Proposed photo voltaic facility on the farm Roodepan 150 Orania district, Northern Cape Province

Ecological Impact Assessment Report

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ABSTRACT

The proposed project site triggers a number of listed activities as included in the Environmental Impact Assessment Regulations (08 December 2014), GN R 982 – 985, in accordance with the National Environmental Management Act, No. 107 of 1998 (NEMA), as amended. The appointed Environmental Assessment Specialist, EnviroNiche, undertook an ecological impact assessment to determine the impacts which may be triggered by the proposed development. The requirements of this assessment were to undertake a specialist study to assess the biodiversity and ecology of the project sites as well as determine the significance of the impacts that the proposed project will have on the identified project site.

The project site is on the farm Roodepan 150 east of Orania. The project site and the surrounding area was assessed for any sensitive ecosystems including drainage lines and wetlands. It was found that the site is in a natural condition used for sheep and cattle farming. Parallel to the R369 road runs a water pipeline on the property while the Orange River is situated on the northern side. Several seasonal drainage lines drains towards the Orange river which makes only the southern half of the property suitable for a solar farm. The project site is situated in the Northern Upper Karoo (NKu 3) and Besemkaree koppies Shrubland (Gh 4) vegetation types. According to Mucina & Rutherford (2006), these vegetation types have a conservation status of “Least Threatened” and according to BGIS the project site is not situated in a threatened ecosystem.

In terms of the National Forest Act (Act 84 of 1998), the Northern Cape Nature Conservation Ordinance and the National Threatened species list (SANBI 2016) some protected species occur on site.

From an ecological perspective the project site is a degraded site due to heavy grazing pressures and it is suitable for the proposed development as long as the construction and operation of the solar facility does not compromise the integrity of the nearby seasonal streams.

RECOMMENDATIONS

The following is recommended:

General

- An Environmental Control Officer (ECO) must be appointed to oversee that the aspects stipulated in the Environmental Permit be carried out properly;
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to;
- The areas to be cleared as well as the construction area should be clearly demarcated;
- All construction vehicles should adhere to clearly defined and demarcated roads;
- Dust suppression and erosion management should be an integrated component of the construction approach;
- No dumping of building waste or spoil material from the development should take place on areas other than a licenced landfill site;
- All hazardous materials should be stored appropriately to prevent contamination of the project site. Any accidental chemical, fuel and oil spills that occur at the project site should be cleaned up appropriately as related to the nature of the spill;

Flora

- Permits must be obtained from DAFF to remove the Shepherd's Trees present on site.
- Weed control measures must be applied to eradicate any noxious weeds (category 1a &1b species) on disturbed areas.

Fauna

- Any fauna threatened by the construction and operation activities should be removed to safety by the ECO or appropriately qualified environmental officer.
- All construction vehicles should adhere to a low speed limit (<30km/h) to avoid collisions with susceptible species such as snakes and tortoises.
- If trenches need to be dug for electrical cabling or other purposes, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are exposed should contain soil ramps allowing fauna to escape the trench.

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1. INTRODUCTION

EnviroNiche Consulting has been appointed by **Ecocompliance (Pty) Ltd** to conduct an ecological impact assessment of the project site as part of an EIA process to obtain environmental authorisation for the proposed Photo Voltaic plant on the farm Roodepan 150 east of Orania.

1.2. Objectives of the report

The following was to be provided / undertaken:

- A brief discussion, using available literature, on the vegetation type in which the broader study area and project site is situated in order to place the study in context.
- A broad-scale map of the vegetation and land cover of the project site using available aerial photography. A description of the dominant and characteristic species within the broad-scale plant communities comprising each of these units was to be provided. This was to cover the entire project site.
- List of all plant species recorded during the survey.
- A list of Red List plant species previously recorded within the quarter degree grids in which the study area and project site is situated, obtained from the relevant authorities.
- List of naturalised plant species recorded on the project site, indicating which are declared weeds or alien invasive species, according to the *National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Regulations, 2014*.
- Identification of sensitive habitats and plant communities. A map of sensitive areas within the project site was to be provided.

A detailed investigation into the status of the vegetation located within the project site was undertaken, including:

- Assessment of the natural vegetation;
- General floristic diversity;
- Habitat suitability for Red Data flora species;
- Potential presence of Red Data flora species;
- Potential presence of sensitive ecosystems

1.3. Legislative framework

Acts such as those listed below (Table 1.1); ensure the protection of ecological processes, natural systems and natural beauty as well as the preservation of biotic diversity in the natural environment. It also ensures the protection of the environment against disturbance, deterioration, defacement or destruction as a result of man-made structures, installations, processes or products or human activities.

Table 1.1: List of relevant legislation

Title of legislation, policy or guideline	Applicability to the project	Administering authority	Date
National Environmental Management Act, No. 107 of 1998 (NEMA), as amended & NEMA EIA Regulations, 2014: GN544, published in Government Gazette 33306 in 2014	An Basic Assessment report (BA) is required for this project	Department of economic, small business development, Tourism and Environmental Affairs (DESTEA)	1998
National Environmental Management: Biodiversity Act (10/2004): Amendments, 2014	Protected species may occur on site	Department of economic, small business development, Tourism and Environmental Affairs (DESTEA)	2014
National Water Act, No. 36 of 1998	The proposed development may trigger a section 21(C and/or i) water use.	Department of Water and Sanitation (DWS)	1998
Northern Cape Nature Conservation Act (Act 9 of 2009)	Protected species could occur on the proposed site	Department of Economic, Small Business Development, Tourism and Environment Affairs (DESTEA)	1969
National Forests Act (Act 84 of 1998)	Protected trees could occur on the proposed sites	Department of Agriculture, Forestry and Fisheries (DAFF)	1998

1.4. STUDY APPROACH AND METHODOLOGY

1.4.1 Vegetation survey

Date of fieldwork: March 2017.

Satellite imagery (Google Earth photos) and 1:50 000 topographic maps were used to find features within the project site.

Quantitative data was collected in each quadrat by undertaking vegetation sampling according to the Braun-Blanquet approach (Mueller-Dombois & Ellenberg 1974; Westhoff & van der Maarel 1978). In each sample site the following data was collected:

Habitat data:

- amount of bare soil;
- rock cover;
- slope;

- aspect in degrees;
- latitude and longitude position (from GPS) in decimal degrees;
- presence of biotic disturbances, e.g. grazing, animal burrows, etc.

Vegetation data

- species present;
- cover estimation of each species according to the Braun-Blanquet scale;
- vegetation height.

Data analysis

- The plant communities that were identified were described using the vegetation sample data.
- Additional checklists of plant species were compiled by traversing the project site on foot and recording species as they were encountered. Plant names follow those of POSA (2015).
- All exotic species categorised as alien invaders or weeds as listed in the *National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Regulations, 2014* were also recorded.

Due to the brief duration of the survey, the species list provided for the project site cannot be regarded as comprehensive, but is nevertheless likely to include the majority of the dominant and common species present.

1.4.2 Red Data plant species

A list of species collected within the quarter degree square **2924CD** are listed together with the species noted during the site visit. For all threatened plants that occur in the general geographical area of the project site, a rating of the likelihood of it occurring within the project site is given as follows:

- LOW: no suitable habitats occur on site / habitats on site do not match habitat description for species;
- MEDIUM: habitats on site match the general habitat description for species (e.g. grassland), but detailed microhabitat requirements (e.g. rocky grassland on shallow soils overlying dolomite or dolerite) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;
- HIGH: habitats found on site match very strongly the general and microhabitat description for the species (e.g. rocky grassland on shallow soils overlying granite);
- DEFINITE: species found on site.

Impact rating methodology

Direct, indirect and cumulative impacts of the issues identified in the EIA phase must be assessed in terms of the following criteria:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it will be indicated whether:
  - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1
  - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  - medium-term (5–15 years) – assigned a score of 3
  - long term (> 15 years) - assigned a score of 4; or
  - permanent - assigned a score of 5;
- The **consequences (magnitude)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability** of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- The **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- The **status**, which will be described as either positive, negative or neutral.
- The *degree* to which the impact can be **reversed**.
- The *degree* to which the impact may cause **irreplaceable loss of resources**.
- The *degree* to which the impact can be **mitigated**.

The significance is calculated by combining the criteria in the following formula:

$S=(E+D+M)P$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude
P = Probability

The significance weightings for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

1.4,4 Wetland Assessment and Delineation Methodology

Wetland delineation

Introduction

For the purposes of this investigation a wetland was defined according to the definition in the National Water Act (Act 36 of 1998) as: "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

In 2005 the DWS (the Department of Water and Sanitation, previously referred to as the Department of Water Affairs and Forestry, DWAF) published a wetland delineation procedure in a guideline document named "*A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas*", guidelines for the undertaking of biodiversity assessments. These guidelines contain a number of stipulations relating to the protection of wetlands and the undertaking of wetland assessments. These guidelines state that a wetland delineation procedure must identify the outer edge of the temporary zone of the wetland, which marks the boundary between the wetland and adjacent terrestrial areas and it is that part of the wetland that remains flooded or saturated close to the soil surface for only a few weeks in the year, but long enough to develop anaerobic conditions and determine the nature of the plants growing in the soil.

The guidelines also state that locating the outer edge of the temporary zone must make use of four specific indicators namely:

- the terrain unit indicator;
- the soil form indicator;
- the soil wetness indicator; and
- the vegetative indicator.

