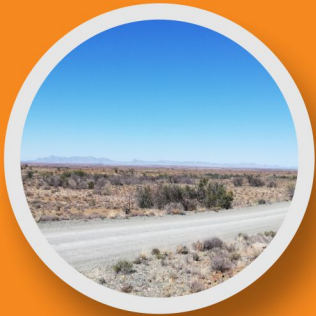


# APPENDIX F.5

## Aquatic Biodiversity and Species



## 1. APPENDIX F.5– Site Sensitivity Verification for Aquatic Biodiversity

As required in Part A of the Government Gazette 43110, GN 320, a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area. The details of the site sensitivity verification for Aquatic Biodiversity are noted below:

Date of Site Visit	8 November 2020
Specialist Name	Toni Belcher
Professional Registration No.	400040/10
Specialist Affiliation / Company	Toni Belcher Sole Proprietary
Specialist Topic	Aquatic Biodiversity
Proposed WEF Project Name	Kwagga WEF 2 (Remainder of and Portions 1, 3, 6, 7, 8, 9, 10, 11 and 12 of Farm Wolwe Kraal No. 17; Farm Annex Wolwe Kraal No. 18; and Farm Annex Welbedacht No.19)

## 2. Description of the Proposed Project

Kwagga WEF 2 is proposed to comprise of 55 turbines with a total installed generation capacity of up to 341 MW. The associated infrastructure will comprise of internal roads of approximately 55 km that will need to have a width of 6 to 8 m and internal transmission lines (preferably underground) that will follow the roads. The site will also contain offices (2 stacked containers), an Operation and Maintenance control centre, ablution facilities and guardhouse. Six alternative sub-station sites and laydown areas have been proposed for the site. A Battery Energy Storage System is being considered for the site.

It is proposed each WEF will make use of approximately 8333 kl per month during the construction stage of the projects. Water used during the Operation phase of the projects will primarily be for drinking and sanitation purposes. The Project Applicant proposes municipal water be trucked to the site, however, notes that alternative sources are still being investigated. At this stage, no water is planned to be abstracted from or discharged to any surface water systems.

## 3. Method of the Site Sensitivity Verification

This Site Sensitivity Verification was informed by a combination of desktop assessments of existing freshwater ecosystem information for the study area and surrounding catchments, as well as by a more detailed assessment of the freshwater features on the various farm portions that comprise the study area. The following websites were used to determine the aquatic biodiversity conservation importance mapping and presence of aquatic biota associated with the aquatic habitats in the site:

- National Environmental Screening Tool:  
<https://screening.environment.gov.za/screeningtool/#/pages/welcome>
- South African National Biodiversity Institute Biodiversity GIS: <http://bgis.sanbi.org/>
- Western Cape Department of Agriculture CapeFarmMapper:  
<https://gis.elsenburg.com/apps/cfm/>

- Freshwater Biodiversity Information System: <https://freshwaterbiodiversity.org/> and
- iNaturalist: <https://www.inaturalist.org/taxa>

The site was visited at the end of the rainy season for a single day on 8 November 2020 to verify the aquatic features occurring on the site. No additional site visits are deemed necessary. The field visit comprised of delineation, characterisation and integrity assessments of the aquatic habitats within the site. Mapping of the freshwater features was undertaken using a GPS Tracker and mapped in PlanetGIS and Google Earth Professional.

The following techniques and methodologies were utilised to undertake the assessments:

1. The guideline document, “A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas” document, as published by DWAF (2005) was followed for the delineation of the aquatic habitats;
2. The present ecological condition of the watercourses and wetlands was determined using national River Health Programme and Wet-Health methodologies;
3. The ecological importance and ecological sensitivity (EI&ES) assessment of the wetlands and watercourses were conducted according to the guidelines as developed by DWAF (1999); and
4. Recommendations are made concerning the adoption of buffer zones within the site were based on watercourse and wetland functioning and site characteristics.

#### 4. Aquatic Features in the Study Area

The study area is located in the upper catchments of the Kouka, a tributary of the Gouritz River System, and the Amos/Sout River, a tributary in the Groot/Gamtoos River System (Figure 1). Table 1 provides an overview and summary of the water resource information for the farm on which the development is proposed.

*Table 1: Key water resources information for the proposed project development area*

Descriptor	Name / details	Notes
Water Management Area (WMA)	Breede-Gouritz WMA with a small portion in Fish to Tsitsikamma WMA	
Catchment Areas	Leeu/Kouka and Hout Rivers, tributaries of the Kouka River Muishond se Loop and Brandleege Rivers, tributaries of the Amos/Sout River	Upper portion of the Olifants River in the Gouritz River; Upper portion of the Amos River, Groot/Gamtoos River
Quaternary Catchment	J32C (Kouka) L12A (Muishond se Loop River)	
Present Ecological state	Kouka: B (largely natural) Muishond: B (largely natural)	DWS (2012) assessment for the Kouka and Muishond se Loop Rivers (See Appendix B)
Ecological Importance and Ecological Sensitivity	Kouka: High Muishond: High/Moderate	
Location of the centre of the site	32°57'37.12"S	Latitude
	22°42'38.68"E	Longitude

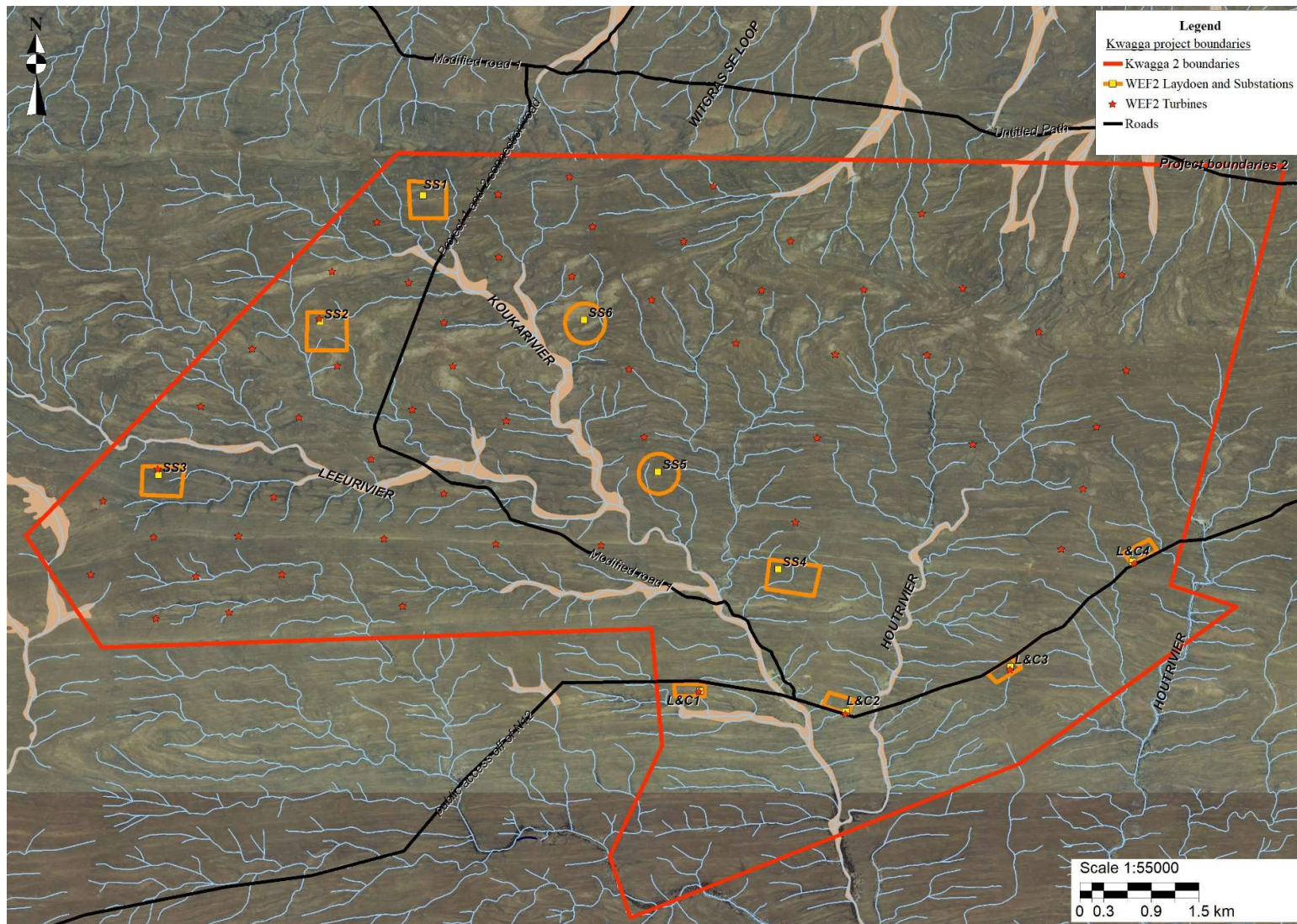


Figure 1. Orthophotograph of the site taken in 2016 showing the mapped watercourses within the site

#### 4.1. Description of Aquatic Features

The site falls across the watershed between north-east flowing streams of the Muishond se Loop and Brandleegte Rivers that drain into Groot/Gamtoos River System; and the south to south-easterly flowing streams of the Leeu and Hout Rivers that drain into the Gouritz River System (Figure 1).

The northerly flowing streams in the northern extent of the site are all tributaries drain into the Amos River, north of the site. The Amos River is joined by several other streams to form the Sout River. This river is joined by the Kariega River at Beervlei Dam to form the Groot River. The Groot River flows in a south-easterly direction to where it is joined by the Kouga River upstream of Hankey. These two rivers form the Gamtoos River which flows for a short distance before draining into the sea north-east of Jefferys Bay.

The southerly draining streams all drain into the Kouka River, a tributary of the Traka River that flows southwards through the Swartberg Mountains to join the Olifants River in its upper reaches. The Olifants River joins the Gamka River downstream of Calizdorp to form the Gouritz River that drains into the sea west of Mossel Bay.

Within the study area, the streams fall within the foothill zones of the Great Karoo Ecoregion. The watercourses in this region, due to the low rainfall of the area, are non-perennial (ephemeral) rivers tending to only flow for relatively short periods immediately following rainfall events. They comprise primarily of gravel bed, single to multiple channels. The larger streams contain distinct riparian vegetation that comprises of a mix of low trees and shrubs such as *Vachellia karroo*, *Searsia lancea*, *Searsia pallens*, *Gymnosporia* sp., *Carissa haematocarpa*, *Melianthus comosus*, and *Lycium* spp. (Figure 2). The smaller watercourses have less distinct vegetation that tends to comprise of a low density of *Vachellia karroo* with *Stipagrostis namaquensis* and other grasses (Figure 3).



Figure 2. View of the Leeu River with its more significant riparian vegetation that is still in a relatively natural ecological condition

Only localised impacts occurred along the rivers where the agricultural activities within the site have directly impacted on the watercourses. At these points that are typically along the access roads through the site, there has been some removal of indigenous riparian vegetation or habitat modification within the watercourse at the road crossing. There are about ten small instream dams within the property. Land use is largely livestock grazing that has also impacted on the vegetation in and adjacent to the watercourses. The invasion of alien vegetation along the watercourses is relatively low and comprises of invasive plants such as *Opuntia ficus-indica* (prickly pear), *Xanthium strumarium* (cocklebur), *Tagetes minuta* (khaki weed) and *Hypochaeris radicata* (false dandelion).



Figure 3. View of the more disturbed Kouka River with a riparian zone that comprises largely of just *Vachellia karroo*

#### 4.2. Biodiversity Importance of the Aquatic Features

The catchment of the Brandleegte River is mapped as a Freshwater Ecosystem Priority Area Sub-catchment (Figure 4) as well as an aquatic Critical Biodiversity Area (Figure 5) with the wider river corridor also being mapped as a terrestrial Critical Biodiversity Areas. Portions of the Leeu and Kouka River are also mapped as aquatic CBAs where there is good riparian vegetation. The Kouka River Sub-catchment is mapped as an Upstream Catchment that is important to be maintained in its current ecological condition so as to not impact on the downstream Olifants River that provides important habitat for indigenous fish species.

The mapped Freshwater Ecosystem Priority Area and aquatic Critical Biodiversity Area are considered to be in a natural condition and are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure. These areas should be maintained in a natural or near-natural state or where necessary rehabilitated. Only low-impact, biodiversity-sensitive land uses are considered appropriate.

All of the remaining watercourses are mapped as aquatic Ecological Support Areas that are not essential for meeting biodiversity targets, but that play an important role in delivering ecosystem services. The ecological functioning of these watercourses should not be compromised by the proposed project activities.

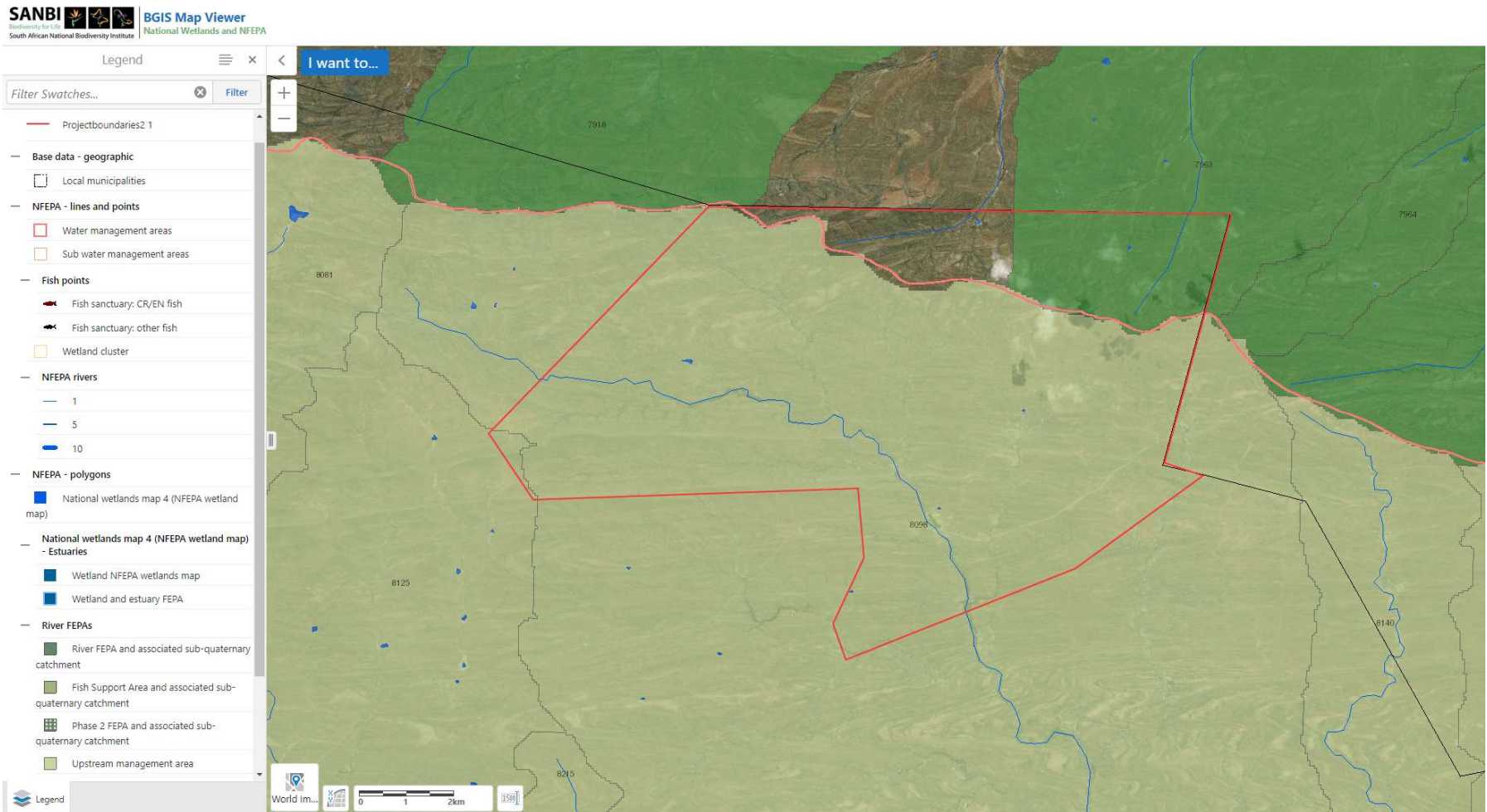


Figure 4. Freshwater Ecosystem Priority Area mapping for the site (2011 CSIR National Freshwater Ecosystem Priority Areas, obtained from SANBI Biodiversity GIS, November 2020)

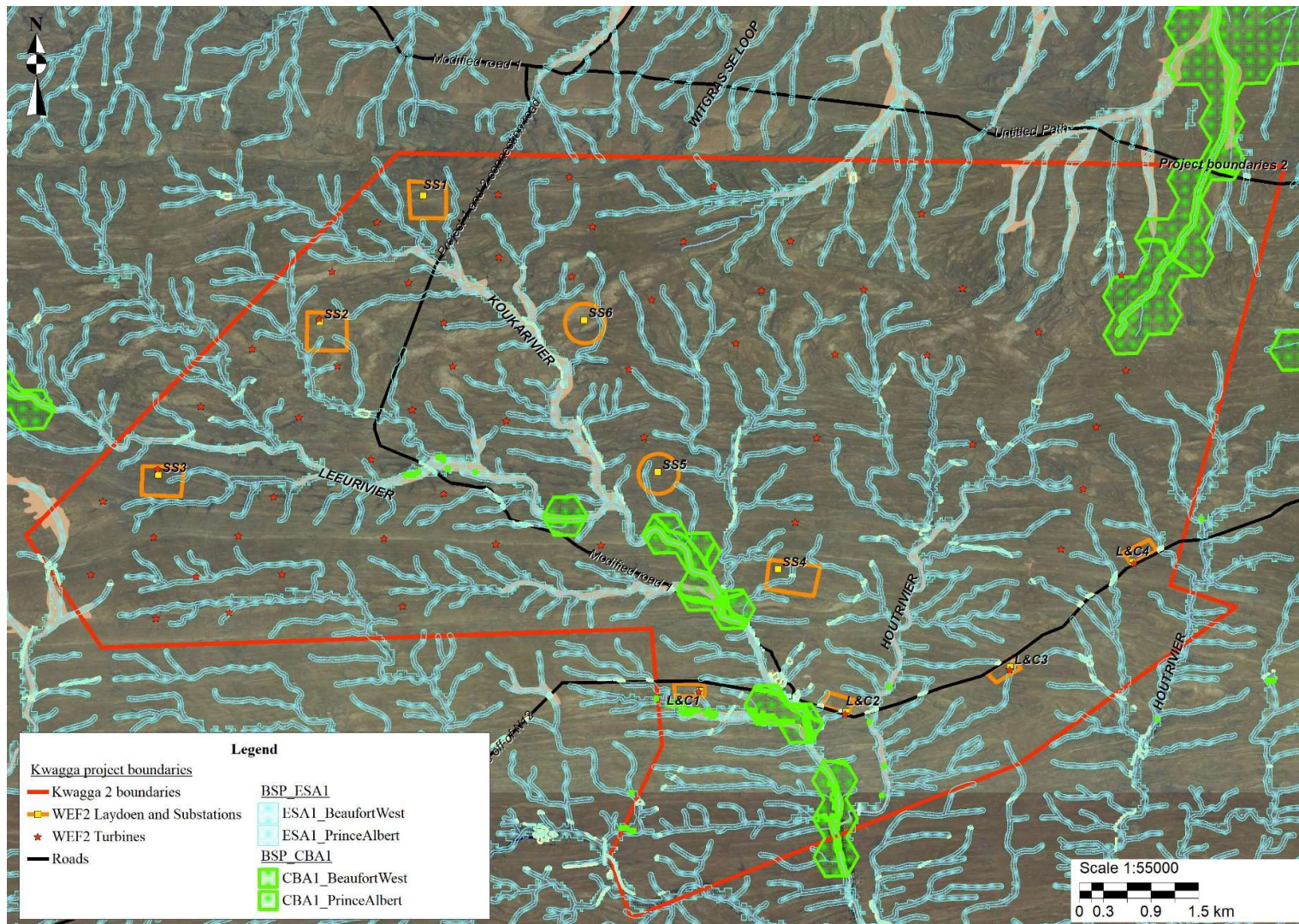


Figure 5. Aquatic Critical Biodiversity and Ecological Support Area mapping for the site



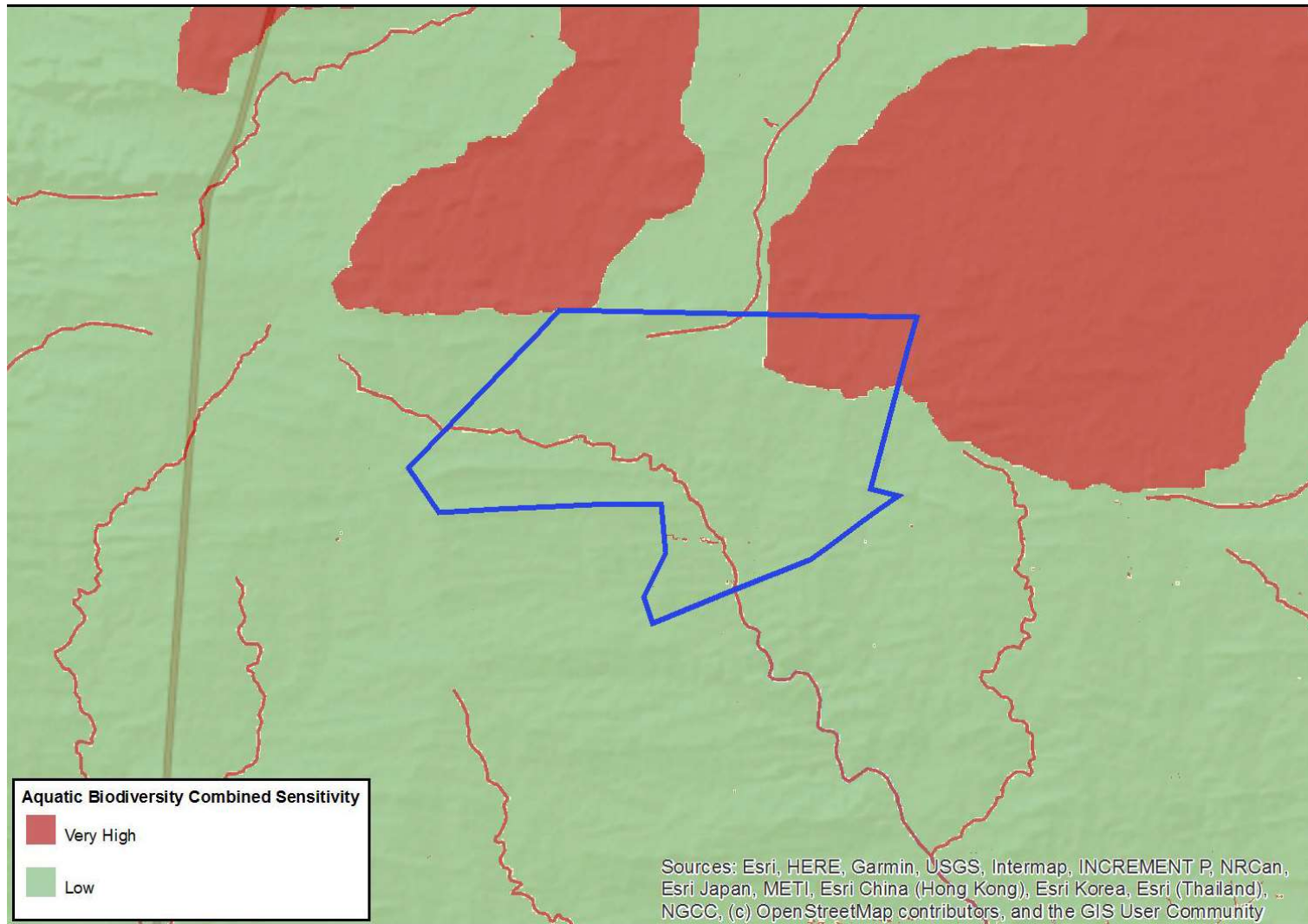


Figure 6. Screening Tool map of the site (blue polygon) for the mapped Aquatic Biodiversity Combined Sensitivity

The only wetlands mapped within the site are wetlands associated with dams that are mapped as artificial Freshwater Ecosystem Priority Area Wetlands.

