PROPOSED OPENING OF LEEUWENFONTEIN QUARRY, BEAUFORT WEST LOCAL MUNICIPALITY, WESTERN CAPE PROVINCE

BIODIVERSITY ASSESSMENT

Terrestrial Ecological Assessment (Fauna and Flora) and Aquatic (Wetland) Ecological Assessment for the Proposed Leeuwenfontein Quarry

Compiled by

FLORI SCIENTIFIC SERVICES

JUNE 2021

PROJECT TITLE: Proposed Opening of Leeuwenfontein Quarry

STUDY NAME: Biodiversity Impact Assessment

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EXECUTIVE SUMMARY

Background

It is the intention of Barry Theron Contractors Consultant to open a quarry approximately 32km northwest of Murraysburg on Portion 2 of the Farm Leeuwenfontein 6-RD, in the Beaufort West Local Municipality of the Central Karoo District Municipality, Western Cape Province. The extent of the quarry will be 4,43ha, which will include the crushing facilities.

Chameleon Environmental was appointed to undertake the environmental studies on behalf of Barry Theron Contractors. Flori Scientific Services cc was appointed as the independent consultancy to conduct a biodiversity assessment, which includes a terrestrial ecological (fauna and flora) assessment and an aquatic (wetland) assessment, for the study site.

Site visits were conducted on 15 April and 31 May 2021.

Location of the study area

The study site is situated on Portion 2 of the Farm Leeuwenfontein 6-RD, and is approximately 32km northwest of the small town of Murraysburg; 20km east of the N1 Highway; and 20km northeast of the R63 (Murraysburg – Graaff-Reinet Rd).

TERRESTRIAL ECOLOGY

Vegetation

The vegetation of the study site is typical dry grassland with medium grass cover and scattered very low microphyllous (small-leaved) shrubs and no trees. The dry late summer/autumn white grasses of *Aristida* and *Eragrostis* species are common within the veld. The vegetation of the study site is moderately degraded with the dominant impacts that of grazing of livestock, mostly sheep. The soils of the study area were sandy yellow-red apedal and well-drained, but shallow. The area is scattered with blackish rocks (commonly known as 'ysterklip' iron stone).

There were no alien weed plant species found on site. *Medicago laciniata* is a common weed found in the Upper Karoo which could potentially be in the area.

There are no red data listed (RDL) plant species or priority species in the study area.

Category Description	Classification
Biome	Nama-Karoo
Bioregion	Upper Karoo
Veldtype	Eastern Upper Karoo
Status of veldytpe (Ecosystem)	Not threatened (Least Threatened / Least Concern)

Fauna

The region of the study area is fairly open with low levels of urbanisation. The general region in which the study area is situated is open Nama-Karoo grassland and shrubveld (Eastern Upper Karoo veldtype). The grassland is less species-rich and less dense at the study site than down in the lowlands and areas closer to Murraysburg. Due to low rainfall and low livestock carrying capacity the main farming activity is the grazing of sheep. It is understandable that a number of wild faunal species will be present in the region. However, lack of water and low grazing levels will limit numbers and species. Many of the wild animals will predominantly be moving in and out of the area in search of water and food. The study site is small and lacks any ideal habitats for the long-term or permanent presence and breeding of most wild fauna species, including reptiles and birds.

AQUATIC ECOLOGY

Watercourses in the study area

There are no watercourses in the study area, including small streams, distinctive drainage lines and wetlands. However, due to the mountainous terrain of the area, with numerous valleys and slopes, there are a number of small seasonal drainage lines and small seasonal streams to be found, especially in the steep valleys. There is a small seasonal drainage line just more than 100m north of the boundary of the study site.

Drainage areas

Level	Category
Primary Drainage Area (PDA)	L
Quaternary Drainage Area (QDA)	L21B
Water Management Area (WMA) – Previous	Fish to Tsitsikamma
Water Management Area (WMA) – New	Mzimvubu-Tsitsikamma (WMA 7)
Sub-Water Management Area	Gamtoos
Catchment Management Agency (CMA)	Mzimvubu-Tsitsikamma (CMA 7)
Wetland Vegetation Ecoregion	Upper Nama-Karoo
RAMSAR Site	No
Wetland FEPA	No
Fish FEPA	No
Fish FSA	No
Fish Corridor	No
Fish Migratory	No
Priority Quaternary Catchment	No
National Strategic Water Source Area (SWSA)	No
Provincial Important Water Source Area (WSA)	No

Sensitivity analyses

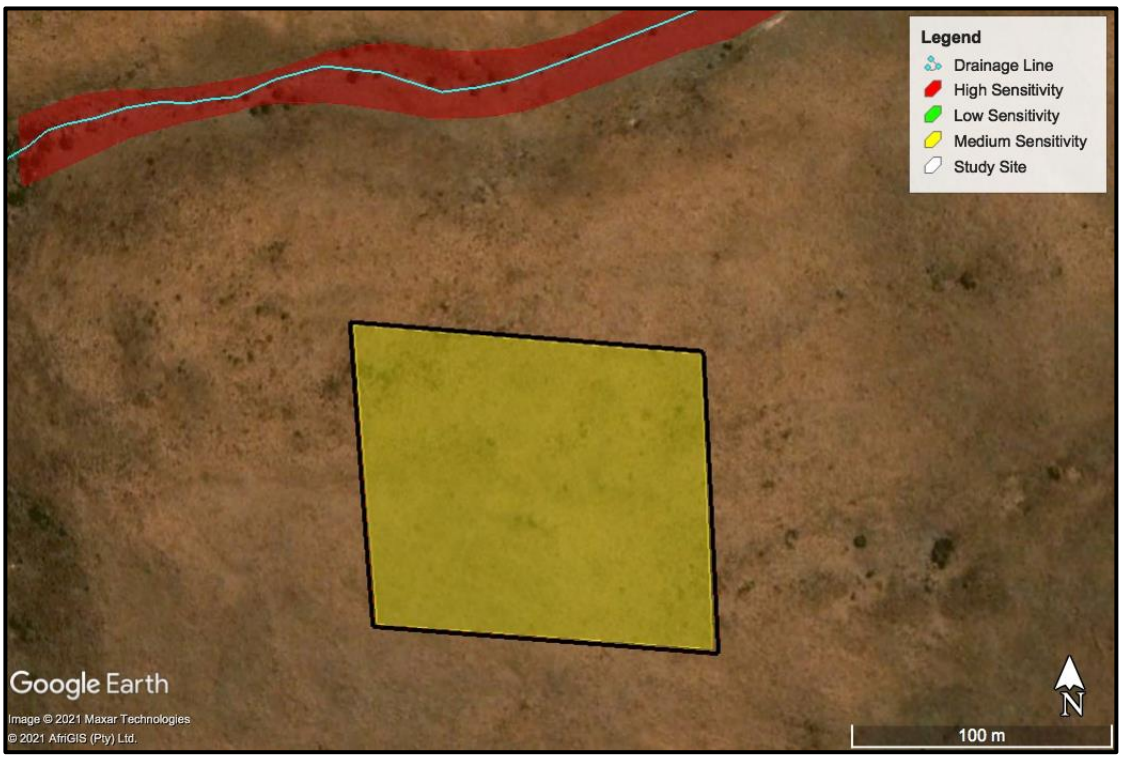
The ecological sensitivity of the study area is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit, whether it is floristic or faunal in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

Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity
Arid Grassland	Medium/Low	Medium	**Medium**

The study site was determined to have a sensitivity of 'Medium'. This is mostly due to the fact that the site is moderately degraded grassland and that there is the likelihood that a number of different free-roaming wild animals traverse the site and area on a fairly regular basis.

Below is a sensitivity map of the study area, also showing the sensitive drainage line to the north of the site.



Sensitivity map

Fatal flaws

There are no fatal flaws.

Priority areas

The study area is not situated within any 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) focus areas.

Conclusions

- The study site is situated within veldtype known as Eastern Upper Karoo, which is within the Nama-Karoo Biome of South Africa.
- The site is not within a threatened veldtype (ecosystem).
- The site is not within or close to any priority areas, which include protected areas (nature reserves), important bird areas (IBAs) and national protected area expansion strategy (NPAES) focus areas.
- There are no watercourses in the study area, including wetlands. However, there is a small seasonal drainage line north of the study site that needs to be considered.
- During field investigations no Red Data Listed (RDL) or Orange Data Listed (ODL) plants were found, including protected trees. None are expected to occur.
- The study site is not situated within a Critical Biodiversity Area (CBA) or Ecological Support Area (ESA).
- There are no 'high' sensitive habitats present on site.
- No red data listed (RDL) faunal species were observed to be present and / or breeding with the study area boundaries.
- Site investigations were conducted during the summer and winter months and the findings and availability of field data are sufficient to achieve acceptable findings and outcomes from the assessment.
- There are no obvious fatal flaws in terms of the natural environment.
- Taking all findings and recommendations into account it is the reasonable opinion of the author / specialist that the activity may be authorised. The project and related activities may proceed to the next phase.

Recommendations

- Recommended mitigating measures as proposed in this study and report should be implemented if the findings of this report are to remain pertinent.
- A 50m buffer zone between the northern boundary of the site and a small drainage line north of the site is recommended. This buffer zone is a 'no-go' zone.

EXPERTISE AND EXPERIENCE OF SPECIALIST

EXPERTISE

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

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

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

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

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

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

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

13 years direct experience in EIAs.

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

DECLARATION

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

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

Act as an independent specialist in compiling this report;

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

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

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

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

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

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1 ACRONYMS

BA	Basic Assessment
CBA	Critical Biodiversity Areas
CMA	Catchment Management Agencies
DEA	Department of Environmental Affairs (Old name of DEFF)
DEFF	Department of Environment, Forestry & Fisheries
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 / average height 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
WCCBA	Western Cape Critical Biodiversity Areas
WMA	Water Management Areas
WRC	Water Research Commission
WUL	Water Use Licence
WULA	Water Use Licence Application

2 BACKGROUND

2.1 Project overview

It is the intention of Barry Theron Contractors Consultant to open a quarry approximately 32km northwest of Murraysburg on Portion 2 of the Farm Leeuwenfontein 6-RD, in the Beaufort West Local Municipality of the Central Karoo District Municipality, Western Cape Province. The extent of the quarry will be 4,43ha, which will include the crushing facilities.

Chameleon Environmental was appointed to undertake the environmental studies on behalf of Concor Infrastructure. Flori Scientific Services cc was appointed as the independent consultancy to conduct a biodiversity assessment, which includes a terrestrial ecological (fauna and flora) assessment and an aquatic (wetland) assessment, for the study site.
Site visits were conducted on 15 April and 31 May 2021.

2.2 Scope of work

The scope of work was understood to be as follows:

- Conduct a biodiversity impact assessment for the study site, which includes fauna & flora as well as watercourses (aquatic);
- Conduct site visits and investigations;
- Compile a biodiversity report, which addresses potential impacts on the natural environment;
- Determine if there are any fatal flaws, high sensitive areas, no-go zones, etc.;
- Identify and delineate any sensitive areas / habitats, recommend buffers (if required); and
- Provide recommendations and mitigating measures, if and where necessary.

2.3 Quality and age of base data

The latest data sets were used for the report and conclusions reached, in terms of background information for veldtypes, ecosystems, threatened ecosystems, red data listed (RDL) fauna and flora species.
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).
- Protected areas: Protected Areas Register (PAR): DEFF – (https://portal.environment.gov.za).

- RDL species: Red List of South Africa Plants (latest update) – (www.redlist.sanbi.org).
- Veldtypes and ecosystems: Mucina & Rutherford, 2006, 2010. Updated 2012, 2018.
- National Wetland Map (Map 5) – SANBI & Water Research Commission (WRC).
- Endangered Wildlife Trust (EWT) – latest data sets – (www.ewt.org.za).
- SANBI data sets – latest updated website data (www. bgis.sanbi.org).
- Western Cape Biodiversity Spatial Plan (2017).
- Western Cape Critical Biodiversity Areas (WCCBA) (2017).

2.4 Assumptions and limitations

The assumptions and limitations for the assessment are as follows:

- All information regarding the proposed project and related activities as provided by the Client are taken to be accurate.
- Site investigations were conducted on 15 April and 31 May 2021. The site visits fall within the wet and dry seasons for the region.
- During site investigations all areas were easily accessed. There were no areas that could not be investigated or accessed. Permission to private property was obtained prior to visits.
- The study site is very small with easy access and limited variation in biodiversity. The field investigations conducted are therefore sufficient to make informed conclusions and recommendations for the study and necessary investigations.
- The site investigations and study are deemed adequate for the project and no further specialist environmental studies are necessary or recommended.
- Precise buffer zones, regulated zones, etc. or exact GPS positions cannot be made using generalised corridors or kml files on Google Earth. However, buffer zones and delineations drawn are accurate to within a few metres;
- The latest data sets were used as background information and desktop review for the project. The data sets were verified and refined during field investigations (ground-truthing). 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 (10.8); Google Earth; and Garmin Base Maps

2.5 Consultation process for the study

Emails were exchanged and telephone conversations held with the lead EAP (Chameleon Environmental) regarding the project. Landowners were contacted directly to arrange access to their

private properties for the necessary site investigations. During site visits landowners accompanied Specialists to the relevant sites.