In addition, the wetland and a protective buffer zone, beginning from the outer edge of the wetland temporary zone, must be designated as sensitive in a sensitivity map. The guidelines

stipulate buffers to be delineated around the boundary of a wetland; the wetland and a protective buffer zone, beginning from the outer edge of the wetland temporary zone, must be designated as sensitive and a 30m buffer delineated around the edge of the wetland in which no development must be allowed to occur.

Desktop delineation

Use was made of 1:50 000 topographic maps, and geo-referenced Google Earth images to generate digital base maps of the project site onto which the wetland boundaries were delineated. A desktop delineation of suspected wetland areas was undertaken by identifying rivers and wetness signatures from the digital base maps. All identified areas suspected to be wetlands were then further investigated in the field.

Site assessment

The project site was traversed by foot and road to determine the presence of any wetland area/s. Notes were made of the broad ecological condition of the project site and any signs indicating the presence of a wetland. Delineation started in the lowest lying point of the project site and auger samples were taken at approximately 2m intervals. A Dutch soil auger was used to extract the cores to a depth of 50cm.

The wetlands were subsequently classified according to their hydro-geomorphic determinants based on modification of the system proposed by Brinson (1993), and modified for use in South Africa by Marneweck and Batchelor (2002) and subsequently revised by Kotze *et al*. (2004). Notes were made on the levels of degradation in the wetlands based on field experience and a general understanding of the types of systems present.

1.5. ASSUMPTIONS

- The biodiversity at both project sites will be in a degraded state because both the sites are man-made;
- The biodiversity at the project site will be destroyed.

1.6 LIMITATIONS

- Detailed layout of site was not available, however it is expected that the property will be developed for the solar plant.

2. DESCRIPTION OF THE PROJECT

The proposed photo voltaic facility is on the farm Roodepan 150. The facility is designed to generate 450MW electricity from solar radiation. There are three existing 400 kV power lines which cut across the farm. The PV facility will be connected to the ESKOM grid via these power lines.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Description of the broader study area and project site

3.1.1 Location

The farm Roodepan 150 is situated about 4,5km from Orania along the R369 which links Orania and Vanderkloof (Figure 6.1 and Figure 6.2). The project site falls within the quarter degree square **2924CD**.

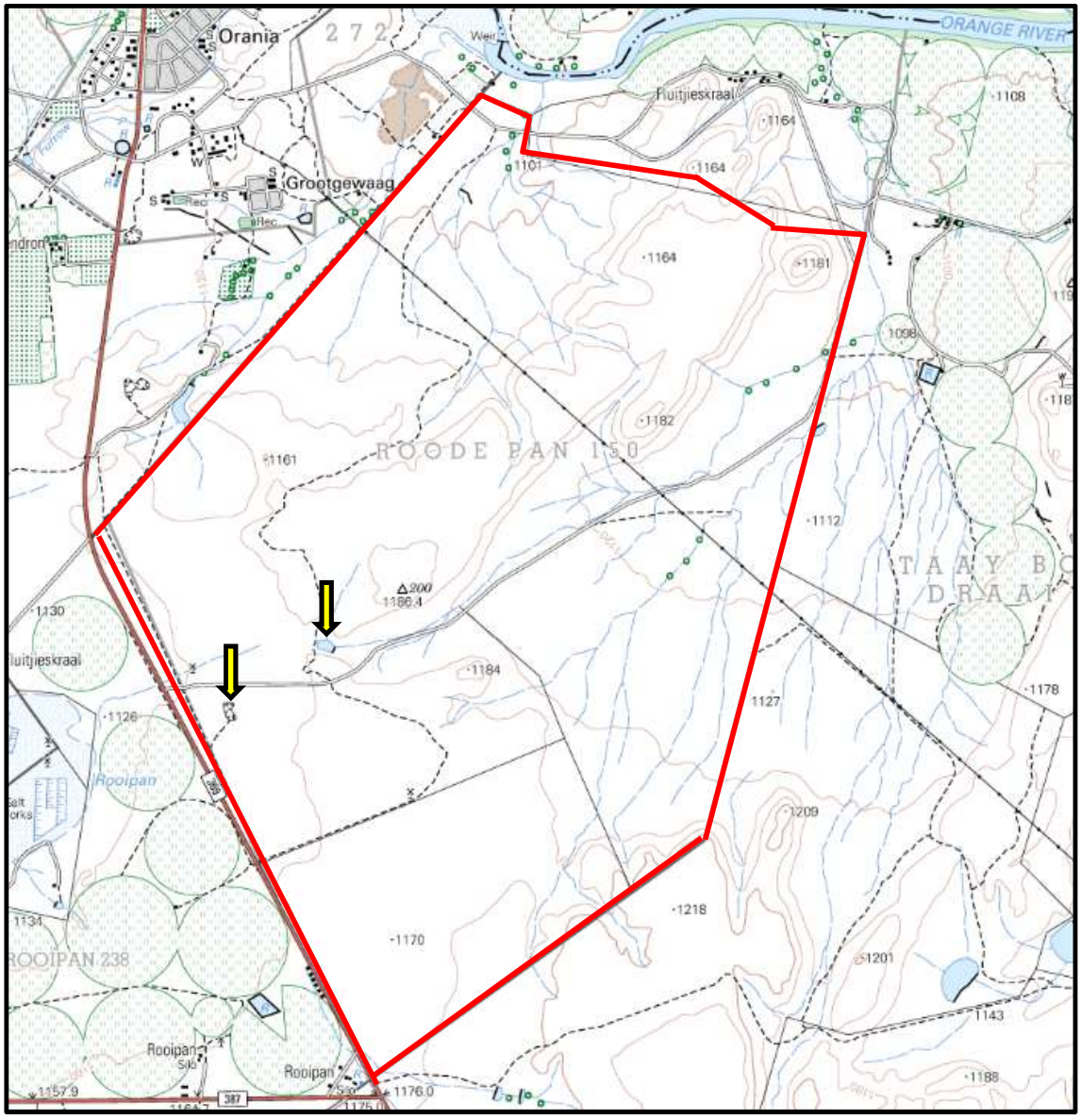

Figure 3.1: Topographic map of the Roodepan 150 farm (red polygon). Yellow arrows indicate small man-made dams.

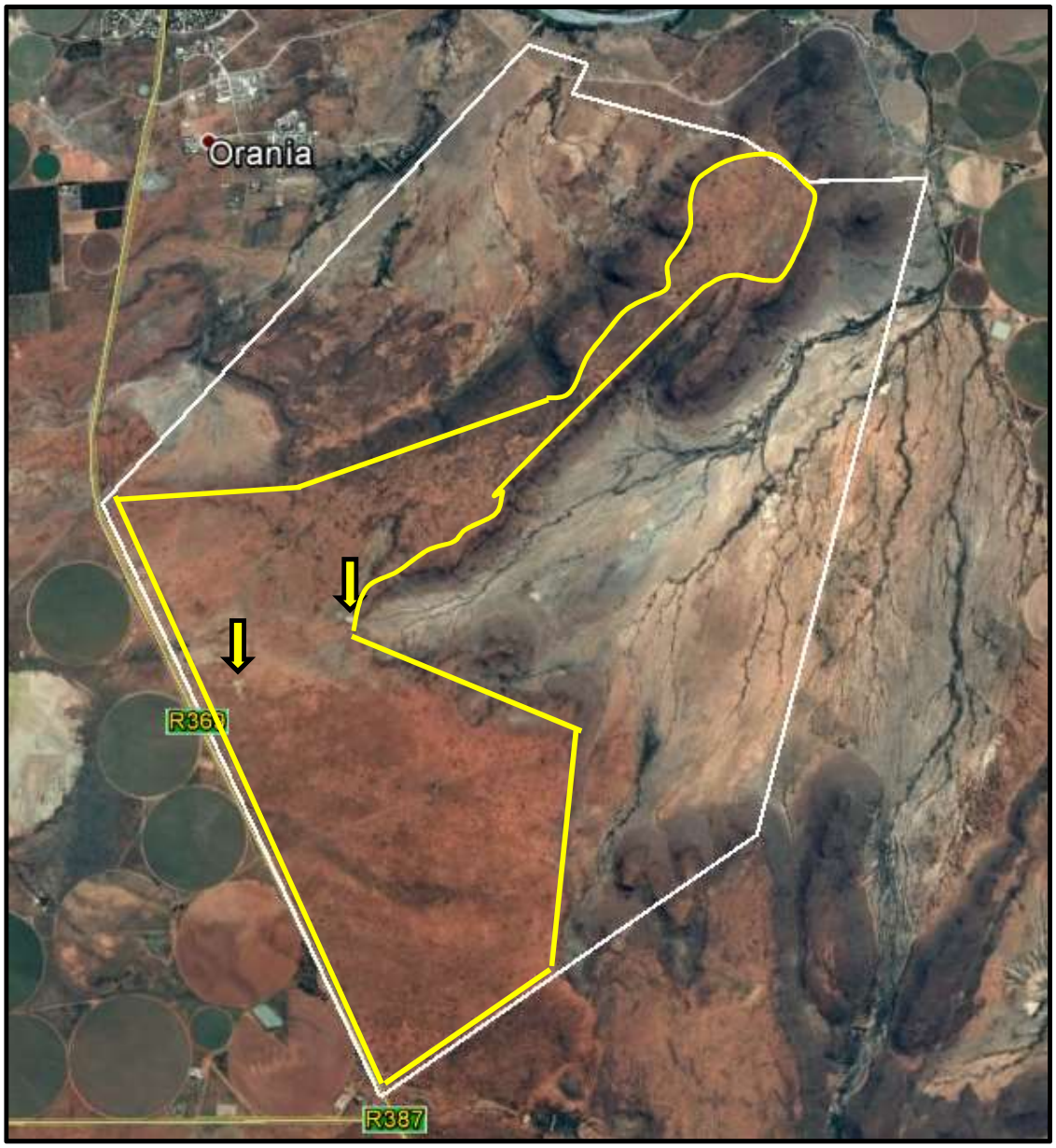

Figure 3.2: A close-up satellite image of project site (white polygon). Yellow arrows indicate small man-made dams. Yellow polygon indicates area suitable for development (Google Earth).

