bissau and Sierra Leone. Current projects also span all nine provinces in South Africa.
- 15 years experience in the coordination and management of multi-disciplinary teams, such as specialist teams for small to large scale EIAs and environmental monitoring programmes, throughout Africa and inclusive of marine, coastal and inland systems. This includes project and budget management, specialist team management, client and stakeholder engagement and project reporting.
- GIS mapping and sensitivity analysis

TERTIARY EDUCATION

- 1994: B Sc Degree (Botany & Zoology) - NMU
- 1995: B Sc Hon (Zoology) - NMU
- 1996: M Sc (Botany - Rivers) - NMU
- 2000: Ph D (Botany – Estuaries & Mangroves) – NMU

EMPLOYMENT HISTORY

- 1996 – 2000 Researcher at Nelson Mandela University – SAB institute for Coastal Research & Management. Funded by the WRC to develop estuarine importance rating methods for South African Estuaries
- 2001 – January 2003 Training development officer AVK SA (reason for leaving – sought work back in the environmental field rather than engineering sector)
- February 2003- June 2005 Project manager & Ecologist for Strategic Environmental Focus (Pretoria) – (reason for leaving – sought work related more to experience in the coastal environment)
- July 2005 – June 2009 Principal Environmental Consultant Coastal & Environmental Services (reason for leaving – company restructuring)
- June 2009 – August 2018 Owner / Ecologist of Scherman Colloty & Associates cc
- August 2018 Owner / Ecologist - EnviroSci (Pty) Ltd

SELECTED RELEVANT PROJECT EXPERIENCE

World Bank IFC Standards

- Kenmare Mining Pilivilli, Mozambique - wetland (mangroves, peatlands and estuarine) assessment and biodiversity offset analysis - current
- Botswana South Africa 400kv transmission line (400km) biodiversity assessment on behalf of Aurecon - current
- Farim phosphate mine and port development, Guinea Bissau – biodiversity and estuarine assessment on behalf of Knight Piesold Canada – 2016.
- Tema LNG offshore pipeline EIA – marine and estuarine assessment for Quantum Power (2015).
- Colluli Potash South Boulder, Eritrea, SEIA marine baseline and hydrodynamic surveys co-ordinator and coastal vegetation specialist (coastal lagoon and marine) (on-going).
- Wetland, estuarine and riverine assessment for Addax Biofeuls Sierra Leone, Makeni for Coastal & Environmental Services: 2009
- ESHIA Project manager and long-term marine monitoring phase coordinator with regards the dredge works required in Luanda bay, Angola. Monitoring included water quality and biological changes in the bay and at the offshore disposal outfall site, 2005-2011

South African

- Plant search and rescue, for NMBM (Driftsands sewer, Glen Hurd Drive), Department of Social Development (Military veterans housing, Despatch) and Nxuba Wind Farm, - current
- Wetland specialist appointed to update the Eastern Cape Biodiversity Conservation Plan, for the Province on behalf of EOH CES appointment by SANBI – current. This includes updating the National Wetland Inventory for the province, submitting the new data to CSIR/SANBI.
- CDC IDZ Alien eradication plans for three renewable projects Coega Wind Farm, Sonop Wind Farm and Coega PV, on behalf of JG Afrika (2016 – 2017).
- Nelson Mandela Bay Municipality Baakens River Integrated Wetland Assessment (Inclusive of Rehabilitation and Monitoring Plans) for CEN IEM Unit - Current
- Rangers Biomass Gasification Project (Uitenhage), biodiversity and wetland assessment and wetland rehabilitation / monitoring plans for CEM IEM Unit – current.
- Gibson Bay Wind Farm implementation of the wetland management plan during the construction and operation of the wind farm (includes surface / groundwater as well wetland rehabilitation & monitoring plan) on behalf of Enel Green Power - current
- Gibson Bay Wind Farm 133kV Transmission Line wetland management plan during the construction of the transmission line (includes wetland rehabilitation & monitoring plan) on behalf of Eskom – 2016.

- Tsitsikamma Community Wind Farm implementation of the wetland management plan during the construction of the wind farm (includes surface / biomonitoring, as well wetland rehabilitation & monitoring plan) on behalf of Cennergi – completed May 2016.
- Alicedale bulk sewer pipeline for Cacadu District, wetland and water quality assessment, 2016
- Mogalakwena 33kv transmission line in the Limpopo Province, on behlaf of Aurecon, 2016
- Cape St Francis WWTW expansion wetland and passive treatment system for the Kouga Municipality, 2015
- Macindane bulk water and sewer pipelines wetland and wetland rehabilitation plan 2015
- Eskom Prieska to Copperton 132kV transmission line aquatic assessment, Northern Cape on behalf of Savannah Environmental 2015.
- Joe Slovo sewer pipeline upgrade wetland assessment for Nelson Mandela Bay Municipality 2014
- Cape Recife Waste Water Treatment Works expansion and pipeline aquatic assessment for Nelson Mandela Bay Municipality 2013
- Pola park bulk sewer line upgrade aquatic assessment for Nelson Mandela Bay Municipality 2013
- Transnet Freight Rail – Swazi Rail Link (Current) wetland and ecological assessment on behalf of Aurecon for the proposed rail upgrade from Ermelo to Richards Bay
- Eskom Transmission wetland and ecological assessment for the proposed transmission line between Pietermaritzburg and Richards Bay on behalf of Aurecon (2012).
- Port Durnford Exarro Sands biodiversity assessment for the proposed mineral sands mine on behalf of Exxaro (2009)
- Fairbreeze Mine Exxaro (Mtunzini) wetland assessment on behalf of Strategic Environmental Services (2007).
- Wetland assessment for Richards Bay Minerals (2013) – Zulti North haul road on behalf of RBM.
- Biodiversity and aquatic assessments for 105 renewable projects in the past 6 years in the Western, Eastern, Northern Cape, KwaZulu-Natal and Free State provinces. Clients included RES-SA, RedCap, ACED Renewables, Mainstream Renewable, GDF Suez, Globeleq, ENEL, Abengoa amongst others. Particular aquatic sensitivity assessment and Water Use License Applications on behalf of Mainstream Renewable Energy (8 wind farms and 3 PV facilities.), Cennergi / Exxaro (2 Wind farm), WKN Wind current (2 wind farms & 2 PV facilities), ACED (6 wind farms) and Windlab (3 Wind farms) were also conducted. Several of these projects also required the assessment of the proposed transmission lines and switching stations, which were conducted on behalf of Eskom.
- Vegetation assessments on the Great Brak rivers for Department of Water and Sanitation, 2006 and the Gouritz Water Management Area (2014)
- Proposed FibreCo fibre optic cable vegetation assessment along the PE to George, George to Graaf Reinet, PE to Colesburg, and East London to Bloemfontein on behalf of SRK (2013-2015).

12. Appendix 2 – DWS Risk Assessment

APPENDIX C3 -
HERITAGE IMPACT ASSESSMENT

BVI CONSULTING ENGINEERS: PROPOSED R516 UPGRADE (33799.00C-L-076) PROJECT, WATERBERG DISTRICT MUNICIPALITY, LIMPOPO PROVINCE

Archaeological Impact Assessment

Prepared for: **BVi Consulting Engineers**

Prepared by: **Exigo Sustainability**

Email info@exigo3.com
Tel +27 012 751 2160
Fax +27 086 607 2406

Postnet Suite 74,
Private Bag X07,
Arcadia, 0007

Vat nr: 4910184854
Registration nr: 2006/011434/07

Innovation in Sustainability

www.exigo3.com

ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) ON PORTIONS OF THE FARMS DOORNFONTEIN 498KQ, RIETFONTEIN 541 KQ, WEIHOEK 540 KQ, WEIKRANS 539KQ, ROOYKRANS 538KQ, KNOPPIESKRAAL 537 KQ, LEEUWPOORT 554KQ, RIETFONTEIN 536 KQ, VLAKFONTEIN 535KQ, MORGENZON 533KQ, TOOYSKRAAL 531 KQ FOR THE PROPOSED R516 UPGRADE (33799.00C-L-076) PROJECT, WATERBERG DISTRICT MUNICIPALITY, LIMPOPO PROVINCE

Conducted for:
BVi Consulting Engineers

Compiled by:
Nelius Kruger (BA, BA Hons. Archaeology Pret.)

Reviewed by:
Nsovo Mdungazi (CES)

DOCUMENT DISTRIBUTION LIST

Name	Institution
Nsovo Mdungazi	CES
	BVi Consulting Engineers

DOCUMENT HISTORY

Date	Version	Status
25 September 2021	1.0	Draft

DECLARATION

I, Nelius Le Roux Kruger, declare that –

- I act as the independent specialist;
- I am conducting any work and activity relating to the proposed R516 Upgrade (33799.00C-L-076) Project in an objective manner, even if this results in views and findings that are not favourable to the client;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have the required expertise in conducting the specialist report and I will comply with legislation, including the relevant Heritage Legislation (National Heritage Resources Act no. 25 of 1999, Human Tissue Act 65 of 1983 as amended, Removal of Graves and Dead Bodies Ordinance no. 7 of 1925, Excavations Ordinance no. 12 of 1980), the Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment (SAHRA, AMAFA and the CRM section of ASAPA), regulations and any guidelines that have relevance to the proposed activity;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this declaration are true and correct.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations

_____

Signature of Specialist
Company: Exigo Sustainability
Date: 25 September 2021

This Archaeological Impact Assessment report has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the NEMA Table below.

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
1.(1) (a) (i) Details of the specialist who prepared the report	Page 4, Section 1.2 and Addendum 1 of Report.	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 1.2 and Addendum 1 of Report.	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page 4 of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 1.3 and Section 1.4: Project Brief and Terms of Reference	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 3: Archaeo-Historical Context	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 6: Statement of Significance and Impact Rating	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 4: Method of Enquiry	-
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 4: Method of Enquiry	-
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 6: Statement of Significance and Impact Rating	-
(g) An identification of any areas to be avoided, including buffers	Section 5: Results Archaeological Survey	-
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 6: Statement of Significance and Impact Rating	-
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4.2: Limitations and Constraints	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 6: Statement of Significance and Impact Rating	
(k) Any mitigation measures for inclusion in the EMPr	Section 6.3: Management Actions Section 7: Recommendations	
(l) Any conditions for inclusion in the environmental authorisation	N/A	None required
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 6.3: Management Actions Section 7: Recommendations	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 & Section 6	
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 6.3: Management Actions Section 7: Recommendations	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process will be conducted as part of the EIA and EMPr process.
(p) A summary and copies if any comments that were received during any consultation process	N/A	Not applicable.
(q) Any other information requested by the competent authority.	N/A	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 1.5: CRM: Legislation, Conservation and Heritage Management	

EXECUTIVE SUMMARY

This report details the results of an Archaeological Impact Assessment (AIA) in support of an Environmental Impact Assessment (EIA) process for the proposed R516 Upgrade (33799.00C-L-076) Project on Portions of the farms Doornfontein 498KQ, Rietfontein 541 KQ, Weihoek 540 KQ, Weikrans 539KQ, Rooykrans 538KQ, Knoppieskraal 537 KQ, Leeuwpoort 554KQ, Rietfontein 536 KQ, Vlakfontein 535KQ, Morgenzon 533KQ, Tooyskraal 531 KQ in the Waterberg District Municipality of the Limpopo Province. The proposed project entails the road improvement on Road R516 Section 1 over a distance of 36km. The report includes background information on the area's archaeology, its representation in Southern Africa, and the history of the larger area under investigation, survey methodology and results as well as heritage legislation and conservation policies. A copy of the report will be supplied to the South African Heritage Resources Agency (SAHRA) and recommendations contained in this document will be reviewed.

Project Title	R516 Upgrade (33799.00C-L-076) Project
Project Location	**Road Upgrade Western Offset: S24.888057° E27.530850°** **Road Upgrade Midpoint: S24.898140° E27.712800°** **Road Upgrade Eastern Offset: S24.871332° E27.871544°**
1:50 000 Map Sheet	2427DC, 2427DD
Farm Portion / Parcel	Doornfontein 498KQ, Rietfontein 541 KQ, Weihoek 540 KQ, Weikrans 539KQ, Rooykrans 538KQ, Knoppieskraal 537 KQ, Leeuwpoort 554KQ, Rietfontein 536 KQ, Vlakfontein 535KQ, Morgenzon 533KQ, Tooyskraal 531 KQ
Magisterial District / Municipal Area	Waterberg District Municipality
Province	Limpopo Province

The history of the eastern Limpopo Province and the Waterberg is reflected in an immensely rich archaeological landscape. The interaction between the climate, geology, topography, and the fauna and flora in the Waterberg Biosphere over millions of years has established a milieu in which prehistoric and historic communities thrived. Stone Age habitation occurs in places, mostly in open air locales or in sediments alongside rivers or pans. Bantu-speaking groups moved into this area during the last millennia and these groups, who practiced herding, agriculture, metal working and trading, found a suitable living environment during the Earlier, Middle and Later Iron Age. It was here that their chiefdoms flourished. European farmers, settling in the area since the middle of the 19th century, divided up the landscape into a number of farms. Historical trade routes were well established before the period of Colonial expansion and these routes mainly existed as a direct consequence of mining. During the nineteenth century the Highveld was extensively settled by both Bantu and European groups that migrated into this area and the landscape saw intensive conflicts and war events towards the end of the 19th century. In recent years an urban element developed, expanding at a rapid rate, largely as a result of farming development in the region.

The farms and project zones subject to this assessment was portioned towards the end of the 19th century and no particular reference to archaeological sites or features of heritage potential were recorded during an examination of literature thematically or geographically related to the project area within the road reserve. An examination of historical aerial imagery and archive maps indicate that the larger landscape had been utilized for agriculture and game faming as well as tourism during the last century. Much of the project areas have been altered and transformed in the last century – particularly where the existing SANRAL road reserve has been

cleared and vegetated with grasses and the quarry location has seen historical and more recent excavations and quarrying. During the survey, **no heritage receptors were noted** and it might be assumed that the proposed development will result in a minimal (if any) impact on heritage resources. This inference is made subject to further on-site observations required during pre-construction vegetation clearing and earth moving activities. The following recommendations are made based on general observations in the proposed R516 Upgrade (33799.00C-L-076) Project in terms of heritage resources management.

- The site survey for the R516 Upgrade (33799.00C-L-076) Project AIA was limited to the SANRAL road reserve and findings from the desktop assessment, indicating a sparse human settlement pattern and significant agriculture development during the last century, suggest a low heritage potential for the project area. However, the possibility that undetected heritage receptors might be present in the project footprint should not be excluded and the close and frequent monitoring of the initial stages of the project (vegetation clearing, earth moving and excavations) by an informed Environmental Control Officer (ECO) is recommended. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.
- It is recommended that the EIA public participation and social consultative process address the possibility of heritage resources graves occurring in the project area.
- It should be stated that it is likely that further undetected archaeological remains might occur elsewhere in the project landscape along water sources and drainage lines, fountains and pans would often have attracted human activity in the past. Also, since Stone Age material seems to originate from below present soil surfaces in eroded areas, the larger landscape should be regarded as potentially sensitive in terms of possible subsurface deposits. Burials and historically significant structures dating to the Colonial Period occur on farms in the area and these resources should be avoided during all phases of construction and development, including the operational phases of the development.

Cognisant of known site distribution patterns in this section of the Limpopo Province, and based on general on-site observations and off-site assessments and, notably the fact that the project site and its immediate surrounds have previously been transformed by historical agriculture and more recent development, the author of this report is of the opinion that the construction of the R516 Upgrade Project, will have no impact on archaeological artefacts, features or structures surviving in primary context and the project may process from a heritage impact perspective subject to the fact that no previously undetected heritage remains (for example, those in sub-surface deposits) are exposed at any stage of the development.

This report details the methodology, limitations and recommendations relevant to these heritage areas, as well as areas of proposed development. It should be noted that recommendations and possible mitigation measures are valid for the duration of the development process, and mitigation measures might have to be implemented on additional features of heritage importance not detected during this Phase 1 assessment (e.g. uncovered during the construction process).

NOTATIONS AND TERMS/TERMINOLOGY

Absolute dating: Absolute dating provides specific dates or range of dates expressed in years.

Archaeological record: The archaeological record minimally includes all the material remains documented by archaeologists. More comprehensive definitions also include the record of culture history and everything written about the past by archaeologists.

Artefact: Entities whose characteristics result or partially result from human activity. The shape and other characteristics of the artefact are not altered by removal of the surroundings in which they are discovered. In the Southern African context examples of artefacts include potsherds, iron objects, stone tools, beads and hut remains.

Assemblage: A group of artefacts recurring together at a particular time and place, and representing the sum of human activities.

Context: An artefact's context usually consists of its immediate *matrix*, its *provenience* and its *association* with other artefacts. When found in *primary context*, the original artefact or structure was undisturbed by natural or human factors until excavation and if in *secondary context,* disturbance or displacement by later ecological action or human activities occurred.

Cultural Heritage Resource: The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

Cultural landscape: A cultural landscape refers to a distinctive geographic area with cultural significance.

Cultural Resource Management (CRM): A system of measures for safeguarding the archaeological heritage of a given area, generally applied within the framework of legislation designed to safeguard the past.

Feature: Non-portable artefacts, in other words artefacts that cannot be removed from their surroundings without destroying or altering their original form. Hearths, roads, and storage pits are examples of archaeological features

Impact: A description of the effect of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space.

Lithic: Stone tools or waste from stone tool manufacturing found on archaeological sites.

Matrix: The material in which an artefact is situated (sediments such as sand, ashy soil, mud, water, etcetera). The matrix may be of natural origin or human-made.

Midden: Refuse that accumulates in a concentrated heap.
Microlith: A small stone tool, typically knapped of flint or chert, usually about three centimetres long or less.
Monolith: A geological feature such as a large rock, consisting of a single massive stone or rock, or a single piece of rock placed as, or within, a monument or site.

Phase 1 CRM Assessment: An Impact Assessment which identifies archaeological and heritage sites, assesses their significance and comments on the impact of a given development on the sites. Recommendations for site mitigation or conservation are also made during this phase.

Phase 2 CRM Study: In-depth studies which could include major archaeological excavations, detailed site surveys and mapping / plans of sites, including historical / architectural structures and features. Alternatively, the sampling of sites by collecting material, small test pit excavations or auger sampling is required. Mitigation / Rescue involves planning the protection of significant sites or sampling through excavation or collection (in terms of a permit) at sites that may be lost as a result of a given development.

Phase 3 CRM Measure: A Heritage Site Management Plan (for heritage conservation), is required in rare cases where the site is so important that development will not be allowed and sometimes developers are encouraged to enhance the value of the sites retained on their properties with appropriate interpretive material or displays.

Provenience: Provenience is the three-dimensional (horizontal and vertical) position in which artefacts are found. Fundamental to ascertaining the provenience of an artefact is *association,* the co-occurrence of an artefact with other archaeological remains; and *superposition,* the principle whereby artefacts in lower levels of a matrix were deposited before the artefacts found in the layers above them, and are therefore older.

Random Sampling: A probabilistic sampling strategy whereby randomly selected sample blocks in an area are surveyed. These are fixed by drawing coordinates of the sample blocks from a table of random numbers.

Scoping Assessment: The process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an impact assessment. The main purpose is to focus the impact assessment on a manageable number of important questions on which decision making is expected to focus and to ensure that only key issues and reasonable alternatives are examined. The outcome of the scoping process is a Scoping Report that includes issues raised during the scoping process, appropriate responses and, where required, terms of reference for specialist involvement.

Site (Archaeological): A distinct spatial clustering of artefacts, features, structures, and organic and environmental remains, as the residue of human activity. These include surface sites, caves and rock shelters, larger open-air sites, sealed sites (deposits) and river deposits. Common functions of archaeological sites include living or habitation sites, kill sites, ceremonial sites, burial sites, trading, quarry, and art sites,

Stratigraphy: This principle examines and describes the observable layers of sediments and the arrangement of strata in deposits

Systematic Sampling: A probabilistic sampling strategy whereby a grid of sample blocks is set up over the survey area and each of these blocks is equally spaced and searched.

Trigger: A particular characteristic of either the receiving environment or the proposed project which indicates that there is likely to be an *issue* and/or potentially significant *impact* associated with that proposed development that may require specialist input. Legal requirements of existing and future legislation may also trigger the need for specialist involvement.

LIST OF ABBREVIATIONS

Abbreviation	Description
ASAPA	Association for South African Professional Archaeologists
AIA	Archaeological Impact Assessment
BP	Before Present
BCE	Before Common Era
BGG	Burial Grounds and Graves
CRM	Culture Resources Management
EIA	Early Iron Age (also Early Farmer Period)
EIA	Environmental Impact Assessment
EFP	Early Farmer Period (also Early Iron Age)
ESA	Earlier Stone Age
GIS	Geographic Information Systems
HIA	Heritage Impact Assessment
ICOMOS	International Council on Monuments and Sites
K2/Map	K2/Mapungubwe Period
LFP	Later Farmer Period (also Later Iron Age)
LIA	Later Iron Age (also Later Farmer Period)
LSA	Later Stone Age
MIA	Middle Iron Age (also Early later Farmer Period)
MRA	Mining Right Area
MSA	Middle Stone Age
NHRA	National Heritage Resources Act No.25 of 1999, Section 35
PFS	Pre-Feasibility Study
PHRA	Provincial Heritage Resources Authorities
SAFA	Society for Africanist Archaeologists
SAHRA	South African Heritage Resources Association
YCE	Years before Common Era (Present)

TABLE OF CONTENTS

LIST OF FIGURES

1 BACKGROUND

1.1 Scope and Motivation

Exigo Sustainability (Pty) Ltd (Exigo) was commissioned by BVi Consulting Engineers CES to conduct an Archaeological Impact Assessment (AIA) study in support of an Environmental Impact Assessment (EIA) process for the proposed R516 Upgrade (33799.00C-L-076) Project in the Limpopo Province. The rationale of this AIA is to determine the presence of heritage resources such as archaeological and historical sites and features, graves and places of religious and cultural significance in previously unstudied areas; to consider the impact of the proposed project on such heritage resources, and to submit appropriate recommendations with regard to the cultural resources management measures that may be required at affected sites / features.

1.2 Project Direction

Exigo's expertise ensures that all projects be conducted to the highest international ethical and professional standards. As archaeological specialist for Exigo Sustainability, Mr Neels Kruger acted as field director for the project; responsible for the assimilation of all information, the compilation of the final consolidated AIA report and recommendations in terms of heritage resources on the demarcated project areas. Mr Kruger is an accredited archaeologist and Culture Resources Management (CRM) practitioner with the Association of South African Professional Archaeologists (ASAPA), a member of the Society for Africanist Archaeologists (SAFA) and the Pan African Archaeological Association (PAA) as well as a Master's Degree candidate in archaeology at the University of Pretoria.

1.3 Project Brief

CES was appointed by BVi Consulting Engineers to undertake the EIA for the proposed upgrade of the R516 road on Portions of the farms Noodhulp 492KQ, Klippan 490KQ, Zwartkloof 707KQ, Droogekloof 471KQ, Farm 474KQ, Farm 472KQ, Farm 562KQ, Olievenfontein 475KQ, Rietspruit 527KQ, Grootfontein 528KQ, Tooyskraal 531KQ, Waterberg District Municipality in the Limpopo Province (hereafter referred to as the "R516 Upgrade (33799.00C-L-076) Project").

The goal of the road improvement on Road R516 Section 1, is to relieve traffic congestion to an acceptable level of service; improve road geometry and road safety; reconstruct bridges and other structures for hydraulic and traffic capacity improvement; and provide adequate pavement capacity for the 20-year design period. A section of 36km will be upgraded and a temporary bypass will be constructed during the project development but the project will be **limited to the existing SANRAL road reserve**.

Figure 1-1: Map indicating the project areas subject to the proposed R516 Upgrade (33799.00C-L-076) Project.

1.4 Terms of Reference

Heritage specialist input into the Environmental Impact Assessment (EIA) process is essential to ensure that, through the management of change, developments still conserve our heritage resources. It is also a legal requirement for certain development categories which may have an impact on heritage resources. Thus, EIAs should always include an assessment of heritage resources. The heritage component of the EIA is provided for in the **National Environmental Management Act, (Act 107 of 1998)** and endorsed by section 38 of the **National Heritage Resources Act (NHRA - Act 25 of 1999)**. In addition, the NHRA protects all structures and features older than 60 years, archaeological sites and material and graves as well as burial sites. The objective of this legislation is to ensure that developers implement measures to limit the potentially negative effects that the development could have on heritage resources. Based hereon, this project functioned according to the following **terms of reference for** heritage specialist input**:**

- *Provide a detailed description of all archaeological artefacts, structures (including graves) and settlements which may be affected, if any.*
- *Assess the nature and degree of significance of such resources within the area.*
- *Establish heritage informants/constraints to guide the development process through establishing thresholds of impact significance.*
- *Assess and rate any possible impact on the archaeological and historical remains within the area emanating from the proposed development activities.*
- *Propose possible heritage management measures provided that such action is necessitated by the development.*
- *Liaise and consult with the South African Heritage Resources Agency (SAHRA). A Notification of Intent to Develop (NID) will be submitted to SAHRA at the soonest opportunity.*

1.5 CRM: Legislation, Conservation and Heritage Management

The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

1.5.1 Legislation regarding archaeology and heritage sites

The South African Heritage Resources Agency (SAHRA) and its provincial offices aim to conserve and control the management, research, alteration and destruction of cultural resources of South Africa. It is therefore vitally important to adhere to heritage resource legislation at all times.

a. National Heritage Resources Act No 25 of 1999, section 35

According to the National Heritage Resources Act No 25 of 1999 (section 35) the following features are protected as cultural heritage resources:

a. Archaeological artefacts, structures and sites older than 100 years

b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography

c. Objects of decorative and visual arts

d. Military objects, structures and sites older than 75 years

e. Historical objects, structures and sites older than 60 years

f. Proclaimed heritage sites

g. Grave yards and graves older than 60 years

h. Meteorites and fossils

i. Objects, structures and sites of scientific or technological value.

In addition, the national estate includes the following:

a. Places, buildings, structures and equipment of cultural significance

b. Places to which oral traditions are attached or which are associated with living heritage

c. Historical settlements and townscapes

d. Landscapes and features of cultural significance

e. Geological sites of scientific or cultural importance

f. Archaeological and paleontological sites

g. Graves and burial grounds

h. Sites of significance relating to the history of slavery

i. Movable objects (e.g. archaeological, paleontological, meteorites, geological specimens, military, ethnographic, books etc.)

With regards to activities and work on archaeological and heritage sites this Act states that:

"No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit by the relevant provincial heritage resources authority." (34. [1] 1999:58)

and

"No person may, without a permit issued by the responsible heritage resources authority-

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. (35. [4] 1999:58)."

and

"No person may, without a permit issued by SAHRA or a provincial heritage resources agency-

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority;

(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals (36. [3] 1999:60)."

b. Human Tissue Act of 1983 and Ordinance on the Removal of Graves and Dead Bodies of 1925

Graves and burial grounds are commonly divided into the following subsets:

a. ancestral graves
b. royal graves and graves of traditional leaders
c. graves of victims of conflict
d. graves designated by the Minister
e. historical graves and cemeteries
f. human remains

Graves 60 years or older are heritage resources and fall under the jurisdiction of both the National Heritage Resources Act and the Human Tissues Act of 1983. However, graves younger than 60 years are specifically protected by the Human Tissues Act (Act 65 of 1983) and Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws. Such burial places also fall under the jurisdiction of the National Department of Health and the Provincial Health Departments.

c. National Heritage Resources Act No 25 of 1999, section 35

This act (Act 107 of 1998) states that a survey and evaluation of cultural resources must be done in areas where development projects, that will change the face of the environment, will be undertaken. The impact of the development on these resources should be determined and proposals for the mitigation thereof are made. Environmental management should also take the cultural and social needs of people into account. Any disturbance of landscapes and sites that constitute the nation's cultural heritage should be avoided as far as possible and where this is not possible the disturbance should be minimized and remedied.

1.5.2 Background to HIA and AIA Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. Heritage sites are frequently threatened by development projects and both the environmental and heritage legislation require impact assessments (HIAs & AIAs) that identify all heritage resources in areas to be developed. Particularly, these assessments are required to make recommendations for protection or mitigation of the impact of the sites. HIAs and AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage

resources including archaeological and palaeontological sites that might occur in areas of developed and (b) make recommendations for protection or mitigation of the impact on the sites.

A detailed guideline of statutory terms and requirements is supplied in Addendum 1.

2 REGIONAL CONTEXT

2.1 Area Location

The proposed R516 Upgrade (33799.00C-L-076) Project occurs on Portions of the farms Doornfontein 498KQ, Rietfontein 541 KQ, Weihoek 540 KQ, Weikrans 539KQ, Rooykrans 538KQ, Knoppieskraal 537 KQ, Leeuwpoort 554KQ, Rietfontein 536 KQ, Vlakfontein 535KQ, Morgenzon 533KQ, Tooyskraal 531 KQ in the Waterberg District Municipality, Limpopo Province. The project area is situated approximately 50km west from the town of Bela Bela along the existing R516. The study areas appear on 1:50000 map sheets 2427DC, 2427DD (see Figure 2-1) and a key location point for the project is:

- **Road Upgrade Western Offset:** S24.888057° E27.530850°
- **Road Upgrade Midpoint:** S24.898140° E27.712800°
- **Road Upgrade Eastern Offset:** S24.871332° E27.871544°

2.2 Area Description: Receiving Environment

The study area lies within the Savanna biome which is the largest biome in Southern Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). Fire and grazing also keep the grassy layer dominant. The most recent classification of the area by Mucina & Rutherford shows that the site is classified as Dwaalboom Thornveld. The project area is characterised by slightly undulating to flat plains with major drainage channels bisecting the area. The topography across the site is slightly undulating.

2.3 Site Description

The proposed project is situated in a rural agricultural zone along in the Waterberg Biosphere. The farms Doornfontein 498KQ, Rietfontein 541 KQ, Weihoek 540 KQ, Weikrans 539KQ, Rooykrans 538KQ, Knoppieskraal 537 KQ, Leeuwpoort 554KQ, Rietfontein 536 KQ, Vlakfontein 535KQ, Morgenzon 533KQ, Tooyskraal 531 KQ subject to this assessment are situated on flat plains south of the Waterberg Mountain Range. Generally, the terrains consist of flatter parcels of developable in a landscape that has, in places, been transformed by historical and more recent crop and livestock farming but farm portions under study have remained relatively pristine in recent years. The region consists mostly of crop, cattle and game farms and tourism establishments. Indigenous grassland and Bushveld vegetation remain across much of the landscape. The SANRAL road reserve is fenced and for the largest part covered in grasses.

The existing R516 road crosses a number of bridges which were constructed in the 1970's and these structures do not require heritage mitigation.

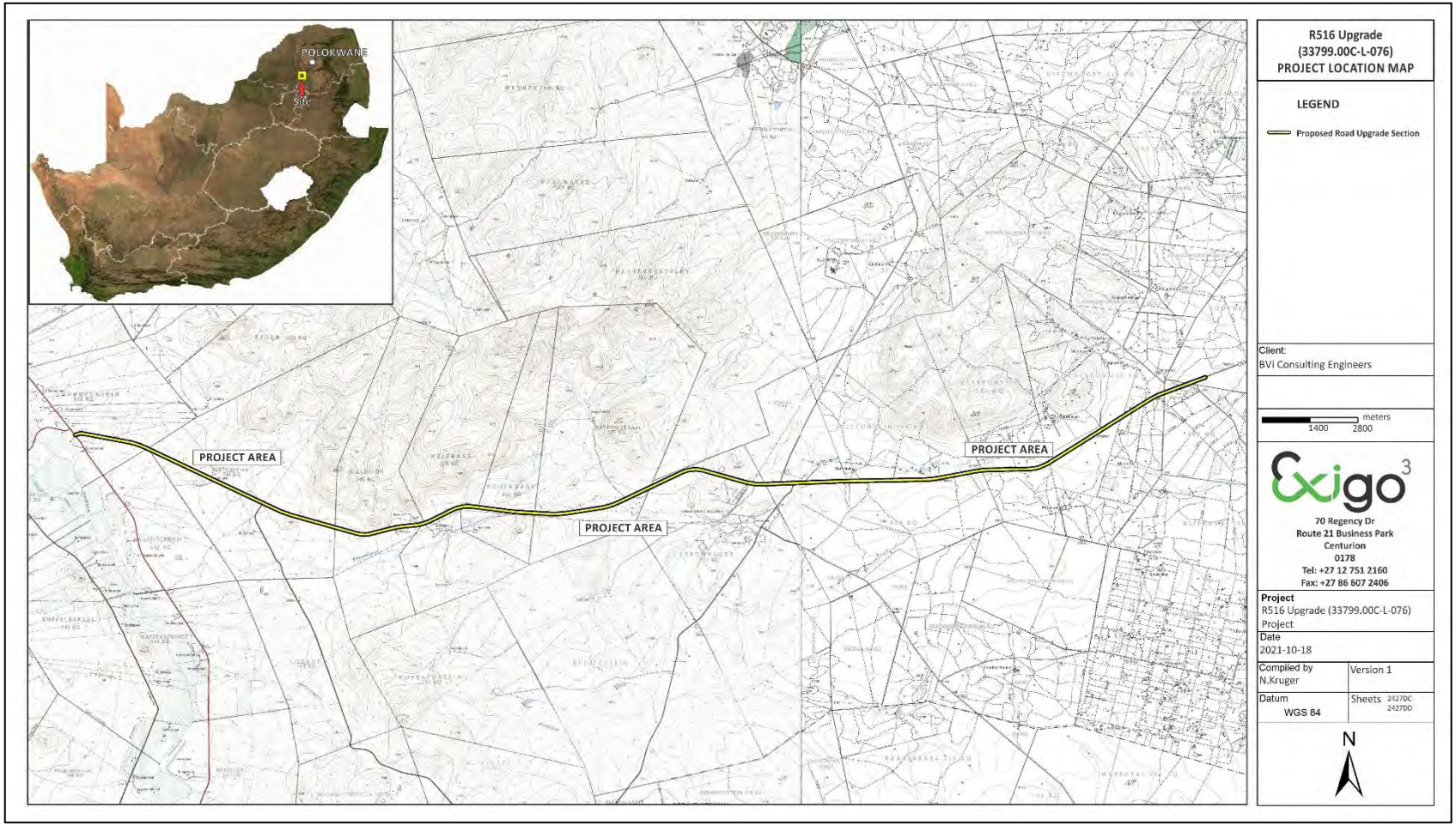


Figure 2-1: 1:50 00 Map representation of the location of the proposed R516 Upgrade (33799.00C-L-076) Project (sheet 2427DC, 2427DD).

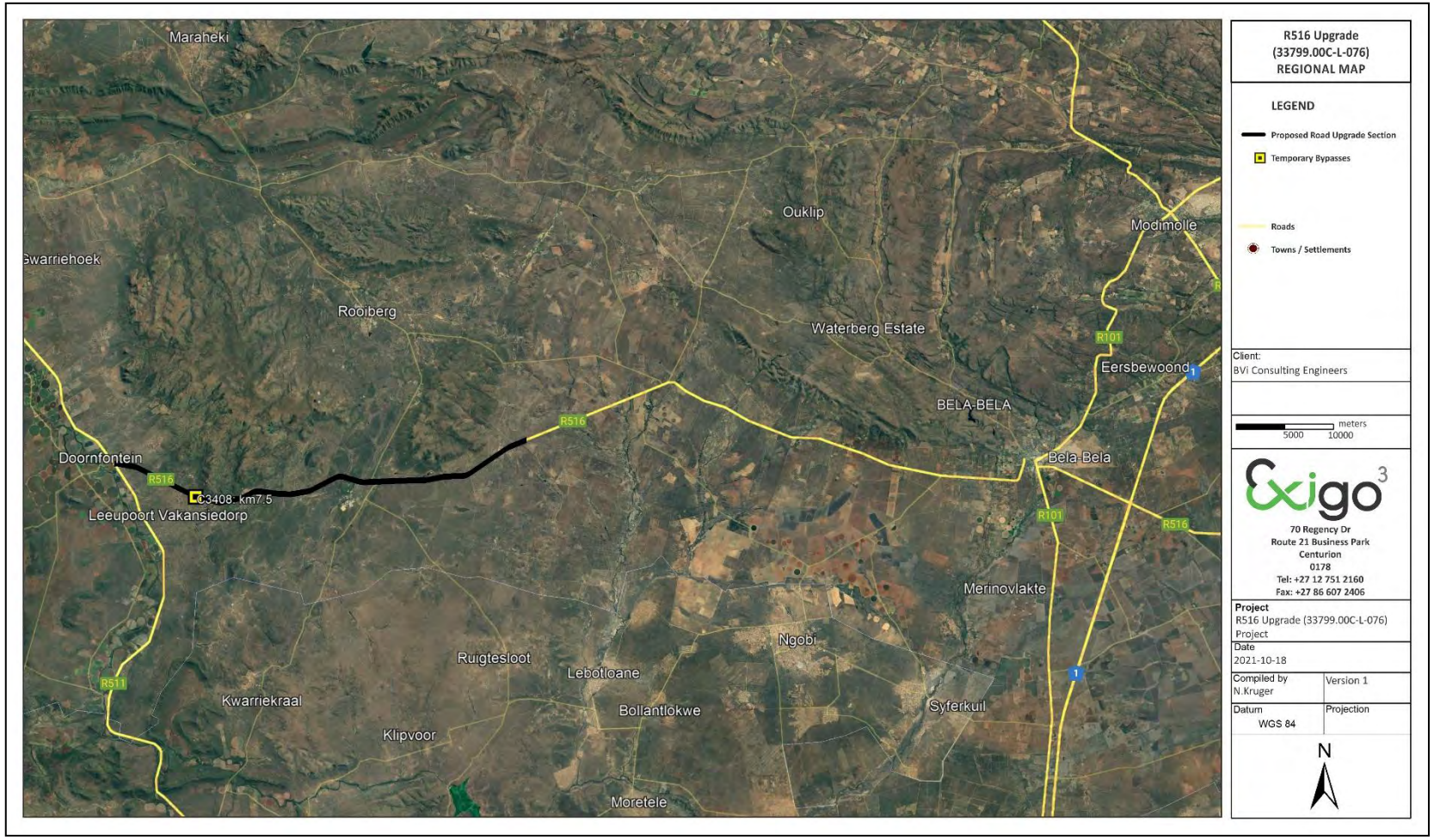


Figure 2-2: Aerial map providing a regional context for the proposed R516 Upgrade (33799.00C-L-076) Project.

3 ARCHAEO-HISTORICAL CONTEXT

3.1 The archaeology of Southern Africa

Archaeology in Southern Africa is typically divided into two main fields of study, the **Stone Age** and the **Iron Age** or **Farmer Period**. The following table provides a concise outline of the chronological sequence of periods, events, cultural groups and material expressions in Southern African pre-history and history.

Table 1 Chronological Periods across Southern Africa

Period	Epoch	Associated cultural groups	Typical Material Expressions
Early Stone Age 2.5m – 250 000 YCE	Pleistocene	Early Hominins: *Australopithecines* *Homo habilis* *Homo erectus*	Typically large stone tools such as hand axes, choppers and cleavers.
Middle Stone Age 250 000 – 25 000 YCE	Pleistocene	First *Homo sapiens* species	Typically smaller stone tools such as scrapers, blades and points.
Late Stone Age 20 000 BC – present	Pleistocene / Holocene	*Homo sapiens sapiens* including San people	Typically small to minute stone tools such as arrow heads, points and bladelets.
Early Iron Age / Early Farmer Period 300 – 900 AD **(commonly restricted to the interior and north-east coastal areas of Southern Africa)**	Holocene	First Bantu-speaking groups	Typically distinct ceramics, bead ware, iron objects, grinding stones.
Middle Iron Age (Mapungubwe / K2) / early Later Farmer Period 900 – 1350 AD **(commonly restricted to the interior and north-east coastal areas of Southern Africa)**	Holocene	Bantu-speaking groups, ancestors of present-day groups	Typically distinct ceramics, bead ware and iron / gold / copper objects, trade goods and grinding stones.
Late Iron Age / Later Farmer Period 1400 AD -1850 AD **(commonly restricted to the interior and north-east coastal areas of Southern Africa)**	Holocene	Various Bantu-speaking groups including Venda, Thonga, Sotho-Tswana and Zulu	Distinct ceramics, grinding stones, iron objects, trade objects, remains of iron smelting activities including iron smelting furnace, iron slag and residue as well as iron ore.
Historical / Colonial Period ±1850 AD – present	Holocene	Various Bantu-speaking groups as well as European farmers, settlers and explorers	Remains of historical structures e.g. homesteads, missionary schools etc. as well as, glass, porcelain, metal and ceramics.

3.2 Discussion: The Waterberg Heritage Landscape

The cultural landscape of the Waterberg encompasses a period of time that spans millions of years, covering human cultural development from the Stone Ages up to recent times. It depicts the interaction between the first humans and their adaptation and utilization to the environment, the migration of people, technological advances, warfare and contact and conflict. Resources, and in particular mineral resources, in what is now

known as the Thabazimbi region have been extensively utilised by prehistoric and historic groups. The greater region has several important Stone Age localities with deep occupation deposits and importantly, a widespread occurrence of open-air sites. The shelter site of Olieboomspoort near Lephalale show a succession from the Earlier, Middle and Later Stone Ages (ESA, MSA and LSA) and up to historic times (van der Ryst 2006). Early Iron Age (EIA) localities such as Diamant are particular important. At this locality in the western Waterberg the EIA facies of Diamant was first identified at the eponymous locality (Huffman 1990). Diamant has also delivered the earliest evidence for glass trade beads and domesticated dogs in the Limpopo Province (van der Ryst 2006). The movement of African farmers into this region is documented by their ceramics and settlements (Huffman 2007b). The later occupations of agropastoralists groups are complex (Schapera 1942, 1965; Breutz 1953, 1989; Bergh 1998). The accounts of early travellers provide important data on the fauna, flora and inhabitants of the Waterberg. The observations of travellers, missionaries and hunters who traversed the region throughout the 18th and the 19th centuries constitute a source of implicit ethnography on the late presence of hunting and gathering groups, the African farmers and inmoving colonists (Baines 1872, 1877; Smith 1836; Schlömann 1896; Wallis [Baines] 1946; Burke [Mauch's journals] 1969). The region is also rich in rock art (Eastwood and Eastwood 2006).

3.2.1 Early History and the Stone Ages

According to archaeological research, the earliest ancestors of modern humans emerged some two to three million years ago. The remains of Australopithecine and *Homo habilis* have been found in dolomite caves and underground dwellings in the Riverton Area at places such as Sterkfontein and Swartkrans near Krugersdorp. Homo habilis, one of the Early Stone Age hominids, is associated with Oldowan artefacts, which include crude implements manufactured from large pebbles. The Acheulian industrial complex replaced the Oldowan industrial complex during the Early Stone Age. This phase of human existence was widely distributed across South Africa and is associated with *Homo erectus*, who manufactured hand axes and cleavers from as early as one and a half million years ago. Middle Stone Age sites dating from as early as two hundred thousand years ago have been found all over South Africa. Middle Stone Age hunter-gatherer bands also lived and hunted in the Orange and Vaal River valleys. These people, who probably looked like modern humans, occupied campsites near water but also used caves as dwellings. They manufactured a wide range of stone tools, including blades and point s that may have had long wooden sticks as hafts and were used as spears. Excavations at Makapansgat near to Mokopane provided evidence of occupation by Australopithecus africanus from approximately 3.3 million years ago. There is evidence of long occupation from the Cave of Hearths with stone tools and associated debris from a date of 400,000 B.P while upper strata are characterised by Middle Stone Age assemblages of 110,000 to 50,000 B.P. and Late Stone Age assemblages dating from 10,000 to 5,000 years B.P. characterised by the Smithfield B industry. The site is one of the few to exhibit Acheulean assemblages in Southern Africa and also contains overlying Middle Stone Age Howiessonspoort industry tools and early evidence of fire use (Bergh, 1999; Mitchell, 2002). Both ESA and MSA sites are known from the Limpopo Valley as well as lithic industries that appear to be transitional between the two ages and with dates estimated at 300,000 years ago (Kuman et al. 2005).The presence of numerous rock art sites with associated stone tool assemblages in the Limpopo River basin, Blouberg, Makgabeng, Waterberg and Soutpansberg attests to the presence of Late Stone Age San/Bushman communities across the region (e.g. Pager, 1973: Eastwood et al., 2002). The Central Limpopo Basin, including the Soutpansberg, Limpopo Valley, the Blouberg-Makgabeng area and the Pafuri area, has over 700 documented rock art sites and is one of the few regions where paintings and engravings occur, sometimes at the same site (Eastwood and Hanisch 2003).

The cultural historical landscape of the Waterberg area spans million years with evidence of hominin occupation, Stone Age traditions, Iron Age farmers and historical events. Makapansgat, a deep limestone cave near Mokopane has yielded remains of *Australopithecus africanus* that dates to more than 3 million years

BP and also *Homo erectus*, dating to approximately 1 million years BP. However, Earlier Stone Age (ESA) material is scarce on the Waterberg plateau. The Middle Stone Age (MSA) is abundantly represented in the Waterberg area and archaeological excavations at sites such as the Olieboomspoort Shelter in the north-western part of the Waterberg have yielded rich MSA deposits which display a large degree of specialisation and skill in stone working (Van der Ryst 1996). These groups occupied open camps which were situated in the proximity of water sources such as pans, lakes or rivers. There is a noticeable gap in the Waterberg between MSA assemblages and material form the Later Stone Age (LSA), suggesting that the Waterberg may not have seen dense human occupation for a long period of time. However, Later Stone Age groups, including the San hunter gatherers and Khoi herders frequented the area in the last few millennia, and numerous LSA sites have been discovered and excavated. Similarly, LSA evidence such as stone implements, ceramics and a wealth of rock paintings and markings are scattered over the plateau.