The Screening Tool has indicated that the catchment of the Brandleege Rivers is of very high sensitivity while the remainder of the site is considered of low Aquatic Biodiversity Combined Sensitivity (Figure 6). This is linked to the Freshwater Ecosystem Priority Area and aquatic Critical Biodiversity Area mapping of this river. The main watercourses of the Leeu and Muishond se Loop Rivers are also indicated as being of very high Aquatic Biodiversity Combined Sensitivity.

#### **4.3. Present Ecological Status, Ecological Importance and Sensitivity and Recommended Ecological Condition**

The aquatic features within the site are all mostly in a **largely natural** (B Category) ecological condition and are considered of **moderate** ecological importance and sensitivity. The southward flowing Leeu and Kouka Rivers and their larger tributaries, as well as the northern flowing larger tributaries of the Brandleege and Muishond se Loop River, however, provide a more significant ecological corridor within the landscape that is deemed to be of **high** ecological importance and sensitivity. Where localised impacts to the watercourses have taken place the habitat integrity of the watercourse has been reduced in places to **moderately modified** (C Category) however these impacts are direct habitat disturbances and do not impact on the overall ecological integrity or ecological importance and sensitivity of the watercourses. It is recommended that the watercourses remain in their current ecological integrity of largely natural to moderately modified. The Leeu, Brandleege and Muishond se Loop Rivers, in particular, should remain in their current condition of largely natural, given the high ecological importance and sensitivity. The more impacted Kouka River should not be allowed to degrade below moderately modified.

### **5. Outcome of Aquatic Assessment**

The site visit confirmed that the Leeu, Brandleege and Muishond se Loop Rivers and many of their larger tributaries within the site were in a largely natural ecological condition and of high ecological importance and sensitivity due to the good riparian vegetation associated with these watercourses that provide important ecological corridors in the landscape for the movement of biota. The Kouka River is the largest river within the site but has been more impacted in its lower reaches as a result of the existing agricultural activities, and in particular grazing of the riparian vegetation with the resulting erosion of the river channels.

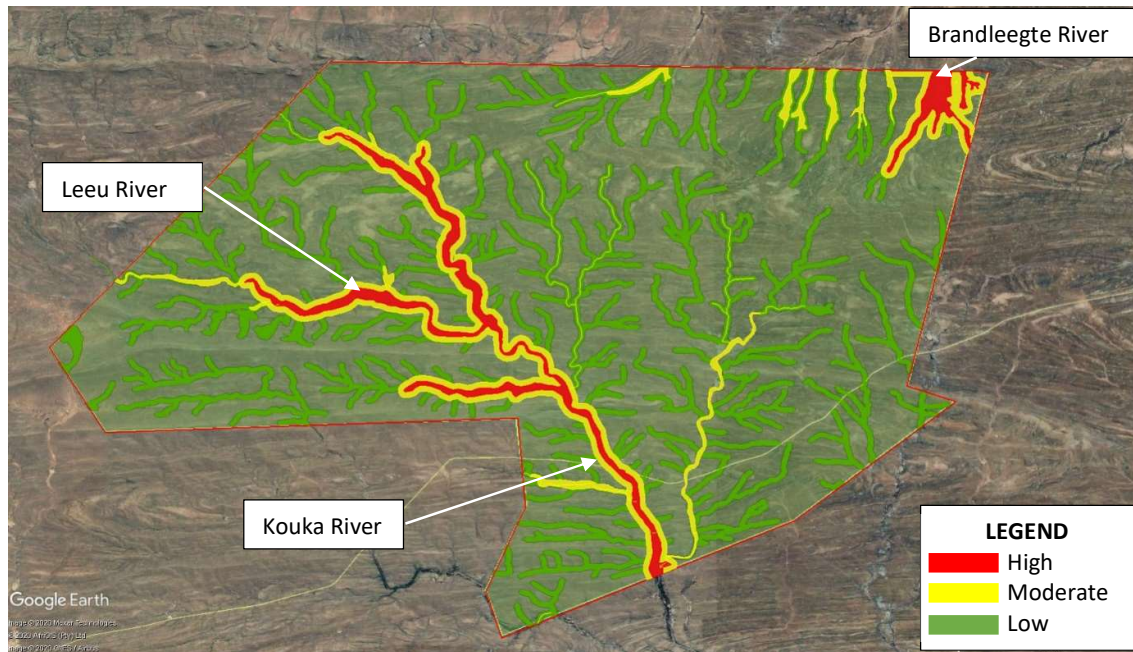


Figure 7. Google Earth image with the Aquatic Ecosystem Sensitivity mapping where the green area indicates low sensitivity, the yellow the moderate sensitivity and the red the high sensitivity areas

This assessment thus largely concurs with the **Very high/High** Aquatic Biodiversity Combined Sensitivity mapping of the screening tool for the Leeu/Kouga, Brandleegte and Muishond se Loop Rivers (Figure 7). The other larger watercourses within the site are deemed to be of **Moderate** sensitivity while the smaller watercourses, as well as the recommended buffer areas (100m for the larger streams and 35m for the smaller watercourses), are considered as of **Low** Aquatic Biodiversity Combined Sensitivity.

## 6. Description of Potential Aquatic Ecosystem Impacts

Most of the potential aquatic ecosystem impacts of the proposed project are likely to take place during the construction phase.

The potential aquatic ecosystem impacts of all the proposed activities during construction include:

- Disturbance and possibly loss of aquatic habitats within the watercourses with the associated impact to sensitive aquatic biota;
- The removal of indigenous riparian and instream vegetation that has the potential to reduce the ecological integrity and functionality of the watercourses;
- Demand for water for construction could place stress on the existing available water resources;
- Road crossing structures if not adequately designed could impede flow in the watercourses;

- Alien vegetation infestation within the aquatic features due to disturbance; and
- Increased sedimentation and risks of contamination of surface water runoff during construction.

During the operational phase for all the proposed works, the potential impacts would include:

- Ongoing disturbance of aquatic features and associated vegetation along access roads or adjacent to the infrastructure that needs to be maintained;
- Modified runoff characteristics from hardened surfaces at the turbines and the substation as well as along the access roads that have the potential to result in erosion of hillslopes and watercourses; and
- Possible increase in water consumption and potential for water quality impacts (such as contamination from sewage generated onsite) as a result of the operation of the site.

During the decommissioning phase, the potential impacts would largely be associated with an increased disturbance of aquatic habitat due to the increased activity on the site. Increased sedimentation and risks of contamination of surface water runoff may also occur.

The cumulative impact of the project activities together with the existing activities in the area could have the potential to reduce the integrity of the watercourses if not properly mitigated and managed. By implementing suitable buffers (100m for the larger streams and 35m for the smaller watercourses is recommended) along the watercourses and minimising the works within the river/stream corridors the impact of the proposed project activities would be low and unlikely to impact on the integrity of the aquatic ecosystems.

## 7. Consideration of propose project activities

Figure 8 shows the proposed project layout together with the aquatic ecosystem sensitivity mapping that includes the recommended buffer areas. References to project components below are indicated in Figure 8.

In terms of the proposed layout for Kwagga WEF 2, it is recommended that:

1. Turbines: A few turbines would require a slight shift to move them outside of the recommended buffers;
2. Laydown and office/compound area alternatives: With the exception of the eastern-most laydown area (L&C4), the proposed alternatives would need to be moved slightly to place them outside of the recommended aquatic buffers;
3. Substation alternatives: The northern-most substation (SS1) alternative has been placed where it would have the least impact on drainage features within the site, however, it is located on a slope that is probably a less suitable site for the substation. In most of the sites (SS2, SS3 and SS6), the aquatic features comprise of small ephemeral streams that

could be avoided in the final siting of the substation or the watercourse could be diverted and addressed in the stormwater management plan for the substation. SS4 and SS5 also contain smaller streams within their proposed sites that may be difficult to avoid thus these two proposed sites would be likely to have more significant aquatic ecosystem impacts; and

4. Road: The proposed upgraded access road is an existing road that would need to be widened and improved. Any widening should take place away from the watercourse to avoid impacting on the watercourse as far as possible. Crossings through the stream should preferably be perpendicular to the watercourse to minimise the length of road placed within the watercourse channel and riparian zone. The road crossing structures in the watercourses are recommended to be simple concrete slabs placed on the bed of the watercourses that will not impede flow in the watercourses.

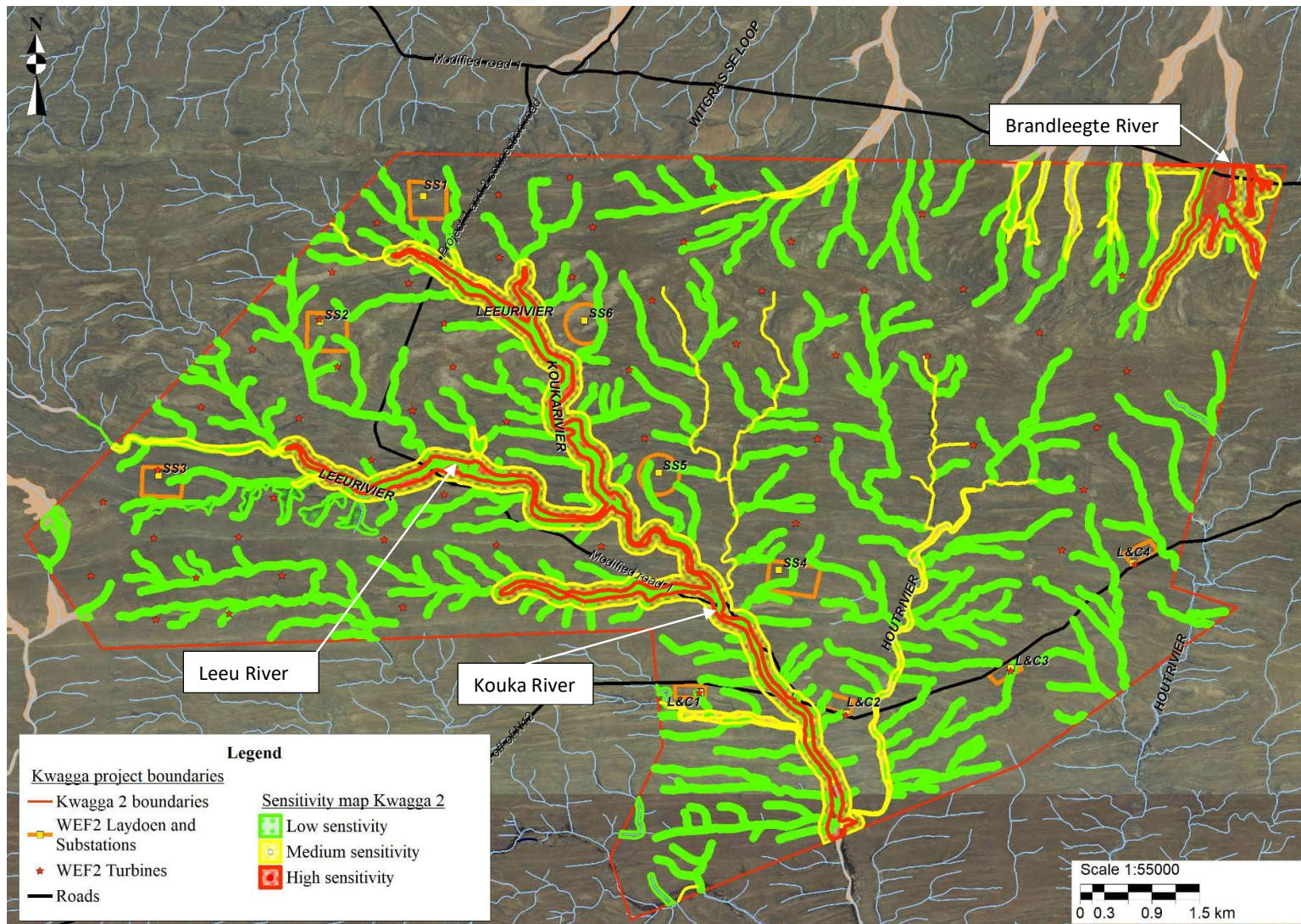


Figure 8. Google Earth image with the aquatic sensitivity mapping shown together with the proposal layout

## 8. REFERENCES

- Department of Water Affairs and Forestry. (1998). *National Water Act*. Act 36. South Africa.
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- Middleton, B.J., Midgley, D.C and Pitman, W.V., (1990). *Surface Water Resources of South Africa*. WRC Report No 298/1.2/94.
- Mucina, L. and Rutherford, M. C. (eds.) (2004) *Vegetation map of South Africa, Lesotho and Swaziland*. Strlitzia 18. South African National Biodiversity Institute, Pretoria.
- SANBI Biodiversity GIS 2012. <http://bgis.sanbi.org/capetown/bionetwork.asp>
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- WRC. (2011). *Atlas for Freshwater Ecosystem Priority Areas – Maps to support sustainable development of water resources* (WRC Report No. TT 500/11).

**APPENDIX A: SPECIALIST DETAILS, EXPERTISE AND DECLARATION*****Qualifications of Specialist Consultant***

**Name:** Antonia Belcher  
**Contact details:** 53 Dummer St, Somerset West, 7130; Phone: 082 883 8055;  
 Email: toni@bluescience.co.za  
**Profession:** Aquatic Scientist (P. Sci. Nat. 400040/10)  
**Fields of Expertise:** Specialist in freshwater assessments, monitoring and reporting  
**Years in Profession:** 29+ years

Toni Belcher worked for the Department of Water Affairs and Forestry for more than 17 years. During this period she worked for the Directorate Water Quality Management, the Institute for Water Quality Studies and the Western Cape Regional Office and has built up a wide skills base on water resource management and water resource quality for rivers, estuaries and the coastal marine environment. Since leaving the Department in 2007, she has been working in her private capacity and was co-owner of BlueScience (Pty) Ltd, working in the field of water resource management and has been involved in more than 500 aquatic ecosystem assessments for environmental impact assessment and water use authorisation purposes. In 2006 she was awarded a Woman in Water award for Environmental Education and was a runner up for the Woman in Water prize for Water Research.

**Professional Qualifications:**

1984 Matriculation Lawson Brown High School  
 1987 B.Sc. – Mathematics, Applied Mathematics University of Port Elizabeth  
 1989 B.Sc. (Hons) – Oceanography University of Port Elizabeth  
 1998 M.Sc. – Environmental Management (cum laude) Potchefstroom University

**Key Skills:** Areas of specialisation: Aquatic ecosystem assessments, Monitoring and evaluation of water resources, Water resource legislation and authorisations, River classification and Resource Quality Objectives, River Reserve determination and implementation, Water Quality Assessments, Biomonitoring, River and Wetland Rehabilitation Plans, Catchment management, River maintenance management, Water education.

**Summary of Experience:**

1987 – 1988	Part-time field researcher, Department of Oceanography, University of Port Elizabeth
1989 – 1990	Mathematics tutor and administrator, Master Maths, Randburg and Braamfontein Colleges, Johannesburg
1991 – 1995	Water Pollution Control Officer, Water Quality Management, Department of Water Affairs, Pretoria
1995 – 1999	Hydrologist and Assistant Director, Institute for Water Quality Studies, Department of Water Affairs and Forestry, Pretoria
1999 – 2007	Assistant and Deputy Director, Water Resource Protection, Western Cape Regional Office, Department of Water Affairs, Cape Town
2007 – 2012	Self-employed – Aquatic Specialist
2013 – 2020	Senior Aquatic Specialist and part-owner, BlueScience
2020 – present	Self-employed– Aquatic Specialist



***Declaration of Independence***

I, Antonia Belcher, declare that –

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



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Signature of the Specialist

Toni Belcher Sole Proprietary

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Name of Company:

20 November 2020

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Date



# environmental affairs

Department:  
Environmental Affairs  
REPUBLIC OF SOUTH AFRICA

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

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

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

### PROJECT TITLE

**Scoping and Environmental Impact Assessment for the Proposed Development of the 341 MW Wind Energy Facility (i.e. Kwagga WEF 2), near Beaufort West, Western Cape**

#### Kindly note the following:

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

#### Departmental Details

##### Postal address:

Department of Environmental Affairs  
Attention: Chief Director: Integrated Environmental Authorisations  
Private Bag X447  
Pretoria  
0001

##### Physical address:

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

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

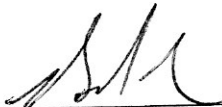
**1. SPECIALIST INFORMATION**

Specialist Company Name:	Toni Belcher Sole Proprietary		
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level EME	4 Percentage Procurement recognition
Specialist name:	Toni Belcher		
Specialist Qualifications:	M.Sc		
Professional affiliation/registration:	SACNASP (400040/10 Ecological and Environmental Science)		
Physical address:	53 Dummer Street, Somerset West		
Postal address:	53 Dummer Street, Somerset West		
Postal code:	7130	Cell:	+27 82 883 8055
Telephone:	+27 82 883 8055	Fax:	-
E-mail:	toni@BlueScience.co.za		

**2. DECLARATION BY THE SPECIALIST**

I, Antonia Belcher, declare that –

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



Signature of the Specialist

Toni Belcher Sole Proprietary

Name of Company:

