environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

THE PROPOSED ESTABLISHMENT OF GAS TURBINES AND A BATTERY ENERGY STORAGE SYSTEM ON PORTION A, B, C F AND G OF THE REMAINING EXTENT OF THE FARM VETLAAGTE 4, EMTHANJENI LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE.

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
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Departmental Details

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Pretoria
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Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Flori Scientific Services			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Johannnes Maree			
Specialist Qualifications:	MSc; MBA			
Professional affiliation/registration:	SACNASP (Reg. No: 400077/91)			
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E-mail:	johannes@flori.co.za			

2. DECLARATION BY THE SPECIALIST

I, ____JOHANNES OREN MAREE_____, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Flori Scientific Services cc

Name of Company:

7/12/2020

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, __JOHANNES O. MAREE_______________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Flori Scientific Services cc

Name of Company

7/12/2020

Date

Col

Signature of the Commissioner of Oaths

2020/12/07

Date

SOUTH AFRICAN POLICE SERVICE
MODIMOLLE
2020 -12- 07
COMMUNITY SERVICE CENTRE
SUID-AFRIKAANSE POLISIEDIENS

DE AAR G5 SITES

BIODIVERSITY IMPACT ASSESSMENT

Terrestrial Ecological Assessment and Aquatic Assessment for the Proposed Gas Turbines and Batteries on the Remaining Extent of the Farm Vetlaagte 4, De Aar, Northern Cape Province

Compiled by

FLORI SCIENTIFIC SERVICES

OCTOBER 2020

PROJECT INFORMATION

PROJECT TITLE: De Aar G5 Sites

STUDY NAME: Biodiversity Impact Assessment

COMPILED BY: Flori Scientific Services cc
15 Kiaatsingel, Bosveldsig Phase 8, Modimolle, 0510
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AUTHOR: Johannes Oren Maree, *MSc.; MBA; Pr. Sci. Nat.*
SACNASP (Reg. No.: 400077/91)

DATE OF REPORT: 14 October 2020

REPORT STATUS: Final Report

REPORT REFERENCE: G5/BA_01

EXECUTIVE SUMMARY

Project Overview

Sativa Travel and Environmental Consultants (Pty) Ltd (STEC) has been appointed by The Applicants to undertake the environmental approvals for the installation of 19.5 MW Gas Turbines and a Battery Energy Storage System (BESS) on each Portion (facility) on the Remaining Extent of the Farm Vetlaagte 4 within Emthanjeni Local Municipality, Northern Cape Province. Each site currently holds a positive Environmental authorization for the establishment of a Solar PV park. Portions A, B, C and F are authorized to generate up to 75 MW electricity from Solar PV panels while Portion G is authorized for 30 MW.

The applicants wish to establish Gas Turbines with a maximum electrical output of 19.5 MW, with a BESS to create a hybrid electricity generation facility on each portion. This Hybrid power generation facility (on each portion) will have a higher dispatch level and allow for the generation of electricity for more hours of the day, as is desired in The Risk Mitigated Independent Power Producer Procurement Programme (RMIPPPP) currently underway by the Department of Mineral Resources and Energy (DMRE).

Field investigations were conducted on 10 & 11 October 2020.

Location of the study area

The study site is located approximately 6 km east of the town of De Aar, in the Emthanjeni Local Municipality, Northern Cape Province. The study site is situated on the Remaining Extent of the Farm Vetlaagte 4.

Vegetation

No Red Data Listed (RDL) plants were observed during field investigations and none are expected to occur.

Watercourses

There are no perennial rivers or semi-perennial rivers in the study area. The main river in the region is the Brak River, which flows north of the study site.

East along the study site is a broad, shallow ancient floodplain or river system that feeds into the Brak River. The area east of the study site is a highly erratic and ephemeral watercourse (drainage system), which almost never flows, end to end, even during periods of significant rainfall.

Drainage Regions

Below is a summary of the drainage regions in which the study site is situated.

Level	Category
Primary Drainage Area (PDA)	D
Quaternary Drainage Area (QDA)	D62D
Water Management Area (WMA) – Previous / Old	Lower Orange
Water Management Area (WMA) – New (as of Sept. 2016)	Orange (WMA 6)
Sub-Water Management Area	Orange Tributaries
Catchment Management Agency (CMA)	Orange (CMA 6)
Wetland Vegetation Ecoregion	Upper Nama-Karoo
Strategic Water Source Area (SWSA)	Yes (De Aar)
Priority Quaternary Catchment	No
Fish FEPA	No
Fish FSA	No
Fish Corridor	No
Fish Migratory Corridor	No
Priority Quaternary Catchment	No

Ecological Sensitivity

The ecological sensitivity of the study area is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit, whether it is floristic or faunal in nature. According to the analyses of the floristic, fanual and overall ecological sensitivities there are no high sensitivity areas or habitats.

However, watercourses are, by default, deemed to be sensitive, even if they area degraded. The watercourses in the area must therefore be seen as sensitive.

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity
Karoo Shrubland	Medium/Low	Medium	**Medium**
Watercourse	Medium	Medium	**Medium**

Fatal Flaws

There are no fatal flaws and the project may proceed. Mitigating measures, including buffer zones must be implemented.

Conclusions

The conclusions of the study are as follows:

- The study site is within the veldtype known as Northern Upper Karoo, which is part of the Nama-Karoo Biome.
- The veldtype is not a threatened ecosystem.
- There are no 'high sensitivity' habitats within the study area. However, all watercourses are, by default, viewed as sensitive and must therefore be approached as such.
- The overall sensitivity of the terrestrial ecology of the study site is 'Medium'
- There is a watercourse (river / drainage system) east of the study area. Some of this watercourse is within Portions F & G of the study site.

Recommendations

All mitigating measures must be implemented, including delineated buffer zones and regulated areas.

REVIEW AND APPROVAL

Name	Title	Signature	Date
Johannes Maree	Ecologist & Author (Flori Scientific Services)		**14/10/2020**
Moses Kgopana	Lead EAP (SativaTravel and Environmental Consultants (Pty) Ltd)		**15/10/2020**

Acknowledgements

The author would like to acknowledge and thank Sativa Travel and Environmental Consultants (Pty) Ltd (STEC) and other roleplayers for their assistance with project information and responding to queries related to the project.

EXPERTISE & DECLARATION OF THE SPECIALIST

EXPERTISE

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

2 Masters degrees (MSc & MBA); 2 Diplomas (Business & Public Speaking).

Co-Authored two books: Cut Flowers of the World. 2010 (1st ed) & 2020 (2nd ed), Briza, Pretoria.

SAQA accreditation in training, assessing & service provision (AgriSeta).

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

21 years experience in technical and managerial positions, project management and consultancy.

19 years experience in writing of articles, books, training material, training & presentations, proposals.

13 years direct experience in EIAs.

Has conducted hundreds of field investigations and compiled hundreds of technical speciaist reports for EIAs, including ecological assessments (fauna & flora), wetland assessments and avifauna impact assessments. Projects include power lines, roads, quarries, housing developments, mines and wind farms.

DECLARATION

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

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

Act as an independent specialist in compiling this report;

Do not have any financial interests, or stand to gain in any way in the undertaking of this activity, other than remuneration for work performed;

Do not have any vested interest in the proceeding activity or project;

Have no, neither will engage in, conflicting interests in the undertaking of this activity;

Undertake to disclose, to the competent authority, any material information that has, or may have, the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required; and

Will provide competent authority access to my information regarding the report and investigations, whether such information is favourable to the applicant or not.

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ACRONYMS

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

1 BACKGROUND

1.1 Project overview

Sativa Travel and Environmental Consultants (Pty) Ltd (STEC) has been appointed by The Applicants to undertake the environmental approvals for the installation of 19.5 MW Gas Turbines and a Battery Energy Storage System (BESS) on each Portion (facility) on the Remaining Extent of the Farm Vetlaagte 4 within Emthanjeni Local Municipality, Northern Cape Province. Each site currently holds a positive Environmental authorization for the establishment of a Solar PV park. Portions A, B, C and F are authorized to generate up to 75 MW electricity from Solar PV panels while Portion G is authorized for 30 MW.

The applicants wish to establish Gas Turbines with a maximum electrical output of 19.5 MW, with a BESS to create a hybrid electricity generation facility on each portion. This Hybrid power generation facility (on each portion) will have a higher dispatch level and allow for the generation of electricity for more hours of the day, as is desired in The Risk Mitigated Independent Power Producer Procurement Programme (RMIPPPP) currently underway by the Department of Mineral Resources and Energy (DMRE).

Field investigations were conducted on 10 & 11 October 2020.

1.2 Purpose of the study

The project requires Environmental Authorisations. Therefore a Basic Assessment (BA) process is required, which includes the need for specialist studies such as ecological and aquatic assessments. Therefore, a biodiversity assessment (which includes terrestrial ecology and aquatic ecology) is needed. The purpose of the study is to assess the natural environment of the site and to determine if any ecological sensitive habitats (including watercourses) are present; if any red data listed (RDL) fauna and flora are present; etc. If so, to highlight and assess the potential impacts the project might have on these environments and species and to recommend mitigating measures where and if necessary to reduce the impacts arising from the proposed project.

1.3 Quality and age of base data

The latest data sets were used for the report in terms of background information for veldtypes, ecosystems, threatened ecosystems, red data listed (RDL) fauna and flora species and priority areas.

The data used is of high quality and was sourced from the same data sets that are generally used and approved by most consultants and governmental organisations.

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

- Screening Tool: Dept. Environmental Affairs (DEA) – (www.screening.environment.gov.za).
- Threatened ecosystems: South African National Biodiversity Institute - (www.bgis.sanbi.org).

- RDL species: Red List of South Africa Plants (latest update) – (www.redlist.sanbi.org).
- Veldtypes and ecosystems: Mucina & Rutherford, 2006, 2010. Updated 2012.
- Endangered Wildlife Trust (EWT) – latest data sets – (www.ewt.org.za).
- SANBI data sets – latest updated website data (www. bgis.sanbi.org).
- Northern Cape Critical Biodiversity Areas (2016).

1.4 Assumptions and Limitations

The assumptions and limitations for the assessment are as follows:

- All information regarding the proposed project and related activities as provided by the Client are taken to be accurate.
- Field investigations were conducted on 10 & 11 October 2020, which forms part of the summer investigations.
- The summer investigations are deemed sufficient for the study site. A number of other specialist studies have recently been conducted on the area and these were also used as references. Therefore, adequate information has been collated.
- Precise buffer zones, regulated zones, etc. or exact GPS positions cannot be made using generalised corridors or kml files on Google Earth. However, buffer zones and delineations drawn are accurate to within a few metres;
- The latest data sets were used as background information and desktop review for the project. The data sets were verified and refined during field investigations (ground-truthing). These include inaccurate Wetland Map 5 delineations for the area.
- Equipment used: Standard soil augers; hand-held Garmin GPS instrument; EC & pH hand-held meters; IPhone 7 for photographs, MacBook Pro and Epson PC Laptops; Google earth maps, 1:50 000 South African topographical maps.
- Computer packages used: MS Word; MS Excel; Adobe Photoshop, ARC GIS; Google Earth; Garmin Base Maps; and

2 METHODOLOGY

2.1 Desktop assessment

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

organisations. A number of fairly recent specialist studies have been conducted in the De Aar area and on the study site itself. These studies were also consulted and reviewed.

2.2 Site investigations

Site investigations of the study site and surrounding areas were conducted on 10 and 11 October 2020. During field surveys cognisance was taken of the following environmental features and attributes:

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

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

2.3 Floristic Sensitivity

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

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

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

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

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

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

Each vegetation unit is subjectively rated on a sensitivity scale of 1 to 10, in terms of the influence that the particular Sensitivity Criterion has on the floristic status of the plant community. Separate Values are multiplied with the respective Criteria Weighting, which emphasizes the importance or triviality that the individual Sensitivity Criteria have on the status of each community.

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

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

2.4 Faunal Sensitivity

The different habitats within the study area and nearby surrounding areas were scrutinised for attributes that are deemed to be suitable for high diversity of fauna, as well as for Red Data species. Special consideration was given to habitats of pristine condition and high sensitivity.

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

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

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

2.5 Present Ecological State (PES)

The Present Ecological State (PES) is the current (present) ecological condition (state) in which the watercourses are found, prior to any further developments or impacts from the proposed project. The PES of watercourses found in the study area is just as important to determine, as are the potential impacts of the proposed development. The PES of a watercourse is assessed relative to the deviation from the Reference State (also known as the Reference Condition).

The reference state is the original, natural or pre-impacted condition of the system. The reference state is not a static condition but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES Method (DWA, 2005) was used to establish the present state (integrity) of the unnamed drainage line in the study area. The methodology is based on the modified Habitat Integrity approach of Kleynhans (1996, 1999). The criteria used for assessing the PES of watercourses are found in Table 1. The scores for the various attributes are found in Table 2. These criteria were selected based on the assumption that anthropogenic modification of the criteria and attributes listed under each selected criterion can generally be regarded as the primary causes of the ecological integrity of a watercourse.

Table 3 provides guidelines for determining the category of the Present Ecological Status (PES) based on the total score determined during assessments. This approach is based on the assumption that extensive degradation of any of the attributes may determine the PES of the watercourse (DWA, 2005).

Table 1: Habitat assessment criteria

Rating Criteria	Relevance
Hydrology	
Flow modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural lands. Changes in flow regime (timing, duration, frequency), volumes, and velocity, which affect inundation of wetland habitats resulting in floristic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.
Permanent inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.
Water quality	
Water Quality Modification	From point or diffuse sources. Measured directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment Load Modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats.

Geomorphology & Hydraulics	
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities, which reduce or changes wetland habitat directly in inundation patterns.
Biota	
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.
Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.
Invasive Plant Encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).
Alien Fauna	Presence of alien fauna affecting faunal community structure.
Over utilisation of Biota	Overgrazing, over fishing, over harvesting of plant material, etc.

Table 2: Scoring guidelines for habitat assessment

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

Table 3: Wetland integrity categories

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

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

2.6 Ecological Importance and Sensitivity (EIS)

Ecological importance and sensitivity (EIS) looks at the importance of the wetland, watercourse or water ecosystem in terms of biodiversity and maintenance. The determination is not just based on the identified watercourse in isolation, but also its' importance in terms of supplying and maintaining services to the larger catchment and water systems up and downstream.

The ecological sensitivity (ES) part of the EIS looks at how sensitive the system is to changes in services and environmental conditions. The Recommended Environmental Management Class (REMC) is the recommended state to which the watercourse should be returned to or maintained at. The EIS categories and descriptions are outlined in the table below (Table 4).

A high REMC relates to ensuring a high degree of sustainability and a low risk of ecosystem failure occurring. A low REMC would ensure marginal sustainability, but with a higher risk of ecosystem failure. The REMC is based on the results obtained from assessing the ecosystem / watercourse / wetland in terms of EIS, PES and function, and the desire to with realistic recommendations and mitigating actions to return the system to a certain level of functionality and original state. The determination of the Environmental Importance and Sensitivity (EIS) of the watercourses identified in the study area are shown below (Table 4).

Table 4: EIS Categories and Descriptions

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

2.7 Ecological Impact Assessment

2.7.1 Criteria for the classification of an impact

Scale (Extent)

Considering the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful

during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact.

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

Duration

Indicates what the lifetime of the impact will be.

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

Magnitude (Intensity)

Describes whether an impact is destructive or benign.

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

Probability

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

- Improbable: Likelihood of the impact materialising is very low.
- Low probability / possible: The impact may occur.
- Medium probability: It is more than likely that the impact will occur.

- Highly probable: High likelihood that the impact will occur.
- Definite / Unknown: The impact will definitely (most certainly) occur, or is unknown and therefore needs to be afforded a high probability score.