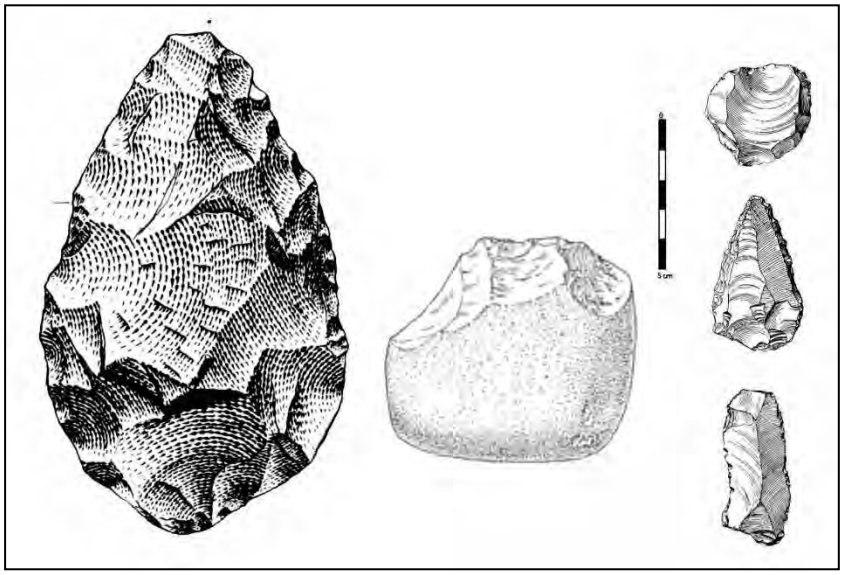


Figure 3-1: Typical ESA handaxe (left) and cleaver (center). To the right is a MSA scraper (right, top), point (right, middle) and blade (right, bottom).

3.2.2 Rock Art of the Waterberg Landscape

The Waterberg Plateau is rich in rock art and rock markings and many such sites are still to be described and studied. At many sites “refined” San paintings occur with cruder depictions in red or white paint (sometimes black), painted directly with fingers by later Farmer groups. Numerous paintings of people in trance positions, dance scenes of men and women, men with hunting equipment, a large variety of antelope and other animals, imaginary rain animals, handprints, and geometric designs form part of the contents of the rock art of the Waterberg (Van der Ryst 1998). Two traditions of Rock Art occur in the Waterberg. First the more "naturalised" form of fine-line art, including skilled depictions of animals and people, attributed to San Hunter Gatherers. The second tradition, often called “Late White” art, is characterised by more geometric, schematic illustrations which includes a large amount of finger painting. This tradition is associated with Iron Age farmers.

3.2.3 Pastoralism and the last 2000 years

Until 2000 years ago, hunter-gatherer communities traded, exchanged goods, encountered and interacted with other hunter-gatherer communities. From about 2000 years ago the social dynamics of the Southern African landscape started changing with the immigration of two 'other' groups of people, different in physique, political, economic and social systems, beliefs and rituals. One of these groups, the Khoekhoe pastoralists or herders entered Southern Africa with domestic animals, namely fat-tailed sheep and goats, travelling through

the south towards the coast. They also introduced thin-walled pottery common in the interior and along the coastal regions of Southern Africa. Their economic systems were directed by the accumulation of wealth in domestic stock numbers and their political make-up was more hierarchical than that of the hunter-gatherers.

3.2.4 Iron Age / Farmer Period

The beginnings of the Iron Age (Farmer Period) in Southern Africa are associated with the arrival of a new Bantu speaking population group at around the third century AD. These newcomers introduced a new way of life into areas that were occupied by Later Stone Age hunter-gatherers and Khoekhoe herders. Distinctive features of the Iron Age are a settled village life, food production (agriculture and animal husbandry), metallurgy (the mining, smelting and working of iron, copper and gold) and the manufacture of pottery. Iron Age people moved into Southern Africa by c. AD 200, entering the area either by moving down the coastal plains, or by using a more central route. From the coast they followed the various rivers inland. Being cultivators, they preferred rich alluvial soils. The Iron Age can be divided into three phases. The Early Iron Age includes the majority of the first millennium A.D. and is characterised by traditions such as Happy Rest and Silver Leaves. The Middle Iron Age spans the 10th to the 13th Centuries A.D. and includes such well known cultures as those at K2 and Mapungubwe. The Late Iron Age is taken to stretch from the 14th Century up to the colonial period and includes traditions such as Icon and Letaba.

Early Sotho-Tswana History

Within a larger archaeological context, Iron Age settlement representations in the form of stone walling in the Waterberg can undoubtedly be traced back to ancestral Sotho-Tswana occupation and developments from the sixteenth century AD onwards. Diagnostic pottery assemblages are commonly used in the South African Iron Age to infer group identities and to trace movements across the landscape. Similarly, the migration of the Sotho-Tswana speakers in South Africa in the 16th century marked a new ceramic style, known as Moloko. The Moloko Tradition can be divided into two phases: an early phase (e.g. Icon) in which sites were usually located at the foot of hills and contained little or no stone walling; and a later phase characterised by extensive stone wall complexes which were often erected on hills. In the Waterberg area, this later phase manifested in the Madikwe ceramic facies with pottery typically displaying stab and fingernail impression decoration motives. At around the 17th century, Madikwe pottery developed into a tradition known as “Buispoort”, sites of which display complex and elaborate stone walling. The stone walls were erected to construct stock byres and to demarcate residential units where pole-and-dagha (clay) huts were placed.

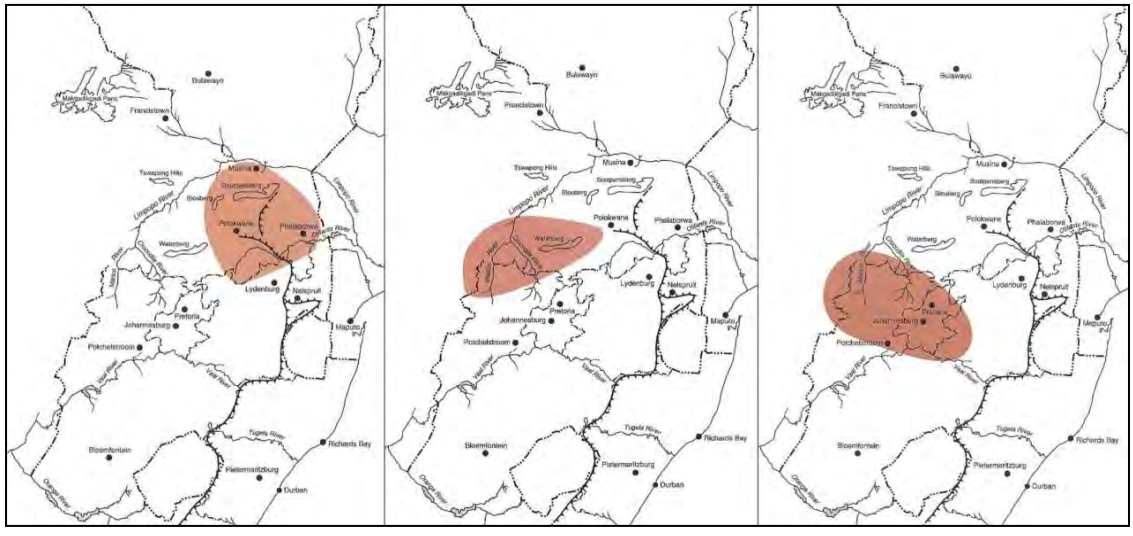


Figure 3-2: Map detailing the distribution of 16th century Maloko (left), 17th century Madikwe (centre) and 18th century Buispoort tradition sites (After Huffman 2007).

Figure 3-3: Ceramic decoration motives typical of 17th century Madikwe (left) and later Buispoort (right) facies (After Huffman 2007).

In addition, various Sotho-Tswana groups were found in the interior of the Highveld areas of South Africa by the end of the 18th century. These units occupied a large area, from present-day Botswana across large sections of the old Transvaal, the Free State Province into the Northern Cape. Based on Sotho-Tswana oral histories various groups acted as cores from which the Sotho-speaking communities sprouted.

3.2.5 Later History: Reorganization, Colonial Contact and living heritage.

The Historical period in Southern Africa encompass the course of Europe's discovery of South Africa and the spreading of European settlements along the East Coast and subsequently into the interior. In addition, the formation stages of this period are marked by the large-scale movements of various Bantu-speaking groups in the interior of South Africa, which profoundly influenced the course of European settlement. Finally, the final retreat of the San and Khoekhoen groups into their present-day living areas also occurred in the Historical period in Southern Africa.

The Waterberg was considered remote and inaccessible by early white migrants from the south and, with the exception of a few hunting and trading expeditions passing through, the area was one of the last regions in the former Transvaal to be permanently occupied by white farmers. Although the first Voortrekker farmers moved into the Waterberg during the 1850's, the region has been increasingly occupied on a regular basis only since the early part of the twentieth century. The early historical period of the area is dominated by the siege of Makapansgat where in September 1854, Chief Makapane and over 1 500 of his people died of hunger, dehydration and injuries after being besieged in the cave by a Boer commando in retaliation for an attack on a Voortrekker settlement. The majority of farms in the Waterberg area were surveyed in the late 1860's as part of the Transvaal government's strategy to settle white farmers in the Waterberg region. At that time, access to the Waterberg plateau was circuitous and difficult with the shortest route extending via Sandrivierspoort near present-day Vaalwater. After a railway line to Vaalwater was completed in the 1920's, maize became an economically viable crop but by the end of the 1960's, slumps in maize prices resulted in many farmers abandoning crop farming in favour of cattle. Large scale iron ore mining has emerged to become a primary economical enterprise in recent years. However, farming communities have settled in the landscape at the beginning of the 20th century.

The Voortrekker Carl Van Heerden established the first farm in what is now the town of Bela-Bela and called it Het Bad but prior to his arrival Tswana tribes first moved into the region in the 1800's and they discovered

hot springs in the area. In 1873, President Burgers' Transvaal government bought the land and established a resort called Hartingsburg after the prominent Dutch biologist Pieter Harting. The British occupied the town during the Anglo Boer War, and renamed the post office Warm Baths in 1903, and proclaimed the boundaries of Warmbaths to be the entire farm of Het Bad. In 1920 Warmbaths was proclaimed a “township” and the township was designed by architect John Abraham Moffat in that year. In 1950, it became a magisterial district. In 1932 Warmbaths became a village town and was established as a town council in 1960. On 14 June 2002 the South African government officially renamed the town to Bela-Bela (meaning "boiling boiling").

3.2.6 Documented Heritage Sites and sensitive areas in the Project Landscape

During surveys for Rhino Minerals Andalusite Mine on the Farm Buffelsfontein 353 KQ, Huffman (2004, 2006a, 2007a, 2009a) recorded an EIA village on red colluvial/alluvial deposits and several grain bin stands. The LIA homesteads contained several burnt houses. He ascribed the burning to a severe drought (Huffman 2009b). He also noted MSA lithics but not of any significance. In a subsequent AIA no settlements were recorded but isolated fragments of pottery and slag suggest a buried occupation (Huffman 2009a). Van Schalkwyk (2007) in an assessment for cultural heritage resources on sections of the farms Amandelbult 383KQ and Elandsfontein 386KQ in the Thabazimbi District recorded surface MSA and LSA lithics. He also noted two possible EIA sites whereas most of the others that were identified are from the Late Iron Age/early Historical period, the latter features assigned Medium significance. A buffer zone is already in place following on previous recommendations on Iron Age remains within this general area (Van Schalkwyk 1994, 2001, 2003, 2004; Van Schalkwyk et al. 2004). Coetzee (2008) in a report for the PPC expansion project recorded only a small Stone Age lithic scatter from the prehistoric period. However, 10 historical houses from the 1930s to 1940s have been documented as well as several graves. In the greater region Dreyer (2011) in an assessment for proposed chrome mining developments found no heritage remains at at Hartbeestkopje 367KQ, Schilpadnest 385KQ and Moddergat 389KQ, in the Northam District but recorded historical material at Zwartkop 369KQ. At Boikarabelo excavations of an extensive grain bin-site and surface collections of around 12 Iron Age settlements demonstrated Tswana settlement sequences that include a probable early Moloko (probably Icon) facies and at least one site had been identified to the Letsibogo facies. The relative age of the sites were therefore inferred to range from the late 17th to late 18th centuries (Digby Wells Environmental 2011). Hutten (2013a, 2013b, 2013c) in several assessments for solar developments noted that there was an absence of heritage resources on the farms Liverpool and Aapiesdraai near Koedoeskop, whereas a historic structure, outside the developments, was recorded at Grootkuil. Van Vollenhoven in an HIA for the proposed development of a limestone mine on Portion 1 of the farm Nooitgedacht 136 JQ, Portion 1 of the farm Buffelskraal 545 KQ and Portions 3, 4, 5, 6 and the Remainder of Krokodilkraal 545 KQ in the Thabazimbi District reported that no heritage resources have been identified and that the surveyed properties have been used for cattle farming and extensive agriculture. In a draft scoping report for the proposed township on Portion 20 and 22 of the farm Theunispan 293 LQ, Portion 1-4 and a portion of the remainder of the Farm Grootdoorn 292 LQ, portion 3 of the Farm Steenbokpan 295 seven heritage sites of significance or value were identified within the area proposed for the development of the Steenbokpan Extension 3 Township. These comprise five informal cemeteries, all on portions of Grootdoorn and two historic structures of the Harmse family homestead (Ila 2014; PGS 2014). In an extension of a mining licence for clay extraction on the farm Nooitgedacht 436 JR Portion 25 an informal cemetery with 15 graves was identified (African Heritage Consultants 2013). African Heritage Consultants (2011, 2014) in a Phase 1 AIA identified numerous stone-walled enclosures, a pre-colonial mine, graves, and historic structures that include a weir and bridge at the Sondagsriver. The scoping report on heritage for Project Infinity Sishen Iron Ore Thabazimbi Mine (Shangoni Management Services 2013) noted that MSA lithics were present in an area with sheet erosion.

The proposed mining on Wachsteenbietjesdraai 350 KQ and Kwaggashoek 345 KQ is in close proximity from the Mostert Tunnel Cave south of Thabazimbi that has significant geological formations. Gatkop Cave on the farm Randstephane 455 KQ ESE of Thabazimbi was also investigated. The locality lies within an area with rich iron ore deposits that are currently being explored by Aquila Resources in view of future extraction. It is an important heritage resource of high cultural significance that is still being used for ritual ceremonies and constitutes a contentious issue in view of the developments. Madimatle Mountain at Donkerpoort 448 KQ and Gatkop Cave on Randstephane 455 KQ hold significant spiritual, ancestral and cultural heritage importance to the local community, local traditional healers, local traditional leaders, persons that practice and belong to certain African Christian denominations. Kruger (2015) identified a large Iron Age occupation site was documented around the slopes of a prominent hill directly east of the R510 road. At the site, which (including the hill) measures approximately 500m x 400m, clear vegetation changes and the occurrence of *Euphorbia candelabrum* trees, dense stands of *Cenchrus ciliaris* (blue buffalo grass) and couch grass indicate middens, cattle dung accumulations and activity areas. *Cenchrus ciliaris* (blue buffalo grass) is often a good indication of the presence of Iron Age sites where these grass types are closely linked to nitrate-rich livestock enclosures (e.g. Denbow 1979). A number of collapsed stone wall structures, terraces and platforms occur at the site and considering the intensification of stone wall building in this landscape after the 17th century as well as the settlement of Sotho-Tswana groups, the walls are probably not older than 300 years. Based on observations derived from the aerial survey it is clear that the site is part of a larger complex of which the nucleus seems to centre around a large hill directly east of the site discussed. Here, large occupation areas and a number of stone wall structures are visible on aerial imagery.

4 METHODOLOGY

4.1 Sources of Information

Data from detailed desktop, aerial and field studies were interrogated in order to sample surface areas systematically and to ensure a high probability of heritage site recording.

4.1.1 Desktop Study

The larger landscape of Waterberg has been well documented in terms of its archaeology and history. A desktop study was prepared in order to contextualize the proposed project within a larger historical milieu. Numerous academic papers and research articles supplied a historical context for the project area and archival sources, aerial photographs, historical maps and local histories were used to create a baseline of the landscape's heritage. In addition, the study drew on available unpublished Heritage Assessment reports to give a comprehensive representation of known sites in the study area. These included:

- Hutten, M. 2013c. HIA for the proposed solar park development on the farm Aapieskruil near Koedoeskop, Limpopo Province. Compiled for: Jonk Begin Omgewingsdienste.
- Fourie, W. 2012. Wachteenbietjesdraai 350 KQaAnd Kwaggashoek 345 KQ Heritage Impact Report on proposed mining activities of Project Phoenix. PGS Heritage Consultants
- Fourie, W. 2014. Proposed Development of the Steenbokpan Extension 3 Township on the Remainder and Portions 1, 2, 3 and 4 of the Farm Grootdoorn 292 LQ, Portions 20, 22 and 25 of the Farm Theunispan 293 LQ and Portion 3 of the Farm Steenbokpan 295 LQ at Steenbokpan, Lephalale Local Municipality, Waterberg District, Limpopo Province. Client: Flexilor Properties (Pty) Ltd . PGS Heritage Consultants
- Van Schalkwyk, J.A. 2004. Heritage impact report for the Amandelbult electricity sub-transmission lines, Amandelbult Platinum Mine, Limpopo Province. Unpublished report 2004KH32. Pretoria: National Cultural History Museum.
- Van Schalkwyk, J. 2007. Survey of heritage resources in the location of the proposed Merensky Mining Project, Amandelbult Section, Rustenburg Platinum Mine, Limpopo Province. Prepared For

WSP Environmental.

- Van Vollenhoven, A. July 2013. A Report on a Cultural Heritage Impact Assessment for the Continental Limestone Mine, close to Thabazimbi, Limpopo Province.

4.1.2 Aerial Survey

Aerial photography is often employed to locate and study archaeological sites, particularly where larger scale area surveys are performed. The site assessment of the project area relied on this method to assist the site surveys. Here, depressions, variation in vegetation, soil marks and landmarks were examined and specific attention was given to shadow sites (shadows of walls or earthworks which are visible early or late in the day), crop mark sites (crop mark sites are visible because disturbances beneath crops cause variations in their height, vigour and type) and soil marks (e.g. differently coloured or textured soil (soil marks) might indicate ploughed-out burial mounds). Attention was also given to moisture differences, as prolonged dampening of soil as a result of precipitation frequently occurs over walls or embankments. In addition, historical aerial photos obtained during the archival search were scrutinized and features that were regarded as important in terms of heritage value were identified and if they were located within the boundaries of the project area, they were physically visited in an effort to determine whether they still exist and in order to assess their current condition and significance. By superimposing high frequency aerial photographs with images generated with Google Earth as well as historical aerial imagery, potential sensitive areas were subsequently identified, geo-referenced and transferred to a handheld GPS device. These areas served as reference points from where further surveys were carried out.

4.1.3 Mapping of sites

Similar to the aerial survey, the site assessment of the project area relied heavily on archive and more recent map renderings of the project areas to assist the site survey where historical and current maps of the project area were examined. By merging data obtained from the desktop study and the aerial survey, sites and areas of possible heritage potential were plotted on these maps of the larger Waterberg region using GIS software. These maps were then superimposed on high-definition aerial representations in order to graphically demonstrate the geographical locations and distribution of potentially sensitive landscapes.

4.1.4 Field Survey

Archaeological survey implies the systematic procedure of the identification of archaeological sites. An archaeological survey of the R516 Upgrade (33799.00C-L-076) Project area was conducted in September 2021. The process encompassed a random field survey in accordance with standard archaeological practice by which heritage resources are observed and documented. Particular focus was placed on GPS reference points identified during the aerial and mapping survey. Where possible, random spot checks were made and potentially sensitive heritage areas were investigated. Using a Garmin GPS, the survey was tracked and general surroundings were photographed with a Samsung Digital camera. Real time aerial orientation, by means of a mobile Google Earth application was also employed to investigate possible disturbed areas during the survey.

4.2 Limitations and Constraints

The site survey for the R516 Upgrade (33799.00C-L-076) Project AIA primarily focused around areas tentatively identified as sensitive and of high heritage probability (i.e. those noted during the mapping and aerial survey) as well as areas of potential high human settlement catchment. In terms of on-site limitations during the survey, the following should be noted:

- The study areas are accessed directly via the R516 road – since the project is limited to the existing SANRAL road reserve no site access restrictions were encountered.
- The surrounding vegetation in the project area mostly comprised out bushveld vegetation occasional trees and mixed grasslands. The general visibility at the time of the AIA survey (September 2021) was moderate to high and the archaeological observations on site was not restricted.

Cognisant of the constraints noted above, it should be stated that the possibility exists that individual sites could be missed due to the localised nature of some heritage remains as well as the possible presence of sub-surface archaeology. Therefore, maintaining due cognisance of the integrity and accuracy of the archaeological survey, it should be stated that the heritage resources identified during the study do not necessarily represent all the heritage resources present in the project area. The subterranean nature of some archaeological sites, dense vegetation cover and visibility constraints sometimes distort heritage representations and any additional heritage resources located during consequent development phases must be reported to the Heritage Resources Authority or an archaeological specialist.

Figure 4-1: View of general surroundings at the R516 – R511 intersection, the western offset of the project.

Figure 4-2: View of game farm fencing along the SANRAL servitude in the project area.

Figure 4-3: View of the entrance to the Raputhi informal settlement along the R516 in the project area.

Figure 4-4: View of general surroundings along the SANRAL servitude in the project area.

Figure 4-5: View of general surroundings along the SANRAL servitude in the project area.

Figure 4-6: View of general surroundings along the SANRAL servitude in the project area looking west.

Figure 4-7: View of surroundings along the SANRAL servitude in the project area.

Figure 4-8: View the R516 road servitude in the proposed project area.

Figure 4-9: View of a bridge along the R516 road in the project area, constructed in 1975.

Figure 4-10: View of general surroundings at the eastern offset of the project along the R516 road.

4.3 Impact Assessment

For consistency among specialists, impacts were rated and assessed using an Impact and Risk Assessment Methodology provided by CES[1], for the Scoping Phase of the EIA process in accordance with the requirement of EIA Regulations. Please refer to Section 6 and Addendum 2.

[1] CES Risk Assessment Methodologies Internal guideline document, 2019

5 RESULTS: ARCHAEOLOGICAL SURVEY

5.1 The Off-Site Desktop Survey

In terms of heritage resources, the general landscape around the project area is primarily well known for its Iron Age Farmer and Colonial / Historical Period archaeology related to farming, rural expansion and warfare of the past century. No particular reference to archaeological sites or features of heritage potential were recorded during an examination of published literature thematically or geographically related to the project target properties.

An analysis of historical aerial imagery and archive maps reveals the following (see Figure 5-1 to Figure 5-6):

- The farms subject to this assessment (Doornfontein 498KQ, Rietfontein 541 KQ, Weihoek 540 KQ, Weikrans 539KQ, Rooykrans 538KQ, Knoppieskraal 537 KQ, Leeuwpoort 554KQ, Rietfontein 536 KQ, Vlakfontein 535KQ, Morgenzon 533KQ, Tooyskraal 531 KQ) are is indicated on an early map of the Transvaal (Jeppe, 1899).
- A number of farmsteads, shops, so-called “huts”, a “ruin” as well quarries are indicated on 1963 - 1967 maps of the project area along the R516. These maps indicate cultivated fields in places in the project landscape.
- Possible buildings and potential man-made structures appear within the project area on historical aerial imagery along the R516 road in the second part of the 20th century. The regional road which is currently the R516 road existed at the time and was constructed during the first part of the 20th century and upgraded in 1975.
- According to Van Warmelo’s ethnological survey of 1935, the larger landscape was settled by the “baKKatla baMosithla”, the “baxaSeleka (Nawa) and the baMosethla groups at the time.

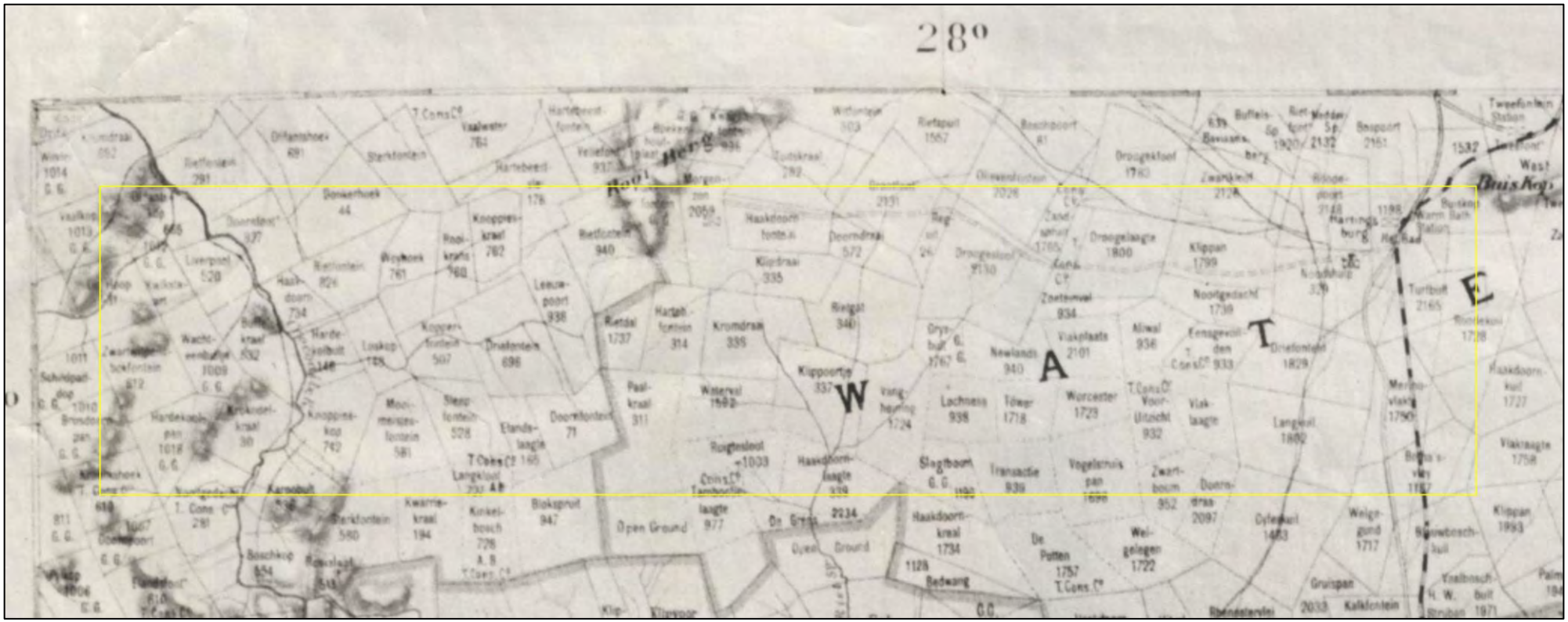


Figure 5-1: Historical map of the southern Waterberg region dating to 1899 (Jeppe) indicating the presence of the project area and related farms (yellow outline).

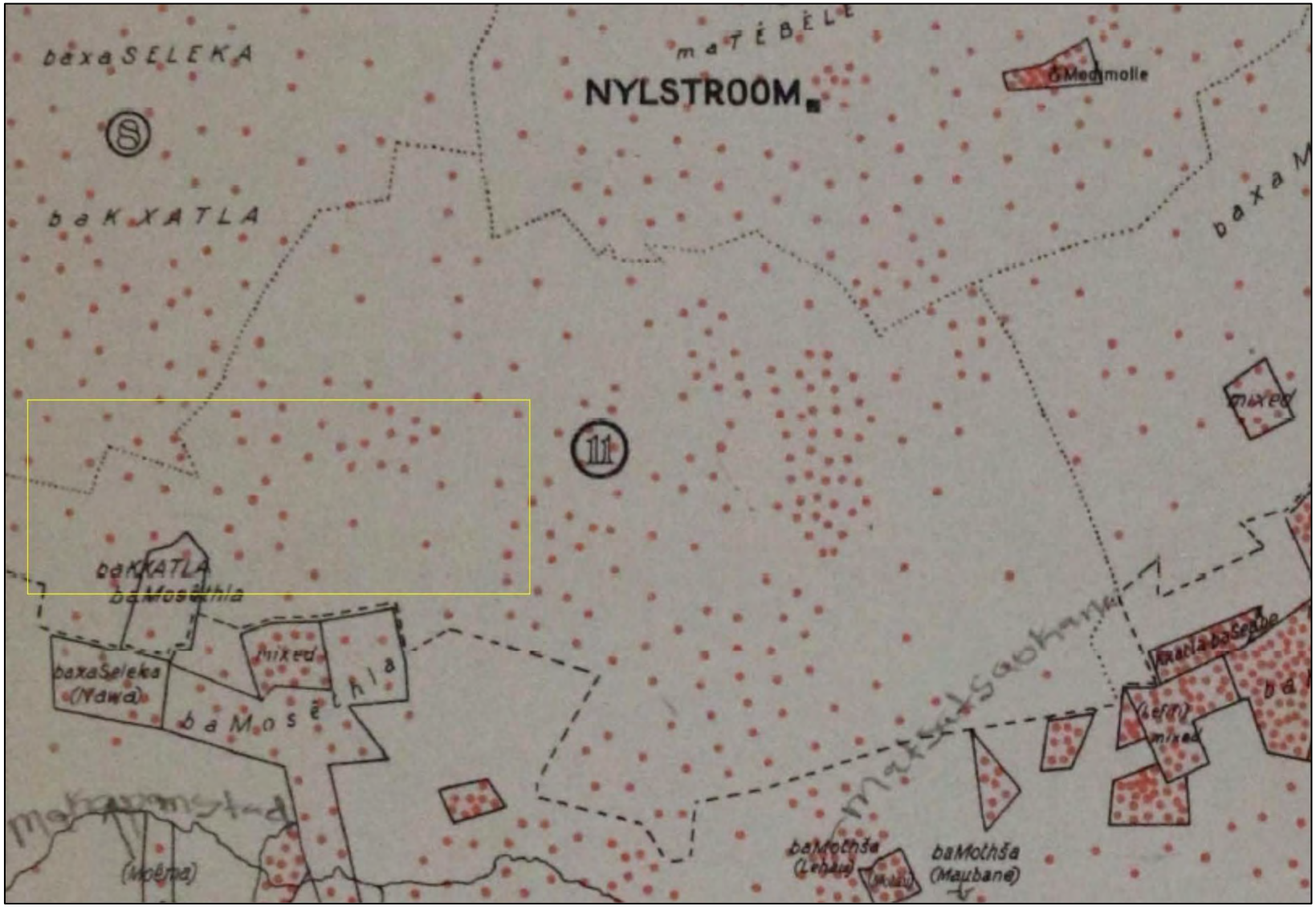


Figure 5-2: An excerpt of Van Warmelo's Map of the project landscape and project area (yellow outline) dating to 1935. Each red dot represents "10 taxpayers".

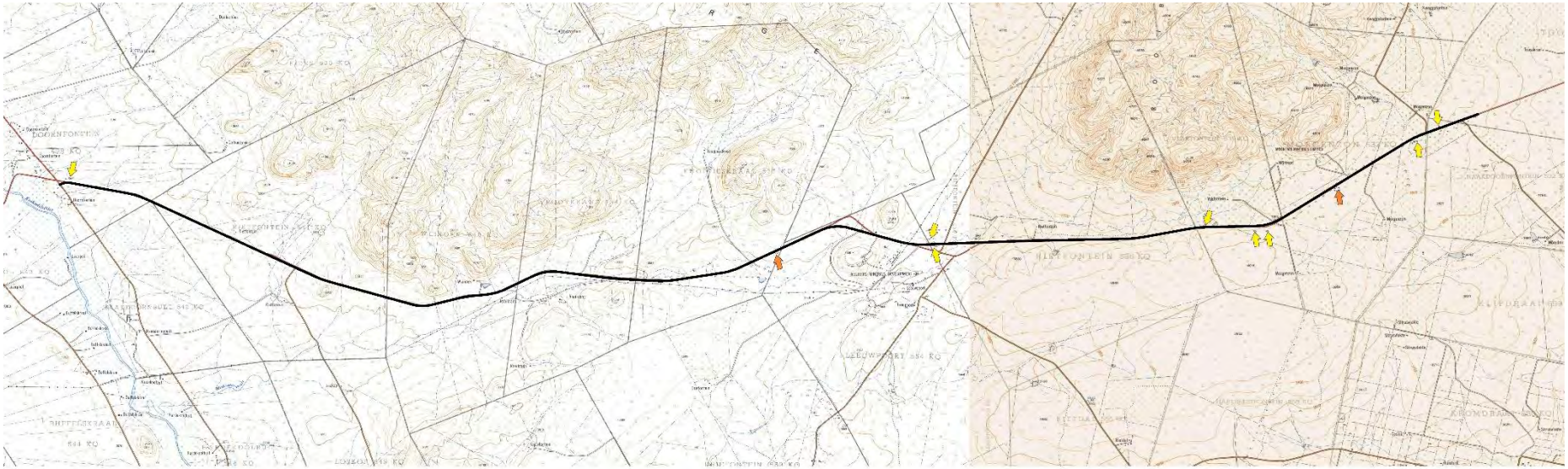


Figure 5-3:

Historical topographic maps of the project area indicating the locations of R516 (black line) and the proposed quarry site (yellow outline) in the past decades. Yellow arrows indicate man-made structures and the orange arrows indicate quarries and diggings.

5.2 The Archaeological Site Survey

An analysis of historical aerial imagery and archive maps of areas subject to this assessment suggests a landscape which has been subjected to historical farming and development within the SANRAL road reserve possibly sterilising the area of heritage remains. This inference was confirmed during an archaeological site assessment during which no *in situ* heritage remains were encountered. The following observations were made during the site survey:

5.3 The Stone Age

Stone Age material generally occurs along drainage lines and exposed surfaces in the landscape. During the site survey no Stone Age occurrences were documented in any of the project areas.

5.4 The Iron Age Farmer Period

A frontier zone between the east and the west, the Northern Limpopo landscape holds vast amounts of Iron Age (Farmer period) remnants but no Farmer Period occurrences were noted in in any of the project areas.

5.5 Historical / Colonial Period and recent times

Bela-Bela (Warmbaths) and its surroundings have a long and extensive Colonial Period settlement history. From around the first half of the 19th century, the area was frequented by explorers, missionaries and farmers who all contributed to a recent history of contact and conflict. The remnants of recent occupation and mining are scattered across the landscape but no Historical / Colonial Period occurrences were observed in in any of the project areas. In terms of the built environment, the project area has no significance, as there are no old buildings, structures, or features, old equipment, public memorial or monuments in the footprint areas.

5.6 Graves

No graves of human burial places were noted during the site investigation of in any of the project areas. In the rural areas of the Limpopo Province graves and cemeteries often occur within settlements or around homesteads but they are also randomly scattered around archaeological and historical settlements. The probability of informal human burials encountered during development should thus not be excluded. Should any unmarked human burials/remains be found during the course of construction, work in the immediate vicinity should cease and the find must immediately be reported to the archaeologist, or the South African Heritage Resources Agency (SAHRA). Under no circumstances may burials be disturbed or removed until such time as necessary statutory procedures required for grave relocation have been met.

6 RESULTS: STATEMENT OF SIGNIFICANCE AND IMPACT RATING

6.1 Potential Impacts and Significance Ratings[2]

The following section provides a background to the identification and assessment of possible impacts and alternatives, as well as a range of risk situations and scenarios commonly associated with heritage resources management. A guideline for the rating of impacts and recommendation of management actions for areas of heritage potential within the study area is supplied in Section 10.2 of Addendum 3.

[2] Based on: W inter, S. & Baumann, N. 2005. *Guideline for involving heritage specialists in EIA processes: Edition 1.*

6.2 General assessment of impacts on heritage resources

Generally, the value and significance of archaeological and other heritage sites might be impacted on by any activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, of any archaeological material or object (as indicated in the National Heritage Resources Act (No 25 of 1999)). Thus, the destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial construction period. However, in the long run, the proximity of operations in any given area could result in secondary indirect impacts. The EIA process therefore specifies impact assessment criteria which can be utilised from the perspective of a heritage specialist study which elucidates the overall extent of impacts.

6.2.1 Issues Identification Matrix

As noted previously, impacts were rated and assessed using an Impact and Risk Assessment Methodology provided by CES, for the Scoping Phase of the EIA process in accordance with the requirement of EIA Regulations. Please refer to Addendum 2.

The following tables summarize impacts to heritage receptors for the proposed R516 Upgrade (33799.00C-L-076) Project.

Impact Assessment: Archaeology

Criteria	Nature	Temporal Scale	Spatial Scale	Severity	Probability	Overall Significance before mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Overall Significance after mitigation
Impact 1: Loss of Heritage Resources										
Road Upgrade Alignment	Negative	Short term	Study area	Slight	Definite	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE

Impact Assessment: Built Environment

Criteria	Nature	Temporal Scale	Spatial Scale	Severity	Probability	Overall Significance before mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Overall Significance after mitigation
Impact 1: Loss of Heritage Resources										
Road Upgrade Alignment	Negative	Short term	Study area	Slight	Definite	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE

Impact Assessment: Cultural Landscape

Criteria	Nature	Temporal Scale	Spatial Scale	Severity	Probability	Overall Significance before mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Overall Significance after mitigation
Impact 1: Loss of Heritage Resources										
Road Upgrade Alignment	Negative	Short term	Study area	Slight	Definite	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE

Impact Assessment: Human Burial Sites

Criteria	Nature	Temporal Scale	Spatial Scale	Severity	Probability	Overall Significance before mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Overall Significance after mitigation
Impact 1: Loss of Heritage Resources										
Road Upgrade Alignment	Negative	Short term	Study area	Slight	Definite	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE

Previous studies conducted in the southern Limpopo Province and the Waterberg suggest a rich and diverse archaeological landscape. Generally, the area is highly suitable for pre-colonial habitation and, even though the project area contains no visible tangible heritage remains, the probability of exposing archaeological remains that might be present in surface and sub-surface deposits along drainage lines and in pristine areas during development should not be excluded.

6.2.2 Archaeology

The study did not identify any archaeological receptors which will be directly impacted by the proposed project and no impact on archaeological sites or features is anticipated.

6.2.3 Built Environment

The study identified no buildings or structures of historical or heritage significance. For the rest of the project area, the general landscape holds varied significance in terms of the built environment as the area comprises historical farming remnants and relatively newly established industrial zones, settlements and townlands. However, no impact on built environment sites is anticipated.

6.2.4 Cultural Landscape

Generally, the proposed project area and its surrounds are characterised by open fields and game and agricultural farmlands as well as the Bela-Bela townscape. Further away from the project area, the landscape is typical of the rural north Limpopo with undulating hills with flatter plains in-between. This landscape stretches over many kilometres and the proposed project is unlikely to result in a significant impact on the landscape.

6.2.5 Graves / Human Burials Sites

No human burials were documented in the project area and no impact on human remains is foreseen. In the rural areas of the Limpopo Province graves and cemeteries sometimes occur within settlements or around homesteads but they are also randomly scattered around archaeological and historical settlements. The probability of additional and informal human burials encountered during development should thus not be excluded. In addition, human remains and burials are commonly found close to archaeological sites; they may be found in "lost" graveyards, or occur sporadically anywhere as a result of prehistoric activity, victims of conflict or crime. It is often difficult to detect the presence of archaeological human remains on the landscape as these burials, in most cases, are not marked at the surface.

Human remains are usually observed when they are exposed through erosion. In some instances packed stones or rocks may indicate the presence of informal pre-colonial burials. If any human bones are found during the course of construction work then they should be reported to an archaeologist and work in the immediate vicinity should cease until the appropriate actions have been carried out by the archaeologist. Where human remains are part of a burial they would need to be exhumed under a permit from SAHRA (for pre-colonial burials as well as burials later than about AD 1500). Should any unmarked human burials/remains be found during the course of construction, work in the immediate vicinity should cease and the find must immediately be reported to the archaeologist, or the South African Heritage Resources Agency (SAHRA). Under no circumstances may burials be disturbed or removed until such time as necessary statutory procedures required for grave relocation have been met.

6.2.6 Impact Statement

Cognisant of known site distribution patterns in this section of the Limpopo Province, and based on general on-site observations and off-site assessments and, notably the fact that the project site and its immediate

surrounds have previously been transformed by historical agriculture and more recent development, the author of this report is of the opinion that the construction of the R516 Upgrade Project, will have no impact on archaeological artefacts, features or structures surviving in primary context and the project may process from a heritage impact perspective subject to the fact that no previously undetected heritage remains (for example, those in sub-surface deposits) are exposed at any stage of the development.

6.3 Management actions

Recommendations for relevant heritage resource management actions are vital to the conservation of heritage resources. A general guideline for recommended management actions is included in Section 10.4 of Addendum 3.

OBJECTIVE: ensure conservation of heritage resources of significance, prevent unnecessary disturbance and/or destruction of previously undetected heritage receptors.

No specific mitigation measures in terms of further heritage resources management are required for the R516 Upgrade (33799.00C-L-076) Project. However, the following general recommendations should be considered:

PROJECT COMPONENT/S	All phases of construction and operation.		
POTENTIAL IMPACT	Damage/destruction of sites.		
ACTIVITY RISK/SOURCE	Digging foundations and trenches into sensitive deposits that are not visible at the surface.		
MITIGATION: TARGET/OBJECTIVE	To locate previously undetected heritage remains / graves as soon as possible after disturbance so as to maximize the chances of successful rescue/mitigation work.		
MITIGATION: ACTION/CONTROL		**RESPONSIBILITY**	**TIMEFRAME**
Fixed Mitigation Procedure (**required**)			
Short-term Site Monitoring: Monitoring of site clearing and earth moving during initial stages of the development to detect the presence of possible heritage resources in the project area. **General Site Monitoring:** Regular examination of trenches and excavations for the total duration of construction.		ECO	Monitor as frequently as practically possible.
PERFORMANCE INDICATOR	Archaeological sites are discovered and mitigated with the minimum amount of unnecessary disturbance.		
MONITORING	Successful location of sites by person/s monitoring.		

7 RECOMMENDATIONS

The larger landscape around the project area indicates a rich heritage horizon encompassing Iron Age Farmer and Colonial / Historical Period archaeology primarily related to farming, rural expansion and warfare of the past century. The farms and project zones subject to this assessment was portioned towards the end of the 19th century and no particular reference to archaeological sites or features of heritage potential were recorded during an examination of literature thematically or geographically related to the project area within the road reserve. An examination of historical aerial imagery and archive maps indicate that the larger landscape had been utilized for agriculture and game faming as well as tourism during the last century. Much of the project areas have been altered and transformed in the last century – particularly where the existing SANRAL road reserve has been cleared and vegetated with grasses. During the survey, **no heritage receptors were noted** and it might be assumed that the project activities will result in a minimal (if any) impact on heritage resources. This inference is made subject to further on-site observations required during pre-construction vegetation clearing and earth moving activities. The following recommendations are made based on general observations in the proposed R516 Upgrade (33799.00C-L-076) Project in terms of heritage resources management:

- The site survey for the R516 Upgrade (33799.00C-L-076) Project AIA was limited to the SANRAL road reserve and findings from the desktop assessment, indicating a sparse human settlement pattern and significant agriculture development during the last century, suggest a low heritage potential for the project area. However, the possibility that undetected heritage receptors might be present in the project footprint should not be excluded and the close and frequent monitoring of the initial stages of the project (vegetation clearing, earth moving and excavations) by an informed Environmental Control Officer (ECO) is recommended. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.
- It is recommended that the EIA public participation and social consultative process address the possibility of heritage resources graves occurring in the project area.
- It should be stated that it is likely that further undetected archaeological remains might occur elsewhere in the project landscape along water sources and drainage lines, fountains and pans would often have attracted human activity in the past. Also, since Stone Age material seems to originate from below present soil surfaces in eroded areas, the larger landscape should be regarded as potentially sensitive in terms of possible subsurface deposits. Burials and historically significant structures dating to the Colonial Period occur on farms in the area and these resources should be avoided during all phases of construction and development, including the operational phases of the development.

In addition to these site-specific recommendations, careful cognizance should be taken of the following:

- As Palaeontological remains occur where bedrock has been exposed, all geological features should be regarded as sensitive.
- Water sources such as drainage lines, fountains and pans would often have attracted human activity in the past. As Stone Age material occur in the larger landscape, such resources should be regarded as potentially sensitive in terms of possible subsurface deposits.

8 BIBLIOGRAPHY

8.1 Published Literature

Acocks, J.P.H. 1988. Veld types of South Africa (3rd edition). Memoirs of the Botanical Survey of South Africa 57: 1-146

Bergh, J.S. 1999. Geskiedenisatlas van Suid-Afrika: die vier noordelike provinsies. Pretoria: J.L. van Schaik.

Breul, H. 1948. The Earlier Stone Age or Old Palaeolithic Industries in the Vaal River Basin. Archaeological Survey. Archaeological Series No. VI:8-18.

Childs, S.T & Killich, D.1993. Indigenous African Metallurgy Nature and Culture. Annual Review of Anthropology: 22 (317-337)

Deacon, H.J. 1970. The Acheulian Occupation at Amanzi Springs Uitenhage District, Cape Province. Cape provincial museums at the Albany Museum

Deacon, J. 1996. Archaeology for Planners, Developers and Local Authorities. National Monuments Council. Publication no. P021E.