26 May 2021

Date

Details of Specialist, Declaration and Undertaking Under Oath

3. UNDERTAKING UNDER OATH/ AFFIRMATION

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



Signature of the Specialist

Toni Belcher Sole Proprietary

Name of Company

26 May 2021

Date

71900209 CST  
I NUPHAT

Signature of the Commissioner of Oaths

2021-05-26

Date



**APPENDIX B: PES, EI AND ES FOR THE MAJOR WATERCOURSES IN THE STUDY AREA (DWS, 2012)**

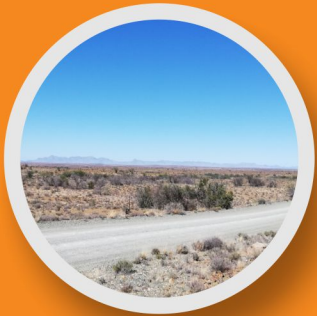
SELECT SQ REACH	SQR NAME	LENGTH km	STREAM ORDER	PES ASSESSED BY XPERTS? (IF TRUE="Y")	REASONS NOT ASSESSED	PES CATEGORY DESCRIPTION	PES CATEGORY BASED ON MEDIAN OF METRICS
J32C-08098	Kouka	29.53	1	Y		LARGELY NATURAL	B
MEAN EI CLASS	MEAN ES CLASS	DEFAULT ECOLOGICAL CATEGORY (EC)	RECOMMENDED ECOLOGICAL CATEGORY (REC)				
HIGH	HIGH	B	#NUM!				
PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE			ECOLOGICAL SENSITIVITY		
INSTREAM HABITAT CONTINUITY MOD	SMALL	FISH SPP/SQ		INVERT TAXA/SQ		FISH PHYS-CHEM SENS DESCRIPTION	
RIP/WETLAND ZONE CONTINUITY MOD	SMALL	FISH: AVERAGE CONFIDENCE		INVERT AVERAGE CONFIDENCE		FISH NO-FLOW SENSITIVITY DESCRIPTION	
POTENTIAL INSTREAM HABITAT MOD ACT.	SMALL	FISH REPRESENTIVITY PER SECONDARY: CLASS		INVERT REPRESENTIVITY PER SECONDARY, CLASS		INVERT PHYS-CHEM SENS DESCRIPTION	
RIPARIAN-WETLAND ZONE MOD	MODERATE	FISH REPRESENTIVITY PER SECONDARY: CLASS		INVERT RARITY PER SECONDARY: CLASS		INVERTS VELOCITY SENSITIVITY	
POTENTIAL FLOW MOD ACT.	SMALL	FISH RARITY PER SECONDARY: CLASS		ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	VERY HIGH	RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) INTOLERANCE WATER LEVEL/FLOW CHANGES DESCRIPTION	HIGH
POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES	SMALL	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH)	VERY HIGH	HABITAT DIVERSITY CLASS	VERY LOW	STREAM SIZE SENSITIVITY TO MODIFIED FLOW/WATER LEVEL CHANGES DESCRIPTION	VERY HIGH
		RIPARIAN-WETLAND NATURAL VEG RATING BASED ON % NATURAL VEG IN 500m (100%=5)	VERY HIGH	HABITAT SIZE (LENGTH) CLASS	HIGH	RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL	HIGH
		RIPARIAN-WETLAND NATURAL VEG IMPORTANCE BASED ON	VERY HIGH	INSTREAM MIGRATION LINK CLASS	VERY HIGH		
				RIPARIAN-WETLAND ZONE MIGRATION LINK	VERY HIGH		
				RIPARIAN-WETLAND ZONE HABITAT	HIGH		
				INSTREAM HABITAT INTEGRITY CLASS	VERY HIGH		

SELECT SQ REACH	SQR NAME	LENGTH km	STREAM ORDER	PES ASSESSED BY EXPERTS? (IF TRUE="Y")	REASONS NOT ASSESSED	PES CATEGORY DESCRIPTION	PES CATEGORY BASED ON MEDIAN OF METRICS
L12A-07868	Muishond se Loop	33.00	1	Y		LARGELY NATURAL	B
MEAN EI CLASS	MEAN ES CLASS	DEFAULT ECOLOGICAL CATEGORY (EC)	RECOMMENDED ECOLOGICAL CATEGORY (REC)				
HIGH	MODERATE	B	#NUM!				
PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE				ECOLOGICAL SENSITIVITY	
INSTREAM HABITAT CONTINUITY MOD	SMALL	FISH SPP/SQ		INVERT TAXA/SQ	27.00	FISH PHYS-CHEM SENS DESCRIPTION	
RIP/WETLAND ZONE CONTINUITY MOD	SMALL	FISH: AVERAGE CONFIDENCE	#DIV/0!	INVERT AVERAGE CONFIDENCE	1.15	FISH NO-FLOW SENSITIVITY DESCRIPTION	
POTENTIAL INSTREAM HABITAT MOD ACT.	SMALL	FISH REPRESENTIVITY PER SECONDARY: CLASS		INVERT REPRESENTIVITY PER SECONDARY, CLASS	VERY HIGH	INVERT PHYS-CHEM SENS DESCRIPTION	MODERATE
RIPARIAN-WETLAND ZONE MOD	SMALL	FISH REPRESENTIVITY PER SECONDARY: CLASS		INVERT RARITY PER SECONDARY: CLASS	VERY HIGH	INVERTS VELOCITY SENSITIVITY	VERY HIGH
POTENTIAL FLOW MOD ACT.	SMALL	FISH RARITY PER SECONDARY: CLASS		ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	LOW	RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) INTOLERANCE WATER LEVEL/FLOW CHANGES DESCRIPTION	LOW
POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES	NONE	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	LOW	HABITAT DIVERSITY CLASS	LOW	STREAM SIZE SENSITIVITY TO MODIFIED FLOW/WATER LEVEL CHANGES DESCRIPTION	VERY HIGH
		RIPARIAN-WETLAND NATURAL VEG RATING BASED ON % NATURAL VEG IN 500m (100%=5)	VERY HIGH	HABITAT SIZE (LENGTH) CLASS	HIGH	RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL CHANGES DESCRIPTION	LOW
		RIPARIAN-WETLAND NATURAL VEG IMPORTANCE BASED ON EXPERT RATING	LOW	INSTREAM MIGRATION LINK CLASS	VERY HIGH		
				RIPARIAN-WETLAND ZONE MIGRATION LINK	VERY HIGH		
				RIPARIAN-WETLAND ZONE HABITAT INTEGRITY CLASS	VERY HIGH		
				INSTREAM HABITAT INTEGRITY CLASS	VERY HIGH		

Scoping and Environmental Impact Assessment for the proposed development of the 341 MW Kwagga Wind Energy Facility 2 near Beaufort West, Western Cape

# APPENDIX F.6

## Terrestrial Biodiversity and Species



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# SITE SENSITIVITY VERIFICATION REPORT:

## Kwagga Wind Energy Facility 2 (Pty) Ltd

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### TERRESTRIAL BIODIVERSITY AND ECOLOGY

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<i>Report prepared for:</i> CSIR – Environmental Management Services SMART PLACES: Sustainable Ecosystems P O Box 320 Stellenbosch, 7599 South Africa	<i>Report prepared by:</i> Ekotrust cc 7 St George Street Lionviham, Somerset West, 7130 South Africa
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**V.2**

**19 January 2021**



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# REGULATIONS GOVERNING THIS REPORT

This report has been prepared in terms of the EIA Regulations under the National Environmental Management Act (Act No. 107 of 1998) (NEMA 2014, 2017, 2020).

## **Appointment of specialist**

Ekotrust cc was commissioned by CSIR (EMS, SMART PLACES) Stellenbosch to provide an assessment on the terrestrial ecology and biodiversity of the Kwagga Wind Energy Facility 2 (WEF), located to the south of Beaufort West in the Western Cape.

## **Company profile:**

Name of Company: Ekotrust cc  
(Registration number: CK90/05465/23)  
Sole Member: Dr Noel van Rooyen  
Founding date: 1990

Ekotrust cc specialises in habitat evaluation, vegetation classification and mapping, floristic diversity assessments, rare species assessments, alien plant assessments and management, wildlife management, wildlife production and economic assessments, veld condition assessment, bush encroachment, fire management, carrying capacity, wildlife numbers and ratios.

## **Specialist declaration**

We, Noel van Rooyen and Gretel van Rooyen, as the appointed independent specialists, hereby declare that we:

- act as independent specialists in this application;
- perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report, as it relates to our specialist input/study, to be objective, true and correct within the framework of assumptions and limitations;
- do not have and will not have any business, financial, personal or other interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations 2014, and amendments 2017, NEMA 2020 Procedures for the assessment and minimum requirements for reporting on identified environmental themes in terms of Sections 24(5) (a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for environmental authorisation, and any specific environmental management act;
- declare that there are no circumstances that may compromise our objectivity in performing such work;
- have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- will comply with the Act, Regulations and all other applicable legislation;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- have no vested interest in the proposed activity proceeding;
- undertake to disclose to the applicant and the competent authority all material information in our possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the

application by the competent authority; or the objectivity of any report, plan or document to be prepared by us for submission to the competent authority;

- all the particulars furnished by me in this form are true and correct; and
- realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

**Indemnity and conditions relating to this report:**

The observations, findings, recommendations and conclusions provided in the current report are based on the compilers' best scientific and professional knowledge and other available information. If new information should become available Ekotrust cc reserves the right to modify aspects of the report. This report (hard copy and/or electronic) must not be amended or extended without the prior written consent of the author. Furthermore, any recommendations, statements or conclusions drawn from or based on this report must make reference to the report. If these recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety (as an Appendix).

Although Ekotrust cc has exercised due care in preparing this report, it accepts no liability, and by receiving this document, the client indemnifies Ekotrust cc against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document.



Signature of specialists:

Name of specialists: Dr N van Rooyen

Prof. MW van Rooyen

Date: 19 January 2021

19 January 2021

# GENERAL INFORMATION

**Study site:** Kwagga WEF 2: Most of the site covered by the farm Wolvekraal 17

**Client:** ABO Wind Renewable Energies (Pty) Ltd: Kwagga Wind Energy Facility 2 (Pty) Ltd (Reg. no. 2020/429949/07)

**Approximate size of property:** 9283 ha

**Environmental Assessment Practitioner (EAP):**

CSIR: SMART PLACES  
Environmental Management Services  
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Stellenbosch 7599  
Contact person: Lizande Kellerman  
Tel. +27 (0) 21 888 2489  
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**Botanical assessment by:**

This specialist assessment has been undertaken by Dr Noel van Rooyen and Prof Gretel van Rooyen of Ekotrust cc. The *curriculum vitae* of the specialists are included in Appendix D of this assessment.

Dr Noel van Rooyen Pr.Sci.Nat; Reg. no. 401430/83 - Botanical Sciences  
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# TERMS OF REFERENCE

The Scope of Work for the terrestrial biodiversity and ecology specialist study includes the following tasks:

- Compilation of a specialist study in adherence to:
  - o the gazette *Procedures for the assessment and minimum requirements for reporting on identified environmental themes in terms of Sections 24(5) (a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for environmental authorisation* (GG 43110 / 320, 20 March 2020);
  - o any additional relevant legislation and guidelines that may be deemed necessary.
- The assessment should be based on existing information, national and provincial databases, SANBI mapping, professional experience and field work conducted.
- Undertake a site inspection to identify the site sensitivities, and verify them in terms of the National Web-Based Screening Tool (<https://screening.environment.gov.za/>).
- If needed, liaise with the South African National Biodiversity Institute (SANBI) to obtain information on sensitive species flagged in the National Web-Based Screening Tool (where species names are obscured / only numbered).
- Describe the terrestrial ecological features of the project area, with focus on features that are potentially impacted by the proposed project. The description should include the major habitat forms within the study site, giving due consideration to terrestrial ecology (flora and fauna), Species of Conservation Concern (SCC) or Protected Species.
- If applicable, specify development set-backs / buffers, and provide clear reasons for these recommendations.
- Map the sensitive ecological features within the proposed project area, showing any “no-go” areas (i.e. “very high” sensitivity).
- Provide input on the preferred infrastructure locations following the sensitivity analysis.
- Provide sensitive features spatial data in a useable GIS format (kmz / shp).
- Provide an assessment of direct, indirect and cumulative impacts associated with the proposed WEF, with and without mitigation.
- Address relevant concerns / comments raised by Interested and Affected Parties and Stakeholders, including the Competent Authority, during Public Participation Processes on the draft Basic Assessment Report (BAR).
- Identify relevant legislative requirements and permits that may be required.
- Recommend mitigation measures, best practice management actions, monitoring requirements, and rehabilitation guidelines for all identified impacts to be included in the Environmental Management Programme (EMPr).
- Update draft specialist study report after Environmental Assessment Practitioner (EAP) and client review (before public release) and after public review for submission to the Competent Authority for decision-making.
- Address any queries from the Competent Authority during the decision-making phase (as and when they arise).

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# LIMITATIONS, ASSUMPTIONS AND UNCERTAINTIES

The following assumptions, limitations or uncertainties are listed regarding the evaluation of the impacts of the proposed Kwagga Wind Energy Facility 2 (Pty) Ltd project on the terrestrial biodiversity and ecology.

- The site verification survey was conducted during very dry conditions at the end of October/beginning of November 2020, following four years of drought. Large-scale mortality of plants had occurred and conditions for vegetation surveys were appalling.
- Rare and threatened plant and animal species are generally uncommon and/or localised and the once-off survey may fail to locate such species.
- Furthermore, rare plant species usually occur in specialised and localised habitats and positive identifications of rare plant species are best done when the plants are in flower.
- No trapping (either camera trapping or by way of Sherman traps) was conducted for fauna, since these methods generally provide an underrepresentation of the full faunal diversity within the limited timeframe available.

# 1. INTRODUCTION

ABO Wind Renewable Energies (Pty) Ltd proposes to develop three Wind Energy Facilities (WEFs) and their associated infrastructure near Beaufort West in the Western Cape Province, on behalf of three separate project Applicants, namely:

- Kwagga 1 = Kwagga Wind Energy Facility 1 (Pty) Ltd (Reg. no. 2020/258426/07)
- Kwagga WEF 2 = Kwagga Wind Energy Facility 2 (Pty) Ltd (Reg. no. 2020/429949/07)
- Kwagga 3 = Kwagga Wind Energy Facility 3 (Pty) Ltd (Reg. no. 2020/429978/07)

The WEFs will have a total installed capacity of: 279 MW (Kwagga 1); 341 MW (Kwagga WEF 2); and 204.6 MW (Kwagga 3), respectively. Each WEF will consist of turbines with have a hub height of up to 180 m and a rotor diameter of up to 200 m and an output of approximately 6.2 MW. Each turbine will have a footprint of approximately 1 ha (which includes the crane pad). The temporary hardstand areas and construction period laydown areas will cover approximately 15 ha and six (6) ha, respectively. The Kwagga WEF 2 will comprise 55 turbines (42 turbines in the main/priority area and 13 turbines in the secondary area).

Scoping and Environmental Impact Assessment processes are required for the proposed development of Kwagga Wind Energy Facility 2 (WEF). As required in Part A of the Government Gazette 43110, GN 320, a site sensitivity verification must be undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area.

The current report presents the specialist assessment of the terrestrial biodiversity and ecology component of the Site Sensitivity Verification for the proposed Kwagga WEF 2 project.

## 2. APPROACH AND METHODOLOGY

### 2.1 Approach

The study commenced as a desktop study, followed by field-based surveys at the end of October and beginning of November 2020. The focus of the site visit was to undertake a site sensitivity verification in order to confirm the current land use and environmental sensitivity as identified in the screening tool. Surveys (fauna and flora) of the Kwagga WEF 2 project were conducted to identify sensitive habitats, for the classification of the vegetation into habitats (or plant communities), compiling of species lists and to search for Species of Conservation Concern (SCC).

Hard copy and digital information from spatial databases, such as BGIS of the South African Biodiversity Institute (SANBI) for maps of Critical Biodiversity Areas, Protected Areas, Protected Area Expansion Strategy, Freshwater Ecosystem Priority Areas; the geological survey maps (3222 Beaufort West); land type maps (3222 Beaufort West); topocadastral maps (1:50 000 maps); vegetation types of Mucina & Rutherford (2006, 2018); NewPosa database of SANBI; and databases of the Animal Demography Unit, University of Cape Town, were sourced to provide information on the environment and biodiversity of the study area.

Satellite images (Google Earth) were used to stratify the area into relatively homogeneous terrain/vegetation units. The vegetation survey consisted of visiting the mapped units and systematically recording plant species on site, and estimating their cover. The data of all vegetation surveys on Kwagga WEFs 1, 2 & 3 were combined to improve the identification of habitat types in the area. Overall, eight broad habitat types were distinguished within the combined

area. A total of 37 sites were surveyed on Kwagga WEF 2. Physical habitat features were also noted. During the site visit, digital photographs were taken, and representative photographs of the different habitats are included in the report. The site was also surveyed for rare, threatened and/or endemic plant species during the site visit.

The animal survey was limited to day-time visual assessments on site. Animal species present on site were mainly attained by means of direct or indirect sighting methods (animals, spoor, burrows, scats, sounds), whilst traversing the site by vehicle or on foot. Red listed species are generally uncommon and/or localised and the survey may have been insufficient to record their presence at or near the proposed development.

## 2.2 Vegetation and flora

Plant species data were summarised in a phytosociological table and habitats (plant communities) were identified, described and mapped. The checklist of plant species in Appendix B was compiled from own surveys and the NewPosa database of SANBI ([newposa.sanbi.org](http://newposa.sanbi.org)). The IUCN status, conservation and protected status of all plant species provided in Appendix B were determined from available literature and Acts, e.g. NewPosa database ([newposa.sanbi.org](http://newposa.sanbi.org)), and Red list database ([redlist.sanbi.org](http://redlist.sanbi.org)) of the South African National Biodiversity Institute; NEM:BA (2007c) (ToPS list); WCNECO (1974, as amended 2000) and CITES (2019).

## 2.3 Fauna

Species lists (the term species is used here in a general sense to denote species, subspecies and varieties) of the faunal component were sourced from the Animal Demography Unit, University of Cape Town website ([adu.uct.ac.za](http://adu.uct.ac.za)) and consulting of available databases and/or relevant literature, e.g. Skinner and Chimimba (2005), Alexander and Marais (2007), Bates *et al.* (2014), Child *et al.* (2016), Leeming (2003) and Mecenero *et al.* (2013) to determine the diversity, conservation status and distribution of relevant faunal species.

## 2.4 Sensitivity assessment

Based on the environmental features and the species encountered in the on-site survey, a sensitivity assessment of each habitat was done (Chapter 5). Sensitive features are presented spatially in GIS format (provided as a separate .kmz file).

## 2.5 Sources of information

### **Vegetation:**

- Vegetation types occurring in the area were obtained from Mucina & Rutherford (2006, 2018);
- Conservation status of the vegetation types was obtained from Mucina & Rutherford (2006), the National List of Threatened Ecosystems (NEMA 2011) and SANBI (2018a);
- A list of endemic species per national vegetation type was obtained from Mucina & Rutherford (2006);
- The Kwagga WEF 2 site does not occur in any Centre of Endemism (Van Wyk & Smith 2001).
- A plant species checklist of the immediate region around the site was obtained from the NewPosa database of the South African National Biodiversity Institute (SANBI) (Appendix A) (website accessed November 2020).
- The IUCN Red List Category for the plant species was extracted from the Threatened Species Programme (Red List of South African plants; website accessed November 2020) as well as the NewPosa database of



the South African National Biodiversity Institute (SANBI) (website accessed November 2020).

- WCNECO (1974 as amended in 2000) was consulted to establish provincially specially protected and protected status of plant species.
- The National Protected tree list (NFA 2019) was consulted.

#### **Fauna**

- Lists of mammals, reptiles, birds, frogs, scorpions, (Scorpiones), spiders (Arachnida), butterflies (Lepidoptera), lacewings (Neuroptera), dung beetles (Scarabinae) and dragonflies (Odonata) were extracted from the Animal Demography Unit, University of Cape Town website (<http://vmus.adu.org.za>; accessed November 2020) and supplemented by information gathered in Bates *et al.* (2014) for reptiles; Skinner and Chimimba (2005) for mammals; and Mecenero *et al.* (2013) for butterflies (Appendix B).
- The IUCN Red List Category for the animal species was extracted from Animal Demography Unit, University of Cape Town website; Child *et al.* (2016), Bates *et al.* (2014) for reptiles; Skinner and Chimimba (2005) for mammals; and Mecenero *et al.* (2013) for butterflies. No IUCN Categories are however available for lacewings, dung beetles, spiders and scorpions.
- WCNECO (1974) was consulted to establish provincially specially protected and protected status of animal species.

#### **Other**

- The National Protected Areas Expansion Strategy (NPAES) was consulted for possible inclusion of the site into a protected area in future ([biodiversityadvisor.sanbi.org](http://biodiversityadvisor.sanbi.org); accessed November 2020).
- The Western Cape Biodiversity Area Maps were consulted for inclusion of the site into a Critical Biodiversity Area or Ecological Support Area ([biodiversityadvisor.sanbi.org](http://biodiversityadvisor.sanbi.org); accessed November 2020).

#### **Regulatory framework**

- Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA 1998, when applying for Environmental Authorisation were published in the Government Gazette 43110, No 320, 20 March 2020.
- 

## 3. STUDY AREA

### 3.1 Location

The Kwagga WEF 2 site is situated in the Western Cape province about 80 km south of Beaufort West on the N12 road to Oudsthoorn. The site covers approximately 9283 ha and the GPS coordinate of the dwelling at Wolvekraal 17 is 32° 59' 23.6" S; 22° 43' 02.7" E. The altitude of the site ranges from 950 m in the south to 1093 m at Dwaalberg in the north (Figure 1). The site is drained from north to south by a number of ephemeral watercourses.

