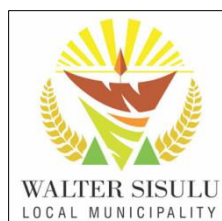


MALETSWAI LANDFILL SITE

Terrestrial Biodiversity Impact Assessment for the Proposed Development of a New Landfill Site (Class B) & Infrastructure on the Remaining Extent of Portion 1 of the Farm Melkspruit No.12, Walter Sisulu Local Municipality, Eastern Cape Province



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APPLICANT: Walter Sisulu Local Municipality

Report Reference: Maletswai LF_TR_02
Date of Report: **May 2026**

i. DOCUMENT INFORMATION

PROJECT TITLE: Maletswai Landfill Site

STUDY NAME: Terrestrial Biodiversity Impact Assessment

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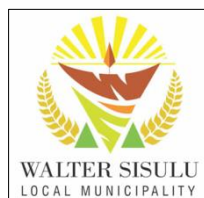
CONTACT PERSON: Kabedi Mashilo

APPLICANT: Walter Sisulu Local Municipality

DATE OF REPORT: May 2026 (edited 23 August 2026)

REPORT STATUS: Final Report

REPORT REFERENCE: Maletswai LF_TR_02



ii. EXECUTIVE SUMMARY

Project Overview

The existing landfill site at Maletswai (Aliwal North) has reached the end of its' lifespan and is in the process of being decommissioned. A new landfill site is urgently required and as part of the process two nearby potential sites were recommended by authorities. These sites need to be investigated as to their viability.

Rambuda Consultants (Pty) Ltd was appointed as the lead Environmental Assessment Practitioner (EAP) on the project. Flori Scientific Services cc was appointed to conduct a site investigation and aquatic impact assessment for the site alternatives.

Site investigations were conducted over two days on 17 & 18 November 2025, which is during the wet (summer) season for the region.

Note: The study only focusses on the three potential alternative sites. It does not address the old site or its' closure (decommissioning).

Conclusions

- Three alternative sites were investigated for the establishment of a new but necessary landfill site of Maletswai (Aliwal North).
- All three sites (Preferred site, Option 1 and Option 2) are within the veldtype (ecosystem) known as Eastern Upper Karoo. The veldtype is not a threatened veldtype and has a status of 'least concern'.
- The main watercourses in the region are the perennial Orange River and semi-perennial Melkspruit. The Melkspruit flows north into the Orange River and varies from about 1,7km to 2,4km west of the general study site. The Orange River varies in distance between 450m and 500m northwest of the Preferred Site.
- There are a few small and highly ephemeral streams and drainage lines in the vicinity of the site alternatives. Those in the vicinity of the Preferred Site flow directly into the Orange River, while those near Options 1 & 2 flow into the Melkspruit. There are no wetlands in the or near to the three site alternatives.
- There is a small out-of-stream impoundment at the Preferred Site. The impoundment is not a natural watercourse.

- The screening tool assessment sensitivities were assessed during the site investigations with the results as follows:

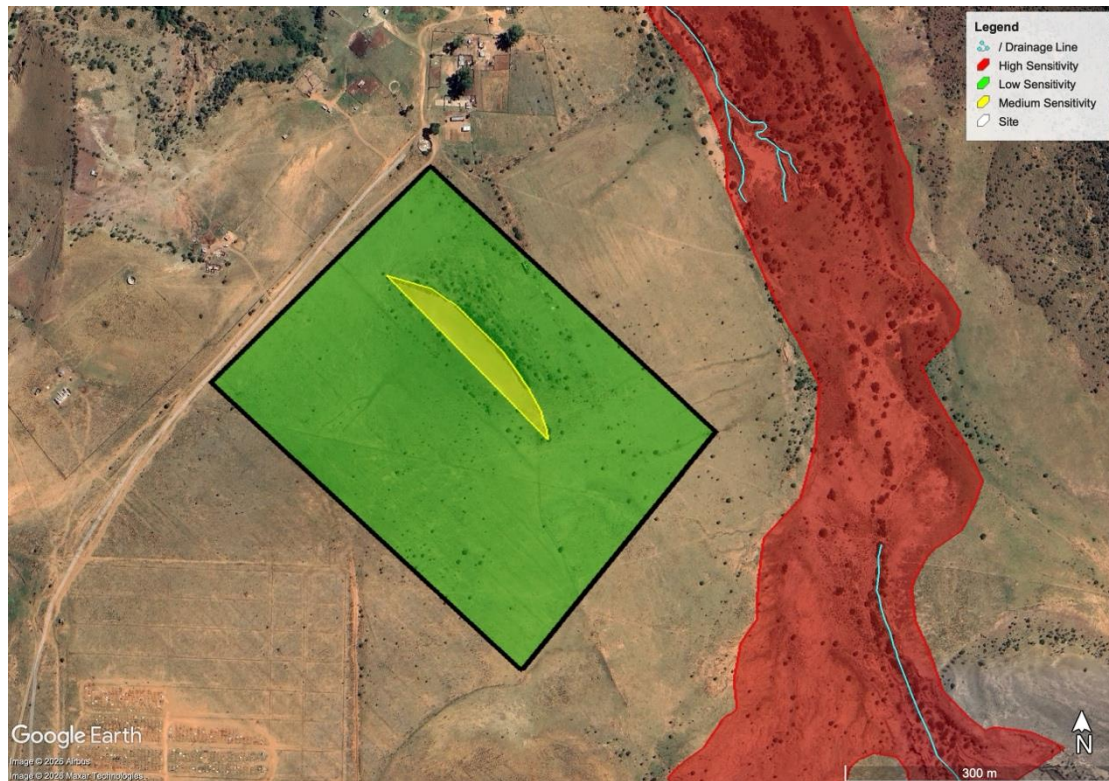
Theme	Screening Tool Sensitivity	Site Investigations Sensitivity	Findings
Terrestrial biodiversity	Very High & Low	Very High & Low	Verified (Confirmed)
Aquatic biodiversity	Very High & Low	Very High & Low	Verified (Confirmed)
Animal species	High & Low	High & Low	Verified (Confirmed)
Plant species	Low	Low	Verified (Confirmed)

- As part of the study and assessment the site ecological importance (SEI) for the identified habitats were calculated with the following results:

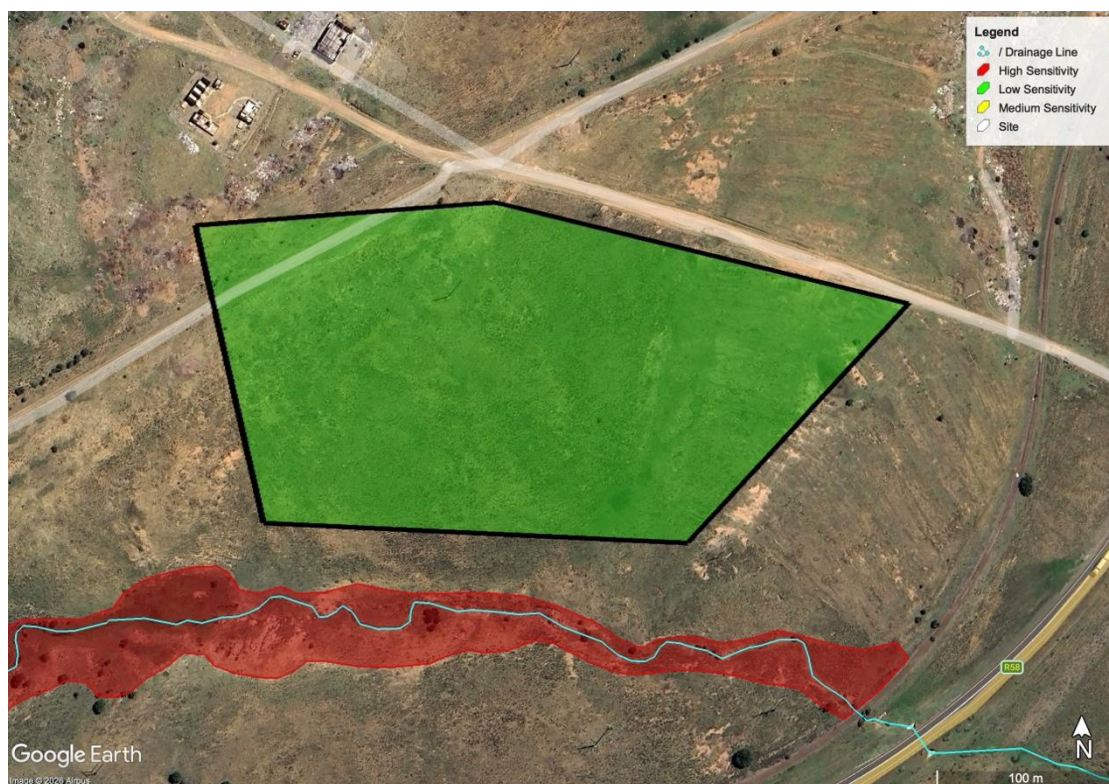
Aspect	Habitat / Ecosystem	Result
Conservation Importance	Altered Environment	Low
	Karoo Shrubland	Low
	Watercourses	High
Functional Integrity	Altered Environment	Low
	Karoo Shrubland	Medium
	Watercourses	Medium
Receptor Resilience	Altered Environment	Medium
	Karoo Shrubland	Medium
	Watercourses	Low
Biodiversity Importance	Altered Environment	Low
	Karoo Shrubland	Low
	Watercourses	Medium
Site Ecological Importance	Altered Environment	Low
	Karoo Shrubland	Low
	Watercourses	High

- The recommended site alternative for the new landfill site is: The Preferred Site.
- Buffer zones around all natural watercourses of 32m wide from the streambank edges are recommended. Buffer zones include 'high sensitivity' aquatic areas.
- There are no sensitive terrestrial habitats or areas and therefore no terrestrial biodiversity related buffer zones or regulated zones are required or recommended for the proposed project.
- It is the opinion of the specialist that the project should be authorised and allowed to proceed, with the implementation of buffers and other listed mitigating measures.

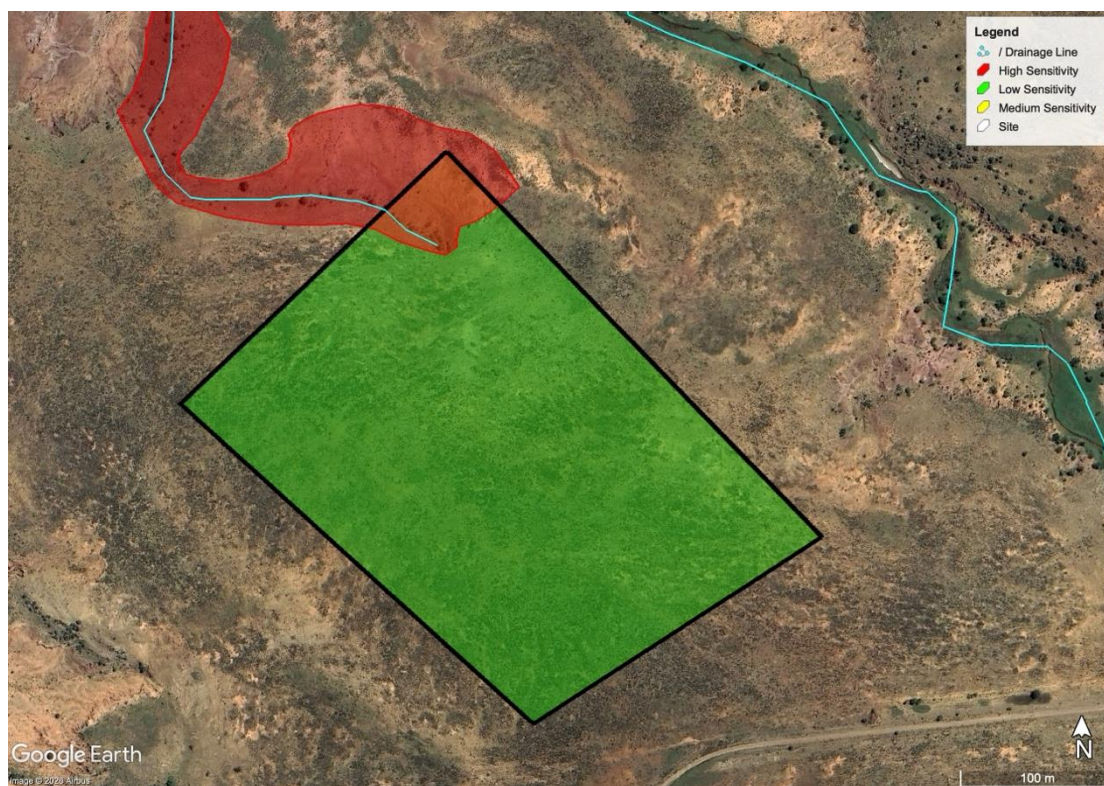
Below are the sensitivity maps for the three sites investigated for the new landfill site.



Sensitivity Map: Preferred Site



Sensitivity Map: Option 1



Sensitivity Map: Option 2

iii. REPORT REQUIREMENTS

Below are the requirements for specialist reports as per the Procedures for the Assessment and Minimum Criteria for Reporting in identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation, which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. “the Protocols”) and in Government Notice No. 1150 of 30 October 2020; and Appendix 6 of the Environmental Impact Assessment Regulations (Gazette No. 40772, 7 April 2017, as amended).

The report, as a minimum, contains the following information:

Protocols	Section
Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	iv, 9.15
A signed statement of independence by the specialist.	iv, separate document
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	1.5
A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant.	2
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.	1.4
A location of the areas not suitable for development, which are to be avoided.	5
Description of potential impacts, cumulative impacts, and proposed mitigating measures.	6
Proposed impact management actions and mitigating measures or inclusion in the EMP.	6.5
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 any conditions to which this statement is subjected.	7

iv. EXPERTISE & EXPERIENCE OF SPECIALIST

Johannes Oren Maree

Expertise of Specialist

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

- 3 Masters degrees (MSc, MBA, MTS); 2 Diplomas (Business & Public Speaking).
- Co-Author of two books: Cut Flowers of the World. 2010 & 2020 (2nd ed), Briza, Pretoria.
- SAQA accreditation and qualifications in training, assessing & service provision (AgriSeta).
- Registered with South African Council for Natural Scientific Professions (SACNASP). Registration number: 005165
- 21 years of experience in technical and managerial positions, project management and consultancy.
- 19 years of experience in writing of articles, books, training material, training & presentations, and proposals.
- 15 years of direct experience in EIAs.
- Conducted hundreds of field investigations and compiled hundreds of technical specialist reports for EIAs, ecological (fauna & flora), aquatic and avifauna impact assessments.
- Projects include power lines, roads, quarries, residential and mixed developments, mines, wind- and solar PV farms.

Declaration

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

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

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

Signed:

Electronic Signature

Date: 23 August 2026

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viii. ACRONYMS

BA	Basic Assessment
CBA	Critical Biodiversity Area(s)
CMA	Catchment Management Agencies
DFFE	Department of Forestry, Fisheries and the Environment
DWS	Department Water and Sanitation
EIA	Environmental Impact Assessment
ESA	Ecological Support Area(s)
IBA	Important Bird Area(s)
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NEMPAA	National Environmental Management: Protected Areas Act (Act 57 of 2003)
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy
ODL	Orange Data Listed
PDA	Primary Drainage Area(s)
QDA	Quaternary Drainage Area(s)
RDL	Red Data Listed
SANBI	South African National Biodiversity Institute
SWSA	Strategic Water areas of South Africa
WMA	Water Management Areas

1 BACKGROUND

1.1 Project Overview

The existing landfill site at Maletswai (Aliwal North) has reached the end of its' lifespan and is in the process of being decommissioned. A new landfill site is urgently required and as part of the process two nearby potential sites were recommended by authorities. These sites need to be investigated as to their viability.