Deacon, J.1997. Report: Workshop on Standards for the Assessment of Significance and Research Priorities for Contract Archaeology. In: Newsletter No 49, Sept 1998. Association for Southern African Archaeologists.

Denbow, J.R. 1979. Cenchrus ciliaris: an ecological indicator of Iron Age middens using aerial photography in eastern Botswana. South African Journal of Science 75:405—408

Esterhuysen, A., 2007. The Earlier Stone Age. In Bonner, P., Esterhuysen, A., Jenkins, T. (eds.): A Search for Origins: Science, History and South Africa's 'Cradle of Humankind'. Johannesburg: Wits University Press. Pg 110 -121.

Evers, T.M.1988. The recognition of Groups in the Iron Age of Southern Africa. PhD thesis. Johannesburg: University of the Witwatersrand.

Hall, M. 1987. The Changing Past: Farmers, Kings & Traders in Southern Africa 200 – 1860 Cape Town, Johannesburg: David Philip

Hamilton, C. (Ed.) 1995. The Mfecane Aftermath. Johannesburg: Wits U.P.

Huffman, T.N. 2007. Handbook to the Iron Age. Pietermaritzburg: University of Kwazulu-Natal Press

Maggs, TM.O. 1976. Iron Age Communities of the Southern Highveld. Pietermaritzburg: University of Natal Press.

Mitchell, P. 2002. The Archaeology of Southern Africa. Cambridge Africa Collection. Cambridge: Cambridge University Press.

Raper, P.E. 2004. South African place names. Johannesburg: Jonathan Ball Publishers

Swanepoel, N. et al (Eds.) 2008. Five hundred years rediscovered. Johannesburg: Wits University Press

Van der Ryst, M.M. 2006. 'Seeking Shelter: Hunter-Gatherer-Fishers of Olieboomspoort, Limpopo, South Africa.' PhD diss., University of the Witwatersrand.

Van Warmelo, N.J. 1935. A Preliminary Survey of the Bantu Tribes of South Africa. Ethnographic Publications No. 5. Pretoria: Government Printer.

8.2 Unpublished Sources and Reports

Fourie, W. 2012. Wachteenbietjesdraai 350 KQaAnd Kwaggashoek 345 KQ Heritage Impact Report on proposed mining activities of Project Phoenix. PGS Heritage Consultants

Fourie, W. 2014. Steenbokpan Township Development. Proposed Development of the Steenbokpan Extension 3 Township on the Remainder and Portions 1, 2, 3 and 4 of the Farm Grootdoorn 292 LQ, Portions 20, 22 and 25 of the Farm Theunispan 293 LQ and Portion 3 of the Farm Steenbokpan 295 LQ at Steenbokpan, west of Lephalale in the Lephalale Local Municipality, Waterberg District, Limpopo Province. Client: Flexilor Properties (Pty) Ltd . PGS Heritage Consultants

Hutten, M. 2010. Heritage Impact Assessment for the proposed De Put Residential Township Development south of Northam, Limpopo Province

Pistorius, J.C.C. 2007. A Phase 1 Heritage Impact Assessment Study for ESKOM's proposed new 400kV Powerl Line route between the Matimba B Power Station and the Marang Substation near Rustenburg. Pretoria.

Van Schalkwyk, J.A. 1994. A survey of archaeological and cultural historical resources in the Amandelbult mining lease area. Unpublished report 94KH03. Pretoria: National Cultural History Museum.

Van Schalkwyk, J.A. 2001. A survey of cultural resources in two development areas, Amandelbult, Northern Province. Unpublished report 2001KH13. Pretoria: National Cultural History Museum.

Van Schalkwyk, J.A. 2003. A survey of archaeological sites for the Amandelbult Platinum Mine Seismic exploration program. Unpublished report 2003KH16. Pretoria: National Cultural History Museum.

Van Schalkwyk, J.A. 2004. Heritage impact report for the Amandelbult electricity sub-transmission lines, Amandelbult Platinum Mine, Limpopo Province. Unpublished report 2004KH32. Pretoria: National Cultural History Museum.

Van Schalkwyk, J. 2007. Survey of heritage resources in the location of the proposed Merensky Mining Project, Amandelbult Section, Rustenburg Platinum Mine, Limpopo Province. Prepared For WSP Environmental.

Van Vollenhoven, A. July 2013. A Report on a Cultural Heritage Impact Assessment for the Continental Limestone Mine, close to Thabazimbi, Limpopo Province.

8.3 Web Sources and Legislation

Human Tissue Act and Ordinance 7 of 1925, Government Gazette, Cape Town

National Resource Act No.25 of 1999, Government Gazette, Cape Town

SAHRA, 2005. Minimum Standards for the Archaeological and the Palaeontological Components of Impact Assessment Reports, Draft version 1.4.

www.sahra.org.za/sahris
Accessed 2021-09-25

http://csg.dla.gov.za/index.html
Accessed 2021-09-25

8.4 Archive Sources and Maps

Troye 1899: New Railway and Postal Map of the Transvaal Colony

Jeppe 1899: Map of the Transvaal or SA Republic and Surrounding Territories

9 ADDENDUM 1: SPECIALIST CV

NELIUS LE ROUX KRUGER

BHCS Hons. (Archaeology)

(Date compiled: 2021/01/10)

PERSONAL DETAILS

Nationality:	South African
Date of Birth:	3 April 1979
Postal Address:	Postnet Suite 74, Private Bag x04, Menlo Park, 0102
Work Address:	70 Regency Dr, Route 21 Business Park, Centurion, 0178
Telephone numbers:	W: +27 12 751 2160 C: +27 82 967 2131
Identity number:	790403 5029 087
Languages:	English, Afrikaans, Sepedi (Basic)

HIGHER EDUCATION

University Attended:	University of the Pretoria
Degree Obtained:	BA Archaeology *(Cum Laude)* 2002
Major Subjects:	Anthropology, Archaeology, English, Afrikaans
University Attended:	University of the Pretoria
Degree Obtained:	BHCS Hons. Archaeology (*Cum Laude)* 2004

PROFESSIONAL AFFILIATIONS

Member of the Association for South African Professional Archaeologists (ASAPA).

Member of the Council of the Association for South African Professional Archaeologists (ASAPA): CRM Portfolio

Member of the CRM Section of the Association for South African Professional Archaeologists (ASAPA).

Member of the Society of Africanist Archaeologists (SAFA).

Member of the South African Museums Association (SAMA).

Accredited Professional Archaeologist & CRM Practitioner by the Association for South African Professional Archaeologists (ASAPA) & Heritage Natal (AMAFA).

HONOURS AND AWARDS

Aage V. Jensen Development Foundation (Denmark) grant for participation in the joint SAFA/PAA Congress, Dakar, Senegal (2010).

Five Hundred Years Initiative (NRF) Research Grant (2008 – 2009).

University of Pretoria post-graduate Merit Grant for MA studies in Archaeology (2004 – 2008).

University of Pretoria (CINDEK) bursary for post-graduate studies awarded by the Centre of Indigenous Knowledge (2003).

South African Archaeological Society's Hanisch Award for best graduate student in the Department of Anthropology and Archaeology at the University of Pretoria (2003).

University of Pretoria Academic Honorary Colours (2002).

University of Pretoria Graduate Merit Grant (2002).

University of Pretoria honorarium for archaeological collections management at the Department of Archaeology and Anthropology (2001).

CURRENT STATUS

Heritage Resources Manager for Exigo Sustainability

Social impact Assessor and Research Associate for Exigo Sustainability

Associate and Unit Manager at Exigo Sustainability (formerly AGES Gauteng)

Part-time Lecturer (Archaeology) Department Anthropology and Archaeology (University of Pretoria)

SPECIALITY FIELDS

- Integrated Heritage and Archaeological Impact Assessment (Phase 1, 2 & 3), complying to SAHRA, PHRA and industry standards for heritage impact assessments.

- Industry standard Heritage Resources Management Plans, complying to SAHRA & PHRA standards for heritage impact assessments.

- Heritage destruction / alteration / excavation permitting facilitation and associated research.

- General facilitation in consultation and negotiation with heritage resources authorities (SAHRA, PHRA's).

- Heritage-related social consultation and focus group facilitation (for example, with Interested and Affected parties).

- Historical and anthropological studies.

- Heritage and Social Spatial Development Frameworks & Strategic Development Area Frameworks for municipalities.

- Industry standard and compliant Social Impact Assessments (SIA's).

- Mine Social and Labour Plans (SLP's)and social facilitation.

- Socio-cultural baseline studies and research.

- GIS and geo-spatial referencing and data analysis, heritage and social mapping.

PROFESSIONAL SKILLS & EXPERIENCE

Nelius Le Roux Kruger, an associate at Exigo Sustainability, is an accredited ASAPA (Association of Southern African Professional Archaeologists) archaeologist and Culture Resources Management (CRM) Practitioner with over 15 years' experience in the fields of heritage resources assessment, conservation management and social studies. In addition, he is involved in various aspects of social research and social impact assessment. He holds a BHCS (Hons) Archaeology degree from the University of Pretoria specializing in the Iron Age Farmer and Colonial Periods of South Africa. He has worked extensively on archaeological and heritage sites of the time periods and cultural contexts present in Southern Africa, both in the commercial and academics spheres and he holds vast experience in human remains relocation and related social consultation. Nelius has conducted social research projects across Southern Africa involving Social Impact Assessments as well as the compilation and monitoring of mining social and labor plans, public meeting facilitation and socio-cultural studies. His experience is not limited to South Africa and he has worked on archaeological and socio-cultural research projects across Africa and the Middle East. His publication record includes a number of academic publications in peer reviewed journals and books as well as a vast number of Heritage Management Reports. Nelius' expertise includes CRM assessment and management, applications in heritage legislation, Social Impact Assessment, social consulting as well as geospacing and Geographical Information Systems (GIS) applications in archaeology and CRM. Nelius is a conscientious and committed archaeologist and social scientist who is dedicated to the professionalism of the discipline of archaeology and social studies. He approaches all aspects of his specialst fields with enthusiasm, maintaining best practise at all times. When working with people, he strives to manage interpersonal communication and group dynamics with dedication, promoting positive group cohesion.

SELECTED PUBLICATIONS

Kruger, N. In Prep. Living the frontier: Ritual and Conflict in Ha-Tshirundu.
Kruger, N. 2016. Forthcoming. The Crocodile in his Pool: Notes on a significant find in the Ha-Tshirundu area, Limpopo Valley, South Africa. Nyame Akuma Bulletin of the Association of Africanist Archaeologists.
Antonites, A. & Kruger, N. et al. 2014. Report on excavations at Penge, a frst-millennium Doornkop settlement. Southern African Humanties 26:177-92
Antonites, A. & Kruger, N. 2012. **A Preliminary Assessment of Animal Distribution on a 19th Century VhaVenda Settlement. Nyame** Akuma Bulletin of the Association of Africanist Archaeologists. 2012:77
Kruger, N. In Prep. Living the frontier: Ritual and Conflict in Ha-Tshirundu.
Kruger, N. 2009. Forthcoming. The Crocodile in his Pool: Notes on a significant find in the Ha-Tshirundu area, Limpopo Valley, South Africa. Nyame Akuma Bulletin of the Association of Africanist Archaeologists.
Kruger, N. 2008. Ha Tshirundu: Landscape, Lived experience and Land Reform. Poster presented at the South African Association for Archaeologists Biannual Congress, Cape Town, March 2008.
Mathers, K. & Kruger, N. 2008. The Past is another Country: Archaeology in the Limpopo Province in Smith, A. & Gazin-

Schwartz, A (Eds.). 2008. Landscapes of Clearance: Archaeological and Anthropological Perspectives. California: Left Coast Press

SELECTED PROJECTS

NATIONAL

- Phase 1 Heritage Impact Assessment (HIA) and further heritage management for the upgrading of the Warrenton Anglo Boer War blockhouse, Warrenton, Northern Cape Province
- Phase 1 Heritage Impact Assessment (HIA) and Phase 2 Site Investigation for the restoration of the old Johannesburg Fort, Constitution Hill, Johannesburg, Gauteng Province
- Phase 1 Heritage Impact Assessment (HIA) and further heritage management for the upgrading/refurbishment of the Burgershoop MPCC, Mogale City, Gauteng Province
- Phase 1 Heritage Impact Assessment (HIA) of historical period heritage sites on the farm Roodekrans, Dullstroom area, Mpumalanga Province
- Phase 1 Heritage Impact Assessment (HIA) of a historical bridge on the farm Pienaarspoort 339jr at Delfsand, Gauteng Province
- Phase 1 Heritage Impact Basements (HIAs) for 20 PV Solar Parks on location at Upington, Kimberley, Vryburg, Kuruman, Kathu, Hotazel, Douglas, Groblershoop and Prieska, Northern Cape Province, South Africa.
- Phase 1 Heritage Impact Assessments (HIAs) for 18 large scale water supply projects on location at East London, Mthatha, Ngcobo, Barley East, Elliot, Cathcart, King Williams Town and Mdantsane, Eastern Cape Province, South Africa.
- Phase 1 Heritage Impact Assessments (HIAs) for more than 40 residential infrastructure developments across South Africa.

INTERNATIONAL

- Heritage Impact Assessment for the Kitumba Copper-Gold Project (KCGP), Zambia
- Heritage Scoping Study for the BTR Kitumba Project, Mumbwa, Zambia
- Heritage Scoping Study for the Buckreef Gold Project, Geita, Tanzania
- Phase 2 mitigation and heritage assessment of the Koidu Monkey Hill Iron Age metallurgy site, Koidu Diamond Mine, Sierra Leone
- Phase 2 heritage site mitigation of the Sessenge archaeological site, Kibali Gold Mine,Democratic Republic of the Congo

10 ADDENDUM 2: HERITAGE LEGISLATION BACKGROUND

10.1 CRM: Legislation, Conservation and Heritage Management

The broad generic term Cultural Heritage Resources refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

10.1.1 Legislation regarding archaeology and heritage sites

The South African Heritage Resources Agency (SAHRA) and their provincial offices aim to conserve and control the management, research, alteration and destruction of cultural resources of South Africa. It is therefore vitally important to adhere to heritage resource legislation at all times.

d. National Heritage Resources Act No 25 of 1999, section 35

According to the National Heritage Resources Act of 1999 a historical site is any identifiable building or part thereof, marker, milestone, gravestone, landmark or tell older than 60 years. This clause is commonly known as the "60-years clause". Buildings are amongst the most enduring features of human occupation, and this definition therefore includes all buildings older than 60 years, modern architecture as well as ruins, fortifications and Iron Age settlements. "Tell" refers to the evidence of human existence which is no longer above ground level, such as building foundations and buried remains of settlements (including artefacts).

The Act identifies heritage objects as:

- objects recovered from the soil or waters of South Africa including archaeological and palaeontological objects, meteorites and rare geological specimens
- visual art objects
- military objects
- numismatic objects
- objects of cultural and historical significance
- objects to which oral traditions are attached and which are associated with living heritage
- objects of scientific or technological interest
- any other prescribed category

With regards to activities and work on archaeological and heritage sites this Act states that:

"No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit by the relevant provincial heritage resources authority." (34. [1] 1999:58)

and

"No person may, without a permit issued by the responsible heritage resources authority-

(d) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(e) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(f) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(g) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. (35. [4] 1999:58)."

and

"No person may, without a permit issued by SAHRA or a provincial heritage resources agency-

(h) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(i) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority;

(j) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals (36. [3] 1999:60)."

e. Human Tissue Act of 1983 and Ordinance on the Removal of Graves and Dead Bodies of 1925

Graves 60 years or older are heritage resources and fall under the jurisdiction of both the National Heritage Resources Act and the Human Tissues Act of 1983. However, graves younger than 60 years are specifically protected by the Human Tissues Act (Act 65 of 1983) and the Ordinance on the Removal of Graves and Dead Bodies (Ordinance 7 of 1925) as well as any local and regional provisions, laws and by-laws. Such burial places also fall under the jurisdiction of the National Department of Health and the Provincial Health Departments. Approval for the exhumation and re-burial must be obtained from the relevant Provincial MEC as well as the relevant Local Authorities.

10.1.2 Background to HIA and AIA Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. Heritage sites are frequently threatened by development projects and both the environmental and heritage legislation require impact assessments (HIAs & AIAs) that identify all heritage resources in areas to be developed. Particularly, these assessments are required to make recommendations for protection or mitigation of the impact of the sites. HIAs and AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources including archaeological and palaeontological sites that might occur in areas of developed and (b) make recommendations for protection or mitigation of the impact on the sites.

The National Heritage Resources Act (Act No. 25 of 1999, section 38) provides guidelines for Cultural Resources Management and prospective developments:

***"38.** (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a*

development categorised as:

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site:

(i) exceeding 5 000 m^2 in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."

And:

"The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

(k) The identification and mapping of all heritage resources in the area affected;

(l) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;

(m) an assessment of the impact of the development on such heritage resources;

(n) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;

(o) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(p) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(q) plans for mitigation of any adverse effects during and after the completion of the proposed development (38. [3] 1999:64)."

Consequently, section 35 of the Act requires Heritage Impact Assessments (HIAs) or Archaeological Impact Assessments (AIAs) to be done for such developments in order for all heritage resources, that is, all places or objects of aesthetics, architectural, historic, scientific, social, spiritual, linguistic or technological value or significance to be protected. Thus any assessment should make provision for the protection of all these heritage components, including archaeology, shipwrecks, battlefields, graves, and structures older than 60

years, living heritage, historical settlements, landscapes, geological sites, palaeontological sites and objects. Heritage resources management and conservation.

10.2 Assessing the Significance of Heritage Resources

Archaeological sites, as previously defined in the National Heritage Resources Act (Act 25 of 1999) are places in the landscape where people have lived in the past – generally more than 60 years ago – and have left traces of their presence behind. In South Africa, archaeological sites include hominid fossil sites, places where people of the Earlier, Middle and Later Stone Age lived in open sites, river gravels, rock shelters and caves, Iron Age sites, graves, and a variety of historical sites and structures in rural areas, towns and cities. Palaeontological sites are those with fossil remains of plants and animals where people were not involved in the accumulation of the deposits. The basic principle of cultural heritage conservation is that archaeological and other heritage sites are valuable, scarce and *non-renewable.* Many such sites are unfortunately lost on a daily basis through development for housing, roads and infrastructure and once archaeological sites are damaged, they cannot be re-created as site integrity and authenticity is permanently lost. Archaeological sites have the potential to contribute to our understanding of the history of the region and of our country and continent. By preserving links with our past, we may not be able to revive lost cultural traditions, but it enables us to appreciate the role they have played in the history of our country.

- Categories of significance

Rating the significance of archaeological sites, and consequently grading the potential impact on the resources is linked to the significance of the site itself. The significance of an archaeological site is based on the amount of deposit, the integrity of the context, the kind of deposit and the potential to help answer present research questions. Historical structures are defined by Section 34 of the National Heritage Resources Act, 1999, while other historical and cultural significant sites, places and features, are generally determined by community preferences. The guidelines as provided by the NHRA (Act No. 25 of 1999) in Section 3, with special reference to subsection 3 are used when determining the cultural significance or other special value of archaeological or historical sites. In addition, ICOMOS (the Australian Committee of the International Council on Monuments and Sites) highlights four cultural attributes, which are valuable to any given culture:

- *Aesthetic value:*

Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria include consideration of the form, scale, colour, texture and material of the fabric, the general atmosphere associated with the place and its uses and also the aesthetic values commonly assessed in the analysis of landscapes and townscape.

- *Historic value:*

Historic value encompasses the history of aesthetics, science and society and therefore to a large extent underlies all of the attributes discussed here. Usually a place has historical value because of some kind of influence by an event, person, phase or activity.

- *Scientific value:*

The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality and on the degree to which the place may contribute further substantial information.

- *Social value:*

Social value includes the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a certain group.

It is important for heritage specialist input in the EIA process to take into account the heritage management structure set up by the NHR Act. It makes provision for a 3-tier system of management including the South Africa Heritage Resources Agency (SAHRA) at a national level, Provincial Heritage Resources Authorities (PHRAs) at a provincial and the local authority. The Act makes provision for two types or forms of protection of heritage resources; i.e. formally protected and generally protected sites:

Formally protected sites:

- Grade 1 or national heritage sites, which are managed by SAHRA
- Grade 2 or provincial heritage sites, which are managed by the provincial HRA (MP-PHRA).
- Grade 3 or local heritage sites.

Generally protected sites:

- Human burials older than 60 years.
- Archaeological and palaeontological sites.
- Shipwrecks and associated remains older than 60 years.
- Structures older than 60 years.

With reference to the evaluation of sites, the certainty of prediction is definite, unless stated otherwise and if the significance of the site is rated high, the significance of the impact will also result in a high rating. The same rule applies if the significance rating of the site is low. The significance of archaeological sites is generally
ranked into the following categories.

Significance	Rating Action
No significance: sites that do not require mitigation.	None
Low significance: sites, which may require mitigation.	2a. Recording and documentation (Phase 1) of site; no further action required 2b. Controlled sampling (shovel test pits, auguring), mapping and documentation (Phase 2 investigation); permit required for sampling and destruction
Medium significance: sites, which require mitigation.	3. Excavation of representative sample, C14 dating, mapping and documentation (Phase 2 investigation); permit required for sampling and destruction [including 2a & 2b]
High significance: sites, where disturbance should be avoided.	4a. Nomination for listing on Heritage Register (National, Provincial or Local) (Phase 2 & 3 investigation); site management plan; permit required if utilised for education or tourism
High significance: Graves and burial places	4b. Locate demonstrable descendants through social consulting; obtain permits from applicable legislation, ordinances and regional by-laws; exhumation and reinternment [including 2a, 2b & 3]

Furthermore, the significance of archaeological sites was based on six main criteria:

- Site integrity (i.e. primary vs. secondary context),
- Amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter),
- Social value,
- Uniqueness, and
- Potential to answer current and future research questions.

11 ADDENDUM 3: IMPACT ASSESSMENT METHODOLOGY

11.1.1 Issues Identification Matrix

impacts were rated and assessed using an Impact and Risk Assessment Methodology provided by CES, for the Scoping Phase of the EIA process in accordance with the requirement of EIA Regulations. Here, two parameters and five factors are considered when assessing the significance of the identified issues, and each is scored. ***Significance*** is achieved by ranking the five criteria presented in Table 1 below, to determine the overall significance of an issue. The ranking for the "effect" (which includes scores for duration; extent; consequence and probability) and reversibility / mitigation are then read off the matrix presented in Table 2 below, to determine the overall significance of the issue. The overall significance is either negative or positive.

- ***Duration*** - The temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.

- ***Extent*** - The spatial scale defines the physical extent of the impact.

- ***Consequence*** - The consequence scale is used in order to, as far as possible, objectively evaluate how severe a number of negative impacts associated with the issue
under consideration might be, or how beneficial a number of positive impacts associated with the issue under consideration might be.

- The ***probability*** of the impact occurring - The likelihood of impacts taking place as a result of project actions arising from the various alternatives. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development and alternatives. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.

- ***Reversibility / Mitigation*** – The degree of difficulty of reversing and/or mitigating the various impacts ranges from easily achievable to very difficult. The four categories used are listed and explained in Table 1 below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

11.1.2 Assessing Impacts

The CES rating scale used in this assessment takes into consideration the following criteria, and includes the new criteria for assessing post mitigation significance (residual impacts), by incorporating the principles of reversibility and irreplaceability:
- **Nature of impact** (Negative or positive impact on the environment).
- **Type of impact** (Direct, indirect and/or cumulative effect of impact on the environment).
- **Duration, Extent, Probability** (see **Table** below)

Duration (Temporal Scale)		Score
Short term	Less than 5 years	1
Medium term	Between 5-20 years	2
Long term	Between 20 and 40 years (a generation) and from a human perspective also permanent	3
Permanent	Over 40 years and resulting in a permanent and lasting change that will always be there	4
Extent (Spatial Scale)		
Localised	At localised scale and a few hectares in extent	1
Study Area	The proposed site and its immediate environs	2
Regional	District and Provincial level	3
National	Country	3
International	Internationally	4
Probability (Likelihood)		
Unlikely	The likelihood of these impacts occurring is slight	1
May Occur	The likelihood of these impacts occurring is possible	2
Probable	The likelihood of these impacts occurring is probable	3
Definite	The likelihood is that this impact will definitely occur	4

- **Severity or benefits**

Impact Severity (The severity of negative impacts, or how beneficial positive impacts would be on a particular affected system or affected party)		Score
Very severe	**Very beneficial**	**4**
An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.	
Severe	**Beneficial**	**3**
Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.	
Moderately severe	**Moderately beneficial**	**2**
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing the sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.	
Slight	**Slightly beneficial**	**1**
Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.	
No effect	**Don't know/Can't know**	
The system(s) or party(ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.	

** In certain cases it may not be possible to determine the severity of an impact thus it may be determined: Don't know/Can't know*

The scores for the three criteria in the Tables above are added to obtain a composite score. They must then be considered against the severity rating to determine the overall significance of an activity. This is because the severity of the impact is far more important than the other three criteria. The overall significance is then obtained by reading off the matrix presented in the table below. The overall significance is either negative or positive (Criterion 1) and direct, indirect or cumulative (Criterion 2).

SEVERITY	COMPOSITE DURATION, EXTENT & PROBABILITY SCORE									
	3	4	5	6	7	8	9	10	11	12
Slight	3	4	5	6	7	8	9	10	11	12
Mod severe	3	4	5	6	7	8	9	10	11	12
Severe	3	4	5	6	7	8	9	10	11	12
Very severe	3	4	5	6	7	8	9	10	11	12

The **environmental significance** scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of especially a social nature need to reflect the values of the affected society.

OVERALL SIGNIFICANCE *(The combination of all the above criteria as an overall significance)*	
VERY HIGH NEGATIVE	**VERY BENEFICIAL**
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects. *Example: The loss of a species would be viewed by informed society as being of VERY HIGH significance.* *Example: The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.*	
HIGH NEGATIVE	**BENEFICIAL**
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light. *Example: The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated.* *Example: The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.*	
MODERATE NEGATIVE	**SOME BENEFITS**
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. *Example: The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.*	
LOW NEGATIVE	**FEW BENEFITS**
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. *Example: The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels.* *Example: The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.*	
NO SIGNIFICANCE	
There are no primary or secondary effects at all that are important to scientists or the public. *Example: A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.*	
DON'T KNOW	
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. *Example: The effect of a particular development on people's psychological perspective of the environment.*	

11.1.3 Post Mitigation Significance

Once mitigation measure are proposed, the following criteria are then used to determine the overall post mitigation significance of the impact:

- Reversibility: The degree to which an environment can be returned to its original/partially original state.
- Irreplaceable loss: The degree of loss which an impact may cause.
- Mitigation potential: The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. The four categories used are listed and explained in Table 5 below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

Reversibility	
Reversible	*The activity will lead to an impact that can be reversed provided appropriate mitigation measures are implemented.*
Irreversible	*The activity will lead to an impact that is permanent regardless of the implementation of mitigation measures.*
Irreplaceable loss	
Resource will not be lost	*The resource will not be lost/destroyed provided mitigation measures are implemented.*
Resource will be partly lost	*The resource will be partially destroyed even though mitigation measures are implemented.*
Resource will be lost	*The resource will be lost despite the implementation of mitigation measures.*
Mitigation potential	
Easily achievable	*The impact can be easily, effectively and cost effectively mitigated/reversed.*
Achievable	*The impact can be effectively mitigated/reversed without much difficulty or cost.*
Difficult	*The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs.*
Very Difficult	*The impact could be mitigated/reversed but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly.*

12 ADDENDUM 4: CONVENTIONS USED TO ASSESS THE SIGNIFICANCE OF HERITAGE

12.1 Site Significance Matrix

According to the NHRA, Section 2(vi) the **significance** of heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these. The following matrix is used for assessing the significance of each identified site/feature.

2. SITE EVALUATION			
2.1 Heritage Value (NHRA, section 2 [3])	High	Medium	Low
It has importance to the community or pattern of South Africa's history or pre-colonial history.			
It possesses unique, uncommon, rare or endangered aspects of South Africa's natural or cultural heritage.			
It has potential to yield information that will contribute to an understanding of South Africa's natural and cultural heritage.			
It is of importance in demonstrating the principle characteristics of a particular class of South Africa's natural or cultural places or objects.			
It has importance in exhibiting particular aesthetic characteristics valued by a particular community or cultural group.			
It has importance in demonstrating a high degree of creative or technical achievement at a particular period.			
It has marked or special association with a particular community or cultural group for social, cultural or spiritual reasons (sense of place).			
It has strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.			
It has significance through contributing towards the promotion of a local sociocultural identity and can be developed as a tourist destination.			
It has significance relating to the history of slavery in South Africa.			
It has importance to the wider understanding of temporal changes within cultural landscapes, settlement patterns and human occupation.			
2.2 Field Register Rating			
National/Grade 1 [should be registered, retained]			
Provincial/Grade 2 [should be registered, retained]			
Local/Grade 3A [should be registered, mitigation not advised]			
Local/Grade 3B [High significance; mitigation, partly retained]			
Generally Protected A [High/Medium significance, mitigation]			
Generally protected B [Medium significance, to be recorded]			
Generally Protected C [Low significance, no further action]			
2.3 Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Local			
Specific community			

12.2 Impact Assessment Criteria

The following table provides a guideline for the rating of impacts and recommendation of management actions for sites of heritage potential.

Significance of the heritage resource

This is a statement of the nature and degree of significance of the heritage resource being affected by the activity. From a heritage management perspective, it is useful to distinguish between whether the significance is embedded in the physical fabric or in associations with events or persons or in the experience of a place; i.e. its visual and non-visual qualities. This statement is a primary informant to the nature and degree of significance of an impact and thus needs to be thoroughly considered. Consideration needs to be given to the significance of a heritage resource at different scales (i.e. site-specific, local, regional, national or international) and the relationship between the heritage resource, its setting and its associations.

Nature of the impact

This is an assessment of the nature of the impact of the activity on a heritage resource, with some indication of its positive and/or negative effect/s. It is strongly informed by the statement of resource significance. In other words, the nature of the impact may be historical, aesthetic, social, scientific, linguistic or architectural, intrinsic, associational or contextual (visual or non-visual). In many cases, the nature of the impact will include more than one value.

Extent

Here it should be indicated whether the impact will be experienced:

- On a site scale, i.e. extend only as far as the activity;
- Within the immediate context of a heritage resource;
- On a local scale, e.g. town or suburb
- On a metropolitan or regional scale; or
- On a national/international scale.

Duration

Here it should be indicated whether the lifespan of the impact will be:

- Short term, (needs to be defined in context)
- Medium term, (needs to be defined in context)
- Long term where the impact will persist indefinitely, possibly beyond the operational life of the activity, either because of natural processes or by human intervention; or
- Permanent where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Of relevance to the duration of an impact are the following considerations:

- Reversibility of the impact; and
- Renewability of the heritage resource.

Intensity

Here it should be established whether the impact should be indicated as:

- Low, where the impact affects the resource in such a way that its heritage value is not affected;
- Medium, where the affected resource is altered but its heritage value continues to exist albeit in a modified way; and
- High, where heritage value is altered to the extent that it will temporarily or permanently be damaged or destroyed.

Probability

This should describe the likelihood of the impact actually occurring indicated as:

- Improbable, where the possibility of the impact to materialize is very low either because of design or historic experience;
- Probable, where there is a distinct possibility that the impact will occur;
- Highly probable, where it is most likely that the impact will occur; or
- Definite, where the impact will definitely occur regardless of any mitigation measures

Confidence

This should relate to the level of confidence that the specialist has in establishing the nature and degree of impacts. It relates to the level and reliability of information, the nature and degree of consultation with I&AP's and the dynamic of the broader socio-political context.

- High, where the information is comprehensive and accurate, where there has been a high degree of consultation and the socio-political context is relatively stable.
- Medium, where the information is sufficient but is based mainly on secondary sources, where there has been a limited targeted consultation and socio-political context is fluid.
- Low, where the information is poor, a high degree of contestation is evident and there is a state of socio-political flux.

Impact Significance

The significance of impacts can be determined through a synthesis of the aspects produced in terms of the nature and degree of heritage significance and the nature, duration, intensity, extent, probability and confidence of impacts and can be described as:

- Low; where it would have a negligible effect on heritage and on the decision
- Medium, where it would have a moderate effect on heritage and should influence the decision.
- High, where it would have, or there would be a high risk of, a big effect on heritage. Impacts of high significance should have a major influence on the decision;
- Very high, where it would have, or there would be high risk of, an irreversible and possibly irreplaceable negative impact on heritage. Impacts of very high significance should be a central factor in decision-making.

12.3 Direct Impact Assessment Criteria

The following table provides an outline of the relationship between the significance of a heritage context, the intensity of development and the significance of heritage impacts to be expected

	TYPE OF DEVELOPMENT			
HERITAGE CONTEXT	**CATEGORY A**	**CATEGORY B**	**CATEGORY C**	**CATEGORY D**
CONTEXT 1 High heritage Value	Moderate heritage impact expected	High heritage impact expected	Very high heritage impact expected	Very high heritage impact expected
CONTEXT 2 Medium to high heritage value	Minimal heritage impact expected	Moderate heritage impact expected	High heritage impact expected	Very high heritage impact expected
CONTEXT 3 Medium to low heritage value	Little or no heritage impact expected	Minimal heritage impact expected	Moderate heritage impact expected	High heritage impact expected
CONTEXT 4 Low to no heritage value	Little or no heritage impact expected	Little or no heritage impact expected	Minimal heritage value expected	Moderate heritage impact expected

NOTE: A DEFAULT "LITTLE OR NO HERITAGE IMPACT EXPECTED" VALUE APPLIES WHERE A HERITAGE RESOURCE OCCURS OUTSIDE THE IMPACT ZONE OF THE DEVELOPMENT.

HERITAGE CONTEXTS	**CATEGORIES OF DEVELOPMENT**
Context 1: Of high intrinsic, associational and contextual heritage value within a national, provincial and local context, i.e. formally declared or potential Grade 1, 2 or 3A heritage resources **Context 2:** Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3B heritage resources. **Context 3:**	**Category A: Minimal intensity development** - No rezoning involved; within existing use rights. - No subdivision involved. - Upgrading of existing infrastructure within existing envelopes - Minor internal changes to existing structures - New building footprints limited to less than 1000m2. **Category B: Low-key intensity development** - Spot rezoning with no change to overall zoning of a site. - Linear development less than 100m

Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3C heritage resources **Context 4:** Of little or no intrinsic, associational or contextual heritage value due to disturbed, degraded conditions or extent of irreversible damage.	- Building footprints between 1000m2-2000m2 - Minor changes to external envelop of existing structures (less than 25%) - Minor changes in relation to bulk and height of immediately adjacent structures (less than 25%). **Category C: Moderate intensity development** - Rezoning of a site between 5000m2-10 000m2. - Linear development between 100m and 300m. - Building footprints between 2000m2 and 5000m2 - Substantial changes to external envelop of existing structures (more than 50%) - Substantial increase in bulk and height in relation to immediately adjacent buildings (more than 50%) **Category D: High intensity development** - Rezoning of a site in excess of 10 000m2 - Linear development in excess of 300m. - Any development changing the character of a site exceeding 5000m2 or involving the subdivision of a site into three or more erven. - Substantial increase in bulk and height in relation to immediately adjacent buildings (more than 100%)

12.4 Management and Mitigation Actions

The following table provides a guideline of relevant heritage resources management actions is vital to the conservation of heritage resources.

No further action / Monitoring

Where no heritage resources have been documented, heritage resources occur well outside the impact zone of any development or the primary context of the surroundings at a development footprint has been largely destroyed or altered, no further immediate action is required. Site monitoring during development, by an ECO or the heritage specialist are often added to this recommendation in order to ensure that no undetected heritage\ remains are destroyed.

Avoidance

This is appropriate where any type of development occurs within a formally protected or significant or sensitive heritage context and is likely to have a high negative impact. Mitigation is not acceptable or not possible. This measure often includes the change / alteration of development planning and therefore impact zones in order not to impact on resources.

Mitigation

This is appropriate where development occurs in a context of heritage significance and where the impact is such that it can be mitigated to a degree of medium to low significance, e.g. the high to medium impact of a development on an archaeological site could be mitigated through sampling/excavation of the remains. Not all negative impacts can be mitigated.

Compensation

Compensation is generally not an appropriate heritage management action. The main function of management actions should be to conserve the resource for the benefit of future generations. Once lost it cannot be renewed. The circumstances around the potential public or heritage benefits would need to be exceptional to warrant this type of action, especially in the case of where the impact was high.

Rehabilitation

Rehabilitation is considered in heritage management terms as a intervention typically involving the adding of a new heritage layer to enable a new sustainable use. It is not appropriate when the process necessitates the removal of previous historical layers, i.e. restoration of a building or place to the previous state/period. It is an appropriate heritage management action in the following cases:

- The heritage resource is degraded or in the process of degradation and would benefit from rehabilitation.
- Where rehabilitation implies appropriate conservation interventions, i.e. adaptive reuse, repair and maintenance, consolidation and minimal loss of historical fabric.
- Where the rehabilitation process will not result in a negative impact on the intrinsic value of the resource.

Enhancement

APPENDIX C4 -
TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT

SCIENTIFIC TERRESTRIAL SERVICES

TERRESTRIAL BIODIVERSITY ASSESSMENT

AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESS FOR THE PROPOSED IMPROVEMENT OF NATIONAL ROAD R516 SECTION 1 FROM R511 (STARTING AT 0.00 KM) TO TOOYSPRUIT (ENDING AT 36.67 KM), LIMPOPO PROVINCE

Prepared for:	BVI Consulting Engineers
Prepared by:	Scientific Terrestrial Services CC
Report author:	D. van der Merwe S. L Daniels F. Mamphoka (Cand. Sci. Nat)
Report reviewers:	C. Hooton N. Cloete (Pr. Sci. Nat)
Report reference:	STS 210050
Date:	July 2022

Part of the SAS Environmental Group of Companies

Website: http://www.sasenvironmental.co.za

EXECUTIVE SUMMARY

Scientific Terrestrial Services CC (STS) was appointed by BVI Consulting Engineers to conduct a terrestrial biodiversity assessment as part of the Environmental Authorisation (EA) process for the proposed improvement of the national road R516 in the Limpopo Province. The portion of the R516 road earmarked for improvement covers a total distance of approximately 83.80 km. However, for the purpose of the EA, the road has been split into two sections, hereafter referred to as the "R516_L_75" and "R516_L_83", and thus separate reports produced for each section of the road. The R516_L_75 road upgrade project starts at Doornfontein (at start mark of 0 km) and ends at the Tooyspruit (at 36.67 km). The field assessment focussed on assessing the habitat of the road reserve associated with the R516_l_75. For the purpose of this report, the R516_L_75 and its associated road reserve is referred to as the study area.

Following the field assessment, three habitat units could be distinguished for the study area. The habitat units were determined based on species composition, vegetation structure, ecological function, biophysical environment, and habitat condition:

- **Mowed Road Verge Habitat**: this habitat unit was largely homogenous and consisted of mowed grassy areas with occasional, scattered trees. Overall, this habitat unit supported a moderately low species diversity of both faunal and floral species;
- **Mixed Bushveld:** this habitat was associated with areas next to the Mowed Road Verge Habitat (usually fenced off from this habitat and comprised of privately owned farms and land). Typically, this habitat was characterised by the presence of a well-developed tree layer; and
- **Freshwater Habitat**: this habitat unit traversed several watercourses as defined in the National Water Act, 1998 (Act No. 36 of 1998) (NWA) (e.g., the Tooypruit), as well as several preferential flow paths which are not considered true watercourses as defined by the NWA. During the time of the field assessment, most of the Freshwater Habitat features were dry. Both the watercourses and the preferential flow paths supported a similar floral composition and structure, hence the classification as one habitat unit. This features, which should act as corridors no longer perform this function as fencing reduces the potential movement of fauna.

The sensitivities, from a combined floral and faunal perspective, of each of the habitat units, were as follows: the Mowed Road Verge Habitat was of a **moderately low sensitivity,** whereas the Freshwater and Mixed Bushveld Habitat were of **intermediate sensitivity**.

No Red Data List (RDL) species, Threatened or Protected Species (TOPS), or species listed under the Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003) (LEMA) were observed during the field assessment. However, two protected tree species as per the National Forest Act, 1998 (Act No. 84 of 1998) (NFA), namely *Sclerocarya birrea* subsp*. caffra* and *Combretum imberbe,* were identified within the study area. If the proposed road upgrade is authorised, all species of conservation concern (SCC) recorded during the field assessment (i.e., the two NFA species) should, where possible, be relocated to suitable habitat outside the direct footprint (as far as is feasible). Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. From a faunal perspective no SCC are anticipated to utilize the R516_L_75 study area as habitat on a permanent basis. It is possible, as the adjacent habitats are natural habitat where many nature reserves persist, that several SCC may cross the road in search of resources. Where feasible, rescue and relocation should be done by a suitably qualified specialist. Any other floral or faunal SCC encountered during the construction phase of the proposed development should also be relocated by a suitably qualified specialist and, where required, the necessary permits should be applied for.

The study area is not located within a threatened vegetation type or within a protected area. According to the Limpopo Conservation Plan, the study area is located within a CBA1, ESA1, and ESA2. Given 1) the largely modified nature and lowered capacity to provide suitable habitat for SCC and provide intact landscape corridors (i.e., within the Mowed Road Verge Habitat) or 2) localised extent and location immediately adjacent to the road verge (i.e., within the Mixed Bushveld), no CBA1 habitat was identified within the study area. No ESA habitat was identified within the Mowed Road Verge Habitat, although the propensity of the Freshwater habitat to provide functions of ESA habitat is apparent (this habitat does provide dispersal corridors, albeit in a modified and limited fashion). Furthermore, the Mixed Bushveld habitat is considered to provide ESA habitat that functions in connectivity with the greater surrounding areas. As such, impacts to ESA habitat within the Freshwater Habitat and Mixed Bushveld are anticipated with the proposed road upgrade activities. However, if mitigation measures are appropriately implemented, the associated impacts to the ESA habitat can be reduced to lower levels.

The floral impact significance prior to the implementation of mitigation measures varied between medium and low for the Mowed Road Verge Habitat, The Mixed Bushveld habitat and the Freshwater Habitat and was low for the Transformed Habitat. With the implementation of mitigation measures, the proposed impact significance was reduced.

It is recommended that current (decommissioned and/or unused) infrastructure e.g., bridges (see section 6.1 for details) be investigated for potential use during the proposed road upgrade to minimise vegetation clearance and/or infrastructure wastage.

It is the opinion of the ecologists that this study provides the relevant information required to implement Integrated Environmental Management (IEM) and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development.

DOCUMENT GUIDE

The table below provides a guide to the reporting of biodiversity impacts as they relate to 1) Government Notice No. 320 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on **Terrestrial Biodiversity** as published in Government Gazette 43110 dated 20 March 2020, and 2) Government Notice No. 1150 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on **Terrestrial Plant and Animal Species** as published in Government Gazette 43855 dated 30 October 2020.

Theme-Specific Requirements as per Government Notice No. 320 Terrestrial Biodiversity Theme – Very High Sensitivity Rating as per Screening Tool Output		
No.	SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS	Section in report/Notes
2	Terrestrial Biodiversity Specialist Assessment	
2.1	The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.	Appendix J
2.2	The assessment must be undertaken on the preferred site and within the proposed development footprint.	Section 1
2.3	The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:	
2.3.1	A description of the ecological drivers or processes of the system and how the proposed development will impact these;	Section 4
2.3.2	Ecological functioning and ecological processes (e.g., fire, migration, pollination, etc.) that operate within the preferred site;	Section 4
2.3.3	The ecological corridors that the proposed development would impede including migration and movement of flora and fauna;	Section 4
2.3.4	The description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Area (*FEPA*) sub catchments;	Section 4
2.3.5	A description of terrestrial biodiversity and ecosystems on the preferred site, including: a) main vegetation types; b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified; c) ecological connectivity, habitat fragmentation, ecological processes and fine scale habitats; and d) species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified;	Section 3 (desktop analysis)
2.3.6	The assessment must identify any alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification; and	Not Applicable.
2.3.7	The assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:	
2.3.7.1	Terrestrial Critical Biodiversity Areas (CBAs), including: *a) the reasons why an area has been identified as a CBA;* *b) an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;* *c) the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);* *d) the impact on ecosystem threat status;* *e) the impact on explicit subtypes in the vegetation;* *f) the impact on overall species and ecosystem diversity of the site; and* g) *the impact on any changes to threat status of populations of species of conservation concern in the CBA;*	Section 3 (desktop analysis) and 4
2.3.7.2	Terrestrial Ecological Support Areas (ESAs), including:	

	a) the impact on the ecological processes that operate within or across the site; *b) the extent the proposed development will impact on the functionality of the ESA; and* c) *loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;*	
2.3.7.3	Protected areas as defined by the National Environmental Management: Protected Areas Act, 2003 including- *a) an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;*	Section 3 (desktop analysis)
2.3.7.4	Priority areas for protected area expansion, including- *a) the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network;*	Section 3 (desktop analysis)
2.3.7.5	SWSAs including: *a) the impact(s) on the terrestrial habitat of a SWSA; and* b) *the impacts of the proposed development on the SWSA water quality and quantity (e.g., describing potential increased runoff leading to increased sediment load in water courses);*	Section 3 (desktop analysis)
2.3.7.6	FEPA sub catchments, including- *a) the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;*	Not Applicable
2.3.7.7	Indigenous forests, including: *a) impact on the ecological integrity of the forest; and* b) *percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.*	Not Applicable
2.4	The findings of the assessment must be written up in a Terrestrial Biodiversity Specialist Assessment Report.	
	Results of the Floral Assessment as well as conclusions on Terrestrial Biodiversity as it relates to vegetation communities and the results of the Faunal Assessment as well as conclusions on Terrestrial Biodiversity as it relates to faunal communities are in Sections 4 – 6.	
3	Terrestrial Biodiversity Specialist Assessment Report	
3.1	The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:	
3.1.1	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Appendix J
3.1.2	A signed statement of independence by the specialist;	Appendix J
3.1.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 1.2
3.1.4	A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Section 2 Appendices C, D & E
3.1.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.2
3.1.6	A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	Section 5
	Impact Assessment Requirements 3.1.7 Additional environmental impacts expected from the proposed development; 3.1.8 Any direct, indirect and cumulative impacts of the proposed development; 3.1.9 The degree to which impacts and risks can be mitigated; 3.1.10 The degree to which the impacts and risks can be reversed; 3.1.11 The degree to which the impacts and risks can cause loss of irreplaceable resources;	Section 6

	3.1.12 Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	
3.1.13	A motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	Not Applicable to this report
3.1.14	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Executive Summary & Section 7
3.1.15	Any conditions to which this statement is subjected.	Section 5 & 6
3.2	The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.	This report is submitted to the EAP and applicant and will be appended to the EIA / EMP by the EAP in due course as part of the application process
3.3	A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY OF TERMS

Most definitions are based on terms and concepts elaborated by Richardson *et al*. (2011), Hui and Richardson (2017) and Wilson *et al*. (2017), with consideration to their applicability in the South African context, especially South African legislation [notably the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA), and the associated Alien and Invasive Species Regulations, 2020].