Significance

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

Status

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

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

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

2.7.2 Scoring Method

The impact assessment takes into account the nature, scale and duration of the effects on the natural environment and whether such effects are positive (beneficial) or negative (detrimental). A scoring method (rating system) is applied to the potential impact on the affected environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each issue the following criteria are used and points awarded as shown below in Table 5.

Table 5: Scoring method for impact assessment

Magnitude (Intensity)	**Duration**
10 - Very high/unknown	5 - Permanent
8 - High	4 - Long-term*
6 - Moderate	3 - Medium-term (5-15 years)
4 - Low	2 - Short-term (0-5 years)
2 - Minor	1 - Immediate
0 - None	0 - None
Scale (Extent)	**Probability**
5 – International	5 – Definite / Unknown
4 – National	4 – Highly probable
3 – Regional	3 – Medium probability

2 – Local	2 – Low probability
1 - Site only	1 – Improbable
0 – None	0 – None

* Impact ceases after operational life of the activity

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:

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

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

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

3 RECEIVING ENVIRONMENT

3.1 Study Site Location

The study site is located approximately 6 km east of the town of De Aar, in the Emthanjeni Local Municipality, Northern Cape Province (Figure 1). The study site is situated on the Remaining Extent of the Farm Vetlaagte 4. The study site consists of 5 individual portions as numbered below in Figure 2, below.

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

- De Aar: 30°38'51.38"S; 24°00'39.89"E.
- Approximate centre of each of the 5 Portions of the Study Site:
    - A: 30°38'51.04"S; 24° 5'26.19"E.
    - B: 30°39'27.46"S; 24° 5'27.29"E.
    - C: 30°40'1.18"S; 24° 5'31.53"E.
    - F: 30°42'1.40"S; 24° 5'8.82"E.
    - G: 30°41'25.11"S; 24° 5'56.66"E.
- Quarter Degree Square (QDS): 3024CA.
- Quaternary Drainage Area (QDA): D62D.

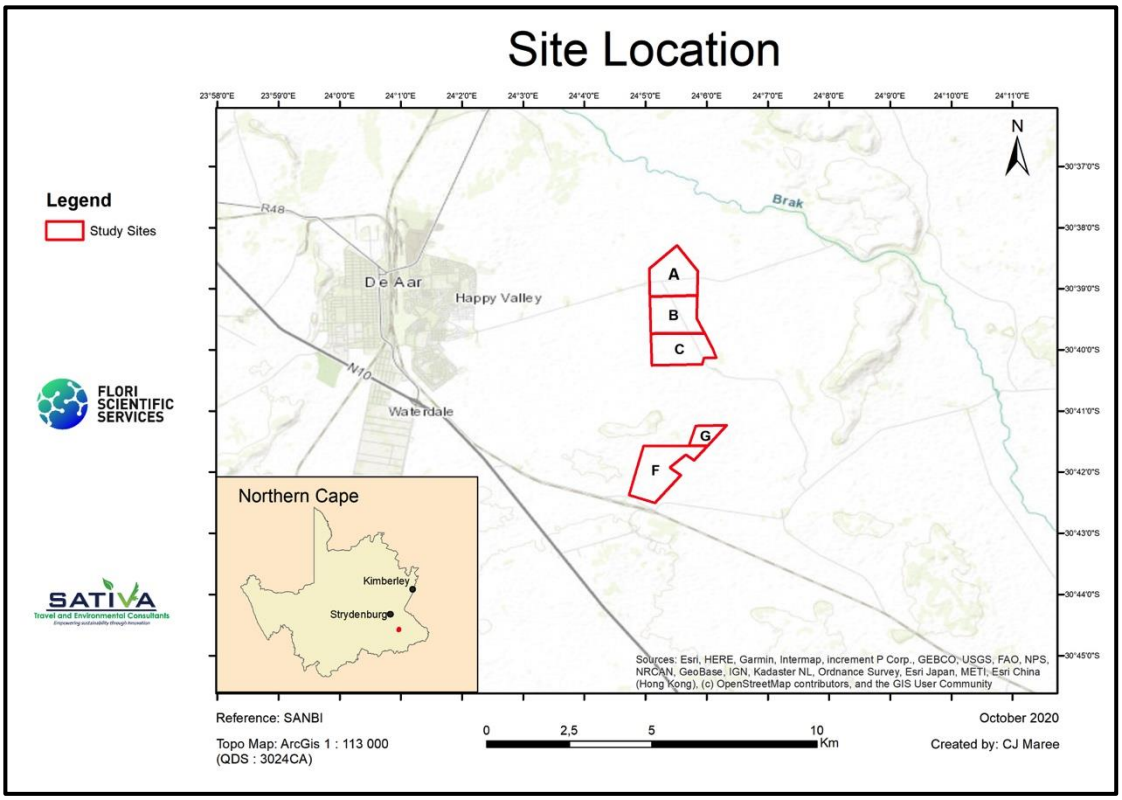

Figure 1: Study site location

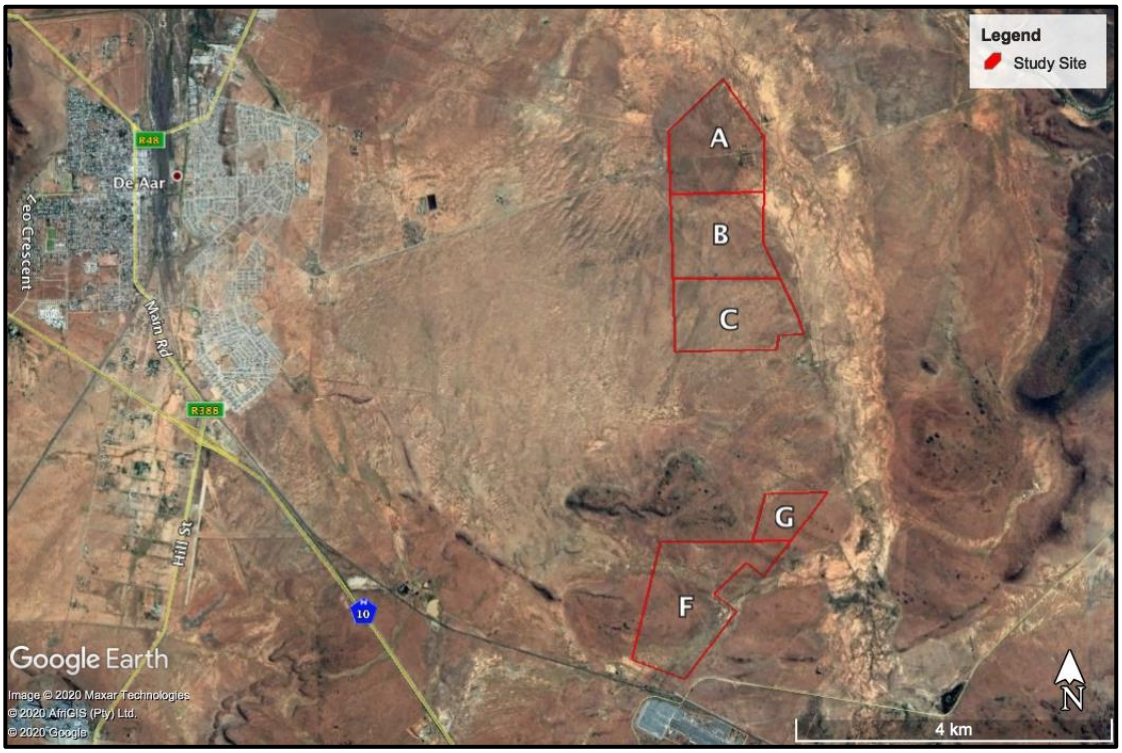

Figure 2: Site location (Google Earth)

3.2 Topography

The topography of the area is that of flat to gently undulating plains, with isolated hills, mountains and inselbergs. Many of these mountains have flat, plateaus. Broad but shallow valleys or ancient watercourses and drainage lines are spread throughout the area, in which highly seasonal and ephemeral streams flow. The study site is situated on flat to gently undulating plains with a broad shallow valley / ancient floodplain along the eastern boundaries.

The average height above sea level (asl) across Portions A, B & C is about 1 246 m with a downward slope from south to north and west to east, with an average slope of 1,2%. The average height above sea level across Portions F & G is about 1 285 m with a downward slope from south to north and south and east into the shallow valley, with an average slope of 0,85 – 1,7%.

3.3 Geology and Soils

Shales of the Volksrust Formation and to a lesser extent the Prince Albert Formation (both of the Ecca Group) as well as Dwyka Group diamictites form the underlying geology of the study site and area in which Northern Upper Karoo veldtype dominants. Jurassic Karoo Dolerite sills and sheets support this vegetation complex in places. Superficial deposits, including calcretes, of the Kalahari Group cover wide stretches of land in the region (Mucina & Rutherford, 2006). Soils are variable from shallow to deep, red-yellow, apedal, freely drained soils to very shallow Glenrosa and Mispah forms. Land types are mostly those of Ae, Ag and Fc.

Short descriptions of the prominent landtypes of the study area are shown below (Table 6).

Table 6: Description of land types found in the region

Land Type	Description
Ae	Red-yellow apedal, freely drained soils (Red, high base status soils, > 300 mm deep, without dunes). Moderately deep (average 500-1200 mm) red, freely drained, apedal (= structureless) soils. Soils occur in areas associated with low to moderate rainfall (300-700 mm per annum) in the interior of South Africa and have a high fertility status. A wide range of texture occurs (usually sandy loam to sandy clay loam).
Ag	Red-yellow apedal, freely drained soils (Red, high base status soils, < 300 mm deep). These shallow (< 300 mm), red, freely-drained, apedal (= structureless) soils occur in arid to semi-arid areas associated with low rainfall (< 500 mm per annum) and are underlain by hard to weathered rock. A wide range of textures may occur (usually loamy sand to sandy loam). Stones or rocks are often present on the soil surface.
Fc	Glenrosa and/or Mispah forms (other soils may occur); lime generally present in the entire landscape. Generally shallow soils consisting of a topsoil directly underlain by weathered rock (Glenrosa form) or hard rock (Mispah form), sometimes with surface rock and steep slopes. Found in drier areas than some of the broad soils patterns of the region or areas on base-rich parent materials, so that lime occurs throughout the landscape.

3.4 Climate

The average annual rainfall for De Aar is approximately 297 mm (en.climate-data.org). The study site is situated within the drier rainfall region (201+ mm to 400 mm) of South Africa (Figure 3) and in the Cold Interior Climate Zone (Figure 4).

Rainfall in the regions peaks in early autumn (March). The mean annual precipitation (MAP) across the region ranges from about 190 mm in the west to 400 mm in the northeast. Mean maximum and minimum monthly temperatures for Britstown are 37,9°C and –3,6°C for January and July, respectively. Corresponding values are 37,1°C and –4,8°C for De Aar and 39,0°C and –2,3°C for Kareekloof (northwest of Strydenburg) (Mucina & Rutherford, 2006).

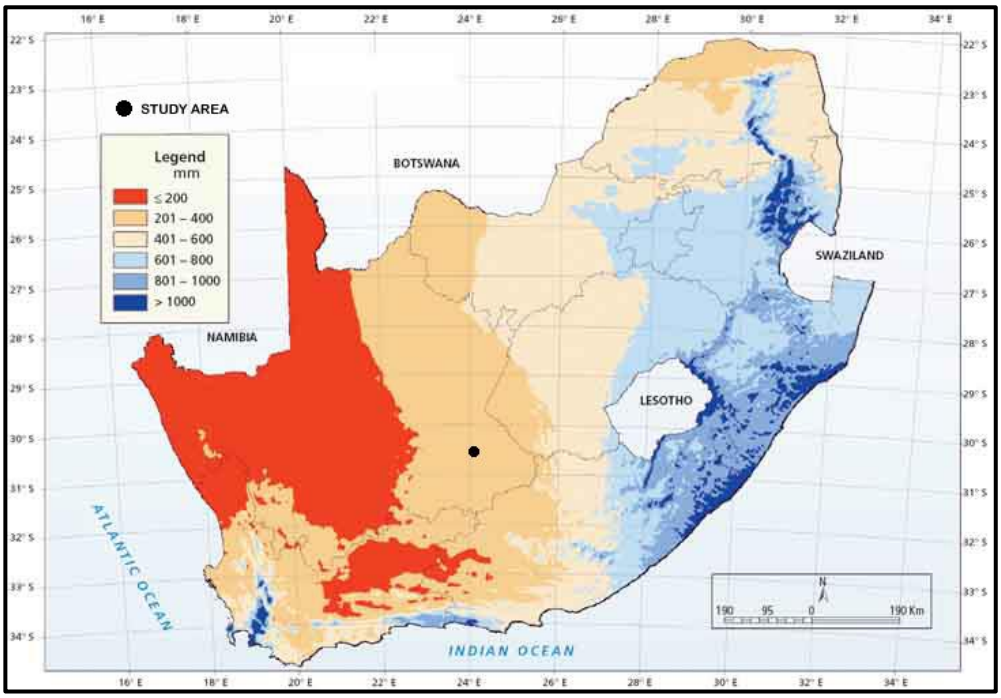

Figure 3: Rainfall zones of South Africa

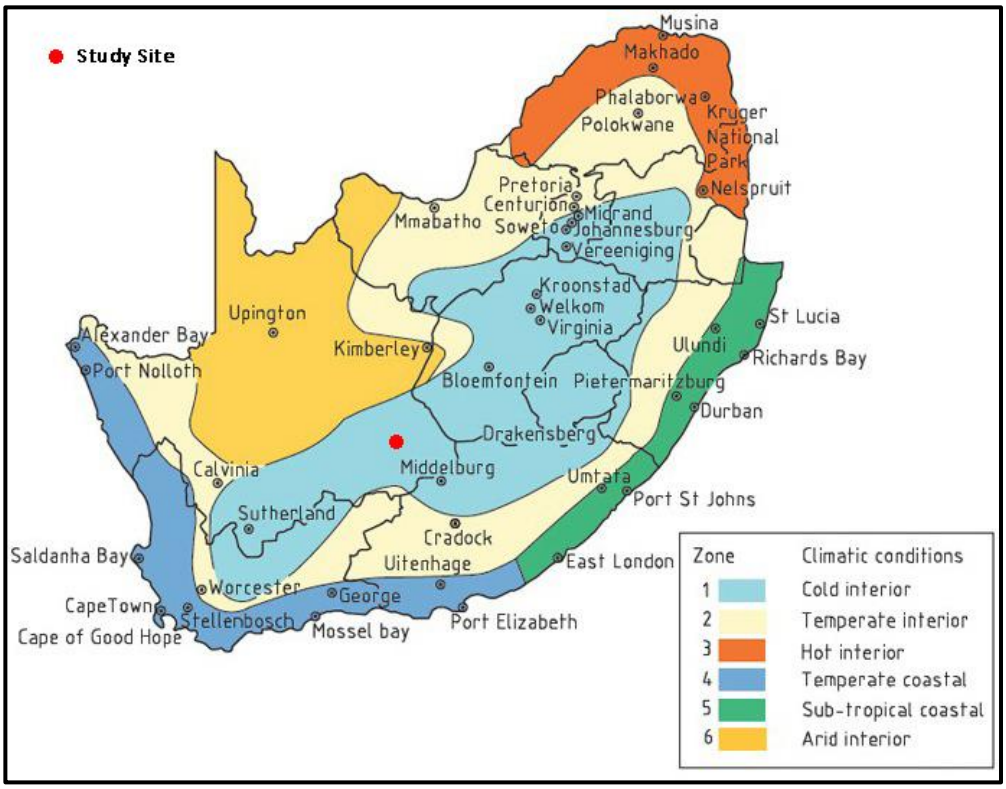

Figure 4: Climatic zones of South Africa

3.5 Landcover

The landcover of the study area is predominantly open, Karoo shrubland, with little to no development, dwellings and structures. The area is mostly used for grazing of livestock, with low levels of cultivation type agriculture. The levels of urbanisation are very low, with the small town of De Aar being the highest nearby urban area.