Rambuda Consultants (Pty) Ltd was appointed as the lead Environmental Assessment Practitioner (EAP) on the project.

Flori Scientific Services cc was appointed to conduct a site investigation and aquatic impact assessment for the site alternatives.

Site investigations were conducted over two days on 17 & 18 November 2025, which is during the wet (summer) season for the region.

Note: The study only focusses on the three potential alternative sites. It does not address the old site or its' closure (decommissioning).

1.2 Purpose of the study

The purpose of the study is to conduct a terrestrial ecological impact assessment to determine the ecological sensitivities and habitats of the study area. To investigate the fauna and flora and determine if there are any priority species present. Furthermore, the purpose of the study is to conduct an impact assessment and then put forward recommended mitigating measures specifically aimed at reducing the negative impacts on the natural environment.

1.3 Quality and age of base data

Data used for background information included the following:

- Threatened ecosystems: Revised list of national threatened ecosystems. 2022. NEMBA, DFFE.
- Veldtypes and ecosystems: Mucina & Rutherford, 2006, 2010. Updated 2012, 2018.
- SANBI data sets – latest updated website data (www.bgis.sanbi.org).
- Environmental Screening Tool – DFFE (screening.environment.gov.za).
- National Freshwater Ecosystem Priority Areas (NFEPA) – DWS & SANBI databases.
- National Wetland Map 5 (2018) – SANBI, CSIR.
- Eastern Cape Province Biodiversity Conservation Plan (2019).

1.4 Assumptions and Limitations

The assumptions and limitations for the assessment are as follows:

- All information regarding the project as provided by the Client is taken to be accurate.

- Field investigations were conducted on 17 & 18 November 2025, which is during the wet (summer) season for the region. The habitats and aquatic systems are well known to the specialist who has conducted similar studies in the region.
- During site investigations all areas were easily accessed.
- The site investigations and study are considered adequate for the project and no further specialist aquatic (surface water, wetland, etc.) studies are necessary or recommended.
- Precise buffer zones or exact GPS positions cannot be made using generalised corridors or KML files on Google Earth. However, the buffer zones drawn are accurate to within 2-3m;
- There were no significant or specific limitations encountered that hindered the outcomes of the study.
- **NOTE:** Recommendations put forward in the report are based on actual biodiversity and specialist findings, but this does not mean that legal requirements do not still apply. In other words, recommendations do not negate legal requirements as set out in various acts such as NEMA (Act 107 of 1998) and NEMBA (Act 10 of 2004) and amendments.
- **NOTE:** Recommendations and impact assessments are based on the project information and location as obtained at the time of the study. Any later changes in project layout, site location, etc. may negate the findings and recommendations of this study and report.

1.5 Duration, Season and relevance to Outcome of Assessment

Site investigations were conducted over two days on 17 & 18 November 2025, which is during the wet (summer) season for the region. The area had received good summer rainfall as well as later autumn rain, resulting in a longer growing season. The study site is a small footprint, which was easily accessed and investigated. All information was able to be collected, including whether protected plants and trees may be present. During site investigations the environments encountered were expected and there were no unusual or unexpected habitats, species (fauna and flora) encountered. The specialist conducting the study has knowledge and experience of the region and ecosystems, having conducted other projects in the region.

Therefore, in terms of duration the two days were adequate for the area and project. In terms of the season the wet (summer) assessed was relevant to the findings and outcome of the assessment.

2 METHODOLOGY

2.1 Desktop Assessment

A desktop assessment was conducted using background data as shown above in Section 1.3.

The desktop assessment included generating a report from the national screening tool. This assessment was later ground truthed during the site investigation and either confirmed (verified) or disputed.

2.2 Site Investigation

A site investigation was undertaken on 1 October 2025 during which time the desktop assessment was also ground truthed. Cognisance was taken of environmental features and habitats.

2.3 Site Ecological Importance

Site ecological importance (SEI) is a function of the Biodiversity Importance (BI) of the Receptor (e.g. species of conservation concern (SCC); the floral and faunal communities / habitats present on the site) and its resilience to impacts (Receptor Resilience (RR)).

The formula for Site Ecological Importance (SEI) is as follows:

$$\text{SEI} = \text{BI} + \text{RR}$$

The SEI can be evaluated from the matrix below (Table 1).

However, the BI and RR first need to be evaluated before been able to determine the SEI. The methodology is found in the appendices (see Section 9.6).

Thereafter the recommended guidelines for the category or sensitivity level of the SEI can be determined using the SEI matrix in Table 2.

Table 1: Site Ecological Importance Matrix

Site Ecological Importance (SEI)		Biodiversity Importance (BI)				
		Very High	High	Medium	Low	Very Low
Receptor Resilience (RR)	Very Low	Very High	Very High	High	Medium	Low
	Low	Very High	Very High	High	Medium	Very Low
	Medium	Very High	High	Medium	Low	Very Low
	High	High	Medium	Low	Very Low	Very Low
	Very High	Medium	Low	Very Low	Very Low	Very Low

Table 2: Recommended Approach and Guidelines per SEI Category (Sensitivity Level)

Category	Criteria
Very High	<u>Avoidance mitigation</u> , no destructive development activities should be considered. Offset mitigation not acceptable / not possible. (i.e. last remaining populations of species, last remaining good condition patches of ecosystems / unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	<u>Avoidance mitigation</u> wherever possible. Minimisation mitigation changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	<u>Minimisation and restoration mitigation</u> development activities of medium impact acceptable followed by appropriate restoration activities.
Low	<u>Minimisation and restoration mitigation</u> development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	<u>Minimisation mitigation</u> development activities of medium to high impact acceptable and restoration activities may not be required.

2.4 Impact Assessment

An impact assessment was conducted using the scoring methodology shown below in Table 3 and Table 4. More details regarding the method are found in the appendices (9.13).

Table 3: Scoring Method for Impact Assessment

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

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

$$\text{Significance (SP)} = [\text{Magnitude (M)} + \text{Duration (D)} + \text{Scale(S)}] \times \text{Probability (P)}.$$

Table 4: Significance Scoring

Score	Significance Points (SP)	Description
<10	Negligible	The impact is non-measurable to zero / absent.
10 – 20	Low	Where the impact would not have a direct influence on the decision to develop in the area.
20 – 50	Medium	Where the impact could influence the decision to develop in the area unless it is effectively mitigated.
50 – 70	High	Where the impact must have an influence on the decision process to develop in the area.
>70	Very High	Where the impact may constitute a fatal flaw for the project.

3 RECEIVING ENVIRONMENT

3.1 Study Site Location

The study site consists of three potential alternative sites for the new Maletswai Landfill Site. The study site is west of Maletswai (Aliwal North), south of the Orange River and north of the R58 in the Eastern

Cape Province. The preferred site (Site 1) is north of the existing landfill site and the two alternative site options (Option 1 & Option 2) are south and southwest.

Note: The study only focusses on the three alternative sites investigated for the new potential landfill site. It does not directly address the old landfill site or its' closure (decommissioning).

- Preferred Site : 30°41'25.76"S; 26°39'50.87"E.
- Option 1 (1st Alternative): 30°42'23.93"S; 26°40'19.00"E.
- Option 2 (2nd Alternative): 30°42'27.15"S; 26°39'28.44"E.
- Existing Maletswai Landfill Site: 30°42'12.61"S; 26°40'11.37"E.
- Maletswai (Aliwal North): 30°41'45.14"S; 26°42'32.18"E.
- Quarter Degree Square (QDS): 3026DA.
- Quaternary Drainage Area (QDA): D14A.



Figure 1: Study Site Location (Google Earth)

Table 5: Photographs of the study site

	
Preferred Site	Preferred Site
	
Option 1	Option 2

3.2 Topography

The topography of the area is undulating plains and low hills. The average height above sea level at Site 1 (Preferred Alternative) is approximately 1 323m, with a maximum and minimum of around 1 326m and 1 321m, respectively. The general downward slope is from southwest to northeast.

The average height above sea level at Site 2 (Alternative) is approximately 1 343m, with a maximum and minimum of around 1 346m and 1 338m, respectively. The general downward slope is from north to south. The low point in the general area is the Orange River to the north of the site alternatives and the existing Maletswai Landfill Site.

3.3 Climate

The study site is situated within the medium rainfall zone of 401mm – 601mm per annum and in the Cold Interior Climatic Zone of South Africa. The site is within a summer rainfall region of South Africa, with mild to warm summers and cool to cold winters that are very dry. Frost during the winter months is common. The average annual rainfall in the area of Maletswai (Aliwal North) is typically between 400mm to 500mm. With most rainfall occurring in the months of December and January. The overall yearly mean for temperatures for the area is 15°C to 20°C. The warmest period is from December to February with daily

highs typically 28 - 30°C. The coolest period is the winter months of June to July, with mean temperatures around 7 - 8°C and overnight lows around 0 - 1°C.

3.4 Vegetation

3.4.1 General vegetation

The study site is within the Upper Karoo Bioregion of the Nama-Karoo Biome. The site is within the original extent of the veldtype commonly known as **Eastern Upper Karoo**.

Eastern Upper Karoo is characterised by flats and gently sloping plains (interspersed with hills and rocky areas of Upper Karoo Hardeveld in the west, Besemkaree Koppies Shrubland in the northeast and Tarkastad Montane Shrubland in the southeast), dominated by dwarf microphyllous shrubs, with 'white' grasses of the genera *Aristida* and *Eragrostis* (these become prominent especially in the early autumn months after good summer rains). The grass cover increases along a gradient from southwest to northeast (Mucina & Rutherford, 2010).

The study site is in an area where there are nearby hills covered with Besemkaree Koppies Shrubland. The area is also where the two biomes of Grassland and Nama-Karoo integrate.

Vegetation along the small, seasonal drainage lines and streams is often classified or group under Inland Azonal Vegetation and more specifically as Upper Gariep Alluvial Vegetation (Mucina & Rutherford, 2010).

Eastern Upper Karoo is not a threatened veldtype (ecosystem) with a status of 'Least Concern' (Revised National List of Threatened Ecosystems. 2022. DFFE).

Table 6, below, shows the hierarchy and classifications of the vegetation of the study area.

Table 6: Vegetation classification of the study site

Category Description	Classification
Biome	Nama-Karoo
Bioregion	Upper Karoo
Vegetation Types	Eastern Upper Karoo
Status	Least concern (Not threatened)

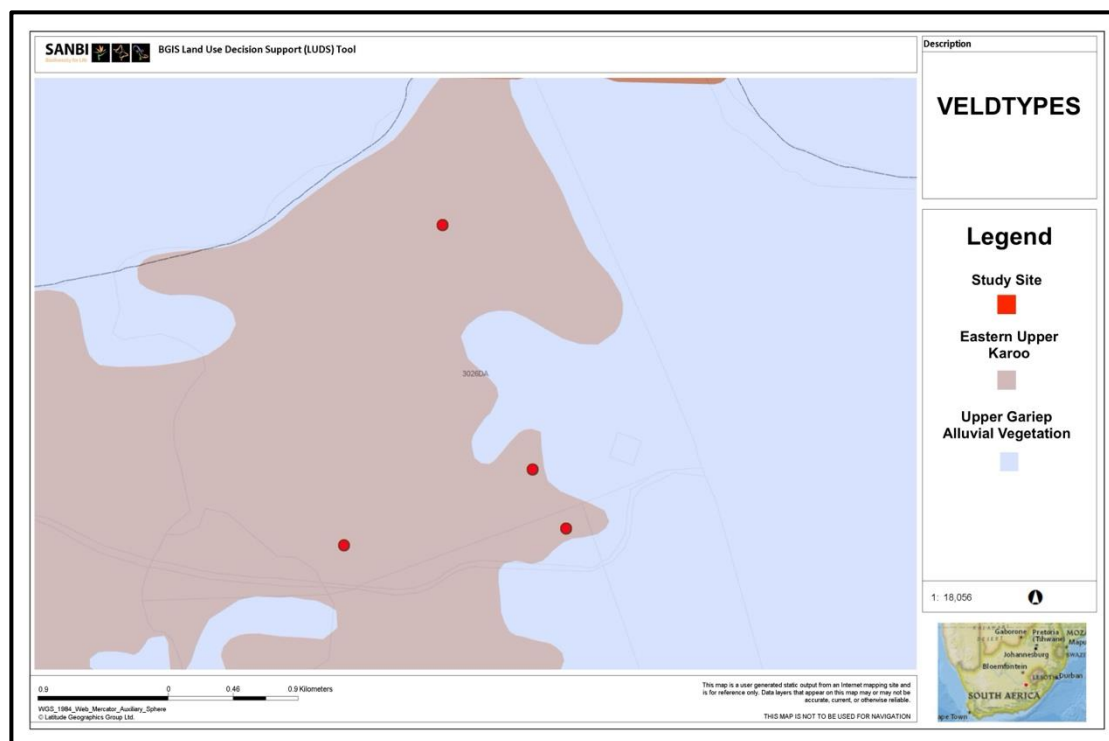


Figure 2: Original extent of veldtypes in which the study site is located

3.4.2 Vegetation of the study site

The vegetation at the sites of Option 1 and Option 2 are characteristic of Eastern Upper Karoo with low scattered karroid shrubs and poor grass cover. The veld is not pristine but moderately degraded, especially Option 2 which is fairly close to the existing landfill site and has being degraded by a 'spill over' of negative impacts from the landfill site and related activities.

The vegetation at the Preferred Site has been altered and badly degraded over the years. The area was previously ploughed resulting in alterations and loss of original karoo vegetation. The vegetation of the Preferred Site is badly degraded and altered and is not characteristic of original Eastern Upper Karoo shrubland.

There is no aquatic vegetation was observed on the study site.

The national screening tool assessment does not list or highlight any floral species of conservation concern (SCC) for the general area in which the study site (all three site alternatives) is situated. The screening tool assesses the Plant Theme Sensitivity for the area as 'low'. This was verified during site investigations and no floral SCC were observed and none are expected to be present.

3.5 Conservation status

The conservation status (or threat status) of the veldtype in which the study site is situated is shown in the table below (Table 7). The status is based on the Red List of Ecosystems (Skowno, 2019. SANBI) and the Revised List of Threatened Ecosystems (DFFE, 2020).

See appendices (Section 9.2) for a description of threat status categories.

Table 7: Veldtype status

Veldtype	Status	Info
Eastern Upper Karoo	Least Concern	Statutorily conserved in Mountain Zebra and Karoo National Parks as well as in Oviston, Commando Drift, Rolfontein and Gariep Dam Nature Reserves. About 2% of the unit has been transformed, largely due to building of dams (Gariep, Grassridge, Killowen, Kommandodrift, Kriegerspoort, Lake Arthur, Modderpoort, Schuil Hoek, Vanderkloof, Victoria West, Wonderboom and Zoetvlei). <i>Medicago laciniata</i> is a common and widespread alien plant. Erosion is moderate (60%) and high (38%). Veld managers perceive much of the Eastern Upper Karoo to be experiencing changes in species composition requiring high-priority action (Hoffman et al. 1999) (Mucina & Rutherford, 2010)

3.6 Watercourses in the study area

The main watercourses in the region are the perennial Orange River and semi-perennial Melkspruit. The Melkspruit flows north into the Orange River and varies from about 1,7km to 2,4km west of the study site. The Orange River varies in distance between 450m and 500m northwest of Site 1. The Orange River is the largest and longest river in South Africa (Figure 3).