Alien species (syn. exotic species; non-native species)	A species that is present in a region outside its natural range due to human actions (intentional or accidental) that have enabled it to overcome biogeographic barriers.
Biological diversity or Biodiversity (as per the definition in NEMBA)	The variability among living organisms from all sources including, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.
Biome - as per Mucina and Rutherford (2006)	A broad ecological spatial unit representing major life zones of large natural areas – defined mainly by vegetation structure, climate, and major large-scale disturbance factors (such as fires).
Bioregion (as per the definition in NEMBA)	A geographic region which has in terms of section 40(1) been determined as a bioregion for the purposes of this Act;
Critical Biodiversity Area (CBA)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation, and ridges.
Corridor	A dispersal route or a physical connection of suitable habitats linking previously unconnected regions.
Disturbance	A temporal change, either regular or irregular (uncertain), in the environmental conditions that can trigger population fluctuations and secondary succession. Disturbance is an important driver of biological invasions.
Ecoregion	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Endangered	Organisms in danger of extinction if causal factors continue to operate.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g., southern Africa), national (South Africa), provincial, regional, or even within a particular mountain range.
Ecological Support Area (ESA)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
Ground-truth	Ground truth is a term used in various fields to refer to information provided by direct observation (i.e., empirical evidence) as opposed to information provided by inference.
Habitat (as per the definition in NEMBA)	A place where a species or ecological community naturally occurs.
Important Bird and Biodiversity Area (IBA)	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
Indigenous vegetation (as per the definition in NEMA)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
Invasive species	Alien species that sustain self-replacing populations over several life cycles, produce reproductive offspring, often in very large numbers at considerable distances from the parent and/or site of introduction, and have the potential to spread over long distances.
Listed alien species	All alien species that are regulated in South Africa under the NEMBA, Alien and Invasive Species Regulations, 2020.
Least Threatened	Least threatened ecosystems are still largely intact.
Native species (syn. indigenous species)	Species that are found within their natural range where they have evolved without human intervention (intentional or accidental). Also includes species that have expanded their range as a result of human modification of the environment that does not directly impact dispersal (e.g., species are still native if they increase their range as a result of watered

	gardens but are alien if they increase their range as a result of spread along human-created corridors linking previously separate biogeographic regions).
Red Data Listed (RDL) species	According to the Red List of South African plants (http://redlist.sanbi.org/) and the International Union for Conservation of Nature (IUCN), organisms that fall into the Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
Species of Conservation Concern (SCC)	The term SCC in the context of this report refers to all RDL and IUCN listed threatened species as well as protected species of relevance to the project.

LIST OF ACRONYMS

AIP	Alien and Invasive Plant
BGIS	Biodiversity Geographic Information Systems
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CR	Critically Endangered
DFFE	Department of Forestry, Fisheries, and the Environment
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
E-GIS	Environmental Geographical Information Systems
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
EW	Extinct in the Wild
GBIF	Global Biodiversity Information Facility
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
Ha	Hectare
IBA	Important Bird and Biodiversity Area
IEM	Integrated Environmental Management
IUCN	International Union for Conservation of Nature
LC	Least Concern
LEDET	Limpopo Department of Economic Development, Environment & Tourism
LEMA	Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003)
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential Evaporation
MASMS	Mean Annual Soil Moisture Stress (% of days when evaporative demand was more than double the soil moisture supply)
MAT	Mean Annual Temperature
MFD	Mean Frost Days
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMPPA	National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)
NPAES	National Protected Area Expansion Strategy
P	Protected
PES	Present Ecological State
POC	Probability of Occurrence
QDS	Quarter Degree Square
RDL	Red Data Listed
SABAP 2	South African Bird Atlas Project 2
SACAD	South African Conservation Areas Database
SACNASP	South African Council for Natural Scientific Professionals
SANBI	South African National Biodiversity Institute
SanParks	South African National Parks
SAPAD	South African Protected Areas Database
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services CC
SWSA	Strategic Water Source Area
TOPS	Threatened or Protected Species
TSP	Threatened Species Programme
VEGMAP	National Vegetation Map Project
VU	Vulnerable
WSAs	Water Source Areas

1. INTRODUCTION

Scientific Terrestrial Services CC (STS) was appointed by BVI Consulting Engineers to conduct a terrestrial biodiversity assessment as part of the Environmental Authorisation (EA) process for the proposed improvement of the national road R516 in the Limpopo Province. The portion of the R516 road earmarked for improvement covers a total distance of approximately 83.80 km. However, for the purpose of the EA, the road has been split into two sections, hereafter, referred to as the "R516_L_75" and the "R516_L_83", and thus separate reports are produced for each section of the road. The R516_L_75 (STS 210050, 2021, i.e., this report) road upgrade project starts at Doorsfontein (at start mark of 0 km) and ends at the Tooyspruit (at marker 36.67 km). The R516_L_83 (STS 210051, 2021) extends from the Tooyspruit (from the 36.67 km mark) and ends in Bela-Bela where it intersects the R101 at marker 83.80 km. This report focuses on the R516_L_75 road upgrade and, for the purpose of this report, are henceforth referred to as the "study area".

The study area is located within the Thabazimbi Local Municipality, which is an administrative area within the Waterberg District Municipality and extends from the intersection with Road R511 (Brits to Thabazimbi road) in the town of Doorsfontein in an easterly direction until it terminates at marker 36.67 km in the town of Tooyspruit. Currently, the study area consists of a two-lane, single carriageway road with gravel shoulders along most of the route. The road has an average surfaced width of 7 m and each shoulder is ± 1.5 m wide. The road reserve width varies between 35 m and 40 m. This rural section of the R516 road can be classified as a Class 2[1] rural major arterial road. The settlement development environment along the road is rural farmland.

This report, after consideration of the description of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP), the regulatory authorities and the developing proponent, by means of the presentation of results and recommendations as to the viability of the proposed development activities from a biodiversity resource management perspective.

[1] According to the TRH 26 South African Road Classification and Access Management Manual, class 2 roads are major arterial roads whose function is mobility. Arterial roads are vehicle priority, access managed, mobility routes whose major function is to provide for movement of person and goods vehicles between cities, towns, or urban districts with as few restrictions as possible.

1.1 Project Description

The improvement of the existing National Route R516, Section 1 from the R511 (starting at marker 0.0 km) to the town of Tooyspruit (ending at marker 36.67 km) in the Limpopo Province has been proposed. The project route is a 36.67 km long road section comprised of a two-lane single carriageway with an average paved width of 7 m, 1.5 m gravel shoulders and a ± 40 m wide road reserve.

The proposed project will entail the widening of the existing road, bridges and culverts. During the proposed improvement activities, a temporary bypass will be required. This bypass, referred to as Bypass C3408: km7,5 is located at the 7.5 km mark of the R516. Furthermore, a proposed road realignment of the D928: Assen (with associated drainage infrastructure (i.e., culverts)) is also proposed.

The objective of this project is to improve the road to relieve congestion to acceptable levels of service, improve road safety, and provide adequate pavement capacity for the design period. The proposed design cross-section includes two 3.7 m lanes with 3 m surfaced shoulders for improved safety and future road maintenance. This will include widening the bridges and drainage infrastructure where necessary. Materials will be sourced from a nearby quarry, pending further investigation. Major aspects of the improvement project include the following:

General Roadworks:

- Rehabilitating the existing road pavement;
- Realignment of four sub-standard vertical curves to comply with the requirements for a 120km/h design speed. Earthworks are required at two of these curves with the existing cutting extended to a maximum of 2.5 m;
- Widening of the current road cross-section to 3.7 m lanes and 3.0 m surfaced shoulders;
- Addition of turning lanes at seven intersections;
- Proposed addition of public transport facilities (two bus stops) and sidewalks on both sides of the R516 near Raphuti intersections (approx. 11.5 km);
- Temporary widening of existing road and bypasses to accommodate two-way traffic during construction;
- Possible realignment of a 1600 m section of Road D928 (Assen) to ensure it is situated opposite Road D928 (Rooiberg) and a possible new drainage structure;

- Relocation of protected trees that are too close to the road surface and pose a safety risk to motorists; and
- Removal of vegetation in excess of 1 ha outside of the road reserve for possible stockpile areas (yet to be identified).

Drainage, culverts and bridges:

- Widening of seven river bridges and eight major culverts;
- The replacement of two major culverts;
- One new major culvert to be constructed;
- Minor structural repair and possible erosion protection works at four major culverts; and
- The widening and/or replacing minor culverts.

Material sources:

- Material from a nearby quarry will be used for the proposed road upgrades (refer to STS 22-2023 (2022)).

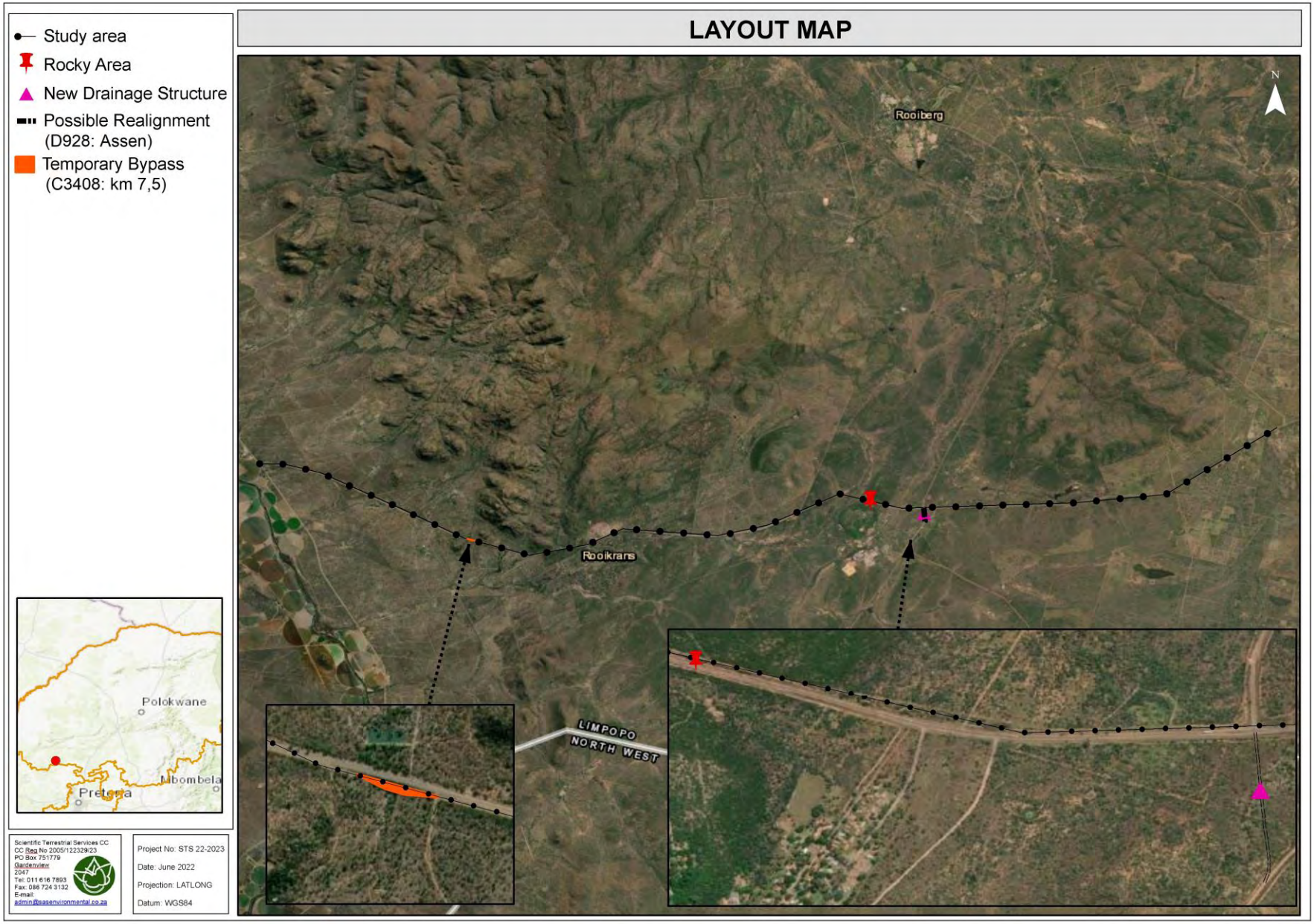


Figure 1: Digital Satellite image depicting the location of the study area in relation to surrounding areas.

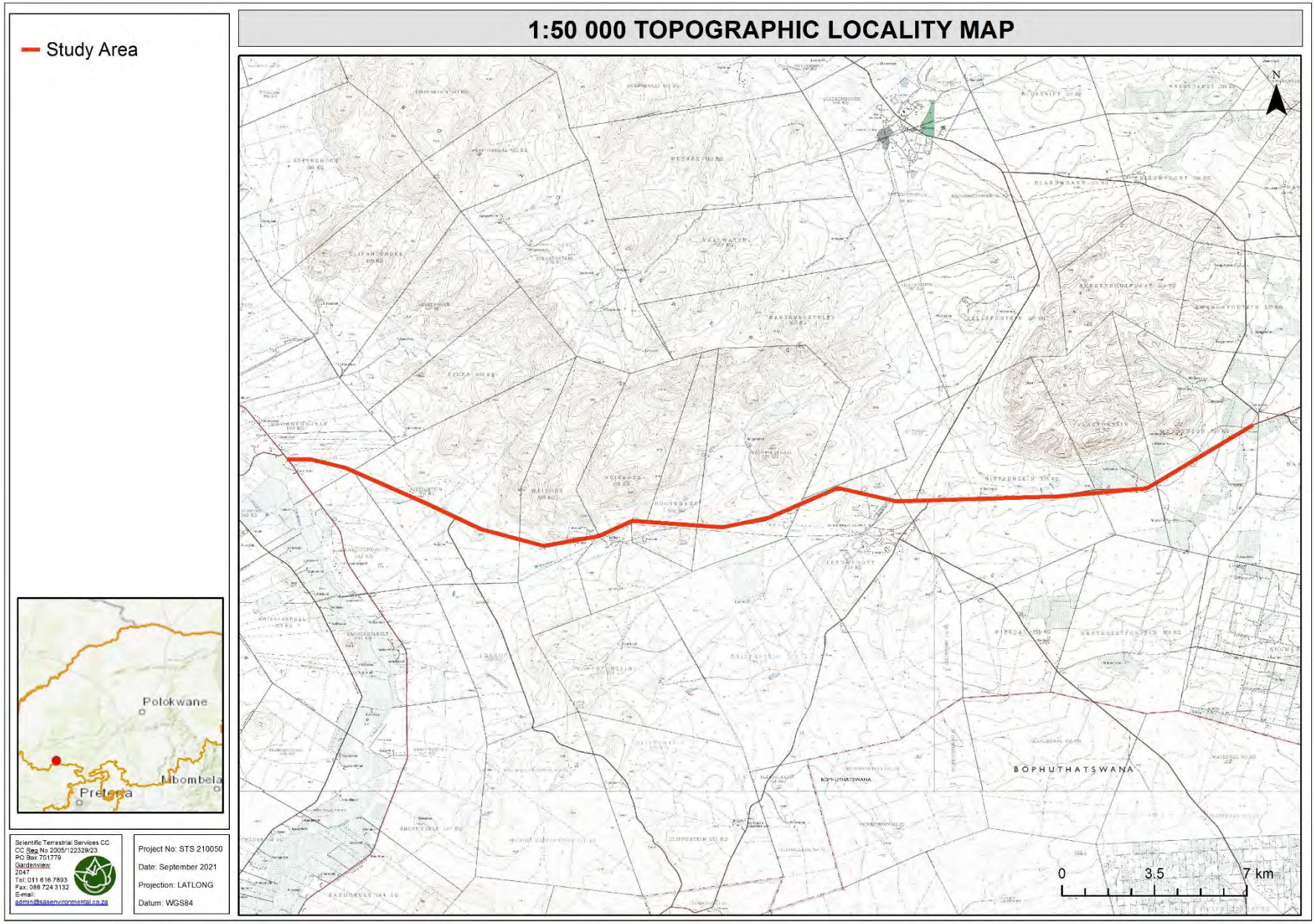


Figure 2: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.

1.2 Project Scope

Specific outcomes in terms of this report are outlined below:

- To state the indemnity and terms of use of this report (Appendix A) as well as to provide the details of the specialists who prepared the reports (Appendix J);
- To outline the legislative requirements that were considered for the assessment (Appendix B of this report);
- Compile a desktop assessment with all relevant information as presented by South African National Biodiversity Institute (SANBI)'s Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org) and the Environmental Geographical Information Systems (E-GIS) website (https://egis.environment.gov.za/). The desktop assessment aims to gain background information on the physical habitat and potential floral and faunal ecology associated with the study area;
- To define the Present Ecological State (PES) of the biodiversity of the study area;
- To determine and describe habitats, communities and the ecological state of the study area;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including the potential of suitable habitat to occur within the study area for SCC;
- To identify and consider all sensitive landscapes, including rocky ridges, wetlands or any other special features such as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs);
- To determine the environmental impacts that the proposed construction and improvement of the national road R516 section 1 might have on the biodiversity associated with the study area; and
- To develop mitigation and management measures for all phases of the development.

1.3 Assumptions and Limitations

The following assumptions and limitations apply to this report:

- The biodiversity assessment was confined to the study area, *i.e.,* the R516_L_75, and does not include detailed results of the neighbouring and adjacent properties (i.e., the R516_L_83), although ecologically important or sensitive areas according to the desktop databases of the neighbouring and adjacent properties were considered as part of the desktop assessment in Section 3. Sampling, by its nature, means that not all individuals are assessed and identified. Some species and taxa associated with the study area may have been missed during the assessment. It is, however, expected that most floral and faunal communities have been accurately assessed and

considered. Relevant online sources and background information were further assessed to improve on the overall understanding of the study area's ecology;

- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. Two field assessments were undertaken from the 1st to the 2nd of September 2021 and from the 18th to 19th May 2022, which falls outside of the flowering season for the area;
- Due to most faunal taxa's nature and habits, it is unlikely that all species would have been observed during a field assessment of limited duration. Due to the locality of the study area (agricultural lands) and the cyclical nature of many species' life stages, as well as the season of the assessment, very few faunal species were observed. As such, background data (desktop) and literature studies (previous work undertaken in the area) were used to further infer faunal species composition and sensitivities in relation to the available habitat;
- The data presented in this report are based on two site visits undertaken from the1st to the 2nd of September 2021 and from the 18th to 19th May 2022. A more comprehensive assessment would require that assessments take place in all seasons of the year. However, on-site data were augmented with all available desktop data. Together with project experience in the area, the findings of this assessment are considered an accurate reflection of the ecological characteristics of the study area;
- The extend of the representation of the Freshwater Habitat was based on floral vegetation and was not delineated in accordance with the "Updated manual for the identification and delineation of wetland and riparian resources (DWAF, 2008). It is thus recommended that an accurate delineation and marking of the boundary of this habitat be done by a qualified freshwater specialist in order to determine the developable areas for the development. Furthermore, differentiation of the Freshwater habitat from watercourses (as defined by the National Water Act, 1998 (Act No. 36 of 1998) (NWA) and Preferential Flow Paths is based on the discretion of the authors and should be accurately delineated and categorised as part of a formal Freshwater Assessment;
- For mapping purposes, a 60 m buffer (i.e., 30 m on either side of the existing road) has been mapped to illustrate the approximate location of the road reserve. Thus, the mapped buffer zone should be used as a guide to illustrate the location of the road reserve and not an accurate representation of the width of the road reserve. Furthermore, the bypasses have been mapped to provide an indication of the extent of such features; and
- Some floral SCC identities will not be made known in this report (due to the limited field duration and seasonal variation), although their potential to occur on-site will still be

assessed. As per the best practise guideline that accompanies the SANBI protocol and the National Web-based Environmental Screening Tool (hereafter referred to as the "**National Screening Tool**"), the name of the certain sensitive species may not appear in the final Environmental Impact Assessment (EIA) report nor any of the specialist reports released into the public domain. It will be referred to as sensitive plants, and its threat status included, e.g., critically endangered sensitive plant.

1.4 Legislative Requirements

The following legislative requirements were considered during the assessment:

- The Constitution of the Republic of South Africa, 1996[2];
- The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA);
- The National Forest Act, 1998 (Act No. 84 of 1998) (NFA);
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPPA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
    - Government Notice (GN) number R.1020: Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated 25 October 2020 as it relates to the NEMBA;
    - GN number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 October 2020;
- Government Gazette 45421 dated 10 May 2019 as it relates to the Department of Forestry, Fisheries, and the Environment (DFFE's) (previously the Department of Environmental Affairs (DEA)) national environmental screening report required with an application for EA as identified in regulation 16(1)(v) of Environment Impact Assessment (EIA) Regulations, 2014, as amended:
    - GN No. 320 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity as published in Government Gazette 43110 dated 20 March 2020; and
    - GN No. 1150 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Plant and

[2] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 1996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

Terrestrial Animal Species as published in Government Gazette 43855 dated 30 October 2020; and

- The Limpopo Environmental Management Act, 2003 (Act No.7 of 2003) (LEMA).

The details of each of the above, as they pertain to this study, are provided in **Appendix B** of this report.

2. ASSESSMENT APPROACH

2.1 Desktop Research Approach

Maps and digital satellite images were generated prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. The biodiversity desktop assessment is confined to the study area and does not include the neighbouring and adjacent properties, although the sensitivity of surrounding areas is included on the respective maps. Relevant databases and documentation that were considered during the assessment of the study area included [3]:

- 2010 National Protected Area Expansion Strategy (NPAES) (Government of South Africa. 2010; DEA & SANBI, 2009), including the below-listed vector datasets:
  - NPAES Focus Areas 2010: National Protected Areas Expansion Strategy: Focus areas for protected area expansion (South African National Parks (SanParks), 2010);
  - NPAES Formal: Polygons of formal protected national parks areas in South Africa (SANParks/SANBI, 2013); and
  - NPAES Protected Areas – Informal: Informal conservation areas in South Africa (SANParks/SANBI, 2012).
- The South African Conservation Areas Database, Quarter 4 (SACAD, 2021);
- The South African Protected Areas Database, Quarter 4 (SAPAD, 2021);
- The National Vegetation Map Project (VEGMAP), with the below vector dataset used for information on Biomes, Bioregions and Vegetation Type(s):
  - 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018a);
- The National List of Threatened Ecosystems 2011 (SANBI 2011; South Africa, 2011);

[3] Datasets obtained from:
- SANBI BGIS (2019). The South African National Biodiversity Institute - Biodiversity GIS (BGIS) [online]. URL: http://bgis.sanbi.org as retrieved in 2019; and
- DEA Environmental Geographical Information Systems (E-GIS) website. URL: https://egis.environment.gov.za/

- From the National Biodiversity Assessment (NBA, 2018) Terrestrial Assessment project (Skowno *et al*., 2019):
    - 2018 Terrestrial ecosystem threat status and protection level - remaining extent (SANBI, 2018b); and
    - 2018 Terrestrial ecosystem threat status and protection level layer (SANBI, 2018c);
- The Important Bird and Biodiversity Areas (IBA) Programme and vector dataset (BirdLife South Africa, 2015; Marnewick *et al*., 2015a and 2015b), in conjunction with the South African Bird Atlas Project 2 (SABAP 2);
- The International Union for Conservation of Nature (IUCN);
- The National Screening Tool (accessed 2021); and
- From the 2017 Strategic Water Source Areas (SWSA) project:
    - 2017 SWSA **Surface water** (Water Research Commission, 2017).

2.2 General Approach

An on-site visual assessment of the study area was conducted to confirm the assumptions made during the consultation of the background maps and to determine whether the ecological status of the habitat associated with the study area has changed.

The vegetation surveys are based on the subjective sampling method which is a technique where the specialist chooses specific sample sites within the area of interest, based on their professional experience and background research done for the site, to allow representative recordings of floral communities and optimal detection of SCC (**Appendix C**).

For the faunal field surveys, a reconnaissance 'walkabout' was undertaken to confirm habitat types and to consider whether the areas are representative of these habitats, with special emphasis being placed on areas that may potentially support faunal SCC. Sites were investigated on foot to identify and define the faunal assemblage within the footprint area. A detailed explanation of the method of assessment is provided in **Appendix D** of this report. The faunal categories covered in this assessment include mammals, avifauna, herpetofauna and general invertebrates.

The below list includes the steps followed during the preparation for, and the undertaking of, the field assessments:

- To guide the selection of appropriate sample sites, background data and digital satellite images were consulted before going to the site, during which broad habitats,

vegetation types and potentially sensitive sites were identified. The results of these analyses were then used to focus the fieldwork on specific areas of concern and to identify areas where targeted investigations were required (e.g., for SCC detection and within the direct footprint of the proposed parking area);

- Databases used for background information include the SANBI Threatened Species Programme (TSP), the NBA (2018), National Threatened Ecosystems (2011), SAPAD & SACAD (Quarter 4, 2021), NPAES (2011), and IUCN;
- The subjective sampling method requires that field assessment take place on foot. Based on the broad habitat units delineated before going to the site, and points of interest recorded, which is updated based on on-site observations, the selected sample areas were surveyed on foot, following subjective transects, to identify the occurrence of the dominant plant species and habitat diversities, but also to detect SCC which tend to be sparsely distributed; and
- Photographs were taken of each vegetation community that are representative of the typical vegetation structure of that community, as well as photos of all detected SCC (where such species were not flagged on the National Screening Tool as sensitive species for which identities may not be made known).

For the methodologies relating to the impact assessment and development of the mitigation measures, please refer to **Appendix E** of this report.

2.3 Sensitivity Mapping

All the ecological features associated with the study area were considered, and sensitive areas were delineated using a Global Positioning System (GPS). A Geographic Information System (GIS) was used to project these features onto satellite imagery.

3. RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics of the Study Area

The following table contains data accessed as part of the desktop assessment. It is important to note, that although all data sources used provide useful and often verifiable high-quality data, the various databases do not always provide an entirely accurate indication of the area's actual biodiversity characteristics, and as such require ground truthing.

Table 1: Summary of the terrestrial conservation characteristics for the study area (Quarter Degree Square (QDS) 2427DD and 2427DC)

DESCRIPTION OF THE VEGETATION TYPE(S) RELEVANT TO THE STUDY AREA ACCORDING TO THE 2018 FINAL VEGETATION MAP OF SOUTH AFRICA, LESOTHO AND SWAZILAND (SANBI 2006–2018 & SANBI, 2018A)			
BIOME		The R516_L_75 road is situated within the Savanna Biome.	
BIOREGION		The R516_L_75 is located within the Central Bushveld Bioregion.	
VEGETATION TYPE (FIGURE 3)		Central Sandy Bushveld (SVcb 12)	Western Sandy Bushveld (SVcb 16)
ALTITUDE (M)		850–1 450	900 - 1200
CLIMATE		Summer rainfall with very dry winters.	Summer rainfall with very dry winters.
CLIMATE	MAP (mm)	596	552
	MAT (°C)	18.0	19.3
	MFD (Days)	14	15
	MAPE (mm)	2234	2418
	MASMS (%)	77	79
DISTRIBUTION		Limpopo, Mpumalanga, Gauteng, and North-West Provinces	Limpopo and North-West Provinces
GEOLOGY & SOILS		The large southern and eastern parts of this area are underlain by granite of the Lebowa Granite Suite and some granophyre of the Rashoop Granophyre Suite (both Bushveld Complex, Vaalian). In the north, the sedimentary rocks of the Waterberg Group (Mokolian Erathem) are most important. Specifically, sandstone, conglomerate and siltstone of the Alma Formation and sandstone, siltstone and shale of the Vaalwater Formation. Well-drained, deep Hutton or Clovelly soils often with a catenary sequence from Hutton at the top to Clovelly on the lower slopes; shallow, skeletal Glenrosa soils also occur. Land types, mainly Bb, Fa, Ba, Bd and Ac.[4]	Sandstone and mudstone of the Matlabas Subgroup and sandstone, subordinate conglomerate, siltstone and shale of the Kransberg Subgroup (both Mokolian Waterberg Group) are found in the north. Archaean granite and gneiss of the Swazian Erathem and granite of the Lebowa Granite Suite (Bushveld Igneous Complex) are found in the west and southeast of the area, respectively. Soils are plinthic catena, eutrophic, red-yellow apedal, freely drained, high base status, Hutton and Clovelly with some Glenrosa and Mispah soil forms. Several areas have less sandy soil than that of SVcb 12 Central Sandy Bushveld. Land types mainly Bd, Ah, Ae and Fa.[4]
CONSERVATION		Vulnerable. Target 19%. Less than 3% statutorily conserved spread thinly across many nature reserves. Erosion very low to high, especially in some places, northeast of Groblersdal.	Least threatened. Target 19%. About 6% statutorily conserved. Erosion is generally low to very low.
VEGETATION & LANDSCAPE FEATURES (DOMINANT FLORAL TAXA IN APPENDIX D)		Low undulating areas, sometimes between mountains, and sandy plains and catenas supporting tall, deciduous *Terminalia sericea* and *Burkea africana* woodland on deep sandy soils (with the former often dominant on the lower slopes of sandy catenas) and low, broad-leaved *Combretum* woodland on shallow rocky or gravelly soils. Species of *Senegalia*, *Ziziphus* and *Euclea* are found on flats and lower slopes on eutrophic sands and some less sandy soils. *A. tortilis* may dominate some areas along valleys. Grass-dominated	Varies from tall open woodland to low woodland, broad-leaved as well as microphyllous tree species prominent. Dominant species include *Senegalia erubescens* on flat areas, *Combretum apiculatum* on shallow soils of gravelly upland sites and Terminalia sericea on deep sands. Occurs on slightly undulating plains.

[4] Land types: A soils are mineral horizon soils. Ac and Ae are red and/or yellow, freely drained soils; B horizon soils have a diverse range of properties. Bb, Ba, Bd are upland duplex and margalitic soils; E soils have light bleached colours. Ea soils are Dark, blocky clay topsoils (often swelling clays) and/or red, structured clays; Fa are Shallow, and/or rocky, often steep, highly leached (very little lime).

<table>
<tr><td></td><td>herbaceous layer with relatively low basal cover on dystrophic sands.</td><td colspan="2"></td></tr>
<tr><td>CONSERVATION DETAILS PERTAINING TO THE AREA OF INTEREST (VARIOUS DATABASES)</td><td></td><td colspan="2">NATIONAL WEB BASED ENVIRONMENTAL SCREENING TOOL (2020)</td></tr>
<tr><td rowspan="2">NBA (2018):
1) ECOSYSTEM THREAT STATUS
2) ECOSYSTEM PROTECTION LEVEL</td><td rowspan="2">The road cuts across two vegetation types; the Western Sandy Bushveld which is currently Least Concerned and Well Protected, and the Central Sandy Bushveld which is currently Least Concerned and Poorly Protected.
i. The NBA is the primary tool for monitoring and reporting on the state of biodiversity in South Africa. Two headline indicators that are applied to both ecosystems and species are used in the NBA: threat status[5] and protection level[6].</td><td colspan="2">➢ The screening tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas</td></tr>
<tr><td>ANIMAL SPECIES THEME</td><td>For the animal species theme, the study area is considered to have an overall sensitivity of high. There is a high sensitivity for these species: Smutsia temmnickii (ground pangolin (VU)), Sagittarius serpentarius (Secretary bird (EN)), Aquila verreauxxi (the black eagle (LC)), Acinonyx jubatus (Cheetah (VU)), Crocidura maquassiensis (the Makwassie musk shrew (LC)), Lycaon pictus (African Wild Dog (EN)), and Sensitive species 12[7] (for which its identity cannot be made known to the public domain).</td></tr>
<tr><td rowspan="2">NATIONAL THREATENED ECOSYSTEMS[8] (2011)</td><td rowspan="2">There are no threatened ecosystems within 10 km of the study area according to the National Threatened Ecosystem Database (2011).

For Environmental Impact Assessments (EIAs), the 2011 National list of Threatened Ecosystems remains the trigger for a Basic Assessment in terms of Listing Notice 3 of the EIA Regulations published under the National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA).</td><td>PLANT SPECIES THEME</td><td>For the plant species theme, the study area is considered to have a medium sensitivity for its proximity to these trigger species: Cucumis humifructus (Aardvark cucumber (VU)), Brachycorythis conica subsp. transvaalensis (Albertina Sisulu Orchid, (CR)), and Hesperantha bulbifera (pink evening flower, (Rare)).</td></tr>
<tr><td>IBA (2015) (FIGURE 4)</td><td>The study area is located within a 10 km radius of Important Bird Areas (IBA, 2015). The Waterberg System IBA is located within approximately 1 km north east of the study area and the Northern Turf Thornveld located 800 m west of the study area.</td><td>TERRESTRIAL BIODIVERSITY THEME</td><td>For the terrestrial biodiversity theme, the entire study area is considered to have an overall sensitivity of very high. The trigger biodiversity themes are: Critical biodiversity area 1, Critical biodiversity area 2 Ecological support area 1, Ecological support area 2, and proximity to private owned protected nature reserves, which corresponds with the Limpopo C-Plan (2013).</td></tr>
</table>

[5] Ecosystem threat status tells us about the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Figure 3). The conceptual 'end point' of decline for an ecosystem is termed 'collapse' and is equivalent to extinction in the species Red Listing framework. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Concern (LC), based on the proportion of each ecosystem type that remains in good ecological condition relative to a series of thresholds.

[6] Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Not Protected, Poorly Protected, Moderately Protected or Well Protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the National Environmental Management: Protected Areas Act (Act 57 of 2003).

[7] According to the best practise guidelines provided by SANBI, the name of sensitive species provided by the Online EIA screening tool may not appear in the final EIA report nor any of the specialist reports released into the public domain. This is to protect species that are under threat to factors such as illegal harvesting and overexploitation.

[8] For Environmental Impact Assessments (EIAs), the 2011 National list of Threatened Ecosystems remains the trigger for a Basic Assessment in terms of Listing Notice 3 of the EIA Regulations 2014, as amended published under the National Environmental Management Act, 1998 (Act No. 107 of 1998). The data contained in NBA 2018 represents an update of the assessment of threat status for terrestrial ecosystems, but the National List of Threatened Terrestrial Ecosystems has not yet been revised.

<table>
<tr><td rowspan="3">NPAES (2010); (FIGURE 4) SAPAD (2021, Q4) (FIGURE 5); SACAD (2021, Q4) (FIGURE 6).</td><td rowspan="3">According to the SAPAD (2021_Q4) there are twelve protected private nature reserves within a 10 km radius of the road, namely: Conteno, Die Kraal, Du Plessis No1 and No 2, Flovin Mauken, Knopieskop, Koedoeskop, MJ Herman, Rooiberg, Sterkfontein, Timbewaar, and Vrug-op-Arbeid Private Nature reserves.

The SACAD (2021_Q4) indicated 6 conservation areas within 10 km of the study area, namely the Kgaswane Mountain Reserve, Magaliesburg Biosphere Reserve, Marico Biosphere Reserve, Nylsvley Nature Reserve, Pretoria Botanical Garden and Waterberg Biosphere Reserve.

The National Protected Areas Expansion Strategy Database (NPAES, 2010) identified the North-West/Gauteng Bushveld focus area for protected areas expansion 10km southwest of the study area and the Northern Turf Thornveld 2 km west of the study area.</td><td colspan="2">STRATEGIC WATER SOURCE AREAS FOR SURFACE WATER (2017)</td></tr>
<tr><td colspan="2">Surface Water Strategic Water Source Area (SWSAs) are defined as areas of land that supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size. they include transboundary areas that extend into Lesotho and Swaziland. The Sub-National Water Source Areas (WSAs) are not nationally strategic as defined in the report but were included to provide a complete coverage.</td></tr>
<tr><td>NAME & CRITERIA</td><td>The study area is not within 10 km of a Strategic Water Source Area.</td></tr>
<tr><td colspan="4">DETAIL OF THE AREA OF INTEREST IN TERMS OF THE LIMPOPO CONSERVATION PLAN V2 (2013) – FIGURE 7</td></tr>
<tr><td>CBA 1 AND 2, ESA 1 AND 1, NATURAL AREAS, PROTECTED AREAS AND OTHER NATURAL AREAS.</td><td colspan="3">The study area is scattered around Critical biodiversity area 1 (1.16 km length), Critical biodiversity area 2 (7.05 km length), Ecological support area 1 (10. 5 km length), Ecological support area (2.2 km length), and Other Natural Areas (14.23 km length).

Land Management Recommendations for CBA1s: Obtain formal conservation protection where possible. Implement appropriate zoning to avoid net loss of intact habitat or intensification of land use. Incompatible Land-Use: Urban land-uses including Residential (including golf estates, rural residential, resorts), Business, Mining & Industrial; Infrastructure (roads, power lines, pipelines).

CBA 2's are considered "optimal" best design selected sites, areas selected to meet biodiversity pattern and/or ecological process targets. Alternative sites may be available to meet targets. Land Management Recommendations for CBA2s: Avoid conversion of agricultural land to more intensive land uses, which may have a negative impact on threatened species or ecological processes. Incompatible Land-Use: Urban land-uses including Residential (golf estates, rural residential, resorts), Business, mining & Industrial, Infrastructure (roads, power lines, pipelines). More intensive agricultural production than currently undertaken on site. Note: Certain elements of these activities could be allowed subject to detailed impact assessment to ensure that developments were designed to CBA2. Alternative areas may need to be identified to ensure the CBA network still meets the required targets.

Land Management Recommendations for ESAs: Implement appropriate zoning and land management guidelines to avoid impacting on ecological processes. Avoid intensification of land use and fragmentation of natural landscapes. Incompatible Land-Use: Urban land-uses including Residential (including golf estates, rural residential, resorts), Business, Mining & Industrial; Infrastructure (roads, power lines, pipelines).
Note: Certain elements of these activities could be allowed subject to detailed impact assessment to ensure that developments were designed to maintain the overall ecological functioning of ESAs.

Natural areas are natural and intact areas but are not required to meet targets, nor have they been identified as Critical Biodiversity Areas or Ecological Support Areas. No management objectives, land management recommendations or land-use guidelines are prescribed. These areas are nevertheless subject to all applicable town and regional planning guidelines and policy. Where possible existing "Not Natural" areas should be favoured for development before "Other natural areas".</td></tr>
</table>

	Other natural areas are natural and intact areas but are not required to meet targets, nor have they been identified as Critical Biodiversity Areas or Ecological Support Areas. No management objectives, land management recommendations or land-use guidelines are prescribed. These areas are nevertheless subject to all applicable town and regional planning guidelines and policy. Where possible existing “Not Natural” areas should be favoured for development before "Other natural areas".

EOO = Extent of Occurrence; NBA = National Biodiversity Assessment; SAPAD = South African Protected Areas Database; SACAD = South African Conservation Areas Database; NPAES = National Protected Areas Expansion Strategy; IBA = Important Bird Area; MAP = Mean annual precipitation; MAT = Mean annual temperature; MAPE = Mean annual potential evaporation; MFD = Mean Frost Days; MASMS = Mean annual soil moisture stress (% of days when evaporative demand was more than double the soil moisture supply); CBA = Critical Biodiversity Areas; ESA = Ecological Support Areas; Strategic Water Source Areas; Water Source Areas.

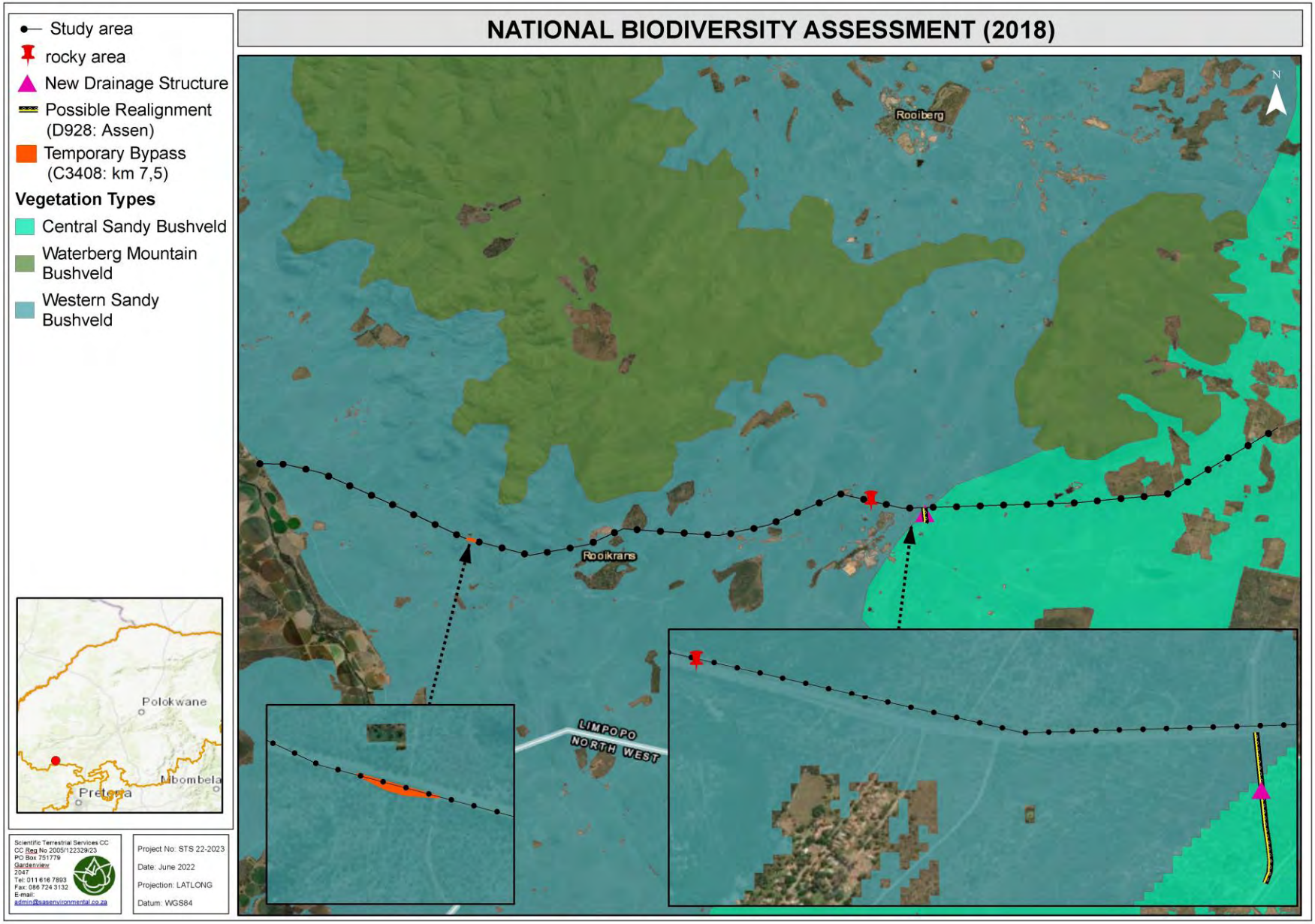


Figure 3: The study area in relation to the remaining extent of the vegetation types according to the National Biodiversity Assessment (NBA, 2018).