3.1.2 Topography

The topography of the landscape is flat with scattered dolerite ridges and hills. The landscape drains towards the Orange River and numerous seasonal drainage lines occur nearby (Fig 3.1 & 3.2).

3.1.3 Geology & soils

The geology consists of mud and sandstones of the Ecca Group. The soils varies from deep aeolian sand deposits of the Hutton, Bainsvlei and Plooysburg forms. The clayey soils and are of the Kroonstad, Rensburg forms (MacVicar *et al.* 1974).

3.1.4 Climate (Rainfall & temperatures)

The Orania area receives summer rainfall and is approximately 275 mm per annum. The mean annual temperature is 16,5°C (Mucina & Rutherford, 2006).

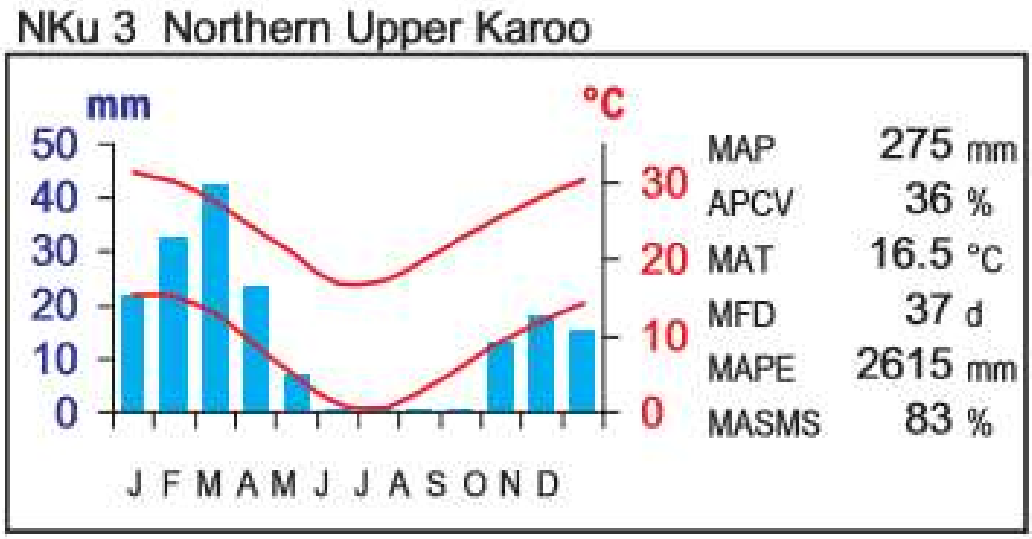

Figure 3.3: A climate-diagram of the Northern Upper Karoo (Mucina & Rutherford, 2006).

3.1.5 Land use & land cover

The project sites are situated in agricultural area. Most of the arable land has been transformed for crop production. Most of the veld is being used for grazing.

3.1.6 Vegetation, biogeography and conservation value

The most recent description of the broader study area's vegetation is the general description by Mucina & Rutherford (2006) relating to the vegetation which is considered to be the "Vegetation of South Africa, Lesotho and Swaziland" as well as its accompanying map of the country by (Mucina *et al.*, 2005). This memoir contains species information and a comprehensive conservation assessment of all vegetation types.

The Northern Upper Karoo (NKu 3) (Fig 8.1) dominates the vegetation of the project site, as well as the areas surrounding the site. According to Mucina & Rutherford (2006), the vegetation type has a conservation status of "Least Threatened". According to BGIS (2017) the site is not situated in a threatened ecosystem.

4. RESULTS

4.1 Vegetation overview

4.1.1 Broad vegetation types

The study area and project site is situated in the Northern Upper Karoo (NKu 3) and Besemkaree koppies Shrubland (Gh 4) (Mucina & Rutherford, 2006).. The distribution of this vegetation type is limited to the northern and central Karoo as well as the western Free State.

The vegetation of the vegetation type is a dry karroid grassland which occurs on deep calcretes deposits. It consists of a grass layer which is dominated by *Themeda triandra, Eragrostis superba, Enneapogon scoparius* and *Eragrostis lehmanniana* and a few scattered individuals of *Acacia karroo* shrubs. Other species present are *Pentzia incana, Lycium cinereum, Felicia muricata, Aristida congesta*, *Chrysocoma ciliata, Rhigozum trichotomum, Asparagus glaucus, Pteronia glauca, Pegolettia retrofracta* and *Stipagrostis uniplumis,*

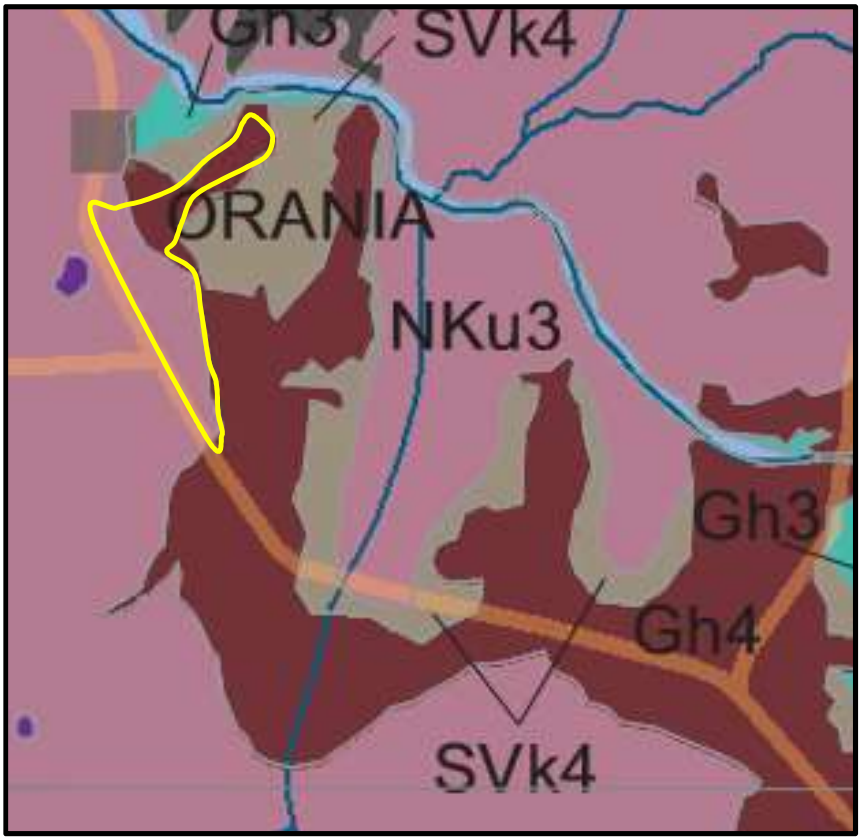

Figure 4.1: A vegetation map of the project site (yellow polygon) and the surrounding areas which is dominated by the Northern Upper Karoo (NKu 3) and Besemkaree koppies Shrubland (Gh 4) (Mucina & Rutherford, 2006).

A species list from POSA (http://posa.sanbi.org) of the project area was obtained. POSA generated species lists also contain updated Red Data species status (http://redlist.sanbi.org/). Only protected and red data species that may potentially occur in the study area and project site have been listed under results. The actual field survey

confirmed which of the species, recorded by the POSA list, (Annexure C) actually occur in the study area. In addition some species not listed by POSA are listed in Annexure B.

A total of 8 species have been recorded to occur in the degree square (POSA data) around Orania while 86 species have been recorded at the project site.

a) Conservation status of broad vegetation types

The vegetation types of South Africa have been classified according to their conservation status which is, in turn, assessed according to the degree of transformation and rates of conservation. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. On a national scale these thresholds are as depicted in the table below, as determined by best available scientific approaches (Driver *et al.* 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver *et al.* 2005).

Table 4.1: Determining ecosystem status (from Driver *et al.* 2005). *BT = biodiversity target (the minimum conservation requirement.

Habitat remaining (%)			
	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

The National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011), published under the National Environment Management: Biodiversity Act (Act No. 10 of 2004), lists national vegetation types that are afforded protection on the basis of rates of transformation. The threshold for listing in this legislation is higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in the scientific literature.

Table 4.2: Conservation status of the vegetation type occurring in and around the study area.

Vegetation Type	**Target (%)**	**Conserved (%)**	**Transformed (%)**	**Conservation Status**	
				Driver *et al.*, 2005; Mucina & Rutherford, 2006	National Ecosystem List (NEM:BA)
Northern Upper Karoo	21%	0,3%	4%	Least Threatened	Not Listed
Besemkaree koppies	28%	5%	3%	Least Threatened	Not Listed

According to Mucina and Rutherford (2006) the Northern Upper Karoo vegetation type (Nku 3) is poorly protected within formal conservation areas (0,3%), and 63% of this unit has been transformed. The conservation status of this unit is classified as **Least Threatened** and is not listed under the National List of Ecosystems that are Threatened and in need of protection

(GN1002 of 2011), published under the National Environment Management: Biodiversity Act (Act No. 10 of 2004). The Besemkaree koppies shrubland vegetation type (Gh 4) is also poorly protected within formal conservation areas (5%), and 3% of this unit has been transformed. The conservation status of this unit is classified as **Least Threatened** and is not listed under the National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011), published under the National Environment Management: Biodiversity Act (Act No. 10 of 2004).

b) Red List and protected plant species of the study area

As previously mentioned, a species list was obtained from POSA for the relevant degree grids. The species on this list were evaluated to determine the likelihood of any of them occurring in the study area and the project site. Of the species that are considered to occur within the geographical area under consideration, there were **10** species which are regarded conservation worthy. **Zero** species recorded in the degree grids are listed on the Red List plant species (Red-flagged species in Annexure C) but one is listed in terms of the National Forests Act (Act 84 of 1998) (Green-flagged species in Annexure B).