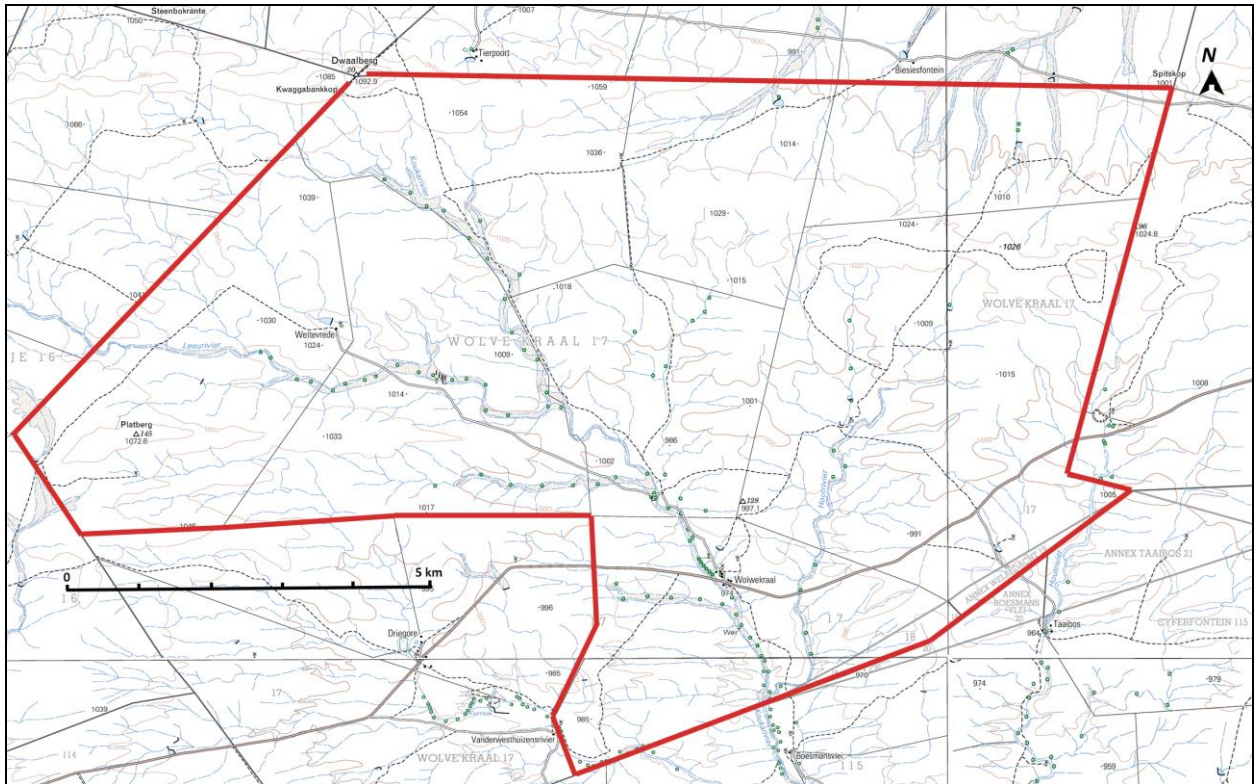


Figure 1: Topocadastral map of the Kwagga WEF 2 site.



Figure 2: Google satellite image of the Kwagga WEF 2 site.

## 3.2 Geology

The geology of the Kwagga WEF 2 site is depicted in the geological maps of 3222 Beaufort West and Oudtshoorn 3322 (Figure 3). The dominant geology consists of mudstone (red in places) with sandstone and thin greenish cherty beds (Pa) of the Abrahamskraal Formation, Beaufort Group. Alluvium occurs along the drainage lines.

## 3.3 Land Types

The land types of the Kwagga WEF 2 site are depicted in the land type maps of 3222 Beaufort West and Oudtshoorn 3322 (Figure 4). Land types denote areas that display a marked degree of uniformity with respect to terrain form, soil pattern and climate. A terrain unit within a land type is any part of the land surface with homogeneous form and slope. The Kwagga WEF 2 site falls in the Fc163b unit. The Fc Land Type consists of Glenrosa and/or Mispah soil forms where lime is generally present in the entire landscape.

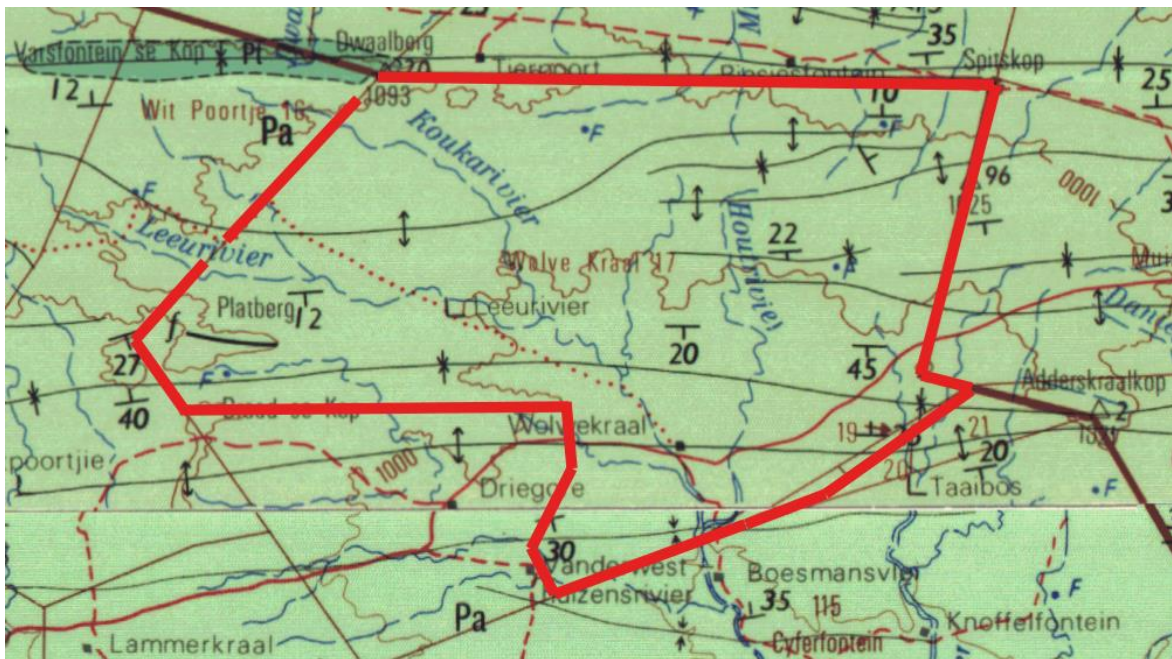


Figure 3: Geology of the Kwagga WEF 2 site (Geological Survey 1979).

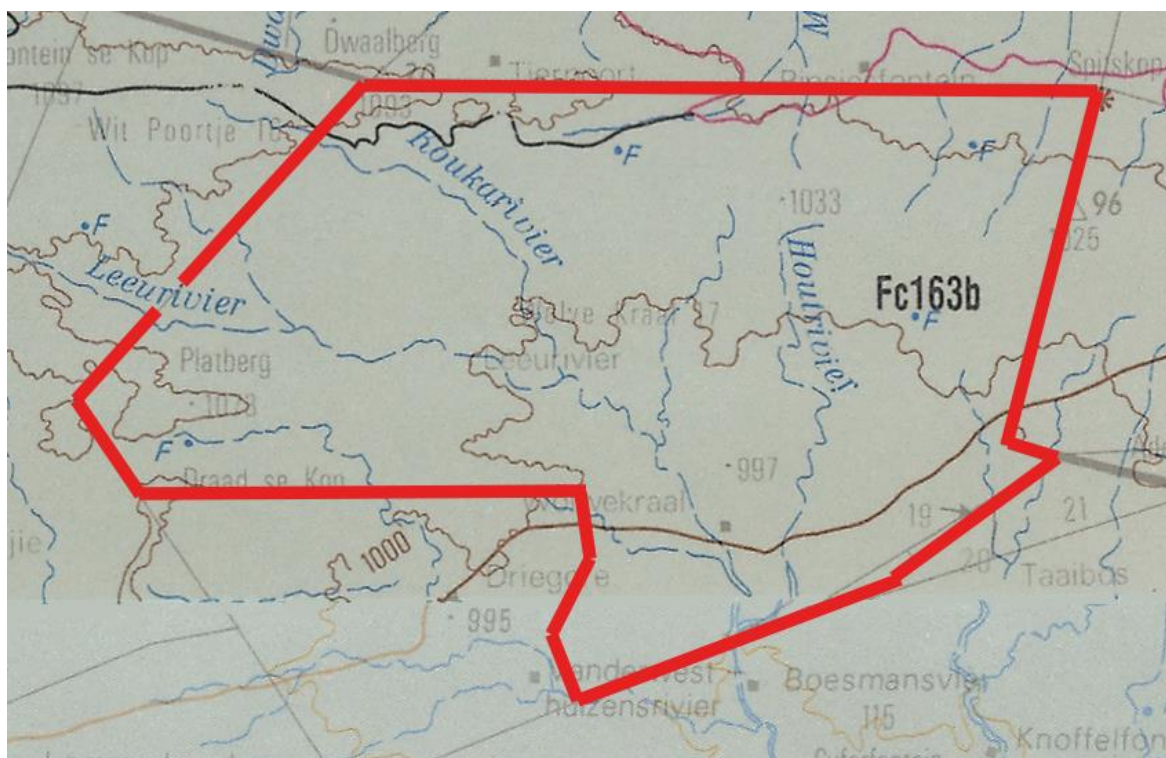


Figure 4: Land type of the Kwagga WEF 2 site (Land Type survey 1987).

### 3.4 National Environmental Management: Protected Areas Act (Act No. 10 of 2003) and National Protected Areas Expansion Strategy (NPAES)

The study site is not located in a protected area and does not form part of the NPAES (NPAES 2010).

### 3.5 Critical Biodiversity Areas (CBAs)

Critical Biodiversity Areas (CBAs) are areas required to meet biodiversity targets for ecosystems, species or ecological processes. CBAs are regarded as areas of high biodiversity and ecological value and need to be kept in a natural or near-natural state, with no further loss of habitat or species. The definitions for CBAs are (SANBI 2018b):

- CBA 1: Areas that are irreplaceable for meeting biodiversity targets. There are no other options for conserving the ecosystems, species or ecological processes in these areas”
- CBA 2: Areas that are the best option for meeting biodiversity targets, in the smallest area, while avoiding conflict with other land uses.

The CBA map in Figure 5, indicates the presence of a CBA along the main watercourses on Wolvekraal. The main reasons provided for the mapping of the CBAs (Figure 5) were: (1) very high terrestrial sensitivity indicated in the shale gas SEA (without an indication of what caused the high sensitivity); (2) very high dry river sensitivity indicated in the shale gas SEA; (3) water resource protection (FEPAs); foothill rivers; and presence of the Cape mountain zebra.

Development within Critical Biodiversity Areas is not encouraged. According to the Western Cape Biodiversity Spatial Plan Handbook (Pool-Stanvliet *et al.* 2017) permissible land uses are those that are compatible with maintaining the natural vegetation cover of CBAs in a healthy ecological state, and that do not result in loss or degradation of natural habitat. Undesirable land uses in terrestrial CBAs are those that cause loss of natural habitat or ecosystem functionality, such as: (i) mining or prospecting; (ii) intensive agriculture (cultivation) or plantation forestry; (iii) residential, commercial or industrial developments; (iv) game-proof fences in CBA corridors; (v) linear infrastructure that disrupts the connectivity of CBA corridors; and (vi) extensive or intensive grazing that results in species diversity being lost through selective or over-grazing (Pool-Stanvliet *et al.* 2017).

An Ecological Support Areas (ESA) is not essential for meeting biodiversity targets, but plays an important role in supporting the ecological functioning in a CBA. ESAs need to be maintained in at least a functional and often natural state, but some limited habitat loss may be acceptable. It is important that the project should not compromise the functional (natural) state of the ESAs as required by the conservation plan of the Western Cape (Pool-Stanvliet *et al.* 2017). The ESAs in Figure 5 follow the smaller watercourses.

Other Natural Areas (ONAs) have not been identified as a priority, but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Land use guidelines for terrestrial Other Natural Areas (ONAs) are not required to meet biodiversity targets. ONAs represent the largest area in the region and form a matrix within which the CBAs and ESAs occur (Figure 5).

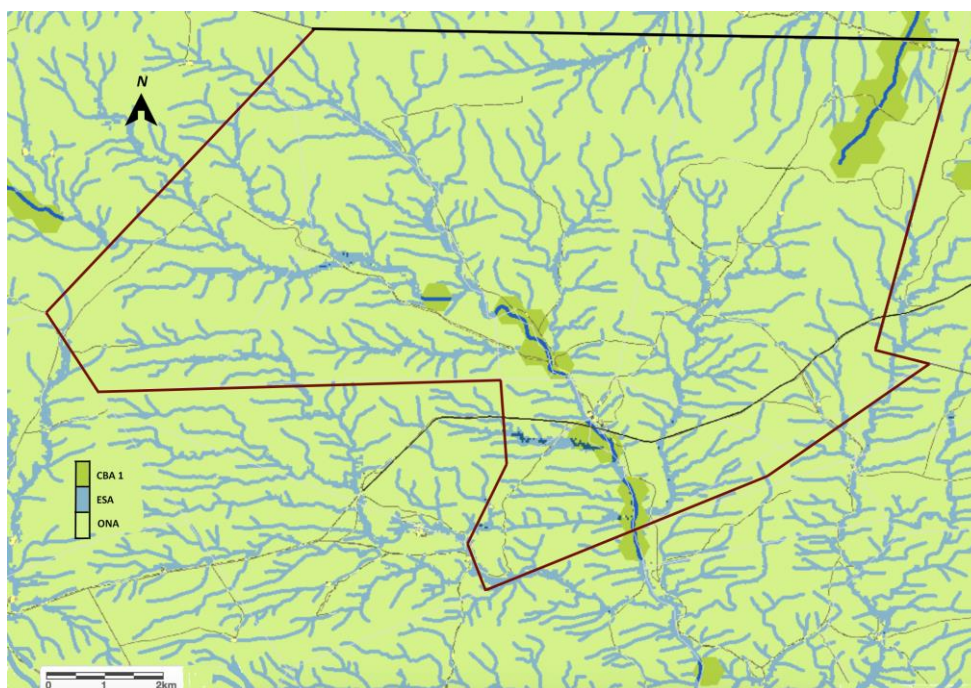


Figure 5: Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and Other Natural Areas (ONAs) of the Kwagga WEF 2 site and environs (biodiversityadvisor.sanbi.org).

### 3.6 Freshwater Ecosystem Priority Areas (FEPAs)

Freshwater Ecosystem Priority Areas (FEPA) are priority areas for conserving freshwater ecosystems and supporting sustainable use of water resources and upstream management areas (Driver *et al.* 2011) (Figure 6). The northeastern section of the Kwagga WEF 2 site is classified as a Freshwater Ecosystem Priority Area (FEPA).

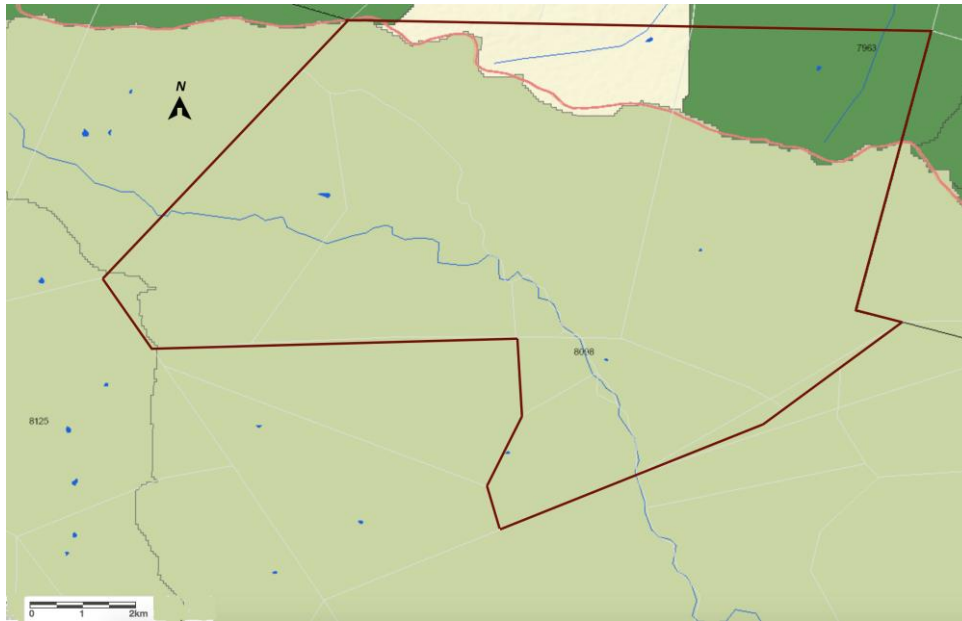


Figure 6: Freshwater priority areas (FEPA) in the Kwagga WEF 2 site. Dark green indicates river and associated sub-quaternary catchment (or quinary catchment) and light green the upstream catchment.

## 4. VEGETATION

### 4.1 Introduction

The site falls in the Nama-Karoo Biome and more specifically in the Lower Karoo Bioregion (NKI) between Beaufort West and Klaarstroom. The site does not fall within any Centre of Endemism according to Van Wyk and Smith (2001).

### 4.2 Broad-scale vegetation types

The site is located in the Gamka Karoo (NKI 1) vegetation type (Mucina & Rutherford 2006). The vegetation type covers 20 325 km<sup>2</sup> in South Africa and occurs between the Great Escarpment (Nuweveld Mountains) in the north and Cape Fold Belt Mountains (Swartberg Mountains) in the south. It occurs on irregular to slightly undulating plains covered with dwarf spiny shrubland, dominated by Karoo dwarf shrubs. Mudrock and sandstones of the Beaufort Group with some Ecca Group shales cover the area. The dominant shrub and dwarf shrub species are *Lycium* spp., *Rhigozum obovatum*, *Vachellia karroo*, *Searsia burchellii*, *Chrysocoma ciliata*, *Eriocephalus* spp., *Felicia*

*muricata* and *Pentzia incana*. The most prominent grass species include *Aristida congesta*, *Aristida diffusa*, *Fingerhuthia africana*, *Stipagrostis ciliata*, *Stipagrostis obtusa* and *Eragrostis* spp.

The vegetation type is classified as "least threatened" with about 2% statutorily conserved in the Karoo National Park and some private nature reserves (Mucina & Rutherford 2006, NEMA 2011, SANBI 2018a). Only a small part has undergone transformation. Endemic plant species include *Chasmatophyllum stanleyi*, *Hereroa incurva*, *Hoodia dregei*, *Ruschia beaufortensis*, *Jamesbrittenia tenuifolia*, *Manulea karrooica* and *Piранthus comptus*.

### 4.3 Description of habitats (plant communities)

The data of all vegetation surveys on Kwagga 1, 2 and 3 WEFs were combined to improve the identification of habitat types in the area. Overall, eight habitat types were distinguished. The vegetation on site is structurally fairly homogeneous with dwarf shrubs (Karoo bushes) being dominant. Based on species composition, eight habitats (plant communities) were distinguished, described and mapped on Kwagga WEF 2 (Figure 7).

#### Habitat 1. *Rhigozum obovatum* – *Trichodiadema decorum* dwarf shrubveld

This shrubveld covers small areas of Kwagga WEF 2 and occurs on crests and scarps of hills, ridges and mountains of Kwagga WEF 2 (Figures 7, 8 & 9). Surface rocks cover from 10% to >75% of the area, with a mean of 52%. Gravel covers from 10–30% of the soil surface with a mean of 16%. The shallow, well-drained yellow-brown, red-brown to brown, sandy loam soils are derived from mudrock.

The diagnostic species of this habitat (community) include *Bulbine triebneri*, *Trichodiadema decorum*, *Melica decumbens*, *Felicia muricata*, *Helichrysum zeyheri*, *Pelargonium laxum* and *Adromischus triflorus* (species group 1, Appendix A).

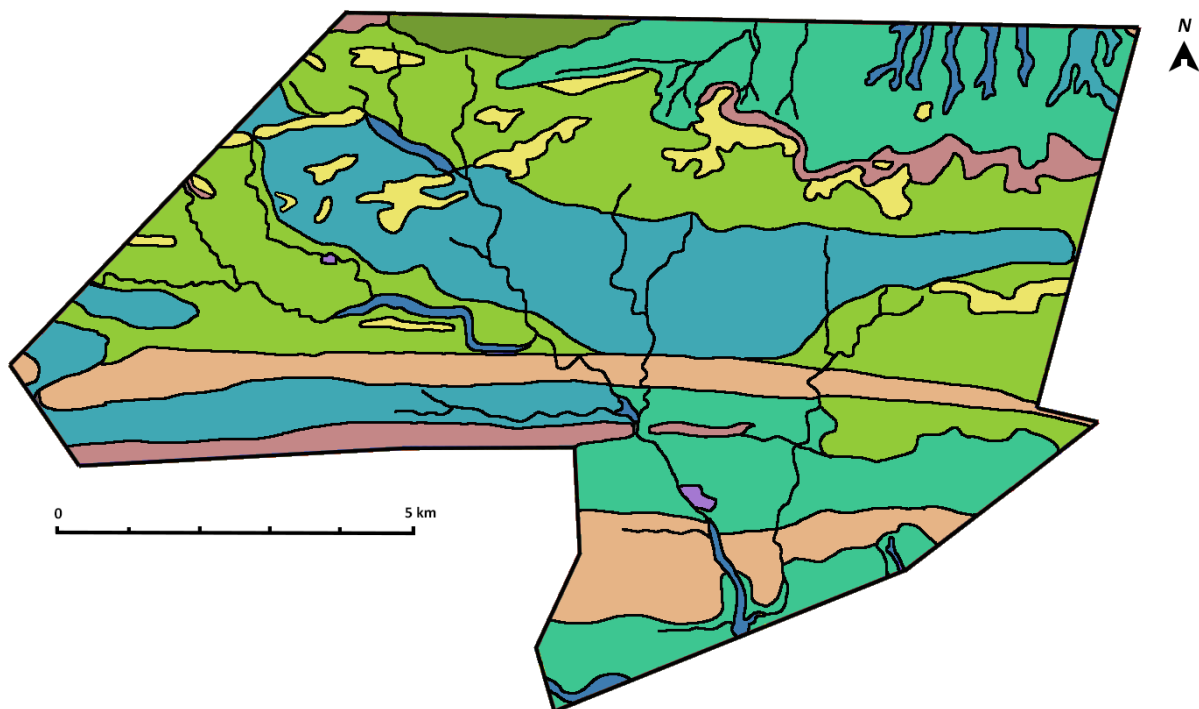


Figure 7: Vegetation map of the Kwagga WEF 2 site.