The national wetland map (Map 5, 2018) (overlaid on Google Maps) does not highlight any wetlands in the vicinity of the three sites (Existing landfill site, Site 1 (Preferred new landfill site), Site 2 (Alternative site)) (Figure 4).

There are a few small and highly ephemeral streams and drainage lines in the vicinity of the alternative landfill sites. Those in the vicinity of Preferred Site flow directly into the Orange River, while those near Option 1 and Option 2 flow into the Melkspruit. There is a small out-of-stream impoundment (farm dam) at the Preferred Site. The small impoundment is not very functional and was created to trap (impound) surface rainwater run-off, probably to retain some water for grazing livestock. However, the water volumes are low and the impoundment is dry (that is, no visible surface water) for most of the year. The impoundment is not a natural watercourse.

Option 1 is situated on the north side of a small natural seasonal stream / drainage line, while there is a small natural drainage line that originates in Option 2.

An aquatic impact assessment report, with more detail was compiled for the project (see Maree JO, Feb. 2026),



Figure 3: Main watercourses in the region



Figure 4: National Wetland Map (Map 5, 2018)

3.7 Fauna

Field observations were limited to one day, which limits the observation and identification of fauna in the field.

The national screening tool assessment for the study area lists the potential presence of three faunal species of conservation concern (SCC). The regional statuses of the faunal SCC and their likelihood to be present on the study site are shown in the table below (Table 8).

Most of the listed faunal SCC, if present in the region, will be found more west of the study site, which is more open natural karroid shrubland and further away from the disturbances of the town, landfill site and other industrial activities.

There is a low possibility of only two faunal SCC been routinely present in the study area, namely marsh rat and spotted-necked otter.

Table 8: Faunal SCC potentially present in the area of the study site

Species	Common Name	Regional Status	Screening Tool Potential Presence	Likelihood to be present on the study site
<i>Hydricis maculicollis</i>	Spotted-necked otter	Vulnerable	Medium	No. Possibly found along the Orange River
<i>Hydroprogne caspia</i>	Caspian tern	Vulnerable	Medium	Yes, but more along the Orange River

<i>Sagittarius serpentarius</i>	Secretarybird	Vulnerable	High	Yes, but more likely in the open grassland and shrubland plains to the west of the study site
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3.7.1 Mammals

No mammal species were observed on the study site during field investigations, but a few are expected to occur, mostly rodents, which would include alien house mice and rats.

The national screening tool lists the 'medium' potential presence of one mammal SCC, namely, the spotted-necked otter. The otter will not be found on the study site, but along the Orange River to the north of the site and within existing riparian vegetation.

The national screening tool assessment does not flag or list the potential presence of any rodent SCC.

No other mammal SCC were observed in the study area.

The potential mammal assemblage in the general area, and in particular the less disturbed areas, is expected to comprise mainly of small- to medium-sized terrestrial mammals adapted to semi-arid Karoo shrubland and grassland, together with species associated with agricultural land and disturbed environments. The vegetation of the general area is characterised by open plains with low Karoo shrubs and an appreciable grass component, providing habitat for rodents, hares, mongooses, small carnivores and grazing/browsing species. Regional surveys in Eastern Upper Karoo have recorded a diverse mammal assemblage, while comparable Karoo areas support species such as aardvark, porcupine, bat-eared fox, mongoose, springbok and small antelope.

The Orange River and associated riparian vegetation are particularly important, because they provide habitat that differs substantially from the surrounding dry Karoo. Species associated with riverine / riparian vegetation, water and alluvial soils may therefore occur in the broader study area even where they would be unlikely to occur within the landfill footprint itself. Of particular importance is the Riverine Rabbit (*Bunolagus monticularis*), a Critically Endangered species associated with suitable riverine vegetation on alluvial soils in parts of the Karoo. However, the rabbit is not found in the area of the study site but much further west in the Karoo of the Northern Cape. Given that the proposed landfill is in close proximity to the existing landfill, the immediate footprint is likely to favour disturbance-tolerant mammals, including rodents, mongooses, hares and other generalist species, rather than specialist or shy larger mammals.

A list of potential mammals occurring in the region can be found in the appendices.

3.7.2 Avifauna

The study site is not within an Important Bird Area (IBA). No avifaunal SCC were observed during the site visit. However, the Caspian tern and Secretarybird, both which are SCC, have been recorded in the general area. Numerous common birds were observed along the Orange River area.

The screening tool assessment lists the 'high' potential presence of Secretarybird and the 'medium' potential presence of Caspian tern in the area. This is confirmed (verified) with the background data reviewed.

3.7.3 Reptiles

The study area is not within a lizard hotspot, but is within a snake hotspot. Lizards tend to prefer rocky habitats and the study site is on a rocky mountain slope and a number of common lizards are present. However, it is unlikely that any of the lizard and snake SCC for the province will be found on the study site. Reptiles will be found east of the study site along the rocky plateau and mountains near Aliwal North.

The national screening tool does not list or flag the potential presence of any reptile SCC for the study area.

3.7.4 Amphibians

A number of common frog species will be found in the Orange River to the north of the study site. The Orange River and associated tributaries in the Aliwal North area provide suitable habitat for a number of common and widespread amphibian species associated with the eastern Karoo ecosystems. Amphibian diversity within the region is influenced by the presence of perennial water sources, temporary inundated depressions, and semi-arid terrestrial habitats adjacent to the river corridor. Species expected to occur are primarily widespread habitat generalists and river-associated taxa typical of the upper Orange River catchment.

Riverine habitats and permanent freshwater systems are likely to support species such as the Cape River Frog (*Amietia fuscigula*) and Common River Frog (*Amietia delalandii*), both of which are commonly associated with rivers, streams, dams, and well-vegetated freshwater habitats. Semi-arid terrestrial and seasonal wetland habitats in the broader landscape may support species including the Karoo Toad (*Vandijkophrynus garipeensis*), Senegal Running Frog (*Kassina senegalensis*), and Weale's Running Frog (*Semnodactylus wealii*). More generalist species such as the Guttural Toad (*Sclerophrys gutturalis*) and Common Platanna (*Xenopus laevis*) are also likely to occur in suitable aquatic and riparian habitats in the general area (du Preez, L. & Carruthers, 2017; SA Frog Atlas Project, Frog Map).

3.7.5 Invertebrates

Invertebrates such as spiders, scorpions and butterflies are important faunal groups, but are difficult to fully assess in a short period. During field investigations specific attention was given to priority species such as Mygalomorphae arachnids (Trapdoor and Baboon spiders) and red data butterflies.

The national screening tool flags does not list or flag / list any insect SCC or other invertebrate SCC potentially occurring in the study area.

The study site is within degraded Eastern Upper Karoo veld / vegetation and the insect fauna expected within the veldtype (in good condition) is consequently likely to be dominated by grassland insects and shrubland-associated insects, particularly grasshoppers, beetles, ants, termites, butterflies, moths, bees and other pollinating insects. The Karoo BioGaps Project (SANBI, 2020. <https://www.sanbi.org/karoo-biogaps-project>) demonstrate that the Eastern Upper Karoo supports a diverse terrestrial fauna, and insect groups are particularly responsive to the availability of flowering plants, shrubs, grasses, bare soil and seasonal rainfall. Given the location of the proposed landfill adjacent to an existing disturbed landfill and relatively close to the Orange River, the assessment should also recognise disturbance-tolerant and landfill-associated insects, including flies, beetles and cockroaches, as well as aquatic and semi-aquatic insects associated with the riverine environment. The table below therefore represents potential insect taxa expected in the broader study area, rather than confirmed species records from the development footprint.

A list of potential insects found in the region is in the appendices.

4 SITE SENSITIVITY ASSESSMENT

4.1 National Screening Tool Assessment

4.1.1 Screening Tool Assessment

The Department of Forestry, Fisheries and Environment (DFFE) has developed a desktop screening tool that is to be used as a guideline in an initial desktop assessment of a project site (www.screening.environment.gov.za). The screening tool is a guideline tool that needs to be verified during site investigations (ground truthing).

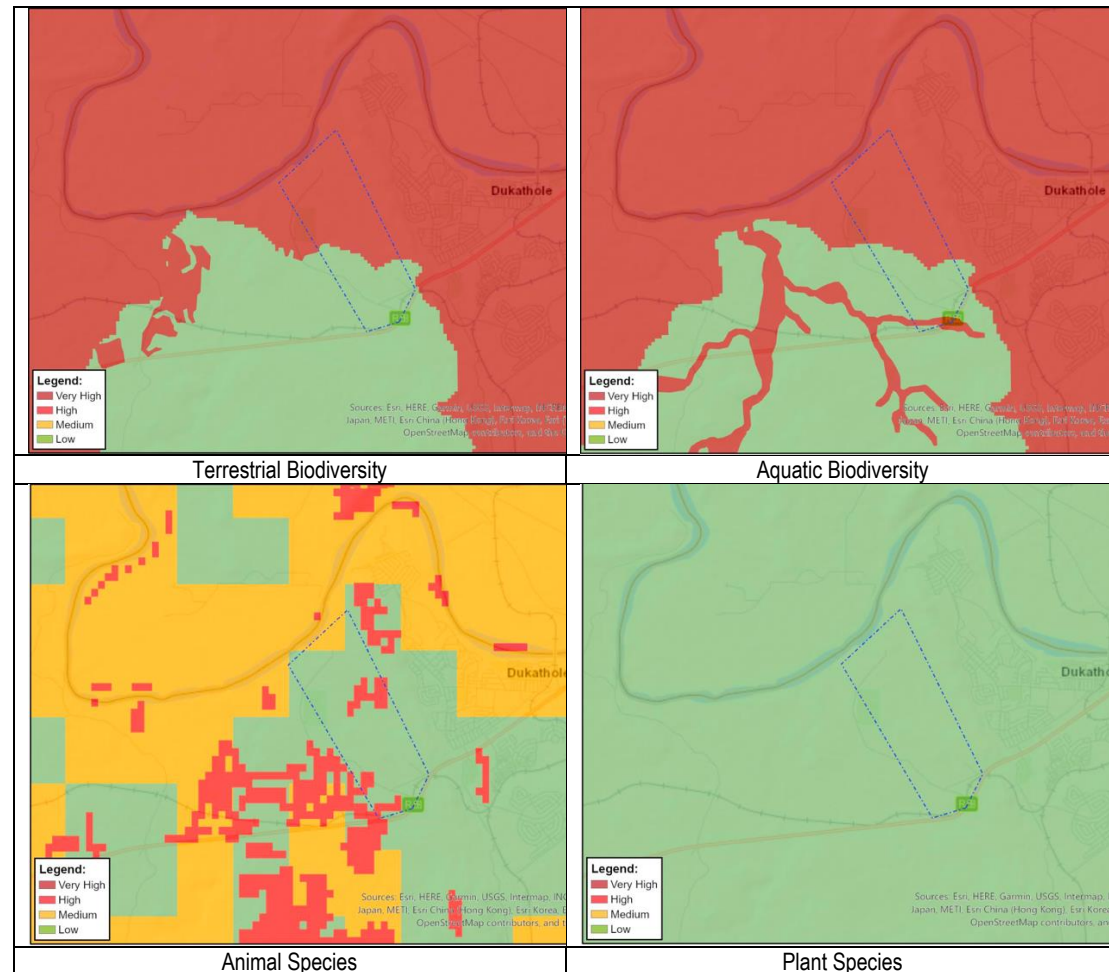
According to the national screening tool assessment the various natural environment sensitivities for the study site and surroundings are as follows:

Theme	Sensitivity
Terrestrial biodiversity	Very High & Low
Aquatic biodiversity	Very High & Low
Animal species	High & Low

Plant species	Low
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Table 9, below shows the maps generated by the screening tool assessment.

Table 9: Screening Tool Assessment Maps



4.1.2 Site Sensitivity Verification of Desktop Assessment

The screening tool and the gazetted protocols (GN R320 of 20 March 2020 and GN R 1150 of 30 October 2020) require a site sensitivity verification to be completed to either confirm or dispute the findings and sensitivity ratings of the screening tool. During site investigations the screening tool assessments were ground truthed and found to be as follows:

Theme	Sensitivity
Terrestrial biodiversity	Low
Aquatic biodiversity	Very High & Low
Animal species	Medium & Low
Plant species	Low

Terrestrial Biodiversity

The reasons given by the screening tool for the 'very high' sensitivity areas are due to the presence of demarcated FEPA sub-catchment and ecological support area (ESA 2).

Aquatic Biodiversity

The Preferred Site is within a 'very high' area, while Options 1 & 2 are within a 'low' sensitivity area. The drainage line systems in the area of site Options 1 & 2 are delineated 'very high'. The 'very high' areas are because it is within an ESA and FEPA sub-catchment.

Plant Sensitivity

The plant sensitivities were confirmed (verified) during site investigations to be as per the screening tool assessment. No floral SCC were observed in the study area.

Animal Sensitivity

The sensitivities in the screening tool were confirmed (verified). The 'high' areas are suitable habitat for foraging for Secretarybirds.

Table 10: Comparison between Screening Tool and Site Assessments

Theme	Screening Tool Sensitivity	Site Investigations Sensitivity	Findings
Terrestrial biodiversity	Very High & Low	Very High & Low	Verified (Confirmed)
Aquatic biodiversity	Very High & Low	Very High & Low	Verified (Confirmed)
Animal species	High & Low	High & Low	Verified (Confirmed)
Plant species	Low	Low	Verified (Confirmed)

4.2 National Priority Areas

The study site (Preferred site, Option 1 and Option 2) is not within any priority areas.

The preferred site is approximately 4,8km (within the 5km) radius of the Buffelspruit Nature Reserve. The nature reserve will not be impacted on at all by the new landfill site as it is east of Aliwal North. The town is therefore inbetween the study site and the nature reserve (Figure 5).

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



Figure 5: Location of Buffelspruit Nature Reserve in relation to the study area

4.3 Critical Biodiversity Areas & Ecological Support Areas

According to the Eastern Cape Province Biodiversity Conservation Plan (2019) the study area is not within any terrestrial and aquatic critical biodiversity areas (CBAs). The study site is within terrestrial ecological support areas (ESA 1 & 2). The Preferred site is not within any aquatic ESAs, but Options 1 & 2 do infringe on the edges or demarcated aquatic ESAs (ESA 1) (Figure 6, Figure 7).