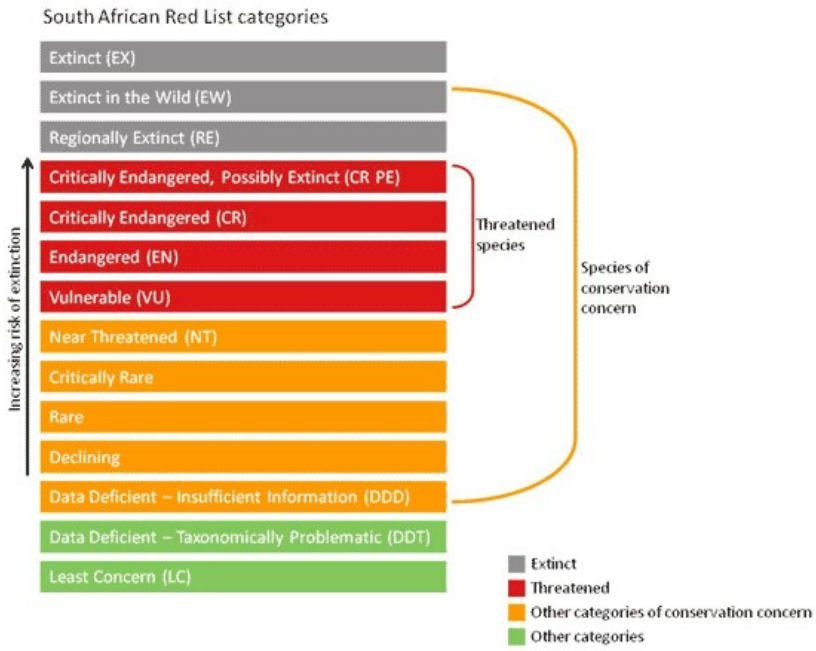

Figure 4.2: Schematic representation of the South African Red List categories. Taken from http://redlist.sanbi.org/redcat.php

Table 4.3: Species listed as conservation worthy within the South African Red List (SARL), National Forest Act (NFA), and Northern Cape Nature Conservation Ordination (NCNCO)

Family	Species	Source
AMARYLLIDACEAE	Ammocharis coranica (Ker Gawl.) Herb.	NCNCO
AMARYLLIDACEAE	Nerine laticoma	NCNCO
APOCYNACEAE	Fockea angustifolia K.Schum.	NCNCO
ASPHODELACEAE	Aloe claviflora	NCNCO
CAPPARACEAE	Boscia albitrunca	NFA
EUPHORBIACEAE	Euphorbia rhombifolia Boiss.	NCNCO
MESEMBRYANTHEMACEAE	Psilocaulon coriarium (Burch. ex N.E.Br.) N.E.Br.	NCNCO
COLCHICACEAE	Ornithoglossum vulgare B.Nord.	NCNCO
IRIDACEAE	Moraea polystachya (Thunb.) Ker Gawl.	NCNCO
MESEMBRYANTHEMACEAE	Psilocaulon coriarium (Burch. ex N.E.Br.) N.E.Br.	NCNCO

4.1.2 Fine- scale vegetation description of the site

It was found that the vegetation of the project sites is not related to the Northern Upper Karoo (NKu 3) as described by Mucina & Rutherford (2006). The dominant plants are the karroid shrubs *Rhigozum trichotomum, Chrysocoma ciliata, Ruschia spinosa, Pentzia globosa, Pegolettia retrofracta, Eriocephalus ericoides, Felicia muricata, Hertia pallens, Lycium cinereum, Walafrida albens, Searsia ciliata* and the grasses *Aristida congesta, Chloris virgata* and *Eragrostis lehmanniana, Fingerhuthia africana*. and *Enneapogon cenchroides.* Other plants noted are the trees *Searsia lancea, Vachelia* [*Acacia*] *karroo,* and *Prosopis glandulosa.*

The project site is in a highly transformed state due to the impact by heavy grazing by sheep and cattle. According to the property owner the farm was hired by farmer in the Orania district for a substantial number of years. They have overstocked the farm with sheep and cattle which resulted in the serious degradation of the vegetation. The plateau section is now completely covered by the indigenous invader Driedoring (*Rhigozum trichotomum*) while serious erosion occurs on the area which slopes towards the Orange River.

Red List and protected plant species noted during the survey in this community:

There are protected species present on site on the project site (Table 4.3):

Ecosystem function

- Due to the disturbance almost no ecosystem function is present on certain areas of the project site
- Trees and shrubs provide nesting areas for avifauna and occasional shelter for terrestrial fauna;
- Niche habitats for fauna – providing sheltered burrows and nesting sites;
- Micro-climate is created by the shrubs and trees housing species sensitive to direct sunlight or frost.

c) Wetland communities

There are wetland areas on the project site as well as nearby. There are two small man-made dams which trap storm water (Fig 3.1 & 3.2). Further towards the Orange River are numerous drainage lines – a sign of poor vegetation cover and serious erosion.

Ecosystem function

- Reeds, trees and shrubs provide nesting areas for avifauna and occasional shelter for terrestrial fauna;
- Niche habitats for fauna – providing sheltered burrows and nesting sites;
- Micro-climate is created by the shrubs and trees housing species sensitive to direct sunlight or frost.

Present ecological status (PES)

A mean Present Ecological Status (PES) value between 0 and 5 is obtained from the PES calculations and a PES class is attributed to the stream based on Table 4.2 - 4.6. It should however be noted that if a score of less than 2 is attributed to any impact, the lowest rating is used to attribute PES class and not the mean.

Table 4.4: Present Ecological Status Categories of Wetlands (adapted from Kleynhans, 1996 & 1999).

ECOLOGICAL CATEGORY	SCORE	DESCRIPTION
A	>90-100%	Unmodified, natural
B	>80-90%	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged
C	>60-80%	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged
D	>40-60%	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred
E	>20-40%	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive
F	0-20%	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.

Table 4.5: PES calculation for the dams

Criteria & attributes	Relevance	Score	Confidence
Hydraulic/Geomorphic			
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats.	1	**4**
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities which reduce or changes wetland habitat directly or through changes in inundation patterns.	1	**5**
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.	1	5
Indigenous Vegetation Removal Invasive plant encroachment	Direct destruction of habitat through any human activities affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion. Affect habitat characteristics through	2	5
Alien fauna	Presence of alien fauna affecting faunal community structure.	1	4
Overutilisation of biota	Overgrazing, Over-fishing, etc.	1	4
Mean		1,2	4
Class		**B**	

Table 4.6: PES calculation for the seasonal stream (drainage line)

Criteria & attributes	Relevance	Score	Confidence
Hydraulic/Geomorphic			
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats.	2	**4**
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities which reduce or changes wetland habitat directly or through changes in inundation patterns.	3	**5**
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.	2	5
Indigenous Vegetation Removal Invasive plant encroachment	Direct destruction of habitat through any human activities affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion. Affect habitat characteristics through	2	5
Alien fauna	Presence of alien fauna affecting faunal community structure.	2	4
Overutilisation of biota	Overgrazing, Over-fishing, etc.	1	4
Mean		2	4
Class		**B**	

Ecological Importance and Sensitivity (EIS)

The EIS and functions were calculated using the new draft DWA guidelines and model, as developed by M. Rountree. Information was used form the SIBIS and VEGMAP products. A mean score between 0 and 4 is obtained, with 0 as the lowest and 4 as the highest score. No classification of the scores is given.

Table 4.7: EIS calculation of the wetland areas.

ECOLOGICAL IMPORTANCE AND SENSITIVITY	Score (0- 4)	Confidence (1-5)	Motivation
Biodiversity support	0.00	4.00	
Presence of Red Data species	0.00	4.00	No known red data or protected species observed on site.
Populations of unique species	0.00	4.00	No unique plant or animal populations were observed
Migration / breeding / feeding sites	0.00	4.00	Highly unlikely. No breeding sites were observed with very few bird species seen.
Landscape scale	0.80	5.00	
Protection status of the wetland	1.00	5.00	Wetland does not have a high protection status. The wetland area is being used as a communal grazing area.
Protection status of the vegetation type	0.00	5.00	Wetland does not have a high protection status
Regional context of the ecological integrity	1.00	5.00	The wetland is in PES class B. Wetland functions are still in place but does not have an importance in terms of a regional context
Size and rarity of the wetland type/s present	1.00	5.00	The wetland is not particularly large or rare, and has no vulnerable ecosystem present.
Diversity of habitat types	1.00	5.00	The wetland has a low species diversity as well as habitat diversity. The largest component of the natural vegetation has been

			impacted by grazing and alien invasive species.
Sensitivity of the wetland	1.22	4.00	
Sensitivity to changes in floods	1.50	4.00	No high runoff present in catchment due to the small size of the catchment
Sensitivity to changes in low flows / dry season	1.50	4.00	Minimally impacted by changes in flow. Receives water in rainy season and dry for largest part of the year.
Sensitivity to changes in water quality	0.50	4.00	The wetland receives storm water runoff of various qualities during the rainfall season.
ECOLOGICAL IMPORTANCE & SENSITIVITY	0,7	4	

The riparian areas of the stream and pan as well as the dam have an Ecological Importance and Sensitivity (EIS) score of 0,7 (Table 4.7). This is a value between 0 and 4, with 0 being very low and 4 very high. The riparian vegetation therefore has a low EIS score. It is regarded as being not ecologically important or sensitive with a low biodiversity and plays a low role in moderating water quality and quantity.