Legend to Figure 7:

- |          |  |  |
|----------|--|--|
| <b>1</b> |  | <i>Rhigozum obovatum</i> - <i>Trichodiadema decorum</i> dwarf shrubveld    |
| <b>2</b> |  | <i>Rhigozum obovatum</i> - <i>Sericocoma avolans</i> dwarf shrubveld       |
| <b>3</b> |  | <i>Ruschia cradockensis</i> - <i>Crassula deltoidea</i> dwarf shrubveld    |
| <b>4</b> |  | <i>Lycium cinereum</i> - <i>Anacampseros ustulata</i> dwarf shrubveld      |
| <b>5</b> |  | <i>Ruschia spinosa</i> - <i>Monsonia camdeboensis</i> dwarf shrubveld      |
| <b>6</b> |  | <i>Rhigozum obovatum</i> - <i>Pteronia viscosa</i> dwarf shrubveld         |
| <b>7</b> |  | <i>Pentzia incana</i> - <i>Stipagrostis obtusa</i> dwarf shrubveld         |
| <b>8</b> |  | <i>Vachellia karroo</i> - <i>Lycium oxycarpum</i> bushveld of watercourses |
|          |  | Infrastructure   |



Figure 8: The *Rhigozum obovatum* – *Trichodiadema decorum* dwarf shrubveld on crests and scarps of hills.





Figure 9: The *Rhigozum obovatum* – *Trichodiadema decorum* dwarf shrubveld on crests and scarps of mountains.

- Small trees (>3–6 m) have a mean canopy cover of less than 1% and are represented by *Searsia pallens* and *Diospyros lycioides*.
- Shrubs cover on average 3% of the area and are characterised by *Rhigozum obovatum*, *Grewia robusta* and *Gymnosporia szyszylowiczii*.
- Dwarf shrubs cover 11% of the habitat and include *Lycium cinereum*, *Pentzia incana*, *Hermannia linearifolia*, *Nenax microphylla*, *Gorteria alienata*, *Gnidia deserticola*, *Pentzia quinquefida*, *Lacomucinaea lineata*, *Pteronia glauca*, *Pteronia adenocarpa*, *Anacampseros albidiflora* and *Ruschia spinosa*.
- The grass layer is poorly developed and covers on average 5% of the area. The dominant grass species include *Aristida adscensionis*, *Aristida congesta*, *Aristida diffusa*, *Digitaria argyrograpta* and *Tragus koelerioides*.
- Succulent species that are prominent in this habitat include *Euphorbia stellispina*, *Adromischus triflorus*, *Trichodiadema pomeridianum* and *Drosanthemum* spp.
- Herbaceous species have a mean canopy cover of less than 2%. The most common species include *Dianthus micropetalus*, *Manulea* sp., *Gazania heterochaeta*, *Cuspidia cernua* and *Curio radicans*.

Rare and/or protected species in habitat 1:

SA Red data list: None

NEM:BA (ToPS): None

NFA: None

WCNCA: 18 species of the Aizoaceae including *Conophytum truncatum*; *Anacampseros albidiflora*, *A. telephiastrum*, *A. ustulata*, *Hoodia pilifera*

CITES: *Euphorbia stellispina*, *E. mauritanica*, *E. suffulta*, *Anacampseros albidiflora*, *A. telephiastrum*, *A. ustulata*, *Hoodia pilifera*

Endemic species: None

## Habitat 2. *Rhigozum obovatum* – *Sericocoma avolans* dwarf shrubveld

This shrubveld occurs on crests of hills and ridges in the southern parts of the Kwagga WEF 2 (Figures 7 & 10). Surface rocks cover from 10% to >75% of the area, with a mean of 52%. Gravel covers from 10–30% of the soil surface with a mean of 25%. The shallow, well-drained orange-brown, yellow-brown to red-brown, sandy loam soils are derived from mudrock.



Figure 10: The *Rhigozum obovatum* – *Sericocoma avolans* dwarf shrubveld on ridges and rocky outcrops.

There are no diagnostic species in this habitat, but the following species are common to habitats 1 & 2 (species group 2, Appendix A): *Eriocephalus brevifolius*, *Sericocoma avolans*, *Helichrysum pumilio*, *Hermannia linearifolia*, *Dianthus micropetalus*, *Osteospermum scariosum* and *Anacampseros albidiflora*.

- Small trees (>3–6 m) have a mean canopy cover of less than 1% and the most prominent species are *Diospyros lycioides* and *Searsia pallens*.
- Shrubs cover on average 1% of the area and are characterised by *Rhigozum obovatum*, *Grewia robusta*, *Searsia burchellii* and *Gymnosporia szyszlowiczii*.
- Dwarf shrubs cover 13% of the habitat and include *Ruschia spinosa* (d), *Eriocephalus ericoides* (d), *Chrysocoma ciliata* (d), *Lycium cinereum*, *Asparagus aethiopicus*, *Pteronia empetrifolia*, *Pteronia adenocarpa*, *Eriocephalus brevifolius*, *Helichrysum pumilio*, *Hermannia linearifolia*, *Monsonia camdeboensis*, *Amphiglossa* sp., *Lacomucinaea lineata*, *Pteronia glauca* and *Nenax microphylla*.
- Prominent succulent species in this habitat include *Euphorbia stellispina*, *Euphorbia suffulta*, *Antimima* sp., *Mesembryanthemum (Phyllobolus)* sp., *Mesembryanthemum (Psilocaulon)* sp., *Trichodiadema pomeridianum*, *Anacampseros albidiflora* and *Drosanthemum lique*.
- The grass layer is poorly developed and covers on average 4% of the area. The dominant grass species include *Aristida adscensionis*, *Aristida diffusa*, *Enneapogon desvauxii*, *Oropetium capense* and *Tragus koelerioides*.
- Herbaceous species have a mean canopy cover of less than 2%. The most common species include *Galenia sarcophylla*, *Sericocoma avolans*, *Dianthus micropetalus*, *Gazania heterochaeta* and *Curio radicans*.

Rare and/or protected species in habitat 2:

SA Red data list: None

NEM:BA (ToPS): None

NFA: None

WCNCA: 20 species of the Aizoaceae including *Conophytum truncatum*; *Pachypodium succulentum*, *Haworthiopsis nigra*, *Fockea comaru*, *Hoodia pilifera*, *Anacampseros albidiflora*, *A. telephiastrum*, *A. ustulata*, *Moraea* sp.

CITES: *Euphorbia stellispina*, *E. mauritanica*, *E. suffulta*, *Anacampseros albidiflora*, *A. telephiastrum*, *A. ustulata*, *Hoodia pilifera*, *Pachypodium succulentum*

Endemic species: None

### Habitat 3. *Ruschia cradockensis* – *Crassula deltoidea* dwarf shrubveld

This dwarf shrubveld occurs on the rocky plains and low hills in the northern parts of the Kwagga WEF 2 (Figures 7 & 11). Surface rocks cover from <10% to >75% of the site, with a mean of 37%. Quartzitic gravel covers from <10 to >50% of the soil surface with a mean of 23%. The shallow, well-drained orange-brown to yellow-brown, sandy loam soils are derived from mudrock.

The diagnostic species of this community include *Crassula deltoidea*, *Hereroa* sp. 1, *Anacampseros papyracea* and a *Justicia* sp. (species group 3, Appendix A).

- Small trees (>3–6 m) have a mean canopy cover of less than 1% and are characterised by *Diospyros lycioides*.

- Shrubs cover on average 1% of the area and are represented by *Rhigozum obovatum* and *Grewia robusta*.
- Dwarf shrubs cover 13% of the habitat and include *Ruschia cradockensis* (d), *Eriocephalus ericoides* (d), *Ruschia spinosa* (d), *Lycium cinereum*, *Nenax microphylla*, *Pteronia empetrifolia*, *Felicia filifolia*, *Monsonia camdeboensis*, *Salsola* spp., *Lacomucinaea lineata*, *Asparagus aethiopicus*, *Gnidia deserticola*, *Pteronia glauca* and *Chrysocoma ciliata*,
- Prominent succulent species include *Anacampseros papyracea*, *Anacampseros ustulata*, *Euphorbia stellispina*, *Crassula deltoidea*, *Trichodiadema pomeridianum*, *Drosanthemum lique* and *Mesembryanthemum (Psilocalon)* sp.
- The grass layer is poorly developed and covers on average 6% of the area. The dominant grass species include *Aristida adscensionis*, *Aristida congesta*, *Aristida diffusa*, *Tragus koelerioides*, *Oropetium capense* and *Enneapogon desvauxii*.
- Herbaceous species cover less than 2%. The most common species include *Gazania heterochaeta* and *Curio radicans*.



Figure 11: The *Ruschia cradockensis* – *Crassula deltoidea* dwarf shrubveld on quartzitic rocky plains.

Rare and/or protected species in habitat (community) 3:

SA Red data list: None

NEM:BA (ToPS): None

NFA: None

WCNCA: 18 species of the Aizoaceae including *Conophytum truncatum*, *Anacampseros albidiflora*, *A. ustulata*, *A. papyracea*

CITES: *Euphorbia stellispina*, *E. suffulta*, *Anacampseros albidiflora*, *A. ustulata*, *A. papyracea*

Endemic species: None

**Habitat 4: *Lycium cinereum* – *Anacampseros ustulata* dwarf shrubveld**

This shrubveld occurs on the rocky plains in the central and northern parts of Kwagga WEF 2 (Figures 7 & 12). Surface rocks cover from <10% to >50% of the site, with a mean of 22%. Gravel covers from <10-% to 50% of the soil surface with a mean of 18%. The shallow, well-drained orange-brown, yellow-brown to red-brown, sandy loam soils are derived from mudrock.



Figure 12: The *Lycium cinereum* – *Anacampseros ustulata* dwarf shrubveld on rocky plains in the central and northern parts of Kwagga WEF 2.

The absence of species of species groups 1 – 4 characterise this habitat. There are no diagnostic species in this habitat, but the following species are shared with communities 1, 2 & 3 (species group 5, Appendix A): *Nenax microphylla*, *Gorteria alienata*, *Gnidia deserticola* and *Anacampseros ustulata*.

- Small trees (>3–6 m) have a mean canopy cover less than 1% and are characterised by *Searsia pallens* and *Diospyros lycioides*.
- Shrubs cover on average 1% of the area and are represented by *Rhigozum obovatum* (d), *Grewia robusta* and *Searsia burchellii*.
- Dwarf shrubs cover 12% of the habitat and include *Lycium cinereum* (d), *Eriocephalus ericoides* (d), *Ruschia spinosa*, *Chrysocoma ciliata*, *Pentzia incana*, *Asparagus aethiopicus*, *Asparagus mucronatus*, *Lacomucinaea lineata*, *Hermannia grandiflora*, *Nenax microphylla*, *Gorteria alienata*, *Gnidia deserticola* and *Pteronia glauca*.
- Prominent succulent species include *Euphorbia stellispina*, *Anacampseros ustulata*, *Drosanthemum lique*, *Mesembryanthemum noctiflorum*, *Mesembryanthemum (Psilocaulon) sp.*, *Trichodiadema pomeridianum* and *Crassula capitella*.
- The grass layer is poorly developed and covers on average 6% of the area. The dominant grass species include *Aristida adscensionis*, *Aristida congesta* and *Aristida diffusa*.
- Herbaceous species have a mean canopy cover of less than 1%. The most common species include *Gazania heterochaeta* and *Cuspidea cernua*.

Rare and/or protected species in habitat (community) 4 include:

SA Red data list: None

NEM:BA (ToPS): None

NFA: None

WCNCA: 14 Species of the Aizoaceae, *Anacampseros albidiflora*, *A. ustulata*

CITES: *Euphorbia decepta*, *E. stellispina*, *E. mauritanica*, *E. suffulta*, *Anacampseros albidiflora*, *A. ustulata*

Endemic species: None

**Habitat 5. *Ruschia spinosa* – *Monsonia camdeboensis* dwarf shrubveld**

This shrubveld covers the rocky plains or plateau in the north of Kwagga WEF 2 (Figures 7 & 13). Surface rocks cover from <10% to 30% of the site, with a mean of 14%. Reddish gravel cover ranges from <10 to >50% of the soil surface with a mean of 16%. The shallow, well-drained pink-brown, yellow-brown to red-brown, sandy loam soils are derived from mudrock.

The absence of species of species groups 1–5 characterise this habitat. There are no diagnostic species, but the following species are common to habitats 1–4 (species group 6, Appendix A): *Pteronia glauca*, *Tetragonia* spp., *Galenia fruticosa*, *Euphorbia suffulta*, *Pteronia paniculata*, *Antimima* sp. and *Felicia filifolia*.



Figure 13: The *Ruschia spinosa* – *Monsonia camdeboensis* dwarf shrubveld on rocky plains with reddish rocks and gravel in places.

- Small trees (>3–6 m) have a mean canopy cover less than 1% and are represented by *Diospyros lycioides*.
- Shrubs cover on average 1% of the area and are characterised by *Rhigozum obovatum*, *Searsia burchellii*, *Gymnosporia szyszlowiczii* and *Grewia robusta*.
- Dwarf shrubs cover 14% of the habitat and include *Ruschia spinosa* (d), *Lycium cinereum*, *Ruschia cradockensis*, *Eriocephalus ericoides*, *Chrysocoma ciliata*, *Pteronia glauca*, *Monsonia camdeboensis*, *Asparagus aethiopicus*, *Lacomucinaea lineata*, *Galenia fruticosa*, *Pteronia paniculata*, *Pteronia adenocarpa*, *Pentzia incana*, *Hermannia grandiflora*, *Osteospermum sinuatum* and *Felicia filifolia*.
- Succulent species that are prominent in this habitat include *Euphorbia stellispina*, *Mesembryanthemum (Psilocalon) sp.*, *Mesembryanthemum guerichianum*, *Drosanthemum lique*, *Euphorbia suffulta*, *Antimima sp.*, *Kleinia longiflora* and *Trichodiadema pomeridianum*.
- The grass layer is poorly developed and covers on average 7% of the area. The dominant grass species include *Aristida adscensionis*, *Aristida congesta*, *Aristida diffusa*, *Enneapogon desvauxii* and *Oropetium capense*.
- Herbaceous species have a mean canopy cover of less than 1%. The most common species include *Curio radicans* and *Galenia sarcophylla*.

Rare and/or protected species in habitat 5:

SA Red data list: None

NEM:BA (ToPS): None

NFA: None

WCNCA: 14 species of the Aizoaceae, *Anacampseros albidiflora*, *Hoodia pilifera*, *Moraea* sp.

CITES: *Euphorbia stellispina*, *E. decepta*, *E. mauritanica*, *E. suffulta*, *Gonialoe variegata*, *Anacampseros albidiflora*, *Hoodia pilifera*

Endemic species: None

**Habitat 6. *Rhigozum obovatum* – *Pteronia viscosa* dwarf shrubveld**

This shrubveld occurs on shallow to deep soils on the plains in the north-east and south of Kwagga WEF 2 (Figures 7 & 14). Surface rock and gravel generally cover <10% of the soil surface. The grey-brown, orange-brown to red-brown, sandy loam soils are derived from mudrock.



Figure 14: The *Rhigozum obovatum* – *Pteronia viscosa* dwarf shrubveld on the sandy loam plains.

The absence of species of species groups 1–6 characterise this habitat. There are no diagnostic species, but the following species are common to habitats 1–6 (species groups 7 & 9 Appendix A): *Searsia pallens*, *Rhigozum obovatum*, *Pteronia viscosa* and *Pteronia adenocarpa*.

- Small trees (>3–6 m) have a mean canopy cover of 1% and are characterised by *Vachellia karroo* and *Diospyros lycioides*.
- Shrubs cover on average 4% of the area and are represented by *Rhigozum obovatum* (d), *Searsia burchellii*, *Gymnosporia szyszyłowiczii*, *Grewia robusta*, *Lycium oxycarpum* and *Cadaba aphylla*.
- Dwarf shrubs cover 13% of the habitat and include *Ruschia spinosa* (d), *Lycium cinereum* (d), *Eriocephalus ericoides* (d), *Tetraena chrysopterum*, *Pentzia incana*, *Asparagus aethiopicus*, *Lacomucinaea lineata*, *Chrysocoma ciliata* and *Pteronia adenocarpa*.
- Prominent succulent species include *Euphorbia stellispina*, *Trichodiadema pomeridianum*, *Drosanthemum lique* and *Drosanthemum hispidum*.
- The grass layer is poorly developed and covers on average 9% of the area. The dominant grass species include *Aristida adscensionis*, *Aristida congesta*, *Aristida diffusa*, *Enneapogon desvauxii*, *Stipagrostis obtusa*, *Tragus berteronianus* and *Oropetium capense*.

- Herbaceous species have a mean canopy cover of less than 1%. The most common species include *Sesamum capense*, *Kewia salsoloides* and *Galenia sarcophylla*.

Rare and/or protected species in habitat 6:

SA Red data list: None

NEM:BA (ToPS): None

NFA: None

WCNCA: 13 species of the Aizoaceae, *Anacampseros albidiflora*, *Hoodia pilifera*

CITES: *Euphorbia stellispina*, *E. mauritanica*, *E. suffulta*, *Anacampseros albidiflora*, *Hoodia pilifera*

Endemic species: None

#### **Habitat 7. *Pentzia incana* – *Stipagrostis obtusa* dwarf shrubveld**

This dwarf shrubveld occurs on the sandy plains in the central parts and the broad valley in the south-western part of Kwagga WEF 2 (Figures 7 & 15). Surface rocks and gravel are mostly absent with a mean surface cover of less than 2% for rocks and gravel respectively. The intermediate to deep grey-brown, orange-brown to red-brown, sandy to sandy loam soils are derived from mudrock.



Figure 15: The *Pentzia incana* – *Stipagrostis obtusa* dwarf shrubveld on plains with deep sandy to sandy loam soils.

The absence of species of species groups 1–7 characterise this habitat. There are no diagnostic species in this habitat, although species groups 8 & 11 are shared with habitat 7. The following species are shared with habitats 1–6 (species group 8, Appendix A): *Eriocephalus ericoides*, *Drosanthemum lique*, *Ruschia cradockensis*, *Pteronia sordida* and the grasses *Aristida congesta*, *Eragrostis obtusa* and *Enneapogon desvauxii*.

- Small trees (>3–6 m) have a mean canopy cover less than 1% and are characterised by *Diospyros lycioides*.
- Shrubs cover on average 1% of the area and are represented by *Lycium oxycarpum*, *Cadaba aphylla*, *Searsia burchellii* and *Gymnosporia szyszyłowiczii*.
- Dwarf shrubs cover 12% of the habitat and include *Pentzia incana* (d), *Lycium cinereum* (d), *Eriocephalus ericoides*, *Ruschia* spp., *Tetraena chrysopteron*, *Osteospermum sinuatum* and *Asparagus aethiopicus*.
- Prominent succulent species include *Mesembryanthemum guerichianum*, *Drosanthemum lique*, *Drosanthemum hispidum* and *Mesembryanthemum (Psilocaulon)* sp.

- The grass layer covers on average 21% of the area. The dominant grass species include *Aristida adscensionis*, *Aristida congesta*, *Stipagrostis obtusa*, *Tragus berteronianus*, *Enneapogon desvauxii* and *Sporobolus fimbriatus*.
- Herbaceous species have a mean canopy cover of less than 1%. The most common species include *Sesamum capense*, *Kewa salsoloides* and *Galenia sarcophylla*.

Rare and/or protected species in habitat 7:

SA Red data list: None  
 NEM:BA (ToPS): None  
 NFA: None  
 WCNCA: 14 species of the Aizoaceae  
 CITES: None  
 Endemic species: None

**Habitat 8. *Vachellia karroo* – *Lycium oxycarpum* bushveld of watercourses**

This habitat is associated with the watercourses on site (Figures 7, 16 & 17). The shallow to deep grey to grey-brown sandy soils are alluvial in origin.

The diagnostic species of this community include *Setaria verticillata*, *Cenchrus ciliaris*, *Melianthus comosus*, *Searsia lancea*, *Stipagrostis namaquensis* and *Chloris virgata* (species group 10, Appendix A).



Figure 16: The *Vachellia karroo* – *Lycium oxycarpum* bushveld of ephemeral watercourses in the upper catchments.





Figure 17: The *Vachellia karroo* – *Lycium oxycarpum* bushveld of ephemeral watercourses in the lower catchments.

- Tall trees (>6 m) cover on average 2% of the area and the prominent species include *Vachellia karroo* and *Searsia lancea*.
- Small trees (>3–6 m) have a mean canopy cover of 12% and are characterised by *Diospyros lycioides* and *Searsia pallens*.
- Shrubs cover on average 23% of the area and are characterised by *Lycium oxycarpum*, *Searsia burchellii*, *Gymnosporia szyszylowiczii*, *Carissa haematocarpa* and *Grewia robusta*.
- Dwarf shrubs cover 10% of the habitat and include *Lycium cinereum*, *Melianthus comosa*, *Oedera humilis*, *Tetraena lichtensteiniana*, *Salsola* spp. and *Pentzia incana*.
- Succulent species in this habitat include *Mesembryanthemum guerichianum*, *Mesembryanthemum noctiflorum*, *Malephora* sp., *Aptenia* sp., and *Mesembryanthemum (Psilocaulon)* sp.
- The grass layer is poorly developed and covers on average 9% of the area. The dominant grass species include *Setaria verticillata*, *Cenchrus ciliaris*, *Stipagrostis namaquensis*, *Stipagrostis ciliata*, *Chloris virgata* and *Cynodon incompletus*.
- Herbaceous species have a mean canopy cover of less than 2%. The most common species include *Leysera tenella*, *Galenia papulosa*, *Aptosimum indivisum*, *Arctotis leiocarpa* and *Kewa salsoloides*.