4 TERRESTRIAL ECOLOGY

4.1 Vegetation

The study site is situated in the Nama-Karoo Biome of South Africa (Figure 5). The site is within the original extent of the veldtype (or ecosystem) known as Northern Upper Karoo (Figure 6). The veldtype is part of the Upper Karoo Bioregion of the Nama-Karoo Biome.

The Nama-Karoo flora is not particularly rich, and in comparison with analogous biomes on other continents, does not stand out in contrast to the Succulent Karoo (Cowling et al. 1998). The Nama-Karoo Biome does not contain any centre of endemism (Van Wyk & Smith 2001). Unlike other biomes of South Africa, local endemism is very low (with the highest number of local endemics concentrated in

the Upper Karoo Hardeveld). Asteraceae (daisy family), Fabaceae (pea family) and Poaceae (grasses) are the dominant families in the Nama-Karoo, which is common in the floral make-up of arid and semi-arid regions. In the north and east of the Nama-Karoo Biome Poaceae, Fabaceae and elements of tropical summer-rainfall floras (i.e. Acanthaceae, Capparaceae and Cucurbitaceae) become more prevalent (Mucina & Rutherford, 2006, 2010).

The Nama-Karoo Biome is subdivided into three broad Bioregions, namely, Upper Karoo, Lower Karoo and Bushmanland & West Griqualand. (Figure 5). The hierarchy of the vegetation units (veldtypes) in which the study site is situated is shown below in Table 7.

Table 7: Hierarchy of vegetation of the study site

Category Description	Classification
Biome	Nama-Karoo
Bioregion	Upper Karoo
Vegetation Types	Northern Upper Karoo
Conservation Status	Least Threatened / Least Concern

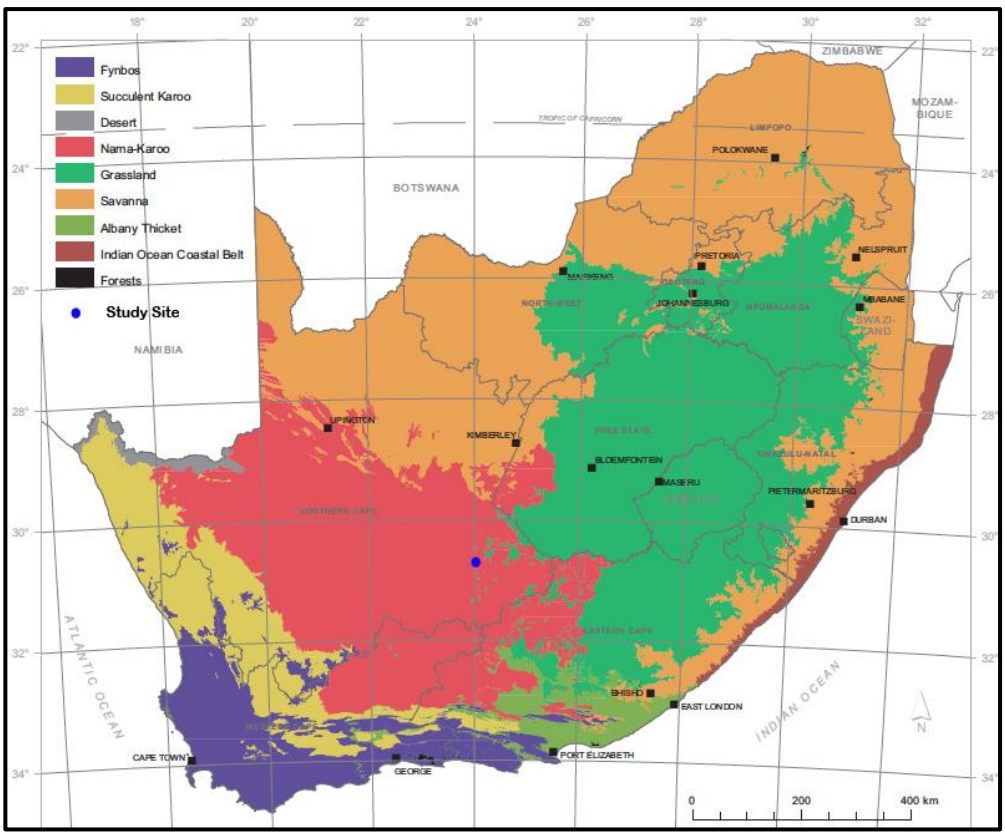

Figure 5: Biomes

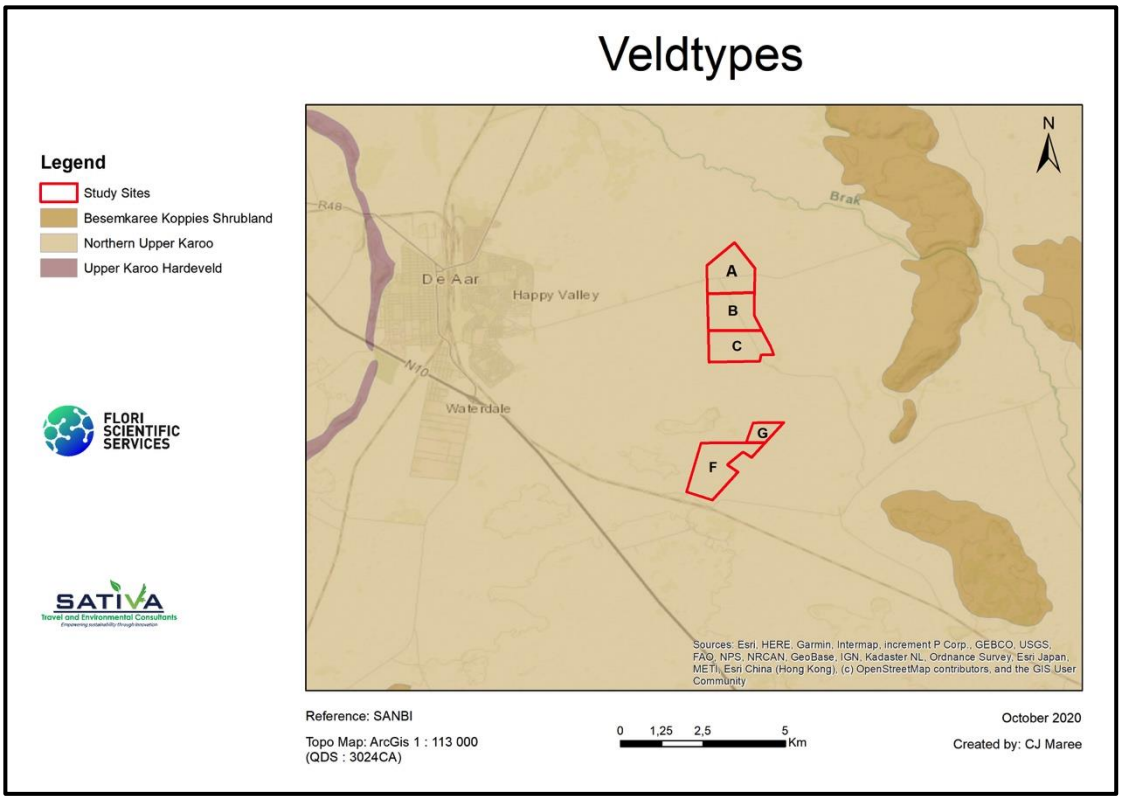

Figure 6: Veldtypes

Northern Upper Karoo is a veldtype (or ecosystem) that is characterised by shrubland dominated by dwarf Karoo shrubs, grasses and *Acacia mellifera* subsp. *detinens* (=Vachellia mellifera) and some other low small trees (especially on sandy soils in the northern parts and vicinity of the Orange River). The topography tends to be flat to gently sloping plains, with isolated hills of Upper Karoo Hardeveld in the south and Vaalbos Rocky Shrubland in the northeast and with many interspersed pans (Mucina & Rutherford, 2006).

4.1.1 Vegetation of the study site

No Red Data Listed (RDL) plants were observed during field investigations and none are expected to occur. Previous specialist studies conducted on the same sites also found no RDL plant species (Hoare, 2012). The main species observed on site are listed in the appendices.

4.1.2 Protected trees

The only potential protected tree species occurring in the region and potentially the study site is the Shepherd's tree (*Boscia albitrunca*). However, during previous investigations (Hoare, 2012) and the latest investigations undertaken for this study, no Shepherd's trees were found on site. It is safe to say that there are no protected trees in the study area.

According to the National Forests Act (Act No. 84 of 1998): *"No person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister."*

Any removal or pruning of these species will require a license to be issued from the administrators of the National Forests Act. These act as an extension of the Department of Agriculture, Forestry and Fisheries (DAFF).

4.2 Conservation status

The study site is situated within the veldtype of Northern Upper Karoo, which is not a threatened ecosystem. The conservation statuses of the veldtypes (ecosystems) and a short description of their statuses are shown in the table below (Table 8).

Table 8: Veldtype status

Veldtype	Status	Information
Northern Upper Karoo	Least Threatened (LT) or Least Concern (LC)	Little to no none of the veldtype is conserved in statutory conservation areas (formal protected areas). About 4%+ has been cleared for cultivation (the highest proportion of any type in the Nama-Karoo) or irreversibly transformed by building of dams (Houwater, Kalkfontein and Smart Syndicate Dams). Areas of human settlements are increasing in the northeastern part of this vegetation type (Hoffman *et al.* 1999). Erosion is moderate (46.2%), very low (32%) and low (20%).

The Biodiversity Act, 2004 (Act No.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). The criteria for determining the status of an ecosystem (or veldtype) are shown below in Table 9, with the levels or structure shown in Figure 7 (Mammal Red List, 2016).

Table 9: Ecosystem Status: Simplified explanation of categories used

STATUS	% Transformed	Effect on Ecosystem
Least Threatened (LT) / Least Concerned (LC)	0-20% (<20% loss)	No significant disruption of ecosystem functions

Vulnerable (VU)	20-40% (>20% loss)	Can result in some ecosystem functions being altered
Endangered (EN)	40-60% (>40% loss)	Partial loss of ecosystem functions
Critically Endangered (CR)	>60% or BT Index for that specific veldtype	Species loss. Remaining habitat is less than is required to represent 75% of species diversity

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

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

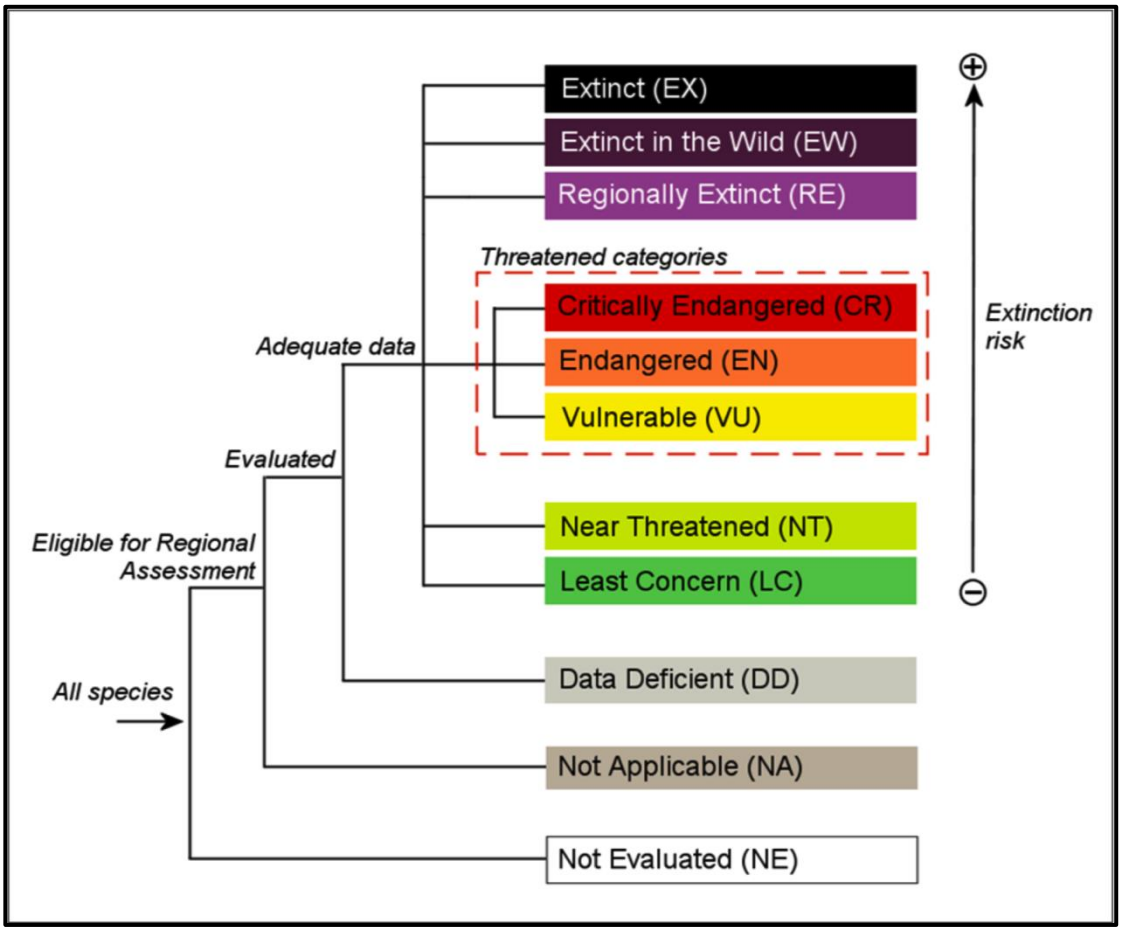

Figure 7: Structure of categories used at the regional level

4.2.1 Alien plants identified in the Study Area

A few Alien Plant Species were identified in the study area. The main weed species present in the area is Honey Mesquite (*Prosopis glandulosa*). Honey Mesquite is a Category 2 declared weed. There were no major areas of invasive weed infestation.

The categories are as set out in the Conservation Act of Agricultural Resources Act, 1983 (CARA) (Act 43 of 1983) and more recently NEM:BA, 2004 (Act No. 10 of 2004): Alien Invasive Species List 2016).

Prosopis glandulosa is regarded as one of the 12 agriculturally most important invasive alien plants in South Africa, and is widely distributed in Northern Upper Karoo veldtype (Hoffman et al. 1999). *Prosopis* occurs in generally isolated patches, with densities ranging from very scattered to medium (associated with the lower Vaal River drainage system and the confluence with the Orange River) to localised closed woodland on the western border of the unit with Bushmanland Basin Shrubland (Mucina & Rutherford, 2006).

4.3 Fauna

4.3.1 Mammals

There is one mammal species of low conservation concern that could potentially occur in the general area, namely, Geoffroy's Horseshoe Bat. The bat is a cave-dwelling species, which limits its distribution. There are no caves in the study area and therefore no roosting / ideal habitat. However, there is a very low possibility that there are some bats dwelling in rock crevices in the hills east and northeast of the site.

Black-footed cat and Cape fox are two mammals that are protected under the National Environmental Management: Biodiversity Act and may potentially occur in the region. It is possible that that these species may traverse the site while foraging, but that it was unlikely that they would occur there as permanent residents. This is primarily due to the close proximity of the site to the town of De Aar. The proximity of humans and domestic animals, such as dogs, are factors that would lead to these animals not occurring on site (Hoare, 2012).

There are no reptile species of conservation concern that have a distribution that includes the study area.