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

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

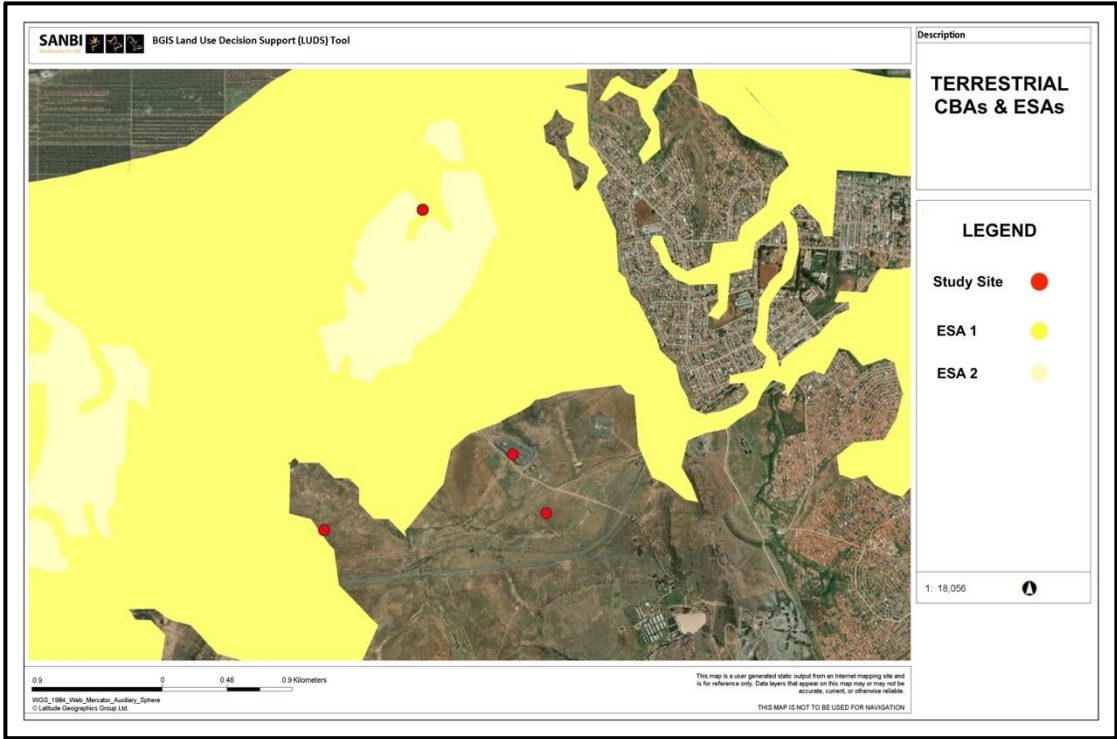


Figure 6: Terrestrial CBAs and ESAs

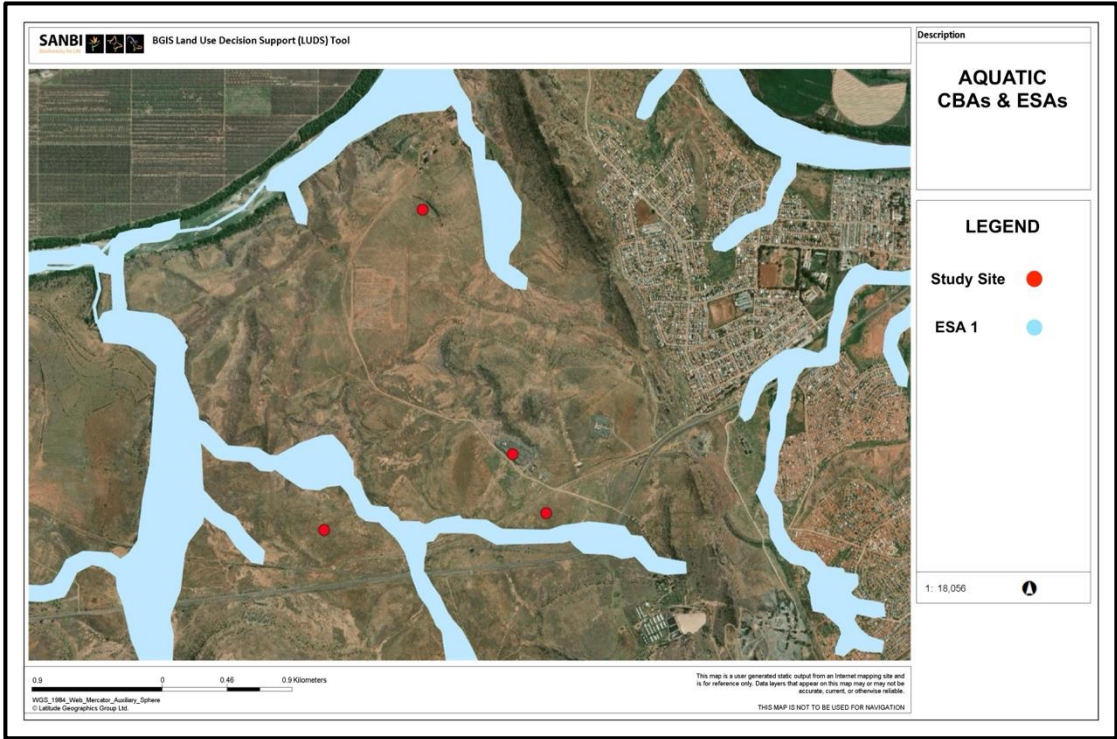


Figure 7: Aquatic CBAs and ESAs

5 SENSITIVITY MAPPING OF THE STUDY AREA

5.1 Habitats Present on the Study Site

The following distinctive habitats are found within the extent of the study site and surrounding areas:

- Altered environment
- Karoo shrubland
- Watercourses

The Preferred site is within an altered environment, where the area was previously cleared and ploughed. Thereby altering and badly degrading the original Karoo shrubland. Option 1 and Option 2 are within Karoo shrubland that is moderately degraded. There are also a few small streams (watercourses) present in the area, especially near Options 1 & 2.

The Orange River is not within the study area and therefore not mentioned, although it is a major watercourse in the region.

5.2 Site Ecological Importance

The site ecological importance (SEI) was determined using the methodology described above (see Section 2.3). Each distinctive habitat / ecosystem mentioned above was assessed separately in terms of the project footprint in or across that habitat (Table 11).

Table 12 and Table 13 are the matrices used and shown in the Methodology. Here they are shown with the habitats inserted.

Table 11: Site Ecological Importance

Aspect	Habitat / Ecosystem	Result
Conservation Importance	Altered Environment	Low
	Karoo Shrubland	Low
	Watercourses	High
Functional Integrity	Altered Environment	Low
	Karoo Shrubland	Medium
	Watercourses	Medium
Receptor Resilience	Altered Environment	Medium
	Karoo Shrubland	Medium
	Watercourses	Low
Biodiversity Importance	Altered Environment	Low
	Karoo Shrubland	Low
	Watercourses	Medium
Site Ecological Importance	Altered Environment	Low
	Karoo Shrubland	Low
	Watercourses	High

Table 12: Biodiversity Importance Matrix with Habitats inserted

Biodiversity Importance (BI)		Conservation Importance (CI)				
		Very High	High	Medium	Low	Very Low
Functional Integrity (FI)	Very High	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium (WC)	Medium	Low (KS)	Very Low
	Low	Medium	Medium	Low	Low (AE)	Very Low
	Very Low	Medium	Low	Very Low	Very Low	Very Low

AE = Altered environment; KS = Karoo shrubland; WC = Watercourses

Table 13: Site Ecological Importance Matrix with Habitats inserted

Site Ecological Importance (SEI)		Biodiversity Importance (BI)				
		Very High	High	Medium	Low	Very Low
Receptor Resilience (RR)	Very Low	Very High	Very High	High	Medium	Low
	Low	Very High	Very High	High (WC)	Medium	Very Low
	Medium	Very High	High	Medium	Low (AE) (KS)	Very Low
	High	High	Medium	Low	Very Low	Very Low
	Very High	Medium	Low	Very Low	Very Low	Very Low

AE = Altered environment; KS = Karoo shrubland; WC = Watercourses

Table 14, below, shows the recommended approach to the different habitats on site, depending on the level of sensitivity as determined in the SEI.

Table 14: Recommended approach to Habitats depending on Sensitivity Rating (Category)

Habitats	Category	Criteria
	Very High	Avoidance mitigation, no destructive development activities should be considered. Offset mitigation not acceptable / not possible. (i.e. last remaining populations of species, last remaining good condition patches of ecosystems / unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
Watercourses	High	Avoidance mitigation wherever possible. Minimisation mitigation changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
	Medium	Minimisation and restoration mitigation development activities of medium impact acceptable followed by appropriate restoration activities.
Altered Environment	Low	Minimisation and restoration mitigation development activities of medium to high impact acceptable followed by appropriate restoration activities.

& Karoo Shrubland		
	Very Low	Minimisation mitigation development activities of medium to high impact acceptable and restoration activities may not be required.

5.3 Sensitivity mapping of the study area

All relevant datasets, DFFE screening desktop assessment, SEI and field investigations were taken into account in determining the sensitivity mapping of the study site. The demarcated CBAs and ESAs are taken into consideration and given weight. However, the sensitivities of the habitats in the study site are primarily based on the actual state and levels of function found during site investigations. Some habitats, such as watercourses are, by default, considered sensitive, despite their present ecological state.

The SEI assessment forms the basis for the sensitivity mapping. The categories for the sensitivity map are kept to High, Medium and Low. They correspond to the SEI sensitivity categories as shown below in Table 15.

Table 15: Comparison between SEI and Mapping Sensitivities

SEI Sensitivity Categories	Mapping Sensitivity Categories
Very High	'Fatal Flaw' or 'No-Go' Zone
High	High
Medium	Medium
Low	Low
Very Low	

The biodiversity sensitivities are shown in the maps below (Figure 8, Figure 9, Figure 10).

The 'high sensitive' areas / habitats are the watercourses, which are small seasonal streams and drainage lines. The large perennial Orange River, which is outside of the study area, has a sensitivity of 'very high'. The 'low' sensitivity areas are the altered environments and Karoo shrubland. Therefore, the only 'high' sensitive areas and habitats are the watercourses.

The large 'high sensitivity' areas shown in Figure 8 and Figure 10 include areas that have high levels of erosion and gully formation near and along the watercourses and low-lying areas and therefore best avoided entirely.

The potential sites basically have a 'low' aquatic sensitivity. However, Option 1 is situated directly on the edge of natural watercourses and therefore potentially has a bigger negative impact on the aquatic environment. Option 2 is similar to Option 1, with a drainage line within the demarcated site area.

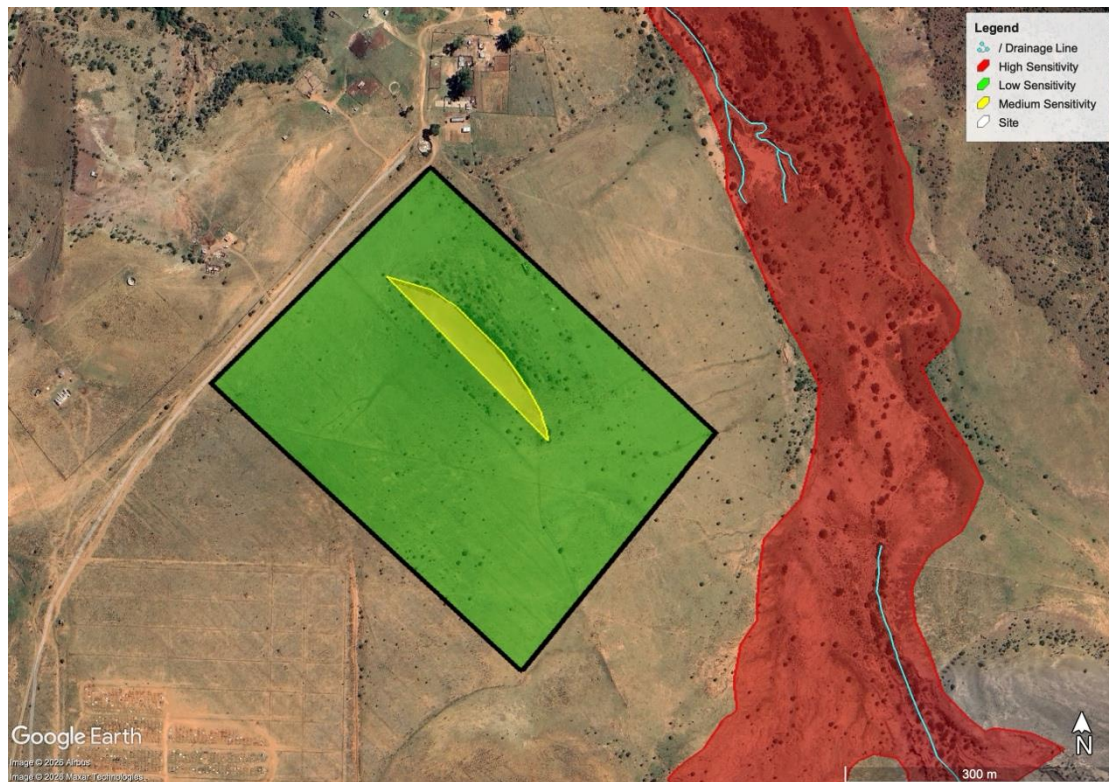


Figure 8: Sensitivity Map: Preferred Site



Figure 9: Sensitivity Map: Option 1

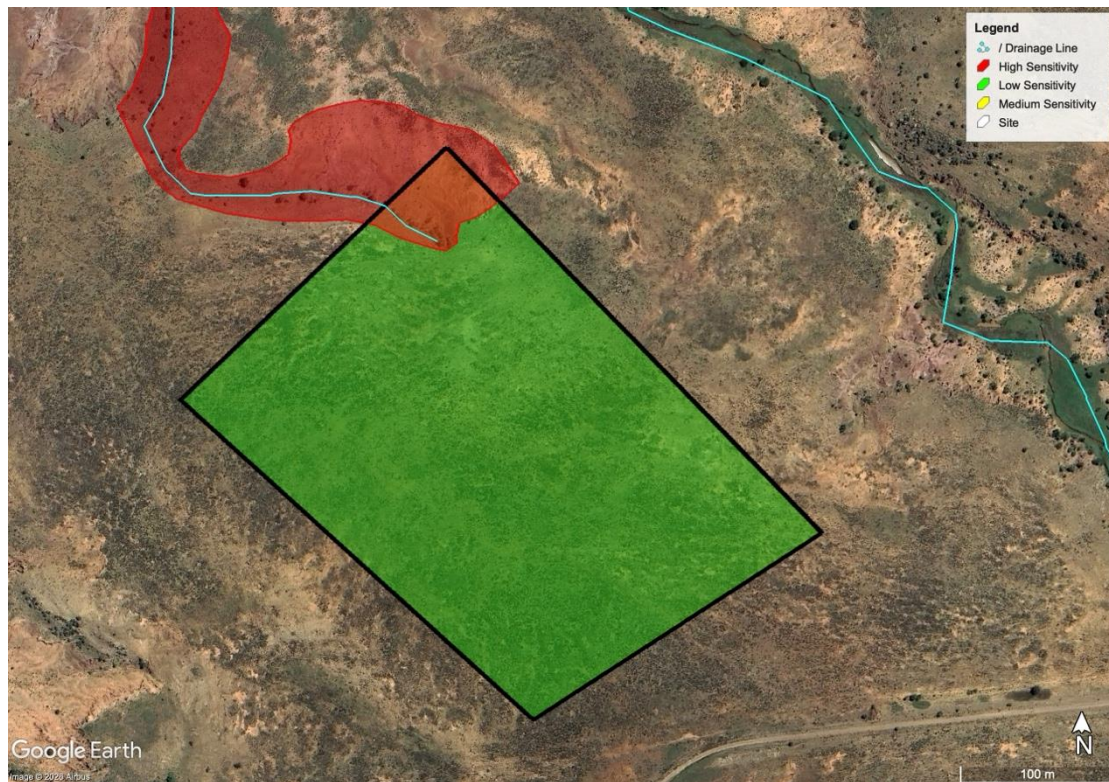


Figure 10: Sensitivity Map: Option 2

5.4 Proposed Buffer Zones & Regulated Zones

Buffer zones around all natural watercourses of 32m wide from the bank edges are recommended.

Buffer zones include 'high sensitivity' aquatic areas as determined and shown above in the sensitivity maps for the three potential site alternatives.

The buffer zone around a natural drainage line is within the site area at Option 2 and the site is therefore also not recommended as a viable option. The buffer zone also includes an area of high erosion potential. (See the appendices for the differences between a buffer zone and a regulated zone).