The PES class and EIS score for the site are a **B** and **0,7** respectively indicating that the wetland areas on site are largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged

d) Alien Invasive Plants (AIPs) confirmed during the survey

Due to the agricultural activities some disturbance of the natural vegetation occurred. Some alien species and pioneer species were noted. The Prosipis tree (*Prosopis glandulosa*) occur on site.

4.2. CRITICAL BIODIVERSITY AREAS AND BROAD–SCALE ECOLOGICAL PROCESSES

4.2.1 Definitions and descriptions of Critical Biodiversity Areas of the Northern Cape Province

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision making tools. The use of CBAs within the Northern Cape Province follows the definition laid out in the guideline for publishing bioregional plans (Anon, 2008).

The identification and mapping of CBAs forms part of the biodiversity assessment of the Northern Cape Province which will be used to inform the development of the Provincial Biodiversity Sector plans, bioregional plans, and also be used to inform Spatial Development Frameworks (SDFs), Environmental Management Frameworks (EMFs), Strategic Environmental Assessments (SEAs) and in the Environmental Impact Assessment (EIA) process in the province.

Simply put, the purpose of the CBA is to indicate spatially the location of critical or important areas for biodiversity in the landscape. The CBA, through the underlying land management objectives that define the CBA, prescribes the desired ecological state in which the province would like to keep this biodiversity. Therefore, the desired ecological state or land management objective determines which land-use activities are compatible with each CBA category based on the perceived impact of each activity on biodiversity pattern and process.

According to the guidelines for bioregional plans, three basic CBA categories can be identified based on three high-level and management objectives (Table 4.8).

Table 4.8: Definitions and framework for linking CBAs to land-use planning and decision-making guidelines based on a set of high-level land biodiversity management objectives (Adapted from the guidelines for bioregional plans (Anon 2008)).

CBA category	**Land Management Objective**
Critical Biodiversity Areas (CBAs) Definition: CBAs are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.	
Protected Areas (PA) & CBA 1	**Natural landscapes:** Ecosystems and species are fully intact and undisturbed.

	These are areas with high irreplaceability or low flexibility in terms of meeting biodiversity pattern targets. If the biodiversity features targeted in these areas are lost then targets will not be met. These are landscapes that are at or past their limits of acceptable change.
CBA 2	**Near-natural landscapes:** Ecosystems and species are largely intact and undisturbed. Areas with intermediate irreplaceability or some flexibility in terms of the area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising the ability to achieve targets. These are landscapes that are approaching but have not passed their limits of acceptable change.
Ecological Support Areas (ESAs) Definition: ESAs are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and / or in delivering ecosystem services that support socio-economic development, such as water provision, food mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.	
ESA	**Functional landscapes:** Ecosystem is moderately to significantly disturb but still able to maintain basic functionality. Individual species or other biodiversity indicators may be severely disturbed or reduced. These are areas with a low irreplaceability with respect to biodiversity pattern targets only.
ONA (Other Natural Areas) and Transformed	Production landscapes: Manage land to optimise sustainable utilisation of natural resources.

According to the BGIS website (2017) the project site is not situated in a critical biodiversity area (CBA).

4.3. FAUNA SURVEY

4.3.1 Mammals

The potential diversity of mammals within the study area is low because it is a human – managed area and most natural habitats have been transformed. There are several factors which will reduce the actual number of species present within the project site. The presence of humans and roads, the destruction of natural vegetation, noise etc., has had a major impact on the natural animal populations in the Solon area.

Listed mammals which may occur in the area include the White-tailed Mouse *Mystromys albicaudatus* (Endangered), and Black-footed Cat *Felis nigripes* (Vulnerable), South African hedgehog *Atelerix frontalis* (SA RDB NT).

During the site visit the following faunal species were confirmed within the project site:

- Dung of Steenbuck (*Raphicerus campestris*) was found
- A porcupine (*Hystrix cristata*) was found
- Single rodent burrows (most likely Four-striped Grass Mouse (*Rabdomys pumilo*).
- Relative large burrows (likely to have been made and utilized by Aardwolf – *Proteles cristatus* and/or Aardvark – *Orycteropus afer*).

None of these species noted within the project site are listed and or protected species.

4.3.2 Birds

Of the 205 bird species that have been recorded in the region a few species occur on the project site.

4.3.3 Reptiles and Amphibians

Of the 25 reptilian species that have been recorded with the region none of these species are listed as Red Data species.

Fifteen amphibian species have been recorded within the region and of these 15 species eight species were recorded within close proximity of the project site. One near threatened species namely the Giant Bullfrog (*Pyxicephalus adspersus*) has been recorded for the quarter degree grid square (QDGS). Although this species was not found on site (not a suitable habitat), it is still likely for this species to occur near the project site as potential suitable habitat (pans and drainage lines) is available south of the project site.

4.4. ECOLOGICAL SENSITIVITY ANALYSIS (Figure 4.4.1)

The sensitivity assessment identifies those parts of the project site that will a have a medium to high conservation value or that will be sensitive to disturbance. Areas containing untransformed natural vegetation, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to have a low sensitivity. The habitat sensitivity assessment was done according to the rules provided in the "Sensitivity mapping rules for biodiversity assessments". There are features within the project site or just outside of the project site that may be considered to have a medium conservation value, as follows:

4.4.1 Streams (perennial & seasonal) and wetlands (pans)(Fig4.4.1)

There are a number of pans in the region. A natural seasonal stream drains towards the Orange River.

- **Potential impacts:** Pollutants from the construction and operation phases of the project might end up in the nearby wetlands. From here the downstream aquatic system such as the pan might be affected.

- **Mitigation measures**: Buffers must be in place to protect these systems. Care must be taken not to spill and pollutants such as oil, diesel or petrol.

Figure 4.4.1: The sensitive systems present within or near the project site. The blue areas are NFEPA-listed water bodies. The red polygon indicates the project site. Yellow arrow indicates a small man-made dam.

4.4.2 Sensitive vegetation:

Besides the wetland (see above) no sensitive plant community occur on the project site

- **Potential impacts:** N/A.
- **Mitigation measures**: N/A

4.4.3 Threatened and protected plant species:

There is no protected species present on the project site.

- **Potential impacts:** N/A.
- **Mitigation measures**: N/A

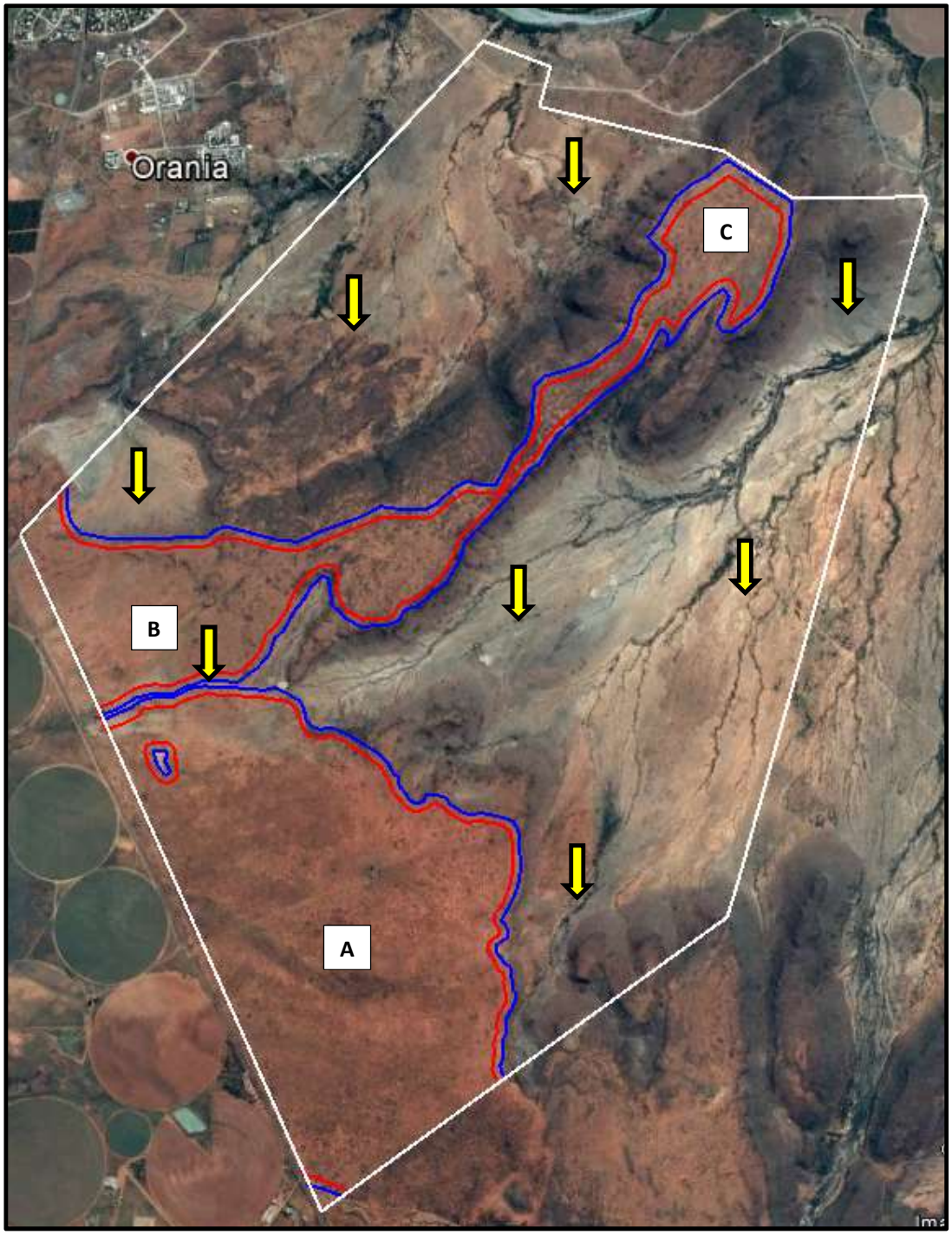

Figure 4.4.2: The arrows and blue lines indicate sensitive systems present within or near the project site. The red line is a 50 m buffer zone to protect the sensitive areas. The areas indicated as A, B & C are degraded areas which are suitable for this kind of development.