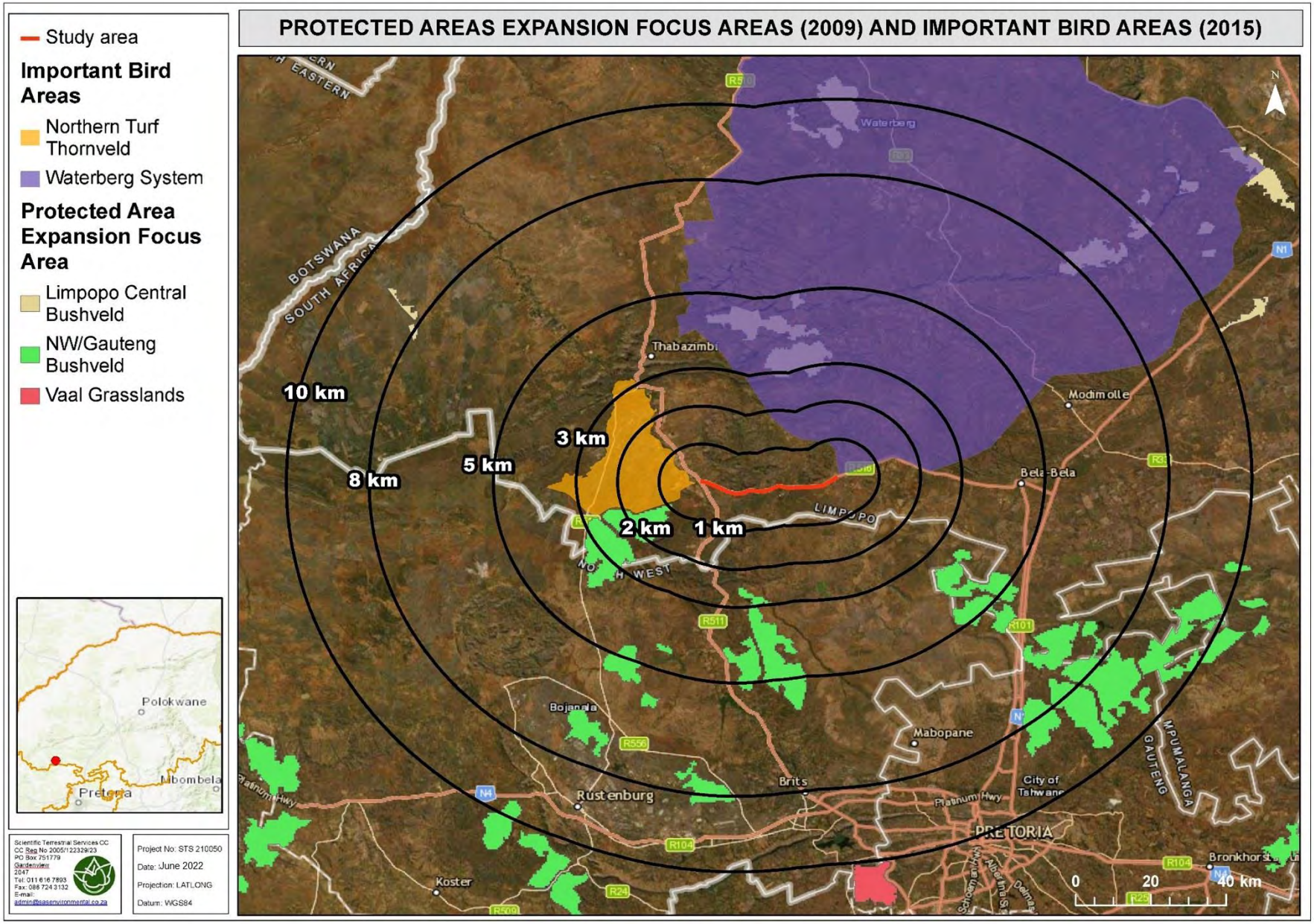


Figure 4: The Important Bird Areas (IBA) and Protected areas within 10 km of the study area, according to NPAES (2010) and IBA database (2015).

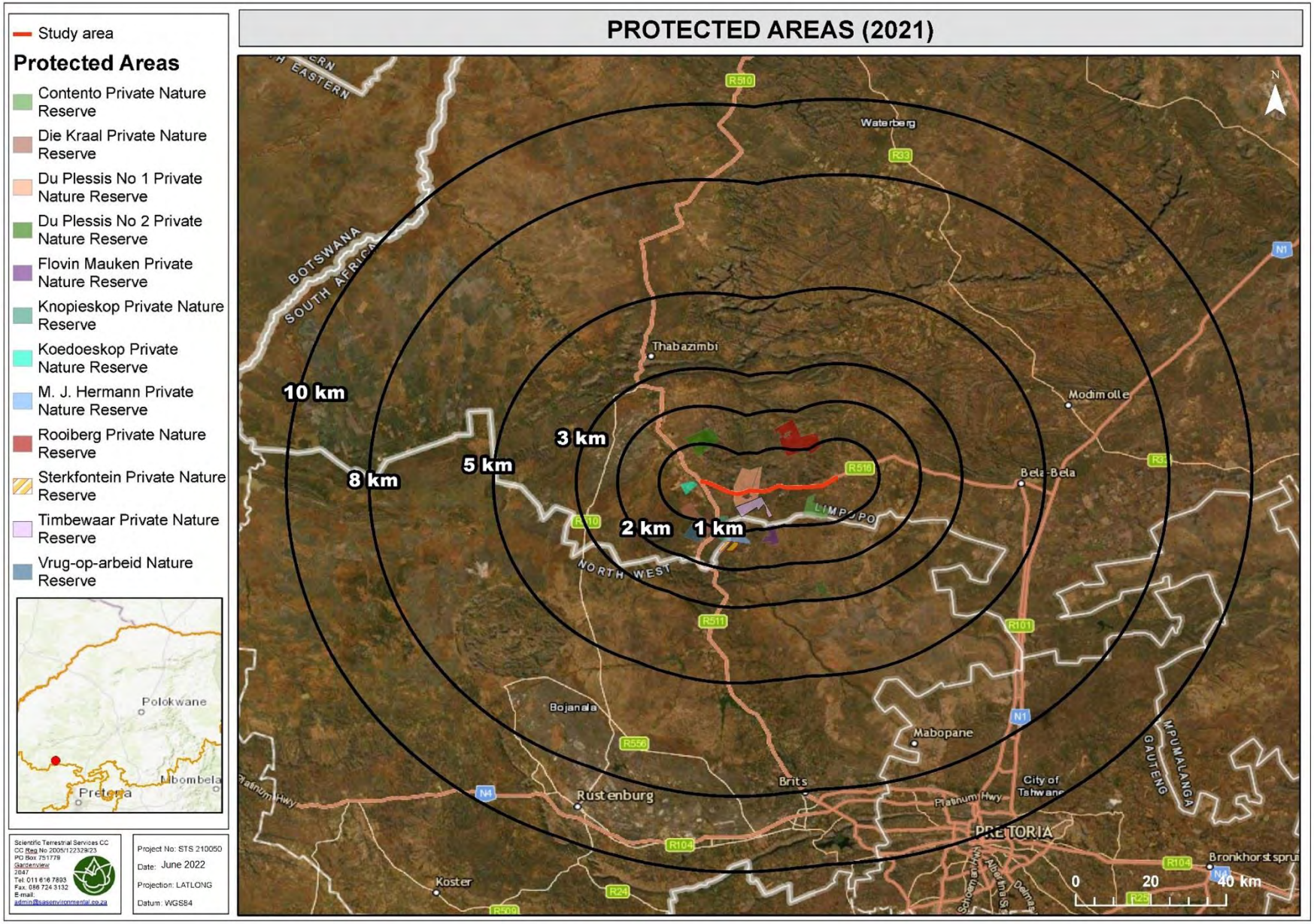


Figure 5: Protected areas within 10 km of the study area, according to SAPAD (2021_Q4).

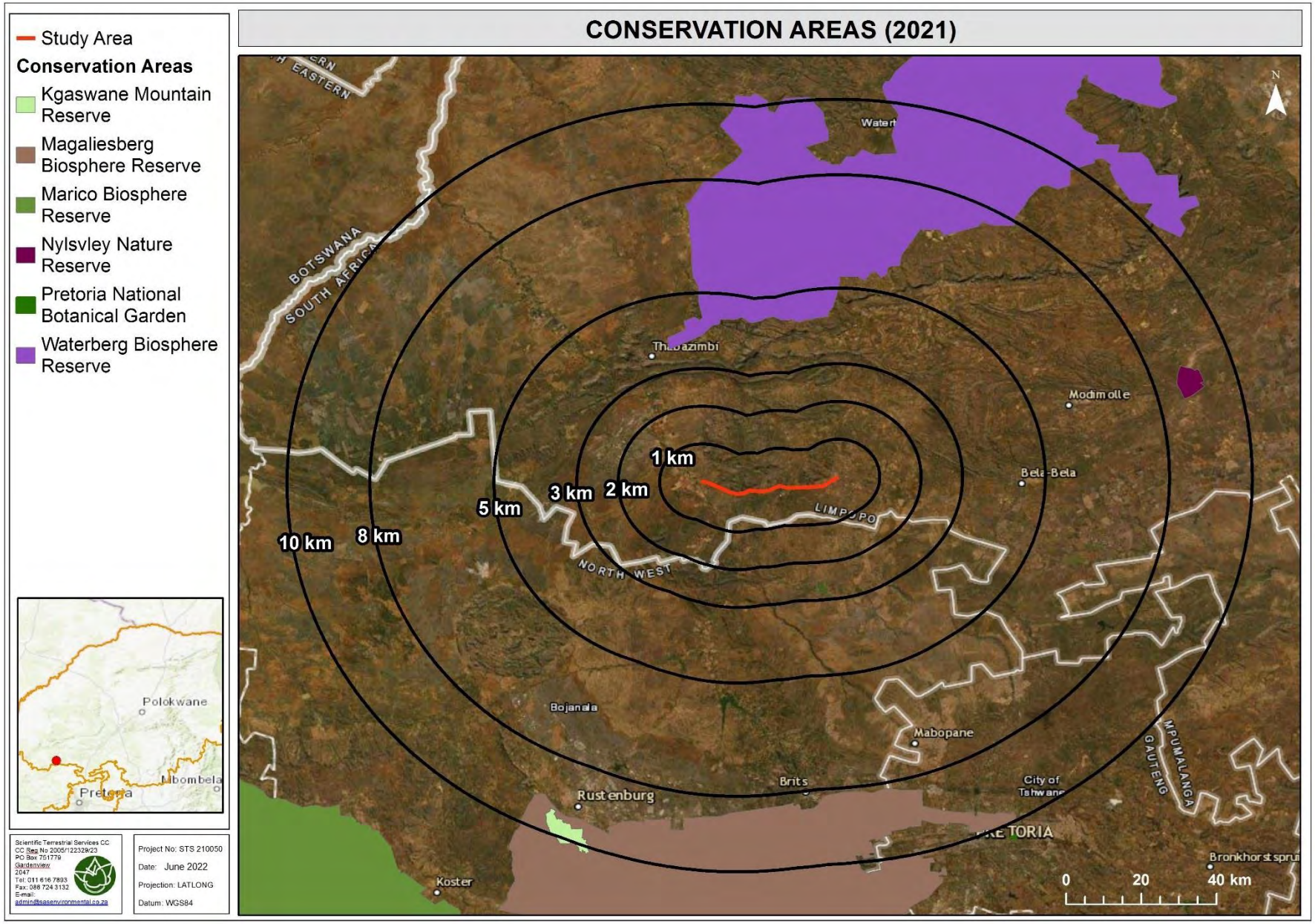


Figure 6: Conservation areas within 10 km of the study area, according to SACAD (2021_Q4).

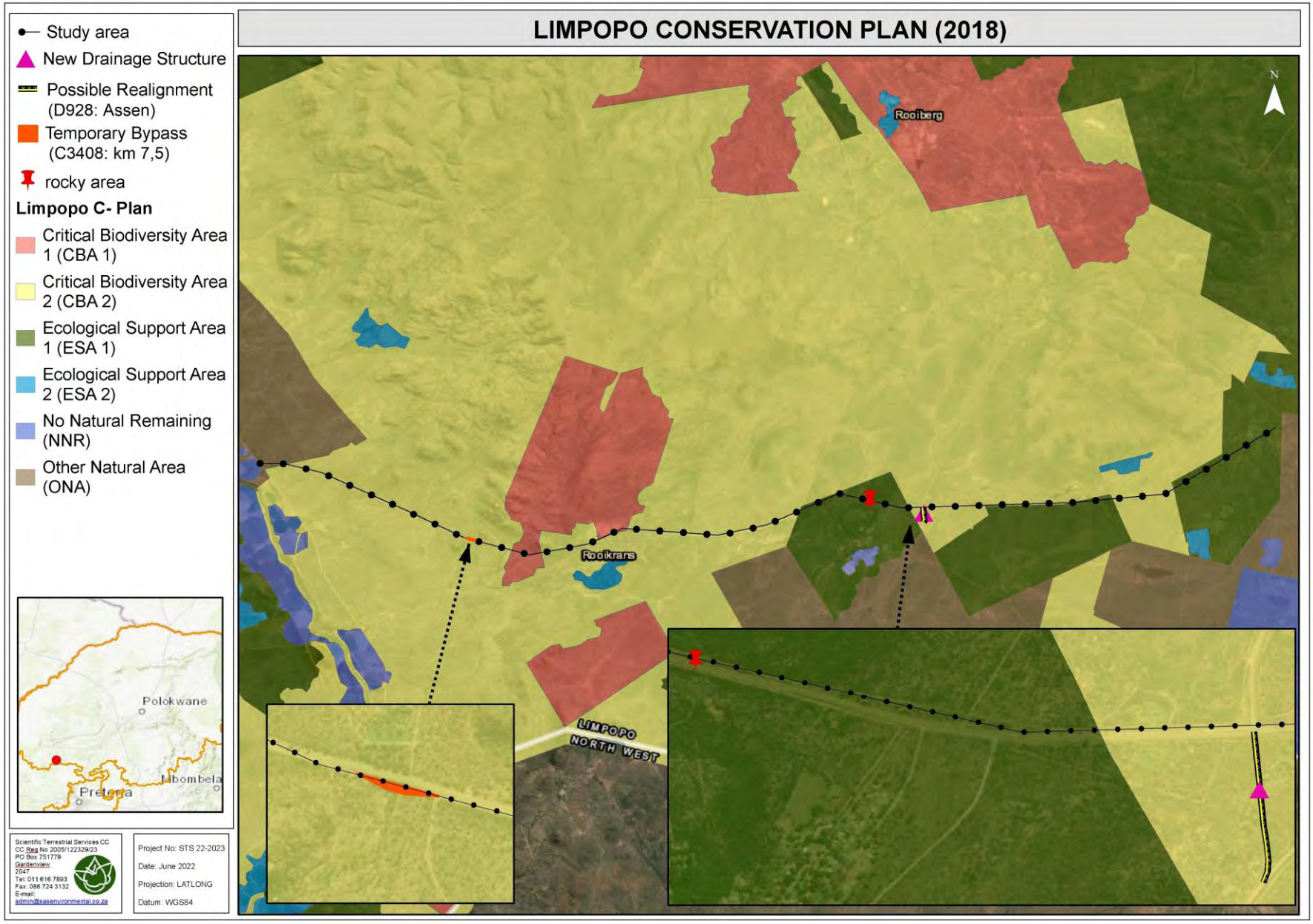


Figure 7: The study area in relation to the Limpopo Conservation Plan (2013).

4. BIODIVERSITY ASSESSMENT RESULTS

The study area falls within two vegetation types, namely i) the Western Sandy Bushveld (located largely within the west of the study area) and ii) the Central Sandy Bushveld (located largely in the east of the study area), i.e., the reference vegetation types. The Western Sandy Bushveld is listed as least concern in Mucina and Rutherford, 2006 and in the updated 2018 Vegetation Map of South Africa, Lesotho, and Swaziland (SANBI, 2018a)). However, the Central Sandy Bushveld is listed as vulnerable in Mucina and Rutherford, 2006, but as Least Concern in the updated 2018 Vegetation Map of South Africa, Lesotho, and Swaziland (SANBI, 2018a)).

Mucina and Rutherford (2006) describe the Western Sandy Bushveld as "varying from tall open woodland to low woodland, with broad-leaved as well as microphyllous[9] tree species prominent. Dominant species include *Senegalia erubescens* on flat areas, *Combretum apiculatum* on shallow soils of gravelly upland sites and *Terminalia sericea* on deep sands. Occurs on slightly undulating plains". In contrast, Mucina and Rutherford (2006) describe the Central Sandy Bushveld as having "low undulating areas that are sometimes between mountains, and sandy plains and catenas supporting tall, deciduous *T. sericea* and *Burkea africana* woodland on deep sandy soils (with the former often dominant on the lower slopes of sandy catenas) and low, broad-leaved *Combretum* woodland on shallow rocky or gravelly soils. Species of *Vachellia, Senegalia*, *Ziziphus* and *Euclea* are found on flats and lower slopes on eutrophic sands and some less sandy soils. *Vachellia tortilis* may dominate some areas along valleys. Grass-dominated herbaceous layer with relatively low basal cover on dystrophic sands."

The study area, i.e., the associated road reserve of the R516_L_75 (including the 30 m buffer), has been largely impacted by anthropogenic activities, including regular grass mowing, dumping of rubbish and rubble, and suppressed fire regimes. The road reserve has further been subjected to several edge effects, including erosion, AIP proliferation, traffic disturbances and habitat fragmentation. The above factors have resulted in a habitat that is different (in terms of species composition and structure) from the neighbouring properties (which are separated from the road reserve by fences). Natural ecological drivers, processes and corridors within the study area have subsequently been altered. However, dispersal

[9] Microphyllus - having very small leaves. From *micro* meaning small and *phyllous* referring to leaves.

corridors for floral species are still present across the study area, albeit in a modified and reduced form.

The biodiversity of the study area can be defined under three broad habitat units as described below (Figure 8). These habitat units were distinguished based on species composition, vegetation structure, ecological function, physical nature of the environment and habitat condition. The three broad habitat units include:

- **Mowed Road Verge Habitat**: this habitat unit was largely homogenous and consisted of mowed grassy areas, with scattered trees throughout;
- **Mixed Bushveld Habitat**: this habitat was associated with areas next to the Mowed Road Verge Habitat (usually fenced off from this habitat and comprised of privately owned farms and land). Typically, this habitat was characterised by the presence of a well-developed tree layer; and
- **Freshwater Habitat**: this habitat unit traversed several watercourses (e.g., the Sleepfonteinspruit), as well as several preferential flow paths which are not considered true watercourses.

A few small Rocky areas were identified within the study area but due to their small extent they are not considered a separate habitat unit within this report and as such, were incorporated into the existing habitat units identified above. Table 2 provides an indication of habitat unit and infrastructure overlap.

Table 2: Habitat unit and proposed Infrastructure Overlap.

Habitat Unit	Major Infrastructure Overlap		
	R516 road upgrade	Temporary Bypasses	Road Realignments
Mowed Road Verge	x	x	x
Mixed Bushveld		x	x
Freshwater Habitat	x	x	x

For a breakdown of the floral and faunal communities, habitat characteristics and conservation sensitivities associated with the above-mentioned habitat units, refer to Section 4.1 and 4.2.

Figure 8 depict the extent of the habitat units within the study area.

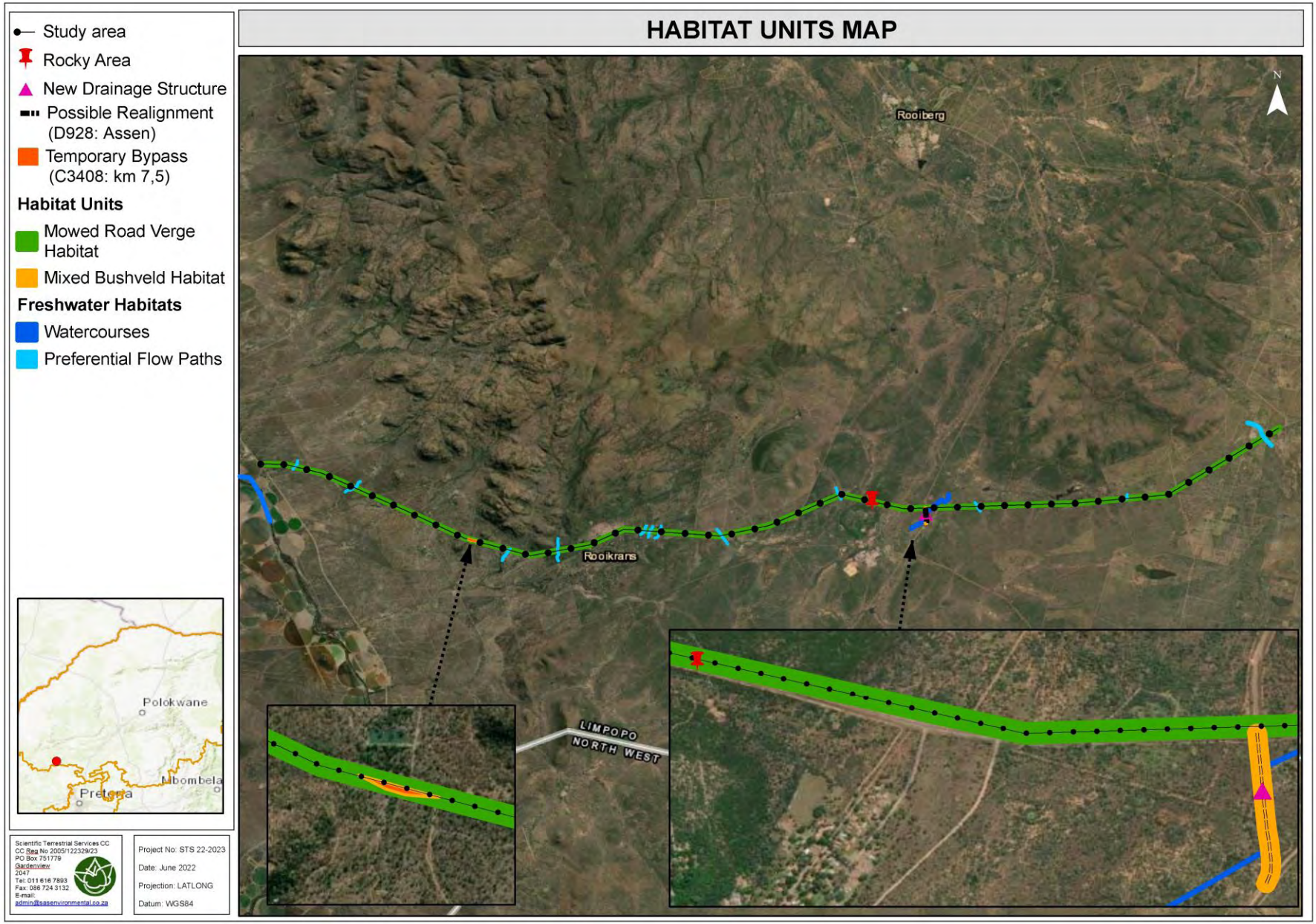


Figure 8: Map illustrating the Habitat units associated with the study area on a macroscale.

4.1 Floral Assessment Results

HABITAT OVERVIEW
Overall, the study area supported a moderately low species diversity. The two broad habitat units identified within the study area included i) Mowed Road Verge Habitat and ii) Freshwater Habitat (discussed in more detail below). Refer to the photographs below for a visual representation of the habitat units and examples of species recorded within these habitats. Mowed Road Verge Habitat – this habitat unit supported a moderately low species diversity and was typically homogenous in nature, consisting of mowed grassy areas along the R516_L_75. Typical grasses recorded included *Cenchrus ciliaris*, *Aristida congesta* subsp. *congesta, Panicum maximum* and *Eragrostis trichophora.* Although grasses were dominant, several trees (mostly fully grown as frequent mowing has killed off small woody saplings) were recorded within the habitat unit. Dominant woody species recorded within the road reserve included *Searsia lancea*, *Sclerocarya caffra* subsp. *birrea, Ziziphus mucronata*, and *Gymnosporia buxifolia*. Less frequently occurring species included *Senegalia galpinii*, *Combretum imberbe*, *Olea europea* subsp. *africana*, and *Combretum zeyheri*. Generally, the herb and forb species diversity were low. Entrances to private properties are situated throughout the road reserve. Several entrances had private gardens within the study area however, these will not be mapped as a separate habitat unit owing to their small size and overall shared species composition. Common garden plants included: *O. europea* subsp. *africana*, *Agave* sp., and *Aloidendron barberae*. Within the central regions of the Mowed Grassland Habitat unit is an area of the road reserve that is rockier (with shallower soils) than the remaining habitat. Although there were some species recorded within these rockier areas that weren't recorded within the surrounding Mowed Grassland Habitat (e.g., *Dodonaea viscosa* and *Pellaea calomelanos*), the overall composition and the capacity to provide habitat for SCC was deemed to be similar, hence the classification as one habitat. The location of this rockier habitat is indicated in (Figure 8). AIPs were recorded throughout the habitat unit and are mostly concentrated around the private property entrances (although the density thereof was deemed to be moderately low). Typical AIP species recorded within the habitat unit included *Agave americana*, *Agave sisalana*, *Argemone ochroleuca* subsp. *ochroleuca*, and *Opuntia cf. ficus-indica*. It is evident that AIP control has been carried out in some areas of the study area, with several *Acacia* species having been cut and poisoned. Freshwater Habitat - this habitat unit was largely degraded in nature. The Freshwater Habitat traversed several watercourses as defined in the National Water Act, 1998 (Act No. 36 of 1998) (NWA) (e.g., the Sleepfonteinspruit), as well as several preferential flow paths which are not considered true watercourses as defined by the NWA. During the time of the field assessment, most of the Freshwater Habitat features were dry. Both the watercourses and the preferential flow paths supported a similar floral composition and structure, hence the classification as one habitat unit. Soil erosion was often associated with the Freshwater Habitat, with bare soils present throughout. Overall species composition within the Freshwater Habitat was low. Common graminoid species recorded within the habitat included *Phragmites australis, Eragrostis lehmanniana, Bulbostylis hispidula* subsp. *pyriformis* and *Digitaria eriantha*. Woody species frequently rerecorded included *S. lancea* and *Z. mucronata*. Compared to the Mowed Grassland Habitat, this habitat unit supported the highest density of AIP species (e.g., *Tagetes minuta, Bidens pilosa,* and *Eucalyptus cf. camaldulensis*). This habitat unit has been significantly impacted by anthropogenic activities, e.g., dumping, erosion and insizement of the channels. Despite the degraded and impacted nature of this habitat unit, the Freshwater habitat unit is considered somewhat unique in the landscape as it provides habitat for species that have a higher affinity for wetter soils and provides potential corridors across the landscape. Mixed Bushveld Habitat – this habitat was located mostly along the outside of the Mowed Road Verge Habitat (usually fenced from this habitat) and comprised of privately owned land and farms. Vegetation structure was characteristically described as comprising of a well-developed grassy layer with an established and diverse tree layer. Overall, the habitat supported a moderate species diversity. Typical woody species recorded within the Mixed Bushveld included *Euclea crispa, Combretum molle, Faurea saligna, Mundulea sericea, Vangauria infausta, Searsia lancea, Terminalia sericea*, and *Ziziphus mucronata*. The herbaceous layer was less diverse, although several species were

HABITAT OVERVIEW

commonly recorded, e.g., *Ceratotheca triloba, Commelina erecta*, *Felicia clavipilosa* subsp*. transvaalensis,* and *Lippia javanica*. Succulent species were not frequently recorded. Typical succulent species recorded included *Aloe marlothii* subsp. *marlothii*, *Euphorbia ingens,* and *Kalanchoe* spp. The graminoid layer was well-developed; dominant species recorded included *Aristida congesta* subsp. *congesta*, *Cymbopogon cf*. *pospischilli*, *Digitaria eriantha, Heteropogon contortus, Hyparrhenia hirta,* and *Panicum maximum*. Although AIP species were not abundant, a variety of species were commonly recorded within the habitat. Typical species recorded included *Bidens Pilosa, Lantana camara, Opuntia ficus-indica, Tagetes minuta*, and *Zinnia peruviana.* Generally, the habitat is located within privately owned property (i.e., farms) in which some form of veld management has occurred. As a result, the Mixed bushveld habitat is in an overall moderate ecological state. Given the moderate ecological condition of this habitat, the moderate species diversity, and the limited impacts from anthropogenic influences (e.g., firewood collection, mowing (as in the Road Verge Habitat) etc), the Mixed Bushveld is considered to share an affinity (in terms of structure and function) with the reference vegetation type. Despite this shared affinity with the reference vegetation type, the habitat is not considered to be fully representative of the Central Sandy Bushveld Habitat.

Photographs: a-b) typical Road Verge Habitat (i.e., mowed grassy areas with scattered trees), c) typical Freshwater Habitat associated with the study area, and d) Typical Mixed Bushveld Habitat associated with the study area.

Photographs: a) some AIP clearing is evident throughout the study area, b-c) typical of the gardens associated with the private properties located along the R516, and d) an AIP species, namely *Argemone ochroleuca* subsp. *Ochroleuca,* recorded within the study area.

HABITAT OVERVIEW		

Photographs: a) *Helichrysum arygroshaerum* (a typical herb species recorded within the Mowed Road Verge Habitat), b) *Albuca glauca* (an infrequently recorded herb recorded within the Mowed Road Verge Habitat), c) *Dombeya rotundifolia* in flower (a typical woody species recorded throughout the study area), and d) *Searsia lancea* (a frequently recorded woody species of both the Mowed Road Verge and the Freshwater Habitats).

Mowed Road Verge Grassland	Freshwater Habitat	Mixed Bushveld Habitat
Vegetation structure		
Short, mowed grassland characterised by low forb diversity and generally a homogenous grass layer. Scattered trees throughout. Overall, the structure and species composition of this habitat is no longer considered representative of the reference vegetation types.	Open grassland often characterised by bare (i.e., unvegetated) areas because of soil erosion. Overall species richness was low. Overall, the structure and species composition of this habitat is no longer considered representative of the reference vegetation types.	Semi-open woodland characterised by a well-developed grassy layer with an established and diverse tree layer. Overall species richness was moderate. This habitat shares an affinity (in terms of structure and species composition) with the reference types.
SPECIES OF CONSERVATION CONCERN		

In terms of Section 56 of the National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEMBA), threatened species are Red Data Listed (RDL) species falling into the Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected (P) categories of ecological status. During the October 2021 field assessment, no RDL species were identified within the study area.

The National Web-based Environmental Screening Tool indicated that the study area is in an area of medium sensitivity from a Plant Species Theme perspective. However, no SCC as identified by the screening tool (namely *Cucumis humifructus* (VU), *Brachycorythis conia subsp. transvaalensis* (CR), *and Hesperantha bulbifera* (Rare)) were recorded with this habitat unit. Thus, the medium sensitivity as denoted by the screening tool was not supported for the Plant Species Theme.

The Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003) (LEMA) provides a list of Specially Protected Species (Schedule 11) and Protected Species (Schedule 12) for the Limpopo Province. These species were also considered as part of the SCC assessment for the study area because they are considered important provincially. Provincially protected species recorded and the Probability of Occurrence (POC) calculations for LEMA protected species are presented below for the habitat units:

- Freshwater Habitat:
  - *Spirostachys africana* (POC = Medium; Status = LC).
- Mixed Bushveld Habitat:
  - *Scadoxus puniceus* (POC = High, Status = LC);

HABITAT OVERVIEW

- *Huernia spp.* (POC = Medium);
- *Stapelia spp.* (POC = Medium); and
- *Spirostachys africana* (POC = Medium; Status = LC).

Additionally, several protected tree species, as per the National Forest Act, 1998 (Act No. 84 of 1998) (NFA), were included in the SCC assessment and several species were observed within the Habitat unit/s. The POC calculations for these species are presented below:

- Mowed Road Verge Habitat:
  - *Sclerocarya birrea* subsp. *caffra* (POC = Confirmed; Status = LC);
  - *Combretum imberbe* (POC = Confirmed; Status = LC); and
  - *Boscia albitrunca* (POC = High; Status = LC).

- Mixed Bushveld Habitat:
  - *Sclerocarya birrea* subsp. *caffra* (POC = Confirmed; Status = LC);
  - *Combretum imberbe* (POC = Confirmed; Status = LC); and
  - *Boscia albitrunca* (POC = High; Status = LC).

- Freshwater Habitat:
  - *Elaeodendron transvaalense* (POC = Medium, Status = NT).

The Threatened or Protected Species (TOPS) List as per the 2007 Regulations provides a list of protected species for the Limpopo Province. No suitable habitat to support TOPS species was identified within the study area.

Permits from the Limpopo Department of Economic Development, Environment & Tourism (LEDET) and authorisation from the Department of Forestry, Fisheries, and the Environment (DFFE) should be obtained to remove, cut, or destroy any of the above-mentioned protected and/or threatened species before any vegetation clearing may take place.

Refer to Appendix H for the complete SCC assessment results.

PRESENCE OF UNIQUE LANDSCAPES

Overall, the Mowed Road Verge Habitat has been significantly modified or degraded and the vegetation communities are no longer considered representative of the reference vegetation types. The Mixed Bushveld Habitat was considered to share an affinity with the reference vegetation types.

The Terrestrial Sensitivity for the entire study area is considered to have a very high sensitivity. The triggered sensitivity feature included the presence of a CBA1, ESA1 and ESA2. Given the level of anthropogenic influences experienced across the study area, the presence of CBA1 habitat was not confirmed for the Mowed Road Verge Habitat. Although CBA habitat is present in the greater area of the Mixed Bushveld habitat, the localised areas along the Mowed Road Verge are unlikely to contribute significantly to CBA processes (thus the classification of CBA within the small sections of Mixed Bushveld immediately adjacent to the Mowed Road Verge (and its edge effects) was not confirmed). Although ESA1 and ESA2 habitat is unlikely to be present within the Mowed Road Verge Habitat (given the high degree of continued disturbance, e.g., mowing and habitat fragmentation), ESA habitat, albeit modified, was confirmed within the Freshwater and Mixed Bushveld Habitats. Although these habitats have been significantly impacted by anthropogenic influences (e.g., dumping) and edge effects (e.g., erosion and AIP proliferation), they still have the propensity to provide important ecological services within the study area and the greater surrounding areas, e.g., including connective and dispersal corridors, albeit in an altered fashion.

CONCLUDING REMARKS

HABITAT OVERVIEW
From a floral perspective, the Mowed Road Verge Habitat is deemed to be of a moderately low ecological importance whereas the Freshwater habitat is deemed to be of intermediate ecological importance within the greater landscape. Key considerations: - The reference vegetation type, as per Mucina & Rutherford (2006), included the Western Sandy Bushveld (in the western sections of the study area) and the Central Sandy Bushveld (in the eastern part of the study area). Given the overall degraded and modified nature of the habitats within the study area, as well as the alteration of natural fire regimes and grazing pressure experienced within the habitat, none of the Habitat units are considered representative of the reference vegetation types. - Overall, the Mowed Road Verge and Mixed Bushveld Habitats provide suitable habitat to sustain viable populations of some floral SCC, especially LEMA and NFA protected species. However, provincially protected species (i.e., as per the LEMA), TOPS species and threatened RDL species are unlikely to be associated with these habitat units. No SCC species were recorded within the Freshwater Habitat and the propensity of the habitat unit to provide suitable habitat for SCC is deemed to be moderately low. If the proposed road upgrade is authorised, it is recommended that all SCC marked during the field assessment be considered for possible relocation to suitable habitat in the nearby, natural surrounding areas. It is recommended that for species that cannot be relocated, seedlings and /or seeds of these species are harvested form the development footprint area before clearing activities commence and grown under nursery conditions with the purpose to use these species for rehabilitation at a later stage. Permits from the relative authorities will be required before any removal or relocation of any protected SCC can take place. - In terms of the National Web-based Environmental Screening Tool outcome, the study area (and its associated habitat units) does not match the medium sensitivity assigned to the Plant Species Theme, especially as suitable habitat to support the triggering sensitive species was not recorded during the field assessment. The study area is located within important biodiversity features such as CBA1 and ESAs. No CBA habitat was recorded within the study area. No ESA habitat was identified within the Mowed Road Verge Habitat or within the Transformed Habitat, although ESA habitat was identified within the Mixed Bushveld habitat. The propensity of the Freshwater habitat to provide functions of ESA habitat is apparent. - Due to the entire study area already being exposed to continued disturbance (e.g., mowing and transformation) and edge effect impacts on both of the habitat units, particularly the Freshwater Habitat and greater Mixed Bushveld, the habitats are susceptible to AIP proliferation. Care must be taken to limit edge effects on the surrounding natural areas. Appropriate stormwater management systems must be implemented with the proposed upgrade, especially were the road crosses watercourses. Furthermore, it is recommended that an AIP species management plan be developed to manage the proliferation of AIPs within the study area. - All the natural areas outside of the authorised footprint must be demarcated as “no-go” areas to ensure no footprint creep takes place.

4.2 Faunal Assessment Results

Selected examples of faunal habitat and species recorded within the Study Area

Photos from left to right: General view of the mowed road reserve habitat (left and centre) and evidence of bush clearing along the road reserve within the Freshwater habitat.

Fauna recorded on site from left to right: *Tragelaphus streptocerus* (Kudu) were seen adjacent the road reserve on several occasions, *Trachylepis varia* (Variable Skink), Swallow nests were observed under several bridges and culverts, *Circaetus pectoralis* (Black-chested Snake Eagle).

Faunal Habitat Overview

The faunal communities associated with the study area had the potential to reflect assemblages in the highly diverse locations adjacent to the road reserve, where several nature reserves, private game lodges and hunting farms are located. The road reserve itself is fenced off from these areas and largely cleared of vegetation and as such has a lower sensitivity from a faunal perspective. The study area will not will not serve as permanent habitat for fauna for the most part as a result of high traffic disturbance. The temporary bypass will transverse more valuable mixed habitat where a rich assemblage of fauna is anticipated. However, this location is situated adjacent the road where most faunal species will avoid due to traffic disturbances. The possible realignment will also transverse more valuable Mixed Bushveld and Freshwater habitat also rich in fauna. Sensitive habit will be lost in this location yet rehabilitation in decommissioned portions following realignment should negate impacts. The road verges have been mowed throughout the length of the study area to clear the view of motorists as to avoid collisions with animals while decreasing the forage and habitat for fauna. Several preferential flow paths transect the road forming portions of the Freshwater Habitat, which would normally act as corridors for faunal movement, but in all cases, these corridors have been fenced and no longer perform this function. As a result of the current land use as a transport corridor, habitat is considered to be degraded

and thus of limited use to fauna. This is specifically true due to the regular disturbance caused by mowing and the removal of sapling trees which may have provided roosting and/ or food resources for select faunal species.
Faunal assemblages associated with the study area were moderately low within the mowed road verge habitat while they are considered intermediate within the degraded freshwater and Mixed Bushveld habitat. Only *Phacochoerus africanus* (Warthog) were observed feeding along the road verge. *Tragelaphus streptocerus* (Kudu) were observed adjacent the road. Several other small mammal grazers able to permeate through fencing, such as Steenbok (*Raphicerus campestris*), *Lepus saxatilis* (Scrub hare) and Duiker (*Sylvicapra grimmia*) are likely to also forage intermittently within the road reserve. These smaller mammal species are able to manoeuvre through the game fences within portions of the study area which are inaccessible to larger antelope. A rich diversity of fauna occurs within the Mixed Bushveld and Freshwater habitat beyond the road reserve where signs of faunal communities typical of the Bushveld were observed.

The most abundant classes observed were avifauna which were common throughout the study area and were particularly rich along more densely structured Mixed Bushveld and Freshwater habitat. Mostly common faunal species were noted along the road reserve and even these species are not anticipated to breed here as a result of the mowing and traffic disturbances from the vehicles travelling along the R516 route. A single reptile was observed utilising the concrete structure of a bridge within the degraded freshwater habitat. No roadkill specimens were observed. The habitat adjacent to the road reserve and within the Mixed Bushveld Habitat will host numerous herpetofaunal species who will traverse the road reserve when necessary and may possibly utilise the tar road edges for basking during the day. No faunal species, besides common invertebrates, are likely to utilise the road reserve permanently as it is anticipated that the forage resources they require would not be easily available and as such fauna would rather utilise areas adjacent to the mowed road reserve habitat that are in a more natural condition. It is further noted that the cyclic mowing of the reserve will be detrimental to various herpetofauna and invertebrates.

Invertebrate species were at low diversities and abundances during the field investigation due to the timing of the surveys. However, considering the locations through which the road traverses, it is considered that very high abundances and diversities of invertebrates will persist within the broader area and within the Mixed Bushveld and Freshwater Habitat units particularly. The road reserve itself will likely be of reduced suitability as invertebrates will be exposed to a high degree of solar radiation due to the lack of cover (as a result of regular mowing and vegetation clearing) and traffic mortalities, thus it is anticipated that they would rather reside in areas adjacent the road reserve where they would find more shelter and food resources.

FAUNAL SCC
No faunal SCC are anticipated to inhabit the road reserve on a permanent basis but may traverse it occasionally (Table 6). Two faunal SCC have been identified by the National Screening Tool, which include: *Sagittarius serpentarius* (Secretarybird (EN) and Sensitive species 7[10] as potentially occurring within the road reserve. These species will not utilise the road reserve as permanent habitat due the constant traffic disturbances, the surrounding game fencing that will limit movement and the reduced habitat suitability, however, these species may cross the R516 sporadically. Any collisions should be recorded to limit potential future collisions. Several SCC may utilise the Mixed Bushveld habitat where the re-alignment and bypass are proposed, yet the small scale and short temporal nature of the activities will not result in long term impacts to these species.
CONCLUDING REMARKS
The proposed upgrading of the road is not anticipated to result in the loss of faunal habitat for the most part as only small portions of Mixed Bushveld will be altered, however, the potential for higher traffic may increase the number of faunal collisions. As the transport route travels adjacent to areas with rich faunal assemblages it is possible that impacts in the form of vehicle collisions could occur to both common faunal species and SCC. To reduce the potential for collisions fencing on both sides of the road verges should ensure that movement into this area by fauna is restricted. To maintain the potential for faunal corridors landowners on either side of the road should be encouraged to open the corridors (beneath culverts and bridges occur) while ensuring faunal movement onto the road is restricted. As the upgrades occur along existing roads, impacts are anticipated to be medium to low and are not anticipated to alter the local habitat from the current *in situ* environment conditions, provided mitigation measures stipulated in this report are adhered to. Where re-alignment or where bypasses are used, the historically utilised road should be ripped and stripped of construction materials and revegetation and AIP monitoring should occur in these locations to re-establish faunal habitat.

[10] According to the best practise guidelines provided by SANBI, the name of sensitive species provided by the Online EIA screening tool may not appear in the final EIA report nor any of the specialist reports released into the public domain. This is to protect species that are under threat to factors such as illegal harvesting and overexploitation.

4.3 Alien and Invasive Plant (AIP) Species

South Africa is home to an estimated 759 naturalised or invasive terrestrial plant species (Richardson et al., 2020), with 327 plant species, most of which are invasive, listed in national legislation[11]. Many introduced species are beneficial, e.g., almost all agriculture and forestry production are based on alien species, with alien species also widely used in industries such as horticulture. However, some of these species manage to "escape" from their original locations, spread and become invasive. Although only a small proportion of introduced species become invasive (~0.1–10%), those that do proceed to impact negatively on biodiversity and the services that South Africa's diverse natural ecosystems provide (from ecotourism to harvesting food, cut flowers, and medicinal products) (van Wilgen and Wilson, 2018).

4.3.1 Legal Context

South Africa has released several Acts legislating the control of alien species. Currently, invasive species are controlled by the NEMBA – Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated 25 October 2020. AIP species defined in terms of NEMBA are assigned a category and listed within the NEMBA List of Alien and Invasive Species (2020) in accordance with Section 70(1)(a) of the NEMBA:

- **Category 1a** species are those targeted for urgent national eradication;
- **Category 1b** species must be controlled as part of a national management programme, and cannot be traded or otherwise allowed to spread;
- **Category 2** species are the same as category 1b species, except that permits can be issued for their usage (e.g., invasive tree species can still be used in commercial forestry, providing a permit is issued that specifies where they may be grown and that permit holders "*Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to Regulation 3*"); and
- **Category 3** are listed invasive species that can be kept without permits, although they may not be traded or further propagated, and must be considered a Category 1b species if they occur in riparian zones.

[11] Government Notice number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004).

Duty of care related to listed invasive species are referred to in NEMBA Section 73[12]. The motivation for this duty of care is both environmentally and economically driven. Management of alien species in South Africa is estimated to cost at least ZAR 2 billion (US$142 million) each year - this being the amount currently spent by the national government's DFFE - i.e., the Working for Water programme (van Wilgen, 2020). Managing AIPs early on will reduce clearing costs in the long run.

4.3.2 Site Results

A total of 13 AIP species were recorded within the study area. Of the 13 AIP species recorded. Although a similar number (i.e., 10) AIP species were recorded in each habitat unit, the density of AIPs within the Freshwater Habitat was much higher than that recorded within the Mowed Road Verge Habitat.

Of the 13 AIP species recorded within the study area, four species are listed under NEMBA category 1b, two species are listed as NEMBA category 2, and one species is listed under NEMBA category 3. The remaining six species are not currently listed in the NEMBA Alien and Invasive Species List of 2020 and thus are not regarded as invasive species. Several of these species are rather seen as problem plants, especially *Bidens Pilosa, Tagetes minuta*, *Sesbania sesban*, and *Agave americana*. Although these species may not pose an immediate risk of displacing native flora, they can become problematic after disturbance events and due to their pioneering nature, will colonise disturbed habitat more readily than native flora.

It is recommended that the study area be targeted for AIP control, especially along the Freshwater Habitat where AIP propagules can be transported to downstream sites.

Refer to table 3 for more details on the AIPs recorded within the study area.

[12] Section 73(2): A person who is the owner of land on which a listed invasive species occurs must-
a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land;
b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and
c) take all the required steps to prevent or minimise harm to biodiversity.

Table 3: Alien and invasive alien species associated with the study area.