There are no sensitive terrestrial habitats or areas and therefore no terrestrial biodiversity related buffer zones or regulated zones are required or recommended for the proposed project.

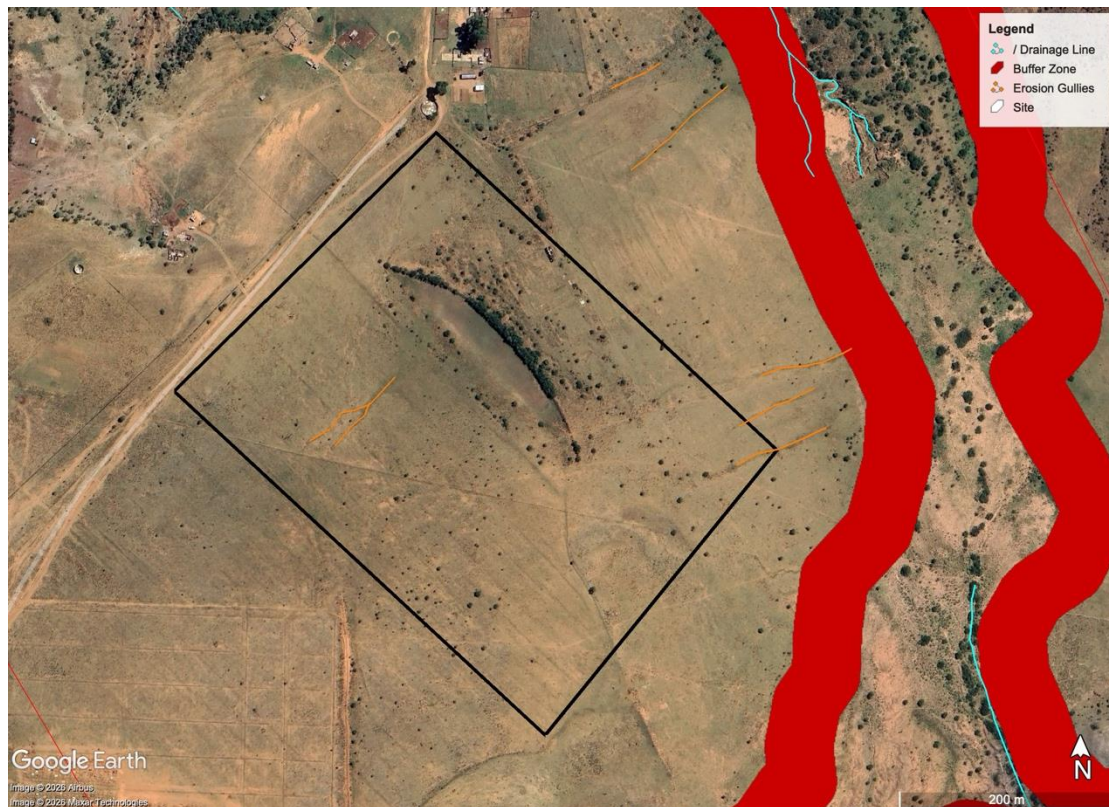


Figure 11: Buffer Zones in the vicinity of Site 1

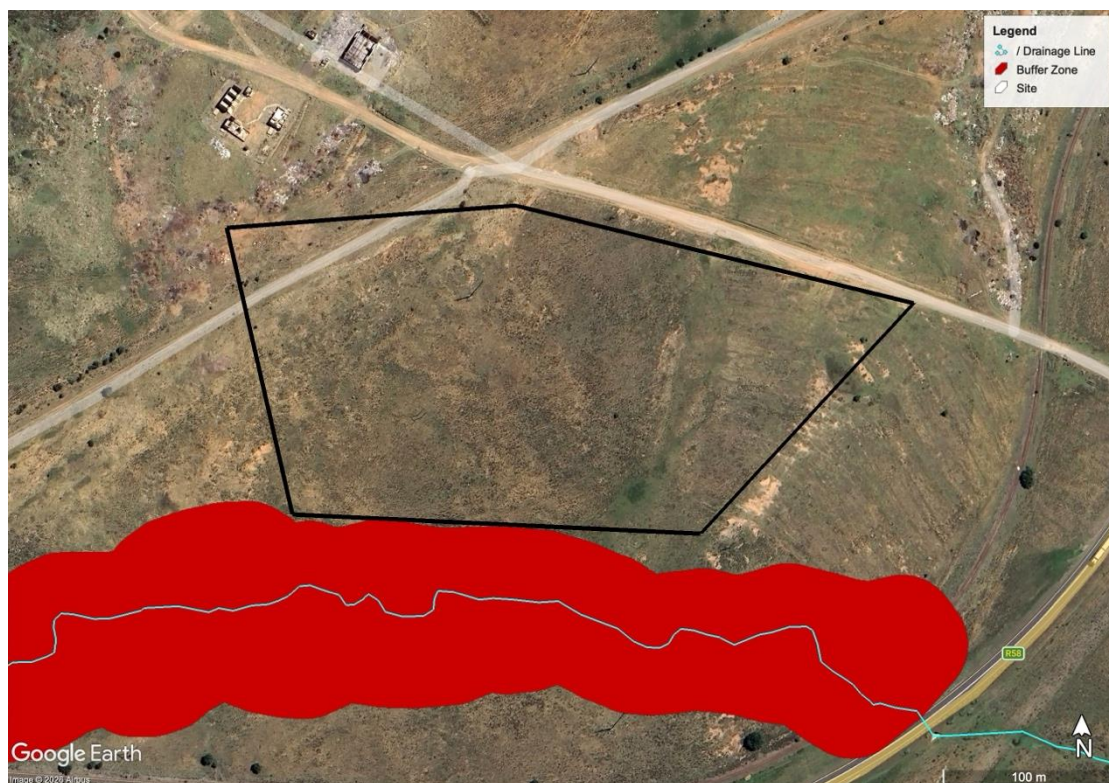


Figure 12: Buffer Zones in the vicinity of Option 1

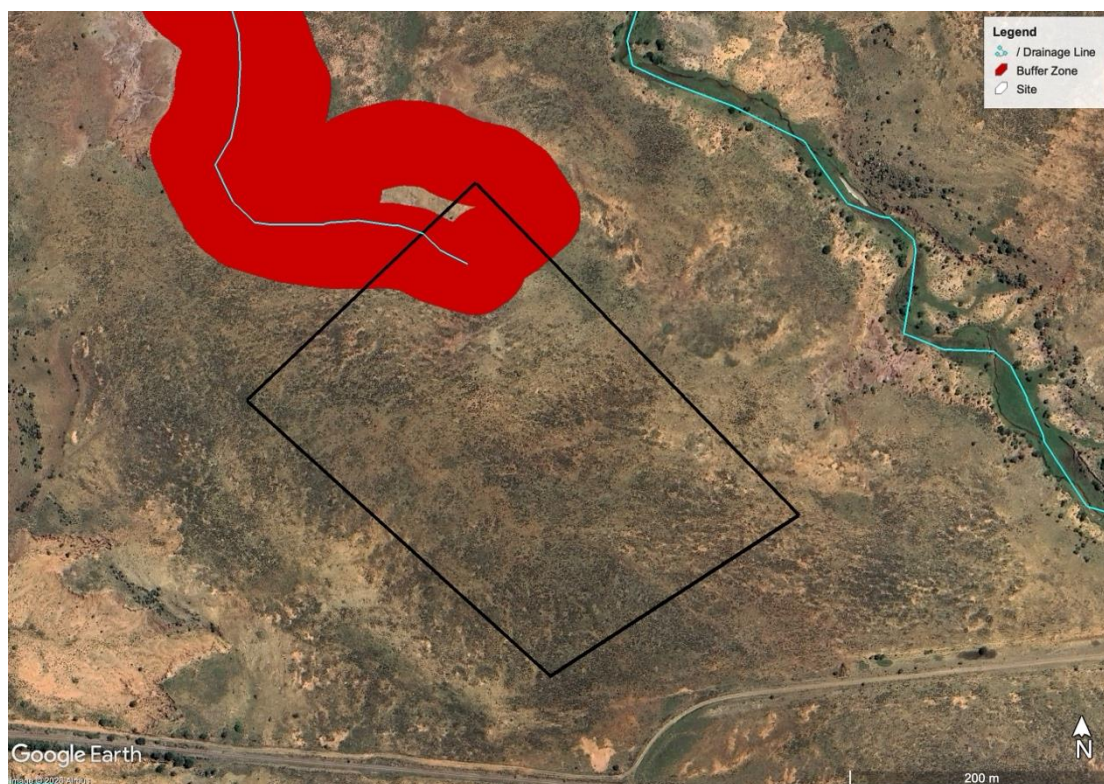


Figure 13: Buffer Zones in the vicinity of Option 2

6 IMPACT ASSESSMENT

6.1 Existing Impacts

There are existing impacts on the aquatic environment in the general area and study site. These negative impacts include formation of erosion gullies and resulting siltation of watercourses.

6.2 Potential Impacts

Potential negative impacts include the pollution of surface stormwater run-off that then lands up in watercourses, as well as pollution of underground water.

There are no positive impacts arising from the proposed project on the immediate environment. However, the opening and proper management of a necessary landfill site will help to reduce negative impacts on other environments by impacts such as random dumping due to lack of proper facilities. In this sense, the project will have positive impacts.

6.3 Cumulative Effect

The Cumulative Effect can be defined as the total of negative impacts on the natural environment that are caused by the sum of all effects of past, current and future activities. The proposed project will lead to an increase in the cumulative impact (sum of negative impacts) on the aquatic environment.

6.4 Assessment of Potential Impacts

The assessment of the potential impacts on the project site and surroundings is shown in Table 17.

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

$$\text{Significance (SP)} = [\text{Extent (E)} + \text{Duration (D)} + \text{Magnitude (M)}] \times \text{Probability (P)}$$

The maximum value is 100 significance points (SP). Environmental impacts will be rated as shown in Table 16 below.

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

Note: The Impact Assessment only relates to the Aquatic Environment.

Table 16: Significance Scoring

Score	Significance Points (SP)	Description
<10	Negligible	The impact is non-measurable to zero / absent.
10 – 20	Low	Where the impact would not have a direct influence on the decision to develop in the area.
20 – 50	Medium	Where the impact could influence the decision to develop in the area unless it is effectively mitigated.
50 – 70	High	Where the impact must have an influence on the decision process to develop in the area.
>70	Very High	Where the impact may constitute a fatal flaw for the project.

Table 17: Impact Assessment of Potential Impacts

Potential Impacts arising from Project	Phase of Project	Impact Rating (Negligible: <10; Low: 10-20; Medium: 20-50; High: 50-70; Very High: >70)					
		Extent	Duration	Magnitude	Probability	Total	Significance
	Establishment Phase: Pre-mitigation	Local (2)	Long-term (4)	Moderate (6)	Medium (3)	36	Medium
	Establishment Phase: Post mitigation	Site (1)	Long-term (4)	Low (4)	Medium (3)	27	Medium
	Operational Phase	Site (1)	Short-term (2)	Low (4)	Low (2)	14	Low
Cumulative Effect of Project on Study Site	After construction and during operational phase	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	Low
	Closure	Can only be meaningfully assessed closer to the event, which might only be in 30 years. Part of the pre-closure process will require site investigations, biodiversity studies and detailed, site-specific rehabilitation plans					
Individual Impacts (Negligible: <10; Low: 10-20; Medium: 20-50; High: 50-70; Very High: >70)							
		Extent	Duration	Magnitude	Probability	Total	Significance

1. Loss of vegetation	Establishment Phase: Pre-mitigation	Local (2)	Long-term (4)	Moderate (6)	Medium (3)	36	Medium
	Establishment Phase: Post mitigation	Site (1)	Long-term (4)	Low (4)	Medium (3)	27	Medium
	Operational Phase	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	Low
	Closure	Can only be meaningfully assessed closer to the event, which might only be in 30 years. Part of the pre-closure process will require site investigations, biodiversity studies and detailed, site-specific rehabilitation plans					
2. Loss of general faunal habitat	Establishment Phase: Pre-mitigation	Local (2)	Long-term (4)	Moderate (6)	Medium (3)	36	Medium
	Establishment Phase: Post mitigation	Site (1)	Long-term (4)	Low (4)	Medium (3)	27	Medium
	Operational Phase	Site (1)	Short-term (2)	Low (4)	Low (2)	14	Low
	Closure	Can only be meaningfully assessed closer to the event, which might only be in 30 years. Part of the pre-closure process will require site investigations, biodiversity studies and detailed, site-specific rehabilitation plans					
3. Impact on invertebrate / insects	Establishment Phase: Pre-mitigation	Local (2)	Long-term (4)	Moderate (6)	Medium (3)	36	Medium
	Establishment Phase: Post mitigation	Site (1)	Long-term (4)	Low (4)	Medium (3)	27	Medium
	Operational Phase	Site (1)	Short-term (2)	Low (4)	Low (2)	14	Low
	Closure	Can only be meaningfully assessed closer to the event, which might only be in 30 years. Part of the pre-closure process will require site investigations, biodiversity studies and detailed, site-specific rehabilitation plans					
4. Impeding & Impounding waterflow	Establishment Phase: Pre-mitigation	Site (1)	Long-term (4)	Low (4)	Medium (3)	27	Medium
	Establishment Phase: Post mitigation	Site (1)	Short-term (2)	Low (4)	Low (2)	14	Low
	Operational Phase	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	Low
5. Altering the flow of a watercourse	Establishment Phase: Pre-mitigation	Site (1)	Short-term (2)	Moderate (6)	Low (2)	18	Low
	Establishment Phase: Post mitigation	Site (1)	Short-term (2)	Low (4)	Low (2)	14	Low
	Operational Phase	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	Negligible
6. Changing the characteristics of a watercourse	Establishment Phase: Pre-mitigation	Site (1)	Short-term (2)	Moderate (6)	Low (2)	18	Low

	Establishment Phase: Post mitigation	Site (1)	Short-term (2)	Low (4)	Low (2)	14	Low
	Operational Phase	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	Low
7. Siltation and erosion	Establishment Phase: Pre-mitigation	Local (2)	Long-term (4)	Moderate (6)	Medium (3)	36	Medium
	Establishment Phase: Post mitigation	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	Low
	Operational Phase	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	Low
8. Fringe Impacts	Establishment Phase: Pre-mitigation	Local (2)	Long-term (4)	Moderate (6)	Medium (3)	36	Medium
	Establishment Phase: Post mitigation	Site (1)	Short-term (2)	Low (4)	Low (2)	14	Low
	Operational Phase	Site (1)	Short-term (2)	Low (4)	Low (2)	14	Low

6.5 Mitigating Measures

The following are mitigating measures that must form part of the conditions of the EMP, WULA / GA and any other management reports or licenses. The mitigating measures relate directly to the impact assessment above and the individual potential impacts. The implementation of the mitigating measures is necessary to reduce the significance of potential impacts as shown above in the impact assessment.

- The landfill must be managed in such a manner that no waste, contaminated runoff, leachate, sediment, hydrocarbons or other pollutants are permitted to enter the nearby Orange River or the associated drainage system, either directly or indirectly. Emphasis should be placed on surface stormwater run-off and separation, landfill cover, erosion control, litter containment, progressive rehabilitation and appropriate surface- and groundwater monitoring.
- An alien invasive weed control programme / plan should be compiled and implemented as part of the routine maintenance of the site. The use of chemical methods should be minimised.