Rare and/or protected species in habitat 8:

SA Red data list: None  
 NEM:BA (ToPS): None  
 NFA: None  
 WCNCA: 14 species of the Aizoaceae, *Moraea* sp.  
 CITES: None  
 Endemic species: None

## 5. ECOLOGICAL SENSITIVITY ANALYSIS: VEGETATION

### 5.1 Introduction

Sensitivity is the vulnerability of a habitat to an impact, for example a wetland or ridge system would be more vulnerable to development than would a sandy plain. Several features of a site can be assessed to derive a sensitivity score, such as:

1. Threatened status of the regional vegetation type wherein the proposed site is situated:
  - the vegetation type on Kwagga WEF 2 is classified as Least Threatened.
2. Percentage of red listed plant species per habitat or site:
  - no red listed plant species were encountered during the site surveys.
3. Number of protected tree species per habitat or site:
  - no protected tree species occur in the region.
4. Percentage of provincially protected plant species per habitat:
  - The number of provincially protected species encountered was ranked from low to high.
5. Presence of plant species per habitat or site (endemic to vegetation type):
  - no endemic plant species were encountered during the surveys.
6. Conservation value of association (habitat) or site:
  - overall the watercourses, rocky ridges and mountainous habitats (with scarps/cliffs) were considered as having a high conservation value.
7. Species richness per habitat or per sample plot (number of plant species):
  - species richness per habitat was ranked from low to high.
8. Degree of connectivity and/or fragmentation of the habitat, i.e. high connectivity and low fragmentation infers a low rating:
  - the only naturally fragmented habitat was the rocky ridges (habitats 1 & 2) which could occur within almost any of the broader habitat types.
9. Soil erosion potential:
  - in general the banks and floodplains along watercourses, as well as the mountainous areas and slopes are more prone to soil erosion.
10. Resilience (this is a measure of the ability of a particular habitat to recover after an impact, i.e. high resilience infers low rating).

### 5.2 Sensitivity model

During the field survey, 37 sites were surveyed at Kwagga WEF 2 out of a total of 125 sample sites for Kwagga WEF 2, 2 & 3. All identifiable plant species were noted and specific attention was given to protected species or species of conservation concern (SCC).

The following **sensitivity model** (Table 1) was applied to the data for each habitat on site. This was achieved by weighting each criterion and calculating the sum for the habitat, which reflects the sensitivity and sensitivity ranking. A brief description of the sensitivity rating of the parameters is provided below:

1. **Threatened status of the ecosystem** (depends on the percentage area intact, or degree of transformation) (Driver *et al.* 2005, Mucina & Rutherford 2006, NEM:BA 2011). The ecosystems are classified into the following categories:
- Low sensitivity: If “Least Threatened”, the vegetation type has most of its habitat intact, i.e. more than 80%; or the vegetation type is adequately statutory or formally conserved in parks and reserves.
  - Moderate sensitivity: If “Vulnerable”, the vegetation type has from 60% to 80% of the ecosystem intact; less than 40% has been transformed which could result in some ecosystem functioning being altered, and/or the ecosystem is statutory poorly conserved. For example, the vegetation type is rich in plant species but is not a pristine example of a vegetation type, therefore some transformation or disturbance occurred, such as human structures and degraded veld due to overgrazing and/or bush encroachment.
  - High sensitivity: If “Endangered”, the vegetation type has from 40% to 60% of the ecosystem intact; or 40% to 60% transformed due to disturbance, cultivation or alien species; or the ecosystem is statutory poorly conserved e.g. less than about 3% conserved.
  - Very high sensitivity: If “Critically Endangered”, the vegetation type has only 16% to 36% of the ecosystem intact. The richer the ecosystem is in terms of species, the higher the percentage threshold.

*Category rating:*

Low	(LT)	= 1
Moderate	(VU)	= 2
High	(EN)	= 3
Very high	(CE)	= 4

2. **Percentage of red list plant species** (listed as threatened following IUCN threatened status): The rating is determined by the presence of redlisted flora in a habitat (calculated as percentage of the total number of species per habitat).

*Category rating:*

None	(0%)	= 0
Low	(>0 – 2%)	= 1
Moderate	(>2 – 5%)	= 2
High	(>5%)	= 3

3. **Presence of protected tree species** (NFA 2019): The presence protected tree species in a habitat is rated as follows:

*Category rating:*

None	(0 species)	= 0
Low	(1 - 2 species)	= 1
Moderate	(3 – 4 species)	= 2
High	(>4 species)	= 3

4. **Percentage of Western Cape protected plant species:** Western Cape Nature and Environmental Conservation Ordinance, 1974 (No. 19 of 1974, as amended in 2000) (WCNECO, 1974) as well as CITES listed plant species (CITES 2019). The rating depends on the percentage of protected species in relation to the total plant species per habitat.

*Category rating:*

None	(0%)	= 0
Low	(>0 - 10%)	= 1
Moderate	(>10 – 20%)	= 2
High	(>20%)	= 3

5. **Percentage of plant species endemic to the particular vegetation type of Mucina & Rutherford (2006):** Refers to the number of species expressed as a percentage of the total number of species per habitat.

*Category rating:*

None	(0%)	= 0
Low	(>0 - 2%)	= 1
Moderate	(2–5%)	= 2
High	(>5%)	= 3

6. **Species richness per habitat:** Expressed as mean number of species per plot in a habitat.

*Category rating:*

Low	(<15)	= 1
Moderate	(15 – 30)	= 2
High	(>30)	= 3

7. **Conservation value of the habitat:** The assessment is made for the habitat in the broader region.

*Category rating:*

Low	= 1
Moderate	= 2
High	= 3

8. **Degree of connectivity and/or fragmentation of the ecosystem:** The degree of connectivity with surrounding or adjacent natural areas and/or fragmentation of habitats, thus high degree of connectivity and low degree of fragmentation infer a high rating.

*Category rating (note reverse order):*

Low	= 3
Moderate	= 2
High	= 1

9. **Erosion potential of the soil:** The erosion potential of the soil is indicated as low, moderate or high, e.g. coarse sandy soils on plains have a low erosion potential.

*Category rating:*

Low	= 1
Moderate	= 2
High	= 3

10. **Resilience:** Is a measure of the ability of a particular road reserve habitat to recover to its current state after an impact, i.e. high resilience infers low rating.

*Category rating (note reverse order):*

Low	= 3
Moderate	= 2
High	= 1

Each criterium is weighted as follows in the model:

Threatened status of the vegetation type	x5
Percentage of red list plant species	x4
Presence of protected tree species	x3
Percentage of Northern Cape or Western Cape protected species	x4
Percentage of endemic species to vegetation type	x2
Species richness	x2
Conservation value (habitat)	x4
Degree of connectivity/fragmentation of habitat	x2
Erosion potential	x2
Resilience	x3

## 5.2.2 Sensitivity rating

The sum of all criteria is obtained per habitat and interpreted as follows:

≤ 39	= low	(L)	(rating scale = 1)
40 – 54	= moderate	(M)	(rating scale = 2)
55 – 69	= high	(H)	(rating scale = 3)
> 70	= very high	(VH)	(rating scale = 4)

In general, these sensitivity ratings are interpreted as follows:

- **Low** sensitivity means the sensitivity should not have an influence on the decision about the project. It is

usually applicable to habitats that have been transformed, especially by human activities. However, no protected species may be removed/destroyed without a permit.

- **Moderate** means a sensitivity rating that is real and sufficiently important to require management, e.g. mitigation measures, management or protection of the rare/threatened fauna and flora, protection of a specific habitat on the property and/or rehabilitation.
- **High** means a sensitivity rating where the habitat should be excluded from any development.
- **Very high** means a sensitivity rating that should influence the decision whether or not to proceed with the project.

Table 1: Sensitivity of the different plant communities identified on site (see Figure 18)

Vegetation types	1	2	3	4	5	6	7	8
Threatened status (x5)	5	5	5	5	5	5	5	5
% Red list species (x4)	0	0	0	0	0	0	0	0
Number of protected trees (x3)	0	0	0	0	0	0	0	0
WCNECO/CITES species (x4)	12	12	12	12	12	12	12	8
Endemic species (x2)	0	0	0	0	0	0	0	0
Species richness (x2)	6	3	3	3	3	3	3	3
Conservation value (x4)	8	8	4	4	4	4	4	12
Connectivity (x2)	4	4	2	2	2	2	2	4
Erosion (x2)	4	2	2	2	2	2	2	6
Resilience (x3)	6	6	6	6	6	6	6	6
Sum:	45	40	34	34	34	34	34	44
Sensitivity rating:	M	M	L	L	L	L	L	M

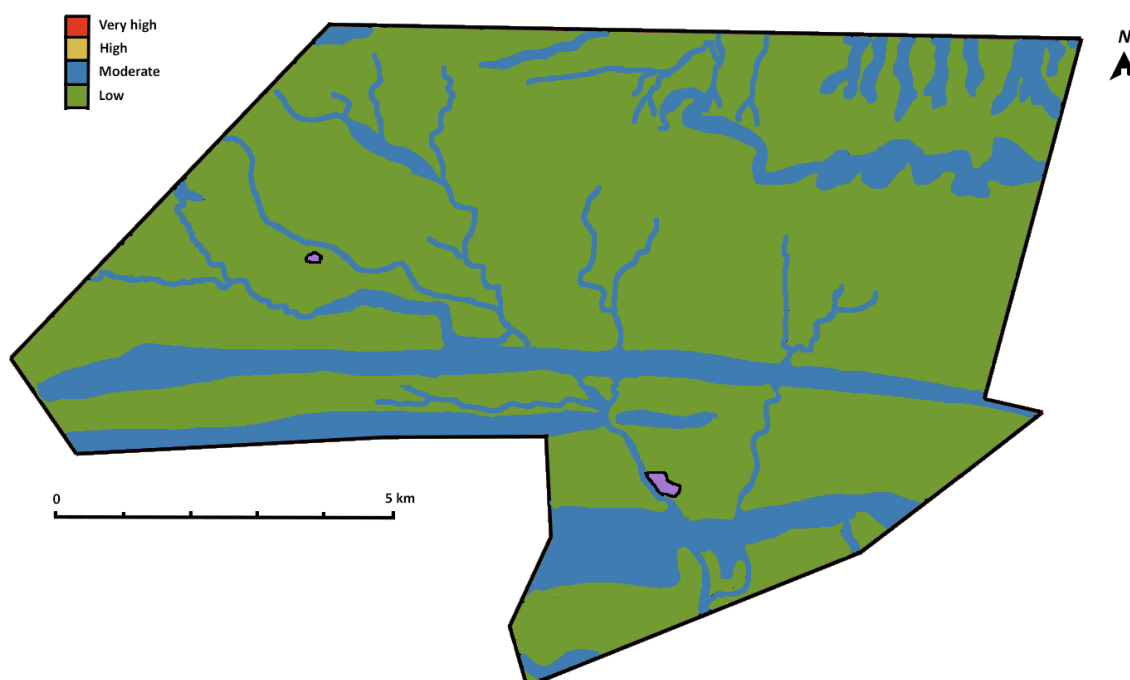


Figure 18: Sensitivity map of the Kwagga WEF 2 site. The sensitivity map (Figure 16) is additionally provided as a .kmz file.

Overall, the mountainous parts (habitats 1 & 2) and drainage lines (habitat 7) were more sensitive than the plains. However, there are a number of protected and CITES listed species found on the rocky ridges (habitats 1 & 2) and the quartzitic rocky plains (habitat 3) which should be taken into account when selecting the sites for turbines.

No buffers are applicable to the development, except along the watercourses, where a standard 32 m buffer is applicable.

Furthermore, although none of the habitats were rated as highly sensitive from a vegetation point of view, this does not exclude the presence of protected and CITES listed species in the habitats. Protected and CITES listed species were not considered as being of conservation concern for the following reasons: In WCNECO (1974, 2000), a number of families and genera, for example the family Aizoaceae, (formerly Mesembryanthemaceae) and genera such as *Mesembryanthemum*, *Drosanthemum*, *Galenia*, *Ruschia* and *Tetragonia* are listed as either Specially Protected Species/Flora or Protected Species/Flora. This blank classification may be because of the presence of one or two species of vulnerable or higher conservation (IUCN) status in the genus. Unfortunately, this then includes many species that are either common, or even weedy, e.g. *Drosanthemum hispidum*, *Galenia namaensis*, *Mesembryanthemum guerichianum* or *Ruschia* species that do not need to be awarded special conservation status. To a large extent, Appendix II of CITES has the same weakness as WCNECO, because it often also simply lists all species within a genus, e.g. *Anacampseros* spp., all succulent *Euphorbia* spp. and *Hoodia* spp. Several species noted on site are provincially protected as well as CITES listed, although none have an IUCN red list status (see Appendix B). Permits will have to be obtained for the removal of the protected species.

## 6. FAUNA

### 7.1 Mammals

The site falls within the distribution range of 20 terrestrial mammal species (<http://vmus.adu.org.za>) (Appendix C).

#### 7.1.1 IUCN threatened mammal species

No IUCN threatened mammal species were listed for the environs of the Kwagga WEF 2 site on the website of the Animal Demography Unit, University of Cape Town. However, the riverine rabbit (*Bunolagus monticularis*) is flagged as medium sensitivity for the site by the 'screening tool'. According to Collins & Du Toit (2016) the riverine rabbit has been sighted in the region, but is unlikely to occur on the Kwagga WEF 2 site. Favourable habitat for the riverine rabbit does not appear to be present of the Kwagga WEF 2 site. Due to intensive grazing by livestock exacerbated by the current drought, the vegetation on site and along many of the drainage lines was degraded.

Among the rodents, Littledale's whistling rat (*Parotomys littledalei*) is listed as Near Threatened (a category that is not a threatened category in the IUCN classification).

### 7.3 Reptiles

Thirty-two reptiles are listed for the region. The Karoo dwarf tortoise (*Chersobius boulengeri*) is listed as IUCN **Endangered** and is also in CITES Appendix II. The Karoo dwarf tortoise is an endemic species occurring in the region.

The most common tortoise on site is the leopard tortoise or bergskilpad *Stigmochelys pardalis*.

Other CITES II listed Chelonians are:

<i>Chersina angulata</i>	Angulate tortoise
<i>Psammobates tentorius tentorius</i>	Karoo tent tortoise
<i>Psammobates tentorius verroxii</i>	Verrox's tent tortoise

**Comment:**

The available fauna lists for the immediate region of the Kwagga WEF 2 site show that the area has been poorly collected in the past. The following additional mammals were either sighted or confirmed by two landowners on site:

**Mammals:**

Artiodactyla:

<i>Sylvicapra grimmia</i>	Grey (bush) duiker	(WC protected species)
<i>Tragelaphus sylvaticus</i>	Greater Kudu	(WC protected species)
<i>Oryx gazella</i>	Gemsbok	(WC protected species)

Carnivores:

<i>Canis mesomelas</i>	Black-backed jackal	
<i>Caracal caracal</i>	Caracal	
<i>Otocyon megalotis</i>	Bat-eared fox	(WC protected species)
<i>Cynictis penicillata</i>	Yellow mongoose	

Primates:

<i>Chlorocebus pygerythrus</i>	Vervet monkey
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Lagomorpha (Hares and rabbits):

<i>Lepus capensis</i>	Cape hare
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# 7. SCREENING REPORT

## 7.1 Summary of screening tool results

### 7.1.1 Plant Species Theme

The screening tool rated the sensitivity of the Plant Species Theme as **Low** (Figure 19) and no species were highlighted as being of concern.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity	Feature(s)
Low	Low sensitivity

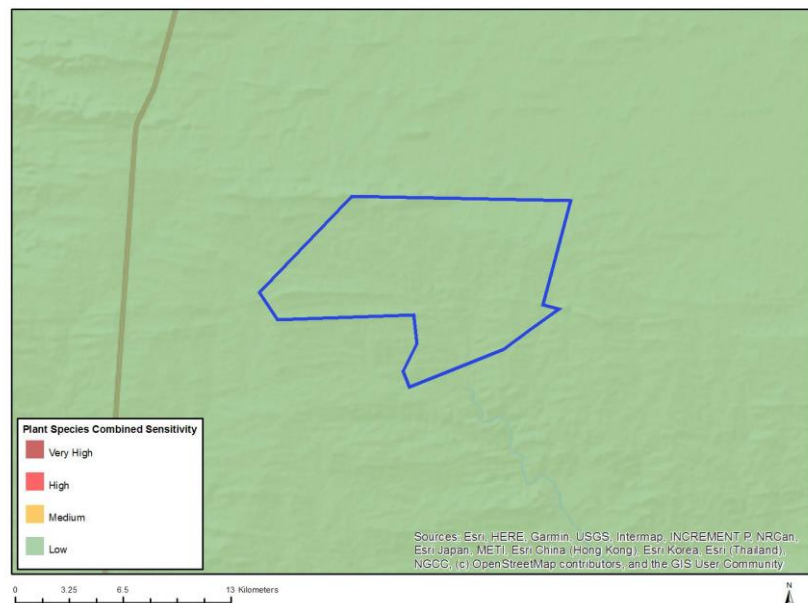


Figure 19: Map and outcome of Plant Species Theme sensitivity generated by the screening tool.

### 7.1.2 Animal theme



The screening tool rated the sensitivity of the Animal Species Theme as **High** (Figure 20). Animal species highlighted by the screening tool for the region included the riverine rabbit (*Bunolagus monticularis*) and Karoo dwarf tortoise (*Chersobius boulengeri*).

Very high sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	x		

Sensitivity	Feature(s)
Medium	Mammalia- <i>Bunolagus monticularis</i>
Medium	Reptilia- <i>Chersobius boulengeri</i>

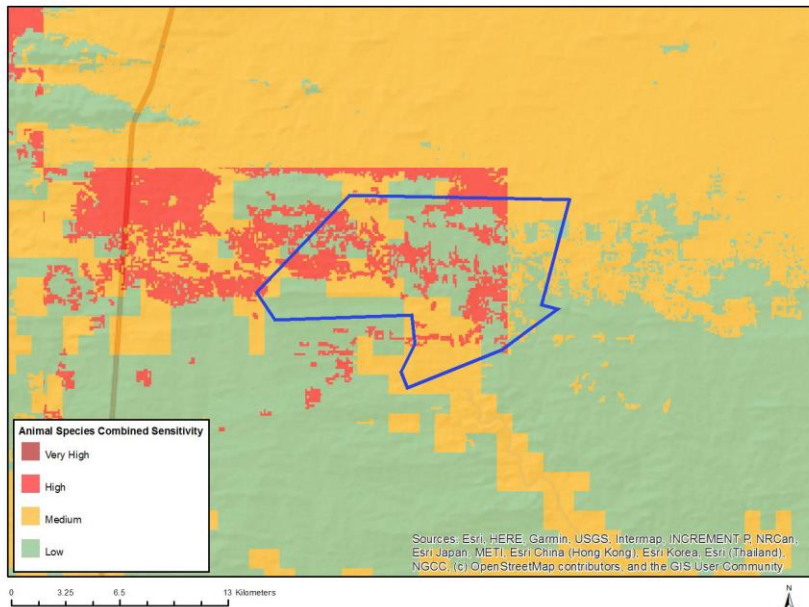


Figure 20: Map and outcome of Animal Species Theme sensitivity generated by the screening tool.

### 7.1.3 Relative Terrestrial Biodiversity theme

The screening tool rated the sensitivity of the Relative Terrestrial Biodiversity theme as **Very High** (Figure 21). The following features were highlighted:

Very high sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
x			

Sensitivity	Feature(s)
Very high	Critical Biodiversity Area 1
Very high	Ecological Support Area 1
Very high	Ecological Support Area 2
Very high	Freshwater ecosystem priority area quinary catchments

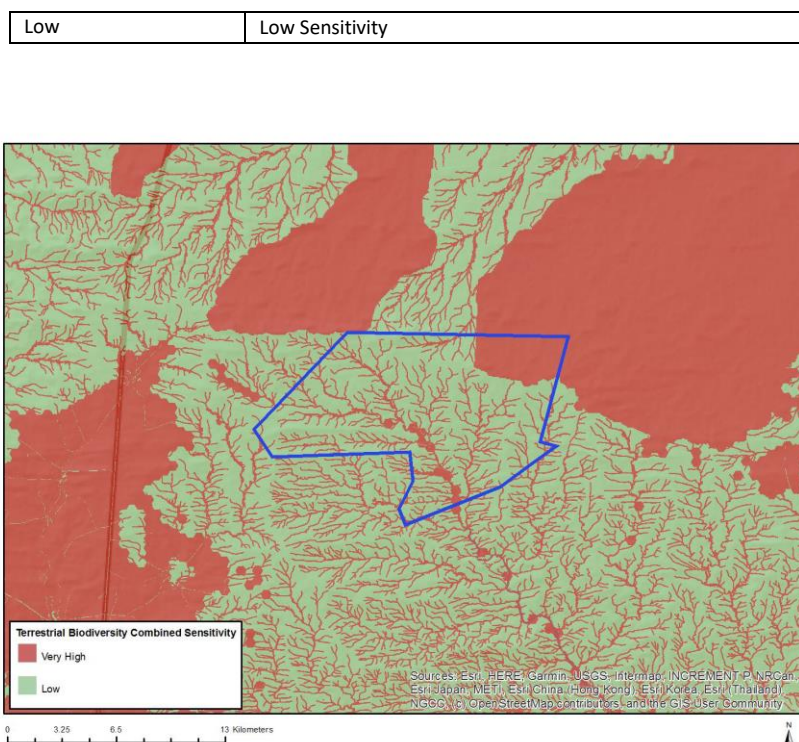


Figure 21: Map and outcome of Relative Terrestrial Biodiversity sensitivity generated by the screening tool.