3 METHODOLOGY

3.1 Desktop assessment

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

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

3.2 Field surveys

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

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

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

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

3.3 Floral Sensitivity

The methodology used to estimate the floristic sensitivity is aimed at highlighting floristically significant attributes and is based on subjective assessments of floristic attributes. Floristic sensitivity is determined across the spectrum of communities that typify the study area. Phytosociological attributes

(species diversity, presence of exotic species, etc.) and physical characteristics (human impacts, size, fragmentation, etc.) are important in assessing the floristic sensitivity of the various communities.

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

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

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

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

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

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

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

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

- Low: 0% – 20%

3.4 Faunal Sensitivity

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

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

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

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

3.5 Present Ecological State

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

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

selected criterion can generally be regarded as the primary causes of the ecological integrity of a watercourse.

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

Table 1: Habitat assessment criteria

Rating Criteria	Relevance
Hydrology	
Flow modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural lands. Changes in flow regime (timing, duration, frequency), volumes, and velocity, which affect inundation of wetland habitats resulting in floristic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.
Permanent inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.
Water quality	
Water Quality Modification	From point or diffuse sources. Measured directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment Load Modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats.
Geomorphology & Hydraulics	
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities, which reduce or changes wetland habitat directly in inundation patterns.
Biota	
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.
Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.
Invasive Plant Encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).
Alien Fauna	Presence of alien fauna affecting faunal community structure.
Over utilisation of Biota	Overgrazing, over fishing, over harvesting of plant material, etc.

Table 2: Scoring guidelines for habitat assessment

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

Table 3: Wetland integrity categories

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

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

3.6 Ecological Importance and Sensitivity

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

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

A high REMC relates to ensuring a high degree of sustainability and a low risk of ecosystem failure occurring. A low REMC would ensure marginal sustainability, but with a higher risk of ecosystem failure. The REMC is based on the results obtained from assessing the ecosystem / watercourse / wetland in

terms of EIS, PES and function, and the desire to with realistic recommendations and mitigating actions to return the system to a certain level of functionality and original state.

Table 4: EIS Categories and Descriptions

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

3.7 Impact Assessment

3.7.1 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

3.7.2 Scoring Method

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

Table 5: Scoring method for impact assessment

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

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

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

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

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

4 RECEIVING ENVIRONMENT

4.1 Study Site Location

The study site (proposed quarry and related infrastructure) is an area of 4,43ha, which is situated on Portion 2 of the Farm Leeuwenfontein 6-RD, in the Beaufort West Local Municipality of the Central Karoo District Municipality, Western Cape Province (Figure 1). The site is approximately 32km northwest of the small town of Murraysburg; 20km east of the N1 Highway; and 20km northeast of the R63 (Murraysburg – Graaff-Reinet Rd).

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

- Approximate centre of Study Site: 31°40'7.00"S; 23°40'26.73"E.
- Murraysburg: 31°57'45.97"S; 23°45'42.04"E.
- Quarter Degree Square (QDS): 3123DA.
- Quaternary Drainage Area (QDA): L21B.

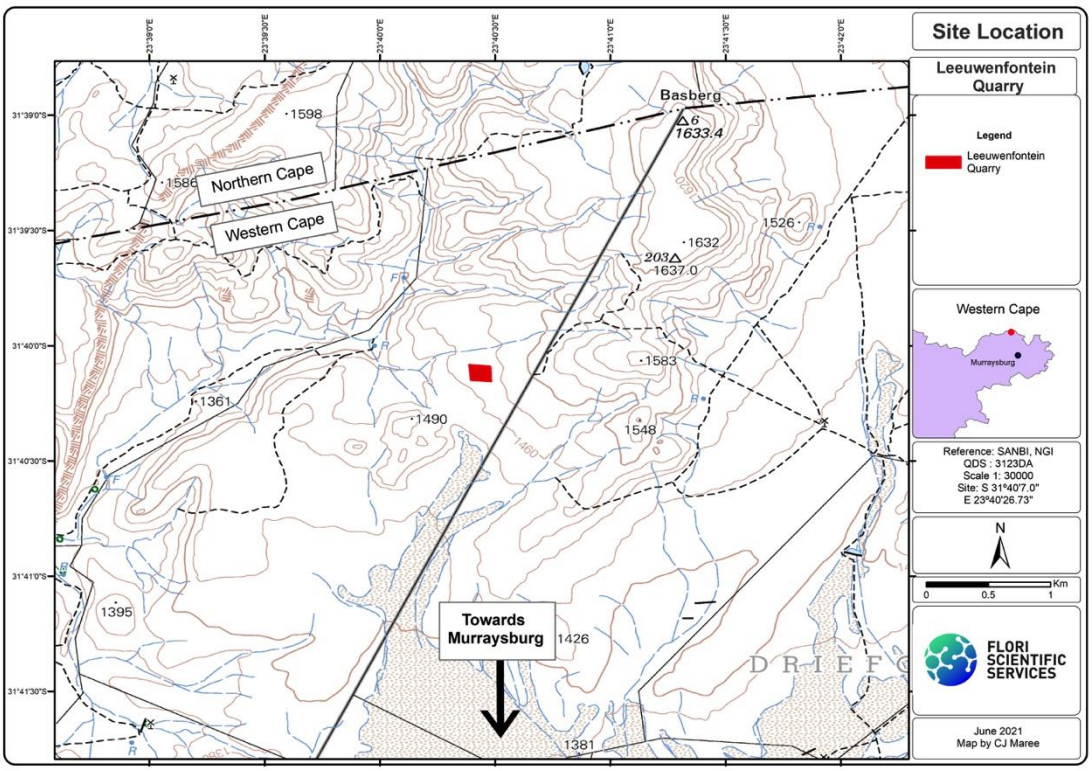


Figure 1: Study Site Location

4.2 Topography

The topography of the region is mountainous with undulating hills, valleys and plateaus. The study site is situated on a plateau or fairly flatish area within the mountains. The average height above sea level for the study site is approximately 1 473m, with maximum and minimum elevations of 1 476m and 1 470m, respectively. The main downward slope is to the north / northwest towards a valley in which a small stream flows.

4.3 Climate

The study site is within a summer rainfall region of the country, although rainfall can be erratic and unreliable. The climate of the study site is similar to that of the small Town of Murraysburg, although the weather may vary at times because the site is situated within the mountains and on top of a plateau, while the town is within a slightly more protected valley environment. The Sneeuberge (Snow Mountains) are to the east of the region and occasional snow can fall in the area.

The study site is situated within a low rainfall region of South Africa that typically averages between 201mm – 400mm per annum (Figure 2). The dry months can be very dry. The site is within the Temperate Interior Climatic Zone of South Africa (Figure 3). The summers are hot to very hot, while the winter nights and early mornings can be cold to very cold, with the temperatures warming up and being mild to warm through the day.

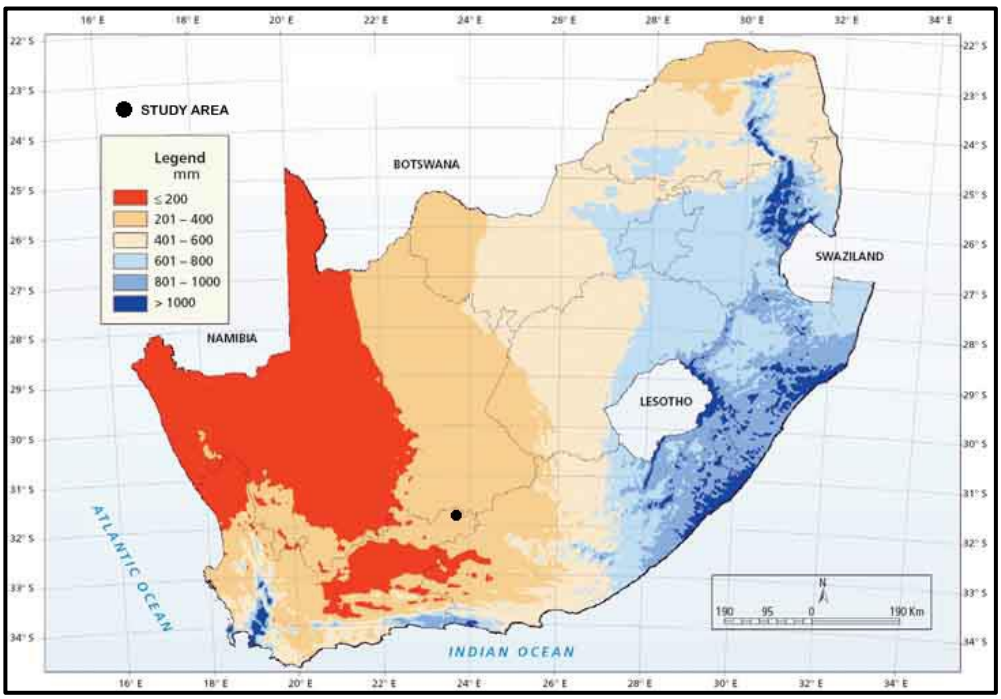


Figure 2: Rainfall Regions of South Africa

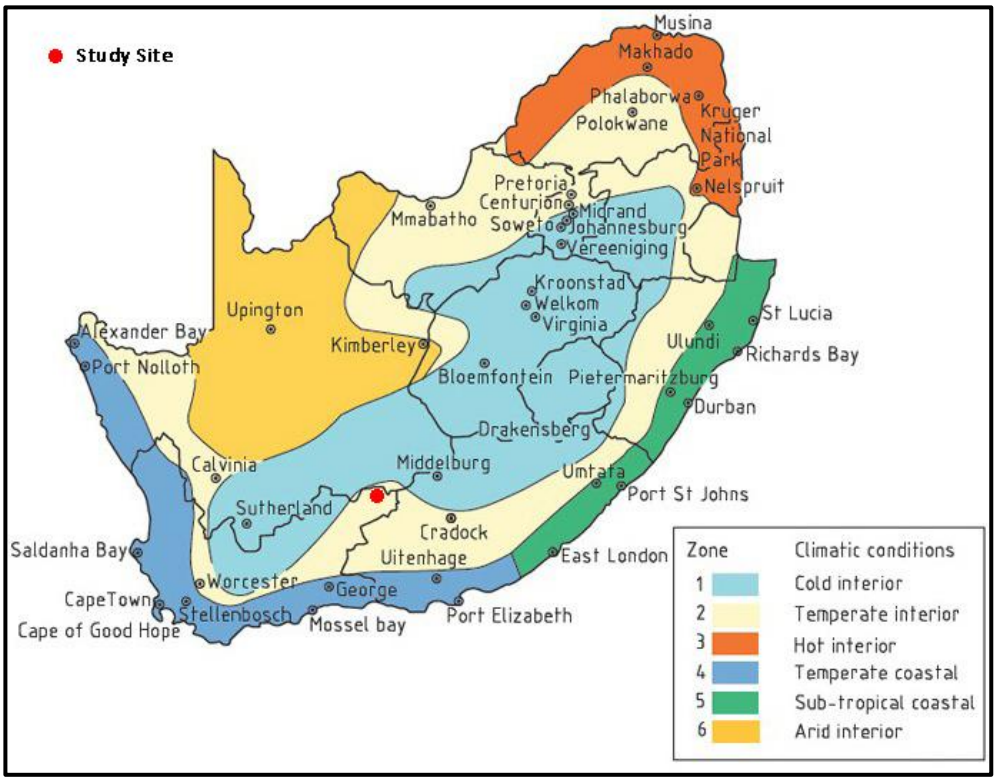


Figure 3: Broad Climatic Zones of South Africa

4.4 Landuse

The study site and surrounding areas are open, dry grassland and shrubland veld that is predominantly used for the grazing and farming of sheep. Due to the low veld carrying capacity and dryness of the region cattle are seldom farmed with in the area. The landuse or landcover of the study site is that of open dry grassland and grazing land with low levels of urbanisation and related infrastructure such as roads.

Figure 4, below, highlights the current landuse of the study site and surrounding areas.