Because the site is fairly near to the Orange River, the following mitigating measures are of particularly importance:

- Maintain a substantial protective separation between the waste disposal footprint and the Orange River and associated drainage features.

- Ensure that clean stormwater is diverted around the landfill and that contaminated runoff cannot discharge towards the Orange River. Settling ponds / maturation ponds are required into which all polluted stormwater and leachate should be diverted and prevented from leaving the site.
- Implement appropriate landfill containment/leachate management and progressively cover exposed waste. The National Norms and Standards for Disposal of Waste to Landfill provide requirements relating to containment barriers, drainage layers and landfill design.
- Establish a surface-water and groundwater monitoring programme, with sampling locations selected to detect any potential migration of landfill-related pollutants towards the Orange River.
- Maintain the natural/vegetated area between the landfill and the river as far as practicable, avoiding unnecessary clearing and using it as an additional attenuation zone for sediment and runoff.

Other mitigating measures are as follows:

- No vegetation within any watercourses may be removed or cleared for any project activities.
- No general terrestrial vegetation, including grasses, may be unnecessarily cleared as this can lead to an increase in erosion potential and resulting siltation of watercourses.
- All access roads must be maintained.
- Dust suppression must be used, especially during dry periods.
- The site must be adequately fenced with diamond mesh or similar block fencing to prevent movement of free-roaming wild animals onto the site.
- In terms of fencing, a multi-layered approach combining heavy-duty perimeter security with high-tensile windblown litter catch nets should be installed. This is important to prevent the spread of wind-blown litter off the site and into the adjacent open areas, including the nearby Orange River.
- No natural watercourses, including drainage lines may be impeded or impounded for the establishment of the landfill site. This includes access roads.
- Under no circumstances may project activities impact on natural watercourses.
- No project-related activities, including temporary sites during establishment be within delineated watercourses or within any delineated buffer zones. This includes access roads into the landfill site.
- A monitoring programme is required for the weekly monitoring of nearby watercourses as well as of any water seepage from out of the landfill site. The weekly monitoring to be done by local officials working at the landfill site. Monthly or bi-monthly monitoring by an independent specialist should also be implemented. This should include water samples that are sent to a registered lab for analysis.

- A surface stormwater management plan is required. This needs to include detail on preventing the flow of clean stormwater onto the landfill site, as well as the seepage and flow of polluted water from out of the landfill site.
- Polluted surface stormwater on the site must be managed and contained as not to allow it to flow off the site to pollute any nearby watercourses.
- The groundwater in the immediate area must also be protected from seepage of polluted and contaminated water arising on the landfill site.
- All planning, design, construction, operation, maintenance and eventual closure of the landfill facility must comply with applicable South African legislation, national norms and standards, accepted industry standards and good engineering practice, including the requirements applicable to landfill classification, containment, waste acceptance, operational controls and rehabilitation. The National Norms and Standards for Disposal of Waste to Landfill, promulgated under the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), specifically prescribe requirements for landfill disposal and minimum engineering design requirements.

7 SUBSTANTIATED STATEMENT

Below is a substantiated statement, based on the findings of the specialist assessment, study and report, regarding the acceptability, or not, of the proposed development, if it should receive approval or not and any conditions to which this statement is subjected.

The screening tool assessment showed that the Plant Theme sensitivity was 'low'. This was verified (confirmed) during field investigations. No floral or faunal SCC were observed. However, in terms of fauna, Secretarybirds have been recorded in the general area of the study site.

There are no watercourses directly within either of the three alternative landfill sites investigated. There is a small impoundment within the area of the Preferred Site. Option 1 is located on the edge of a natural small stream / drainage line, while Option 2 has a small natural drainage line within it. Option 1 & 2 have the potential to have larger negative impacts on the natural water environment.

The main watercourses in the region are the perennial Orange River and semi-perennial Melkspruit. The Melkspruit flows north into the Orange River and varies from about 1,7km to 2,4km west of the study site. The Orange River varies in distance between 450m and 500m northwest of the Preferred Site. The landfill site will have no direct impact on any of these two watercourses.

There are a few small and highly ephemeral streams and drainage lines in the vicinity of the new landfill site alternatives. Those in the vicinity of the Preferred Site flow directly into the Orange River, while those near Option 1 and Option 2 flow into the Melkspruit. There is a small out-of-stream impoundment at the Preferred Site. The small impoundment is not very functional and was created to trap (impound) surface rainwater run-off, probably to retain some water for grazing livestock. However, the water volumes are

low and the impoundment is dry (that is, no visible surface water) for most of the year. The impoundment is not a natural watercourse. There are occasions when a dam becomes part of the natural aquatic environment, but these are mostly in-stream dams that form an integral part of the linear river / stream and are important in terms of upstream and downstream connectivity. Out-of-stream dams do not serve this same important aquatic function. However, there are out-of-stream dams that have become part of the aquatic environment and support wildlife such as waterbirds, but these are typically large dams that have permanent open bodies of water and not small, shallow and insignificant impoundments that dry out quickly, such as the one at the Preferred Site. These large dams act very much like large natural pans or lakes.

The natural environments in the area of Options 1 & 2 are in a much better condition than that of the Preferred Site, which for many years was cultivated fields and is therefore transformed.

Therefore, the Preferred Site is the preferred alternative for the new landfill site, which is required, because the existing old site is at capacity and is in the process of closure.

As mentioned, there is a small out-of-stream impoundment in the area investigated at the Preferred Site, but this feature is far less sensitive than the natural watercourses found adjacent to and within Options 1 & 2. Nevertheless, buffer zones have been delineated that should be strictly implemented. This along with stormwater management plans should ensure that the landfill site will have little to very low negative impacts on the water environment in the area, especially that of natural watercourses.

Site 1 (Preferred Site) is therefore the recommended preferred site alternative for the new Maletswai Landfill Site.

The areas investigated within the three landfill site alternatives are larger than required. This was done in order to give some flexibility in the final placement of the landfill site. Therefore, recommended buffer areas must be implemented and the site should be established as far back away from the impoundment as possible. The site should be properly fenced from the onset. A detailed stormwater plan is also required that must include detail of construction and management. With proper construction and management impacts on the surrounding aquatic systems / water environment will be limited. In reality, the impact on the aquatic environment is low with the implementation of necessary mitigating measures, which not only includes those listed in the report, but also those required by other relevant legislation controlling the establishment and operation of landfill sites. This will include protecting groundwater and controlling of polluted and contaminated onsite surface water.

If properly established and well managed, the landfill site will have little negative impact on the water environment.

8 CONCLUSIONS

The conclusions and recommendations arising from the study are as follows:

Conclusions

- Three alternative sites were investigated for the establishment of a new but necessary landfill site of Maletswai (Aliwal North).
- All three sites (Preferred site, Option 1 and Option 2) are within the veldtype (ecosystem) known as Eastern Upper Karoo. The veldtype is not a threatened veldtype and has a status of 'least concern'.
- The main watercourses in the region are the perennial Orange River and semi-perennial Melkspruit. The Melkspruit flows north into the Orange River and varies from about 1,7km to 2,4km west of the general study site. The Orange River varies in distance between 450m and 500m northwest of the Preferred Site.
- There are a few small and highly ephemeral streams and drainage lines in the vicinity of the site alternatives. Those in the vicinity of the Preferred Site flow directly into the Orange River, while those near Options 1 & 2 flow into the Melkspruit. There are no wetlands in the or near to the three site alternatives.
- There is a small out-of-stream impoundment at the Preferred Site. The impoundment is not a natural watercourse.
- The screening tool assessment sensitivities were assessed during the site investigations with the results as follows:

Theme	Screening Tool Sensitivity	Site Investigations Sensitivity	Findings
Terrestrial biodiversity	Very High & Low	Very High & Low	Verified (Confirmed)
Aquatic biodiversity	Very High & Low	Very High & Low	Verified (Confirmed)
Animal species	High & Low	High & Low	Verified (Confirmed)
Plant species	Low	Low	Verified (Confirmed)

- As part of the study and assessment the site ecological importance (SEI) for the identified habitats were calculated with the following results:

Aspect	Habitat / Ecosystem	Result
Conservation Importance	Altered Environment	Low
	Karoo Shrubland	Low
	Watercourses	High
Functional Integrity	Altered Environment	Low
	Karoo Shrubland	Medium
	Watercourses	Medium
Receptor Resilience	Altered Environment	Medium
	Karoo Shrubland	Medium

	Watercourses	Low
Biodiversity Importance	Altered Environment	Low
	Karoo Shrubland	Low
	Watercourses	Medium
Site Ecological Importance	Altered Environment	Low
	Karoo Shrubland	Low
	Watercourses	High

- The recommended site alternative for the new landfill site is: The Preferred Site.
- Buffer zones around all natural watercourses of 32m wide from the streambank edges are recommended. Buffer zones include 'high sensitivity' aquatic areas.
- There are no sensitive terrestrial habitats or areas and therefore no terrestrial biodiversity related buffer zones or regulated zones are required or recommended for the proposed project.
- It is the opinion of the specialist that the project should be authorised and allowed to proceed, with the implementation of buffers and other listed mitigating measures.

9 APPENDICES

9.1 Photographs

9.1.1 Preferred Site

	
Out-of-stream impoundment on the study site	Out-of-stream small and shallow impoundment
	
Study Site – Preferred Option / Landfill Site	Open previously cultivated fields on the preferred site
	
Preferred site with ridges to the east of the site	Study site – Preferred Site for the new Maletswai Landfill

9.1.2 Option 1

	
Study site – Option 1 (Alternative site to the preferred site)	Study site with R58 in the background
	
Undulating hills of the study site	Study site
	
Some low levels of soil erosion at the study site	Drainage line in the study area

9.1.3 Option 2

	
Study site – Option 2, the second alternative to the preferred site	Study site showing open fairly good quality Karoo Veld
	
Study Site	Study Site
	
Study Site showing undulating plains and low hills	Undulating plains with small seasonal stream in the mid-ground

9.2 Eastern Upper Karoo

Below is a list of species that characterise the veldtype (Mucina & Rutherford, 2010).

Tall Shrubs: *Lycium cinereum* (d), *L. horridum*, *L. oxycarpum*. Low Shrubs: *Chrysocoma ciliata* (d), *Eriocephalus ericoides* subsp. *ericoides* (d), *E. spinescens* (d), *Pentzia globosa* (d), *P. incana* (d), *Phymaspermum parvifolium* (d), *Salsola calluna* (d), *Aptosimum procumbens*, *Felicia muricata*, *Gnidia polycephala*, *Helichrysum dregeanum*, *H. lucilioides*, *Limeum aethiopicum*, *Nenax microphylla*,

Osteospermum leptolobum, *Plinthus karooicus*, *Pteronia glauca*, *Rosenia humilis*, *Selago geniculata*, *S. saxatilis*. Succulent Shrubs: *Euphorbia hypogaea*, *Ruschia intricata*. Herbs: *Indigofera alternans*, *Pelargonium minimum*, *Tribulus terrestris*. Geophytic Herbs: *Moraea pallida* (d), *Moraea polystachya*, *Syringodea bifurcata*, *S. concolor*. Succulent Herbs: *Psilocaulon coriarium*, *Tridentea jucunda*, *T. virescens*. Graminoids: *Aristida congesta* (d), *A. diffusa* (d), *Cynodon incompletus* (d), *Eragrostis bergiana* (d), *E. bicolor* (d), *E. lehmanniana* (d), *E. obtusa* (d), *Sporobolus fimbriatus* (d), *Stipagrostis ciliata* (d), *Tragus koelerioides* (d), *Aristida adscensionis*, *Chloris virgata*, *Cyperus usitatus*, *Digitaria eriantha*, *Enneapogon desvauxii*, *E. scoparius*, *Eragrostis curvula*, *Fingerhuthia africana*, *Heteropogon contortus*, *Sporobolus ludwigii*, *S. tenellus*, *Stipagrostis obtusa*, *Themeda triandra*, *Tragus berteronianus*.

Endemic Taxa Succulent Shrubs: *Chasmatophyllum rouxii*, *Hertia cluytiifolia*, *Rabiea albinota*, *Salsola tetrandra*. Tall Shrub: *Phymaspermum scoparium*. Low Shrubs: *Aspalathus acicularis* subsp. *planifolia*, *Selago persimilis*, *S. walpersii*.

(d) = Dominant.

9.3 Besemkaree Koppies Shrubland

Below is a list of species that characterise the veldtype (Mucina & Rutherford, 2010).

Small Trees: *Cussonia paniculata*, *Ziziphus mucronata*. Tall Shrubs: *Diospyros austro-africana* (d), *Euclea crispa* subsp. *ovata* (d), *Olea europaea* subsp. *africana* (d), *Rhus burchellii* (d), *R. ciliata* (d), *R. erosa* (d), *Buddleja saligna*, *Diospyros lycioides* subsp. *lycioides*, *Ehretia rigida*, *Grewia occidentalis*, *Gymnosporia polyacantha*, *Tarchonanthus minor*. Low Shrubs: *Asparagus suaveolens* (d), *Chrysocoma ciliata* (d), *Amphiglossa triflora*, *Aptosimum elongatum*, *Asparagus striatus*, *Diospyros pallens*, *Eriocephalus ericoides*, *E. spinescens*, *Euryops empetrifolius*, *Felicia filifolia* subsp. *filifolia*, *F. muricata*, *Helichrysum dregeanum*, *H. lucilioides*, *Hermannia multiflora*, *H. vestita*, *Lantana rugosa*, *Limeum aethiopicum*, *Lycium cinereum*, *Melolobium candicans*, *M. microphyllum*, *Nenax microphylla*, *Pegolettia retrofracta*, *Pentzia globosa*, *Rhigozum obovatum*, *Selago saxatilis*, *Stachys linearis*, *S. rugosa*, *Sutera halimifolia*, *Wahlenbergia albens*. Succulent Shrubs: *Aloe broomii*, *Chasmatophyllum musculinum*, *C. verdoorniae*, *Cotyledon orbiculata* var. *dactyloopsis*, *Pachypodium succulentum*. Graminoids: *Aristida adscensionis* (d), *A. congesta* (d), *A. diffusa* (d), *Cenchrus ciliaris* (d), *Cymbopogon caesius* (d), *Cynodon incompletus* (d), *Digitaria eriantha* (d), *Eragrostis curvula* (d), *E. lehmanniana* (d), *Heteropogon contortus* (d), *Setaria lindenberghiana* (d), *Themeda triandra* (d), *Tragus koelerioides* (d), *Cymbopogon pospischilii*, *Enneapogon scoparius*, *Eragrostis chloromelas*, *E. obtusa*, *Eustachys paspaloides*, *Fingerhuthia africana*, *Hyparrhenia hirta*, *Sporobolus fimbriatus*. Herbs: *Convolvulus sagittatus*, *Dianthus caespitosus* subsp. *caespitosus*, *Gazania krebsiana* subsp. *krebsiana*, *Hibiscus pusillus*, *Indigofera alternans*, *I. rhytidocarpa*, *Lepidium africanum* subsp. *africanum*, *Pollichia campestris*. Herbaceous Climber: *Argyrobolus lanceolatum*. Geophytic Herbs: *Albuca setosa*, *Asplenium cordatum*, *Cheilanthes bergiana*, *C. eckloniana*, *Freesia andersoniae*, *Haemanthus humilis* subsp. *humilis*, *Oxalis depressa*, *Pellaea*

calomelanos. Succulent Herbs: *Aloe grandidentata*, *Crassula nudicaulis*, *Duvalia caespitosa*, *Euphorbia pulvinata*, *Huernia piersii*, *Stapelia grandiflora*, *S. olivacea*, *Tridentea gemmiflora*.