The screening tool rated the sensitivity of the Relative Terrestrial Biodiversity theme as **Very High**.

## 7.2 Screening tool in relation to background study and site verification

### 7.2.1 Plant theme

Our background study corresponded with the screening tool that the vegetation and flora are listed as **low** sensitivity. However, many provincially protected/specially protected and CITES II listed species were recorded on site. These species are mostly associated with cliffs, scarps and rocky ridges (outcrops) and these habitats should be avoided during construction.

### 7.2.2 Animal theme

According to Collins & Du Toit (2016) the riverine rabbit has been sighted in the region, but is unlikely to occur on the Kwagga WEF 2 site. Furthermore, the Animal Demography Unit's mammal database has no record of the riverine rabbit in the 3222D degree square. Our site survey did not confirm ideal habitat for the riverine rabbit because the vegetation on site and along many of the drainage lines was degraded due to intensive grazing by livestock exacerbated by the current drought.

Our background study confirmed the probable presence of the Karoo dwarf tortoise (Animal Demography Unit reptile map) although it was not recorded during the site visit.

### 7.2.3 Relative terrestrial biodiversity theme

This theme considers the presence of protected areas, National Protected Area Expansion Strategy (NPAES), CBA, ESA and National Freshwater Ecosystem Priority Area (NFEPA). The study area is not located in a protected area and the vegetation type on site is listed as least threatened.

Our background study indicated that the development will have no impact on existing protected areas nor affect the NPAES. Turbines should not be located within the area demarcated as CBA. Overall the impact of the development within the identified CBAs and ESAs can be limited by good planning.

The Freshwater Ecosystem Priority Areas (FEPAs) or water catchments are priority areas for conserving freshwater ecosystems and supporting sustainable use of water resources and upstream management areas. The screening tool classified the northeastern section of Kwagga WEF 2, covered by the FEPA, as having a very high sensitivity. However, based on the site sensitivity assessment of the vegetation this area was rated as being of low or moderate sensitivity.

## 8. SITE SENSITIVITY VERIFICATION

Prior to commencing with the Terrestrial Biodiversity Specialist Assessment in accordance with the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity (Government Notice 320, dated 20 March 2020), a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

The details of the site sensitivity verification are noted below:

<b>Date of site visit</b>	29 October 2020 to 5 November 2020
<b>Specialist name</b>	N. van Rooyen; M.W van Rooyen
<b>Professional registration number</b>	401430/83 Botanical Science (NvR); 400509/14 Ecological Science (MvR)
<b>Specialist affiliation / company</b>	Ekotruster cc

The site sensitivity verification was undertaken using the following means:

- desk top analysis using satellite imagery;
- consulting geological, land type and vegetation type maps of the region;
- consulting provincial datasets on the latest versions of the mapping of CBAs, ESAs, ONAs, NPAES and PAs;
- checking distribution ranges of IUCN red listed species and species highlighted by the screening tool;
- compiling plant and animal species checklist for the region; and
- on-site inspection.

To verify the site sensitivity of the screening tool, Google satellite images were studied beforehand and the site stratified into relatively homogenous physiographic-physionomic units or habitats. Sites were then selected to represent these habitats. During the field survey, 37 sampling sites were surveyed at the proposed Kwagga WEF 2 development.

### Animal Theme

*Screening tool:* The screening tool rated the sensitivity of the Animal Species Theme as **High**.

*Site verification:*

Mammals:

- Our background study concurred with the possible presence of the riverine rabbit (Collins *et al.* 2016) **in the region but not on the proposed development site**. Furthermore, due to intensive grazing by livestock exacerbated by the current drought, the vegetation on site and along many of the drainage lines was degraded.
- As a precautionary measure developments along the drainage lines should nevertheless be discouraged.

Reptiles:

- Our background study confirmed the presence of the Karoo dwarf tortoise within the 3222D degree square. With proper mitigation measures negative impacts to the Karoo dwarf tortoise could be avoided.

We would rate the sensitivity of the Animal Theme as **Medium** based on the information provided above.

## Plant Theme

*Screening tool:* The screening tool rated the sensitivity of the Plant Species Theme as **Low**.

*Site verification:*

- Our background study corresponded with the screening tool that the plant theme is considered as of a **low** sensitivity. However, many provincially protected/specially protected and CITES II listed species were recorded on site. These species are mostly associated with cliffs, scarps and rocky ridges (outcrops) and permits are needed for the removal of these species.

## Relative Terrestrial Biodiversity Theme

*Screening tool:* The screening tool rated the sensitivity of the Relative Terrestrial Biodiversity theme as **Very High**.

*Site verification:*

- This theme considers the presence of protected areas, National Protected Area Expansion Strategy (NPAES), CBAs, ESAs and National Freshwater Ecosystem Priority Area (FEPAs). Our background study concurred with the findings of the screening tool on the presence of these features.
- The Freshwater Ecosystem Priority Areas (FEPAs) or water catchments are priority areas for conserving freshwater ecosystems and supporting sustainable use of water resources and upstream management areas. The screening tool classified the entire area covered by the FEPA as having a very high sensitivity. However, based on the site assessment of the vegetation most of the area was rated as being of low to moderate sensitivity.

### **Outcome of the site sensitivity verification:**

- We concur that the Plant Theme's site sensitivity is **Low**.
- We would suggest the Animal Theme's site sensitivity to be rated as **Medium**.
- Unfortunately, the screening tool limits the sensitivity either to Very High or Low. This is an issue which should be revisited by the Department of Environmental Affairs since it does not give a proper representation of the site conditions. Although we agree with the delineation of the CBA and its categorization as Very High, the FEPA quinary catchment was classified as low to moderate in the onsite sensitivity analysis. The proportion of the site with a very high sensitivity is thus small and can be avoided by careful placement of infrastructure. Thus, if the same 4-category scale were to be applied to this theme, as in the case of the other themes, we would rate it as **Medium**.

## 9. ENVIRONMENTAL IMPACTS

The following is a list of potential impacts that may occur due to the proposed development. A full description of the impacts will be presented in the specialist EIA report.

### 9.1 Impacts during the construction phase

#### 9.1.1 Direct impacts during the construction phase

- Potential impact 1: The clearing of natural vegetation and resultant loss of faunal habitat;
- Potential impact 2: The loss of threatened, protected and endemic plants/animals;
- Potential impact 3: Direct faunal mortalities due to construction and increased traffic;
- Potential impact 4: Increased noise and light levels; and
- Potential impact 5: Increased dust deposition.

#### 9.1.2 Indirect impacts during the construction phase

- Potential impact 1: Establishment of alien vegetation as a result of the clearing of the vegetation;
- Potential impact 2: Increased water run-off and erosion.
- Potential impact 3: Changes in animal behaviour.

### 9.2 Impacts during the operational phase

#### 9.2.1 Direct impacts during the operational phase

- Potential impact 1: Direct faunal mortalities.
- Potential impact 2: Increased light and noise levels.

#### 9.2.2 Indirect impacts during the operational phase

- Potential impact 1: Establishment of alien vegetation will continue.

### 3.5 Impacts during the decommissioning phase

### 9.3.1 Direct impacts during the decommissioning phase

- Potential impact 1: Some clearing of natural vegetation due to removal of infrastructure.

### 9.3.2 Indirect impacts during the decommissioning phase

- Potential impact 1: Establishment of alien vegetation
- Potential impact 2: Possible ingestion or ensnarement of animals due to waste material lying around.

## 9.4 Cumulative impacts

- Cumulative impact 1: Vegetation loss and habitat destruction and concomittant loss of SCC
- Cumulative impact 2: Compromising integrity of CBA, ESA and NPAES
- Cumulative impact 3: Increased water run-off and erosion.
- Cumulative impact 4: Possible loss of landscape connectivity and disruption of broad-scale ecological processes.

Preferred infrastructure locations:

Turbines:

- Turbines should not be located within or near watercourses or on mountains and rocky ridges where small 'cliffs' are present or on the crest of ridges where the rocky outcrop is present (Figure 22). Patches of quartzitic gravel should also be avoided if possible (part of habitat 3).



Figure 22. Example of a cliff and scarp which should be avoided in placement of wind turbines.

On-site substations:

Most of the locations of sites selected for substations are acceptable. However, the presence of watercourses (drainage lines) will necessitate a slightly different placement in the landscape (micro-siting). The best option from an ecological viewpoint will be Site WEF2 001 followed by Site 03.

Laydown areas:

- All alternatives are acceptable.

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## APPENDIX A

SYNOPTIC TABLE OF PLANT COMMUNITIES OF  
KWAGGA 1, 2 & 3 COMBINED

Community	1	2	3	4	5	6	7	8
<b>Species group 1</b>								
<i>Bulbine triebneri</i>	3						1	1
<i>Trichodiadema decorum</i>	2	1		1				
<i>Melica decumbens</i>	2							1
<i>Manulea</i> sp.	2	1		1				
<i>Felicia muricata</i>	2		1					
<i>Helichrysum zeyheri</i>	2		1					
<i>Pelargonium laxum</i>	2	1						
<i>Adromischus triflorus</i>	2							
<i>Pteronia tricephala</i>	1							
<b>Species group 2</b>								
<i>Hermannia linearifolia</i>	3	2		1				
<i>Eriocephalus brevifolius</i>	2	1			1			
<i>Sericocoma avolans</i>	1	2						
<i>Helichrysum pumilio</i>	2	1			1	1		
<i>Dianthus micropetalus</i>	2	2	1					
<i>Osteospermum scariosum</i>	2	1	1		1			
<i>Anacampseros albidiflora</i>	2	1	1	1	1	1		
<b>Species group 3</b>								
<i>Crassula deltoidea</i>	1	1	3		1			
<i>Hereroa</i> sp. 1		1	3					
<i>Anacampseros papyracea</i>			3					
<i>Trichodiadema barbatum</i>			1					
<i>Faucaria</i> sp.			1					
<i>Justicia</i> sp.			1	1				
<b>Species group 4</b>								
<i>Tragus koelerioides</i>	3	3	3					
<i>Digitaria argyragrapta</i>	4	1	2	1			1	2
<i>Amphiglossa species</i>	2	2	2		1			
<i>Eragrostis obtusa</i>	2	1	1	1		1	1	1
<i>Mesembryanthemum (Phyllobolus)</i> sp.	1	2	1	1				
<i>Eriocephalus spinescens</i>	1	1	2				1	
<i>Crassula muscosa</i>	1	1	1		1			
<b>Species group 5</b>								
<i>Nenax microphylla</i>	4	2	3	2	1	1	1	
<i>Hirpicium alienatum</i>	5	2	1	2		1		1
<i>Gnidia deserticola</i>	4	2	2	2				
<i>Helichrysum lucilioides</i>	3	2	3	1				
<i>Pteronia empetrifolia</i>	2	3	3	1	1			
<i>Gazania heterochaeta</i>	2	2	3	2	1		1	
<i>Anacampseros ustulata</i>	1	1	3	3				
<i>Cuspidia cernua</i>	1	1	1	1		1		1
<b>Species group 6</b>								
<i>Pteronia glauca</i>	2	3	3	2	2		1	
<i>Tetragonia</i> spp.	2	2	2	1	1			
<i>Euphorbia suffulta</i>	1	2	1	1	2	1		
<i>Galenia fruticosa</i>	1	1	1	1	2			
<i>Antimima</i> sp.		2	1	1	1			
<i>Felicia filifolia</i>		1	2	1	1	1		
<i>Pteronia paniculata</i>		1	2	1	1			

**Species group 7**

<i>Rhigozum obovatum</i>	5	5	4	4	5	5	1
<i>Euphorbia stellispina</i>	3	4	3	2	3	2	
<i>Trichodiadema pomeridianum</i>	3	2	3	2	2	2	1
<i>Monsonia camdeboensis</i>	2	3	3	1	3	1	
<i>Oropetium capense</i>	2	2	4	4	1	2	
<i>Pteronia adenocarpa</i>	2	3	1		2	2	
<i>Asparagus striatus</i>	2	2	1	2	1	1	
<i>Curio radicans</i>	1	2	1	1	2	1	
<i>Pentzia quinquefida</i>	3	1	1		1	1	
<i>Searsia pallens</i>	2	1		1		3	1
<i>Pteronia viscosa</i>	1	1			1	3	1
<i>Trachyandra sp.</i>	1	1	1	2	1	2	

**Species group 8**

<i>Stipagrostis obtusa</i>		1	1	1	1	3	3	
<i>Tragus berteronianus</i>	1	1	1	1	1	2	1	1
<i>Sesamum capense</i>						3	2	1
<i>Ruschia sp.</i>	1	1	1	1			3	

**Species group 9**

<i>Eriocephalus ericoides</i>	5	5	5	5	5	5	3	
<i>Aristida congesta</i>	3	2	5	5	5		5	
<i>Aristida diffusa</i>	5	5	3	3	3	3	1	1
<i>Ruschia spinosa</i>	4	5	5	2	4	4	2	1
<i>Drosanthemum lique</i>	2	3	3	2	4	3	5	1
<i>Enneapogon desvauxii</i>	1	3	3	3	4	5	2	1
<i>Asparagus mucronatus</i>	3	2	2	2	2		1	
<i>Ruschia cradockensis</i>	1	1	5	1	3	1	2	
<i>Pteronia sordida</i>	1	1	1		1	1	2	

**Species group 10**

<i>Setaria verticillata</i>	1					1		5
<i>Cenchrus ciliaris</i>								4
<i>Melianthus comosus</i>								3
<i>Searsia lancea</i>								3
<i>Stipagrostis namaquensis</i>								3
<i>Oedera humilis</i>		1					1	2
<i>Leysera tenella</i>		1						2
<i>Eragrostis sp.</i>								2
<i>Chloris virgata</i>							1	2
<i>Amaranthus sp.</i>								2
<i>Tetraena lichtensteiniana</i>						1	1	2
<i>Argemone ochroleuca</i>								2
<i>Malephora sp.</i>								2
<i>Aptosimum indivisum</i>			1					2
<i>Viscum rotundifolium</i>	1					1		2
<i>Cynodon incompletus</i>								2
<i>Tagetes minuta</i>								2
<i>Aptenia sp.</i>								2
<i>Polypogon monspeliensis</i>								2
<i>Arctotis leiocarpa</i>								2
<i>Eragrostis rotifer</i>								2
<i>Bassia salsoloides</i>								2
<i>Galenia papulosa</i>			1			1		1
<i>Tetragonia acanthocarpa</i>	1	1						1
<i>Stipagrostis ciliata</i>						1	1	1
<i>Mesembryanthemum articulatum</i>						1		1
<i>Gazania krebsiana</i>								1

**Species group 11**

<i>Lycium oxycarpum</i>						3	3	5
<i>Vachellia karroo</i>	1	1	1	1		2	1	5
<i>Tetraena chrysopteron</i>		1		1	1	3	3	2
<i>Kewa salsoloides</i>		1	1		1	2	2	2

**Species group 12**

<i>Asparagus burchellii</i>	1	1	1	1	1	3	2	2
<i>Mesembryanthemum guerichianum</i>		1	1	1	2	1	2	3
<i>Galenia sarcophylla</i>		2		1	1	2	1	2
<i>Salsola spp.</i>	1		3	1	1	1	1	2
<i>Mesembryanthemum noctiflorum</i>	1	1	2	1	1	1	1	2
<i>Cadaba aphylla</i>	1	1	1		1	2	2	1

**Species group 13**

<i>Aristida adscensionis</i>	3	3	5	5	5	5	5	3
<i>Chrysocoma ciliata</i>	4	4	3	3	3	3	1	2
<i>Lacomucinaea lineatum</i>	4	2	3	3	3	4	2	2
<i>Lycium cinereum</i>	3	2	4	5	4	5	5	5
<i>Asparagus aethiopicus</i>	2	3	5	4	4	4	4	3
<i>Pentzia incana</i>	4	1	2	2	2	4	4	4
<i>Diospyros lycioides</i>	2	2	3	2	1	3	2	4
<i>Searsia burchellii</i>	4	3	1	1	2	4	1	4
<i>Mesembryanthemum (Psilocalon) spp.</i>	2	2	3	2	5	1	1	1
<i>Grewia robusta</i>	5	2	2	2	1	4	1	3
<i>Gymnosporia szyszyłowiczii</i>	2	2	1	1	3	3	2	4
<i>Drosanthemum hispidum</i>	2	1	2	1	1	2	3	2
<i>Hermannia grandiflora</i>	2	1	2	2	1	1	1	1
<i>Sporobolus fimbriatus</i>	2	1	1				1	3

**Species group 14**

<i>Felicia sp.</i>	1	1	1	1		1		
<i>Crassula subaphylla</i>	1			1	1		1	
<i>Crassula corallina</i>	1	1		1			1	
<i>Hermannia desertorum</i>	1	1		1				
<i>Pteronia sp.</i>	1	1						
<i>Sceletium tortuosum</i>	1	1			1	1		
<i>Euphorbia mauritanica</i>	1	1		1	1			
<i>Astroloba foliolosa</i>	1	1		1				
<i>Anacampseros telephiastrum</i>	1	1						
<i>Conophytum truncatum</i>	1	1	1					
<i>Hoodia pilifera</i>	1	1			1	1		
<i>Melolobium candicans</i>	1						1	1
<i>Carissa haematocarpa</i>	1		1					1
<i>Crassula hemisphaerica</i>	1		1			2		
<i>Albuca sp.</i>	1			1		1	1	
<i>Drimia intricata</i>	1	1	1					
<i>Lepidium africanum</i>	1							1
<i>Hermannia cuneifolia</i>	1	1			1	1		
<i>Dipcadi sp.</i>	1	1		1				
<i>Osteospermum sinuata</i>		1	1		1		1	1
<i>Eriocephalus cf. decussatus</i>		1	1					1
<i>Selago sp.</i>		1	1					1
<i>Moraea sp.</i>		1			1			1
<i>Blepharis sp.</i>					1	1		1
<i>Osteospermum sp.</i>	1							
<i>Mesembryanthemum tetragonum</i>	1				1			
<i>Fingerhuthia africana</i>	1						1	
<i>Ledebouria sp.</i>	1							
<i>Chasmatophyllum musculinum</i>	1						1	
<i>Barleria rigida</i>	1							
<i>Pteronia staehelinoides</i>	1							
<i>Pegoletia retrofracta</i>	1				1			
<i>Hereroa sp.</i>	1		1					
<i>Digitaria eriantha</i>	1							1
<i>Solanum giftbergense</i>	1							
<i>Albuca maxima</i>	1							
<i>Asparagus capensis</i>	1							
<i>Bulbine frutescens</i>	1							
<i>Lessertia fruticosa</i>	1							
<i>Adromischus sp.</i>	1							
<i>Galenia namaensis</i>	1							
<i>Hermannia spinosa</i>	1							1
<i>Atriplex vestita</i>	1					1		
<i>Melolobium cf. microphyllum</i>	1							
<i>Euclea undulata</i>	1							
<i>Limeum aethiopicum</i>	1	1						
<i>Garuleum bipinnatum</i>	1							
<i>Pentameris cf. airoides</i>		1						
<i>Senecio acaulis</i>		1	1					
<i>Lotononis sp.</i>		1	1					
<i>Fockea comaru</i>		1						
<i>Pentzia sphaerocephala</i>		1						
<i>Mesembryanthemum sp. 3</i>		1					1	
<i>Haworthiopsis nigra</i>		1						
<i>Pharnaceum sp.</i>		1						

<i>Monsonia crassicaule</i>	1			
<i>Drimia</i> sp.	1			
<i>Enneapogon cenchroides</i>	1			
<i>Crassula pyramidalis</i>	1			
<i>Pachypodium succulentum</i>	1			
<i>Hermannia coccocarpa</i>	1			1
<i>Hermannia vestita</i>	1		1	
<i>Kleinia longiflora</i>		1	1	
<i>Curio rowleyanus</i>		1	1	
<i>Asparagus capensis</i>		1		
<i>Lessertia</i> sp.		1		
<i>Mesembryanthemum</i> sp. 2		1		1
<i>Crassula capitella</i>			1	1
<i>Ornithogalum species</i>			1	
<i>Euphorbia decepta</i>			1	
<i>Athanasia minuta</i>			1	1
<i>Oedera oppositifolia</i>			1	1
<i>Salsola kali</i>			1	
<i>Osteospermum spinescens</i>			1	
<i>Plinthus karoocicus</i>				1
<i>Gonialoe variegata</i>				1
<i>Crassothonna sedifolia</i>				1
<i>Aizoon canariense</i>				1
<i>Tetraena rigida</i>				1
<i>Opuntia aurantiaca</i>				1
<i>Tetragonia microptera</i>				1
<i>Dicoma capensis</i>				1
<i>Blepharis mitrata</i>				1
<i>Peliostomum leucorrhizum</i>				1
<i>Malephora crassa</i>				1
<i>Opuntia ficus-indica</i>				1
<i>Ursinia nana</i>				1
<i>Amphiglossa triflora</i>				1
<i>Nemesia</i> sp.				1
<i>Stipagrostis uniplumis</i>				1
<i>Mesembryanthemum</i> sp. 1				1
<i>Solanum</i> sp.				1
<i>Hermannia comosa</i>				1
<i>Chenopodium</i> sp.				1
<i>Datura ferox</i>				1
<i>Ehrharta</i> sp.				1
<i>Senecio</i> sp.				1
<i>Mesembryanthemum</i> cf. <i>nitidum</i>				1
<i>Asparagus retrofractus</i>				1
<i>Hermannia</i> sp.				1
<i>Jamesbrittenia species</i>				1
<i>Atriplex semibaccata</i>				1
<i>Bromus pectinatus</i>				1
<i>Fuirena</i> sp.				1
<i>Osteospermum acanthospermum</i>				1
<i>Pseudoschoenus inanis</i>				1
<i>Afroscirpoides dioecus</i>				1
<i>Emex australis</i>				1
<i>Erodium cicutarium</i>				1
<i>Helichrysum leontonyx</i>				1
<i>Malva parviflora</i>				1
<i>Sebaea</i> sp.				1
<i>Sporobolus</i> sp.				1
<i>Sonchus</i> sp.				1
<i>Cyperus</i> sp.				1
<i>Leptochloa fusca</i>				1
<i>Lasiopogon muscoides</i>				1
<i>Sporobolus ioclados</i>				1
<i>Arctotis argentea</i>				1