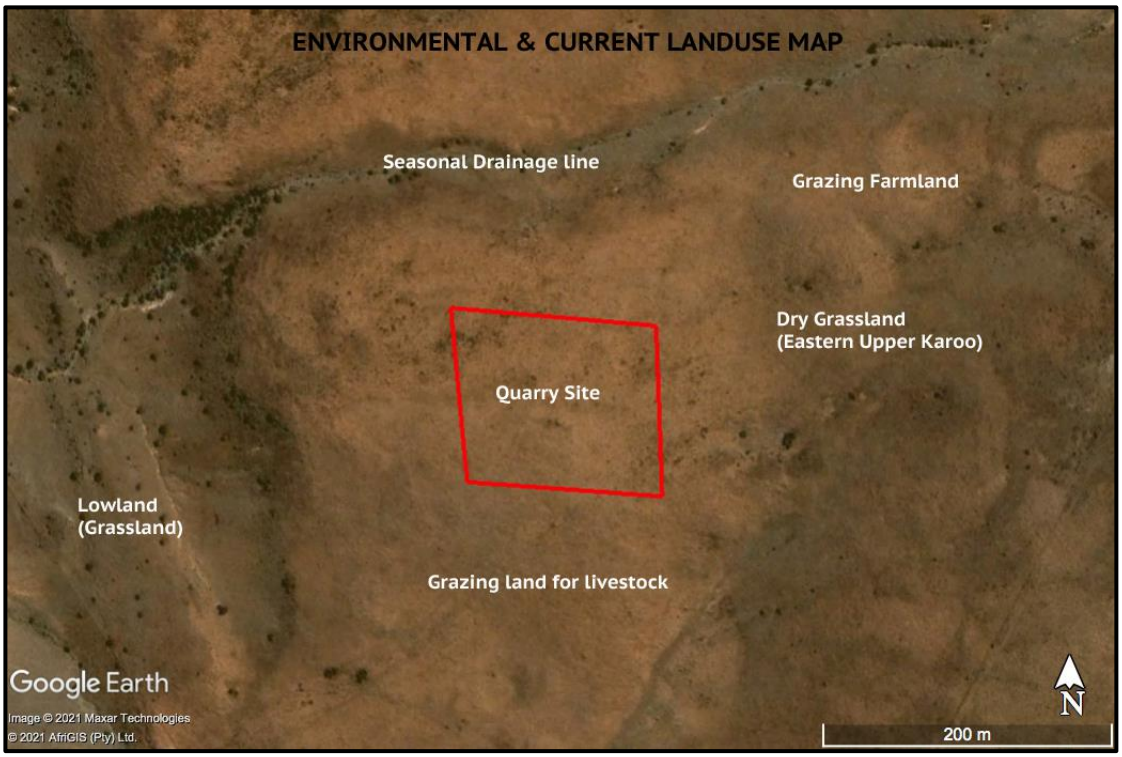


Figure 4: Environmental & Current Landuse Map

5 TERRESTRIAL ECOLOGY

5.1 Vegetation

South Africa is divided up into nine major Biomes. The study site and the surrounding area are within the Nama-Karoo Biome (Figure 5). Mucina & Rutherford (2006) divide the Nama-Karoo into three main bioregions, namely, Bushmanland & West Griqualand; Upper Karoo; and Lower Karoo. The site is within the Upper Karoo Bioregion and within the original extent of the veldtype of **Eastern Upper Karoo** (Figure 6).

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

Table 6: Vegetation hierarchy of the study area

Category Description	Classification
Biome	Nama-Karoo
Bioregion	Upper Karoo
Veldtype	Eastern Upper Karoo

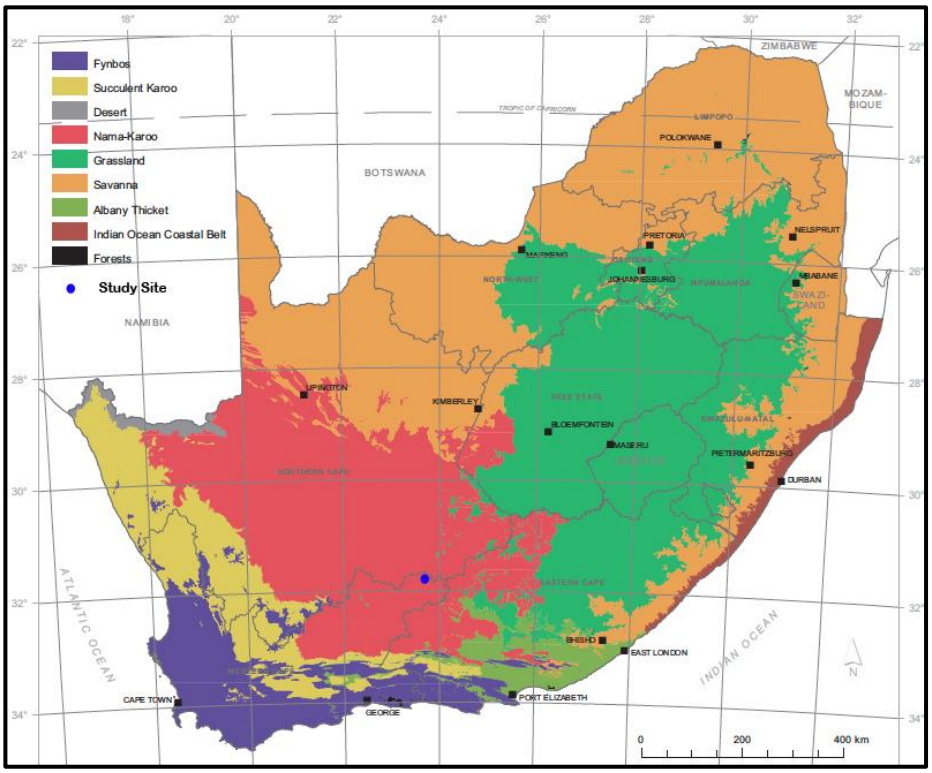


Figure 5: Biomes of South Africa

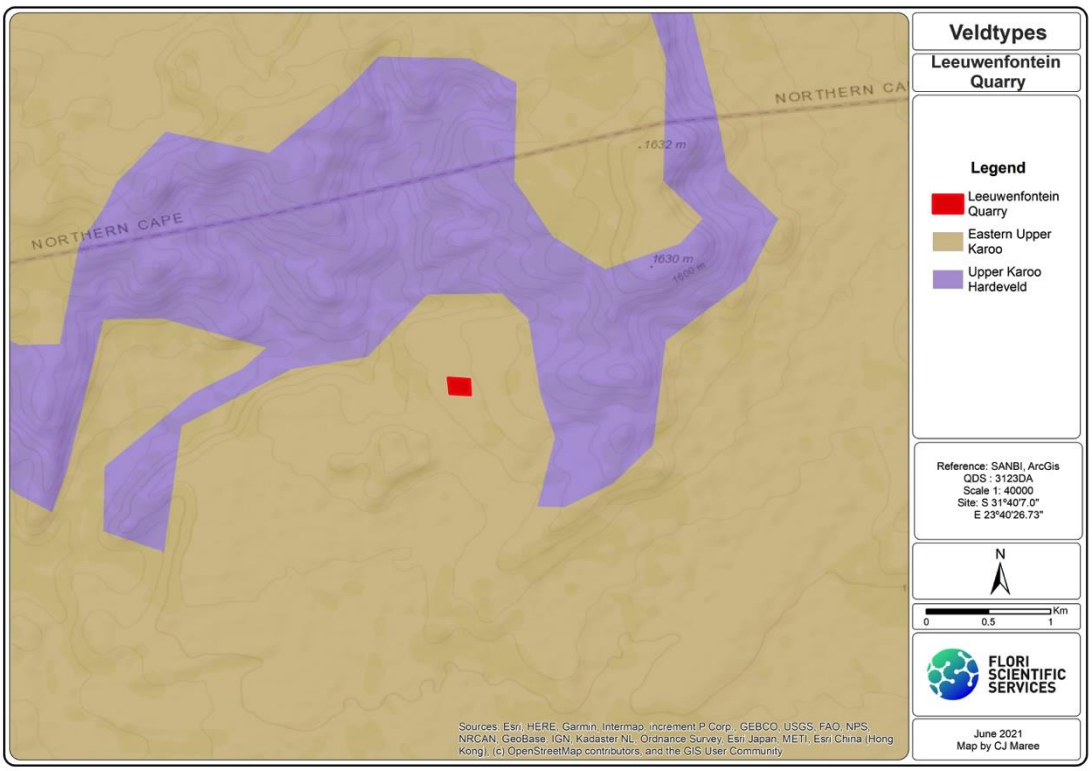


Figure 6: Veldtypes

Eastern Upper Karoo is characterised by flats and gently sloping plains (interspersed with hills and rocky areas of Upper Karoo Hardeveld in the west, Besemkaree Koppies Shrubland in the northeast and Tarkastad Montane Shrubland in the southeast), dominated by dwarf microphyllous shrubs, with 'white' grasses of the genera *Aristida* and *Eragrostis* (these become prominent especially in the early autumn months after good summer rains). The grass cover increases along a gradient from southwest to northeast (Mucina & Rutherford, 2006).

The vegetation of the study site is typical dry grassland with medium grass cover and scattered very low microphyllous (small-leaved) shrubs and no trees (Figure 7). The dry white grasses of *Aristida* and *Eragrostis* species are visible within the veld, with the steeper slopes of the mountains with Upper Karoo Hardeveld vegetation (veldtype) in the background. The vegetation of the study site is moderately degraded with the dominant impacts that of grazing of livestock, mostly sheep. The soils of the study area were sandy yellow-red apedal and well-drained, but shallow. The area is scattered with blackish rocks (commonly known as 'ysterklip' iron stone).

There were no alien weed plant species found on site. *Medicago laciniata* is a common weed found in the Upper Karoo which could potentially be in the area.

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

Figure 7: Photo of study site showing vegetation (Eastern Upper Karoo)

5.2 Priority Floral Species

No Red Data Listed (RDL) species (endangered, threatened or vulnerable) were observed during field investigations. None are expected to occur. No Orange Data Listed (ODL) species were observed either with none expected to occur.

5.3 Threat Status

Eastern Upper Karoo is not a threatened veldtype (ecosystem) and has a threat status / conservation status of 'Least Threatened' (LT) (Table 7).

Table 7: Veldtype status

Veldtype	Status	Description
Eastern Upper Karoo	Least Threatened (LT) / Least Concern (LC)	Statutorily conserved in Mountain Zebra and Karoo National Parks as well as in Oviston, Commando Drift, Rolfontein and Gariep Dam Nature Reserves. About 2% of the veldtype has been transformed, largely due to building of dams (Gariep, Grassridge, Killowen, Kommandodrift, Kriegerspoort, Lake Arthur, Modderpoort, Schuil Hoek, Vanderkloof, Victoria West, Wonderboom and Zoetvlei). *Medicago laciniata* is a common and widespread alien plant. Erosion is moderate (60%) and high (38%). Veld managers perceive much of the Eastern Upper Karoo to be experiencing changes in species composition requiring high-priority action (Mucina & Rutherford, 2006, 2010)

Table 8 below gives a basic description of each of the status categories, while Figure 8 shows the categories in a hierarchical format (IUCN Redlist, 2010).

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

Table 8: Ecosystem Status: Simplified explanation of categories used

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

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

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

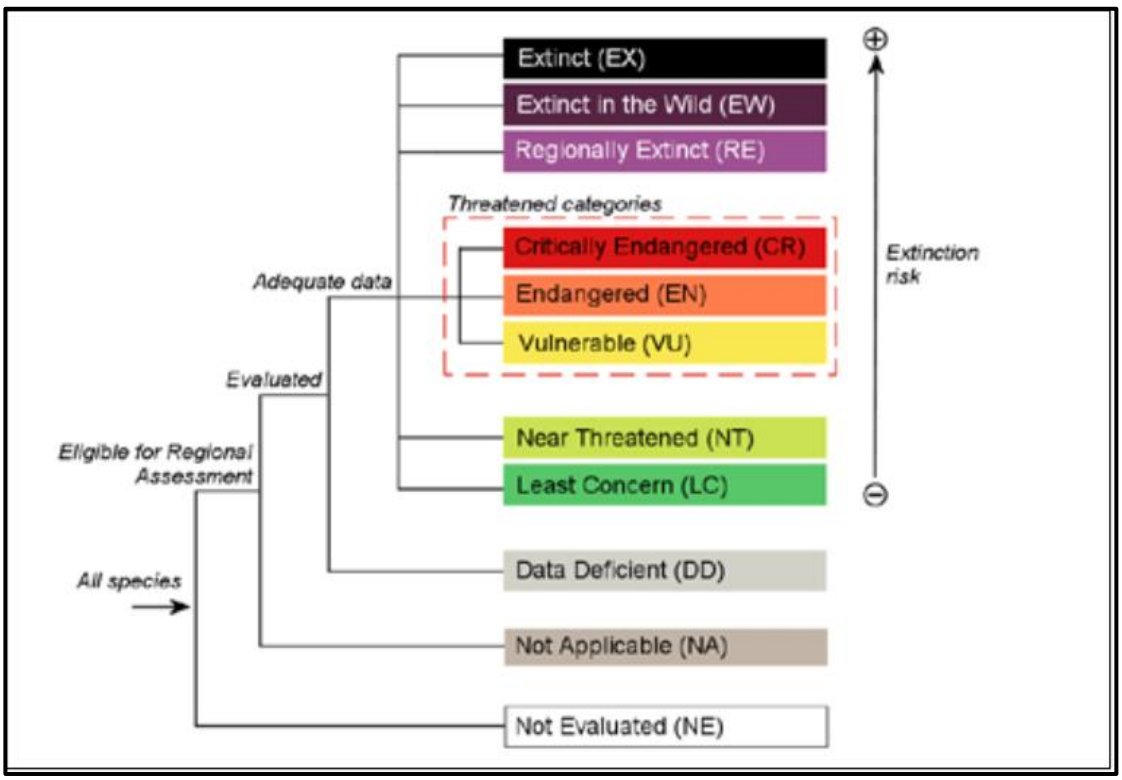


Figure 8: Structure of categories used at the regional level

5.4 Fauna

The region of the study area is fairly open with low levels of urbanisation. The general region in which the study area is situated is open Nama-Karoo grassland and shrubveld (Eastern Upper Karoo veldtype). The grassland is less species-rich and less dense at the study site than down in the lowlands and areas closer to Murraysburg. Due to low rainfall and low livestock carrying capacity the main farming activity is the grazing of sheep. It is understandable that a number of wild faunal species will be present in the region. However, lack of water and low grazing levels will limit numbers and species. Many of the wild animals will predominantly be moving in and out of the area in search of water and food. The study site is small and lacks any ideal habitats for the long-term or permanent presence and breeding of most wild fauna species, including reptiles and birds.