Endemic Taxa Small Tree: *Cussonia* sp. nov. (*P.J. du Preez* 3666 BLFU). Succulent Shrubs: *Euphorbia crassipes*, *Neohenricia sibbettii*, *N. spiculata*.

(d) = Dominant.

9.4 Upper Gariep Alluvial Vegetation

Below is a list of species that characterise the veldtype (Mucina & Rutherford, 2010).

Riparian thickets Small Trees: *Acacia karroo* (d), *Celtis africana* (d), *Salix mucronata* subsp. *mucronata* (d). Tall Shrubs: *Diospyros lycioides* (d), *Melanthus comosus* (d), *Rhus pyroides*. Low Shrubs: *Asparagus setaceus*, *A. suaveolens*. Woody Climber: *Clematis brachiata*. Succulent Shrubs: *Lycium arenicola*, *L. hirsutum*. Herb: *Rubia cordifolia*. **Flooded grasslands & herblands** Graminoid: *Melica decumbens* (d). Herbs: *Cineraria dregeana*, *C. lobata*.

(d) = Dominant.

9.5 Description of threat statuses of veldtypes / ecosystems

Table 18 below, gives a basic description of the status categories. The Biodiversity Act (Act 10 of 2004) provides for listing of threatened or protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or protected. The main purpose for the listing of threatened ecosystems is an attempt to reduce the rate of ecosystem and species destruction and habitat loss, leading to extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems (SANBI).

Table 18: Ecosystem Status: Simplified explanation of categories used

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

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

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

Figure 14 uses the term 'Least Concern' which is similar to that of 'Least Threatened'.

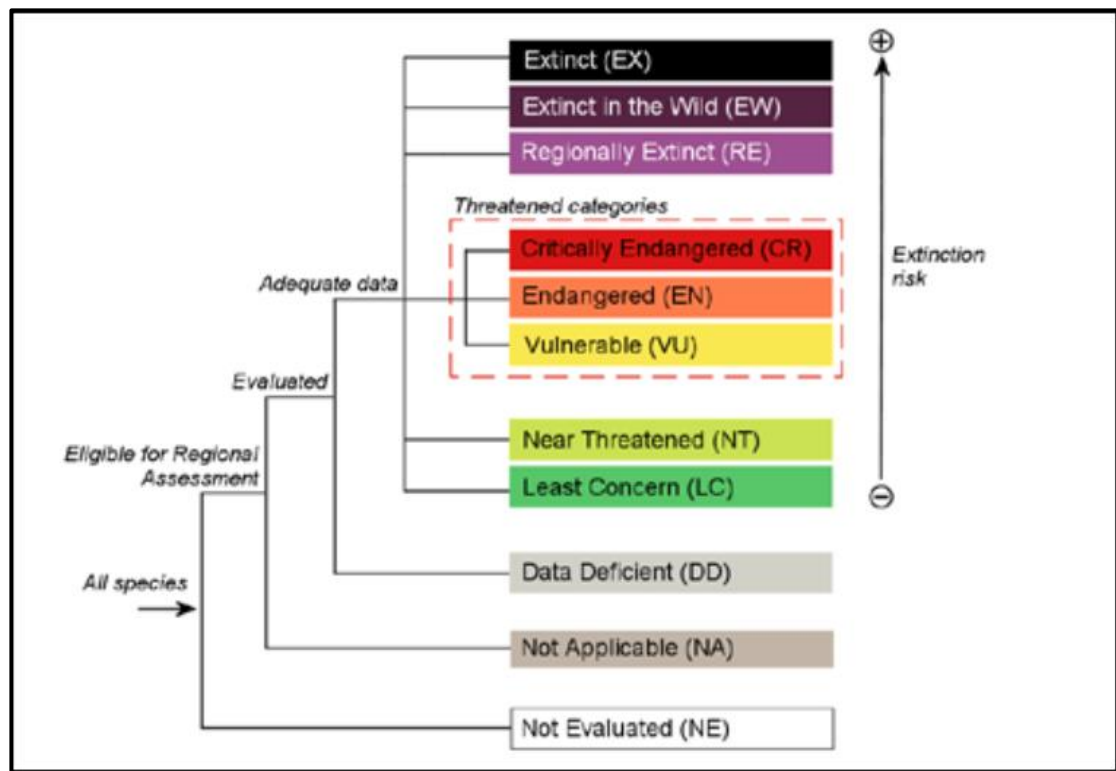


Figure 14: Structure of categories used at the regional level

9.6 Site Ecological Importance (SEI)

Below is the methodology used for determining the SEI of the study site.

9.6.1 Biodiversity Importance

Biodiversity Importance (BI) is a function of conservation importance (CI) and the functional integrity (FI) of the receptor and can be seen as follows: $BI = CI + FI$ (Table 19).

Table 19: Matrix for determination of Biodiversity Importance (BI)

Biodiversity Importance (BI)		Conservation Importance (CI)				
		Very High	High	Medium	Low	Very Low
Functional Integrity (FI)	Very High	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very Low	Medium	Low	Very Low	Very Low	Very Low

9.6.2 Conservation Importance

Conservation Importance (CI) is evaluated in accordance with recognised established internationally acceptable principles and criteria for the determination of biodiversity related value, including the IUCN Red List of Species, Red List of Ecosystems and Key Biodiversity Areas (KBA; IUCN, 2016) (Table 20). Conservation importance (CI) can be defined as: 'The importance of a site for supporting biodiversity features of conservation concern present, e.g., populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.

Table 20: Conservation Importance Categories and Criteria

Conservation Importance	
Category	Criteria
Very High	Globally significant populations of congregatory species (> 10% of global population).
High	- Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 sq.km. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining. - Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (>0.1%) of natural habitat of VU ecosystem type. - Presence of Rare Species. - Globally significant populations of congregatory species (> 1% but < 10% of global population).
Medium	- Confirmed or highly likely occurrence of populations on NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals. - Any area of natural habitat of threatened ecosystem type with status of VU. - Presence of range-restricted species. > 50% of receptor contains natural habitat with potential to support SCC.
Low	- No confirmed or highly likely populations of SCC. - No confirmed or highly likely populations of range-restricted species. < 50% of receptor contains natural habitat with limited potential to support SCC.
Very Low	- No confirmed or highly likely populations of SCC. - No confirmed or highly likely populations of range-restricted species. - No natural habitat remaining.

9.6.3 Functional Integrity

Functional integrity (FI) of the receptor (Vegetation/faunal community or habitat type) is defined as the receptor's current ability to maintain the structure and functions that define it, compared to its known or predicted state under ideal conditions.

FI can further be described or defined as: 'A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts.'

Table 21: Functional Integrity Categories and Criteria

Functional Integrity	
Category	Criteria
Very High	• Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. • High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. • No or minimal current negative ecological impacts with no signs of major past disturbance (e.g. ploughing).
High	• Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type of > 10 ha for EN ecosystem types. • Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. • Only minor current negative ecological impacts (e.g. few livestock utilizing area) with no signs of major past disturbance (e.g. ploughing) and good rehabilitation potential.
Medium	• Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types. • Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. • Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	• Small area (>1ha, but <5ha). • Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. • Several minor and major current negative ecological impacts.
Very Low	• Very small area (< 1 ha). • No habitat connectivity except for flying species or flora with wind- dispersed seeds. • Several major current negative ecological impacts.

9.6.4 Receptor Resilience

The intrinsic ability / capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention.'

Table 22: Receptor Resilience Categories and Criteria

Receptor Resilience	
Category	Criteria
Very High	Habitat that can <u>recover rapidly</u> (in less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	Habitat that can <u>recover relatively quickly</u> (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.
Medium	Will <u>recover slowly</u> (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	Habitat that is <u>unlikely to be able to recover</u> fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.
Very Low	Habitat that is <u>unable to recover</u> from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

9.7 Classification of Watercourses

Watercourses identified are classified along different hydrogeomorphic (HGM) units, typically up to Level 4, in terms of six levels as refined for South Africa by Kleynhans, *et. al.* (2005) and used in the Classification System for Wetlands user manual – SANBI Series 22 (Ollis *et. al.* 2013).

LEVEL 1 System	LEVEL 2 Regional setting (Ecoregion)	LEVEL 3 Landscape Unit	LEVEL 4 HGM Unit	
			HGM Type	Landform
Inland	SA Ecoregions according to DWS and/or NFEPA	- Valley floor - Slope - Plain - Bench	River	- Mountain headwater stream - Mountain stream - Transitional stream - Upper foothill - Lower foothill - Lowland - Rejuvenated foothill - Upland floodplain
			Channelled valley bottom wetland	
			Unchannelled valley bottom wetland	

			Floodplain Wetland	
			Depression	• Exorheic • Endorheic • Dammed
			Seep	• With channel outflow (connected) • Without channel outflow (disconnected)
			Wetland flat	

LEVEL 5 Hydrological Regime	LEVEL 6 Ecosystem Characteristics
• Perenniality (Perennial & non-perennial) • Period & depth of inundation (Limnetic (>2m) and Littoral (<2m) maximum depth at the average annual low water level) • Period of saturation (Only of relevance to actual wetlands)	• Natural vs artificial • Salinity • pH • Substratum type • Vegetation cover type • Geology

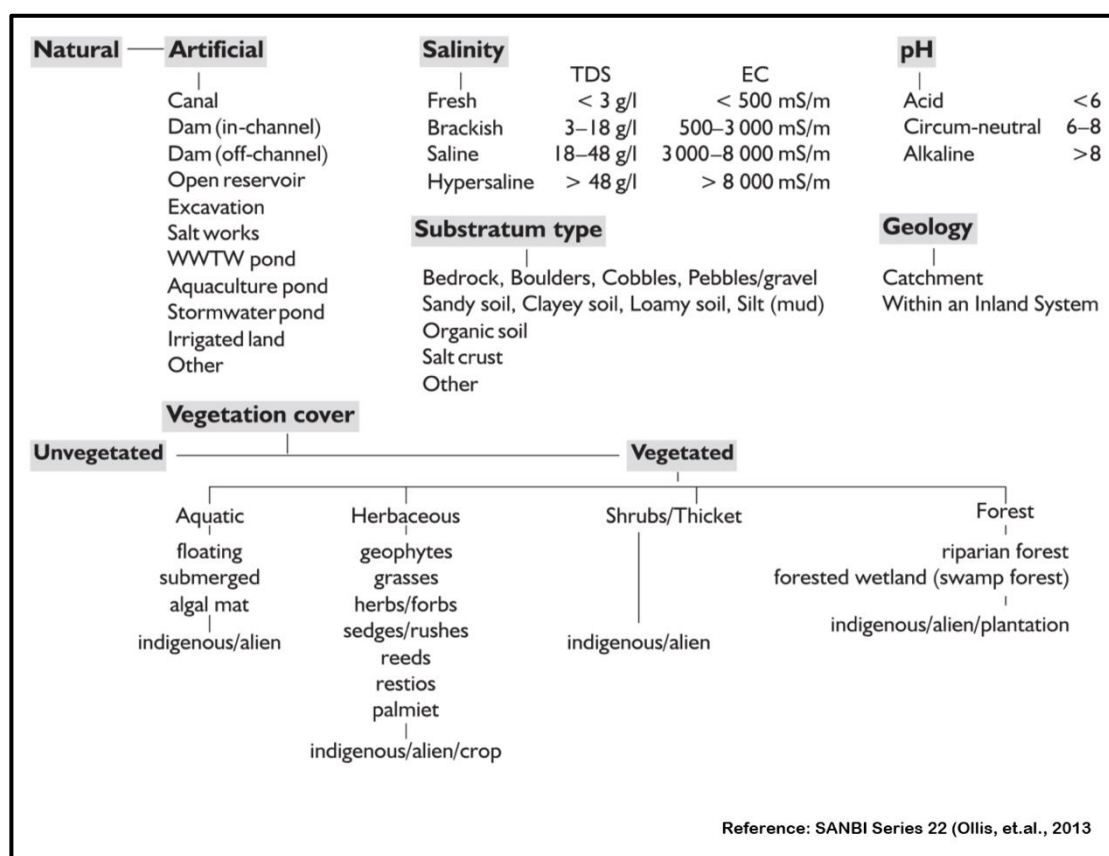


Figure 15: Schematic of Level 6 (Ecosystem Characteristics)

9.8 Definitions

9.8.1 Wetlands

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

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

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

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

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

¹ Precipitation is an important water source and evapotranspiration an important output in all of the above settings
 Water source: * Contribution usually small
 *** Contribution usually large
 */ *** Contribution may be small or important depending on the local circumstances
 */ *** Contribution may be small or important depending on the local circumstances.

 Wetland

9.9 Regulated Zone versus Buffer Zone

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

The following areas / zones and regulations are relevant:

- The **32 m** in the NEMA listed activities. This is 32 m from the 1:1 year flood line or first flood bank of the active stream area. This is not 32 metres from the 1:100 year flood line or 32 metres from the 500 m zone of the delineated wetland as determined by DWS. Experts keep on using

definitions in the NEMA to support or define things or issues in the NWA or vice versa. This should not be done.

- The 1:100 flood line, or the riparian area (whichever is the furthest) as defined by the GN509 in terms of the NWA; or
- The wetland area and 500 m from the wetland area as defined by GN509 in terms of the NWA

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

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

9.10 Legislation relating to buffer & regulated zones for watercourses

1. Listed activities in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) EIA Regulations, 2014 (as amended) must be taken into consideration if any infrastructure is to be placed within the applicable zone of regulation. This must be determined by the EAP in consultation with the relevant authorities;

2. In accordance with GN509 of 2016 as it relates to the NWA, a regulated area of a watercourse for section 21(c) and 21(i) of the National Water Act, 1998 (Act 36 of 1998) is defined as:

- The outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
- In the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or
- A 500 m radius from the delineated boundary (extent) of any wetland or pan

3. In terms of Regulation GN704 of the NWA, 1998 (Act no. 36 of 1998), a 100 m zone of regulation around the watercourses is required. If any mining activities are to take place within 100 metres or the 1:100-year flood lines exemption in terms of this regulation, as well as General Notice No. 1199 of 2009, as it relates to the NWA, will also apply and therefore a Water Use License will be required

9.11 Vegetation indicators for Wetland zones

Below is a summary of vegetation indicators which could be expected in the three different wetness / wetland zones of a wetland (Table 23).

Table 23: Vegetation indicators for wetland zones

Vegetation	Temporary Zone	Seasonal Zone	Permanent Zone
Herbaceous	Predominantly grass species; mixture of species which occur extensively in non-wetland areas, and hydrophilic plant species which are restricted largely to wetland areas.	Hydrophilic sedge and grass species, which are restricted to wetland areas; <i>Phragmites australis</i> .	Dominated by: 1. emergent plants, including reeds (<i>Phragmites australis</i>), a mixture of sedges and bulrushes (<i>Typha capensis</i>), usually >1m tall; and/or 2. floating or submerged aquatic plants.
Woody	Mixture of woody species which occur extensively in non-wetland areas, and hydrophilic plant species that are restricted largely to wetland areas.	Hydrophilic woody species, which are restricted to wetland areas.	Hydrophilic woody species, which are restricted to wetland areas. Morphological adaptations to prolonged wetness (e.g. prop roots).

Reference: Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas. 2nd ed. Sept. 2008. DWS.