4.3.2 Avifauna

There are 10 priority bird species that have a medium to medium/high probability of occurring on the study site from time to time. Seven are threatened species all with a status of 'Vulnerable' and three with a status of 'Near Threatened'. The species likely to use parts of the site for breeding are the Blue Crane (*Anthropoides paradiseus*), Blue Korhaan (*Eupodotis caerulescens*), Kori Bustard (*Ardeotis kori*), Ludwig's Bustard (*Neotis ludwigii*) and Secretarybird (*Sagittarius serpentarius*). The other species, the

African Marsh Harrier (*Circus ranivorus*), Lanner Falcon (*Falco biarmicus*), Lesser Kestrel (*Falco naumanni*), Martial Eagle (*Polemaetus bellicosus*) and Tawny Eagle (*Aquila rapax*), may use the site or parts of the site for foraging. Large flocks of Lesser Kestrel have been observed in this area during previous field surveys (Hoare, 2012).

According to Hoare (2012) the only faunal species of concern potentially occurring on the study site are avifaunal species, namely: Blue Crane (VU), Blue Korhaan (NT), Kori Bustard (VU), Ludwig's Bustard (VU), and Secretarybird (NT).

4.3.3 Faunal Hotspots

The maps below show the areas of South Africa that are hotspots for faunal species of conservation concern for snakes, lizards and butterflies (Figure 8, Figure 9 & Figure 10). The study site is not situated within any quadrants that are hotspots for snakes, lizards or butterflies. The topography and climate of the study area are not ideal for many species of butterflies and lizards, in particular. Butterflies tend to be very specific as to the host trees or shrubs they lay their eggs on and the study site is all but void of trees and shrubs. Lizards ideally prefer rocky outcrops, ridges with good cover and enough vegetation, which lures in potential prey / food for them. This along with good rainfall leads to the lack of ideal habitats for many of these faunal groups.

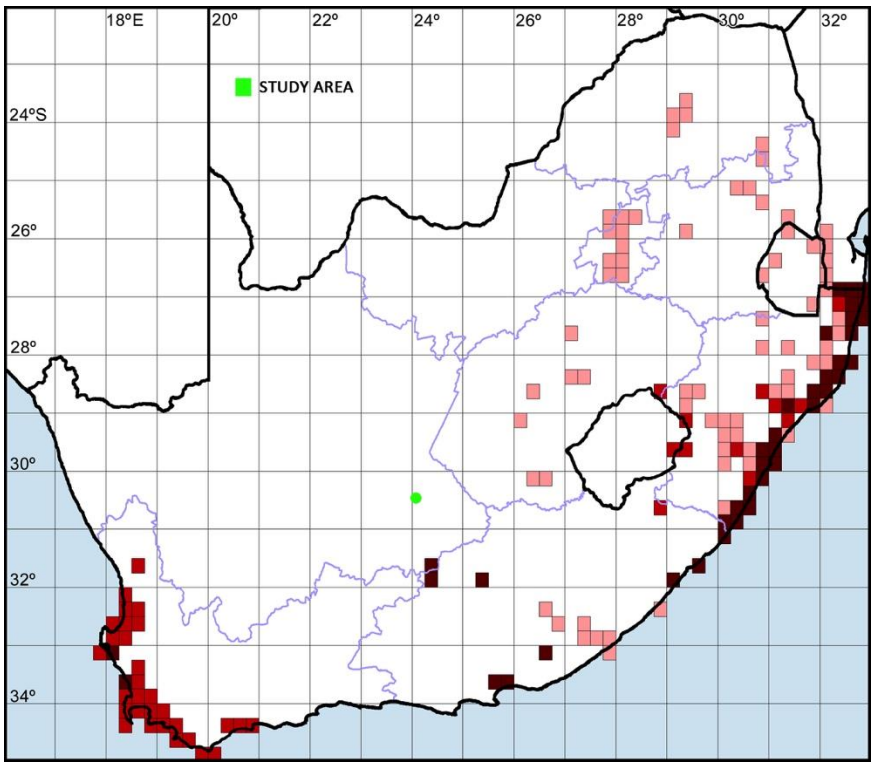

Figure 8: Snake hotspots

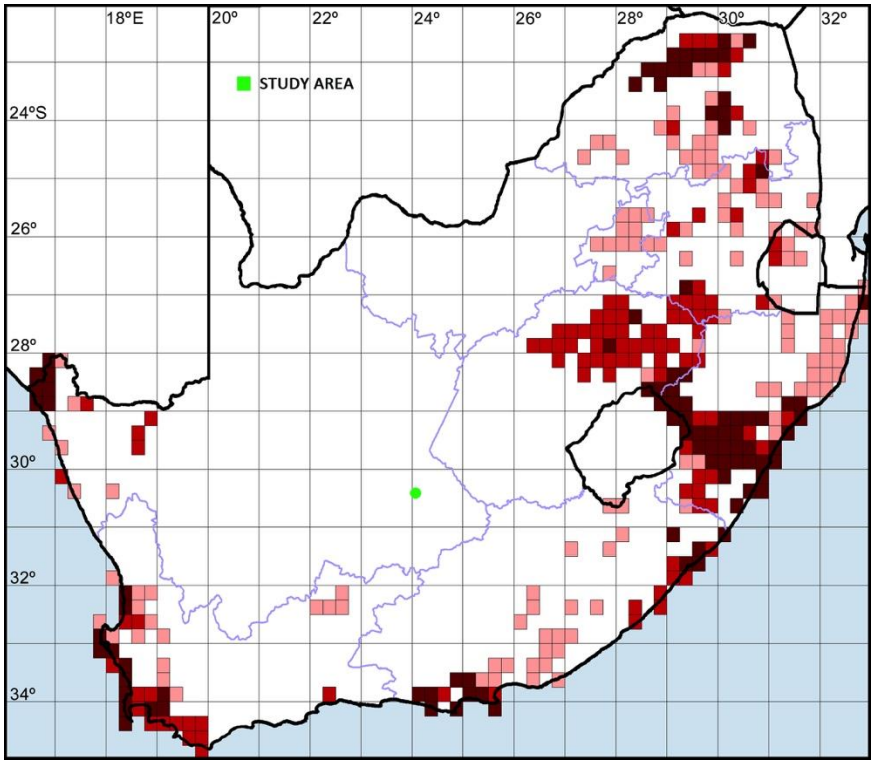

Figure 9: Lizard hotspots

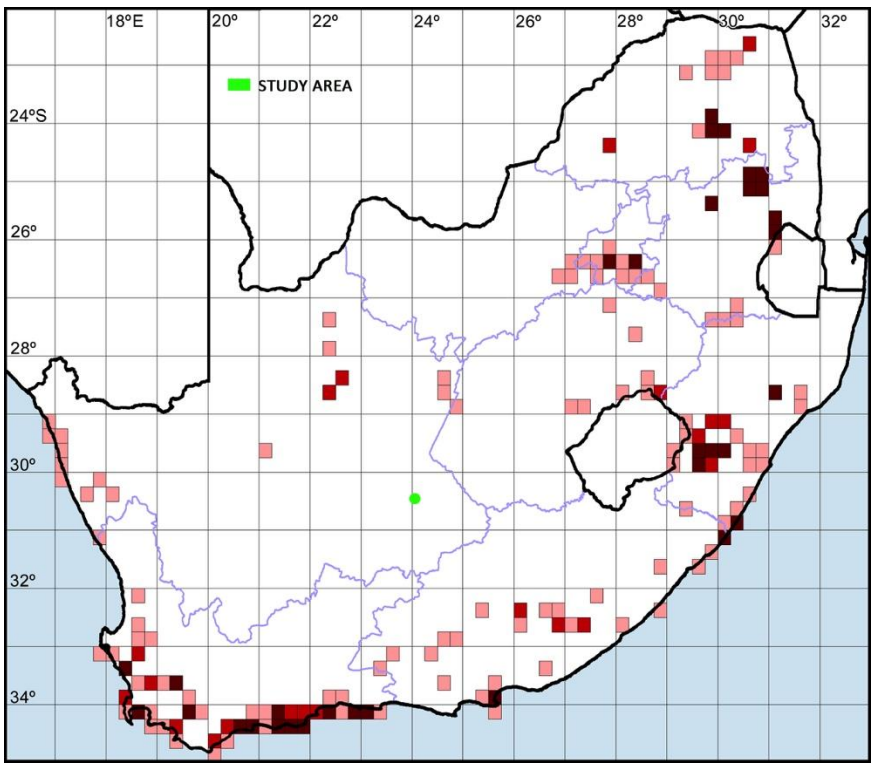

Figure 10: Butterfly hotspots

5 AQUATIC ECOLOGY

The aquatic ecology focuses on the natural surface water (watercourses) within the study site. These watercourses include wetlands, rivers, streams, pans, lakes and natural drainage lines. Manmade structures such as dams or canals are also considered, although these are not necessary as sensitive as natural systems. A pan (freshwater and saltwater) is a type of wetland and must be approached as such. The focus is to delineate watercourses and limit any impact the project might have on these watercourses. All watercourses in South Africa, regardless of their actual condition or ecological state are, by default, viewed as sensitive.

5.1 Watercourses in the study area

There are no perennial rivers or even semi-perennial rivers in the study area. The main river in the region is the Brak River, which is a semi-perennial river in the area of the study site and that flows north of the study site in a generalised southeast to northwest direction and eventually into the Orange River (Figure 11). Mapping datasets from Department of Water and Sanitation (DWS) (as used in Figure 11) only shows two smaller seasonal unnamed streams in the region that are tributaries of the Brak River.
East along the study site is a broad, shallow ancient floodplain or river system that feeds into the Brak River. The area is clearly visible in satellite photos as a lighter colour than the surrounding areas. However, these photos can give the false impression that these systems (which are common in the dry Karoo and Kalahari regions of the country) are active rivers, which they are not. The area east of the study site is a highly erratic and ephemeral watercourse (drainage system), which almost never flows, end to end, even during periods of significant rainfall. The 1:100 year floodlines do not even extent beyond the boundaries of drainage system. SANBI Wetland mapping datasets classify the system as a river.

During site investigations (10 & 11 October 2020) some small patches of surface water were found scattered within the ‘river bed’ / valley area. Many of these are formed by either impounded surface water flow or boreholes that discharge water into a small impoundment to create a drinking area for livestock. Both are manmade activities and structures. It is possible that one or two are from natural shallow springs, but it is difficult to tell due to regular activities in and out of the sites.

The latest dataset for NFEPA systems and Watercourses obtained from SANBI is Wetland Map 5 (2018) (www.bgis.sanbi.org). According to Wetland Map 5 the watercourse east of the study site is classified as a river, which is correct and was verified during site investigations (ground-truthing) (Figure 12).

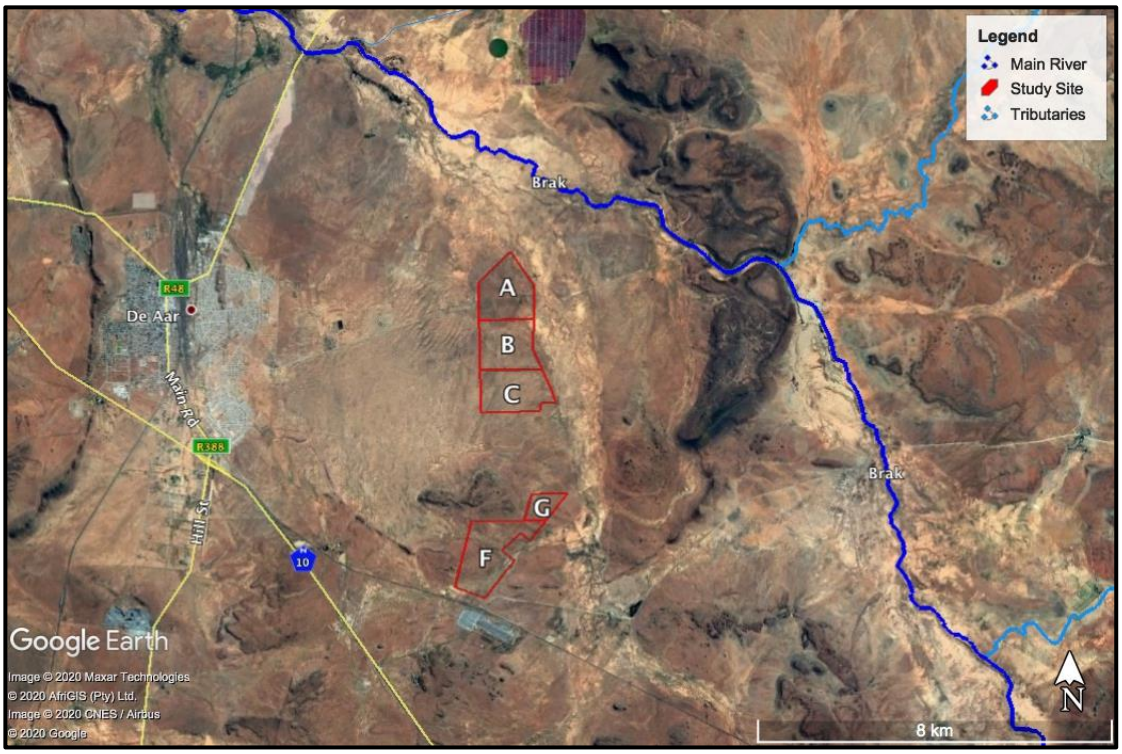

Figure 11: Main rivers in the area

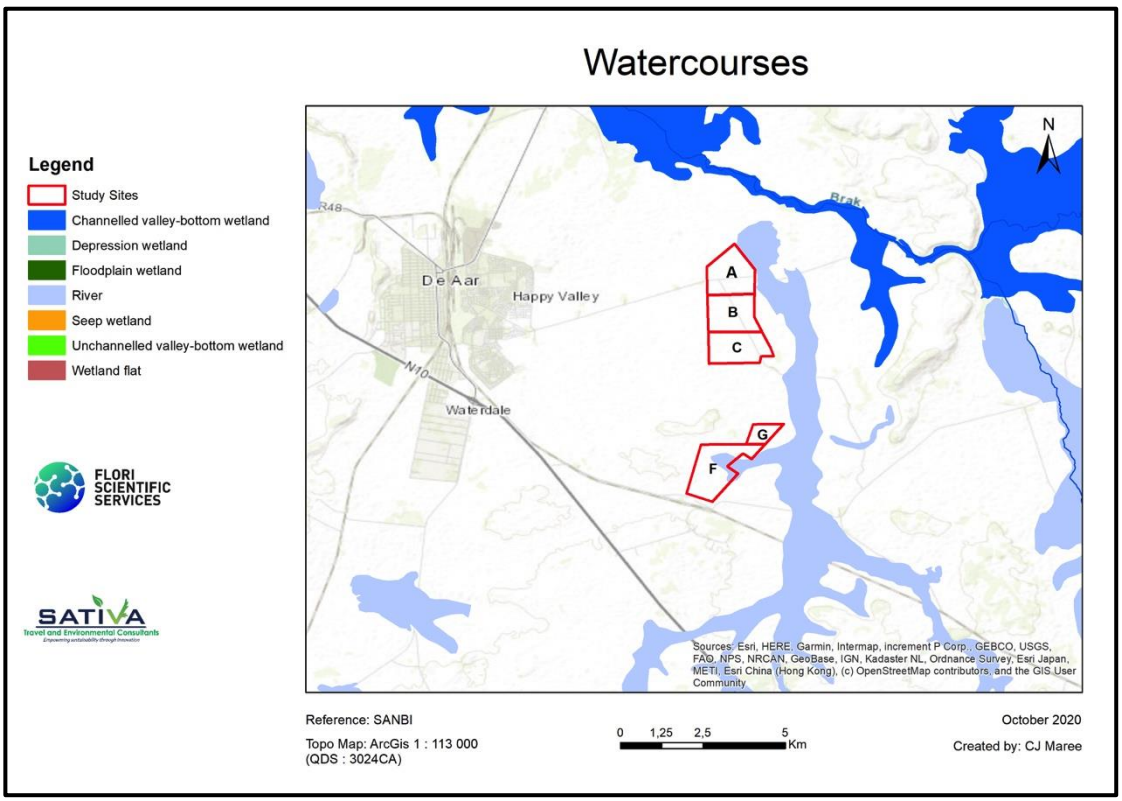

Figure 12: Watercourses - Wetland Map 5 (2018)

5.2 Classification of watercourses in the study area

There are no perennial rivers, streams or wetlands in the study area itself. There is a drainage system east of the site. These watercourses were identified and delineated during field investigations, up to Level 4, in terms of various levels as refined for South Africa by Kleynhans, *et. al*. (2005) and used in the Classification System for Wetlands user manual – SANBI Series 22 (Ollis *et. al.* 2013). See table below (Table 10).