5.4.1 Mammals

The wide-open plains and mountainous areas with low levels of urbanisation are ideal for free roaming wild mammals, but the low rainfall, arid climate, and resulting low grazing potential will limit the permanent presence of mammals in areas such as the study site. Most mammals will tend to roam far and wide in search of food, water and ideal short-term breeding localities. The study site and region are within the distribution range of around 53 mammal species, indicating a medium to medium/high potential.

Species observed in the general area during the site investigations (including those of other nearby studies and reports) include: Kudu (*Tragelaphus strepsiceros*), Aardvark (*Orycteropus afer*), Dassie (Rock Hyrax) (*Procavia capensis*), Springbok (*Antidorcas marsupialis*), Steenbok (*Raphicerus campestris*), Cape Hare (*Lepus capensis*), Scurb hare (*Lepus saxatilis*), Ground Squirrel (*Xerus inauris*), Yellow Mongoose (*Cynictis penicillata*), Bat-eared Fox (*Otocyon megalotis*), Namaqua Rock Mouse (*Aethomys namaquensis*), Karoo Bush Rat (*Otomys unisulcatus*) and Porcupine (*Hystrix africaeaustralis*). Duiker species (Sub-family: Cephalophinae), shrew species (*Graphiurus* spp.), rats and mice. black-backed jackal (*Canis mesomelas*), Cape fox (*Vulpes chama*), caracal (rooikat) (*Caracal caracal*).

Three listed species potentially occur in the area of the study site, namely, Black-footed Cat (*Felis nigripes*) (Vulnerable), Leopard (*Panthera pardus*) (Near-threatened) and Honey Badger (*Mellivora capensis*) (Endangered).

5.4.2 Avifuana

The study area is not situated within or close to an important bird area (IBA). The closest IBA is the Platberg-Karoo Conservancy IBA, which is about 80km northeast of the site. The immediate area is not known as a birding hotspot, but certain priority species such as raptors will fly over the area from time to time in search of food or simply when moving from one area to another. This will be most prevalent

during the summer when migratory species arrive from the northern hemisphere and higher up in Africa. Ostriches are also known to occur in the area as well. The absence of water in the study area such as open bodies of permanent water (including farm dams) and temporary water such as pans and small streams will limit the presence and duration of many bird species, especially any waterbirds. However, the openness of the region, along with the mountains, especially to the east creates ideal habitats for numerous bird species, including priority species such as raptors and vultures. Fortunately, the nature of the project is such that it will not have a measurable negative impact on avifaunal species. This is also due to the very localised nature of the project.

The following priority bird species have previously been recorded in the region and are the ones most likely to be seen in or around the study site (Table 9). Not all of birds tabled are red data listed (RDL) species, but all are seen as priority species. During site investigations in May 2021 a few feathers of a Korhaan (*Eupodotis sp.*) was found near the study site.

Table 9: Priority Bird Species

Scientific Name	Common Name	Status
Ardeotis kori	Kori bustard	Vulnerable
Bubo africanus	Spotted eagle owl	Least concern
Bubo capensis	Cape eagle owl	Least concern
Elanus caerules	Black-shouldered kite	Least concern
Eupodotis vigorsii	Karoo korhaan	Near threatened
Falco naumanni	Lesser kestrel	Vulnerable
Falco peregrinus	Lanner falcon	Vulnerable
Falco rupicoloides	Greater kestrel	Not threatened
Gyps coprotheres	Cape vulture	Endangered
Neotis ludwiggi	Ludwig's bustard	Vulnerable
Polemaetua bellicosus	Martial eagle	Vulnerable

5.4.3 Reptiles

The maps below show the hotspots for priority and species-rich snake and lizard species for South Africa (Figure 9 & Figure 10). The study area is not within any of these hotspots. However, care should still be taken to avoid interacting with snakes should any be encountered. It is more than likely that there are snakes and lizards in the area, due to the remoteness and mostly undisturbed nature of the site and surroundings. According to the Southern African Reptile Conservation Assessment (SARCA) database of the Animal Demography Unit (www.arca.adu.org.za), 23 reptiles have been recorded in the degree square (3123D) in which the study area is situated.

The only listed species known from the area according to the SARCA database is the Karoo Padloper (*Homopus boulengeri*), which is a Karoo endemic restricted to the Nama Karoo Biome. The distribution of this species is however fairly large and the site is not within an area of known significance for this species which appears to favour lowland habitats over mountainous terrain (Arcus, 2018).

It is likely that the Plain Mountain Adder (*Bitis inornata*) occurs within the high-lying areas of the site and surrounding mountains, above 1600 m. This little-known species is found in the Sneeuberge and may potentially occur in the area of the study site. It is currently listed as Endangered and has apparently declined significantly in recent times (Arcus, 2018).

5.4.4 Amphibians

No amphibians were observed during field investigations and none are expected to occur on the site due to the total lack of necessary or ideal habitats, including wetlands, streams, dams, etc. It is likely that a few species will be present in the small streams in the nearby mountain areas, but unlikely in the small nearby seasonal stream.

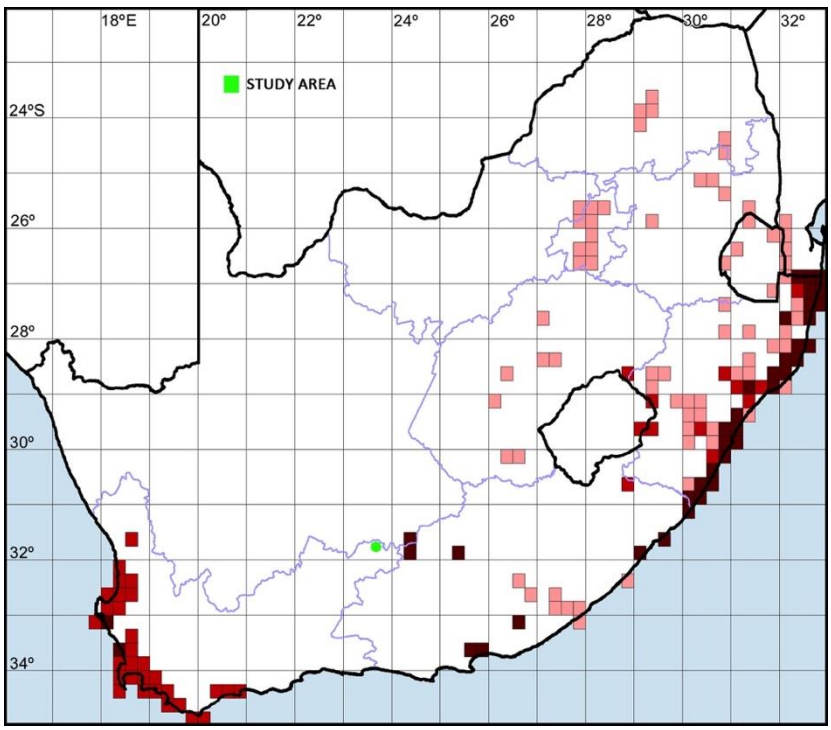


Figure 9: Snake hotspots

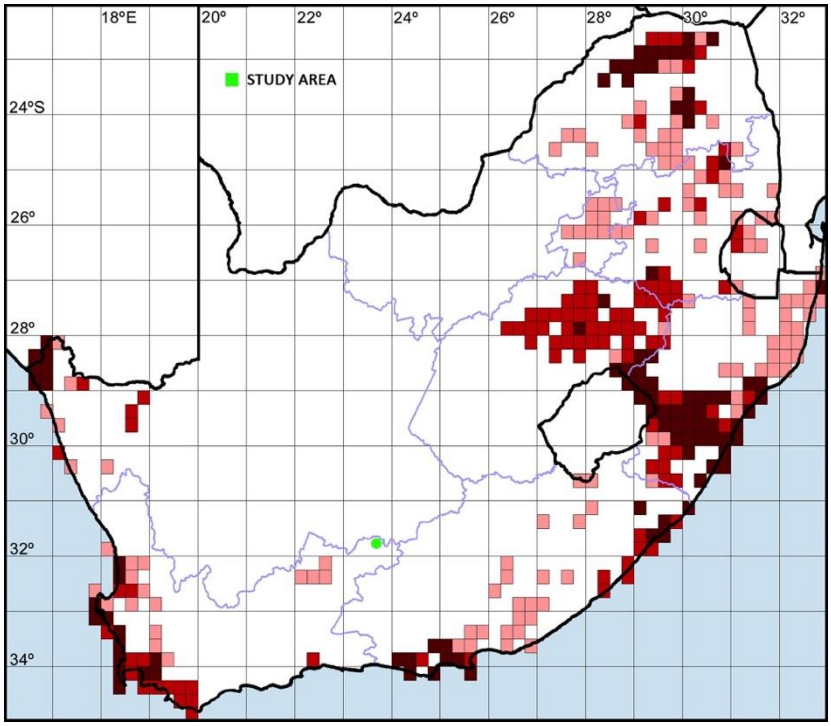


Figure 10: Lizard hotspots

5.4.5 Invertebrates

The map below shows the hotspots for priority butterflies and species-rich areas for South Africa (Figure 11). The study area is not within any of these known hotspots.

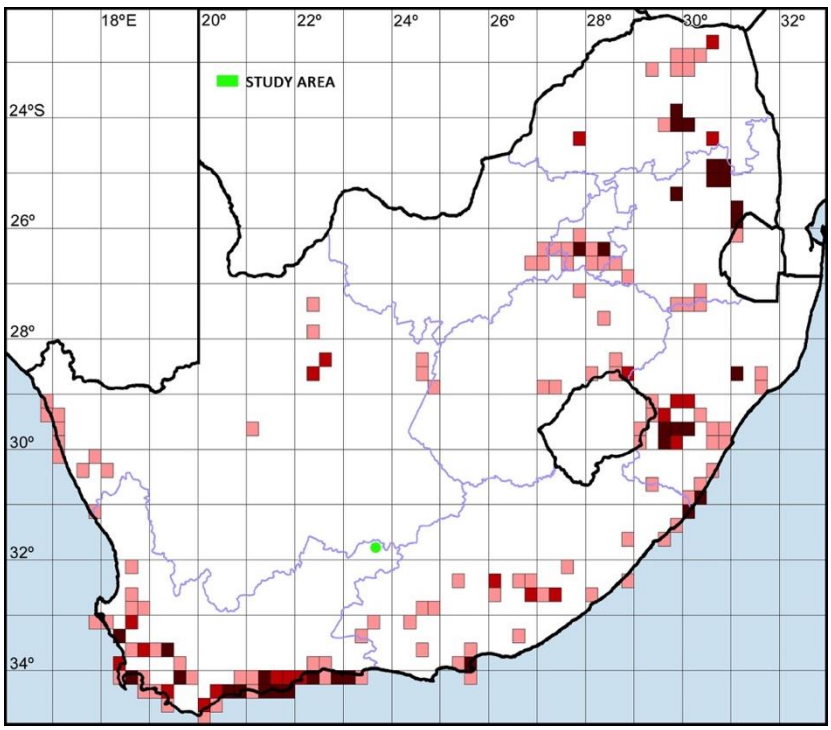


Figure 11: Butterfly hotspots

6 AQUATIC ECOLOGY

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

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

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

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

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

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

6.1 Watercourses in the study area

The Nama-Karoo is an arid biome and most of the rivers are non-perennial, with exceptions such as the Orange River and the few permanent streams in the southwest that originate in the higher-rainfall neighbouring areas (and in the case of the latter terminate in shallow lakes and pans (Bushmanland Vloere) that dry up in the dry season). The few perennial streams that originate in the Nama-Karoo are limited to the wetter east, with the Great Fish River being of note (Mucina & Rutherford, 2006, 2010).

There are no watercourses in the study area, including small streams, distinctive drainage lines and wetlands. However, due to the mountainous terrain of the area, with numerous valleys and slopes, there area a number of small seasonal drainage lines and small seasonal streams to be found, especially in the steep valleys down which any stormwater surface flow will be naturally channelled. There is a small seasonal stream about 600m to the north of the study site, which is an unnamed tributary of the Brak River (Figure 12). The stream flows southwest into the Brak River, which flows southeast and into the Buffels River. There is also a small seasonal drainage line just more than 100m north of the boundary of the study site (Figure 13).