Scientific name	Common name	Origin	NEMBA Category	Mowed Road Verge Habitat	Freshwater Habitat	Mixed Bushveld
Woody Species						
Acacia mearnsii	Black wattle	Australia	2	x	x	
Eucalyptus cf. camaldulensis	River red gum	Australia	1b	x	x	x
Melia azedarach	Syringa	Asia	1b		x	
Pinus cf. canariensis	Canary Pine	Old World	3	x	x	
Sesbania sesban	Egyptian river hemp	NE Africa	NL		x	x
Herbaceous Species						
Argemone ochroleuca subsp. *ochroleuca*	Mexican poppy	Mexico	1b	x	x	x
Bidens pilosa	Blackjack	South America	NL	x	x	x
Tagetes minuta	Khaki weed	South America	NL		x	x
Succulent Species						
Agave americana	Spreading century plant	South America	NL	x		x
Agave sisalana	Sisal	South America	*2*	*x*		x
Opuntia cf. ficus-indica	Sweet prickly pear	South America	1b	x		x
Yukka sp.	Yukka	Americas	NL	x	x	
Graminoid Species						
Pennisetum clandestinum	Kikuyu grass	East Africa	NL	x	x	x

5. SENSITIVITY MAPPING

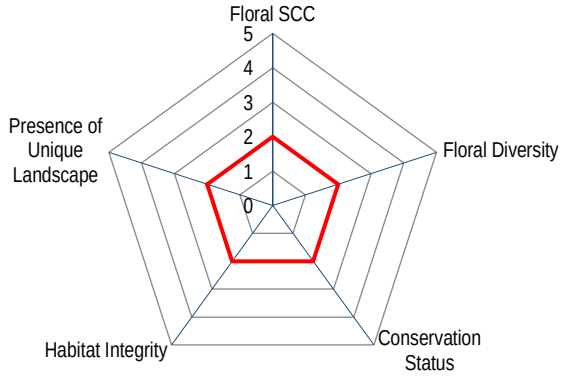
The Screening Tool identified the study area to be in a **medium sensitivity** area for the Plant Species Theme, a **high sensitivity** area for the Animal Species Theme, and a **Very High Sensitivity** area for the Terrestrial Biodiversity Theme. Based on the *ground-truthed* results of the site visit, the following was established for each theme:

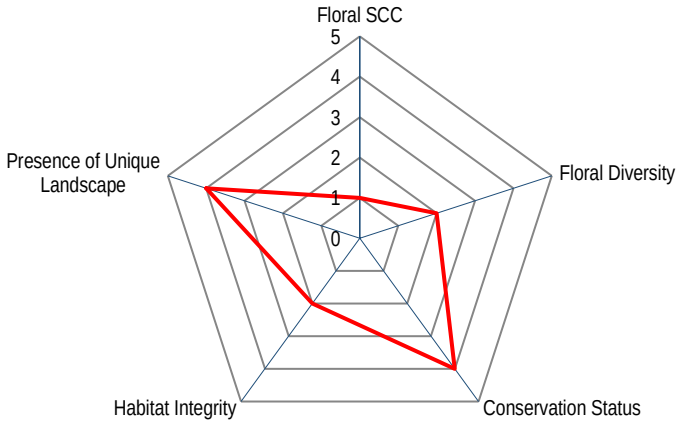
- Terrestrial Biodiversity Theme: Triggering features include CBA and ESA habitat. No CBA habitat was confirmed within the study area. ESA habitat (albeit modified) was recorded within the Mixed Bushveld and Freshwater Habitats. No CBA or ESA habitat was confirmed for the Road Verge Habitat. As such, the very high sensitivity assigned by the National web-based screening tool was confirmed for the Freshwater and Mixed Bushveld habitats but not for the Road Verge Habitat;
- Plant Species Theme: given that no RDL species were recorded and that a lack of suitable habitat for such species was recorded, the medium sensitivity as denoted by the screening tool for the study area was not supported; and
- Animal Species Theme: the constant disturbance to most of the study area where Road Verge Habitat occurs does not provide sustainable or suitable habitat for most faunal species and as such the medium sensitivity aligned for this habitat unit is not supported. However, Freshwater and Mixed bushveld habitat are capable or supporting rich faunal communities of medium sensitivity.

Table 4 below presents the sensitivity of each identified habitat unit for both flora and fauna along with an associated conservation objective and implications for development.

Figure 9 conceptually illustrate areas of ecological sensitivity – depicting the combined sensitivity for flora and fauna. The study area is depicted according to its sensitivity in terms of the presence or potential for SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity.

Table 4: A summary of the Floral and Faunal sensitivity of each habitat unit and implications for development.

Habitat Sensitivity	Conservation objective	Habitat Unit	Key habitat characteristics
Moderately low 	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	Mowed Road Verge Habitat	- Meets the definition of Indigenous Vegetation, albeit in a degraded state. - Habitat has been degraded due to current and historic disturbances (particularly frequent mowing and constant traffic). - The floral communities within this habitat unit have shifted away from the reference vegetation types. Floral species diversity is moderately low. - This Habitat Unit is unlikely to provide higher levels of food resources for fauna as a result of mowing. - Faunal species diversity is considered moderately low - Two NFA protected tree species were recorded within the habitat unit. Habitat to support other SCC (i.e., as per the LEMA, TOPS, and RDL species) is deemed low. - No significant biodiversity features present.

Habitat Sensitivity	Conservation objective	Habitat Unit	Key habitat characteristics
Intermediate  	Preserve and enhance biodiversity of the habitat unit and surrounds while optimizing development potential.	Freshwater Habitat & Mixed Bushveld Habitat	- Meets the definition of Indigenous Vegetation, albeit in a degraded state. Thus suitable habitat for most fauna exists. - Proximity to existing disturbances reduces the suitability for permanent inhabitancy by most fauna; - Habitats have been degraded as is evident with the presence of AIPs. - Habitats associated with a moderate to moderately low floral species diversity. - Floral SCC species recorded within the habitats. Suitable habitat for further floral and faunal SCC deemed moderate. - Despite its level of degradation, these habitats have the propensity to provide important ecological functions (e.g., dispersal and movement corridors) within the study area and the greater surrounding areas because of the presence of ESA habitat.

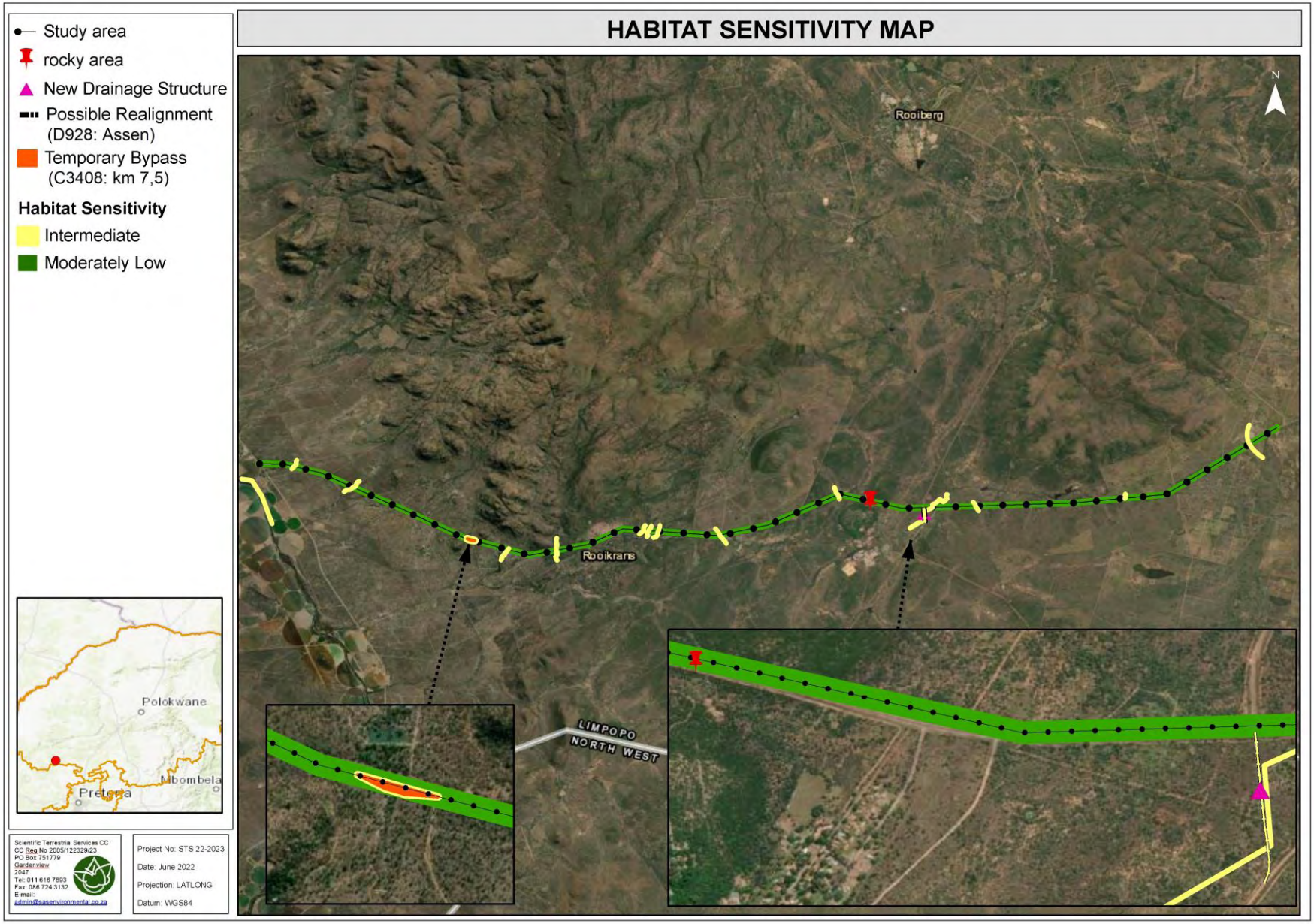


Figure 9: Combined biodiversity sensitivity map of the study area.

6. IMPACT ASSESSMENT

The table below (Table 5) serve to summarise the significance of perceived impacts on the terrestrial ecology of the study area, according to the method described in Appendix E (as provided by the proponent).

An impact discussion and assessment of all potential i) Pre-construction & Planning, ii) Construction, and iii) Operational and Maintenance Phase impacts are provided in Section 6.2. All mitigatory measures required to minimise the perceived impacts are presented in in the impact tables (section 6.1).

6.1 Impact Assessment Tables

The below section provides the findings of the impact assessment undertaken with reference to the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

The tables below (Table 5 & 6) provide the results of the terrestrial biodiversity impact assessment for the floral and faunal ecology respectively.

A discussion is provided for flora and fauna separately in **Sections 6.2.1** and **6.2.2** respectively.

Table 5: Summary of the Impact Assessment of the Pre-Construction & Planning, Construction, and Operational and Maintenance Phases associated with the Floral Ecology of the proposed R516_L_75 Road upgrade.

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
PRE-CONSTRUCTION & PLANNING PHASE													
Impacts to Floral Habitat and Diversity													
Loss of Floral Habitat & Diversity within the Road Verge Habitat	➢ Potential failure to design and implement an AIP Management/Control plan before the commencement of construction activities, resulting in the spread of AIPs from the development footprint to surrounding natural habitat, leading to potential loss of floral species diversity from surrounding natural habitat; and ➢ Potential inadequate design of stormwater management and erosion control, resulting in increased risk of erosion and loss of topsoil which results in the loss of favourable floral habitat beyond the authorised footprint, leading to a decline in floral diversity.	Negative	Direct	Moderate	Study Area	Medium-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)	➢ Minimise loss of indigenous vegetation where possible through adequate planning and, where necessary, by incorporating the sensitivity of the biodiversity report as well as other specialist studies; and ➢ Prior to the commencement of construction activities, an AIP Management/Control Plan should be compiled for implementation: - Removal of AIPs should preferably commence during the pre-construction phase and continue throughout the construction and operational phases. AIPs should be cleared before any vegetation clearing activities commence, thereby ensuring that no AIP propagules are spread with construction rubble, or soils contaminated with AIP seeds during the construction phase; and - An AIP Management/Control Plan should be implemented by a	LOW (-)
Loss of Floral Habitat & Diversity within the Mixed Bushveld Habitat		Negative	Direct	Moderate	Study Area	Medium-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)		LOW (-)

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
Loss of Floral Habitat & Diversity within the Freshwater Habitat		Negative	Direct	Moderate	Study Area	Medium-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)	qualified professional. No use of uncertified chemicals may be used for chemical control of AIPs. Only trained personnel are to use chemical and mechanical control methods of AIPs. Chemical control may not be used within the Freshwater Habitat.	LOW (-)
Impacts to Floral SCC													
Loss of Floral SCC within the Road Verge Habitat	➢ Potential failure to conduct a walkdown of the footprint area and identify SCC for potential relocation, and/or potential failure to relocate, where feasible, potential floral SCC, i.e., protected species according to the LEMA and NFA to suitable habitat outside the development footprint (i.e., in the greater surrounding Mixed Bushveld Habitat). Such activities will lead to the loss of floral SCC, within	Negative	Direct	Moderate	Study Area	Medium-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)	➢ SCC as per the LEMA and NFA were recorded on site and other such species are likely to be located within the study area. A walkdown of the footprint area is required before construction activities commence where anticipated floral SCC/protected species are searched and marked (if encountered); and	LOW (-)
Loss of Floral SCC within the Mixed Bushveld Habitat		Negative	Direct	Moderate	Localised	Medium-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)		LOW (-)

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
Loss of Floral SCC within the Freshwater Habitat	the development footprint areas in the study area.	Negative	Direct	Moderate	Study Area	Medium-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)	➢ If SCC/protected species are encountered and will be affected by the construction activities, these species must be marked and where possible, relocated to suitable habitat surrounding the disturbance footprint. Suitable habitat is available in nearby surrounding locations. For the removal, destruction, or relocation of protected flora.	LOW (-)
CONSTRUCTION PHASE													
Impacts to Floral Habitat & Diversity													
Loss of Floral Habitat & Diversity within the Road Verge Habitat	➢ Site clearing and the removal of vegetation which leads to the loss of floral habitat, diversity and potentially occurring floral SCC; ➢ Proliferation of AIP species that colonise in areas of increased disturbances and that outcompete native species, including the further transformation of adjacent natural habitat that surround the greater study area. This leads to the loss	Negative	Direct	Moderate	Study Area	Medium-term	Definite	Reversible	Resource will be partly lost	Achievable	Moderate (-)	➢ The construction footprint must be kept as small as possible in order to minimise impact on the surrounding environment (edge effect management); ➢ Removal of vegetation must be restricted to what is absolutely necessary and should remain within the approved development footprint. ➢ Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities. Additional road	Low (-)
Loss of Floral Habitat & Diversity within the Mixed Bushveld Habitat		Negative	Direct	Moderate	Study Area	Medium-term	Definite	Reversible	Resource will be partly lost	Achievable	Moderate (-)		Low (-)

Loss of Floral Habitat & Diversity within the Freshwater Habitat	of suitable habitat for floral species; ➢ Dumping of construction material within areas where no construction is planned, thereby leading to further habitat disturbance - allowing the establishment and spread of AIPs; ➢ Failure to rehabilitate bare areas or disturbed sites outside of the footprint area as soon as they become available, potentially resulting in loss of viable soils, increased erosion risks and/or the proliferation of AIPs; ➢ Potentially poorly managed edge effects: - Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to ongoing proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas altering the floral habitat; and - Compaction of soils outside of the study area due to indiscriminate driving of construction vehicles through natural vegetation ➢ Dust generated during construction and operational activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants and potentially further decreasing optimal growing/re-establishing conditions.	Negative	Direct	Moderate	Study Area	Medium-term	Definite	Reversible	Resource will be partly lost	Achievable	Moderate (-)	construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimal; ➢ Care should be taken during the construction and operation of the proposed development to limit edge effects to surrounding natural habitat. This can be achieved by: - Demarcating all footprint areas during construction activities; - No construction rubble or cleared alien invasive species are to be disposed of outside of demarcated areas, and should be taken to a registered waste disposal facility; - All soils compacted as a result of construction activities should be ripped and profiled and reseeded; - Manage the spread of AIP species, which may affect remaining natural habitat within surrounding areas. Specific mention in this regard is made to Category 1b and 2 species identified within the development footprint areas (refer to section 4.3 of this report); and - No dumping of litter, rubble or cleared vegetation on site should be allowed. Infrastructure and rubble removed as a result of the construction activities should be disposed of at an appropriate registered dump site away from the development footprint. No temporary dump sites should be allowed in	Low (-)

												areas with natural vegetation. Waste disposal containers and bins should be provided during the construction phase for all construction rubble and general waste. Vegetation cuttings must be carefully collected and disposed of at a separate waste facility. ➢ If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral rehabilitation later down the line. Spill kits should be kept on-site within workshops. In the event of a breakdown, maintenance of vehicles must take place with care, and the recollection of spillage should be practised, preventing the ingress of hydrocarbons into the topsoil; ➢ Upon completion of construction activities, it must be ensured that no bare areas remain, and that indigenous species be used to revegetate the disturbed area. ➢ Any natural areas beyond the direct footprint, which have been affected by the construction or operational activities, must be rehabilitated using indigenous species; ➢ All soils compacted because of construction activities falling outside of the project area should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas; and ➢ No illicit fires must be allowed during the construction of the proposed development.	

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
Impacts to Floral SCC													
Loss of Floral SCC within the Road Verge Habitat	➢ Potential failure to monitor the success of relocated floral SCC which results in the loss of SCC individuals; ➢ Proliferation of AIP species that colonise in areas of increased disturbances and that outcompete native species, including the further transformation of adjacent natural habitat that surround the greater study	Negative	Direct	Moderate	Study Area	Medium-term	Definite	Reversible	Resource will be partly lost	Achievable	Moderate (-)	➢ No collection of indigenous floral species must be allowed by construction personnel, especially with regards to floral SCC (if encountered); ➢ No collection of floral SCC must be allowed by construction personnel; and ➢ Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC outside of the	Low (-)
Loss of Floral SCC within the Mixed Bushveld Habitat		Negative	Direct	Moderate	Study Area	Medium-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)		Low (-)

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
Loss of Floral SCC within the Freshwater Habitat	area. This leads to the loss of suitable habitat for SCC; ➢ Overexploitation through the removal and/or collection of important or sensitive floral SCC beyond the direct footprint area due to increased presence of workers on site ➢ Potentially poorly managed edge effects: - Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to ongoing proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas altering the floral habitat; and - Compaction of soils outside of the study area due to indiscriminate driving of construction vehicles through natural vegetation.	Negative	Direct	Moderate	Study Area	Medium-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)	proposed development footprint area.	Low (-)
OPERATIONAL & MAINTANANCE PHASE													
Impacts to Floral Habitat & Diversity													
Loss of Floral Habitat & Diversity within the Road Verge Habitat	➢ Ineffective rehabilitation of exposed and impacted areas, increasing erosion risk and AIP proliferation within the surrounding areas;	Negative	Direct	Moderate	Study Area	Medium-term	Definite	Reversible	Resource will be partly lost	Achievable	Moderate (-)	➢ No additional habitat is to be disturbed during the operational & maintenance phase of the proposed road upgrade; ➢ No vehicles are allowed to indiscriminately drive through natural areas;	Low (-)

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
Loss of Floral Habitat & Diversity within the Mixed Bushveld Habitat	➢ Increased introduction and proliferation of alien plant species due to a lack of maintenance activities, or poorly implemented and monitored AIP Management programme, leading to ongoing displacement of natural vegetation outside of the footprint area; ➢ Potential poor management and failure to monitor rehabilitation efforts, leading to: - Compacted soils leading to increased runoff and erosion, as well as increased AIP cover limiting the re-establishment of natural vegetation; and - Increased risk of erosion in areas left disturbed.	Negative	Direct	Moderate	Study Area	Medium-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)	➢ No dumping of litter must be allowed on-site; ➢ Edge effects arising from the proposed road upgrade, such as erosion and AIP species proliferation, which may affect adjacent natural areas, need to be strictly managed. Specific mention in this regard is made of Category 1b and 2 AIP species (as listed in the NEMBA Alien species lists, 2020), in line with the NEMBA Alien and Invasive Species Regulations (2020); ➢ Ongoing AIP monitoring and clearing/control should take place throughout the operational phase, and the project perimeters should be regularly checked for AIP establishment to prevent spread into surrounding natural areas; ➢ AIP vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility, which complies with legal standards; ➢ No illicit fires must be allowed during the operational and maintenance phase of the proposed road upgrade; and ➢ Mowing of the road reserve is suggested to limit the potential of biomass build-up which could lead to runaway fires.	Low (-)
Loss of Floral Habitat & Diversity within the Freshwater Habitat		Negative	Direct	Moderate	Study Area	Medium-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)		Low (-)

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
Impacts to Floral SCC													
Loss of Floral SCC within the Road Verge Habitat	➢ Ineffective rehabilitation of exposed and impacted areas, increasing erosion risk and AIP proliferation within the surrounding areas; ➢ Increased introduction and proliferation of alien plant species due to a lack of maintenance activities, or poorly implemented and monitored AIP Management programme, leading to ongoing displacement of natural vegetation outside of the footprint area; ➢ Unauthorised collection of (relocated or remaining) SCC within the study area.	Negative	Direct	Moderate	Study Area	Medium-term	Definite	Reversible	Resource will be partly lost	Achievable	Moderate (-)	➢ As far as possible, no collection of floral SCC/protected floral species within the study area or adjacent natural habitat must be allowed during the operational phase of the proposed development; and ➢ Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC/protected species or suitable habitat for such species outside of the proposed development footprint.	Low (-)
Loss of Floral SCC within the Mixed Bushveld Habitat		Negative	Direct	Moderate	Study Area	Medium-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)		Low (-)
Loss of Floral SCC within the Freshwater Habitat		Negative	Direct	Moderate	Study Area	Medium-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)		Low (-)

Table 6: Summary of the Impact Assessment of the Pre-Construction & Planning, Construction, and Operational and Maintenance Phases associated with the Faunal Ecology of the proposed R516_L_75 Road upgrade.

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
PRE-CONSTRUCTION & PLANNING PHASE													
Impacts to Faunal Habitat and Diversity													
Loss of Faunal Habitat & Diversity within the Road Verge Habitat	➢ Potential failure to design and implement an AIP Management/Control plan before the commencement of construction activities, resulting in the spread of AIPs into surrounding faunal habitat, leading to reduced resource availability; ➢ Failure to demarcate the proposed culverts, bypasses and diversions prior to construction resulting in excess clearance of vegetation (faunal habitat, notably the Freshwater and Mixed Bushveld units); and ➢ Potential inadequate design of stormwater management and erosion control, resulting in increased risk of erosion and loss of topsoil which results in the loss of favourable floral habitat beyond the authorised footprint, leading to a decline in faunal diversity.	Negative	Direct	Slight	Study Area	Short-term	Probable	Reversible	Resource will be partly lost	Achievable	LOW (-)	➢ Minimise loss of natural vegetation where possible through effective planning and limiting the development footprint to what is essential. The designs must further adhere to all legislation and all reasonable precautions must be taken to prevent potential spills and /or leaks; ➢ Design of infrastructure should be environmentally sound and all construction equipment to be utilised must be in good working condition, all possible precautions taken to prevent potential spills and /or leaks; ➢ It must be ensured that, as far as possible, all proposed infrastructure, including temporary infrastructure, are not placed outside of the authorised footprint, especially within the freshwater habitat that is to be left as open space. ➢ A stormwater management plan should be designed and implemented for all phases of the development, this in order to minimise potential erosion of downslope habitat and sedimentation of watercourses;	LOW (-)
Loss of Faunal Habitat & Diversity within the Mixed Bushveld Habitat		Negative	Direct	Moderate	Study Area	Short-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)		LOW (-)

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
Loss of Faunal Habitat & Diversity within the Freshwater Habitat		Negative	Direct	Moderate	Study Area	Short-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)	➢ An AIP Management/Control Plan should be compiled by a qualified professional and implemented prior to the start of construction activities. No chemical control of AIPs to occur without a certified professional and no chemical control to be permitted in Freshwater habitat; and ➢ Appropriate Rehabilitation measures, Erosion Control, and Bush Encroachment Control Plans should be implemented to ensure control thereof.	LOW (-)
Impacts to Faunal SCC													
Loss of Faunal SCC within the Road Verge Habitat	➢ Potential failure to conduct a walkdown of the footprint area and identify SCC (burrows or nests) for potential relocation, and/or potential failure to relocate, where feasible, potential faunal SCC, i.e., protected species according to the LEMA and TOPS to suitable habitat outside the development footprint (i.e., in the greater surrounding	Negative	Direct	Slight	Study Area	Short-term	Probable	Reversible	Resource will be partly lost	Achievable	LOW (-)	➢ The relocation of faunal SCC must take place prior to the commencement of the construction phase where vegetation clearing will occur. Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. ➢ No collection of faunal SCC within the study area may be	LOW (-)
Loss of Faunal SCC within the Mixed Bushveld Habitat		Negative	Direct	Slight	Study Area	Short-term	Probable	Reversible	Resource will be partly lost	Achievable	LOW (-)		LOW (-)

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
Loss of Faunal SCC within the Freshwater Habitat	Mixed Bushveld Habitat). Such activities will lead to the loss of faunal SCC, within the development footprint areas in the study area.	Negative	Direct	Slight	Study Area	Short-term	Probable	Reversible	Resource will be partly lost	Achievable	LOW (-)	undertaken by any construction personnel; ➢ Edge effect control needs to be implemented to prevent further degradation and potential loss of faunal SCC habitat outside of the proposed development footprint; ➢ Should any other faunal species protected under the NEMBA or LEMA be encountered, construction should be halted and authorisation to relocate such species must be obtained from the LDEDET or DFFE; and ➢ Smaller species such as scorpions and reptiles are likely to be less mobile during the colder period, as such should any be observed in the study site during clearing and operational activities, they are to be carefully and safely moved to an area of similar habitat outside of the disturbance footprint. Personnel working on the road are to be educated about these species and the need for their conservation. Harmless scorpion or reptiles should be carefully relocated by a nominated construction person or staff member. For venomous snakes or scorpions, a suitably trained official or specialist should be contacted to affect the relocation of the species, should it not move off on its own.	LOW (-)

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
CONSTRUCTION PHASE													
Impacts to Faunal Habitat & Diversity													
Loss of Faunal Habitat & Diversity within the Road Verge Habitat	➢ Site clearing and the removal of vegetation which leads to the loss of faunal habitat, diversity and potentially occurring faunal SCC; ➢ Increased risk of collisions with the construction vehicles or other traffic; ➢ Ignition of fires by staff resulting in an uncontrolled fire (may cause significant impacts); ➢ Proliferation of AIP species that colonise in areas of increased disturbances and that outcompete native	Negative	Direct	Slight	Study Area	Short-term	Definite	Reversible	Resource will be partly lost	Achievable	LOW (-)	➢ The construction footprint must be kept as small as possible in order to minimise impact on the surrounding environment (edge effect management); ➢ The construction footprint should be demarcated to ensure that development is restricted to these areas and does not expand beyond the areas demarcated for development. A shade cloth/mesh barrier is considered desirable as this will provide a visual obtrusion for faunal species;	Low (-)
Loss of Faunal Habitat & Diversity within the Mixed Bushveld Habitat		Negative	Direct	Moderate	Study Area	Short-term	Definite	Reversible	Resource will be partly lost	Achievable	Moderate (-)		Low (-)

Loss of Faunal Habitat & Diversity within the Freshwater Habitat	species, including the further transformation of adjacent natural habitat that surround the greater study area. This leads to the loss of suitable habitat for faunal species; ➢ Dumping of construction material within areas where no construction is planned, thereby leading to further habitat disturbance - allowing the establishment and spread of AIPs; ➢ Failure to rehabilitate bare areas, temporary bypasses, historic passes no longer used after re-alignment or disturbed sites outside of the footprint area as soon as they become available, potentially resulting in loss of viable soils, increased erosion risks and/or the proliferation of AIPs; ➢ Potentially poorly managed edge effects: - Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to ongoing proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas altering the faunal habitat; and - Compaction of soils outside of the study area due to indiscriminate driving of construction vehicles through natural vegetation ➢ Dust generated during construction and operational activities accumulating on	Negative	Direct	Moderate	Study Area	Short-term	Definite	Reversible	Resource will be partly lost	Achievable	Moderate (-)	➢ Appropriate sanitary facilities must be provided during the construction of the development and must be removed to an appropriate waste disposal site; ➢ No hunting/trapping or collecting of faunal species is allowed; ➢ Fencing adjacent the road reserve should align with the relevant land-uses (cattle farming/ranching/tourism or hunting) to limit the potential for fauna to get into the road reserve; ➢ If at all possible, existing bridges and culverts should allow for the movement of fauna while minimising the potential for them to enter the road reserve. Co-ordination with the various landowners is recommended and fences should direct species into these safe crossing areas; ➢ Removal of vegetation must be restricted to what is absolutely necessary and should remain within the approved development footprint; ➢ Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities. Additional road construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimal; ➢ Care should be taken during the construction of the proposed road upgraded to limit edge effects to surrounding natural habitat. This can be achieved by: 1. Demarcating all footprint areas during construction activities (no development may occur outside of the road reserve);	Low (-)

	the surrounding faunal individuals, altering the photosynthetic ability of plants and altering faunal resource availability.											2. All soils compacted, especially outside of the development footprint, as a result of construction activities should be ripped and profiled and re-seeded; 3. Manage the spread of AIP species, which may affect remaining natural habitat within surrounding areas. Specific mention in this regard is made to Category 1b and 2 species identified within the development footprint areas (refer to section 4.3.1 of this report); and 4. No dumping of litter, rubble or cleared vegetation on site should be allowed. Infrastructure and rubble removed as a result of the construction activities should be disposed of at an appropriate registered dump site away from the development footprint. No temporary dump sites should be allowed in areas with natural vegetation. Waste disposal containers and bins should be provided during the construction phase for all construction rubble and general waste. Vegetation cuttings must be carefully collected and disposed of at a separate waste facility; ➢ If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral rehabilitation later down the line. Spill kits should be kept on-site within workshops. In the event of a breakdown, maintenance of vehicles must take place with care, and the recollection of spillage should be practised, preventing the ingress of hydrocarbons into the topsoil; and	

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
												➢ Upon completion of construction activities, it must be ensured that no bare areas remain, and that indigenous species be used to revegetate the disturbed area.	
Impacts to Faunal SCC													
Loss of Faunal SCC within the Road Verge Habitat	➢ Ignition of fires by staff resulting in an uncontrolled fire (may cause direct SCC mortality beyond the study area); ➢ Potential collisions of SCC with construction vehicles or road traffic; ➢ Proliferation of AIP species that colonise in areas of increased disturbances and that outcompete native species, including the	Negative	Direct	Slight	Study Area	Short-term	Probable	Reversible	Resource will be partly lost	Achievable	LOW (-)	➢ No collection of faunal SCC within the study area may be undertaken by any construction personnel; ➢ No fires are allowed; ➢ Edge effect control needs to be implemented to prevent further degradation and potential loss of faunal SCC habitat outside of the proposed development footprint; ➢ Should any other faunal species protected under NEMBA or	Low (-)
Loss of Faunal SCC within the Mixed Bushveld Habitat		Negative	Direct	Moderate	Study Area	Short-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)		Low (-)

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
Loss of Faunal SCC within the Freshwater Habitat	further transformation of adjacent natural habitat that surround the greater study area. This leads to the loss of suitable habitat for SCC; ➢ Overexploitation through the removal and/or collection of important or sensitive faunal SCC beyond the direct footprint area due to increased presence of workers on site ➢ Potentially poorly managed edge effects: - Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to ongoing proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas altering the faunal habitat; and - Compaction of soils outside of the study area due to indiscriminate driving of construction vehicles through natural vegetation.	Negative	Direct	Moderate	Study Area	Short-term	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)	LEMA be encountered, construction should be halted and authorisation to relocate such species must be obtained from the LDEDET or the DFFE; and ➢ Smaller species such as scorpions and reptiles are likely to be less mobile during the colder period, as such should any be observed in the study site during clearing and operational activities, they are to be carefully and safely moved to an area of similar habitat outside of the disturbance footprint. Personnel working on the road are to be educated about these species and the need for their conservation. Harmless scorpion or reptiles should be carefully relocated by a nominated construction person or staff member. For venomous snakes or scorpions, a suitably trained official or specialist should be contacted to affect the relocation of the species, should it not move off on its own.	Low (-)

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
OPERATIONAL & MAINTANANCE PHASE													
Impacts to Faunal Habitat & Diversity													
Loss of Faunal Habitat & Diversity within the Road Verge Habitat	➢ Ineffective rehabilitation of exposed and impacted areas, increasing erosion risk and AIP proliferation within the surrounding areas leading to faunal habitat succession; ➢ Ignition of fires by staff resulting in an uncontrolled fire (may cause direct SCC mortality beyond the study area); ➢ Ineffective speed limits, signage and fencing resulting in fauna entering the road reserve resulting in faunal collisions; ➢ Potential poor management and failure to monitor rehabilitation efforts, leading to: - Compacted soils leading to increased runoff and erosion, as well as increased AIP cover limiting the re-establishment of natural vegetation; and - Increased risk of erosion in areas left disturbed.	Negative	Direct	Slight	Study Area	Permanent	Probable	Reversible	Resource will be partly lost	Achievable	LOW (-)	➢ No additional habitat is to be disturbed during the operational & maintenance phase of the proposed road upgrade; ➢ No fires are allowed; ➢ Faunal collisions with motor vehicles (SCC and common species) should be recorded and high-risk areas should be identified and adequate fencing should be installed; ➢ Signage should be incorporated in areas of increased faunal movement or in locations where collisions occur more frequently; ➢ No vehicles are allowed to indiscriminately drive through natural areas; and ➢ No dumping of litter must be allowed on-site.	Low (-)
Loss of Faunal Habitat & Diversity within the Mixed Bushveld Habitat		Negative	Direct	Moderate	Study Area	Permanent	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)		Low (-)
Loss of Faunal Habitat & Diversity within the Freshwater Habitat		Negative	Direct	Moderate	Study Area	Permanent	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)		Low (-)

POTENTIAL ISSUES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION (POSITIVE (+) OR NEGATIVE (-))	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION (POSITIVE (+) OR NEGATIVE (-))
Impacts to Faunal SCC													
Loss of Faunal SCC within the Road Verge Habitat	➢ Ineffective rehabilitation of exposed and impacted areas, increasing erosion risk and AIP proliferation within the surrounding areas; ➢ Ignition of fires by staff resulting in an uncontrolled fire (may cause direct impacts on SCC and their habitat); ➢ Increased introduction and proliferation of alien plant species due to a lack of maintenance activities, or poorly implemented and monitored AIP Management programme, leading to ongoing displacement of fauna and changes in local faunal assemblage structure within and outside of the footprint area; ➢ Unauthorised collection of SCC within the study area.	Negative	Direct	Slight	Study Area	Permanent	Probable	Reversible	Resource will be partly lost	Achievable	LOW (-)	➢ As far as possible, no collection of faunal SCC/protected faunal species within the study area or adjacent natural habitat must be allowed during the operational phase of the proposed development; and ➢ Edge effect control needs to be implemented to prevent further degradation and potential loss of faunal SCC/protected species or suitable habitat for such species outside of the proposed development footprint.	Low (-)
Loss of Faunal SCC within the Mixed Bushveld Habitat		Negative	Direct	Moderate	Study Area	Permanent	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)		Low (-)
Loss of Faunal SCC within the Freshwater Habitat		Negative	Direct	Moderate	Study Area	Permanent	Probable	Reversible	Resource will be partly lost	Achievable	Moderate (-)		Low (-)

6.2 Impact Discussion

The direct impact of the proposed road upgrade on the floral and faunal ecology of the study area is not anticipated to be detrimental. Due to the already modified nature of the habitat units, particularly the Mowed Road Verge Habitat, the associated impacts are anticipated to remain localised – given that mitigation measures are adequately implemented. Furthermore, the localised extent of the Mixed Bushveld unit is not anticipated to be significant.

The overall impact significance prior to the implementation of mitigation measures varied between medium and low for the Mowed Road Verge Habitat, Mixed Bushveld and the Freshwater Habitat. With the implementation of mitigation measures, the proposed impact significance can be reduced to low levels of significance for all habitats.

6.2.1 Impact on Floral Ecology

Impact on Floral Habitat and Diversity

The impact assessment was undertaken on all aspects of floral ecology deemed likely to be affected by the proposed road upgrade. The proposed upgrade activities will result in the clearance of vegetation which may lead to a loss of floral habitat and diversity within the study area. Although, the road upgrade may be associated with the loss of floral species in the footprint area, it is not likely to impact floral communities at a larger local and regional (provincial) level.

The development of the proposed road upgrade within the Mowed Road Verge Habitat unit (of moderately low sensitivity from a floral perspective) will result in the loss of the associated floral habitat. However, this habitat is largely modified and degraded in nature. As such a significant loss of the associated modified floral communities is not anticipated. The proposed road upgrade is not likely to impact floral communities at a larger local and regional (provincial) level.

The development of the proposed road upgrade within the Mixed Bushveld (of intermediate sensitivity from a floral perspective) will result in the loss of the associated floral habitat (especially where temporary bypasses are proposed). However, given the localised extent of these temporary bypasses, significant impacts to the habitat are not anticipated. Impacts can be reduced if mitigation measures are implemented effectively.

The development of the proposed road upgrade within the Freshwater Habitat unit (of intermediate sensitivity from a floral perspective) will result in the loss of the associated floral habitat (especially where bridge widening and/or culverts are to be developed). Furthermore,

the Freshwater Habitat is susceptible to indirect effects (e.g., edge effects) associated with the proposed road upgrade. Although this habitat unit is largely degraded in nature it still provides important ecological functions within the study area and the surrounding areas. As such, strict mitigation measures are to be implemented to ensure that this habitat is not impacted further by the proposed road upgrade. It is advised that existing (decommissioned and/or currently unused bridges) be investigated for potential use and/or upgrade so too limit to extent of construction within the footprint. For example, a bridge exits approx. 50 m north of the proposed road realignment of the D928: Assen. It should be investigated as to whether this structure can be used in the proposed road upgrades to minimise vegetation clearance and infrastructure wastage.

Provided that strict mitigation measures are implemented, it is anticipated that the impact on floral habitat and diversity will be localised in extent and will not impact ecological functioning, ecological corridors, or floral conservation targets for the region.

Negative impacts likely to be associated with the floral ecology within the study area includes, but are not limited to, the following:

- Placement of infrastructure and/or construction material within natural habitat outside of the authorised footprint;
- Destruction of floral habitat during the road upgrade (i.e., Construction) activities; and
- AIP proliferation and erosion in disturbed areas.

Impact on Floral Species of Conservation Concern

No floral RDL, TOPS, or provincially protected species as listed under the LEMA were recorded within the study area. Furthermore, suitable habitat for such species is not present within the footprint areas.

Two protected NFA tree species, namely *Sclerocarya caffra* subsp. *birrea* and *Combretum imberbe*, were recorded within the Mowed Road Verge Habitat and the Mixed Bushveld habitat.

If the proposed road upgrade is authorised, all SCC species recorded during the field assessment (i.e., the two NFA species) should be relocated to suitable habitat outside the direct footprint (as far as is feasible). Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. Permits will be required from the DFFE for the removal, destruction or relocation of these NFA species before any vegetation clearing activities commence. Any other floral SCC encountered during

the construction phase of the proposed development should also be relocated by a suitably qualified specialist and, where required, the necessary permits should be applied for.

It is recommended that for species that cannot be relocated, seedlings and /or seeds of these species are harvested form the development footprint area before clearing activities commence and grown under nursery conditions with the purpose to use these species for rehabilitation at a later stage.

Impact on CBAs, ESAs, Threatened Vegetation and Protected Areas

Due to its largely modified and degraded nature, the Mowed Road Verge Habitat was not considered representative of the reference vegetation types, namely the Western Sandy Bushveld and the Central Sandy Bushveld. However, the Mixed Bushveld Habitat was considered representative of the reference vegetation types, especially as this habitat shared an affinity in terms of structure and function with the reference vegetation type.

The study area is not located within a threatened vegetation type or within a protected area. According to the Limpopo Conservation Plan, the study area is located within a CBA1, ESA1, and ESA2. Given 1) the largely modified nature and lowered capacity to provide suitable habitat for SCC and provide intact landscape corridors (i.e., within the Mowed Road Verge Habitat) or 2) localised extent and location immediately adjacent to the road verge (i.e., within the Mixed Bushveld), no CBA1 habitat was identified within the study area. No ESA habitat was identified within the Mowed Road Verge Habitat, although the propensity of the Freshwater habitat to provide functions of ESA habitat is apparent (this habitat does provide dispersal corridors, albeit in a modified and limited fashion). Furthermore, the Mixed Bushveld habitat is considered to provide ESA habitat that functions in connectivity with the greater surrounding areas. As such, impacts to ESA habitat within the Freshwater Habitat and Mixed Bushveld are anticipated with the proposed road upgrade activities. However, if mitigation measures are appropriately implemented, the associated impacts to the ESA habitat can be reduced to lower levels.

Probable Residual Impacts

Even with extensive mitigation, residual impacts on the receiving floral ecological environment are deemed likely. The following points highlight the key latent impacts that have been identified:

- Further loss of floral habitat and species diversity outside of the footprint area, especially surrounding CBA and ESA habitat, due to footprint creep or poorly managed edge effects; and
- Continued AIP proliferation to adjacent natural vegetation communities (with the Freshwater Habitat of greatest concern).

Cumulative Impacts

The greatest threat to the floral ecology within the study area and the local region is the ongoing proliferation of poorly managed AIP species which can result in an overall cumulative loss of native floral communities within the area.

6.2.2 Impact on Faunal Ecology

Loss of Faunal Habitat and Ecological Structure

The proposed development footprint will be approximately 35 km and is long adjacent to and overlaying an existing road, thus it is anticipated that the upgrades will have limited impact on faunal communities beyond the existing impacts and disturbances. The proposed development will result in minimal localised loss of faunal habitat from the study area since most of the area is already fenced off and degraded thus limiting faunal movement through the road reserve and habitat within it. These areas are already associated with poor habitat and a moderately low diversity of fauna. Habitat loss within bypass locations and realignment areas will largely be temporary in nature or could be offset by rehabilitation of these areas. As such, the proposed upgrades are unlikely to have a significant negative impact on faunal assemblages and movement corridors. Impacts to the Mixed Bushveld and Freshwater habitat are anticipated to be the highest as a result of the increased sensitivity of the units, unmitigated impacts are anticipated to be moderate, with mitigation impact scores expected to drop to low. Unmitigated impacts to the Mowed Road Verge habitat are anticipated to be low.

Impacts to the freshwater habitat are anticipated to be moderate. This habitat should function as a corridor for the movement of fauna but, culverts and bridges beneath the road have been fenced off, limiting the ability for larger faunal species to utilise them as a corridor. Should landowners on either side of the road be open to allowing fences under these structures to be dropped these corridors may be utilised for faunal movement, and this may reduce movement of faunal species within the R516 and thereby reduce collisions with animals. Collisions with wildlife is considered the greatest threat to fauna and humans through the length of the study area and mitigation can only aim at improving fencing along the road reserve and providing suitable crossings where fauna can be directed (i.e. along the fence line to an opening under

the road). A record of accidents and faunal collisions should be kept and any possible mitigation measures (e.g. higher fences, electric fences or shade cloth) should be investigated in locations where collisions are common. Impacts to the Mixed Bushveld are also anticipated to be moderate as a result of the intact faunal assemblages within this unit, however, should rehabilitation of all areas historically utilised roads and bypasses be undertaken impacts can be reduced to Low.

The habitat units identified within the road reserve will likely only provide habitat for common and widespread faunal species, however, there is a possibility that fauna may attempt to cross the road and thus it is possible that impacts do occur to fauna. These impacts are not anticipated to occur frequently and thus impacts are anticipated to be moderate - low to very low but should be monitored to try to improve road safety for both fauna and humans. Signage should be installed in locations where collision occurrence is high and possible speed limit reductions should be considered.

As additional infrastructure occurs along the road reserve for the majority of the project, it is highly unlikely that conservation targets for sensitive faunal species will be impacted. Mitigation efforts should be aimed at improving road safety by ensuring suitable fencing is installed, opening corridors under culverts and bridges and assisting in directing faunal species to utilise these corridors and suitable rehabilitation. Additionally, edge effects from construction activities on the surrounding areas must be limited and an AIP management plan should be implemented.

Impact on Important Faunal SCC

No faunal SCC were observed within the study area during the site assessment, with no signs of potentially occurring SCC utilising the road verge areas for nesting or habitation. Faunal SCC are unlikely to find habitat within the road reserve due to the degraded nature of the habitat, constant traffic and noise disturbances, but the surrounding areas of Mixed Bushveld have suitable habitat which has the potential to host SCC. Furthermore, these SCC may, should conditions force them to, need to cross the road and thus could potentially collide with vehicles. Mitigation should thus be aimed at reducing the potential for SCC to get into the road reserve by ensuring adequate fencing for the relevant adjacent land uses be implemented. The table below provides a list of SCC which may reside in areas adjacent the road reserve and thus potentially may be at risk of vehicle collisions.

Table 7: Faunal SCC which may potentially be placed at risk as they cross the R516 road or in the case fencing is cut or a vehicle crashes through fencing.