Discussion of the ecological sensitivity analysis

The project site cannot be regarded as a threat to these above-mentioned sensitive systems due to the following reasons:

- The NFEPA map does indicate one area namely the small man-made dam in a seasonal drainage;
- According to the BGIS (2015) the site is not situated in an CBA.
- The vegetation is in a degraded state with unpalatable karroid species as the dominant species

It can thus be concluded the project site is not on a sensitive ecosystem and neither does it pose a threat to sensitive ecosystems

5. SITE ASSESSMENT OF IMPACTS

5.1 Overview of the most significant effects of the proposed development

Possible impacts of the proposed prospecting activities

a) Impacts on vegetation and protected plant species

The development will have a low impact on the vegetation at the site because of the lack of plants present.

- **<u>Construction phase</u>**

The site is already in a transformed and in a degraded state.

The proposed development will lead to a direct loss of vegetation.

Consequences of the impact occurring may include:

- general loss of habitat for plant and animal species;
- general reduction in biodiversity;
- disturbance to processes maintaining biodiversity and ecosystem goods and services; and
- loss of ecosystem goods and services: Loss of connectivity and habitat fragmentation happened already because it is a transformed area situated on a farm,
- Erosion risk may result due to the loss of plant cover and soil disturbance created during the construction phase.
- Presence and operation of construction machinery on site. The proposed site is on private property. On farms are constant physical impacts and the impacts by vehicles and machinery would not be new. These machinery will generate dust and noise pollution and other forms of disturbance on site
- Major factors contributing to an invasion by alien invader plants includes habitat disturbance and associated destruction of indigenous vegetation. Consequences of this may include:
    - further loss and displacement of indigenous vegetation;
    - change in vegetation structure leading to change in various habitat characteristics;
    - change in plant species composition;

- change in soil chemistry properties;
- loss of sensitive habitats;
- loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
- fragmentation of sensitive habitats;
- change in flammability of vegetation, depending on alien species;
- hydrological impacts due to increased transpiration and runoff; and
- impairment of wetland function.

From a vegetation perspective the existing vegetation on the site is similar to the region's vegetation, therefore the impact on the vegetation within the project site will not be significant in a broader sense.

Faunal species will primarily be affected by the overall loss of habitat. Increased levels of noise, pollution, disturbance and human presence have already chased away most of the fauna.

An ephemeral drainage line occur between sections A & B (Fig 4.4.2).

Soil erosion is a risk, associated with developments where vegetation clearing and disturbance is taking place. Service roads, pavements and roofs of buildings will generate an increase in runoff during intense rainfall events and may potentially exaggerate the effects of erosion. These eroded materials may enter the nearby streams and rivers and may potentially impact these systems through siltation and change in chemistry and turbidity of the water. With effective mitigation measures in place, including regular monitoring, the occurrence, spread and potential effects of erosion may be limited to an absolute minimum.

In terms of impacts on Critical Biodiversity Areas and Broad-Scale Ecological Processes it is not applicable in this case because no Critical Biodiversity Areas occur at the project site or in the surrounding areas.

- **Operational phase**

The daily maintenance and operation activities of the facilities would generate some noise and disturbance which may deter some fauna from the area. Maintenance activities such as vegetation clearing will impact the biodiversity of the site if not conducted in a sensitive manner.

- Erosion may occur after thunderstorms. Eroded areas may occur on the access road and other exposed areas on slopes. With effective mitigation measures in place, including regular monitoring, the occurrence, spread and potential effects of erosion may be limited to an absolute minimum.

- **De-commissioning phase**

The demolishing of the site could create disturbed areas and erosion and dust pollution may occur

- Erosion may occur after thunder storms. Eroded areas may occur on exposed areas on slopes. Care must be taken that rehabilitation of disturbed area must be done.
- Regular monitoring of these areas must take place to ensure successful rehabilitation.

- **Cumulative impacts**

As the development is proposed to be located within the project site it can be expected that more development might be taking place on selected the project sites in future. Future developments will also require the removal of vegetation which will have an impact. However, the impact will be low due to the degraded nature of the project sites.

It is highly unlikely that a negative cumulative effect could arise from the development of the proposed mine, if future and current development implement mitigation measures proposed for each individual project. It is unlikely that development will result in the reduced ability of the vegetation unit to meet its conservation targets as the conservation status of the region's vegetation is classified as an endangered ecosystem.

Due to the semi-natural environment, already transformed due to some degradation, the earmarked area contribute little towards the functionality of the plant communities and its ecology.

It is recommended that efforts on invasive species management, erosion control and rehabilitation is coordinated with the developer to avoid negative effects of one development on the environmental state on and around the other.

6. MITIGATION AND MANAGEMENT MEASURES

6.1 Impacts of the proposed construction activities, access roads and associated infrastructure

Table 6.1: List of impacts and mitigation measures

1. Activity: Construction and operation of buildings on semi-natural vegetation and disturbed areas
Environmental Aspect: Removal of or excessive damage to vegetation, compaction of topsoil, creation of runoff zone, redistribution and concentration of runoff from surfaces, displacement of terrestrial vertebrates, reduced buffering capacities of the landscapes during extreme weather events.
Environmental impact: Loss of vegetation and/or species of conservation concern, loss of and alteration of microhabitats, altered vegetation cover, site-specific altered distribution of rainfall and resultant runoff patterns, general increase in runoff from hard surfaces and/or bare areas and associated accelerated

erosion, reduction of habitat and resource availability for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased flooding, severe erosion or dust due to lower buffering capacity of sparser vegetation

	Without mitigation	**With mitigation**
Extent (E)	Local (1)	Local (1)
Duration (D)	Long-term (5)	Long-term (5)
Magnitude (M)	Moderate (4)	Low (4)
Probability (P)	Definite (5)	Definite (5)
Significance (S = E+D+M)*P	**Medium (55)**	**Medium (50)**
Status (positive, neutral or negative)	Positive	Positive
Reversibility	Non-reversible	Non-reversible
Irreplaceable loss of resources?	Highly Probable	Highly Probability
Can impacts be mitigated?	Reasonably	

Mitigation:

- After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and active animal burrows.
- Protected plant species must be relocated if possible.
- Animal burrows must be monitored by the ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor.
- Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area.
- Clear as little indigenous vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr, if possible.
- Remove all invasive vegetation before and after construction and continuously up to decommissioning.
- If filling material is to be used, this should be sourced from areas free of invasive species.
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise the handling of topsoil.
- Temporarily stored topsoil must be re-applied within 6 months, topsoil stored for longer need to be managed according to a detailed topsoil management plan.
- Monitor the area regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro-topography and revegetation or soil erosion control efforts accordingly.
- Prevent leakage of oil or other chemicals, and strictly prohibit littering of any kind.
- Monitor the establishment of all invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

If mitigation measures are not strictly followed the following could occur:

- erosion of areas and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands located outside of the project site.
- contamination of drainage lines, lower-lying rivers or wetlands located outside of the project site.
- alteration of occupancy by terrestrial fauna beyond the project site, possible reduction of available habitat and food availability to terrestrial fauna.
- spread and establishment of invasive species.

Residual impacts:

- Altered topsoil characteristics.
- Altered vegetation composition.

2. Activity: Transport of materials to site, movement of vehicles on site during construction and operation.

Environmental Aspect: Compaction of soils, possible contamination by oils or fuels, possible introduction and spread of weeds and alien invasive species, temporary disturbance of terrestrial fauna.

Environmental impact: Loss of vegetation, increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible contamination of soil and groundwater by oil- or fuel spillages, possible establishment and spread of undesirable weeds and alien invasive species that could further damage ecosystem functionality.

	Without mitigation	**With mitigation**
Extent (E)	Regional (1)	Local (1)
Duration (D)	Long-term (1)	Long-term (1)
Magnitude (M)	Low (6)	Small (4)
Probability (P)	Definite (5)	Highly Probable (4)
Significance (S = E+D+M)*P	**Medium (45)**	**Low (24)**
Status (positive, neutral or negative)	Positive	positive
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- Restrict all movement of vehicles and heavy machinery to permissible areas, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas may be allowed.
- Parking areas should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur.
- Strict speed limits must be set and adhered to.
- Driving between dusk and dawn should be permissible to emergency situations only.
- Prevent spillage of any, oils or other chemicals, strictly prohibit other pollution.
- Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment.