Figure 12: Main Rivers and Streams in the Region

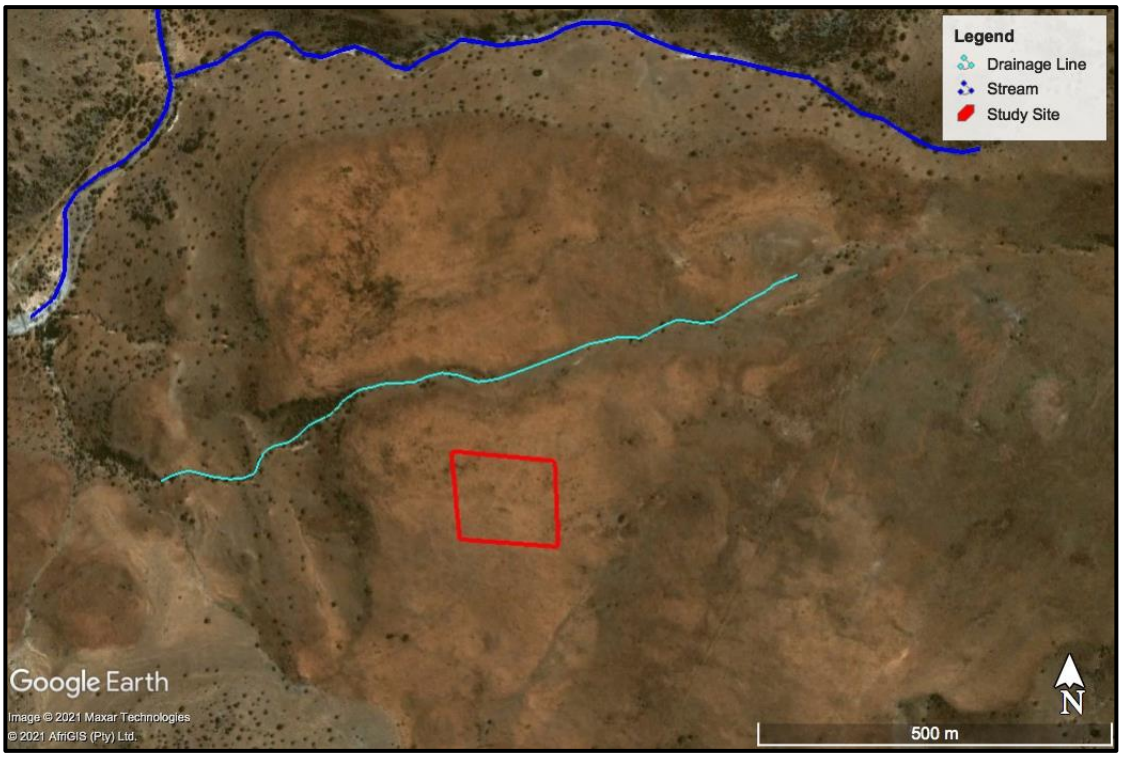


Figure 13: Seasonal Drainage Line

6.2 Classification of watercourses

Watercourses are classified along different hydrogeomorphic (HGM) types or units, up to Level 4, in terms of various levels as refined for South Africa by Kleynhans, *et. al*. (2005) and used in the Classification System for Wetlands user manual – SANBI Series 22 (Ollis *et. al.* 2013). See Table 10, below.

There are no watercourses within the study area. However, the small stream and small drainage line to the north of the study site were classified (Table 11).

Watercourses found on site, or within a 500m radius if the watercourse is a wetland, are assessed in terms of their Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS).

Table 10: Classification System for Watercourses (Levels 1 – 4)

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

Table 11: Classification of Watercourses

Delineated systems	Level 1 System	Level 2 Regional Setting (Ecoregion)	Level 3 Landscape Unit	Level 4 HGM Unit

Unnamed Stream	Inland	Upper Nama-Karoo	Valley Floor	River (Upper foothills)
Drainage Line	Inland	Upper Nama-Karoo	Plain	River (Upper foothills)

6.3 Drainage areas

South Africa can be naturally divided up into a number of geographically occurring Primary Drainage Areas (PDAs) (Figure 14). The PDAs can be further divided into a number of Quaternary Drainage Areas (QDAs). The different areas are demarcated into Water Management Areas (WMAs) and Catchment Management Agencies (CMAs). Previously there were 19 WMAs and 9 CMAs. As of September 2016, the WMAs were revised and there are now officially only 9 WMAs, which correspond directly in demarcation and area to the 9 CMAs (Government Gazette, 16 September 2016. No.1056, pg.169-172) (Figure 15).

The study area is situated within the Primary Drainage Area (PDA) of **L** and in the Quaternary Drainage Area (QDA) of **L21B** (Figure 16 & Figure 17). The site is within the Upper Nama-Karoo Wetland Vegetation Ecoregion (Figure 18). A summary of the catchment areas is shown in Table 12, below. It is important to note that the proposed quarry site is not within an Important Water Source Area on a national or provincial level. This has relevance because the proposed project is a quarry, which potentially could impact on surface as well as ground water reserves.

Table 12: Summary of Catchment Areas

Level	Category
Primary Drainage Area (PDA)	L
Quaternary Drainage Area (QDA)	L21B
Water Management Area (WMA) – Previous	Fish to Tsitsikamma
Water Management Area (WMA) – New	Mzimvubu-Tsitsikamma (WMA 7)
Sub-Water Management Area	Gamtoos
Catchment Management Agency (CMA)	Mzimvubu-Tsitsikamma (CMA 7)
Wetland Vegetation Ecoregion	Upper Nama-Karoo
RAMSAR Site	No
Wetland FEPA	No
Fish FEPA	No
Fish FSA	No
Fish Corridor	No
Fish Migratory	No
Priority Quaternary Catchment	No
National Strategic Water Source Area (SWSA)	No

Provincial Important Water Source Area (WSA)	No

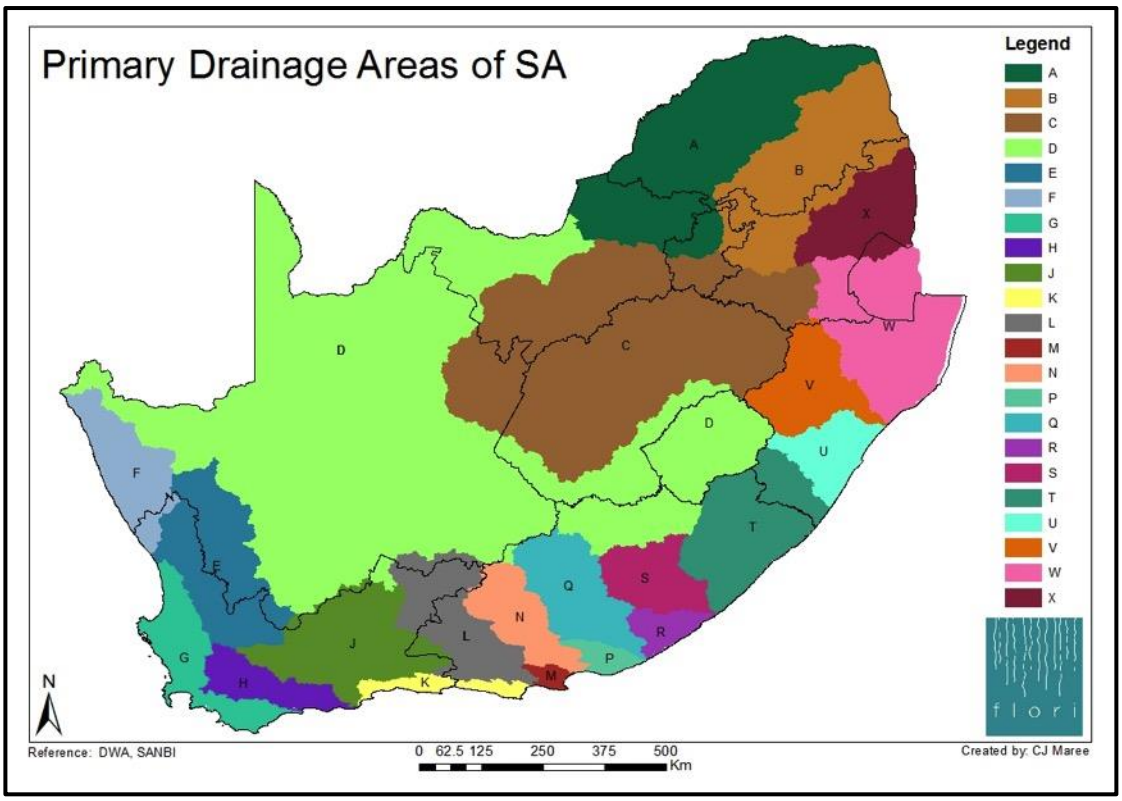


Figure 14: Primary drainage areas of South Africa

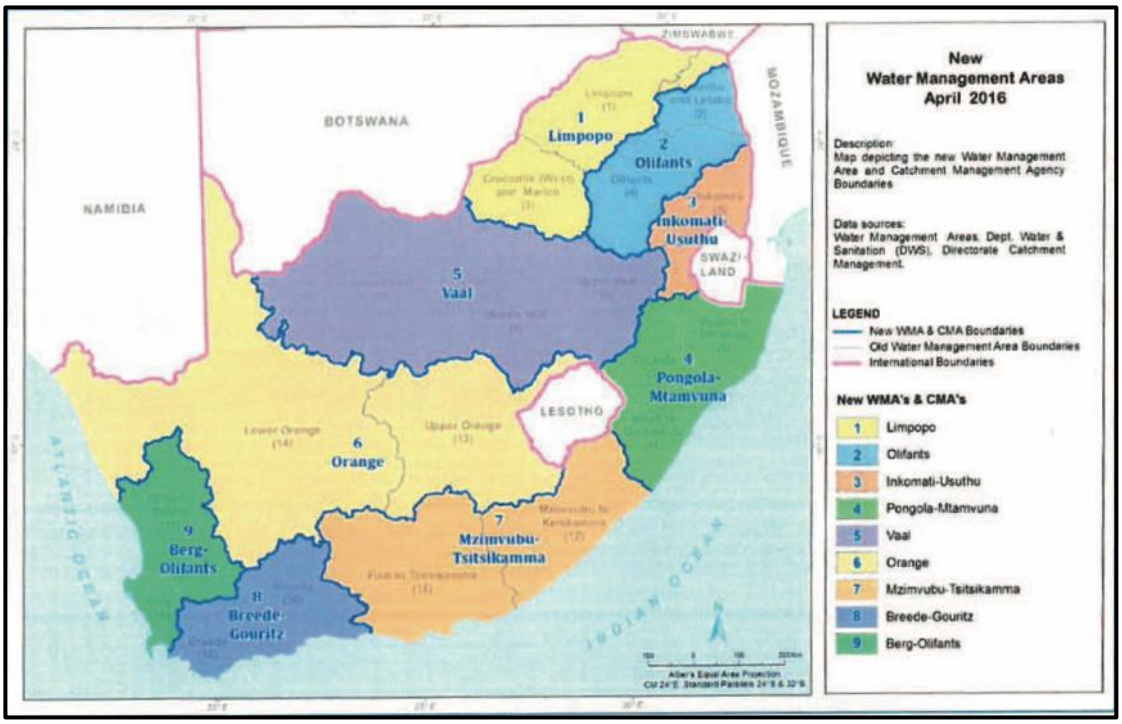


Figure 15: WMAs and CMAs of South Africa

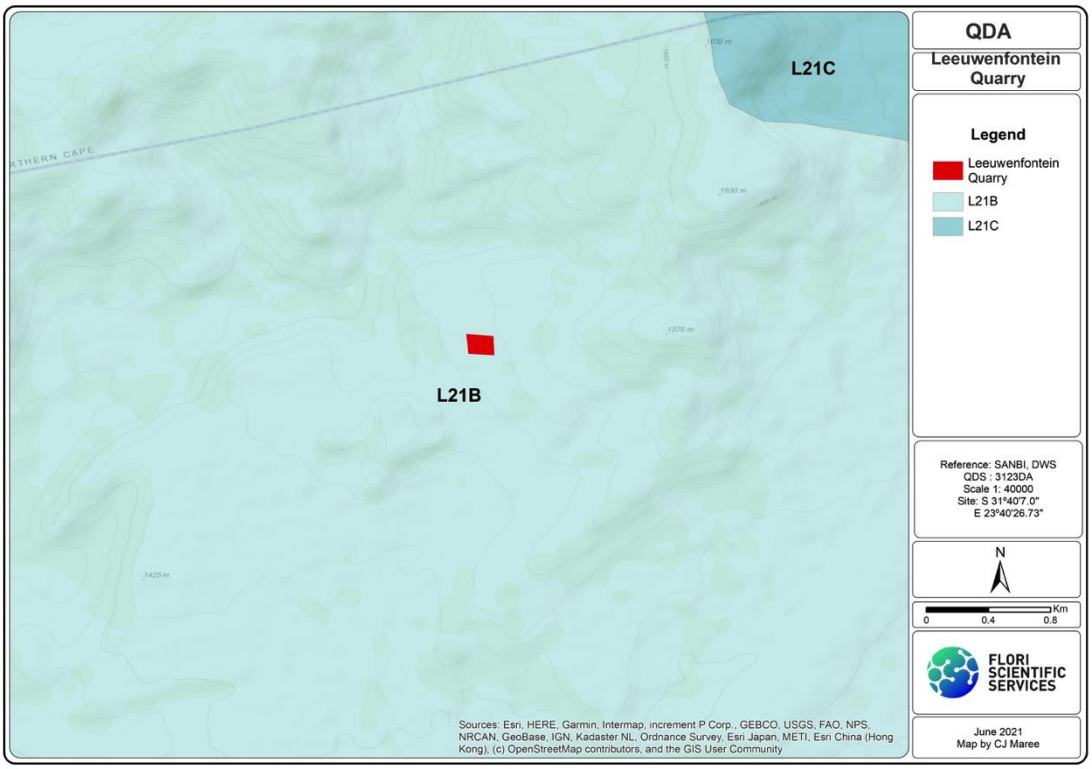


Figure 16: Quaternary Drainage Areas (QDAs)