Table 10: Classification levels 1 - 4

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

Table 11: Classification of Watercourses

Delineated systems	Level 1 System	Level 2 Regional Setting (Ecoregion)	Level 3 Landscape Unit	Level 4 HGM Unit
Brak River	Inland	Upper Nama-Karoo	Valley Floor	River (Lowland)
Tributaries	Inland	Upper Nama-Karoo	Valley Floor	River (Lowland)
Drainage System	Inland	Upper Nama-Karoo	Valley Floor	River (Lowland)

5.3 Drainage areas

The study area is situated within the Primary Drainage Area (PDA) of **D** and the Quaternary Drainage Area (QDA) of **D62D** (Figure 16). The catchment area is within the Orange Water Management Area (WMA 6) and under the jurisdiction of the Orange Catchment Management Agency (CMA 6) (Figure 15). The site is not situated within a priority quaternary drainage catchment, in terms of guidelines and legislation from the Department of Water & Sanitation (DWS). The table below gives a summary of the catchment areas and management areas for the study site (Table 12).

South Africa is geographically divided up into a number of naturally occurring Primary Drainage Areas (PDAs) and Quaternary Drainage Areas (QDAs) (Figure 13). The different areas are demarcated into Water Management Areas (WMAs) and Catchment Management Agencies (CMAs). Until fairly recently there were 19 WMAs and 9 CMAs. Figure 14 shows the extent of the old (or previous) Water Management Areas (WMAs). As of September 2016, these were revised and there are now officially only 9 WMAs, which correspond directly in demarcation to the 9 CMAs (Figure 15) (Government Gazette, 16 September 2016. No.1056, pg. 169-172).

Table 12: Summary of Catchment Areas for the study site

Level	Category
Primary Drainage Area (PDA)	D
Quaternary Drainage Area (QDA)	D62D
Water Management Area (WMA) – Previous / Old	Lower Orange
Water Management Area (WMA) – New (as of Sept. 2016)	Orange (WMA 6)
Sub-Water Management Area	Orange Tributaries
Catchment Management Agency (CMA)	Orange (CMA 6)
Wetland Vegetation Ecoregion	Upper Nama-Karoo
Strategic Water Source Area (SWSA)	Yes (De Aar)
Priority Quaternary Catchment	No
Fish FEPA	No
Fish FSA	No

Fish Corridor	No
Fish Migratory Corridor	No
Priority Quaternary Catchment	No

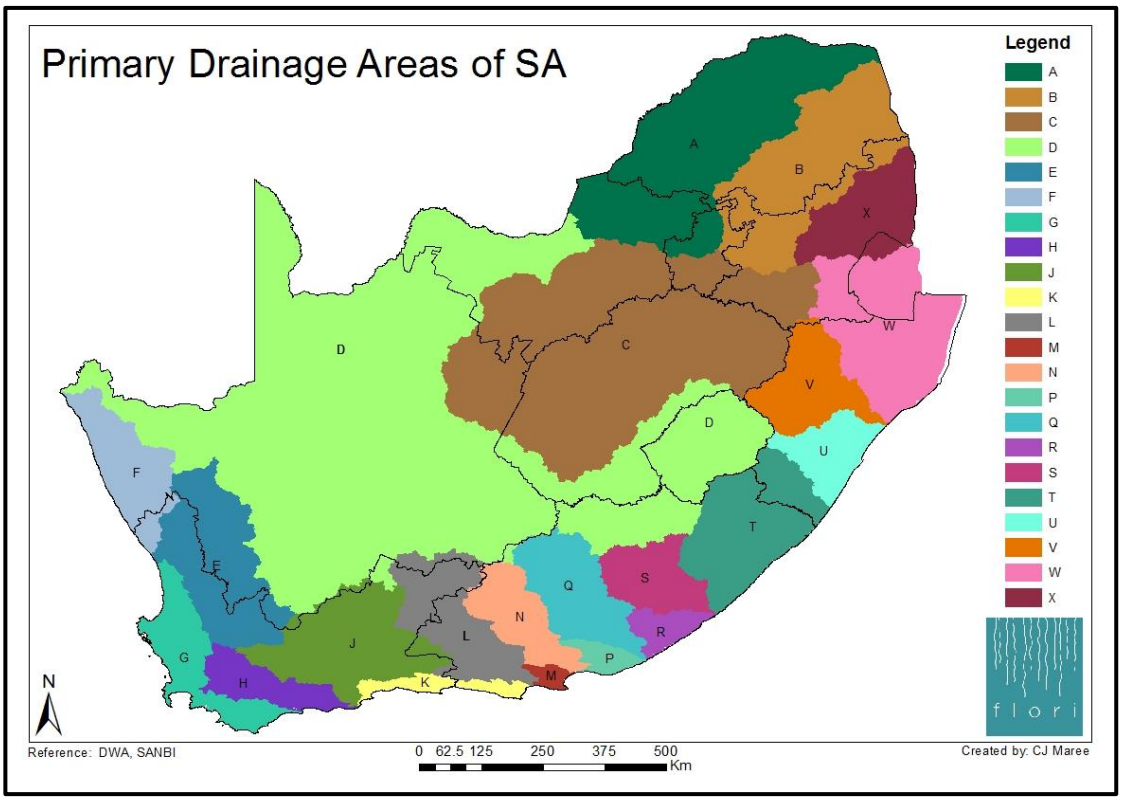

Figure 13: Primary drainage areas of South Africa

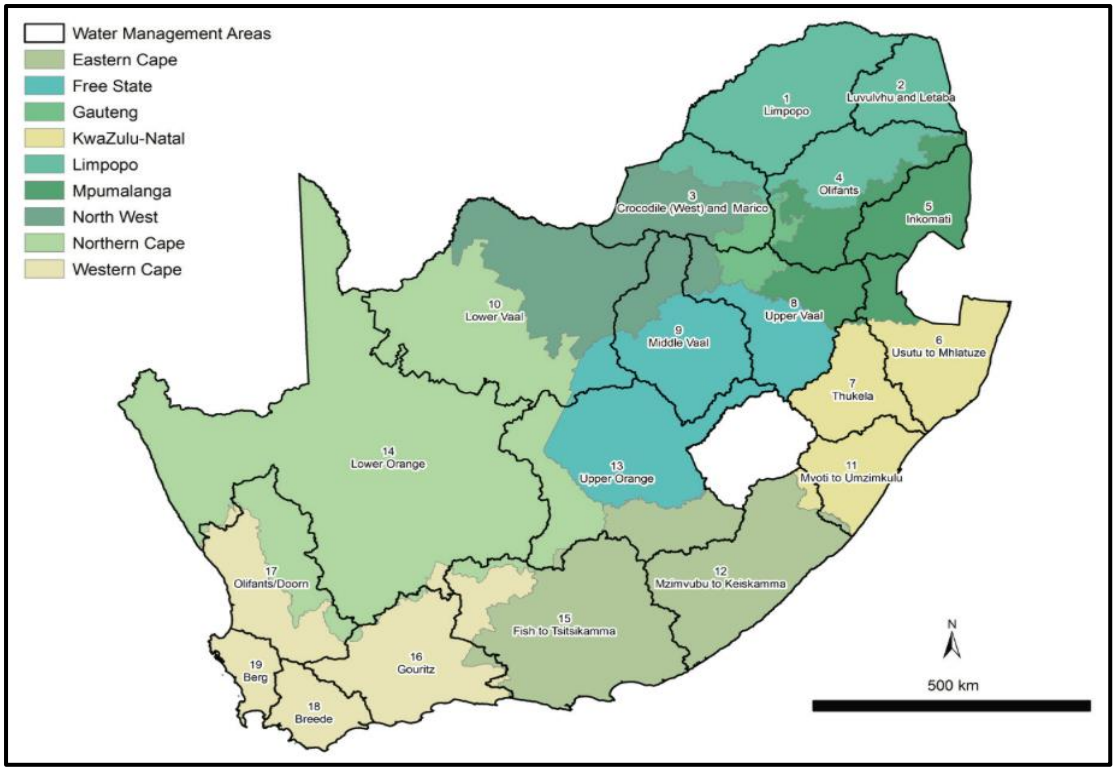

Figure 14: Old WMAs of South Africa

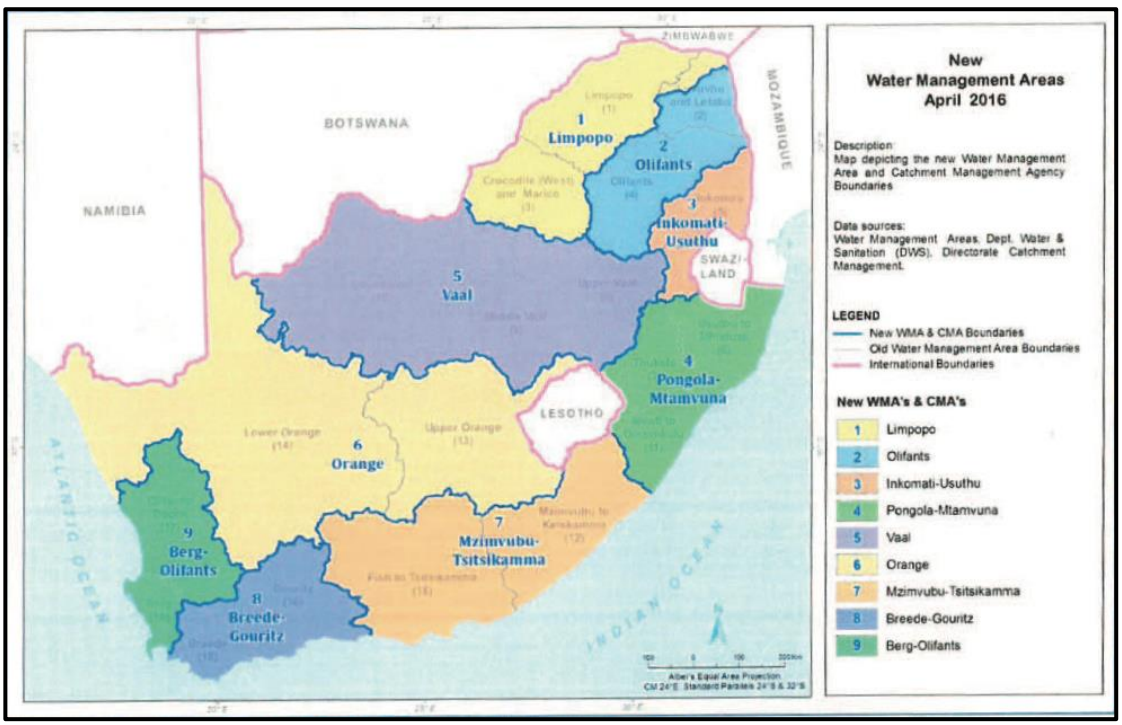

Figure 15: New WMAs & CMAs of South Africa

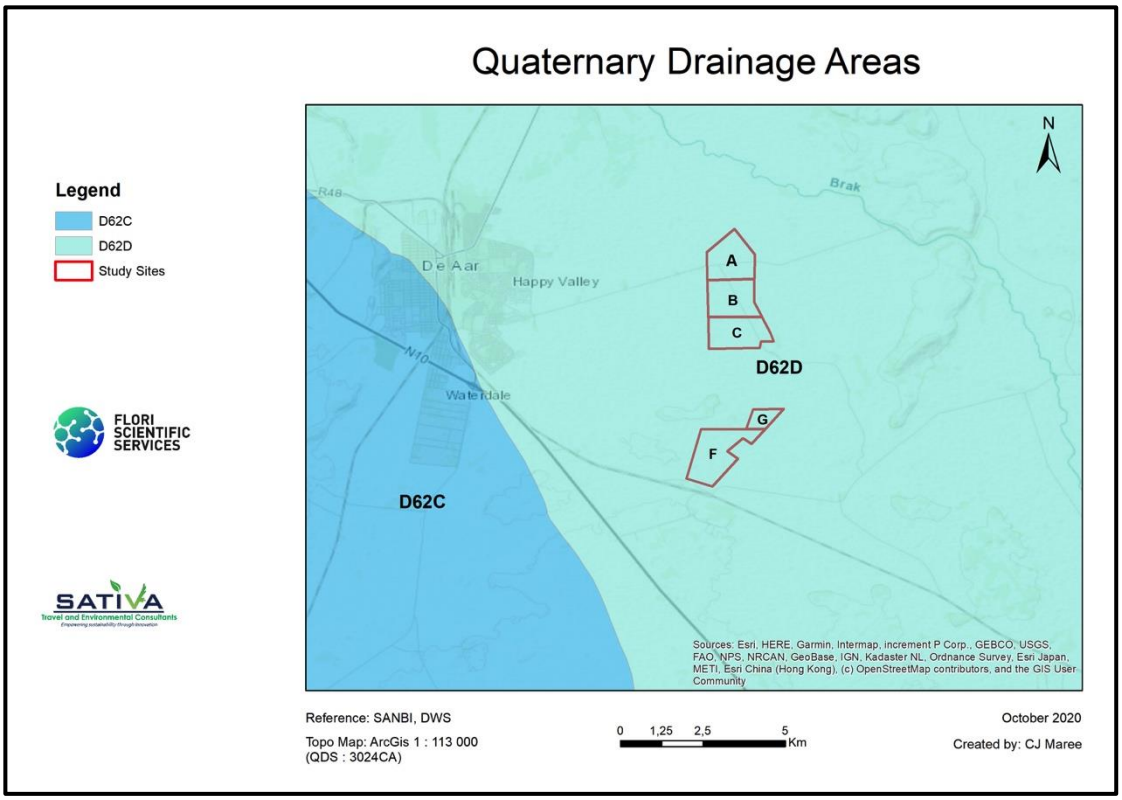

Figure 16: Quaternary drainage areas (QDAs)

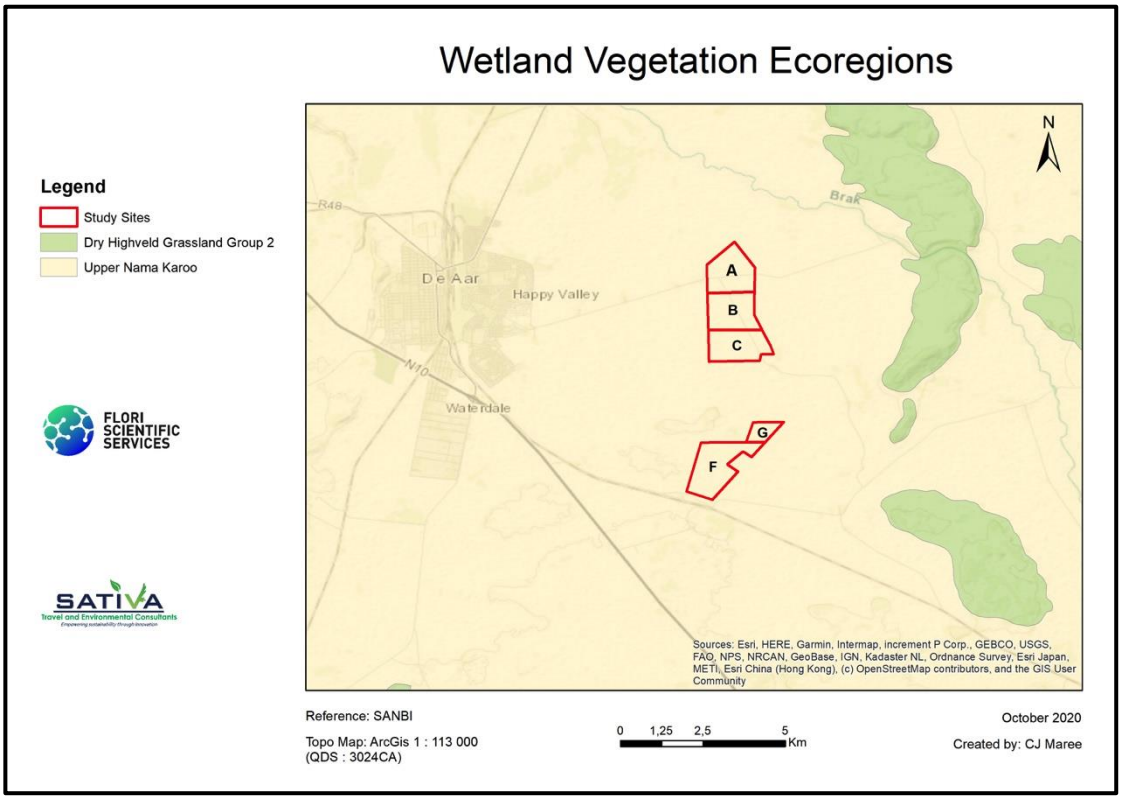

Figure 17: Wetland Vegetation Ecoregions

5.4 Strategic water source areas (SWSA) of South Africa

The study area is not situated within a national Strategic Water Source Area (SWSA) of South Africa (Figure 18). However, it is within a provincial or local Water Source Area (WSA) known as the De Aar WSA (Figure 19).