Below is a list of plant species typically found in freshwater wetlands on the Highveld:

Megagraminoid: *Cyperus congestus* (d). Graminoids: *Agrostis lachnantha* (d), *Carex acutiformis* (d), *Eleocharis palustris* (d), *Eragrostis plana* (d), *E. planiculmis* (d), *Fuirena pubescens* (d), *Helictotrichon turgidulum* (d), *Hemarthria altissima* (d), *Imperata cylindrica* (d), *Leersia hexandra* (d), *Paspalum dilatatum* (d), *P. urvillei* (d), *Pennisetum thunbergii* (d), *Schoenoplectus decipiens* (d), *Scleria dieterlenii* (d), *Setaria sphacelata* (d), *Andropogon appendiculatus*, *A. eucomus*, *Aristida aequiglumis*, *Ascolepis capensis*, *Carex austro-africana*, *C. schlechteri*, *Cyperus cyperoides*, *C. distans*, *C. longus*, *C. marginatus*, *Echinochloa holubii*, *Eragrostis micrantha*, *Ficinia acuminata*, *Fimbristylis complanata*, *F. ferruginea*, *Hyparrhenia dregeana*, *H. quarrei*, *Ischaemum fasciculatum*, *Kyllinga erecta*, *Panicum schinzii*, *Pennisetum sphacelatum*, *Pycreus macranthus*, *P. nitidus*, *Setaria pallide-fusca*, *Xyris gerrardii*.

Herbs: *Centella asiatica* (d), *Ranunculus multifidus* (d), *Berkheya radula*, *B. speciosa*, *Berula erecta* subsp. *thunbergii*, *Centella coriacea*, *Chironia palustris*, *Equisetum ramosissimum*, *Falckia oblonga*, *Haplocarpha lyrata*, *Helichrysum difficile*, *H. dregeanum*, *H. mundtii*, *Hydrocotyle sibthorpioides*, *H. verticillata*, *Lindernia conferta*, *Lobelia angolensis*, *L. flaccida*, *Mentha aquatica*, *Monopsis decipiens*, *Pulicaria scabra*, *Pycnostachys reticulata*, *Rorippa fluviatilis* var. *fluviatilis*, *Rumex lanceolatus*, *Senecio inornatus*, *S. microglossus*, *Sium repandum*, *Thelypteris confluens*, *Wahlenbergia banksiana*. Geophytic Herbs: *Cordylogyne globosa*, *Crinum bulbispermum*, *Gladiolus papilio*, *Kniphofia ensifolia*, *K. fluviatilis*, *K. linearifolia*, *Neobolusia tysonii*, *Nerine gibsonii* (only in Eastern Cape), *Satyrium hallackii* subsp. *hallackii*.

Reed & sedge beds Megagraminoids: *Phragmites australis* (d), *Schoenoplectus corymbosus* (d), *Typha capensis* (d), *Cyperus immensus*. Graminoid: *Carex cernua*. **Water bodies** Aquatic Herbs: *Aponogeton junceus*, *Ceratophyllum demersum*, *Lagarosiphon major*, *L. muscoides*, *Marsilea capensis*, *Myriophyllum spicatum*, *Nymphaea lotus*, *N. nouchali* var. *caerulea*, *Nymphoides thunbergiana*, *Potamogeton thunbergii*. Carnivorous Herb: *Utricularia inflexa*. Herb: *Marsilea farinosa* subsp. *farinosa* (Mucina & Rutherford, 2006).

(d) = Dominant.

9.12 Potential Mammal Fauna found in the region

Mammal Group	Scientific Name	Common Name	Typical Habitat / Association	Potential Occurrence
Elephant shrew	<i>Elephantulus myurus</i>	Eastern Rock Elephant Shrew	Rocky areas, Karoo shrubland	Moderate
Elephant shrew	<i>Elephantulus edwardii</i>	Cape Rock Elephant Shrew	Rocky Karoo habitat	Low–Moderate
Aardvark	<i>Orycteropus afer</i>	Aardvark	Open grassland, shrubland and termite-rich areas	Moderate
Cape porcupine	<i>Hystrix africaeaustralis</i>	Cape Porcupine	Karoo shrubland, grassland and rocky areas	Moderate–High
Cape hare	<i>Lepus capensis</i>	Cape Hare	Open grassland and Karoo shrubland	High
Scrub hare	<i>Lepus saxatilis</i>	Scrub Hare	Grassland, shrubland and agricultural areas	Moderate–High
Smith's red rock rabbit	<i>Pronolagus rupestris</i>	Smith's Red Rock Rabbit	Rocky slopes and koppies	Low–Moderate
Four-striped mouse	<i>Rhabdomys pumilio</i>	Four-striped Mouse	Grassland and shrubland	High
Karoo bush rat	<i>Myotomys unisulcatus</i>	Karoo Bush Rat	Karoo shrubland	Moderate–High
Namaqua rock mouse	<i>Micaelamys namaquensis</i>	Namaqua Rock Mouse	Rocky areas, shrubland and disturbed habitats	High
Multimammate mouse	<i>Mastomys</i> spp.	Multimammate Mouse	Grassland, agricultural and disturbed areas	High
Gerbils	<i>Gerbillurus</i> spp.	Gerbils	Sandy/open soils and Karoo shrubland	Moderate
Gerbil	<i>Tatera</i> spp.	Gerbils	Open grassland and Karoo soils	Moderate
Ground squirrel	<i>Xerus inauris</i>	South African Ground Squirrel	Open Karoo and grassland	Moderate
Springhare	<i>Pedetes capensis</i>	Springhare	Open grassland and Karoo plains	Moderate
Rock hyrax	<i>Procavia capensis</i>	Rock Hyrax	Rocky outcrops and koppies	Moderate
Yellow mongoose	<i>Cynictis penicillata</i>	Yellow Mongoose	Open Karoo, grassland and agricultural land	High
Slender mongoose	<i>Herpestes sanguineus</i>	Slender Mongoose	Grassland, shrubland and riverine margins	Moderate
Small grey mongoose	<i>Galerella pulverulenta</i>	Cape Grey Mongoose	Karoo shrubland, grassland and riverine vegetation	Moderate
Water mongoose	<i>Atilax paludinosus</i>	Water Mongoose	Riverine vegetation and wetlands	Low–Moderate; mainly near river

Cape genet	<i>Genetta genetta</i>	Common Genet	Karoo shrubland, riverine vegetation and agricultural areas	Moderate
Small-spotted genet	<i>Genetta maculata</i>	Small-spotted Genet	Grassland, shrubland and riverine areas	Low–Moderate
Bat-eared fox	<i>Otocyon megalotis</i>	Bat-eared Fox	Open Karoo and grassland	Moderate
Cape fox	<i>Vulpes chama</i>	Cape Fox	Open semi-arid shrubland and grassland	Moderate
Black-backed jackal	<i>Lupulella mesomelas</i>	Black-backed Jackal	Open Karoo, agricultural land and shrubland	Moderate
Honey badger	<i>Mellivora capensis</i>	Honey Badger / Ratel	Extensive natural areas, rocky areas and open shrubland	Low–Moderate
Brown hyena	<i>Parahyaena brunnea</i>	Brown Hyena	Extensive semi-arid natural habitat	Low
African wild cat	<i>Felis lybica</i>	African Wild Cat	Open Karoo, grassland and agricultural areas	Low–Moderate
Black-footed cat	<i>Felis nigripes</i>	Black-footed Cat	Open Karoo grassland and shrubland	Low
Caracal	<i>Caracal caracal</i>	Caracal	Open shrubland, grassland and rocky areas	Low–Moderate
Cape clawless otter	<i>Aonyx capensis</i>	Cape Clawless Otter	Orange River and associated aquatic habitats	Low–Moderate; near river
Common duiker	<i>Sylvicapra grimmia</i>	Common Duiker	Karoo shrubland, grassland and riverine vegetation	Moderate
Steenbok	<i>Raphicerus campestris</i>	Steenbok	Open Karoo shrubland and grassland	Moderate
Springbok	<i>Antidorcas marsupialis</i>	Springbok	Open Karoo plains and grassland	Low–Moderate
Southern African ground pangolin	<i>Smutsia temminckii</i>	Temminck's Ground Pangolin	Open savanna/grassland and termite-rich areas	Low
Riverine rabbit	<i>Bunolagus monticularis</i>	Riverine Rabbit	Dense riverine vegetation on alluvial soils	Low
African molerat	<i>Cryptomys</i> spp.	African Mole-rat	Grassland and Karoo soils	Moderate
Cape golden mole	<i>Chrysochloris</i> spp.	Golden Mole	Loose soils and grassland	Low–Moderate
Bats	<i>Neoromicia</i> spp.	Pipistrelle bats	Open areas, buildings and riparian vegetation	Moderate
Bats	<i>Rhinolophus</i> spp.	Horseshoe bats	Rocky areas, caves/buildings and riparian habitat	Low–Moderate
Bats	<i>Miniopterus</i> spp.	Long-fingered bats	Caves and suitable roosting structures	Low–Moderate

9.13 Potential Insect Fauna found in the region

Insect Group	Representative Taxa / Species	Habitat / Association	Likelihood of Occurrence
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Maletswai Landfill Site: Terrestrial Biodiversity Impact Assessment

Grasshoppers	<i>Acanthacris</i> spp.	Karoo grassland and open areas	High
Grasshoppers	<i>Aiolopus</i> spp.	Grassland and disturbed areas	High
Grasshoppers	<i>Phymateus</i> spp.	Shrubland and grassland	Moderate
Grasshoppers	<i>Zonocerus</i> spp.	Shrubland, grassland and disturbed areas	Moderate
Crickets	Gryllidae spp.	Ground layer, grassland and disturbed areas	High
Katydid	Tettigoniidae spp.	Karoo shrubs and grasses	Moderate
Butterflies	<i>Junonia hierta</i>	Grassland and flowering plants	Moderate–High
Butterflies	<i>Junonia orithya</i>	Open grassland and disturbed vegetation	Moderate
Butterflies	<i>Vanessa cardui</i>	Open areas and flowering vegetation	High
Butterflies	<i>Danaus chrysippus</i>	Flowering plants and shrubland	Moderate
Butterflies	<i>Colotis</i> spp.	Karoo shrubs and flowering vegetation	Moderate
Moths	Noctuidae spp.	Grassland and shrubland	High
Moths	Geometridae spp.	Shrubs and woody vegetation	Moderate
Moths	Sphingidae spp.	Shrubland and flowering plants	Moderate
Dung beetles	<i>Scarabaeus</i> spp.	Grazing areas and animal dung	High
Dung beetles	<i>Onthophagus</i> spp.	Grazing areas and dung	High
Dung beetles	<i>Ateuchus</i> spp.	Grassland and livestock areas	Moderate–High
Darkling beetles	Tenebrionidae spp.	Dry soil, litter and Karoo shrubland	High
Ground beetles	Carabidae spp.	Soil surface and grassland	Moderate–High
Flower beetles	Scarabaeidae spp.	Flowering shrubs and herbs	Moderate
Ladybird beetles	Coccinellidae spp.	Shrubs and herbaceous vegetation	Moderate
Weevils	Curculionidae spp.	Grasses, shrubs and other plants	Moderate
Longhorn beetles	Cerambycidae spp.	Shrubs, trees and dead wood	Low–Moderate
Ants	<i>Camponotus</i> spp.	Soil, shrubs and disturbed ground	High
Ants	<i>Tetramorium</i> spp.	Soil and grassland	High
Harvester ants	<i>Messor</i> spp.	Open Karoo soils and grassland	High
Ants	<i>Pheidole</i> spp.	Soil and disturbed areas	High
Termites	<i>Trinervitermes</i> spp.	Grassland soils	High
Termites	<i>Hodotermes</i> spp.	Dry grassland and Karoo soils	Moderate–High
Termites	<i>Odontotermes</i> spp.	Soil and woody vegetation	Moderate
Honeybee	<i>Apis mellifera</i>	Flowering shrubs and riparian vegetation	High
Carpenter bees	<i>Xylocopa</i> spp.	Flowering plants and woody vegetation	Moderate
Solitary bees	Megachilidae spp.	Flowering plants and bare soil	Moderate
Wasps	Vespidae spp.	Shrubland, grassland and nesting sites	Moderate
Robber flies	Asilidae spp.	Open grassland and shrubland	Moderate
Blowflies	Calliphoridae spp.	Existing landfill and decomposing organic material	High near landfill
Flesh flies	Sarcophagidae spp.	Decomposing organic material	High near landfill
House flies	Muscidae spp.	Waste and organic material	High near landfill
Fruit flies	Drosophilidae spp.	Organic waste and decaying vegetation	High near landfill
Cockroaches	Blattodea spp.	Existing landfill and buildings	Moderate–High

Dragonflies	<i>Anax</i> spp.	Orange River, pools and wetlands	Moderate near river
Dragonflies	<i>Crocothemis</i> spp.	River margins and standing water	Moderate near river
Dragonflies	<i>Orthetrum</i> spp.	River and aquatic margins	Moderate near river
Damselflies	<i>Pseudagrion</i> spp.	Riverine vegetation and flowing water	Moderate near river
Damselflies	<i>Ischnura</i> spp.	Pools, wetlands and river margins	Moderate
Mayflies	Baetidae spp.	Orange River and aquatic habitat	Moderate near river
Caddisflies	Trichoptera spp.	Orange River and associated aquatic habitat	Moderate near river
Aquatic bugs	Gerridae, Corixidae spp.	River margins and standing water	Moderate

9.14 Criteria for the classification of an impact

Scale (Extent)

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

- Site: Within the construction site
- Local: Within a radius of 2 km of the construction site
- Regional: Provincial (and parts of neighbouring provinces)
- National: The whole of the country
- International: Impact is across countries

Duration

Indicates what the lifetime of the impact will be.

- Immediate: The impact will either disappear with mitigation or will be mitigated through natural process in a time span shorter than the construction phase.
- Short-term: The impact will either disappear with mitigation or will be mitigated through natural process within 0 – 5 years.
- Medium-term: The impact will either disappear with mitigation or will be mitigated through natural process within 5 – 15 years.
- Long-term: The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. Impact ceases after the operational life of the activity.
- Permanent: The only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.

Magnitude (Intensity)

Describes whether an impact is destructive or benign.

- Low: Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.
- Medium: Effected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way.
- High: Natural, cultural and social functions and processes are altered to extent that they temporarily cease.
- Very high / Unknown: Natural, cultural and social functions and processes are altered to extent that they permanently cease.

Probability

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

- Improbable: Likelihood of the impact materialising is very low.
- Low probability / Possible: The impact may occur.
- Medium probability: The impact will more than likely occur.
- Highly probable: High likelihood that the impact will occur.
- Definite / Unknown: Impact will (most certainly) occur, or is unknown and therefore needs to be afforded a high probability score.

Significance

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

Status

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

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

9.15 Short CV of Specialist

Name: Johannes Oren Maree

Qualifications

2024 MTS, Grace Communion Seminary (USA)
2000 MBA, Oxford Brookes University (England)
1998 Diploma in Small Business Management (Damelin College)
1988 MSc (Rand Afrikaans University)
1987 BSc (Hons.) (Rand Afrikaans University)
1986 BSc (Rand Afrikaans University)

Publications

- Co-Authoring Book: Cut Flowers of the World. 2010. Briza, Pretoria.
- Cut Flowers of the World, 2ed. 2020. Briza, Pretoria.

- 100s of articles for popular magazines such as Farmer's Weekly & SA Landscape

Professional Memberships

- SA Council of Natural Scientific Professions (SACNASP)
 - Reg. No. 005165
- South African Wetland Society
 - Reg. No: 998061
- Society of Wetland Scientists

Professional Career

Position: Director / Owner

Employer: Flori Scientific Services

Period: 2000 to current

Scope of Work Done:

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

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