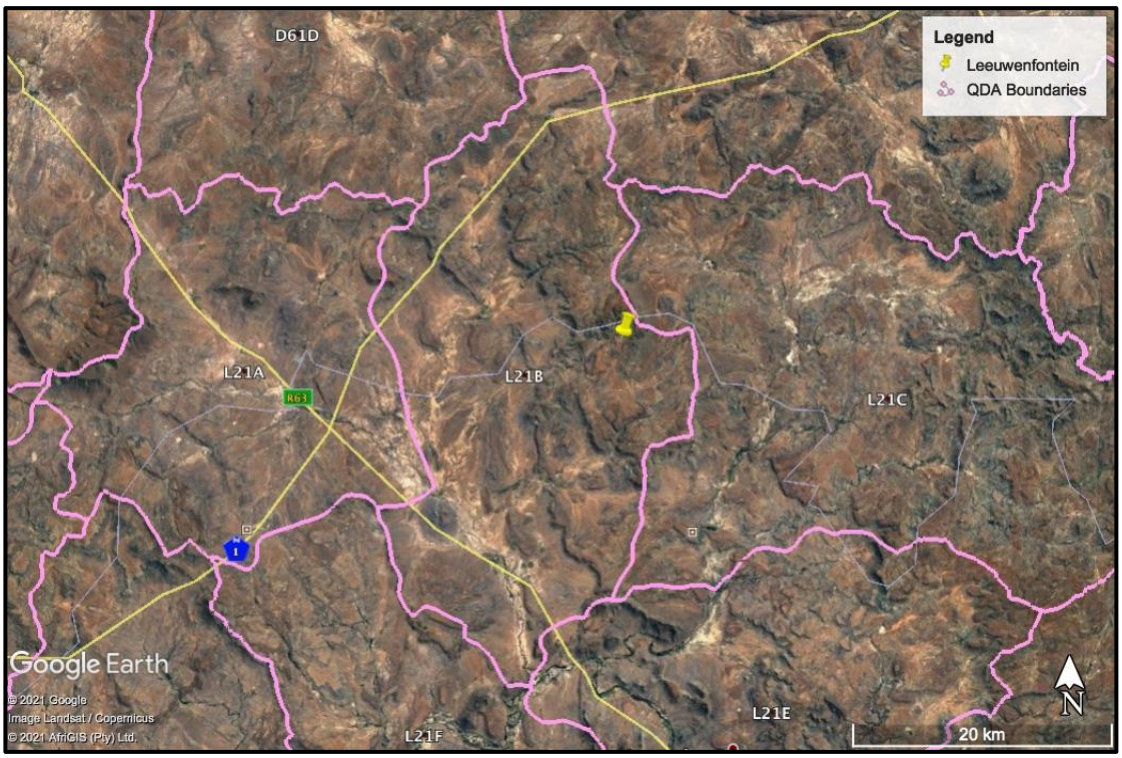


Figure 17: Quaternary Drainage Areas (Google Earth)

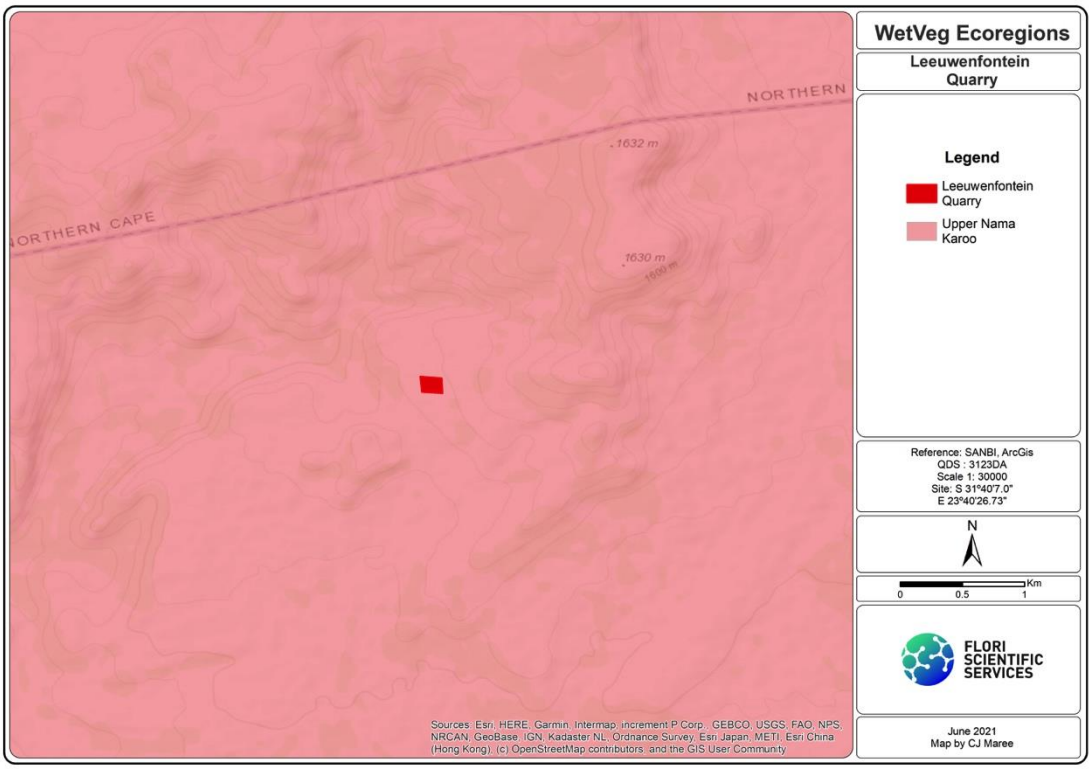


Figure 18: Wetland Vegetation Ecoregion

6.4 Present Ecological State of Watercourses in the Study Area

There are no watercourses in the study site. However, the present ecological state (PES) of a small seasonal stream north of the site was determined, simply to provide more detail and information for the project (Table 13). The assessment criteria and structure are based on the modified Habitat Integrity approach of Kleynhans (1996, 1999). The PES is calculated by looking at the hydrology, geomorphology, water quality and biota. Of importance is the overall PES of the aquatic ecosystem (Table 13).

The small stream is in the upper foothills of the mountains and is in a good, natural state, and has a PES of Category A (Natural / Unmodified). The project will have no impact on this watercourse.

Table 13: PES Assessment

Criteria	Identified Watercourses	
	Stream	Drainage Line
HYDROLOGY		
Flow modification	4	4
Permanent inundation	4	4
WATER QUALITY		
Water Quality Modification	4	4

Sediment Load Modification	5	5
GEOMORPHOLOGY		
Canalisation	5	5
Topographic Alteration	4	4
BIOTA		
Terrestrial Encroachment	4	4
Indigenous Vegetation Removal	5	5
Invasive Plant Encroachment	4	4
Alien Fauna	5	5
Over utilisation of Biota	4	4
Total:	48	48
Average:	4,3	4,3
Category:	**A**	**A**
Description	**Natural / Unmodified**	**Natural / Unmodified**
Recommended EMC	**B**	**B**

6.5 Ecological Importance & Sensitivity of Watercourses

The Ecological Importance and Sensitivity (EIS) ratings of the watercourses identified were determined as shown in the table below (Table 14). As mentioned above, there are no watercourses in the study area, but there are a small, unnamed seasonal stream and small seasonal drainage line to the north, which were assessed. The small stream along with a number of other small streams channel water run-off from the hills and mountains into the Brak River. Due to the low rainfall and aridness of the region these small streams are important on a local and provincial scale. The drainage line is very small and is not significant even on a local scale.

Table 14: EIS of watercourses in the study area

Determinants	Unnamed Stream	Unnamed Drainage Line	Confidence
PRIMARY DETERMINANTS			
1. Rare & Endangered Species	1	1	4
2. Populations of Unique Species	2	1	4
3. Species/taxon Richness	2	1	4
4. Diversity of Habitat Types or Features	1	1	4
5 Migration route/breeding and feeding site for wetland species	1	0	3
6. Sensitivity to Changes in the Natural Hydrological Regime	1	1	3
7. Sensitivity to Water Quality Changes	1	0	3

8. Flood Storage, Energy Dissipation & Particulate / Element Removal	1	0	3
MODIFYING DETERMINANTS			
9. Protected Status	0	0	4
10. Ecological Integrity	1	1	4
TOTAL	11	6	-
AVERAGE	1,1	0,6	-
EIS Category	**C**	**D**	**-**
Description	**Moderate**	**Low**	**-**
	Important on a local scale	**Not important. Fairly insignificant**	

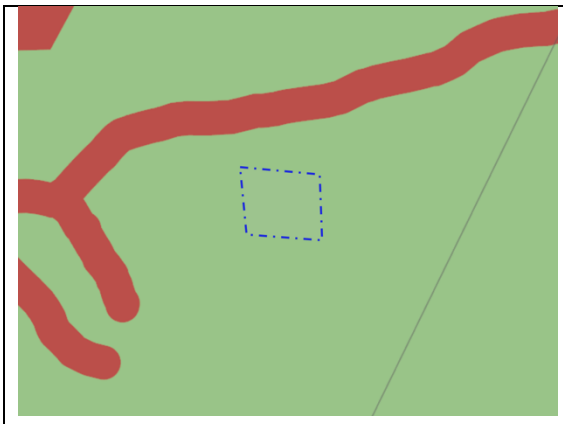
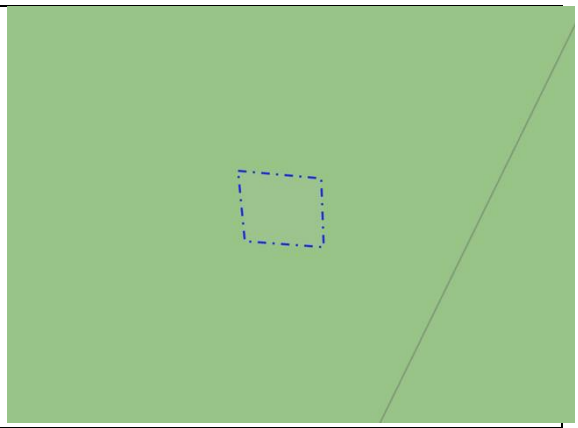
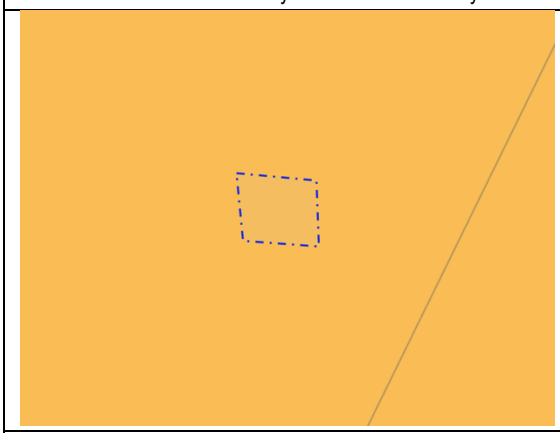
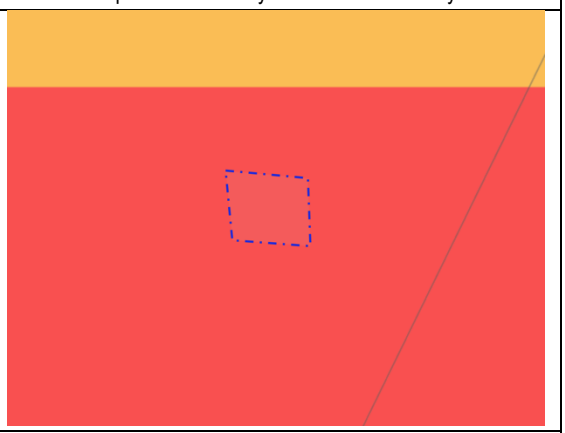
7 SENSITIVITY ASSESSMENT

7.1 DEA Screening Tool Assessment

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

- Terrestrial biodiversity combined sensitivity: Low.
- Aquatic biodiversity combined sensitivity: Low.
- Plant species theme: Medium.
- Animal species theme: High.

Table 15: Maps from DEA Screening Tool

	
Terrestrial Biodiversity Combined Sensitivity	Aquatic Biodiversity Combined Sensitivity
	
Plant Species Theme	Animal Species Theme
Blue Dotted Area: Study Site; Red - High; Yellow – Medium; Green - Low	

During site investigations the sensitivities as shown in the above screening tool results were assessed and verified. Ground-truthing affirmed the DEA Screening Tool assessment that the Terrestrial Biodiversity and Aquatic Biodiversity of the site are indeed 'Low'. The areas in the Terrestrial that show as 'High' are the small streams. These should also show 'High' in the Aquatic. The ground-truthing also affirms that that the plant species theme is 'Medium'. This is not because there is a great diversity or richness of species, or presence of priority species, but more because the veld is in a good condition.