The area in which the study site is situated is a dry part of the country and does not have significant surface water run-off. However, the area has important (or is important) in terms of ground water sources. Either in terms of high ground water recharges levels or good aquifers that are important sources of freshwater. It is important to emphasize that the project will not have an impact at all on the ground water of the area.

A national Strategic Water Source Areas of South Africa (SWSA) are those areas that supply a disproportionate amount of mean annual runoff in relation to the size of the geographical region. These areas are important because they have the potential to contribute significantly to overall water quality and supply, supporting growth and development needs that are often a far distance away. These areas make up 8% of the land area across South Africa, Lesotho and Swaziland, but provide 50% of the water in these countries (SANBI).

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

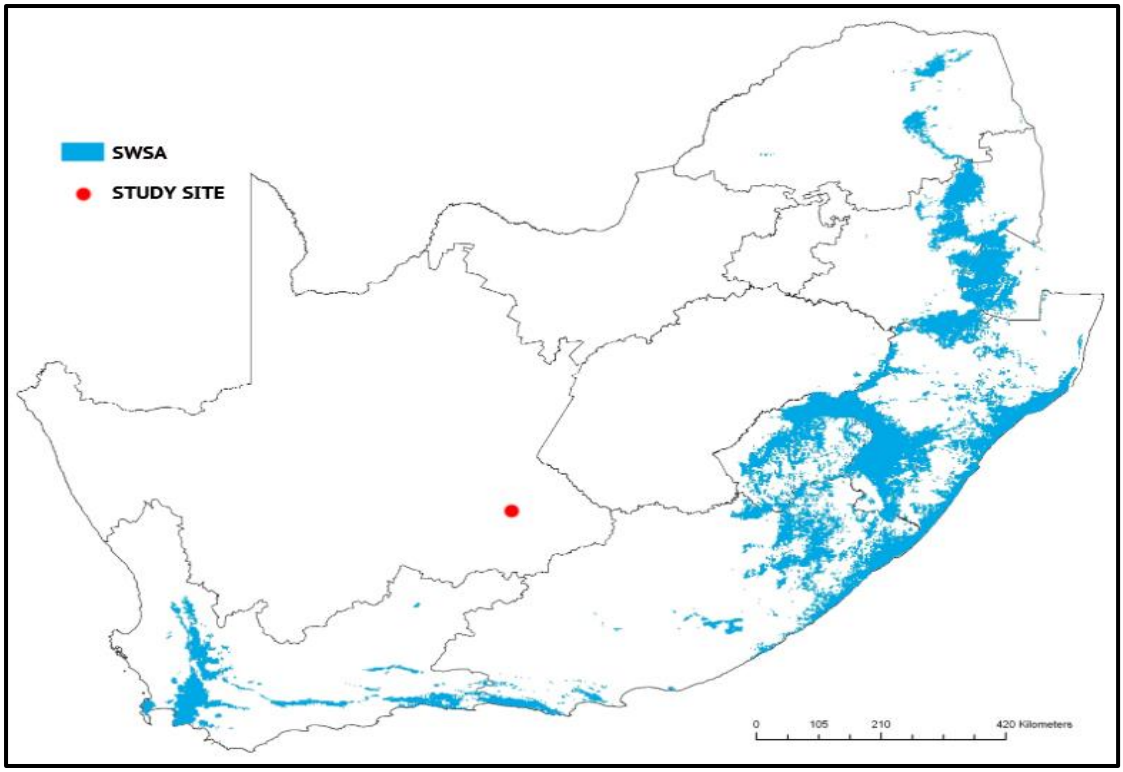

Figure 18: National SWSA of South Africa

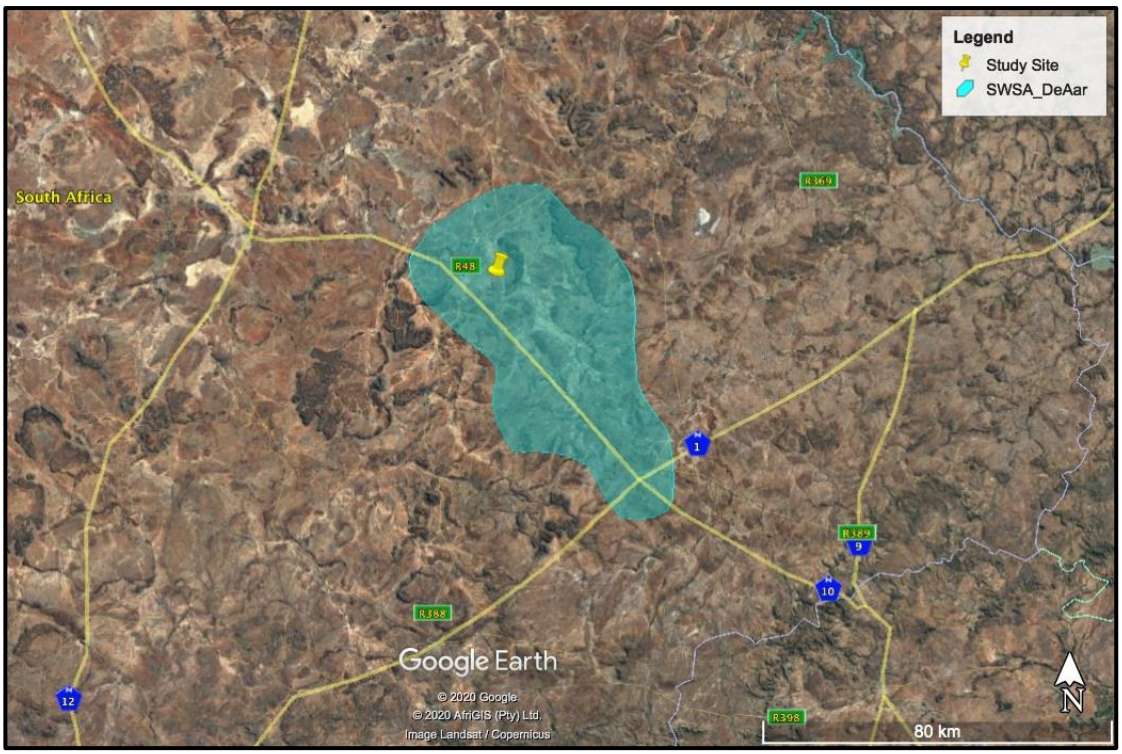

Figure 19: Water Source Area (De Aar)

5.5 PES of watercourses in the study area

The assessment criteria and structure to determine the PES of watercourses is based on the modified Habitat Integrity approach of Kleynhans (1996, 1999). The PES is calculated by looking at the hydrology, geomorphology, water quality and biota of each watercourse. Of importance is the overall PES of the system. The present ecological state of the Brak River and the unnamed river east of the study site were assessed (Table 13).

Table 13: PES of watercourses in the study area

Criteria	Identified Watercourses	
	Unnamed Dry River	**Brak River**
HYDROLOGY		
Flow modification	3	4
Permanent inundation	3	4
WATER QUALITY		
Water Quality Modification	3	4
Sediment Load Modification	3	4
GEOMORPHOLOGY		
Canalisation	3	3
Topographic Alteration	3	4
BIOTA		
Terrestrial Encroachment	3	4
Indigenous Vegetation Removal	3	4
Invasive Plant Encroachment	3	3
Alien Fauna	4	3
Over utilisation of Biota	3	4
Total:	34	41
Average:	3,0	3,7
Category:	**C**	**B**
Integrity (PES):	**Medium**	**High**
PES Description	**Moderately Modified**	**Largely Natural**
Recommended EMC	**C**	**B**

5.6 EIS of Watercourses in the study area

The EIS values of the watercourse/s were determined using the above methodology. The calculations and categories are shown below (Table 14).

Table 14: EIS and EMC values of watercourses

Determinant	Unnamed Dry River	Brak River	Confidence
PRIMARY DETERMINANTS			
1. Rare & Endangered Species	0	2	4
2. Populations of Unique Species	1	2	4
3. Species/taxon Richness	1	2	4
4. Diversity of Habitat Types or Features	1	3	4
5 Migration route/breeding and feeding site for wetland species	0	2	3
6. Sensitivity to Changes in the Natural Hydrological Regime	1	2	3
7. Sensitivity to Water Quality Changes	1	2	3
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	1	2	3
MODIFYING DETERMINANTS			
9. Protected Status	0	0	4
10. Ecological Integrity	1	1	4
TOTAL	7	18	-
AVERAGE	0,7	1,8	-
Overall EIS	**D**	**C**	**-**
Description	**Low**	**Moderate**	**-**

6 SENSITIVITY ASSESSMENT

The sensitivity assessment identifies those areas and habitats within the study site that have a high conservation value and that may be sensitive to disturbance. All watercourses, including seasonal streams and drainage lines are always deemed to be sensitive, by default, even if they are badly degraded. However, keep in mind that this does not necessary mean that they are therefore, by default, 'no-go' areas. Areas or habitats have a higher conservation value (or sensitivity) based on their threatened ecosystem status, presence or ideal habitats for priority species (including Red Data species), species-richness, distinctive habitats, etc. The final ecological sensitivity of the study area is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit, whether it is floristic or faunal in nature.

6.1 Floristic Sensitivity Analysis

Table 15: Floristic sensitivity analysis

Criteria	Distinctive habitats in the study area	
	Karoo Shrubland	Watercourse
Red Data Species	3	4
Habitat Sensitivity	5	5
Floristic Status	3	5
Floristic Diversity	3	5
Ecological Fragmentation	6	6
Sensitivity Index	40%	50%
Sensitivity Level	**Medium/Low**	**Medium**

6.2 Faunal Sensitivity Analysis

Table 16: Faunal sensitivity analysis

Criteria	Distinctive habitats in the study area	
	Karoo Shrubland	Watercourse
Red Data Species	6	6
Habitat Sensitivity	5	5
Faunal Status	5	5
Faunal Diversity	5	5
Ecological Fragmentation	6	6
Sensitivity Index	54%	54%
Sensitivity Level	**Medium**	**Medium**

6.3 Ecological Sensitivity Analysis

The ecological sensitivity of the study area is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit, whether it is floristic or faunal in nature (Table 17). According to the analyses of the floristic, fanual and overall ecological sensitivities there are no high sensitivity areas or habitats. In other words, there are no 'No-Go' areas within the study area.

Table 17: Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity
Karoo Shrubland	Medium/Low	Medium	**Medium**
Watercourse	Medium	Medium	**Medium**

6.4 Priority areas

6.4.1 National Priority Areas

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

The study area is within an Important Bird Area, namely the Platberg-Karoo Conservancy (Figure 20 & Figure 21). The site is not within any other national priority areas. The site is also not within a 5 km radius of any nature reserves. The closest formal protected area (nature reserve) is Doornkloof Provincial Nature Reserve, which is approximately 89 km east of the site.

The dry river system east of the study site is not a NFEPA watercourse, as is the case with the nearby Brak River.

The IBA (Platberg-Karoo Conservancy) is not a formally or informally protected area, but a lower level conservancy, which does not carry the same legal levels of protection that a nature reserve does. However, it is still important to take cognizance of the fact that the area is part of a greater IBA area and therefore take cognizance of the fact that there will be numerous birds in the area. These birds will include priority species such as raptors that are migratory / summer visitors. However, the nature of the project is such that it will have no to insignificant negative impacts on birds.