FAUNAL SCC			
Scientific name	Common Name	Limpopo SoER 2004 Status or TOPS.	IUCN Red List Status
Lycaon pictus	African wild dog	EN	EN
Acinonyx jubatus	Cheetah	VU	VU
Felis lybica	African Wild Cat	VU	NYBA
Damaliscus lunatus	Tsessebe	NA (TOPS, EN)	LC
Hippotragus equinus	Roan	NA (TOPS, VU)	LC
Smutsia temminckii	Pangolin	NA (TOPS, VU)	VU
Panthera pardus	Leopard	NA (TOPS, VU)	VU
Atelerix frontalis	Southern African Hedgehog	NA (TOPS, P)	LC
Connochaetes gnou	Black Wildebeest	NA (TOPS, P)	LC
Crocuta crocuta	Brown Hyaena	NA (TOPS, P)	LC
Mellivora capensis	Honey Badger	NA (TOPS, P)	LC
Ceratogyrus darlingi (synonym Ceratogyrus bechuanicus)	Rear Horned Baboon Spider	NA (TOPS, P)	NYBA
Opisthacanthus asper	Tree Creeper	NA (TOPS, P)	NYBA
Harpactira curator	Malvern Starburst Baboon Spider	NA (TOPS, P)	NYBA
Harpactira gigas	Common Baboon Spider	NA (TOPS, P)	NYBA
Opistophthalmus glabrifrons	Shiny Burrowing Scorpion	NA (TOPS, P)	NYBA

The impact significance on faunal SCC associated with the proposed development is considered range from moderate to low. Moderate impacts are predicted to occur during the construction, operational and maintenance phases of the activity as a result of the long term/permanent activity which prolongs the potential for impacts to occur. With mitigation the impact scores may be reduced to low in all cases.

Probable Residual Impacts

Even with extensive mitigation, residual impacts on the receiving faunal ecological environment are deemed likely. The following points highlight the key residual impacts that have been identified:

- Continued potential for vehicle collisions with SCC and common fauna;
- Reduced potential for mammal movement through corridors as higher traffic increases disturbance; and
- Continued loss of habitat through AIP.

Possible cumulative Impacts

The study area experiences constant traffic and undergoes cyclic mowing which has reduced the suitability of the study area to host most fauna. Furthermore, it has been fragmented from

adjacent habitat as most of the study area is fenced off, limiting faunal movement. The proposed development will result in the minor clearing of vegetation adjacent the road and in road re-alignment and bypass locations and may further promote the spread of AIPs due to these disturbances stemming from construction and operational activities, thus reducing food resources and habitat suitability for faunal species within the local area. Increased traffic as a result of the upgrades may further reduce the potential for mammal movement under bridges and culverts fragmenting the landscape further.

7. CONCLUSION

STS was appointed by BVI Consulting Engineers to conduct a terrestrial biodiversity assessment as part of the EA process for the proposed improvement of the national road R516 in the Limpopo Province. The portion of the R516 road earmarked for improvement and as explained in this report, i.e., the R516_L_75, initiates at Doorsfontein (at start mark of 0 km) and ends at the Tooyspruit (at marker 36.67 km). For the purpose of this report, the R516_L_83 is referred to as the study area.

During the field assessment, three broad habitat units were identified within the study area, namely Mowed Road Verge Habitat, Mixed Bushveld and Freshwater Habitat. The sensitivities, from a floral and faunal perspective, of each of the habitat units was as follows: the Mowed Road Verge Habitat was of a **moderately low sensitivity** whereas the Mixed Bushveld and Freshwater Habitat was of **intermediate sensitivity**.

No SANBI RDL species, TOPS species or species as listed under the LEMA were observed during the field assessment. However, two protected tree species as per the NFA, namely *Sclerocarya birrea* subsp. *caffra* and *Combretum imberbe,* were identified within the study area. If the proposed road upgrade is authorised, all SCC species recorded during the field assessment (i.e., the two NFA species) should be relocated to suitable habitat outside the direct footprint (as far as is feasible). Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. Where feasible, rescue and relocation should be done by a suitably qualified specialist. Any other floral SCC encountered during the construction phase of the proposed development should also be relocated by a suitably qualified specialist and, where required, the necessary permits should be applied for. Faunal SCC are unlikely to utilise the Mowed Road Verge habitat due to the constant disturbance by traffic and the degraded habitat resulting from the cyclic mowing of the road verge. However, they may utilise the adjacent Mixed Bushveld and may transverse the R516 and thus there is the potential for collisions with motor vehicles. Adequate fencing adjacent the road reserve may reduce the potential for collisions to occur. The potential for

suitable faunal corridors through underpasses and culverts should be investigated to reduce the need for fauna to jump fences onto the road reserve, thus reducing the potential for faunal and human fatalities.

The study area is not located within a threatened vegetation type or within a protected area. According to the Limpopo Conservation Plan, the study area is located within a CBA1, ESA1, and ESA2. Given 1) the largely modified nature and lowered capacity to provide suitable habitat for SCC and provide intact landscape corridors (i.e., within the Mowed Road Verge Habitat) or 2) localised extent and location immediately adjacent to the road verge (i.e., within the Mixed Bushveld), no CBA1 habitat was identified within the study area. No ESA habitat was identified within the Mowed Road Verge Habitat, although the propensity of the Freshwater habitat to provide functions of ESA habitat is apparent (this habitat does provide dispersal corridors, albeit in a modified and limited fashion). Furthermore, the Mixed Bushveld habitat is considered to provide ESA habitat that functions in connectivity with the greater surrounding areas. As such, impacts to ESA habitat within the Freshwater Habitat and Mixed Bushveld are anticipated with the proposed road upgrade activities. However, if mitigation measures are appropriately implemented, the associated impacts to the ESA habitat can be reduced to lower levels.

The overall, floral and faunal impact significance prior to the implementation of mitigation measures varied between moderate and low for the Mowed Road Verge Habitat, The Mixed Bushveld habitat and the Freshwater Habitat and was low for the Transformed Habitat. With the implementation of mitigation measures, the proposed impact significance was reduced.

It is recommended that current (decommissioned and/or unused) infrastructure e.g., bridges (see section 6.1 for details) that is located within close proximity to several proposed upgrades be investigated for potential use during the proposed road upgrade to minimise vegetation clearance and/or infrastructure wastage.

It is the opinion of the ecologists that this study provides the relevant information required to implement Integrated Environmental Management (IEM) and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development.

8. REFERENCES

Bromilow, C. (2001). Revised Edition, First Impression. *Problem Plants of South Africa.* Briza Publications, Pretoria, RSA.

BirdLife South Africa. Important Bird Areas 2015 [vector geospatial dataset] 2015. Available from the Biodiversity GIS website. Mucina, L. and Rutherford, M.C. (2006).

Conservation of Agricultural Resources Act (CARA) 43 of 1983.

DEA & SANBI. 2009. National Protected Area Expansion Strategy Resource Document.Chittendan, H. (2007). *Roberts Bird Guide. A comprehensive field guide to over 950 bird species in southern Africa.* John Voeckler Bird Book Fund. Cape Town.

Government of South Africa. 2010. National protected area expansion strategy for South Africa 2008. Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Pretoria, South Africa: The Government of South Africa.

Hui C, Richardson DM (2017) Invasion dynamics. Oxford University Press, Oxford. https://doi.org/10.1093/acprof:oso/9780198745334.001.0001

IUCN (2017). http://www.iucnredlist.org/.

Limonella Consulting. 2021. Proposed Ukupha Poultry Farm Expansion, Klipspruit, Delmas, Mpumalanga Province. Aquatic Biodiversity Assessment. June 2021. Drafted by Limosella Consulting Pty Ltd. Prepared for: Envirolution Consulting.

Marnewick MD, Retief EF, Theron NT, Wright DR, Anderson TA. 2015a. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.

Marnewick MD, Retief EF, Wright DR, Theron NT. 2015b. South Africa's Important Bird and Biodiversity Areas Status Report 2015. Johannesburg: BirdLife South Africa.

Mucina, L. and Rutherford, M.C. (2006). The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19.,(South African National Biodiversity Institute: Pretoria, South Africa). Memoirs of the Botanical Survey of South Africa.

National Environmental Management Act (NEMA) 107 of 1998

National Environmental Management: Biodiversity Act (NEMBA) 10 of 2004.

NBA: Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. 2012. National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria. Online available: http://bgis.sanbi.org/NBA/project.asp

Picker. M., Griffiths. C. & Weaving. A. (2004). New Edition. *Field Guide to Insects of South Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA.

Richardson DM, Pyšek P, Carlton JT (2011) A compendium of essential concepts and terminology in invasion ecology. In: Richardson DM (ed) Fifty years of invasion ecology. The legacy of Charles Elton. Wiley-Blackwell, Oxford, pp 409–420. https://doi.org/10.1002/9781444329988. ch30

SABAP2, 2014. The South Africa Bird Atlas Project 2 database. SACAD: Department of Environmental Affairs. (2021). South Africa Conservation Areas Database (SACAD_OR_2021_Q2). Online available: [http://egis.environment.gov.za].

SANBI. 2011. National List of Threatened Ecosystems 2011 [vector geospatial dataset] 2011. Available from the Biodiversity GIS website.

SANBI. 2013. Grasslands Ecosystem Guidelines: landscape interpretation for planners and managers. Compiled by Cadman, M., de Villiers, C., Lechmere-Oertel, R. and D. McCulloch. South African

SANBI. 2018a. 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland [Vector] 2018. Available from the Biodiversity GIS website.

SANBI. 2018b. Terrestrial ecosystem threat status and protection level - remaining extent [Vector] 2018. URL: http://bgis.sanbi.org

SANBI. 2018c. Terrestrial ecosystem threat status and protection level layer [Vector] 2018. URL: http://bgis.sanbi.org

SANBI BGIS (2021). The South African National Biodiversity Institute - Biodiversity GIS (BGIS) [online]. URL: http://bgis.sanbi.org as retrieved in 2021.

SANParks/SANBI. 2013. NPAES Formal [vector geospatial dataset] 2013. Available from the Biodiversity GIS website

SANParks/SANBI. 2012. NPAES Protected Areas - Informal 2010 [vector geospatial dataset] 2012. Available from the Biodiversity GIS website.

Scientific Terrestrial Services (STS) Project number 22-2023 (2022). Terrestrial Biodiversity Assessment for a Proposed Burrow Pit near Bela-Bela, Limpopo Province. Prepared for BVI Consulting Engineers.

South African National Parks (SANParks). 2010. NPAES Focus Areas 2010 [vector geospatial dataset] 2010. Available from the Biodiversity GIS website.

SAPAD: Department of Environmental Affairs. (2021). South Africa Protected Areas Database (SAPAD_OR_2021_Q2). Online available: [http://egis.environment.gov.za].

Sinclair, I., Hockey, P. & Tarboton, W. 2002. Third Edition. Sasol Birds of Southern Africa. Struik Publishers, Cape Town, RSA

Van Oudtshoorn, F. (2004). Second Edition, Third Print. Guide to Grasses of South Africa. Briza Publications, Pretoria, RSA.

Van Wyk, B. and Malan, S. (1998) *Field Guide to the Wild Flowers of the Highveld.* Struik Publishers, Cape Town.

Water Research Commission. 2017. SWSA Surface water [Vector] 2017. Available from the Biodiversity GIS website.

Wilson JRU, Gaertner M, Richardson DM et al (2017) Contributions to the national status report on biological invasions in South Africa. Bothalia 47:a2207. https://doi.org/10.4102/abc.v47i2.2207

Woodhall, S. (2005). *Field Guide to Butterflies of South Africa.* Struik Publishers (Pty) Ltd, Cape Town, RSA

APPENDIX A: Indemnity and Terms of Use of this Report

The findings, results, observations, conclusions, and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and STS and its staff reserve the right to, at their sole discretion, modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

Although STS CC exercises due care and diligence in rendering services and preparing documents, STS CC accepts no liability and the client, by receiving this document, indemnifies STS CC and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages, and expenses arising from, or in connection with, services rendered, directly or indirectly by STS CC and by the use of the information contained in this document.

This report must not be altered or added to or used for any other purpose other than that for which it was produced without the prior written consent of the author(s). This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

APPENDIX B: Legislative Requirements

CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA, 1996 (ACT 108 OF 1996)

The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998) (NEMA)

The National Environmental Management Act (NEMA; Act 107 of 1998) and the associated Environmental Impact Assessment (EIA) Regulations (GN R982 of 2014) and well as listing notices 1, 2 and 3 (GN R983, R984 and R985 of 2014), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the EIA process depending on the nature of the activity and scale of the impact.

NATIONAL ENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT, 2004 (ACT 10 OF 2004) (NEMBA)

The objectives of this act are (within the framework of NEMA) to provide for:

- The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- The use of indigenous biological resources in a sustainable manner;
- The fair and equitable sharing among stakeholders of the benefits arising from bio prospecting involving indigenous biological resources;
- To give effect to ratify international agreements relating to biodiversity which are binding to the Republic;
- To provide for cooperative governance in biodiversity management and conservation; and
- To provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of the surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources.
Furthermore, a person may not carry out a restricted activity involving either:

a) A specimen of a listed threatened or protected species;
b) Specimens of an alien species; or
c) A specimen of a listed invasive species without a permit.

GOVERNMENT NOTICE NUMBER R.1020: ALIEN AND INVASIVE SPECIES REGULATIONS, 2020 (IN GOVERNMENT GAZETTE 43735), INCLUDING GOVERNMENT NOTICE NUMBER 1003: ALIEN AND INVASIVE SPECIES LISTS, 2020 (IN GOVERNMENT GAZETTE 43726) AS IT RELATES TO THE NEMBA

NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aims to:

- Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur,
- Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and
- Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats.

Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act no 10 of 2004) as:

(a) A species that is not an indigenous species; or
(b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.

Categories according to NEMBA (Alien and Invasive Species Regulations, 2020):

- **Category 1a:** Invasive species that require compulsory control;
- **Category 1b:** Invasive species that require control by means of an invasive species management programme;
- **Category 2:** Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and
- **Category 3:** Ornamentally used plants that may no longer be planted.

CONSERVATION OF AGRICULTURAL RESOURCES ACT, 1983 (ACT 43 OF 1983) (CARA)

Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of species should take place throughout the construction and operation, phases.

LIMPOPO ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 7 OF 2003) (LEMA)

The objectives of this Act are:

- to manage and protect the environment in the Province;
- to secure ecologically sustainable development and responsible use of natural resources in the
- Province;
- generally, to contribute to the progressive realisation of the fundamental rights contained in section 24 of the Constitution of the Republic of South Africa Act, 1996 (Act No. 108 of 1996), and
- to give effect to international agreements effecting environmental management which are binding on the Province.

This Act must be interpreted and applied in accordance with the national environmental management principles set out in Section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT, 2003 (ACT NO. 57 OF 2003) AS AMENDED[13] (NEMPAA)

The objective of this act is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological biodiversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; for the continued existence, governance and functions of South African National Parks; and for matters in connection thereof.

[13] Amendments to the NEMPAA:

- National Environmental Management: Protected Areas Amendment Act 31 of 2004 – Gazette No. 27274, No. 131. Commencement date: 1 November 2005 [Proc. No. R. 58, Gazette No, 28123]
- National Environment Laws Amendment Act 14 of 2009 – Gazette No.32267, No. 617. Commencement date: 18 September 2009 [Proc. 65, Gazette No. 32580]
- National Environmental Management: Protected Areas Amendment Act 15 of 2009 – Gazette No. 32660, No. 748. Commencement date: 23 October 2009 – except for sections 1 and 8 [Proc. No. 69, Gazette No. 32660]
- Schedule 2 amended by Government Notice R236 in Government Gazette 36295 dated 27 March 2013. Commencement date: 1 April 2013 of sections 1 and 8 (relating to Schedule 2) of the National Environmental Management Protected Areas Amendment Act, 15 of 2009 [Proc. No. 7, Gazette No. 36296]
- National Environmental Management: Protected Areas Amendment Act 21 of 2014 - Government Notice 445 in Government Gazette 37710 dated 2 June 2014. Commencement date: 2 June 2014.
- Schedule 2 amendment by General Notice 2 of 2016 in Government Gazette 39728 dated 25 February 2016. Commencement date: 25 February 2016.

APPENDIX C: Floral Method of Assessment

Floral Species of Conservational Concern Assessment

Prior to the site visit, a record of floral SCC and their habitat requirements was developed for the study area, which includes consulting the National Web-based Environmental Screening Tool. Because not all SCC have been included in the Screening Tool layers (e.g., NT and DD taxa), it remains important for the specialist to be on the lookout for additional SCC. For this study, two primary sources were consulted and are described below.

The National Web-Based Environmental Screening Tool

The Screening Tool was accessed to obtain a list of potentially occurring species of conservation concern for the study area. Each of the themes in the Screening Tool consists of theme-specific spatial datasets which have been assigned a sensitivity level namely, "*low*", "*medium*", "*high*" and "*very high*" sensitivity. The four levels of sensitivity are derived and identified in different ways, e.g. for **confirmed** areas of occupied habitat for SCC a Very High and High Sensitivity is assigned and for areas of suitable habitat where SCC may occur based on spatial models only, a Medium Sensitivity is assigned. The different sensitivity ratings pertaining to the Plant [and Animal] Protocols are described below[14]:

- **Very High**: Habitat for species that are endemic to South Africa, where all the known occurrences of that species are within an area of 10 km^2 are considered Critical Habitat, as all remaining habitat is irreplaceable. Typically, these include species that qualify under Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) D criteria of the IUCN or species listed as Critically/ Extremely Rare under South Africa's National Red List Criteria. For each species reliant on a Critical Habitat, all remaining suitable habitat has been manually mapped at a fine scale.
- **High**: Recent occurrence records for all threatened (CR, EN, VU) and/or rare endemic species are included in the high sensitivity level. Spatial polygons of suitable habitat have been produced for each species by intersecting recently collected occurrence records (those collected since the year 2000) that have a spatial confidence level of less than 250 m with segments of remaining natural habitat.
- **Medium**: Model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level. Two types of spatial models have been included. The first is a simple rule-based habitat suitability model where habitat attributes such as vegetation type and altitude are selected for all areas where a species has been recorded to occur. The second is a species distribution model which uses species occurrence records combined with multiple environmental variables to quantify and predict areas of suitable habitat. The models provide a probability-based distribution indicating a continuous range of habitat suitability across areas that have not been previously surveyed. A probability threshold of 75% for suitable habitat has been used to convert the modelled probability surface and reduce it into a single spatial area which defines areas that fall within the medium sensitivity level.
- **Low**: Areas where no SCC are known or expected to occur.

BRAHMS Online Website

The Botanical Database of Southern Africa (BODATSA) is accessed to obtain plant names and floristic details (http://posa.sanbi.org/) for species of conservation concern within a selected boundary;

- This website provides access to South African plant names (taxa), specimens (herbarium sheets) and observations of plants made in the field (botanical records). Data is obtained from the BODATSA, which contains records from the National Herbarium in Pretoria (PRE), the

[14] More details on the use of the Screening Tool for Species of Conservation Concern can be found in the below resources:

- South African National Biodiversity Institute (SANBI). 2020. Draft Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.0.
- The National Web based Environmental Screening Tool website: https://screening.environment.gov.za/screeningtool/#/pages/welcome

Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH).
- Information on habitat requirements etc. is obtained from the SANBI Red List of South African Plants website (http://redlist.sanbi.org/).
- Typically, data is extracted for the Quarter Degree Square (QDS) in which the study area is situated but where it is deemed appropriate, a larger area can be included.

NEMBA TOPS Species

The Threatened or Protected Species (TOPS) Regulations (R 152 of 2007) under Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA), were taken into consideration.

Specially Protected and Protected Species

The Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003) (LEMA) provides a list of Specially Protected Plants (Schedule 11) and Protected Plants (Schedule 12) for the Limpopo Province. These species formed part of the SCC assessment. The list is alliable online at the following link: https://www.unodc.org/res/cld/document/limpopo-environmental-management-act-7-of-2003_html/Limpopo_Enviro_Management_Act.pdf

NFA Species

Tree species as per the National Forest Act, 1998 (Act No. 84 of 1998) (NFA), were included in the SCC assessment.

Throughout the floral assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species.

The Probability of Occurrence (POC) for each floral SCC is described:
- "**Confirmed'**: if observed during the survey;
- "**High**": if within the species' known distribution range and suitable habitat is available;
- "**Medium**": if either within the known distribution range of the species or if suitable habitat is present; or
- "**Low**": if the habitat is not suitable and falls outside the distribution range of the species.

Low POC	Medium POC	High POC	Confirmed

The accuracy of the POC is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Floral Habitat Sensitivity

The floral habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral communities and provide an indication of the overall floristic ecological integrity, importance, and sensitivity of the habitat unit. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):
- **Floral SCC:** The confirmed presence or potential for floral SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region;
- **Conservation Status:** The conservation status of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional and national databases. Whether the habitat is representative of a Critical Biodiversity Area or forms part of an Ecological Support Area is also taken into consideration;
- **Floral Diversity:** The recorded floral diversity compared to a suitable reference condition such as surrounding natural areas or available floristic databases; and

- **Habitat Integrity:** The degree to which the habitat unit is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the floral habitat sensitivity class in which each habitat unit falls. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the habitat unit in question. To present the results use is made of spider diagrams to depict the significance of each aspect of floral ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:

Table C1: Floral habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimizing development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
≥4.5 ≤5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

Vegetation Surveys

When planning the timing of a floristic survey, it is important to remember that the primary objective is not an exhaustive species list but rather to ensure that sufficient data are collected to describe all the vegetation communities present in the area of interest, to optimise the detection of SCC and to assess habitat suitability for other potentially occurring SCC (SANBI, 2020).

The vegetation survey incorporates the subjective (or stratified) sampling method. Subjective sampling is a sampling technique in which the specialist relies on his or her own professional experience when choosing sample sites within the study area. This allows representative recordings of floral communities and optimal detection of SCC. Subjective sampling is used to consider different areas (or habitat units) which are identified within the main body of a habitat/study area.

One of the problems with random sampling, another popular sampling method, is that random samples may not cover all areas of a study area equally and thus increase the potential to miss floral SCC. Random sampling methods also tend to require more time in the field to locate the amount of SCC that can be detected using subjective sampling methods - In the context of an EIA where time constraints are often restrictive, priority needs to be given to collecting data in the shortest time possible without compromising the efficiency of locating SCC (SANBI, 2020).

Vegetation structure has been described following the guideline in Edwards (1983). Refer to Figure C1 below:

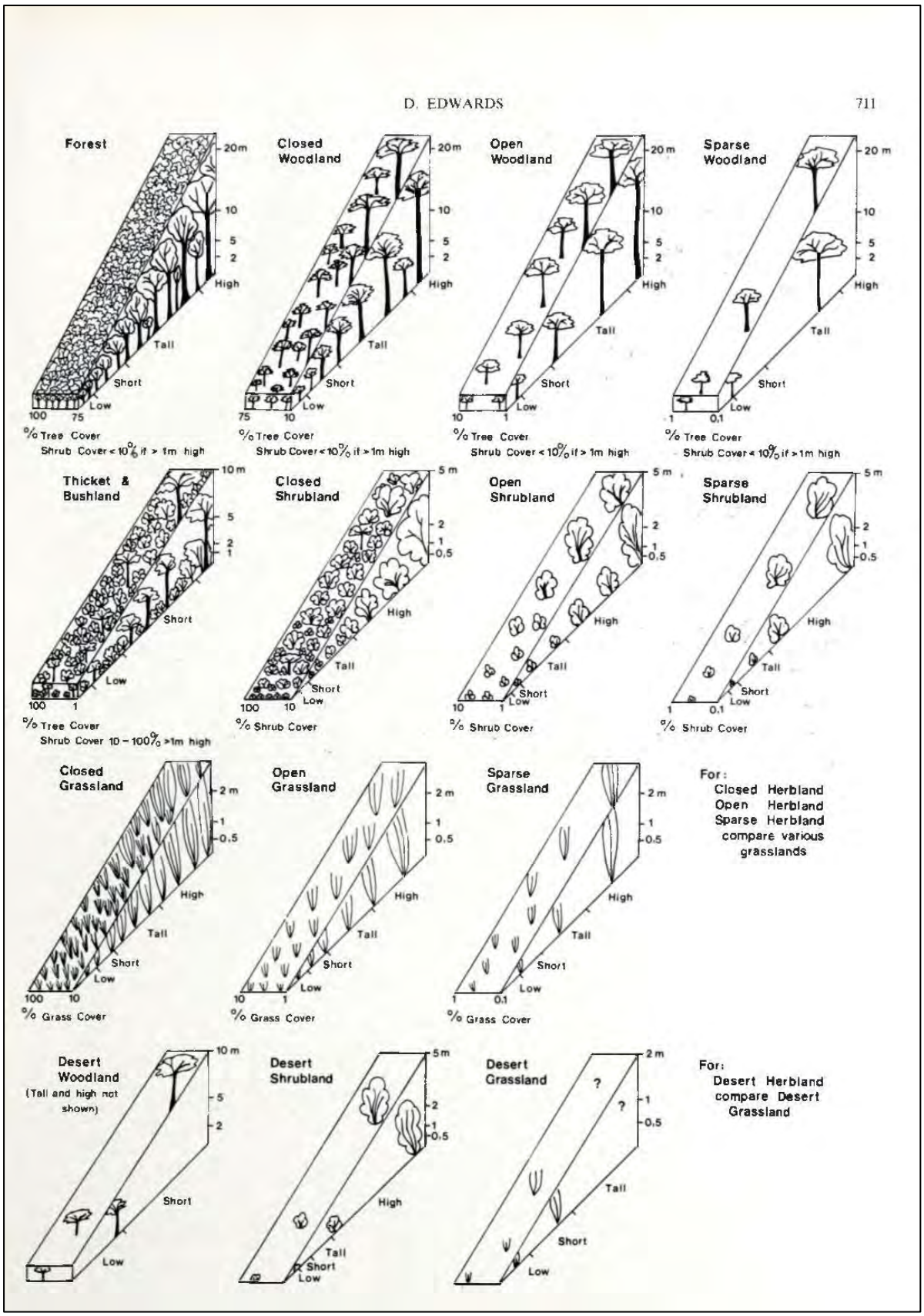


Figure C1: Diagrammatic representation of structural groups and formation classes. Only dominant growth forms are shown.

APPENDIX D: Faunal Method of Assessment

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the site assessment. The presence of human habitation nearby the focus area and the associated anthropogenic activities may have an impact on faunal behaviour and in turn the rate of observations.

Mammals

Mammal species were recorded during the field assessment with the use of visual identification, spoor, call, and dung. Specific attention was paid to mammal SCC as listed by the IUCN, 2015.

Avifauna

The Southern African Bird Atlas Project 2 database (http://sabap2.adu.org.za/) was compared with the recent field survey of avifaunal species identified on the focus area. Field surveys were undertaken utilising visual observation and bird call identification techniques in order to accurately identify avifaunal species. Specific attention was given to avifaunal SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Reptiles

During the field assessment, suitable applicable habitat areas (rocky outcrops and fallen dead trees) were inspected for the presence of reptiles, and any individuals encountered were identified. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which reptile species are likely to occur on the focus area. Specific attention was given to reptile SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Amphibians

Identifying amphibian species is done using direct visual identification along with call identification technique. Amphibian species flourish in and around wetland, riparian and moist grassland areas. It is unlikely that all amphibian species will have been recorded during the site assessment, due to their cryptic nature and habits, varied stages of life cycles and seasonal and temporal fluctuations within the environment. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which amphibian species are likely to occur within the focus area as well as the surrounding area. Specific attention was given to amphibian SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Invertebrates

Whilst conducting transects through the focus area, all insect species visually observed were identified, and where possible photographs taken.

It must be noted however that due to the cryptic nature and habits of insects, varied stages of life cycles and seasonal and temporal fluctuations within the environment, it is unlikely that all insect species will have been recorded during the site assessment period. Nevertheless, the data gathered during the assessment along with the habitat analysis provided an accurate indication of which species are likely to occur in the focus area at the time of survey. Specific attention was given to insect SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Arachnids

Suitable applicable habitat areas (rocky outcrops, sandy areas and fallen dead trees) where spiders and scorpions are likely to reside were searched. Rocks were overturned and inspected for signs of these species. Specific attention was paid to searching for Mygalomorphae arachnids (Trapdoor and Baboon spiders) as well as potential SCC species within the focus area.

Faunal Species of Conservational Concern Assessment

The Probability of Occurrence (POC) for each faunal SCC is described:

- "**Confirmed'**: if observed during the survey;
- "**High**": if within the species' known distribution range and suitable habitat is available;
- "**Medium**": if either within the known distribution range of the species or if suitable habitat is present; or
- "**Low**": if the habitat is not suitable and falls outside the distribution range of the species.

The accuracy of the POC is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Faunal Habitat Sensitivity

The sensitivity of the focus area for each faunal class (i.e. mammals, birds, reptiles, amphibians and invertebrates) was determined by calculating the mean of five different parameters which influence each faunal class and provide an indication of the overall faunal ecological integrity, importance and sensitivity of the focus area for each class. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Faunal SCC:** The confirmed presence or potential for faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Habitat Availability:** The presence of suitable habitat for each class;
- **Food Availability:** The availability of food within the focus area for each faunal class;
- **Faunal Diversity:** The recorded faunal diversity compared to a suitable reference condition such as surrounding natural areas or available faunal databases; and
- **Habitat Integrity:** The degree to which the habitat is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contributes equally to the mean score, which determines the suitability and sensitivity of the focus area for each faunal class. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilisation of the focus area in relation to each faunal class. The different classes and land-use objectives are presented in the table below:

Table D1: Faunal habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1.0 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
≥4.5 ≤ 5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX E: Impact Assessment Methodology

Impact assessment methodology as provided by the proponent.

The aim of Environmental Impact Assessments is to determine the consequences of proposed developments on the environments to better inform decision-making and the management of natural and social systems. The assessment identified and assessed impacts across four phases of development, namely:

- The Planning and Design Phase;
- The Construction Phase;
- The Operational Phase; and
- The Decommissioning Phase.

Evaluation Criteria

CES has developed an evaluation criterion of impacts in accordance with the requirements outlined in Appendix 2 of the EIA Regulations (2014, as amended). This scale takes into consideration the following variables:

- Nature: negative or positive impact on the environment.
- Type: direct, indirect and/or cumulative effect of impact on the environment.
- Significance: The criteria in **Error! Reference source not found.** are used to determine the overall significance of an activity. The impact effect (which includes duration; extent; consequence and probability) and the reversibility/mitigation of the impact are then read off the significance matrix in order to determine the overall significance of the issue. The overall significance is either negative or positive and will be classified as low, moderate or high (Table E1).
- Consequence: the consequence scale is used in order to objectively evaluate how severe a number of negative impacts might be on the issue under consideration, or how beneficial a number of positive impacts might be on the issue under consideration.
- Extent: the spatial scale defines the physical extent of the impact.
- Duration: the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
- Probability: the likelihood of impacts taking place as a result of project actions arising from the various alternatives. There is no doubt that some impacts would occur (e.g., loss of vegetation), but other impacts are not as likely to occur (e.g., vehicle accident), and may or may not result from the proposed development and alternatives. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.
- Reversibility: The degree to which an environment can be returned to its original/partially original state.
- Irreplaceable loss: The degree of loss which an impact may cause.
- Mitigation potential: The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. The four categories used are listed and explained in **Error! Reference source not found.** below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

Table E1: Ranking of Evaluation Criteria

NATURE	
Positive	Beneficial/positive impact.
Negative	Detrimental/negative impact.
TYPE	
Direct	Direct interaction of an activity with the environment.
Indirect	Impacts on the environment that are not a direct result of the project or activity.
Cumulative	Impacts which may result from a combination of impacts of this project and similar related projects.
DURATION	
Short term	Less than 5 years.
Medium term	Between 5-20 years.
Long term	More than 20 years.
Permanent	Over 40 years or resulting in a permanent and lasting change that will always be there.
EXTENT	
Localised	Impacts affect a small area of a few hectares in extent. Often only a portion of the project area.
Study area	The proposed site and its immediate environments.
Municipal	Impacts affect the municipality, or any towns within the municipality.
Regional	Impacts affect the wider district municipality or the Eastern Cape Province as a whole.
National	Impacts affect the entire country.
International/Global	Impacts affect other countries or have a global influence.
CONSEQUENCE	
Slight	Slight impacts or benefits on the affected system(s) or party(ies).
Moderate	Moderate impacts or benefits on the affected system(s) or party(ies).
Severe/ Beneficial	Severe impacts or benefits on the affected system(s) or party(ies).
PROBABILITY	
Definite	More than 90% sure of a particular fact. Should have substantial supportive data.
Probable	Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact, or of the likelihood of an impact occurring.
REVERSIBILITY	
Reversible	The activity will lead to an impact that can be reversed provided appropriate mitigation measures are implemented.
Irreversible	The activity will lead to an impact that is permanent regardless of the implementation of mitigation measures.
IRREPLACEABLE LOSS	
Resource will not be lost	The resource will not be lost/destroyed provided mitigation measures are implemented.
Resource will be partly lost	The resource will be partially destroyed even though mitigation measures are implemented.
Resource will be lost	The resource will be lost despite the implementation of mitigation measures.
MITIGATION POTENTIAL	
Easily achievable	The impact can be easily, effectively and cost effectively mitigated/reversed.
Achievable	The impact can be effectively mitigated/reversed without much difficulty or cost.
Difficult	The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs.
Very Difficult	The impact could be mitigated/reversed but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly.

Table E2: Description of significance ratings.

Significance Rating		Description
LOW NEGATIVE	LOW POSITIVE	The impacts on this issue are acceptable and mitigation, whilst desirable, is not essential. The impacts on the issue by themselves are insufficient, even in combination with other low impacts, to prevent the development being approved. Impacts on this particular issue will result in either positive or negative medium to short term effects on the social and/or natural environment.
MODERATE NEGATIVE	MODERATE POSITIVE	The impacts on this issue are important and require mitigation. The impacts on this issue are, by themselves, insufficient to prevent the implementation of the project, but could in conjunction with other issues with moderate impacts, prevent its implementation. Impacts on this particular issue will usually result in either a positive or negative medium to long-term effect on the social and/or natural environment.
HIGH NEGATIVE	HIGH POSITIVE	The impacts on this issue are serious, and if not mitigated, they may prevent the implementation of the project (if it is a negative impact). Impacts on this particular issue would be considered by society as constituting a major and usually a long-term change to the (natural and/or social) environment, and will result in severe effects or if positive, substantial beneficial effects.

Assessment of Cumulative Impacts

In terms of the NEMA EIA Regulations (2014), a cumulative impact are defined as:
"The past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities".

Project induced cumulative impacts should be considered, along with direct and indirect impacts, in order to better inform the developer's decision making and project development process. Cumulative impacts may be categorised into one or more of the following types:

- **Additive:** the simple sum of all the effects (e.g. the accumulation of ground water pollution from various developments over time leading to a decrease in the economic potential of the resource);
- **Synergistic:** effects interact to produce a total effect greater than the sum of individual effects. These effects often happen as habitats or resources approach capacity (e.g. the accumulation of water, air and land degradation over time leading to a decrease in the economic potential of an area);
- **Time crowding:** frequent, repetitive impacts on a particular resource at the same time (e.g. multiple boreholes decreasing the value of water resources);
- **Neutralizing:** where effects may counteract each other to reduce the overall effect (e.g. infilling of a wetland for road construction, and creation of new wetlands for water treatment); and,
- **Space crowding:** high spatial density of impacts on an ecosystem (e.g. rapid informal residential settlement).

Cumulative impacts are, however, difficult to accurately and confidently assess, owing to the high degree of uncertainty, as well as their often being based on assumptions. It is therefore difficult to provide as detailed an assessment of cumulative impacts as is the case for direct and indirect project induced impacts. This is usually because of the absence of specific details and information related to cumulative impacts. In these situations, the EAP will need to ensure that any assumptions made as part of the assessment are made clear. Accordingly, this includes an overview and analysis of cumulative impacts related to a variety of project actions and does not provide a significance rating for these impacts, as was done for direct project induced impacts. The objective is to identify and focus on potentially significant cumulative impacts so these may be taken into consideration in the decision-making process. It is important to realise these constraints, and to recognise that the assessment will not, and indeed cannot, be perfect. The potential for cumulative impacts will, however, be considered, rather than omitted from the decision making process and is therefore of value to the project and the environment.

Mitigation measure development

The following points present the key concepts considered in the development of mitigation measures for the proposed development.

- *Mitigation* and *performance improvement measures* and actions that address the risks and impacts[15] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be *measurable events with performance indicators, targets and acceptable criteria* that can be tracked over *defined periods*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation.*

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and

[15] Mitigation measures should address both positive and negative impacts

APPENDIX F: Vegetation Type(s)

Central Sandy Bushveld (SVcb 12)

Remarks: *Vachellia sieberiana* occurs in the transition zone with grassland in the east, while *Senegalia caffra* and *Faurea saligna* are dominant in the transition zone to SVcb 17 Waterberg Mountain Bushveld in the western parts of this unit. Central Sandy Bushveld is similar to SVcb 16 Western Sandy Bushveld, but the former is generally moister and cooler and generally lacks species such as *Senegalia erubescens* and *Senegalia nigrescens.* The climate seasons described above also apply to many other vegetation units of the Central Bushveld Bioregion. This vegetation unit includes probably the most intensively studied South African savanna field site of the South African Savanna Ecosystem Programme in the Nylsvley Nature Reserve (Limpopo Province).

Figure F1: SVCB 12 Central Sandy Bushveld: Open Savanna dominated by *Burkea africana* and *Terminalia sericea* on a sandy Ridge south of Mookgophong (Naboomspruit) Image Source: Mucina & Rutherford (2006) Figure 9.21, page 469.

Table F1: Dominant & typical floristic species of the Central Sandy Bushveld (Mucina & Rutherford, 2012)

Group	Speci06
Woody Species	
Tall trees	*Senegalia burkei* (d), *Vachellia robusta, Sclerocarya birrea* subsp. *Caffra.*
Small trees	*Burkea africana* (d), *Combretum apiculatum* (d), *C. zeyheri* (d), *Terminalia sericea* (d), *Ochna pulchra, Peltophorum africanum, Searsia leptodictya., Senegalia erubescens* (d), *Vachellia gerrardii* (d), *S. mellifera* subsp. *detinens* (d), *V. rehmanniana* (d), *Boscia albitrunca* (d), *Combretum apiculatum* (d), *V tortilis* subsp. *heteracantha*, *Terminalia sericea*
Tall shrubs	*Combretum hereroense, Grewia bicolor, G. monticola, Strychnos pungens*
Low shrubs	*Agathisanthemum bojeri* (d), *Indigofera filipes* (d), *Felicia fascicularis, Gnidia sericocephala. Dichapetalum cymosum* (d), *Geoxylic Suffrutex*
Woody Climber	*Asparagus buchananii.*
Graminoid Species	
Graminoids	*Brachiaria nigropedata* (d), *Eragrostis pallens* (d), *E. rigidior* (d), *Hyperthelia dissoluta* (d), *Panicum maximum* (d), *Perotis patens* (d), *Anthephora pubescens, Aristida scabrivalvis* subsp. *scabrivalvis, Brachiaria serrata, Elionurus muticus, Eragrostis nindensis, Loudetia simplex, Schmidtia pappophoroides, Themeda triandra, Trachypogon spicatus*
Succulent Species	
Succulent shrubs	*Euphorbia bergii, Kalanchoe rotundifolia*, *Lycium cinereum*.
Herbaceous species	
Herbs	*Dicerocaryum senecioides* (d), *Barleria macrostegia, Blepharis integrifolia, Crabbea angustifolia, Evolvulus alsinoides, Geigeria burkei, Hermannia lancifolia, Indigofera daleoides, Justicia anagalloides, Kyphocarpa angustifolia, Lophiocarpus tenuissimus, Waltheria indica, Xerophyta humilis.*
Geophytic Herb	*Hypoxis hemerocallidea*
Succulent Herb	*Aloe greatheadii* var. *davyana*

*(d) – Dominant species for the vegetation type

Western Sandy Bushveld (SVcb 16)

Remarks: This unit is drier than the SVcb 12 Central Sandy Bushveld vegetation unit and is distinguished from it by the presence of species as *Senegalia erubescens, Senegalia nigrescens* and *Combretum imberbe*, and general absence of species such as *Burkea africana* and *Ochna pulchra*.

Figure F2: SVcb 16 Western Sandy Bushveld: Open bushveld dominated by C*ombretum apiculatum, Senegalia nigrescens* and *Sporobolus* species on Ruigtevley, Thabazimbi District. Image Source: Mucina & Rutherford (2006) Figure 9.25, page 472.

Table F2: Dominant & typical floristic species of the Western Sandy Bushveld (Mucina & Rutherford, 2006).

Group	Species
Woody Species	
Small trees	*Senegalia erubescens* (d), *A. mellifera subsp. detinens* (d), *A. nilotica* (d), *A.tortilis* subsp. *heteracantha* (d), *Combretum apiculatum* (d), *C.imberbe* (d), *Terminalia sericea* (d), *Combretum zeyheri, Lannea discolor, Ochna pulchra, Peltophorum africanum*
Tall Trees	*Vachellia erioloba, A. nigrescens, Sclerocarya birrea subsp. caffra.*
Tall shrubs	*Combretum hereroense* (d), *Euclea undulata* (d), *Coptosperma supra-axillare, Dichrostachys cinerea, Grewia bicolor, G. flava, G. monticola*
Low shrubs	Clerodendrum ternatum, Indigofera filipes, Justicia flava
Graminoid Species	
Graminoids	*Anthephora pubescens* (d), *Digitaria eriantha* subsp. *eriantha* (d), *Eragrostis pallens* (d), *E. rigidior* (d), *Schmidtia pappophoroides* (d), *Aristida congesta, A. diffusa, A. stipitata* subsp. *graciliflora, Eragrostis superba, Panicum maximum, Perotis patens*
Herbaceous Species	
Herbs	*Blepharis integrifolia, Chamaecrista absus, Evolvulus alsinoides, Geigeria burkei, Kyphocarpa angustifolia, Limeum fenestratum, L. viscosum, Lophiocarpus tenuissimus, Monsonia*

*(d) **–** Dominant species for the vegetation type

APPENDIX G: Species List

Observed Floral Species

Table G1: Dominant floral species encountered within the study area. Alien species are indicated with an asterisk (*).

Species	Mowed Road Verge Habitat	Freshwater Habitat	Mixed Bushveld
Woody Species			
**Acacia mearnsii*	x	x	
**Caesalpinia ferrea*			
**Eucalyptus cf. camaldulensis*	x		x
**Melia azedarach*	x	x	
**Pinus sp.*	x		
**Sesbania sesban*	x	x	x
**Trachycarpus sp.*			
Asparagus laricinus	x	x	x
Barleria sp.	x		
Carissa bispinosa		x	
Clematis braciata	x		
Combretum imberbe (NFA)	x		x
Combretum zeyheri	x		x
Dodonaea viscosa	x		x
Dombeya rotundifolia	x		
Euclea crispa	x	x	x
Euclea undulata	x		x
Faurea saligna	x		x
Gymnosporia buxifolia	x	x	x
Olea europea subsp. *africana*	x	x	x
Pappea capensis	x		x
Sclerocarya caffra subsp. *birrea* (NFA)	x		x
Searsia lancea	x	x	x
Senegalia galpinii	x		x
Terminalia sericea	x		x
Vachellia karroo	x	x	x
Viscum cf. rotundifolium	x		x
Ziziphus mucronata	x	x	x
Herbaceous Species			
**Argemone ochroleuca* subsp. *ochroleuca*	x	x	
**Bidens pilosa*	x	x	x
**Tagetes minuta*	x	x	x
Albuca glauca	x		x
Felicia clavipilosa subsp. *transvaalensis*	x		x
Geigeria sp.	x	x	x
Helichrysum arygroshaerum	x		
Indigophera sp.	x	x	
Justicia flava	x		x

Leonotis sp.	x		x
Tribulus terrestris	x	x	
Succulent Species			
**Yukka sp.*	x		
**Agave americana*	x		
**Agave americana*	x		x
**Opuntia cf. ficus-indica*	x		
**Yukka sp.*	x		x
Aloe marlothii	x		
Aloe greatheadii var. *davyii*	x	x	
Graminoid Species			
**Pennisetum clandestinum*	x	x	
Aristida congesta subsp. *congesta*	x	x	x
Bulbostylis hispidula subsp. *pyriformis*		x	
Cenchrus ciliaris	x	x	x
Chloris virgata	x	x	x
Cynodon dactylon	x		
Cyperus sp.		x	
Digitaria eriantha	x	x	x
Eragrostis lehmanniana	x	x	x
Eragrostis rigidior	x		x
Eragrostis trichophora	x	x	x
Eragrostis trichophora	x	x	x
Heteropogon contortus	x	x	x
Hyparrhenia hirta	x	x	x
Melinis repens	x	x	x
Panicum maximum	x		
Phragmites australis		x	
Pogonathria squarrosa	x	x	
Fern Species			
Pellaea calomelanos	x		

Observed Faunal Species

Table G2: Mammal species observed within the study area.