The screening results for the animal species theme are however disputed. According to site investigations (ground-truthing) the assessment is 'Medium'. The greater area is open, in fairly good condition, and at the foothills of the mountains where numerous wild animal species will be present. However, the aridness of the site and lack of freely available water will limit the continued presence and breeding of animals on the plateau on which the site is located. Species-richness will also not be high, including reptiles, amphibians and insects (butterflies, etc.).

7.2 Ecological Sensitivity Assessment

The sensitivity assessment identifies those areas and habitats within the study site that have a high conservation value and that may be sensitive to disturbance. All watercourses, including seasonal

streams and drainage lines are, by default, viewed as sensitive, even if they are badly degraded. Areas or habitats have a higher conservation value (or sensitivity) based on their threatened ecosystem / veldtype status, ideal habitat for priority species (including Red Data species), species-richness, distinctive habitats, etc. Demarcated priority areas such as nature reserves also have a higher ecological sensitivity, even if not within a threatened ecosystem.

The natural environment within the study area is very homogenous and consists only of one distinctive habitat type, namely, arid grassland. There are no other distinctive habitats such as streams, saltpans, highly distinctive rocky ridges, or even transformed areas. The sensitivities of the habitats are first assessed separately in terms of fauna and flora (Table 16 & Table 17) and then combined into a combined ecological sensitivity analysis (Table 18).

Table 16: Floristic sensitivity analysis

Criteria	Distinctive habitats in the study area
	Arid Grassland
Red Data Species	2
Habitat Sensitivity	3
Floristic Status	3
Floristic Diversity	3
Ecological Fragmentation	4
Sensitivity Index	30%
Sensitivity Level	**Medium/Low**

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

Table 17: Faunal sensitivity analysis

Criteria	Distinctive habitats in the study area
	Arid Grassland
Red Data Species	3
Habitat Sensitivity	4
Faunal Status	5
Faunal Diversity	5
Ecological Fragmentation	4
Sensitivity Index	42%
Sensitivity Level	**Medium**

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

The ecological sensitivity of the study site is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit, whether it is floristic or faunal in nature (Table 18).

Table 18: Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity
Arid Grassland	Medium/Low	Medium	**Medium**

According to the analyses there are no high sensitivity areas or habitats. However, regardless of the rating watercourses are by default viewed as sensitive. However, the study area is not within 100m of any watercourses and no activities will take place within these small drainage lines anyway. The drainage lines will not be negatively impacted by the project or related activities.

7.3 Priority Areas

The study area is not situated within any priority areas.

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

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

7.4 Western Cape Critical Biodiversity Areas

According to the Western Cape Spatial Biodiversity Plan (2017) and Western Cape Critical Biodiversity Areas (WCCBA) (2017), the study site is not situated within any critical biodiversity areas (CBAs) or within any ecological support areas (ESAs) (Figure 19). The ESA areas shown in Figure 19 are link to streams and rivers within mountain valleys. The proposed project will have no impact on these ESA areas.

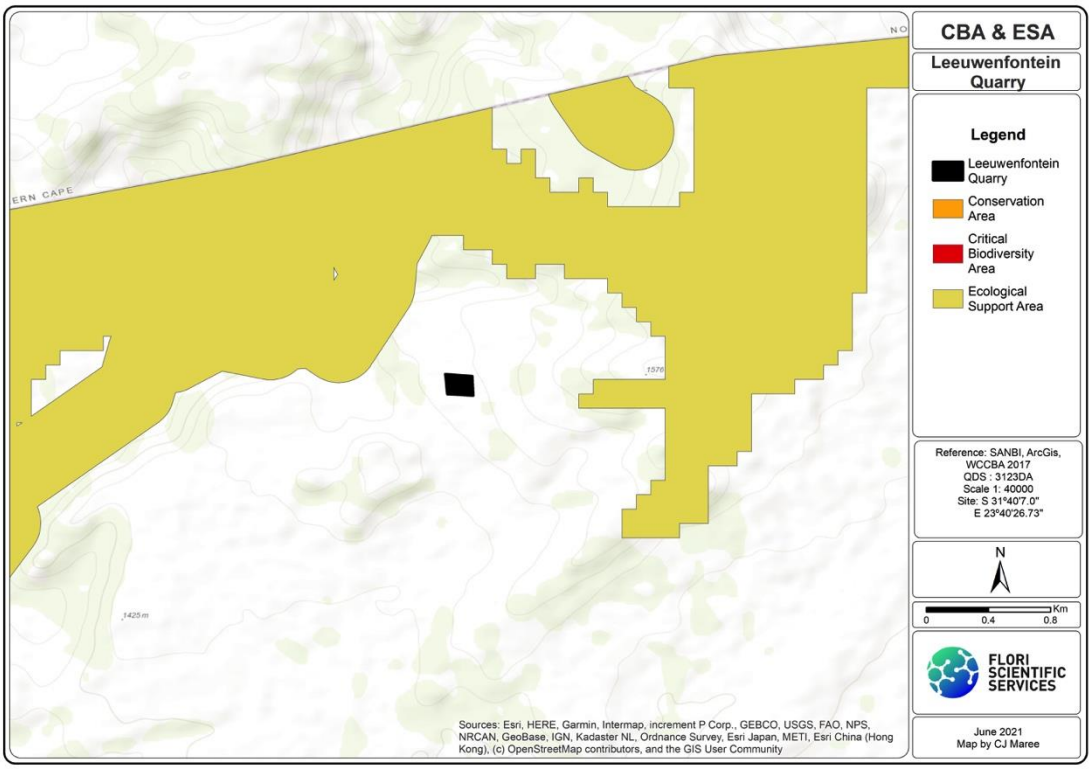


Figure 19: CBAs and ESAs (WCCBP, 2017)

7.5 Sensitive areas identified during field investigations

During site investigations no sensitive habitats or areas were encountered. The study site is fairly small and is situated in the foothills on a plateau of the surrounding mountainous area. The environment of the study site is homogenous and not sensitive, as compared to the steeper mountain slopes and valleys with streams, which are sensitive, but none of which occur in or immediately around the study site. The veldtype of the site (Eastern Upper Karoo) is not a threatened veldtype (ecosystem) and there are no red data listed (RDL) plant species or other priority species present. The sensitivity is therefore homogenous across the site. The sensitivity is determined to be 'Medium'. There are no 'High' or 'Low' Sensitivity areas on the site. The nearby, small drainage line is demarcated as having a sensitivity of 'High' and will be buffered and protected.

The sensitivity of the site borders on 'Low', but due to the fairly good condition of the veld, and openness which raises the wild animal coefficient, it has been cited as 'Medium'.

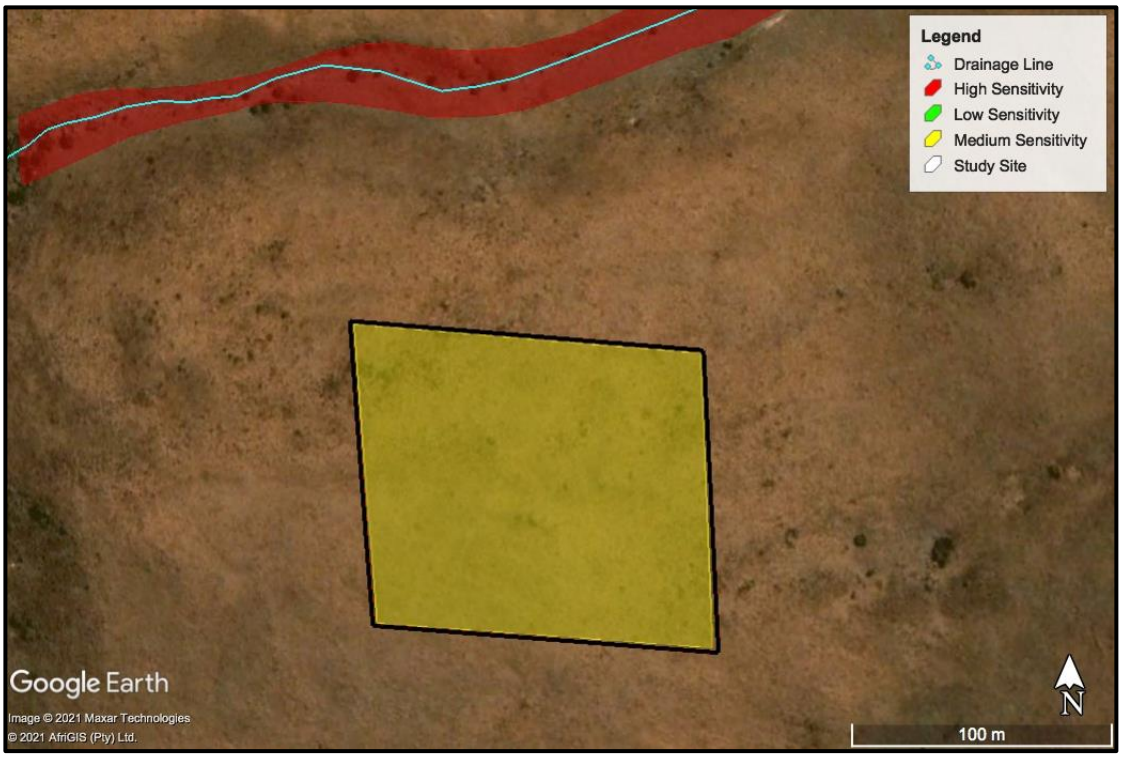


Figure 20: Sensitivity map

8 THE GO, NO-GO OPTION

8.1 Potential Fatal Flaws

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

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

9 IMPACT ASSESSMENT

9.1 Existing Impacts

Existing negative impacts on the study area and surrounding natural environments are low and include farmlands in the form of grazing lands and gravel roads. The biggest negative impacts on the natural environment are a result of over-grazing of sheep, keeping in mind that the area is fairly arid and degraded grasslands / veld is slow to recover. Besides the over-grazed veld and the presence of a few farm roads there are no other existing negative impacts.

9.2 Potential Impacts

The project and related activities do have high potential negative impacts on the natural environment due to the nature of the project. The impacts will however, be at a very localised level (site). With the implementation of mitigating measures and general standards and procedures, the potential impacts can be reduced and contained to the specific quarry site, which includes related machinery and infrastructure such as a small site office and crusher plant. Access roads will need to be maintained in the immediate area of the quarry site. The impacts will be medium-term to long-term and rehabilitation of the site on is required, on closure.
In terms of the natural environment there are no positive impacts arising from the proposed project.

9.3 Assessment of potential impacts

The calculated potential impacts on the natural environment, along with required and necessary mitigating measures are found in the table below (Table 19).

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

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

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

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

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

9.4 Cumulative Impacts

Cumulative impacts can be defined as impacts or effects on the environment which are caused by the combined effects of past, current and future activities. Cumulative impacts are the sum of the overall impacts arising from the project (under the control of the developer), other activities (that may be under the control of others, including other developers, local communities, government and landowners) and other background pressures and trends which may be unregulated.

The cumulative impacts on the study site are:

- Loss of grazing land for the medium- to long-term.
- Loss of natural vegetation for the long-term.
- Very low levels of loss of habitat and ecosystem functions in the area.

The cumulative negative impact on the study site itself is 'high' because of the nature of the project. However, the cumulative negative impact on the farm (property) and surroudning area is 'low'.

9.5 Levels of acceptable change

The cumulative negative impacts will increase in the localised area of the study area, with little to no measurable increase in negative impacts outside of the study area. The levels of change (increase in negative cumulative impacts) due to the activities of the proposed project are at acceptably low levels for the area and for the project to proceed and not create any related 'fatal flaws'.

The negative impact on the actual study site (site) will be 'High'. However, the negative impacts on a local level will be 'Low'.