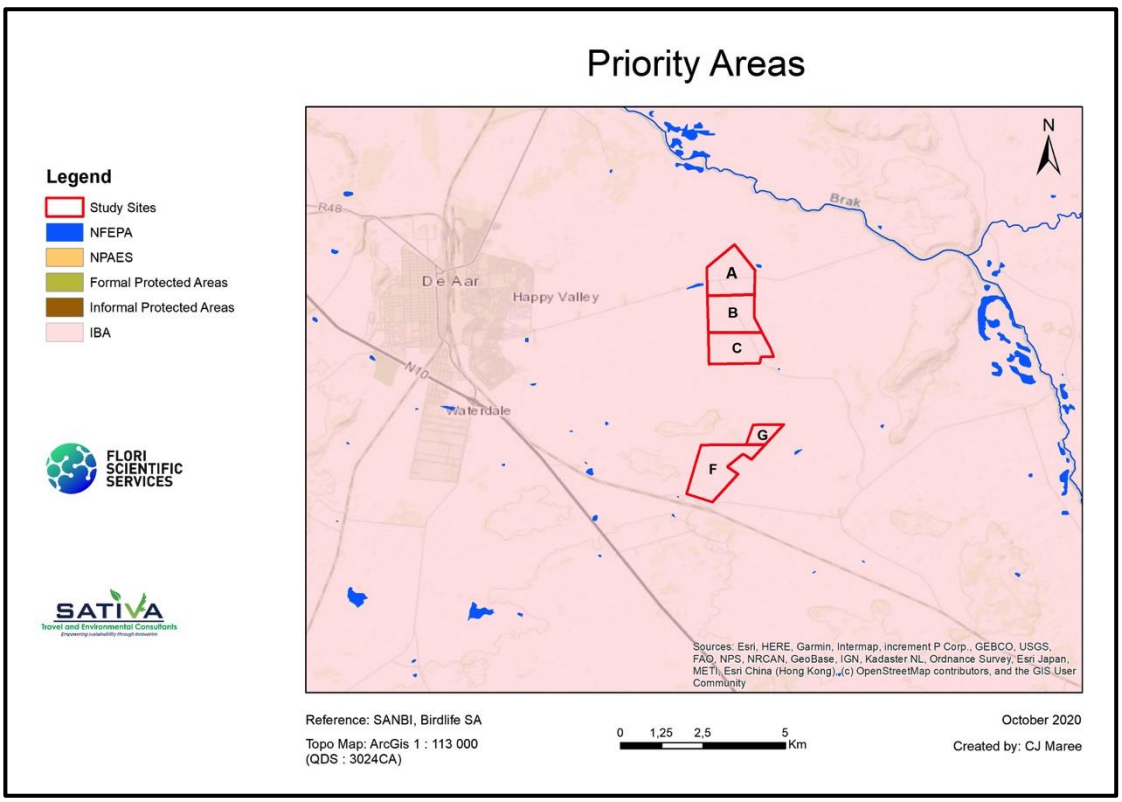

Figure 20: Priority areas

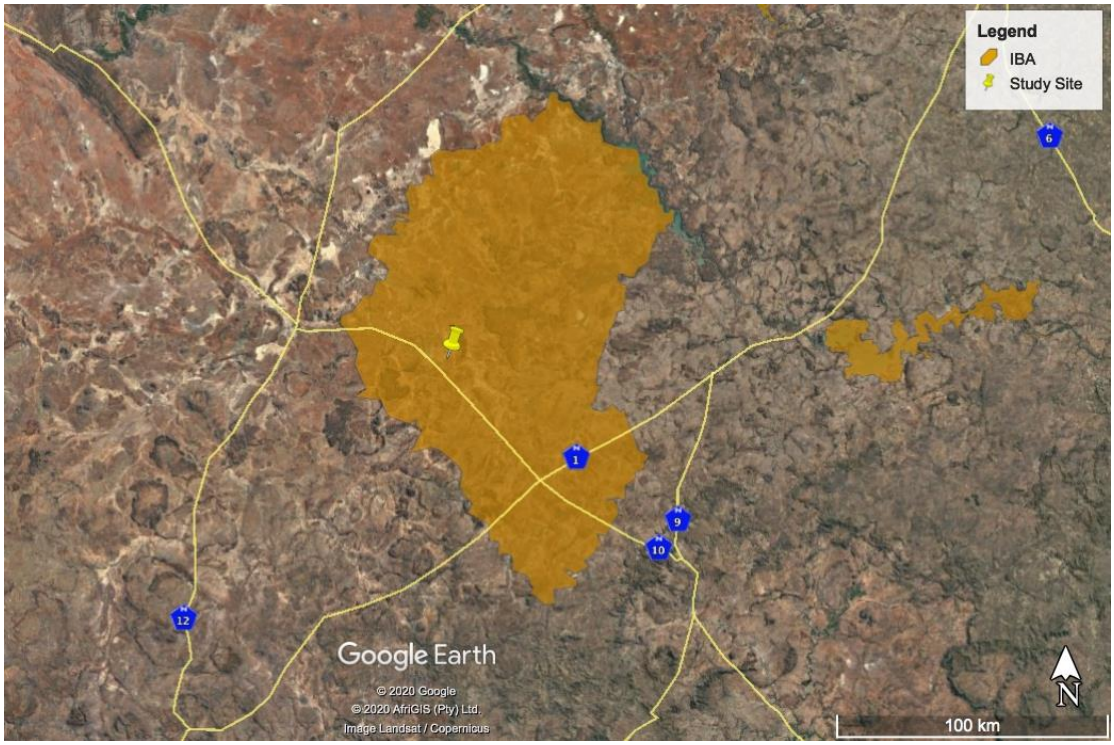

Figure 21: Important Bird Areas (IBAs)

6.4.2 Critical Biodiversity Areas and Ecological Support Areas

According to the Northern Cape Critical Biodiversity Areas (2016) documentation the study site is not situated within any Critical Biodiversity Areas (CBAs) or within any Ecological Support Areas (ESAs) (Figure 22).

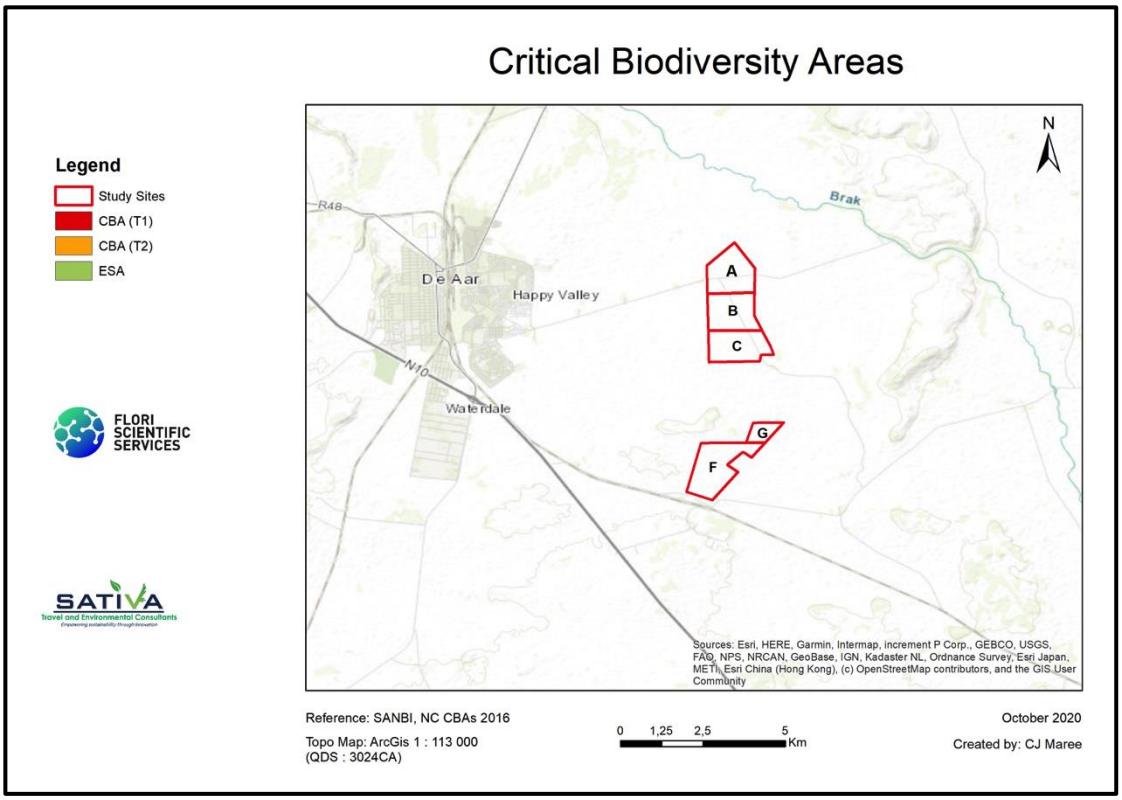

Figure 22: Critical Biodiversity Areas (CBAs)

6.5 DEA Screening Tool

The DEA Screening Tool (www.screening.environment.gov.za) is required for ecological assessments and environmental impact assessments (EIAs). The screening tool was accessed on 12 October 2020. The assessments of sensitivities according to the screening tool are as follows:

- Animal Species Theme: Medium Sensitivity and High Sensitivity.
- Plant Species Theme: Low Sensitivity.
- Aquatic Biodiversity Sensitivity: High.
- Terrestrial Biodiversity Sensitivity: High.

It is unclear why the area would have an aquatic sensitivity of 'high' as there are no real sensitive aquatic biodiversity habitats. The only aquatic system that is sensitive is the Brak River north of the study site. It is possible that this is due to the fact that the area is within the Platberg-Karoo Water Source Area.

It is also unclear why the area would have a terrestrial biodiversity sensitivity of 'high' as the site is not within any CBAs, ESAs or threatened ecosystems. Also the area is not known for high levels of floral endemism or Red Data Listed (RDL) fauna and flora species.

6.6 Delineated Watercourses

The main watercourses in the study site and nearby area (mainly east of the site) were delineated as shown below in Figure 23. The delineation is very close to that of Wetland Map 5 (Figure 12). The region is arid with a low rainfall regime and therefore there are few perennial and even semi-perennial rivers or streams present.

A 100 m buffer zone is recommended for the river system delineated, even though a 32 m or 50 m buffer zone would be adequate. An area along the west side of the river has a few ephemeral drainage lines and it is recommended that this area be avoided for the most part. It is mostly outside of the study site but has been delineated as a regulated area (Figure 23). That is, an area where projected related activities should be regulated (controlled) and kept to a minimum. It is not a 'no-go' zone, as is the case of a buffer zone. A more detailed description of buffer zones and regulated areas can be found in the appendices.

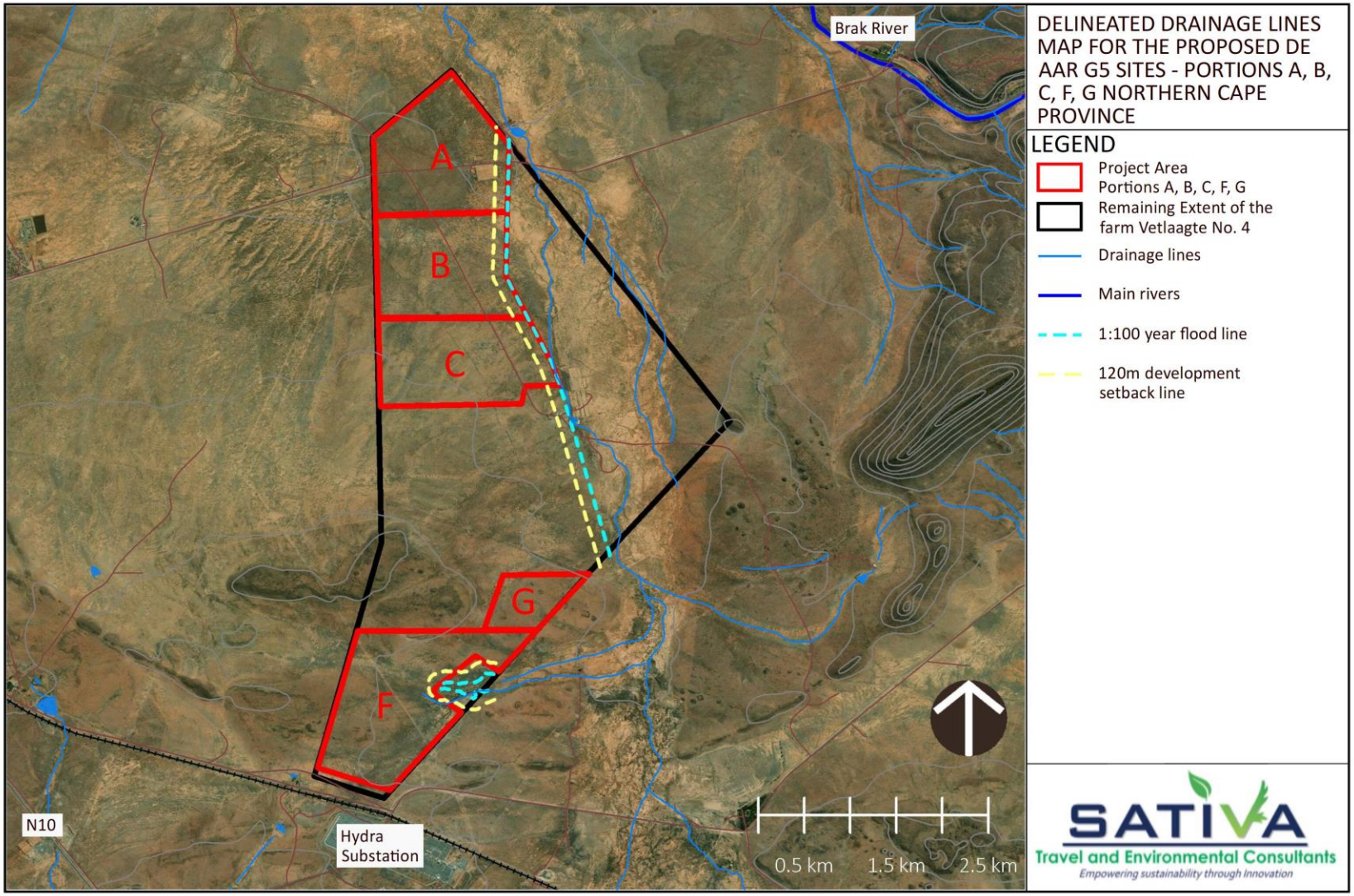

Figure 23: Delineated watercourses

6.7 Sensitive areas identified

6.7.1 Portion A

There are no 'high sensitive' areas or habitats identified in Portion A of the study site. A small portion of the 100 m buffer zone for the river system is within the western boundary of the portion. This area is a 'no-go' zone. There is also a small area in the southeast corner, which is part of the regulated area. Preferably no high level development should take place in this area.

6.7.2 Portion B

There are no 'high sensitive' areas or habitats identified in Portion B of the study site. A small portion of the regulated area is within the northeastern corner of the area. Preferably no high level development should take place in this area.

6.7.3 Portion C

There are no 'high sensitivity' areas or habitats delineated or identified in Portion C, including buffer zones and regulated areas.

6.7.4 Portion F

Based on the spatial datasets, it seems that a portion of a drainage line enters Portion F. However, based on the surveyed 1:100 year floodlines (as per the previously approved EIA), a further 120m development setback line has been delineated and set by the developer to ensure that they remain outside of the regulated area.

6.7.5 Portion G

There are no 'high sensitivity' areas or habitats delineated or identified in Portion G, including buffer zones and regulated areas.

7 IMPACT ASSESSMENT

The impacts of the activities related to the proposed project were rated. There are existing and potential impacts and mitigating measures are recommended to help reduce the sum of the negative impacts (cumulative effect). The impact assessment focuses mainly on the construction phase of the project, but does consider the long-term impact the project may have on the natural environment. The operation phase is only considered in terms of ongoing, routine maintenance after clean up and rehabilitation at the end of the construction phase.

7.1 Existing Impacts

In terms of the natural ecology of the area, the primary existing negative impacts on the study area are low. There is little development or commercial farming present on the study site. The existing impacts include low levels of grazing for livestock and some physical structures.

7.2 Potential Impacts

The potential negative impacts of the proposed project are primarily the loss of some natural shrubland due to the construction of infrastructure including access roads, offices, parking, etc. There are also low level potential impacts on the watercourse (river) along the eastern boundary of the study site.
There are no obvious positive impacts arising from the proposed project.