Scientific Name	Common Name	Conservation Status
MAMMALS		
Lepus saxatilis	Scrub hare	LC
Tragelaphus strepsiceros	Kudu	LC
Atilax paludinosus	Water Mongoose	LC
Sylvicapra grimmia	Common Duiker	LC
Raphicerus campestris	Steenbok	LC
Cercopithicus aethiops	Vervet Monkey	LC
Papio ursinus	Chacma Baboon	LC
Phacochoerus aethiopicus	Warthog	LC
Hystrix africaeaustralis	Cape Porcupine	LC
Genetta maculata	Large-spotted Genet	LC
AVIFAUNA[16]		
Upupa africana	African Hoopoe	LC
Tchagra australis	Brown-crowned Tchagra	LC
Granatina granatina	Violet-eared Waxbill	LC
Uraeginthus angolensis	Blue Waxbill	LC
Passer melanurus	Cape Sparrow	LC
Streptopelia capicola	Cape Turtle Dove	LC
Motacilla capensis	Cape Wagtail	LC
Lanius collaris	Common Fiscal	LC
Pycnonotus tricolor	Dark-capped Bulbul	LC
Bostrychia hagedash	Hadeda Ibis	LC
Numida meleagris	Helmeted Guineafowl	LC
Streptopelia senegalensis	Laughing Dove	LC
Dicrurus adsimilis	Fork-tailed Drongo	LC
Tockus nasutus	African Grey Hornbill	LC
Turdoides jardineii	Arrow-marked Babler	LC
Merops apiaster ,	European Bee-eater	LC
Corythaixoides concolor	Grey Go-away-bird	LC
Acridotheres tristis	Common Myna	LC
Corythaixoides concolor	Grey go-away-bird	LC
Vanellus coronatus	Crowned Lapwing	LC
Streptopelia capicola	Cape Turtle Dove	LC
Columba guinea	Speckled Pigeon	LC
Eplectes orix	Southern Red Bishop	LC
Urolestes melanoleucus	Magpie Shrike	LC
Vanellus armatus	Blacksmith Lapwing	LC
Vidua macroura	Pin-tailed Whydah	LC
Bubulcus ibis	Western Cattle Egret	LC
Amblyospiza albifrons	Thick-billed Weaver	LC
Prinia flavicans	Black-chested Prinia	LC
Bostrychia hagedash	Hadeda Ibis	LC
Tockus leucomelas	Southern Yellow-billed Hornbill	LC
Tockus nasutus	African Grey Hornbill	LC
Dicrurus adsimilis	Fork-tailed Drongo	LC
Pycnonotus tricolor	Dark-capped Bulbul	LC
Elanus caeruleus	Black-shouldered Kite	LC
Urocolius indicus	Red-faced Mousebird	LC
Laniarius atrococcineus	Crimson-breasted Shrike	LC
Tchagra australis	Brown-crowned Tchagra	LC
Ploceus cucullatus	Village Weaver	LC

[16] Data on avifauna were sourced from BirdLife International (2021) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 05/07/2021

Scientific Name	Common Name	Conservation Status
Ploceus velatus	Southern Masked Weaver	LC
Circaetus pectoralis	Black-chested Snake Eagle	LC
Emberiza tahapisi	Cinnamon-breasted Bunting	LC
Turdoides jardineii	Arrow-marked Babbler	LC
Bubalornis niger	Red-billed Buffalo Weaver	LC
Batis molitor	Chinspot Batis	LC
INVERTEBRATES		
Acanthacris ruficornis	Grasshopper	NYBA
Acrotylus sp	Burrowing Grasshoppers	NA
Alcimus sp.	Robber Fly	NA
Anachalcos convexus	Dung Beetle	NYBA
Anomalipus elephas	Large Armoured Darkling Beetle	NYBA
Aspidimorpha tecta	Fools Gold Beetle	NYBA
Brachythemis leucostica	Banded Groundling	LC
Chrysemosa jeanneli	Antlion	NYBA
Cryptocephalus decemnotatus	Ten-spotted Leaf Beetle	NYBA
Dictyophorus spumans	Koppie Foam Locust	NYBA
Dischista rufa	Savannah Fruit Chafer	NYBA
Distoleon pulverulentus	Antlion	NYBA
Dysdercus intermedius	Cotton Stainer	NYBA
Eupezus natalensis	Tree Darkling Beetle	NYBA
Harpagomantis sp.	Praying Mantis	NA
Henosepilachna bifasciata	Cucurbit Ladybeetle	NYBA
Miomantis sp.	Praying Mantis	NA
Musca domestica	House Fly	NYBA
Omomantis sp.	Praying Mantis	NA
Oncocephalus sp.	Assassin Bug	NA
Phymateus leprosus	Leprous Grasshopper	NYBA
Platygryllus sp.	Tree Cricket	NA
Pseudagrion sp.	NA	NA
Ruspolia sp.	Bush cricket	NA
Supella dimidiata	Cockroach	NYBA
Thermophilum homoplatum	Two-spotted Ground Beetle	NYBA
Ypthima asterope	Common Three Wing	NYBA
HERPETOFAUNA		
Amphibians*		
Pyxicephalus edulis	African Bullfrog	P
Chiromantis xerampelina	Southern Foam Nest Frog	LC
Cacosternum boettgeri	Common Caco	LC
Poyntonophrynus fenoulheti	Northern Pygmy Toad	LC
Ptychadena anchietae	Plain Grass Frog	LC
Phrynobatrachus natalensis	Snoring Puddle Toad	LC
Ptychadena mossambica	Broad-banded Grass Frog	LC
Phrynomantis bifasciatus	Banded Rubber Frog	LC
Schismaderma carens	Red Toad	LC
Breviceps adspersus	Bushveld Rain Frog	LC
Kassina senegalensis	Bubbling Kassina	LC
Schismaderma carens	Red Toad	LC
Sclerophrys garmani	Olive Toad	LC
Tomopterna cryptotis	Tremelo Sand Frog	LC
Phrynomantis bifasciatus	Banded Rubber Frog	LC
Reptiles*		
Varanus albigularis	Rock Monitor	LC
Varanus niloticus	Water Monitor	LC
Matobosaurus validau	Common Giant Plated Lizard	LC
Pachydactylus capensis	Cape Gecko	LC
Trachylepis varia	Variable Skink	LC
Stigmochelys pardalis	Leopard Tortoise	LC

Scientific Name	Common Name	Conservation Status
Naja annulifera	Snouted Cobra	LC

LC = Least Concern, NYBA = Not yet been assessed by the IUCN, N/A = Not Applicable.

APPENDIX H: Floral SCC

South Africa uses the internationally endorsed IUCN Red List Categories and Criteria in the Red List of South African plants. This scientific system is designed to measure species' risk of extinction. The purpose of this system is to highlight those species that are most urgently in need of conservation action. For the POC assessment, a list of Red Data Listed (RDL) species previously recorded within the 10 km of the study area was pulled from the Botanical Database of Southern Africa (BODATSA) (http://posa.sanbi.org/). This list was further cross-checked with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) TOPS flora) to identify provincially protected species previously recorded for the area.

Definitions of the national Red List categories

Categories marked with ^{N} are non-IUCN, national Red List categories for species not in danger of extinction but considered of conservation concern. The IUCN equivalent of these categories is Least Concern (LC).

- **Extinct (EX)** A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.
- **Extinct in the Wild (EW)** A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside the past range.
- **Regionally Extinct (RE)** A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
- **Critically Endangered, Possibly Extinct (CR PE)** Possibly Extinct is a special tag associated with the category Critically Endangered, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered.
- **Critically Endangered (CR)** A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
- **Endangered (EN)** A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
- **Vulnerable (VU)** A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
- **Near Threatened (NT)** A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable and is therefore likely to become at risk of extinction in the near future.
- ^{N}**Critically Rare** A species is Critically Rare when it is known to occur at a single site but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
- ^{N}**Rare** A species is Rare when it meets at least one of four South African criteria for rarity but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria. The four criteria are as follows:
  - Restricted range: Extent of Occurrence <500 km^2, OR
  - Habitat specialist: Species is restricted to a specialized microhabitat so that it has a very small Area of Occupancy, typically smaller than 20 km^2, OR

- Low densities of individuals: Species always occurs as single individuals or very small subpopulations (typically fewer than 50 mature individuals) scattered over a wide area, OR
- Small global population: Less than 10 000 mature individuals.

- **Least Concern** A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.
- **Data Deficient - Insufficient Information (DDD)** A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required, and that future research could show that a threatened classification is appropriate.
- **Data Deficient - Taxonomically Problematic (DDT)** A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.
- **Not Evaluated (NE)** A species is Not Evaluated when it has not been evaluated against the criteria. The national Red List of South African plants is a comprehensive assessment of all South African indigenous plants, and therefore all species are assessed and given a national Red List status. However, some species included in Plants of southern Africa: an online checklist are species that do not qualify for national listing because they are naturalized exotics, hybrids (natural or cultivated), or synonyms. These species are given the status Not Evaluated and the reasons why they have not been assessed are included in the assessment justification.

The below tables present the results of the POC assessment.

POC for RDL Floral SCC obtained from BODATSA

Table H1: Red Data Listed plant species recorded in the QDS 2427DD, 2428CC, and 2428CC. Species list obtained from the new Plants of southern Africa (new POSA) online catalogue. Information on species distributions and conservation status were derived from the Red List of South African Plants website (http://redlist.sanbi.org/index.php).

Scientific Name	IUCN	Habitat description	POC
Cucumis humifructus	VU	Range: Eastern and southern tropical Africa, in Gauteng and Limpopo and from Kenya to northern Namibia. Major habitats: Central Sandy Bushveld Description: Woodland and grassland, deep sand, 1350-1500 m.	Low
Cleome conrathii	NT	Range: Kuruman to Pretoria. Major habitats: Grassland, Savanna Description: Stony quartzite slopes, usually in red sandy soil, grassland or deciduous woodland, all aspects	Low
Ceropegia turricula	NT	Range: Lichtenburg to Gravelotte. Major habitats: Savanna Description: Grassland slopes.	Low

Table H2: Plant species triggering the medium sensitivity for the Plant Species Theme as identified by the National Web-based Screening Tool.

Scientific name	IUCN	Habitat descriptions	POC
Cucumis humifructus	VU	Range: Eastern and southern tropical Africa, in Gauteng and Limpopo and from Kenya to northern Namibia. Major habitats: Central Sandy Bushveld Description: Woodland and grassland, deep sand, 1350-1500 m.	Low
Brachycorythis conia subsp. *transvaalensis*	CR	Range: Waterberg to Balfour. Major habitats: Gold Reef Mountain Bushveld, Waterberg Mountain Bushveld, Loskop Mountain Bushveld, Andesite Mountain Bushveld, Waterberg-Magaliesberg Summit Sourveld, Eastern Highveld Grassland, Rand Highveld Grassland, Carletonville Dolomite Grassland.	Low

		Description: Short, open grassland and wooded grassland, on sandy gravel overlying dolomite, sometimes also on quartzite, 1 000-1 705 m.	
Hesperantha bulbifera	Rare	Range: his species ha a wide, but scattered distribution across the eastern summer rainfall areas, from the Soutpansberg in Limpopo to the Boschberg near Somerset East, Eastern Cape. It has not been recorded in KwaZulu-Natal but is likely to occur there. Major habitats: Waterberg Mountain Bushveld, Soutpansberg Summit Sourveld, Karoo Escarpment Grassland, Long Tom Pass Montane Grassland, Escarpment Mesic Thicket, Steenkampsberg Montane Grassland, Northern Escarpment Afromontane Fynbos, Northern Escarpment Quartzite Sourveld, Amathole Montane Grassland, Scarp Forest, Northern Mistbelt Forest, Southern Mistbelt Forest, Northern Afrotemperate Forest. Description: It is localized to ledges on wet cliffs and damp places in the spray of waterfalls.	Low

NEMBA TOPS List for South Africa[17]

Table H3: TOPS list for South Africa – plant species.

NEMBA TOPS LIST (PLANT SPECIES)				
Scientific Name	Common Name	POC	Provincial Distribution	Conservation Status
Adenia wilmsii	No common name	Low	Provincial distribution: Mpumalanga Range: Lydenburg to Waterval Boven Description: Dolerite outcrops or red loam soil, in open woodland, 1300-1500 m.	EN; P
Adenium swazicum	Swaziland Impala Lily	Low	Range: Kruger National Park to Swaziland along the Lebombo Mountains and adjacent areas in south-western Mozambique.	VU
Adenium swazicum	Swaziland Impala Lily	Low	Provincial distribution: Mpumalanga	VU
Aloe albida	Grass Aloe	Low	Provincial distribution: Mpumalanga Range: Aloe albida has a restricted range in the mountains south of Barberton, Mpumalanga, extending to Malolotja in north-western Swaziland.	NT
Aloe pillansii (now *Aloidendron pillansii*)	False Quiver Tree	Low	Provincial distribution: Northern Cape Range: Richtersveld and southern Namibia.	EN
Aloe simii	No common name	Low	Provincial distribution: Mpumalanga Range: This species is endemic to a small area in the transition area between the Mpumalanga Lowveld and Escarpment, where it occurs from Sabie southwards to White River and around Nelspruit. Description: It occurs along drainage lines and in wetlands in open woodland and grassland, 600-1100 m.	EN; P
Clivia mirabilis	"Oorlogskloof' Bush Lily	Low	Provincial distribution: Northern Cape, Western Cape	VU; P
Diaphananthe millarii	Tree Orchid	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal Range: East London and Durban.	VU
Disa macrostachya	No common name	Low	Provincial distribution: Northern Cape	EN; P
Disa nubigena	No common name	Low	Provincial distribution: Western Cape	Rare; P

[17] National Environmental Management: Biodiversity Act 10 of 2004 - Threatened or Protected Species Regulations, 2007. Government Notice R152 in Government Gazette 29657 dated 23 February 2007. Commencement date: 1 June 2007 [GN R150, Gazette no. 29657], as amended.

NEMBA TOPS LIST (PLANT SPECIES)				
Scientific Name	Common Name	POC	Provincial Distribution	Conservation Status
Disa physodes	No common name	Low	Provincial distribution: Western Cape	CR; P
Disa procera	No common name	Low	Provincial distribution: Western Cape	EN; P
Disa sabulosa	No common name	Low	Provincial distribution: Western Cape	EN; P
Encephalartos aemulans	Ngotshe Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
Encephalartos altensteinii	Bread Palm	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
Encephalartos arenarius	Dune Cycad	Low	Provincial distribution: Eastern Cape	EN
Encephalartos brevifoliolatus	Escarpment Cycad	Low	Provincial distribution: Limpopo	EW
Encephalartos caffer	Breadfruit Tree	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
Encephalartos cerinus	Waxen Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
Encephalartos cupidus	Blyde River Cycad	Low	Provincial distribution: Limpopo, Mpumalanga Description: Grassland, on steep, rocky slopes or cliffs and sometimes near seepage areas bordering gallery forests.	CR
Encephalartos dolomiticus	Wolkberg Cycad	Low	Provincial distribution: Limpopo	CR
Encephalartos dyerianus	Lowveld Cycad	Low	Provincial distribution: Limpopo	CR; P
Encephalartos eugene-maraisii	Waterberg Cycad	Low	Provincial distribution: Limpopo	EN
Encephalartos friderici-guilielmi	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
Encephalartos ghellinckii	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
Encephalartos heenanii	Woolly Cycad	Low	Provincial distribution: Mpumalanga Description: Open areas of montane grasslands amidst scarp forest in deep valleys and ravines.	CR
Encephalartos hirsutus	Venda Cycad	Low	Provincial distribution: Limpopo	CR
Encephalartos horridus	Eastern Cape Blue Cycad	Low	Provincial distribution: Eastern Cape	EN
Encephalartos humilis	No common name	Low	Provincial distribution: Mpumalanga Description: Montane and mistbelt grassland, rocky sandstone slopes.	VU; P
Encephalartos inopinus	Lydenburg Cycad	Low	Provincial distribution: Limpopo	CR
Encephalartos laevifolius	Kaapsehoop Cycad	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga Description: Steep, rocky slopes in mistbelt grassland, 1300-1500 m.	CR
Encephalartos lanatus	No common name	Low	Provincial distribution: Gauteng and western Mpumalanga Description:Sheltered, wooded ravines in sandstone ridges, 1200-1500 m.	NT; P
Encephalartos latifrons	Albany Cycad	Low	Provincial distribution: Eastern Cape	CR
Encephalartos lebomboensis	Lebombo Cycad	Low	Provincial distribution: KwaZulu-Natal, Mpumalanga Description: Cliffs and rocky ravines in savanna and grassland.	EN
Encephalartos lehmannii	No common name	Low	Provincial distribution: Eastern Cape	NT; P
Encephalartos longifolius	No common name	Low	Provincial distribution: Eastern Cape	NT; P
Encephalartos middelburgensis	Middelburg Cycad	Low	Provincial distribution: Gauteng, Mpumalanga Description: Open grasslands and in sheltered valleys.	CR

NEMBA TOPS LIST (PLANT SPECIES)				
Scientific Name	Common Name	POC	Provincial Distribution	Conservation Status
Encephalartos msinganus	Msinga, Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
Encephalartos natalensis	Natal Giant Cycad	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
Encephalartos ngoyanus	Ngoye Dwarf Cycad	Low	Provincial distribution: KwaZulu-Natal	VU
Encephalartos nubimontanus	Blue Cycad	Low	Provincial distribution: Limpopo	EW
Encephalartos paucidentatus	No common name	Low	Provincial distribution: Mpumalanga Description: Forest, occurs on steep rocky slopes and alongside streams in deep gorges.	VU; P
Encephalartos princeps	No common name	Low	Provincial distribution: Eastern Cape	VU; P
Encephalartos senticosus	No common name	Low	Provincial distribution: KwaZulu-Natal	VU; P
Encephalartos transvenosus	Modjadje Cycad	Low	Provincial distribution: Limpopo	LC; P
Encephalartos trispinosus	No common name	Low	Provincial distribution: Eastern Cape	VU; P
Encephalartos woodii	Wood's Cycad	Low	Provincial distribution: KwaZulu-Natal	EW
Euphorbia clivicola	No common name	Low	Provincial distribution: Limpopo	CR; P
Euphorbia meloformis	No common name	Low	Provincial distribution: Eastern Cape	NT; P
Euphorbia obesa	No common name	Low	Provincial distribution: Eastern Cape	EN; P
Harpagophytum procumbens	Devil's Claw	Low	Provincial distribution: Free State, Limpopo, Northern Cape, North West	LC; P
Harpagophytum zeyherii	Devil's Claw	Low	Provincial distribution: Gauteng, Limpopo, Mpumalanga, North West	LC; P
Hoodia currorii	Ghaap	Low	Provincial distribution: Limpopo	P
Hoodia gordonii	Ghaap	Low	Provincial distribution: Free State, Northern Cape, Western Cape	DDD; P
Jubaeopsis caffra	Pondoland Coconut	Low	Provincial distribution: Eastern Cape	EN
Merwilla plumbea	Blue Squill	Low	Provincial distribution: KwaZulu-Natal, Mpumalanga Major habitats: Grassland Description: Montane mistbelt and Ngongoni grassland, rocky areas on steep, well drained slopes. 300-2500 m.	NT
Newtonia hildebrandtii var. *hildebrandtii*	Lebombo Wattle	Low	Provincial distribution: KwaZulu-Natal	Now LC
Protea odorata	Swartland Sugarbush	Low	Provincial distribution: Western Cape	CR; P
Siphonochilus aethiopicus	Wild Ginger	Low	Provincial distribution: KwaZulu-Natal, Limpopo, Mpumalanga Range: Sporadically from the Letaba catchment in the Limpopo Lowveld to Swaziland. Extinct in KwaZulu-Natal. Widespread elsewhere in Africa. Description: Tall open or closed woodland, wooded grassland or bushveld.	CR
Stangeria eriopus	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
Warburgia salutaris	Pepper-bark Tree	Low	Provincial distribution: KwaZulu-Natal, Limpopo, Mpumalanga Range: North-eastern KwaZulu-Natal, Mpumalanga and Limpopo Province. Also occurs in Swaziland, Mozambique and Zimbabwe and Malawi. Description: Variable, including coastal, riverine, dune and montane forest as well as open woodland and thickets.	EN

NEMBA TOPS LIST (PLANT SPECIES)				
Scientific Name	Common Name	POC	Provincial Distribution	Conservation Status
Zantedeschia jucunda	Yellow Arum Lilly	Low	Provincial distribution: Limpopo	VU

CR = Critically Endangered**, EN** = Endangered**, EW** = Extinct in the Wild**, NT** = Near Threatened**, VU** = Vulnerable**, P** = Protected, **POC** = Probability of Occurrence.

Provincially Protected Flora (i.e., LEMA)

Table H3: Protected Plants (Schedule 12) for the Limpopo Province[18].

Common name	Scientific name	POC
Trees and Shrubs		
The following Adenia species	*Adenia fruticosa simpliciflora*	Low
Baobab	*Adansonia digitata*	Low
Beech	*Faurea macnaughtonii*	Low
Bitter False Thorn	*Albizia amara sericocephala*	Low
The following Boscia species	*Boscia angustifolia var. corymbosa*	Low
	Boscia foetida minima	Low
Borassus Palm	*Borassus aethiopicum*	Low
Brackenridgea	*Brackenridgea zanguebarica*	Low
Capper Bush	*Capparis sepiaria var. subglabra*	Low
The following Combretum species	*Combretum collinum taborense*	Low
	Combretum padoides	Low
	Combretum petrophilum	Low
	Combretum vendae	Low
The following Commiphora species	*Commiphora zanzibarica*	Low
Currant	*Allophylus ainifolius*	Low
The following elephantorrhiza species	*Elephantorrhiza praetermissa*	Low
The following Grewia species	*Grewia rogersii*	Low
The following Hibiscus species	*Hibiscus articulatus*	Low
	Hibiscus barnardii	Low
	Hibiscus sabiensis	Low
Large Cape Myrtle	*Myrsine pillansii*	Low
Largeleaved Dragon Tree	*Dracaena hookerana*	Low
Largeleaved Saucerberry	*Cordia africana*	Low
The following Maytenus species	*Maytenus oxycarpa*	Low
	Maytenus pubescens	Low
The following Ochna species	*Ochna glauca*	Low
Pepperbark Tree	*Warburgia salutaris*	Low
Pincushion	*Leucospermum saxosum*	Low
The following Rhus species	*Searsia batophylla*	Low
Sand ironplum	*Drypetes mossambicensis*	Low
Salati Palm	*Borassus aethiopicum*	Low
Stinkwood, Black	*Ocotea bullata*	Low
Stinkwood, Transvaal	*Ocotea kenyensis*	Low
Tamboti	*Spirostachys africana*	Medium
The following Tarenna species	*Tarenna zygoon*	Low
Transvaal Red Balloon	*Erythrophysa transvaalensis*	Low
Venda Beadstring	*Alchornea laxiflora*	Low
Wild Banana	*Ensete ventricosum*	Low

[18] https://www.thetreeapp.co.za/team/

Common name	Scientific name	POC
Wild Teak	*Pterocarpus angolensis*	Low
Yellowwood, Outeniqua	*Podocarpus latifolius*	Low
Yellowwood, Real	*Podocarpus falcatus*	Low
Succulents		
All species of aloes indigenous to the Province excluding the following species:		Low
Aculeata	*Aloe aculeata*	Not protected under LEMA
Aloe Catstail	*Aloe castanea*	
Aloe Krans	*Aloe arborescens*	
Aloe Mountain	*Aloe marlothii*	
Ammophilla	*Aloe ammophilla*	
Davyana	*Aloe davyana*	
Fosteri	*Aloe fosteri*	
Globuligemma	*Aloe globuligemma*	
Grandidentata	*Aloe grandidentata*	
Greatheadii	*Aloe greatheadii*	
Lutescens	*Aloe lutescens*	
Mutans	*Aloe mutans*	
Parvibracteata	*Aloe parvibracteata*	
Transvaalensis	*Aloe transvaalensis*	
Wickensii	*Aloe wickensii*	
All species of Brachystelma	*Brachystelma spp*	Low
All species of Ceropegia	*Ceropegia spp*	Low
All species of Duvalia	*Duvalia spp*	Low
The following species Euphorbias:	*Euphorbia barnardii*	Low
	Euphorbia divicola	Low
	Euphorbia grandialata	Low
	Euphorbia groenewaldii	Low
	Euphorbia louwii	Low
	Euphorbia restricta	Low
	Euphorbia rowlandii	Low
	Euphorbia tortirama	Low
	Euphorbia waterbergensis	Low
Ghaap	*Hoodia lugardii*	Low
All species of Ghaap	*Tavaresia spp*	Low
All species of Huernia	*Huernia spp* (i.e., *Huernia zebrina* subsp. *magniflora*)	Low
All species of Huerniopsis	*Huerniopsis spp*	Low
The following Impala Lilies	*Adenium multiflorum*	Low
Multiflorum en Oleifolium	*Adenium olefolium*	Low
Kudu Lily	*Pachypodium saundersii*	Low
All species of Orbeanthus	*Orbeanthus spp*	Low
All species of Orbeas	*Orbea spp*	Low
All species of Orbeopsis	*Orbeopsis spp*	Low
All species of Pachycymbiums	*Pachycymbium spp*	Low
All species of Riocreuxias	*Riocreuxia spp*	Low
All species of Stapeliads	*Stapelia spp*	Low
Stone Plant	*Lithops leslieii*	Low
Other Plants		
The following Agapanthus species	*Agapanthus coddii, A. dyeri*	Low
The following Anacampseros species	*Anacampseros bemenkampii (now A. rhodesica)*	Low
All species of Anomatheca	*Anomatheca spp*	Low
The following Anthericum species	*Anthericum cyperaceum*	Low
The following Arum Lilies:		Low

Common name	Scientific name	POC
Jucunda, Pentlandii and Rehmannii	*Zantedeschia jucunda, Z.pentlandii, Z. rehmannii*	Low
The following Babiana Species	*Babiana hypogea var. longituba*	Low
Batesiana Gasteria	*Gasteria batesiana*	Low
Blue Squill	*Scilla natalensis*	Low
Clivia	*Clivia caulescens*	Low
The following Cyathula species	*Cyathula natalensis*	Low
The following Eragrostis species	*Eragrostis arenicola*	Low
The following Eriosema species	*Eriosema transvaalense*	Low
The following Eulophia species	*Eulophia coddii*	Low
	Eulophia leachii	Low
The following Felicia species	*Felicia fruticosa brevipendunculata*	Low
The following Festuca species	*Festuca dracomontana*	Low
All species of Fire Lily	*Cyrtanthus spp*	Low
The following Freylinia species	*Freylinia tropica*	Low
The following Gladiolus species	*Gladiolus macneilii*	Low
The following Habernaria species	*Habernaria kraenzliniana*	Low
The following Heinsia species	*Heinsia crinita*	Low
The following Hermstaedtia species	*Hermstaedtia capitata*	Low
The following Hippocratea species	*Hippocratea parvifolia*	Low
The following Hymenodictyon species	*Hymenodictyon parvifolium parvifolium*	Low
The following Hyptis species	*Hyptis spicigera*	Low
The following Inula species	*Inula paniculata*	Low
The following Jasminum species	*Jasminum abyssinbicum*	Low
The following Kalanchoe species	*Kalanchoe crundallii*	Low
	Kalanchoe rogersii	Low
The following Kniphofia species	*Kniphofia coralligemma*	Low
	Kniphofia crassifolia	Low
	Kniphofia rigidifolia	Low
The following Kotschya species	*Kotschya thymodora*	Low
The following Melinus species	*Melinus tenuissima*	Low
The following Mondia species	*Mondia whitei*	Low
The following Monsonia species	*Monsonia lanuginosa*	Low
The following Neobulosia species	*Neobulosia tysonii*	Low
The following Nervillia species	*Nervillia umbroza*	Low
The following Nymphaea species	*Nymphaea lotus*	Low
The following Oberonia species	*Oberonia distichia*	Low
The following Oreosyce species	*Oreosyce africana*	Low
Paint Brush	*Haemanthus montanus*	Low
The following Peristrophe species	*Peristrophe cliffordii*	Low
	Peristrophe gililandorum	Low
	Peristrophe transvaalensis	Low
The following Phyllanthus species	*Phyllanthus pinnatus*	Low
The following Pilea species	*Pilea rivularis*	Low
The following Plinthus species	*Plinthus rehmannii*	Low
The following Polycarpea species	*Polycarpia eriantha* var. *effusa*	Low
The following Polystachya species	*Polystachia albescens imbricata*	Low
The following Portulaca species	*Portulaca foliosa*	Low
	Portulaca trianthemoides	Low
The following Rhyncosia species	*Rhyncosia vendae*	Low
Royal Paint Brush (Blood lily)	*Scadoxis puniceus*	Low
The following Sartidia species	*Sartidia jucunda*	Low
The following Schizagyrium species	*Schizagyrium brevifolium*	Low

Common name	Scientific name	POC
All species of South African Orchid	Family Orchidaceae	Low
The following Stadmania species	*Stadmania oppositifolia*	Low
The following Streptocarpus species	*Streptocarpus decipiens*	Low
The following Strophanthus species	*Strophanthus luteolus*	Low
The following Sutera species	*Sutera maerantha*	Low
The following Thorncroftia species	*Thorncroftia media*	Low
All species of Tree Ferns	*Cyathea spp*	Low
All species of Tree Moss	*Porothamnium, Pilotrichella and Papillaria spp*	Low
The following Trilepisium species	*Trilepisium madagascariensis*	Low
The following Tristachya species	*Tristachya trifaria*	Low
The following Turbina species	*Turbina shirensis*	Low
The following Watsonia species	*Watsonia densiflora*	Low
	Watsonia transvaalensis	Low
	Watsonia wilmsii	Low
Wild Ginger	*Burmannia madagascariensis*	Low
Wild Ginger	*Siphonochilus aethiopicus*	Low
The following Xylopia species	*Xylopia parviflora*	Low

Table H4: NFA plant list for species with a known distribution range falling within the study area[19].

SCIENTIFIC NAME	Habitat & Distribution[20] & [21]	National Red List Status	POC
Boscia albitrunca	Habitat mainly includes dry, open woodland and bushveld, mostly in hot, arid, semi-desert areas, often on termitaria. The vast distribution range covers Botswana, Limpopo, Gauteng, North-West, Swaziland, the Free State, Northern Cape and KwaZulu-Natal. It also extends into Zambia, Zimbabwe, and Mozambique.	LC P	High
Combretum imberbe	The leadwood can be found in all the bushveld regions and in mixed forest in southern Africa. Preferred habitat includes open bushveld, mixed woodland, rivers or dry watercourses and often on alluvial soils. It is widespread in Lowveld areas and grows along streams and rivers. Combretum imberbe is widespread in northern Namibia. It is also found in Mpumalanga, Limpopo, North-West Province, Mozambique, and into tropical Africa.	LC P	Confirmed
Catha edulis	Khat is found in woodlands and on rocky outcrops. It is scattered in KwaZulu-Natal and Eastern Cape, mostly from the mistbelt, moving inland. It is also found in the Western Cape, Mpumalanga, Swaziland, Mozambique and through to tropical Africa and the Arab countries.	LC P	Low
Elaeodendron transvaalense	Savanna or bushveld, from open woodland to thickets, often on termite mounds.	NT P	Medium
Sclerocarya birrea subsp. *caffra*	The Marula is widespread in Africa from Ethiopia in the north to KwaZulu-Natal in the south. In South Africa it is more dominant in the Baphalaborwa area in Limpopo. It occurs naturally in various types of woodland, on sandy soil or occasionally sandy loam.	LC P	Confirmed
Philenoptera violacea	Alluvial flats in bushveld	LC P	Low
Pittosporum viridiflorum	*Pittosporum viridiflorum* is widely distributed in the eastern half of South Africa, occuring from the Western Cape up into tropical Africa and beyond to Arabia and India. It grows over a wide range of altitudes and varies in form from one location to	LC P	Low

[19] https://www.thetreeapp.co.za/team/
[20] http://pza.sanbi.org/
[21] http://redlist.sanbi.org/index.php

SCIENTIFIC NAME	Habitat & Distribution[20] & [21]	National Red List Status	POC
	another. *Pittosporum viridiflorum* grows in tall forest and in scrub on the forest margin, kloofs and on stream banks.		
Prunus africana	*Prunus africana* is confined to evergreen forests from near the coast to the mist belt and montane forests in KwaZulu-Natal, Eastern Cape, Swaziland, Mpumalanga, Zimbabwe, and tropical Africa. This It is a moderately fast-growing tree which is sensitive to heavy frost, preferring areas where there is regular rain; it will tolerate moderate frosts.	VU P	Low
Vachellia erioloba	Found in dry woodland, bushveld, grassland, and watercourses in arid areas usually on stony or sandy soil. Widespread in the arid northern provinces of South Africa, also Namibia, Botswana, Zimbabwe, southern Angola, and south-western Zambia.	LC P	Low
Erythrophysa transvaalensis	This species has a limited distribution in South Africa occurring in Gauteng, Limpopo, and the North West Province. It grows in a few places in western Gauteng, on the slope of a hill near the Bospoort Dam in the Rustenburg District, near Thabazimbi, and in the western Waterberg. It was first thought to be endemic to syenite hills (koppies) in the Pilanesberg Nature Reserve, but it has been found since in a wider area (Balkwill 1994). I.C. Verdoorn (1942) described one of the original collections as coming from a norite koppie (near Bosport Dam). It also occurs in Limpopo in a few areas including near the Strydom tunnel on dolomite (Pieter Winter pers. comm.). It has also been collected in Zimbabwe.	LC P	Low
Securidaca longepedunculata	It occurs in the North-West and Limpopo provinces of South Africa, in Mozambique and is widely distributed in tropical Africa. The violet tree is found in woodland and arid savanna soils.	LC P	Low
Podocarpus latifolius	The real yellowwood grows naturally in mountainous areas and forests in the southern, eastern and northern parts of South Africa, extending into Zimbabwe and further north. It is also found on rocky hillsides and mountain slopes but does not get as tall where it is exposed as it does in the forest.	LC P	Low

CR= Critically Endangered, EN = Endangered, LC = Least Concern; NT = Near Threatened, P= Protected, POC = Probability of Occurrence; R = Rare

APPENDIX I: Faunal SCC

Faunal Species of Conservation Concern

Table I1: Red Data Mammal species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status	POC
Diceros bicornis	Black Rhinoceros	CR	CR	Low
Neamblysomus julianae	Juliana's golden mole	CR	VU	Low
Loxodonta africana	African elephant	VU	VU	Low
Lycaon pictus	African wild dog	EN	EN	Low
Amblysomus gunningi	Gunning's golden mole	VU	EN	Low
Lutra maculicollis	Spotted-necked otter	VU	LC	Low
Acinonyx jubatus	Cheetah	VU	VU	Low
Felis lybica	African Wild Cat	VU	NYBA	Low
Panthera leo	Lion	VU	VU	Low
Ceratotherium simum	White rhinoceros	NT	NT	Low

LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN.

Table I2: Red Data Bird species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status	POC
Gyps coprotheres	Cape Vulture	T	VU	Low
Ciconia nigra	Black Stork	T	LC	Low
Falco naumanni	Lesser Kestrel	T	LC	Low
Certhilauda chuana	Short-clawed Lark	T	LC	Low
Pterocles gutturalis	Yellow throated Sandgrouse	T	LC	Low
Anthropoides paradiseus	Blue Crane	T	VU	Low
Gyps africanus	White backed Vultures	T	EN	Low
Ardeotis kori	Kori Bustard	T	LC	Low
Scotopelia peli	Pel's Fishing Owl	T	LC	Low
Bucorvus leadbeateri	Southern Ground Hornbill	T	VU	Low
Buphagus erythrorhynchus	Red-billed Oxpecker	T	LC	Low
Terathopius ecaudatus	Bateleur	T	NT	Low
Polemaetus bellicosus	Martial Eagle	T	NT	Low
Aquila rapax	Tawny Eagle	T	LC	Low
Torgos tracheliotos	Lappet faced Vulture	T	VU	Low
Trigonoceps occipitalis	White headed Vulture	T	VU	Low
Buphagus africanus	Yellow billed Oxpecker	T	LC	Low
Stephanoaetus coronatus	Crowned hawk Eagle	T	NT	Low

LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province

Table I3: Red Data Amphibian species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status	POC
Breviceps sylvestris	Transvaal forest rain frog	VU	EN	Low
Ptychadena uzungwensis		P	LC	Low
Leptopelis bocagii		P	LC	Low
Hemisus guineensis	Guinea Snout-burrower	P	LC	Low

LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, P = Peripheral. NYBA = Not yet been assessed by the IUCN.

Table I4: Red Data Reptile species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status	POC
Homoroselaps dorsalis	Striped Harlequin snake	R	NT	Low
Xenocalamus transvaalensis	Transvaal Quill-snout snake	R	DD	Low
Lamprophis swazicus	Swazi Rock Snake	R	NT	Low
Python natalensis	African Python	VU	NYBA	Low
Lygodactylus methueni	Methuen's Dwarf Gecko	VU	VU	Low
Crocodylus niloticus	Nile Crocodile	VU	LC	Low
Lycophidion variegatum	Variegated Wolf snake	P	NYBA	Low
Psammophis jallae	Jalla's Sand snake	P	NYBA	Low

R = Rare, DD = Data Deficient, LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, P = Peripheral. NYBA = Not yet been assessed by the IUCN.

Table I5: Red Data Invertebrates species mentioned in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status	POC
Taurhina splendens	Splendid fruit chafer *	T	NYBA	Low
Charaxes marieps	Marieps Charaxes butterfly *	T	NYBA	Low
Trichostetha fasicularis	Protea beetle *	T	NYBA	Low
Ischnestoma ficqui	Fruit eating beetles *	T	NYBA	Low

R = Rare, DD = Data Deficient, LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province. * Very little detailed or general information exists on terrestrial invertebrates in the Limpopo Province, thus in general there is very little consolidated information regarding invertebrates (Limpopo SOER, 2004).

Table I6: Animal species triggering the high sensitivity for the Animal Species Theme as identified by the National Web-based Screening Tool.

Scientific name	Common Name	IUCN	POC
Smutsia temmnickii	Ground pangolin	VU	Low
Sagittarius serpentarius	Secretary bird	EN	Low
Aquila verreauxxi	The black eagle	LC	Low
Acinonyx jubatus	Cheetah	VU	Low
Crocidura maquassiensis	The Makwassie musk	LC	Low
Lcaon pictus	African Wild Dog	EN	Low
Sensitive Species 12		VU	Low

South African Bird Atlas Project 2 list

Table I6: Avifaunal Species for the pentads: 2555_2835, and 2600_2835 within the 2427DD and 2427DC.

Pentads	Link to pentad summary on the South African Bird Atlas Project 2 web page
2450_2750	http://sabap2.birdmap.africa/coverage/pentad/2450_2750
2450_2740	http://sabap2.birdmap.africa/coverage/pentad/2450_2740
2455_2735	http://sabap2.birdmap.africa/coverage/pentad/2455_2735
2450_2745	http://sabap2.birdmap.africa/coverage/pentad/2450_2745
2450_2735	http://sabap2.birdmap.africa/coverage/pentad/2450_2735
2450_2730	http://sabap2.birdmap.africa/coverage/pentad/2450_2730

APPENDIX J: Declaration and Specialists CV's

1. (a) (i) Details of the specialist who prepared the report

Samantha-Leigh Daniels	PhD Candidate Plant Science (University of Pretoria)
Daryl van Der Merwe	MSc Conservation Biology (University of Cape Town)
Christopher Hooton	BTech Nature Conservation (Tshwane University of Technology)
Kim Marais	BSc (Hons) Zoology (Herpetology) (University of the Witwatersrand)
Faith Mamphoka	MA Geography and Environment Science (University of the Western Cape)
Nelanie Cloete	MSc Botany and Environmental Management (University of Johannesburg)

1. (A). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

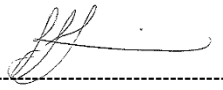
Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Nelanie Cloete		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047	Fax:	086 724 3132
Telephone:	011 616 7893		
E-mail:	nelanie@sasenvgroup.co.za		
Qualifications	MSc Environmental Management (University of Johannesburg) MSc Botany (University of Johannesburg) BSc (Hons) Botany (University of Johannesburg) BSc (Botany and Zoology) (Rand Afrikaans University)		
Registration / Associations	Professional member of the South African Council for Natural Scientific Professions (SACNASP) Member of the South African Association of Botanists (SAAB) Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group Member of the Grassland Society of South Africa (GSSA)		

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Kim Marais		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	1401	Fax:	086 724 3132
Telephone:	011 616 7893		
E-mail:	kim@sasenvgroup.co.za		
Qualifications	BSc (Hons) Zoology (University of the Witwatersrand) BSc (Zoology and Conservation) (University of the Witwatersrand)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Member of South African Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

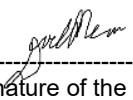
I, Samantha-Leigh Daniels, declare that -

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



I, Daryl van der Merwe, declare that -

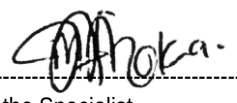
- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity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



Signature of the Specialist

I, Faith Mamphoka, declare that -

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



Signature of the Specialist

I, Christopher Hooton, declare that -

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

Specialist Signature

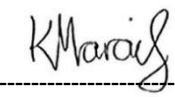
I, Nelanie Cloete, declare that -

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

Signature of the Specialist

I, Kim Marais, declare that -

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



SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF SAMANTHA-LEIGH DANIELS

PERSONAL DETAILS

Position in Company	Junior Floral Ecologist
Joined SAS Environmental Group of Companies	2020

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Association of Botanists (SAAB)
Member of the Botanical Society of South Africa (BotSoc)
Member of the *Association for Tropical Biology and Conservation (ATBC)*

EDUCATION

Qualifications

PhD (Plant Science) (University of Pretoria)	Present
MSc (Plant Science) (University of Pretoria)	2017
BSc (Hons) Zoology & Entomology (University of Pretoria)	2014
BSc Zoology & Entomology (University of Pretoria)	2013

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Free State

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Terrestrial Ecological and Biodiversity Scoping Assessments
- Terrestrial Ecological and Biodiversity Screening Assessments
- Floral Assessments
- Alien and Invasive Control Plan (AICP)
- Terrestrial Monitoring
- Desktop Studies, Mapping and Background Information Research

Training

- Plant species identification
- Herbarium usage and protocols

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF DARYL VAN DER MERWE

PERSONAL DETAILS

Position in Company	Field Biologist
Joined SAS Environmental Group of Companies	2019

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Environmental Observation Network (SAEON)

EDUCATION

Qualifications

MSc (Conservation Biology) (University of Cape Town)	2019
BSc (Hons) Plant Science (Ecology) (University of Pretoria)	2014
BSc Environmental Science (University of Pretoria)	2013

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, Western Cape, Northern Cape

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Faunal assessments
- Invertebrate assessments
- Invertebrate monitoring
- Avifaunal Assessments
- Alien and Invasive Control Plan (AICP)
- Ecological Scans
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use License Applications/ General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of the EMPR and WUL conditions

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF FAITH MAMPHOKA

PERSONAL DETAILS

Position in Company	Junior Field Ecologist & GIS Technician
Joined SAS Environmental Group of Companies	2021

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Wetland Society (SAWS) **#123202**

Member of the International Society of Wetland Scientists

Member of the Western Cape Wetlands Forum (WCWF)
SACNASP Candidate Natural Scientist (Environmental Science) **#129757**

EDUCATION

Qualifications

Master's Degree, Geography & Environment Science (UWC)	2018 - 2019
Honours Degree, Geography (UWC)	2017
BSc. Geology and Geography (Wits University)	2012 - 2014

Short Courses

Tools for Wetland Assessment (Rhodes University)	2020
Spatial Data Science (ESRI Online)	2020
Introduction to Spatial Analysis and Geoprocessing (ESRI Online)	2020
SWM2001x: Solid Waste Management (WBGx Online through EdX)	2020
Wetland Delineation (WC Wetlands Forum)	2019
Wetland Health (WC Wetlands Forum)	2019
Introduction to Earth Observation (Stellenbosch University)	2016

KEY DISCIPLINES

- Desktop Freshwater and Terrestrial Ecosystem Delineation
- Wetland Delineation and Assessment
- Wetland hydropedology
- Spatial analysis and geoprocessing
- Detail mapping and quality control
- WebApp Builder, ESRI Products, Planet GIS, Global Mapper
- AUTOCAD to shapefile conversion, geodatabase management
- Projections and SG Diagrams

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTOPHER HOOTON

PERSONAL DETAILS

Position in Company	Senior Scientist, Member Biodiversity Specialist
Joined SAS Environmental Group of Companies	2013

EDUCATION

Qualifications

BTech Nature Conservation (Tshwane University of Technology)	2013
National Diploma Nature Conservation (Tshwane University of Technology)	2008

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Eastern Cape, Western Cape, Northern Cape, Free State
Africa - Zimbabwe, Sierra Leone

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Faunal Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF NELANIE CLOETE

PERSONAL DETAILS

Position in Company	Senior Scientist, Member Botanical Science and Terrestrial Ecology
Joined SAS Environmental Group of Companies	2011

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 400503/14)
Member of the South African Association of Botanists (SAAB)
Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group
Member of the Grassland Society of South Africa (GSSA)
Member of the Botanical Society of South Africa (BotSoc)
Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2013
MSc Botany (University of Johannesburg)	2007
BSc (Hons) Botany (University of Johannesburg)	2005
BSc (Botany and Zoology) (Rand Afrikaans University)	2004

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Eastern Cape, Free State
Africa - Democratic Republic of the Congo (DRC)

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Plant species and Landscape Plan

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF KIM MARAIS

PERSONAL DETAILS

Position in Company	Senior Scientist Water Resource Manager
Joined SAS Environmental Group of Companies	2015

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 117137/17)
Member of the Western Cape Wetland Forum (WCWF)

EDUCATION

Qualifications

BSc (Hons) Zoology (University of the Witwatersrand)	2012
BSc (Zoology and Conservation) (University of the Witwatersrand)	2011

Short Courses

Aquatic and Wetland Plant Identification (Cripsis Environment)	2019
Tools for Wetland Assessment (Rhodes University)	2018
Certificate in Environmental Law for Environmental Managers (CEM)	2014
Certificate for Introduction to Environmental Management (CEM)	2013

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Biodiversity Action Plans (BAP)
- Alien and Invasive Control Plans (AICP)
- Faunal Eco Scans
- Faunal Impact Assessments

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Watercourse Maintenance and Management Plans
- Freshwater Offset Plan

Aquatic Ecological Assessment and Water Quality Studies

- Riparian Vegetation Integrity (VEGRAI)
- Water quality Monitoring
- Riverine Rehabilitation Plans

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions
- Public Participation processes