Cumulative impacts: • Possible pollution of surrounding areas if no mitigation is implemented. • Contamination of groundwater which is an extremely important source of water supply for the region. • Possible spread of alien invasive species beyond the site if no mitigation is implemented.
Residual impacts: • Related to access roads and internal maintenance tracks only.

Assessment of Cumulative Impacts

1. Nature: Reduced Ability to meet conservation targets		
Environmental Aspect: Reduced ability to meet conservation targets of the Northern Cape Province.		
Environmental impact: The loss of unprotected vegetation types on a cumulative basis from the broad area may impact the countries' ability to meet its conservation targets. The area is not included within a National Protected Areas Expansion Strategy focus area, and falls outside any threatened and or endangered ecosystem type / vegetation type. Although the vegetation type in the study area are classified as Least Threatened, it is poorly protected and certain habitats or communities may be subsequently affected.		
	Overall impact of the proposed project considered in isolation	**Cumulative Impact of the project and other projects in the area**
Extent (E)	Local (1)	Local (3)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	Small (0)	Low (4)
Probability (P)	Very Improbable (1)	Probable (3)
Significance (S = E+D+M)*P	**Low (5)**	**Low (33)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Partially reversible	Low reversibility
Irreplaceable loss of resources?	Not Likely	Probable
Confidence in finding	High	
Mitigation: • Implementation of the required mitigation measures for all developments within the area. • Preconstruction walk-through to ensure that sensitive habitats are avoided. • Minimise the development footprint as far as possible.		

The proposed solar plant development will have a significant impact on the above-ground ecology of the site as it is still a functional ecosystem. The impacts such as erosion potential, dust generation and spread of alien weeds can be lowered if mitigated properly. The project site has a low ecological sensitivity because of the man-made impact on the site.

With the diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of these impacts can be minimised and reduced to acceptable levels. The impact on fauna is expected to be small to negligent.

7. DISCUSSION AND CONCLUSION

The proposed project site triggers a number of listed activities as included in the Environmental Impact Assessment Regulations (08 December 2014), GN R 982 – 985, in accordance with the National Environmental Management Act, No. 107 of 1998 (NEMA), as amended. The appointed Environmental Assessment Specialist, EnviroNiche, undertook an ecological impact assessment to determine the impacts which may be triggered by the proposed development. The requirements of this assessment were to undertake a specialist study to assess the biodiversity and ecology of the project sites as well as determine the significance of the impacts that the proposed project will have on the identified project site.

The project site is on the farm Roodepan 150 east of Orania. The project site and the surrounding area was assessed for any sensitive ecosystems including drainage lines and wetlands. It was found that the site is in a natural condition used for sheep and cattle farming. Parallel to the R369 road runs a water pipeline on the property while the Orange River is situated on the northern side. Several seasonal drainage lines drains towards the Orange river which makes only the southern half of the property suitable for a solar farm. The project site is situated in the Northern Upper Karoo (NKu 3) and Besemkaree koppies Shrubland (Gh 4) vegetation types. According to Mucina & Rutherford (2006), these vegetation types have a conservation status of “Least Threatened” and according to BGIS the project site is not situated in a threatened ecosystem.

In terms of the National Forest Act (Act 84 of 1998), the Northern Cape Nature Conservation Ordinance and the National Threatened species list (SANBI 2016) some protected species occur on site.

From an ecological perspective the project site is a degraded site due to heavy grazing pressures and it is suitable for the proposed development as long as the construction and operation of the solar facility does not compromise the integrity of the nearby seasonal streams.

No-go Option

The No-Go Option means that the status quo in terms of ecosystem functioning and the existence of protected species remains on the project site as the proposed project site will not be developed nor rehabilitated.

However, if the no-go option is applied then the economic benefits and potential growth of the greater Orania area will not be released and it will be considered as a lost opportunity for progress in the region.

Therefore, due to the acceptability of the project site for the development and the overall sensitivity of the project site the no-go option is not considered as being feasible and will therefore not be implemented.

8. RECOMMENDATIONS

The following is recommended:

General

- An Environmental Control Officer (ECO) must be appointed to oversee that the aspects stipulated in the Environmental Permit be carried out properly;
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to;
- The areas to be cleared as well as the construction area should be clearly demarcated;
- All construction vehicles should adhere to clearly defined and demarcated roads;
- Dust suppression and erosion management should be an integrated component of the construction approach;
- No dumping of building waste or spoil material from the development should take place on areas other than a licenced landfill site;
- All hazardous materials should be stored appropriately to prevent contamination of the project site. Any accidental chemical, fuel and oil spills that occur at the project site should be cleaned up appropriately as related to the nature of the spill;

Flora

- Permits must be obtained from DAFF to remove the Shepherd's Trees present on site.
- Weed control measures must be applied to eradicate any noxious weeds (category 1a &1b species) on disturbed areas.

Fauna

- Any fauna threatened by the construction and operation activities should be removed to safety by the ECO or appropriately qualified environmental officer.
- All construction vehicles should adhere to a low speed limit (<30km/h) to avoid collisions with susceptible species such as snakes and tortoises.
- If trenches need to be dug for electrical cabling or other purposes, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are exposed should contain soil ramps allowing fauna to escape the trench.

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ANNEXURE A:

Photos of the project site:

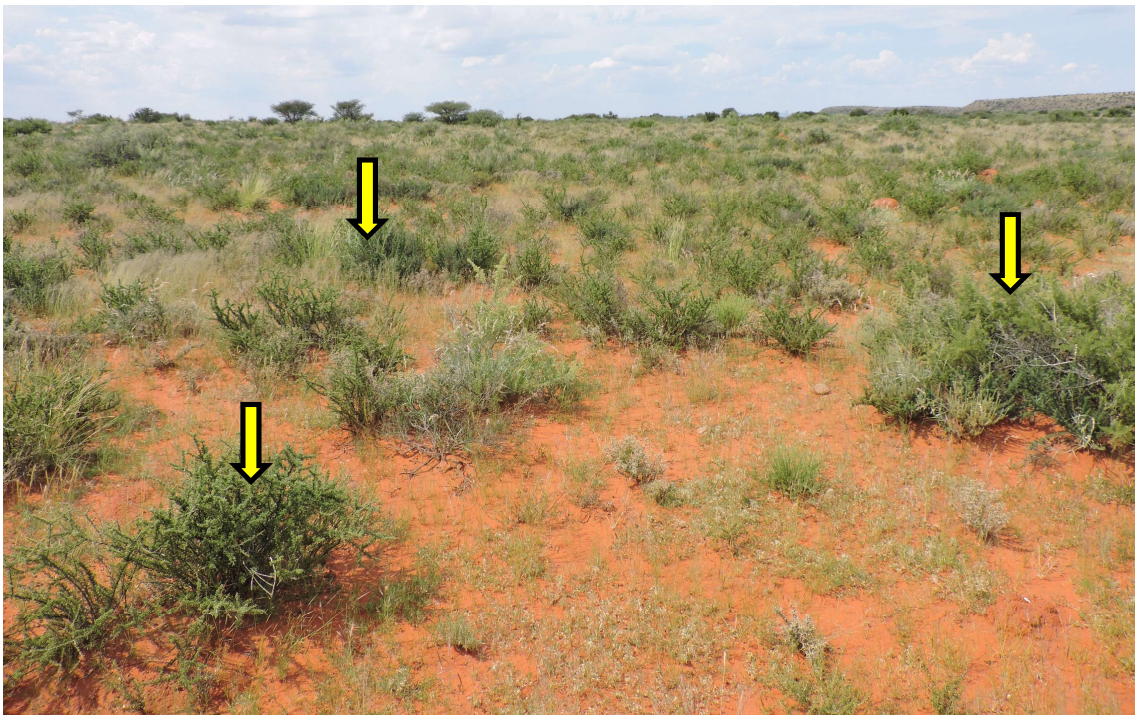

Figure A1: View of an area of the project site. Note the dominance of the encroacher *Rhigozum trichotomum* (arrows)

Figure A2: Note the degraded nature of the vegetation

Figure A3: Note the degraded nature of the vegetation

Figure A4: *Aloe claviflora*.

Figure A5: *Boscia albitrunca*.