7.3 Assessment of potential impacts

The assessment of potential impacts on the natural environment arising from the project and related activities is shown below in Table 18.
The scoring method used in the impact assessment is as follows:

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

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

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

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

7.4 Cumulative Effect

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

Table 18: Assessment of Potential Impacts

Potential Impacts arising from Project	Phase of Project	Impact Rating					
		Extent	Duration	Magnitude	Probability	Total	Significance
Total Impact of Proposed Project	**Construction Phase: Pre-mitigation**	**Local (2)**	**Shot-term (2)**	**Moderate (6)**	**Medium (3)**	**30**	**Moderate**
	Construction Phase: Post mitigation	**Site (1)**	**Shot-term (2)**	**Minor (2)**	**Low (2)**	**10**	**Low**
	Operational Phase	**Site (1)**	**Immediate (1)**	**Minor (2)**	**Improbable (1)**	**4**	**Low**
Mitigating Measures	i. Impacts on the existing natural environment related to the project are '**LOW**' Isolated areas of Karoo shrubland will be transformed and lost. No RDL faunal or floral species will be lost or impacted. In other words, the project footprint is very small in terms of loss of natural vegetation and natural environment. ii. Any temporary storage, lay-down areas or accommodation facilities to be setup in existing built-up areas or disturbed areas where possible. iii. Ensure small footprint during construction phase. iv. Proposed buffer areas (no-go zones) along the watercourse must be implemented and strictly controlled. v. Regulated area to be strictly controlled in terms of development and movement of people and vehicles in and through it. Only low levels of development allowed. vi. All hazardous materials must be stored appropriately to prevent these contaminants from entering the water environment; vii. All excess materials brought onto site for construction to be removed after construction. viii. No open trenches or mounds of soils to be left. ix. Rehabilitation plan for disturbed areas to be compiled and implemented as part of the construction phase. x. No construction vehicles may drive through any watercourses. Existing roads to be used. xii. No concrete or mounds of building sand may be stored temporary during the construction phase within 100 m of the delineated watercourses. xiii. If possible, only existing access roads may be used to and from construction site (study area). xiv. Temporary access roads to be rehabilitated after the construction phase.						
Cumulative Effect of Project on Terrestrial Ecology	After construction and during operational phase	Local (2)	Short-term (2)	Minor (2)	Low (2)	12	**Low**
Cumulative Effect of Project on Aquatic ecology	After construction and during operational phase	Local (2)	Short (1)	Minor (2)	Low (2)	10	**Low**

Individual Impacts							
		Extent	Duration	Magnitude	Probability	Total	Significance
1. Loss of natural vegetation	**Construction Phase: Pre-mitigation**	**Site (1)**	**Shot-term (2)**	**Low (4)**	**Medium (3)**	**21**	**Low**
	Construction Phase: Post mitigation	**Site (1)**	**Shot-term (2)**	**Minor (2)**	**Low (2)**	**10**	**Low**
	Operational Phase	**None (0)**	**Immediate (1)**	**Minor (2)**	**Improbable (1)**	**3**	**Low**
Mitigating Measures	i. No protected trees are within the study site. Therefore no protected trees will be lost or destroyed. ii. Some Karoo shrubland will be lost, but the veldtype is not a threatened ecosystem. iii. Any priority species encountered must be identified and rescue prior to any excavation or construction activities.						
2. Loss or impact on wildlife	**Construction Phase: Pre-mitigation**	**Site (1)**	**Shot-term (2)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**
	Construction Phase: Post mitigation	**Site (1)**	**Shot-term (2)**	**Minor (2)**	**Low (2)**	**10**	**Low**
	Operational Phase	**Site (1)**	**Immediate (1)**	**Minor (2)**	**Improbable (1)**	**4**	**Low**
Mitigating Measures	i. Care must be taken not to interact directly with any wild life encountered. ii. Any bird nests encountered in the vegetation or in the watercourses must not be interfered with. If encountered must first be discussed with specialist.						
3. Fringe impacts arising from construction phase	**Construction Phase: Pre-mitigation**	**Site (1)**	**Shot-term (2)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**
	Construction Phase: Post mitigation	**Site (1)**	**Shot-term (2)**	**Minor (2)**	**Low (2)**	**10**	**Low**
	Operational Phase	**Site (1)**	**Immediate (1)**	**Minor (2)**	**Improbable (1)**	**4**	**Low**
Mitigating Measures	i. Due to the nature of the project the potential for any significant fringe impacts is low. ii. Care must be taken with heavy machinery used on the project. All access roads and farm roads used must be monitored and maintained. iii. Soils and stones excavated may be used in the immediate vicinity and farms as backfill, fixing of roads, filling of dongas, etc. iv. Excavated soils and rocks may not be simply dumped in any pristine bushveld, or within 100 m of the edge of watercourses or dams.						

8 FATAL FLAWS

8.1 Potential Fatal Flaws for the Project

There are no fatal flaws and the project may go ahead. However, mitigating measures still need to be implemented to reduce potential negative impacts. Most importantly is to adhered to recommended buffer zones and regulated areas along the east side of the study site and within Portions F & G.

8.2 Classification criteria

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

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

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

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

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

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

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

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

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

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

9 CONCLUSIONS & RECOMMENDATIONS

9.1 Conclusions

The conclusions of the study are as follows:

- The study site is within the veldtype known as Northern Upper Karoo, which is part of the Nama-Karoo Biome.
- The veldtype is not a threatened ecosystem.
- There are no 'high sensitivity' habitats within the study area. However, all watercourses are, by default, viewed as sensitive and must therefore be approached as such.
- The overall sensitivity of the terrestrial ecology of the study site is 'Medium'
- There is a watercourse (river / drainage system) east of the study area. Some of this watercourse is within Portions F & G of the study site.

9.2 Recommendations

The recommendations of the study are as follows:

- All mitigating measures must be implemented, including delineated buffer zones and regulated areas.

10 APPENDICES

10.1 Photographs

Photo 1: Study site in the area of Portion A

Photo 2: Study site in the area of Portion B

Photo 3: Study site in the area of Portion C

Photo 4: Study site in the area of Portion F

Photo 5: Study site in the area of Portion G

Photo 6: Farm roads running through the study site

Photo 7: Digging of profile holes in the dry river area

10.2 Plant Species

The list below is the dominant plant species found in veldtype of Northern Upper Karoo (Mucina & Rutherford, 2006).

Important Taxa Small Trees: *Acacia mellifera* subsp. *detinens*, *Boscia albitrunca*. Tall Shrubs: *Lycium cinereum* (d), *L. horridum*, *L. oxycarpum*, *L. schizocalyx*, *Rhigozum trichotomum*. Low Shrubs: *Chrysocoma ciliata* (d), *Gnidia polycephala* (d), *Pentzia calcarea* (d), *P. globosa* (d), *P. incana* (d), *P. spinescens* (d), *Rosenia humilis* (d), *Amphiglossa triflora*, *Aptosimum marlothii*, *A. spinescens*, *Asparagus glaucus*, *Barleria rigida*, *Berkheya annectens*, *Eriocephalus eri- coides* subsp. *ericoides*, *E. glandulosus*, *E. spinescens*, *Euryops asparagoides*. *Felicia muricata*, *Helichrysum lucilioides*, *Hermannia spinosa*, *Leucas capensis*, *Limeum aethiopicum*, *Melolobium candicans*, *Microloma armatum*, *Osteospermum leptolobum*, *O. spinescens*, *Pegolettia retrofracta*, *Pentzia lanata*, *Phyllanthus maderaspatensis*, *Plinthus karooicus*, *Pteronia glauca*, *P. sordida*, *Selago geniculata*, *S. saxatilis*, *etragonia arbuscula*, *Zygophyllum lichtensteinianum*. Succulent Shrubs: *Hertia pallens*, *Salsola calluna*, *S. glabrescens*, *S. rabieana*, *S. tuberculata*, *Zygophyllum flexuosum*. Semiparasitic Shrub: *Thesium hystrix* (d), Herbs: *Chamaesyce inaequilatera*, *Convolvulus sagittatus*, *Dicoma capensis*, *Gazania krebsiana*, *Hermannia comosa*, *Indigofera alternans*, *Lessertia pauciflora*, *Radyera urens*, *Sesamum capense*, *Sutera pinnatifida*, *Tribulus terrestris*, *Vahlia capensis*. Succulent Herb: *Psilocaulon coriarium*. Geophytic Herb: *Moraea pallida.*Graminoids: *Aristida adscen- sionis* (d), *A. congesta* (d), *A. diffusa* (d), *Enneapogon desvauxii* (d), *Eragrostis lehmanniana* (d), *E. obtusa* (d), *E. truncata* (d), *Sporobolus*

fimbriatus (d), *Stipagrostis obtusa* (d), *Eragrostis bicolor*, *E. porosa*, *Fingerhuthia africana*, *Heteropogon contor- tus*, *Stipagrostis ciliata*, *Themeda triandra*, *Tragus berteronianus*, *T. koelerioides*, *T. racemosus*.
Biogeographically Important Taxa Herb (western distribution limit): *Convolvulus boedeckerianus*. Tall Shrub (southern limit of distribution): *Gymnosporia szyszylowiczii* subsp. *namibiensis*.
Endemic Taxa Succulent Shrubs: *Lithops hookeri*, *Stomatium pluridens*. Low Shrubs: *Atriplex spongiosa*, *Galenia exigua*. Herb: *Manulea deserticola*.
Acacia is now also known as *Vachellia*.

Below is a list of species observed in the study area and surrounding areas during field investigations:
Allophyllus decipiens, Aptosimum procumbens, Aptosimum spinescens, Arachnioides webbiana subsp. foliosa, Arctotis leiocarpa, Aristida adscensionis Aristida congesta subsp. barbicollis Aristida congesta subsp. congesta Aristida vestita Asparagus striatus Asparagus suaveolens Athanasia minuta subsp. minuta Atriplex vestita var. appendiculata Barleria rigida Bassia salsoloides Berkheya eriobasis Brunsvigia radulosa Bulbostylishumilis Calobota spinescens Campylopus robillardei Cenchrus ciliaris Chaenostoma halimifolium Cheilanthes eckloniana Chloris virgata Chrysocoma ciliata Clutia impedita Colchicum asteroides Commelina africana var. africana Crassula corallina subsp. corallina Cucumis africanus Cucumis heptadactylus Cucumis myriocarpus subsp. leptodermis Cullen tomentosum Cyanella lutea Cynodon incompletus Daubenya comata Dianthus micropetalus Dicoma capensis Digitaria erianthe Dimorphotheca cuneata Dimorphotheca zeyheri Dipcade viride Disa pulchra Empodiumelongatum Enneapogondesvauxii Enneapogonscaber Enneapogonscopariu s Eragrostis bergiana Eragrostis bicolor Eragrostis chloromelas Eragrostis curvula Eragrostis homomalla
Eragrostis lehmanniana var. lehmanniana Eragrostis nindensis Eragrostis obtusa Eragrostis procumbens
*Eragrostis tef Eragrostis truncata Erucastrum strigosum Eulophia foliosa Euphorbia aequoris Euphorbia arida Euphorbia pugniformis Felicia burkei Felicia filifolia subsp. filifolia Felicia muricata subsp. muricata Fingerhuthia africana Galenia pubescens Gazania jurineifolia subsp. jurineifolia Gazania krebsiana subsp. arctotoides Geigeria filifolia Geigeria ornativa subsp. ornativa Gisekia pharnacioides var. pharnacioides Gladiolus dalenii subsp. dalenii Gladiolus ecklonii Gladiolus permeabilis subsp. edulis Gnidia polycephala Grewia flava Haworthia venosa subsp. tessellata Helichrysum asperum var. asperum Helichrysum dregeanum Helichrysum micropoides Helichrysum zeyheri Heliophila minima Heliotropium lineare Hermannia burkei Hermannia cuneifolia var. cuneifolia Hermannia erodioides Hermannia pulchella Hertia

pallens Heteropogon contortus Huernia humilis Hymenophyllum tunbridgense Hypericum lalandii Hypertelis salsoloides var. salsoloides Indigastrum argyraeum Jamesbrittenia filicaulis Kniphofia ensifolia subsp. ensifolia Ledebouria apertiflora Lessertia annularis Lepidostephium denticulatum Leysera tenella Limeum sulcatum var. sulcatum Limosella africana var. africana Lobelia flaccida subsp. flaccida Lotononis platycarpa Lycium horridum Lycium pumilum Manulea fragrans
Melianthus dregeanus Melica decumbens Melolobium candicans Microloma armatum var. armatum Monopsis scabra Moraea falcifolia Nemesia fruticans Oligomeris dipetala var. dipetala Ornithogalum nannodes Ornithoglossum vulgare Oropetium capense Oscularia deltoides Osteospermum leptolobum Osteospermum spinescens Osyris lanceolata Oxalis depressa Othonna pavonia Pachypodium succulentum Panicum coloratum var. coloratum Panicum impeditum Peliostomum leucorrhizum Peliostomum origanoides Pelargonium aestivale Pelargonium pseudofumarioides Pelargonium tragacanthoides *Pennisetum villosum Pentaschistis airoides subsp. airoides Pentaschistis setifolia Pentzia calcarea Pentzia elegans Pentzia globosa Pentzia incana Pentzia lanata Pentzia quinquefida Pentzia spinescens Phymaspermum aciculare Phymaspermum parvifolium Polygala ephedroides Pseudocrossidium crinitum Psilocaulon coriarium Pteronia glauca Pteronia glaucescens Pteronia sordida *Puccinellia distans Radyera urens Riccia albornata Riccia nigrella Rosenia humilis Rosenia oppositifolia Rumex lanceolatus Salsola calluna Salsola dealata Salsola glabrescens Salsola humifusa Salvia verbenaca Satyrium longicaude var. longicaude
Sebaea pentandra var. pentandra Selago albida Selago paniculata Selago saxatilis
Senecio isatideus Sesamum capense Solanum retroflexum *Sorghum halepense Sporobolus discosporus Sporobolus fimbriatus Sporobolus iocladus Stachys cuneata Stachys linearis Stapelia grandiflora var. grandiflora Stipagrostis ciliata var. capensis Stipagrostis namaquensis Stipagrostis obtusa Syringodia concolor Tetragonia fruticosa Themeda triandra Thesium congestum Tortula atrovirens Tragus berteronianus Tragus koelerioides Tragus racemosus Trichostomum brachydontium Tripteris aghillana var. aghillana Urochloa panicoides Wahlenbergia nodosa Zaluzianskya karrooica Zygophyllum microcarpum

10.3 Definitions

10.3.1 Rivers and streams

A river or stream is a linear inland aquatic ecosystem with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel and the riparian zone as a unit (Ollis *et al.* 2013). According to the Water Act and DWS the extent of the river includes the 1:100 year floodline as well.

Most, but not all streams and rivers, have an associated floodplain and / or riparian zone. Although wetlands and rivers are both watercourses, the legal implications differ in terms of development, buffer zones, etc.

10.3.2 Wetlands

'Wetland' is a broad term and for the purposes of this study it is defined according the parameters as set out by the Department of Water & Sanitation (DWS) in their guideline (A practical field procedure for identification and delineation of wetlands and riparian areas, 2005). The classification of wetlands (which is a type of watercourse) is summarised below (Figure 24).

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

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

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

During the site investigations the following indicators were used to determine whether an area needed to be defined as a wetland or not, namely:

- Terrain unit indicator;
- Soil form indicator;
- Soil wetness indicator; and
- Vegetation indicator.

10.3.3 Riparian zones

Riparian vegetation is typically zonal vegetation closely associated with the course of a river or stream and found in the alluvial soils of the floodplain. According to the National Water Act (NWA) riparian habitat is defined as including "*The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.*"

It is important to note that the NWA states that the riparian zone has a floral composition distinct from those of adjacent areas. The NWA also defines riparian zones as areas that "c*ommonly reflect the high-energy conditions associated with the water flowing in a water channel, whereas wetlands display more diffuse flow and are lower energy environments*."

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

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

Water source: * Contribution usually small

*** Contribution usually large

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

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

 Wetland

Figure 24: Classification of wetlands

10.4 Biodiversity Summary of the Emthanjeni Local Municipality

Below is the biodiversity summary for the Local Municipality, in which the study site is situated (Accessed from: SANBI. www.bgis.sanbi.org).

Protected Areas

Land-based protected areas (formal)
None

Ramsar sites
There are no Ramsar sites in the municipality.

Terrestrial Ecosystems

Biomes		
Name	**Size (ha)**	**Size (%)**
Grassland Biome	38861,4 ha	3,41%
Nama-Karoo Biome	1100157,2 ha	96,59%
2 biomes in the municipality covering 1139018,6 ha (100 %)		

Vegetation Types		
Name	**Size (ha)**	**Size (%)**
Besemkaree Koppies Shrubland	52274,3 ha	4,59%
Bushmanland Arid Grassland	6807,1 ha	0,6%
Eastern Upper Karoo	323649,9 ha	28,41%
Highveld Salt Pans	2204,8 ha	0,19%
Northern Upper Karoo	676617,4 ha	59,4%
Upper Karoo Hardeveld	77465,2 ha	6,8%
6 vegetation types in the municipality covering 1139018,6 ha (100 %)		

Threat Status of Veldtypes in the Local Municipality

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

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

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

Freshwater Ecosystems

Rivers
Name
Brak
Elandsfontein
Elandskloof
Graafwaterspruit
Groen
Klein-Seekoei
Ongers
Seekoei
Unknown
9 rivers in the municipality

Estuaries
There are no estuaries in the municipality.

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