Table 19: Assessment of Potential Impacts

Potential Impacts arising from Project	Phase of Project	Impact Rating (Significance: (Total) <30 (Low); 31-59 (Moderate); >60 (High)					
		Extent	Duration	Magnitude	Probability	Total	Significance
Total Impact of Proposed Project	**Construction Phase: Pre-mitigation**	**Local (2)**	**Short-term (2)**	**Moderate (6)**	**Medium (3)**	**30**	**Moderate**
	Construction Phase: Post	**Site (1)**	**Short-term (2)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**

	mitigation						
Mine operation on site level only	**Operational Phase Pre-mitigation**	**Local (2)**	**Long-term (4)**	**High (8)**	**Definite (5)**	**70**	**High**
Mine operation on site level only	**Operational Phase Post mitigation**	**Site (1)**	**Long-term (4)**	**High (8)**	**Definite (5)**	**65**	**High**
Mine operation on a local level	**Operational Phase Post mitigation**	**Local (2)**	**Long-term (4)**	**Minor (2)**	**Medium (3)**	**24**	**Low**
Cumulative Effect of Project on the local Ecology	After construction and during operational phase	**Local (2)**	**Long-term (4)**	**Minor (2)**	**Medium (3)**	**24**	**Low**
Mitigating Measures	**Construction Phase (Site Establishment)** i. The initial Construction Phase (or establishment of the quarry and site) will be 'Low' However, the main impacts will take place during the Operational Phase and actual mining of the quarry material. ii. During the construction phase all temporary laydown areas, ablution facilities, site offices, etc. must only be within the larger demarcated study site (quarry site area). Or within laydown areas that might be established by the proposed wind turbine project, for which the quarry material is specifically required. iii. During the initial Construction Phase / site establishment phase existing access roads must be used as far as possible. These roads need to be maintained and rehabilitated on completion of this phase. Especially those roads that will not be further used. Establishment and use of access roads may be connected with the wind turbine project, which is totally acceptable. iv. Ensure small footprint during construction phase. v. There is a small seasonal drainage line approximately 100m north of the northern boundary of the proposed quarry site. A buffer zone (no-go zone) of 50m from the main drainage channel is recommended. The channel has no riparian zone therefore the buffer measurement is acceptable as recommended. This buffer zone (no-go zone) must be well demarcated and maintained during the operational phase of the quarry. . vi. All excess materials brought onto site for construction to be removed after construction / site establishment. **Operational Phase** vii. No site offices, parking areas, ablution facilities, etc. may be set up outside of the demarcated quarry area. viii. All access roads to the site must be maintained at all times. Many of these roads are gravel / sand public roads used by surrounding farmers and landowners. During the entire operational phase / life of the quarry these roads must be maintained and dust-suppression must be used. ix. Perimeter fences to be routinely monitored and maintained. Assurances need to be in place that local livestock (mainly sheep) as well as wild animals will not be able to enter the mining site. ix. An Erosion Plan to be implemented and monitored during construction phase and operational phases of the project. Even though the erosion potential is low. x. All hazardous materials must be stored appropriately to prevent these contaminants from entering the soils and natural environment. The surrounding areas are grazing lands for sheep. xi. Under no circumstances may farm livestock as well as wild animals be interfered with. xii. All standard quarry mining operation procedures and regulations to be implemented. The mitigating measures recommended here are additional and do not replace any others. **Quarry Closure (Rehabilitation)** xiii. Rehabilitation plan for quarry closure must be compiled prior to termination of mining operations and assurances must be given that it will be implemented. xiv. The rehabilitation will have a positive impact on the site and area, although it will not be able to restore the area back to its original state.						
Individual Impacts							
		Extent	Duration	Magnitude	Probability	Total	Significance
1. Loss of natural vegetation	**Construction Phase: Pre-mitigation**	**Local (2)**	**Short-term (2)**	**Moderate (6)**	**Medium (3)**	**30**	**Moderate**

	Construction Phase: Post mitigation	**Site (1)**	**Short-term (2)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**
	Operational Phase	**Site (1)**	**Long-term (4)**	**High (8)**	**Definite (5)**	**65**	**High**
Mitigating Measures	i. No protected trees are within the study site. Therefore no protected trees will be lost or destroyed. ii. There are no RDL or ODL (Priority) species on site. iii. There are no habitats with 'High' sensitivity. iv. Most of the vegetation (which is sparse grassland) will be lost during the operational phase. v. Any vegetation areas damaged outside of the site during the construction phase (establishment phase) must be rehabilitated during the operational or construction phases. It may not be left until mine closure. vi. A site-specific detailed rehabilitation plan, aimed at quarry closure, must be compiled and assurances given that it will be implemented at mine closure. vii. There are no invasive alien weed problems or plants on site. A weed control programme must be compiled and implemented during the entire lifespan of the mining operations. The plan can be very basic. All weeds must found on site must be routinely removed to avoid any spread or plants going to seed. A record of weeds found on site and treatment used to control them must be kept in the on-site records of the mine.						
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. The site must be well fenced to ensure that free-roaming wildlife (and surrounding livestock – mainly sheep) do not wander into the mine site. iii. Under no circumstances may any wildlife be interfered with, hunted, disturbed. Relevant specialists must first be contacted to consult on how to approach and deal with any dangerous animals found on site (such as snakes) iv. Litter (especially food waste) must be properly dealt with to avoid attracting wild animals such as snakes, rats, mice, jackals, etc. Keeping the mine site clean will help to avoid numerous encounters with wild animals. v. No pets such as cats and dogs may be kept on site.						
5. Siltation and erosion	**Construction Phase: Pre-mitigation**	**Local (2)**	**Shot-term (2)**	**Moderate (6)**	**Medium (3)**	**30**	**Moderate**
	Construction Phase: Post mitigation	**Site (1)**	**Shot-term (2)**	**Minor (2)**	**Low (2)**	**10**	**Low**
	Operational Phase	**Site (1)**	**Immediate (1)**	**Minor (2)**	**Improbable (1)**	**4**	**Low**
Mitigating Measures	i. All mitigating measures as per Item 3 & 4 have reference to siltation and erosion. ii. Carefully monitoring of construction is essential to locate and mitigate any erosion observed speedily. Investigations must be conducted after every rain downpour. Any problems need to be rectified immediately to avoid problem escalating and siltation of downstream dams and stream occurring. iii. Proper systems must be put in place to deal with sewage, grey water and drinking water. These systems must be routinely inspected and maintained to avoid leakage, seepage, etc. which can lead to erosion and other problems.						
6. Impact on watercourses	**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. There is a small, seasonal drainage line about 100m north of the outer boundary of the study site. This watercourse needs to be protected and buffered. A 50m buffer from the main channel of the drainage line is required. This must be implemented as a 'no-go' zone. ii. No project or project-related activities may take place within this buffer zone. iii. The buffer area must be routinely monitored and assurances given that no activities, fringe impacts, etc. are occurring. Any impacts to be rectified immediately. iv. If necessary (or possible) the actual mining (quarry) footprint can be shifted 50m further south, giving if greater protection to the watercourse. However, this is not a requirement.						
7. Fringe impacts arising from construction phase	**Construction Phase: Pre-mitigation**	**Site (1)**	**Shot-term (2)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**
	Construction Phase: Post mitigation	**Site (1)**	**Shot-term (2)**	**Minor (2)**	**Low (2)**	**10**	**Low**
	Operational Phase	**Site (1)**	**Immediate (1)**	**Minor (2)**	**Improbable (1)**	**4**	**Low**
Mitigating Measures	i. Due to the nature of the project the potential for any significant fringe benefits can and will exist. Management must ensure that all fringe impacts are recorded, discussed and dealt with on a regular basis. These may include potential problems such as free water, rubbish, movement of workers into private lands, etc. 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. Any overburden stockpiles must be routinely inspected and maintained as well.						

10 CONCLUSIONS & RECOMMENDATIONS

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

Conclusions

- The study site is situated within veldtype known as Eastern Upper Karoo, which is within the Nama-Karoo Biome of South Africa.
- The site is not within a threatened veldtype (ecosystem).
- The site is not within or close to any priority areas, which include protected areas (nature reserves), important bird areas (IBAs) and national protected area expansion strategy (NPAES) focus areas.
- There are no watercourses in the study area, including wetlands. However, there is a small seasonal drainage line north of the study site that needs to be considered.
- During field investigations no Red Data Listed (RDL) or Orange Data Listed (ODL) plants were found, including protected trees. None are expected to occur.
- The study site is not situated within a Critical Biodiversity Area (CBA) or Ecological Support Area (ESA).
- There are no 'high' sensitive habitats present on site.

- No red data listed (RDL) faunal species were observed to be present and / or breeding with the study area boundaries.
- Site investigations were conducted during the summer and winter months and the findings and availability of field data are sufficient to achieve acceptable findings and outcomes from the assessment.
- There are no obvious fatal flaws in terms of the natural environment.
- Taking all findings and recommendations into account it is the reasonable opinion of the author / specialist that the activity may be authorised. The project and related activities may proceed to the next phase.

Recommendations

- Recommended mitigating measures as proposed in this study and report should be implemented if the findings of this report are to remain pertinent.
- A 50m buffer zone between the northern boundary of the site and a small drainage line north of the site is recommended. This buffer zone is a 'no-go' zone.

11 APPENDICES

11.1 Photographs

	
Study Site	Study Site showing rocky areas which are transitional between the grassveld and the more mountainous Upper Karoo Hardeveld
	
Small farm road in study area	Study Site showing grassland in site with higher mountain areas in the background
	
Weather station on study site, which was erected to monitor climate for the proposed wind farm project	

11.2 List of floral species

Trees

None.

Shrubs

Chrysocoma ciliate, Eriocephalus ericoides, Eriocephalus spinescens, Pentzia globosa. Phymaspermum parvifolium.

Herbaceous and other plants

Felicia muricata, *Osteospermum leptolobum.*

Geophytic Herbs

None

Graminoids (Grasses)

Aristida adscensionis, *Aristida congesta, Aristida diffusa, Cynodon incompletus, Eragrostis bergiana, Stipagrostis ciliata.*

Aquatic plants

None

Alien plants

None.

11.3 Eastern Upper Karoo

Below is the list of the dominant plant species found in the veldtype of Eastern Upper Karoo, as taken from Mucina & Rutheford (2006, 2010).

Tall Shrubs: Lycium cinereum (d), L. horridum, L. oxycarpum. Low Shrubs: Chrysocoma ciliata (d), Eriocephalus ericoides subsp. ericoides (d), E. spinescens (d), Pentzia globosa (d), P. incana (d), Phymaspermum parvifolium (d), Salsola calluna (d), Aptosimum procumbens, Felicia muricata, Gnidia polycephala, Helichrysum dregeanum, H. lucilioides, Limeum aethiopicum, Nenax microphylla, Osteospermum leptolobum, Plinthus karooicus, Pteronia glauca, Rosenia humilis, Selago geniculata, S. saxatilis. Succulent Shrubs: Euphorbia hypogaea, Ruschia intricata. Herbs: Indigofera alternans, Pelargonium minimum, Tribulus terrestris. Geophytic Herbs: Moraea pallida (d), Moraea polystachya, Syringodea bifucata, S. concolor. Succulent Herbs: Psilocaulon coriarium, Tridentea jucunda, T. virescens. Graminoids: Aristida congesta (d), A. diffusa (d), Cynodon incompletus (d), Eragrostis bergiana (d), E. bicolor (d), E. lehmanniana (d), E. obtusa (d), Sporobolus fimbriatus (d), Stipagrostis ciliata (d), Tragus koelerioides (d), Aristida adscensionis, Chloris virgata, Cyperus usitatus, Digitaria eriantha, Enneapogon desvauxii, E. scoparius, Eragrostis curvula, Fingerhuthia africana, Heteropogon contortus, Sporobolus ludwigii, S. tenellus, Stipagrostis obtusa, Themeda triandra, Tragus berteronianus.

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

(d) = Dominant.

11.4 Ecosystems of the Local Municipality

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

Biomes

Biomes		
Name	**Size (ha)**	**Size (%)**
Fynbos Biome	5174,9 ha	0,32%
Grassland Biome	5451,4 ha	0,33%
Nama-Karoo Biome	1622198,3 ha	99,34%
Succulent Karoo Biome	185,5 ha	0,01%
4 biomes in the municipality covering 1633010,1 ha (100 %)		

Veldtypes

Vegetation Types		
Name	**Size (ha)**	**Size (%)**
Bushmanland Vloere	530,6 ha	0,03%
Eastern Upper Karoo	224047,9 ha	13,72%
Gamka Karoo	1027465,6 ha	62,92%
Karoo Escarpment Grassland	7096,5 ha	0,43%
Roggeveld Karoo	75,2 ha	0%
Roggeveld Shale Renosterveld	5560,1 ha	0,34%
Southern Karoo Riviere	106806,3 ha	6,54%
Upper Karoo Hardeveld	215200,9 ha	13,18%
Western Upper Karoo	46227 ha	2,83%
9 vegetation types in the municipality covering 1633010,1 ha (100 %)		

Threatened Veldtypes (Ecosystems)

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.

11.5 Definitions

11.5.1 Rivers and Streams

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

11.5.2 Wetlands

'Wetland' is a broad term and for the purposes of this study it is defined according to the parameters as set out by the Department of Water & Sanitation (DWS) in their guideline (A practical field procedure for identification and delineation of wetlands and riparian areas, 2005). The classification of wetlands (which is a type of watercourse) is summarised below (Figure 21).

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

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

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

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

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

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

Water source: * Contribution usually small

*** Contribution usually large

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

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

 Wetland

Figure 21: Classification of wetlands

11.5.3 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*."

11.6 Conditions for inclusion in the Environmental Authorisation (EA)

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

11.7 Monitoring requirements

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

No special or specific monitoring requirements are required or recommended.

11.8 Short CV of Specialist

Name: Johannes Oren Maree

QUALIFICATIONS

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

FURTHER TRAINING AND DEVELOPMENT

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

PUBLICATIONS

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

PROFESSIONAL MEMBERSHIPS

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

PROFESSIONAL CAREER

Position: **Director / Owner**
Employer: Flori Scientific Services

Period: 2000 to current
Scope of Work Done:

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

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

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

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

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

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