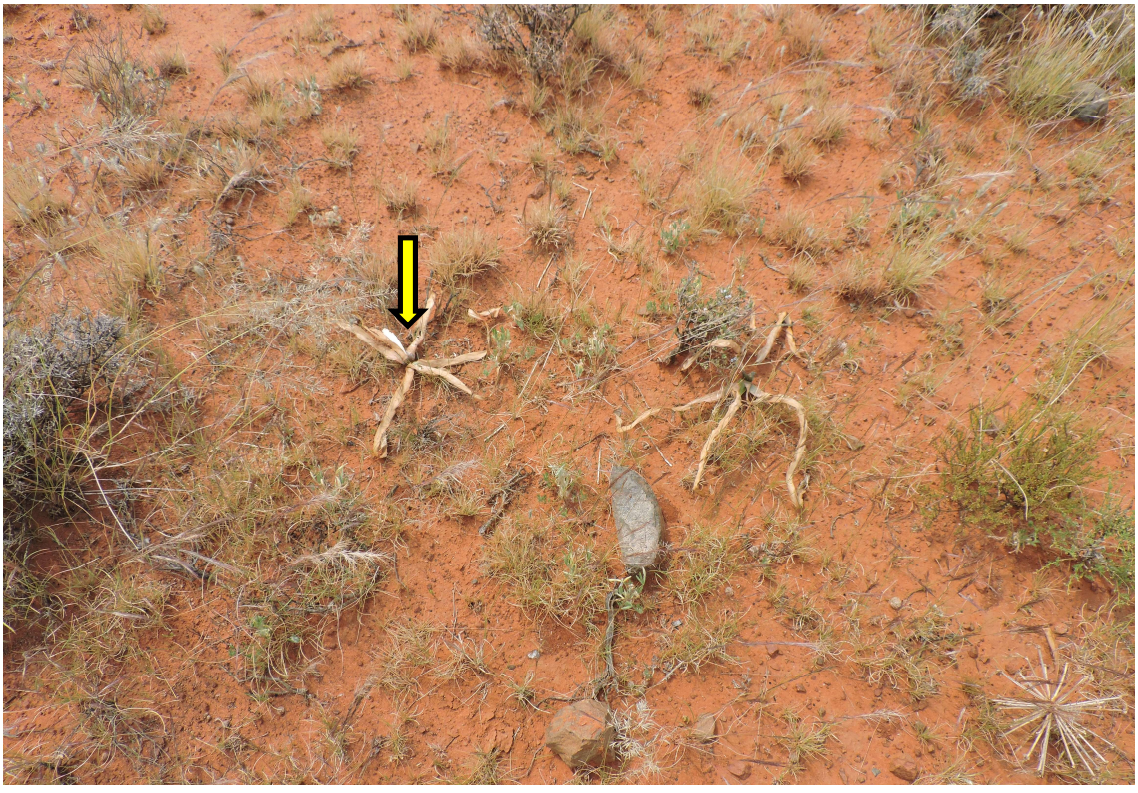

Figure A6: *Nerine laticoma*.

ANNEXURE B:

Preliminary checklist of plant species recorded on site.

Table B1: Species noted at the project site

- Protected according to National Forest Act 1998 / NFA (No 84 of 1998).
- Protected according to Northern Cape Conservation Act, (Act 9 of 2009) (Schedule 1 & 2: Specially Protected Species), and
- * Invasive Alien Plants

Family	Species	Threat status
ACANTHACEAE	Barleria rigida Nees	LC
AIZOACEAE	Tetragonia arbuscula Fenzl	LC
AMARYLLIDACEAE	Ammocharis coranica (Ker Gawl.) Herb.	LC
AMARYLLIDACEAE	Nerine laticoma	LC
ANACARDIACEAE	*Schinus molle L.	
ANACARDIACEAE	Searsia erosa (Thunb.) Moffett	LC
ASPARAGACEAE	Asparagus cooperi Baker	LC
ASPARAGACEAE	Asparagus glaucus Kies	LC
ASPHODELACEAE	Aloe claviflora	LC
ASPHODELACEAE	Bulbine narcissifolia Salm-Dyck	LC
ASTERACEAE	Chrysocoma ciliata L.	LC
ASTERACEAE	Eriocephalus ericoides (L.f.) Druce subsp. ericoides	LC
ASTERACEAE	Euryops subcarnosus DC. subsp. vulgaris B.Nord.	LC
ASTERACEAE	Felicia filifolia (Vent.) Burtt Davy subsp. filifolia	LC
ASTERACEAE	Gazania krebsiana Less. subsp. arctotoides (Less.) Roessler	LC
ASTERACEAE	Helichrysum obtusum (S.Moore) Moeser	LC
ASTERACEAE	Osteospermum spinescens Thunb.	LC
ASTERACEAE	Pegolettia retrofracta (Thunb.) Kies	LC
ASTERACEAE	Pentzia incana (Thunb.) Kuntze	LC
ASTERACEAE	Pteronia glauca Thunb.	LC
ASTERACEAE	Rosenia humilis (Less.) K.Bremer	LC
ASTERACEAE	Tarchonanthus camphoratus L.	LC
BIGNONIACEAE	Rhigozum obovatum Burch.	LC
BIGNONIACEAE	Rhigozum trichotomum Burch.	LC
CAMPANULACEAE	Wahlenbergia nodosa (H.Buek) Lammers	LC
CAPPARACEAE	Boscia albitrunca	LC
COLCHICACEAE	Ornithoglossum vulgare B.Nord.	LC
FABACEAE	Acacia karroo Hayne	LC
FABACEAE	Acacia tortilis	LC
IRIDACEAE	Moraea polystachya (Thunb.) Ker Gawl.	LC
MALVACEAE	Hermannia comosa Burch. ex DC.	LC
MELIANTHACEAE	Melianthus comosus Vahl	LC
MESEMBRYANTHEMACEAE	Psilocaulon coriarium (Burch. ex N.E.Br.) N.E.Br.	LC
NYCTAGINACEAE	Phaeoptilum spinosum Radlk.	LC
PEDALIACEAE	Harpagophytum procumbens (Burch.) DC. ex Meisn. subsp. procumbens	
PEDALIACEAE	Sesamum capense Burm.f.	LC
POACEAE	Aristida adscensionis L.	LC
POACEAE	Aristida congesta Roem. & Schult. subsp. barbicollis (Trin. & Rupr.)	LC
POACEAE	Aristida congesta Roem. & Schult. subsp. congesta	LC
POACEAE	Aristida vestita Thunb.	LC
POACEAE	Brachiaria marlothii (Hack.) Stent	LC
POACEAE	Cenchrus ciliaris L.	LC
POACEAE	*Cenchrus incertus M.A.Curtis	
POACEAE	Chloris virgata Sw.	LC
POACEAE	Digitaria eriantha Steud.	LC
POACEAE	Eleusine coracana (L.) Gaertn. subsp. africana	LC
POACEAE	Enneapogon cenchroides (Licht. ex Roem. & Schult.) C.E.Hubb.	LC
POACEAE	Enneapogon desvauxii P.Beauv.	LC
POACEAE	Enneapogon scaber Lehm.	LC

POACEAE	Enneapogon scoparius Stapf	LC
POACEAE	Eragrostis cilianensis (All.) Vignolo ex Janch.	LC
POACEAE	Eragrostis curvula (Schrad.) Nees	LC
POACEAE	Eragrostis echinochloidea Stapf	LC
POACEAE	Eragrostis lehmanniana Nees var. lehmanniana	LC
POACEAE	Eragrostis nindensis Ficalho & Hiern	LC
POACEAE	Eragrostis obtusa Munro ex Ficalho & Hiern	LC
POACEAE	Eragrostis porosa Nees	LC
POACEAE	Eragrostis superba Peyr.	LC
POACEAE	Eragrostis truncata Hack.	LC
POACEAE	Eustachys paspaloides (Vahl) Lanza & Mattei	LC
POACEAE	Fingerhuthia africana Lehm.	LC
POACEAE	Heteropogon contortus (L.) Roem. & Schult.	LC
POACEAE	Oropetium capense Stapf	LC
POACEAE	Panicum maximum Jacq.	LC
POACEAE	Panicum stapfianum Fourc.	LC
POACEAE	Pogonarthria squarrosa (Roem. & Schult.) Pilg.	LC
POACEAE	Schmidtia pappophoroides Steud.	LC
POACEAE	Setaria lindenbergiana (Nees) Stapf	LC
POACEAE	Sporobolus ioclados (Trin.) Nees	LC
POACEAE	Sporobolus tenellus (Spreng.) Kunth	LC
POACEAE	Stipagrostis ciliata (Desf.) De Winter var. capensis (Trin. & Rupr.) De Winter	LC
POACEAE	Stipagrostis namaquensis (Nees) De Winter	LC
POACEAE	Stipagrostis obtusa (Delile) Nees	LC
POACEAE	Themeda triandra Forssk.	LC
POACEAE	Tragus koelerioides Asch.	LC
POACEAE	Tragus racemosus (L.) All.	LC
RHAMNACEAE	Ziziphus mucronata Willd. subsp. mucronata	LC
RUBIACEAE	Kohautia cynanchica DC.	LC
SANTALACEAE	Osyris lanceolata Hochst. & Steud.	LC
SANTALACEAE	Thesium hystrix A.W.Hill	LC
SCROPHULARIACEAE	Peliostomum leucorrhizum E.Mey. ex Benth.	LC
SCROPHULARIACEAE	Selago albida Choisy	LC
SOLANACEAE	Lycium cinereum Thunb.	LC
SOLANACEAE	Solanum supinum Dunal var. supinum	LC
ZYGOPHYLLACEAE	Tribulus terrestris L.	LC
ZYGOPHYLLACEAE	Zygophyllum incrustatum E.Mey. ex Sond.	LC
ZYGOPHYLLACEAE	Zygophyllum microcarpum Licht. ex Cham. & Schltdl.	LC

ANNEXURE C

List of plant species of conservation concern which are known to occur in the vicinity of study area (2825 BC Quarter Degree Grid). The list is derived from the POSA website. Colours Relate as follow:

Threatened Status: Critically (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient (DDD), NE (NE)

- Protected according to National Forest Act 1998 / NFA (No 84 of 1998).
- Protected according to Free State Conservation Act, Act 8 of 1969 (Schedule 1: Specially Protected Species), and
- * Invasive Alien Plant

Grid: 2924CD		
Synonyms: excluded		
Family	**Species**	**Threat status**
ANACARDIACEAE	Searsia erosa (Thunb.) Moffett	LC
ANACARDIACEAE	Searsia pyroides (Burch.) Moffett var. gracilis (Engl.) Moffett	LC
APOCYNACEAE	Fockea angustifolia K.Schum.	LC
ASTERACEAE	Pentzia calcarea Kies	LC
ASTERACEAE	Senecio sisymbriifolius DC.	LC
CHENOPODIACEAE	Salsola calluna Fenzl ex C.H.Wright	LC
EUPHORBIACEAE	Euphorbia rhombifolia Boiss.	LC
GERANIACEAE	Monsonia glauca R.Knuth	LC