## APPENDIX B

## PLANT SPECIES CHECKLISTS

<sup>1</sup>IUCN category<sup>2</sup>Western Cape Nature and Environmental Conservation Ordinance (WCNECO)<sup>3</sup>CITES = Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES 2020)<sup>4</sup>Species of Conservation Concern<sup>5</sup>ALIEN = ALIEN AND INVASIVE SPECIES<sup>6</sup>NAT = NATURALISED<sup>7</sup>Plants observed during October/November 2020 site visit<sup>8</sup>Newposa list (SANBI)

FAMILY	SPECIES	IUCN <sup>1</sup>	WC <sup>2</sup>	CITES <sup>3</sup>	SCC <sup>4</sup>	ALIEN <sup>5</sup>	NAT <sup>6</sup>	CURRENT <sup>7</sup>	NEWPOSA <sup>8</sup>
Acanthaceae	<i>Barleria rigida</i>							x	
Acanthaceae	<i>Blepharis capensis</i>	LC							x
Acanthaceae	<i>Blepharis mitrata</i>	LC						x	x
Acanthaceae	<i>Blepharis</i> sp.	-						x	
Acanthaceae	<i>Justicia</i> sp.	-						x	
Aizoaceae	<i>Aizoon canariense</i>	LC	x					x	
Aizoaceae	<i>Antimima</i> sp.	-	x					x	
Aizoaceae	<i>Aptenia</i> sp.	-	x					x	
Aizoaceae	<i>Chasmatophyllum musculinum</i>	LC	x					x	
Aizoaceae	<i>Hereroa</i> sp. 1	-	x					x	
Aizoaceae	<i>Conophytum truncatum</i>	LC	x		x			x	
Aizoaceae	<i>Delosperma</i> sp.	-	x						x
Aizoaceae	<i>Drosanthemum hispidum</i>	LC	x					x	x
Aizoaceae	<i>Drosanthemum lique</i>	LC	x					x	x
Aizoaceae	<i>Drosanthemum</i> sp.	-	x						x
Aizoaceae	<i>Faucaria</i> sp.	-	x					x	
Aizoaceae	<i>Galenia acutifolia</i>	LC	x						x
Aizoaceae	<i>Galenia fruticosa</i>	LC	x					x	x
Aizoaceae	<i>Galenia glandulifera</i>	LC	x						x
Aizoaceae	<i>Galenia namaensis</i>	LC	x					x	
Aizoaceae	<i>Galenia papulosa</i>	LC	x					x	x
Aizoaceae	<i>Galenia sarcophylla</i>	LC	x					x	
Aizoaceae	<i>Galenia secunda</i>	LC	x						x
Aizoaceae	<i>Hereroa</i> sp. 2	-	x					x	
Aizoaceae	<i>Leipoldtia</i> sp.	-	x						x
Aizoaceae	<i>Malephora crassa</i>	LC	x					x	
Aizoaceae	<i>Malephora latipetala</i>	LC	x						x
Aizoaceae	<i>Malephora</i> sp.	-	x					x	x
Aizoaceae	<i>Mesembryanthemum articulatum</i>	LC	x					x	x
Aizoaceae	<i>Mesembryanthemum crystallinum</i>	LC	x						x
Aizoaceae	<i>Mesembryanthemum geniculiflorum</i>	LC	x						x
Aizoaceae	<i>Mesembryanthemum guerichianum</i>	LC	x					x	
Aizoaceae	<i>Mesembryanthemum nitidum</i>	LC	x					x	x
Aizoaceae	<i>Mesembryanthemum noctiflorum</i> subsp. <i>stramineum</i>	LC	x					x	x
Aizoaceae	<i>Mesembryanthemum nodiflorum</i>	LC	x						x
Aizoaceae	<i>Mesembryanthemum</i> sp. 1	-	x					x	
Aizoaceae	<i>Mesembryanthemum</i> sp. 2	-	x					x	
Aizoaceae	<i>Mesembryanthemum</i> sp. 3	-	x					x	
Aizoaceae	<i>Mesembryanthemum splendens</i>	LC	x						x

Aizoaceae	<i>Mesembryanthemum splendens</i> subsp. <i>pentagonum</i>	LC	x					x
Aizoaceae	<i>Mesembryanthemum splendens</i> subsp. <i>splendens</i>	LC	x					x
Aizoaceae	<i>Mesembryanthemum tetragonum</i>	LC	x				x	x
Aizoaceae	<i>Mesembryanthemum vaginatum</i>	LC	x					x
Aizoaceae	<i>Mesembryanthemum (Phyllobolus)</i> sp.	-	x				x	
Aizoaceae	<i>Plinthus karoocicus</i>	LC	x				x	
Aizoaceae	<i>Mesembryanthemum (Psilocalon)</i> sp.	-	x				x	
Aizoaceae	<i>Rhinephyllum graniforme</i>	LC	x					x
Aizoaceae	<i>Ruschia centrocapsula</i>	LC	x					x
Aizoaceae	<i>Ruschia cradockensis</i>	LC	x				x	
Aizoaceae	<i>Ruschia</i> sp.	-	x				x	x
Aizoaceae	<i>Ruschia spinosa</i>	LC	x				x	
Aizoaceae	<i>Mesembryanthemum tortuosum</i>	LC	x		x		x	
Aizoaceae	<i>Tetragonia acanthocarpa</i>	LC	x				x	
Aizoaceae	<i>Tetragonia fruticosa</i>	LC	x					x
Aizoaceae	<i>Tetragonia haworthii</i>	LC	x					x
Aizoaceae	<i>Tetragonia microptera</i>	LC	x				x	x
Aizoaceae	<i>Tetragonia</i> spp.	-	x				x	
Aizoaceae	<i>Trichodiadema barbatum</i>	LC	x				x	x
Aizoaceae	<i>Trichodiadema decorum</i>	LC	x				x	x
Aizoaceae	<i>Trichodiadema pomeridianum</i>	LC	x				x	x
Amaranthaceae	<i>Amaranthus</i> spp.	-					x	
Amaranthaceae	<i>Atriplex lindleyi</i> subsp. <i>inflata</i>	NE					x	x
Amaranthaceae	<i>Atriplex nummularia</i> subsp. <i>nummularia</i>	NE					x	x
Amaranthaceae	<i>Atriplex semibaccata</i>	NE					x	x
Amaranthaceae	<i>Atriplex suberecta</i>	NE					x	x
Amaranthaceae	<i>Atriplex vestita</i>	LC					x	
Amaranthaceae	<i>Bassia salsoloides</i>	LC					x	
Amaranthaceae	<i>Chenopodium mucronatum</i>	LC						x
Amaranthaceae	<i>Chenopodium</i> sp.	-					x	
Amaranthaceae	<i>Salsola adisca</i>	LC						x
Amaranthaceae	<i>Salsola kali</i>	NE					x	x
Amaranthaceae	<i>Salsola</i> spp.	-					x	
Amaranthaceae	<i>Sericocoma avolans</i>	LC					x	
Amaryllidaceae	<i>Ammocharis coranica</i>	LC						x
Anacampserotaceae	<i>Anacampseros albidiflora</i>	LC	x	x	x		x	
Anacampserotaceae	<i>Anacampseros arachnoides</i>	LC	x	x	x			x
Anacampserotaceae	<i>Anacampseros filamentosa</i> subsp. <i>filamentosa</i>	LC	x	x	x			x
Anacampserotaceae	<i>Anacampseros papyracea</i>	LC	x	x	x		x	
Anacampserotaceae	<i>Anacampseros telephiastrum</i>	LC	x	x	x		x	
Anacampserotaceae	<i>Anacampseros ustulata</i>	LC	x	x	x		x	x
Anacardiaceae	<i>Schinus molle</i>	NE					x	x
Anacardiaceae	<i>Searsia burchellii</i>	LC					x	
Anacardiaceae	<i>Searsia lancea</i>	LC					x	
Anacardiaceae	<i>Searsia pallens</i>	LC					x	
Apiaceae	<i>Berula thunbergii</i>	LC						x
Apocynaceae	<i>Carissa haematocarpa</i>	LC					x	
Apocynaceae	<i>Ceropegia fimbriata</i>							x
Apocynaceae	<i>Cynanchum viminale</i>	LC						x
Apocynaceae	<i>Fockea comaru</i>	LC	x		x		x	
Apocynaceae	<i>Gomphocarpus filiformis</i>	LC	x					x
Apocynaceae	<i>Hoodia pilifera</i> subsp. <i>annulata</i>	LC	x		x		x	x
Apocynaceae	<i>Huernia barbata</i> subsp. <i>barbata</i>	LC	x		x			x
Apocynaceae	<i>Pachypodium succulentum</i>	LC	x		x		x	
Apocynaceae	<i>Piaranthus comptus</i>	LC	x		x			x
Apocynaceae	<i>Piaranthus geminatus</i> subsp. <i>geminatus</i>	LC	x		x			x
Apocynaceae	<i>Stapelia engleriana</i>	DD	x		x			x
Apocynaceae	<i>Stapeliopsis pillansii</i>	LC	x		x			x
Asparagaceae	<i>Asparagus aethiopicus</i>	LC					x	x
Asparagaceae	<i>Asparagus burchellii</i>	LC					x	
Asparagaceae	<i>Asparagus capensis</i> var. <i>capensis</i>	LC					x	x
Asparagaceae	<i>Asparagus exuvialis</i> forma <i>exuvialis</i>	NE						x
Asparagaceae	<i>Asparagus mucronatus</i>	LC					x	
Asparagaceae	<i>Asparagus recurvispinus</i>	LC						x
Asparagaceae	<i>Asparagus retrofractus</i>	LC					x	
Asparagaceae	<i>Asparagus striatus</i>	LC					x	
Asparagaceae	<i>Asparagus suaveolens</i>	LC						x
Asphodelaceae	<i>Aloe claviflora</i>	LC					x	
Asphodelaceae	<i>Astroloba foliolosa</i>	LC			x		x	
Asphodelaceae	<i>Bulbine frutescens</i>	LC					x	x

Asphodelaceae	<i>Bulbine triebneri</i>	LC				x	
Asphodelaceae	<i>Gonialoe variegata</i>	LC	x			x	x
Asphodelaceae	<i>Haworthiopsis nigra</i> var. <i>nigra</i>	NE	x		x	x	x
Asphodelaceae	<i>Trachyandra karrooica</i>	LC					x
Asphodelaceae	<i>Trachyandra</i> sp.	-				x	
Asteraceae	<i>Amellus strigosus</i> subsp. <i>strigosus</i>	LC					x
Asteraceae	<i>Amphiglossa</i> sp.	-				x	
Asteraceae	<i>Amphiglossa triflora</i>	LC				x	x
Asteraceae	<i>Arctotis argentea</i>	LC				x	
Asteraceae	<i>Arctotis dregei</i>	LC					x
Asteraceae	<i>Arctotis leiocarpa</i>	LC				x	
Asteraceae	<i>Arctotis venusta</i>	LC					x
Asteraceae	<i>Athanasia minuta</i>	LC				x	
Asteraceae	<i>Berkheya spinosa</i>	LC					x
Asteraceae	<i>Chrysocoma ciliata</i>	LC				x	x
Asteraceae	<i>Cotula coronopifolia</i>	LC					x
Asteraceae	<i>Crassothonna protecta</i>	LC					x
Asteraceae	<i>Crassothonna sedifolia</i>	LC				x	
Asteraceae	<i>Curio radicans</i>	LC				x	x
Asteraceae	<i>Curio rowleyanus</i>	DD				x	x
Asteraceae	<i>Cuspidia cernua</i> subsp. <i>annua</i>	LC				x	x
Asteraceae	<i>Dicoma capensis</i>	LC				x	
Asteraceae	<i>Eriocephalus brevifolius</i>	LC				x	
Asteraceae	<i>Eriocephalus ericoides</i>	LC				x	
Asteraceae	<i>Eriocephalus decussatus</i>	LC				x	
Asteraceae	<i>Eriocephalus spinescens</i>	LC				x	x
Asteraceae	<i>Euryops imbricatus</i>	LC					x
Asteraceae	<i>Felicia fascicularis</i>	LC					x
Asteraceae	<i>Felicia filifolia</i>	LC				x	
Asteraceae	<i>Felicia muricata</i> subsp. <i>muricata</i>	LC				x	x
Asteraceae	<i>Felicia</i> sp.	-				x	
Asteraceae	<i>Garuleum bipinnatum</i>	LC				x	
Asteraceae	<i>Gazania heterochaeta</i>	LC				x	
Asteraceae	<i>Gazania krebsiana</i> subsp. <i>arctotoides</i>	LC					x
Asteraceae	<i>Gazania krebsiana</i> subsp. <i>krebsiana</i>	LC				x	x
Asteraceae	<i>Geigeria filifolia</i>	LC					x
Asteraceae	<i>Gorteria alienata</i>	LC				x	x
Asteraceae	<i>Helichrysum asperum</i> var. <i>albidulum</i>	LC					x
Asteraceae	<i>Helichrysum leontonyx</i>	LC				x	
Asteraceae	<i>Helichrysum lucilioides</i>	LC				x	
Asteraceae	<i>Helichrysum pumilio</i>	LC				x	
Asteraceae	<i>Helichrysum rutilans</i>	LC					x
Asteraceae	<i>Helichrysum simulans</i>	LC					x
Asteraceae	<i>Helichrysum zeyheri</i>	LC				x	
Asteraceae	<i>Iflaga glomerata</i>	LC					x
Asteraceae	<i>Kleinia longiflora</i>	LC				x	
Asteraceae	<i>Lasiopogon glomerulatus</i>	LC					x
Asteraceae	<i>Lasiopogon muscoides</i>	LC				x	
Asteraceae	<i>Leysera tenella</i>	LC				x	x
Asteraceae	<i>Maclodium spinosum</i>	LC					x
Asteraceae	<i>Oedera humilis</i>	LC				x	x
Asteraceae	<i>Oedera oppositifolia</i>	LC				x	
Asteraceae	<i>Oncosiphon piluliferus</i>	LC					x
Asteraceae	<i>Osteospermum acanthospermum</i>	LC				x	
Asteraceae	<i>Osteospermum calendulaceum</i>	LC					x
Asteraceae	<i>Osteospermum microphyllum</i>	LC					x
Asteraceae	<i>Osteospermum scariosum</i> var. <i>scariosum</i>	NE				x	x
Asteraceae	<i>Osteospermum sinuatum</i> var. <i>sinuatum</i>	LC				x	x
Asteraceae	<i>Osteospermum</i> sp.	-				x	
Asteraceae	<i>Osteospermum spinescens</i>	LC				x	
Asteraceae	<i>Pegolettia retrofracta</i>	LC				x	
Asteraceae	<i>Pentzia incana</i>	LC				x	x
Asteraceae	<i>Pentzia quinquefida</i>	LC				x	
Asteraceae	<i>Pentzia sphaerocephala</i>	LC				x	
Asteraceae	<i>Phymaspermum parvifolium</i>	LC					x
Asteraceae	<i>Pteronia adenocarpa</i>	LC				x	x
Asteraceae	<i>Pteronia ciliata</i>	LC				x	
Asteraceae	<i>Pteronia empetrifolia</i>	LC				x	x
Asteraceae	<i>Pteronia glauca</i>	LC				x	x
Asteraceae	<i>Pteronia glomerata</i>	LC					x



Asteraceae	<i>Pteronia paniculata</i>	LC				x	
Asteraceae	<i>Pteronia sordida</i>	LC				x	
Asteraceae	<i>Pteronia staezelinoides</i>	LC				x	
Asteraceae	<i>Pteronia tricephala</i>	LC				x	
Asteraceae	<i>Pteronia viscosa</i>	LC				x	x
Asteraceae	<i>Senecio acaulis</i>	LC				x	
Asteraceae	<i>Senecio acutifolius</i>	LC					x
Asteraceae	<i>Senecio angustifolius</i>	LC					x
Asteraceae	<i>Senecio</i> sp.	-				x	
Asteraceae	<i>Seriphium plumosum</i>	-					x
Asteraceae	<i>Sonchus</i> sp.	-				x	
Asteraceae	<i>Tagetes minuta</i>	NE			X	x	
Asteraceae	<i>Ursinia nana</i> subsp. <i>nana</i>	LC				x	x
Bignoniaceae	<i>Rhigozum obovatum</i>	LC				x	
Brassicaceae	<i>Cardamine africana</i>	LC					x
Brassicaceae	<i>Heliophila crithmifolia</i>	LC					x
Brassicaceae	<i>Lepidium africanum</i> subsp. <i>africanum</i>	LC				x	x
Brassicaceae	<i>Lepidium africanum</i> subsp. <i>divaricatum</i>	LC					x
Brassicaceae	<i>Lepidium desertorum</i>	LC					x
Brassicaceae	<i>Lepidium englerianum</i>	LC					x
Brassicaceae	<i>Sisymbrium capense</i>	LC					x
Cactaceae	<i>Cylindropuntia pallida</i>	NE		1b			x
Cactaceae	<i>Opuntia aurantiaca</i>	NE		1b		x	
Cactaceae	<i>Opuntia ficus-indica</i>	NE		1b		x	
Capparaceae	<i>Cadaba aphylla</i>	LC				x	
Caryophyllaceae	<i>Dianthus micropetalus</i>	LC				x	
Celastraceae	<i>Gymnosporia buxifolia</i>	LC					x
Celastraceae	<i>Gymnosporia linearis</i> subsp. <i>linearis</i>	LC					x
Celastraceae	<i>Gymnosporia szyszyłowiczii</i>	LC				x	
Convolvulaceae	<i>Convolvulus sagittatus</i>	LC					x
Crassulaceae	<i>Adromischus filicaulis</i>	LC		x			x
Crassulaceae	<i>Adromischus filicaulis</i> subsp. <i>marlothii</i>	LC		x			x
Crassulaceae	<i>Adromischus liebenbergii</i>	LC		x			x
Crassulaceae	<i>Adromischus</i> sp.	-				x	
Crassulaceae	<i>Adromischus triflorus</i>	LC		x		x	x
Crassulaceae	<i>Crassula capitella</i>	LC				x	
Crassulaceae	<i>Crassula corallina</i> subsp. <i>corallina</i>	LC				x	x
Crassulaceae	<i>Crassula deltoidea</i>	LC				x	
Crassulaceae	<i>Crassula hemisphaerica</i>	LC		x		x	
Crassulaceae	<i>Crassula muscosa</i>	LC				x	
Crassulaceae	<i>Crassula pyramidalis</i>	LC	x	x		x	
Crassulaceae	<i>Crassula subaphylla</i>	LC				x	
Cucurbitaceae	<i>Cucumis africanus</i>	LC					x
Cyperaceae	<i>Afroscirpoides dioecus</i>	LC				x	
Cyperaceae	<i>Cyperus</i> sp.	-				x	
Cyperaceae	<i>Fuirena</i> sp.	-				x	
Cyperaceae	<i>Pseudoschoenus inanis</i>	LC				x	
Cyperaceae	<i>Schoenoplectus decipiens</i>	LC					x
Ebenaceae	<i>Diospyros lycioides</i> subsp. <i>lycioides</i>	LC				x	x
Ebenaceae	<i>Euclea undulata</i>	LC				x	x
Ericaceae	<i>Erica bolusanthus</i>	LC					x
Euphorbiaceae	<i>Euphorbia decepta</i>	LC	x	x		x	
Euphorbiaceae	<i>Euphorbia ferox</i>	LC	x	x			x
Euphorbiaceae	<i>Euphorbia mauritanica</i>	LC	x	x		x	x
Euphorbiaceae	<i>Euphorbia pillansii</i>	LC	x	x			x
Euphorbiaceae	<i>Euphorbia stellispina</i>	LC	x	x		x	
Euphorbiaceae	<i>Euphorbia suffulta</i>	LC	x	x		x	x
Fabaceae	<i>Acacia podalyriifolia</i>	NE			x		x
Fabaceae	<i>Indigofera sessilifolia</i>	LC					x
Fabaceae	<i>Lessertia annularis</i>	LC					x
Fabaceae	<i>Lessertia fruticosa</i>	-				x	
Fabaceae	<i>Lessertia</i> sp.	-				x	
Fabaceae	<i>Lotononis pungens</i>	LC					x
Fabaceae	<i>Lotononis</i> sp.	-				x	
Fabaceae	<i>Medicago laciniata</i> var. <i>laciniata</i>	NE					x
Fabaceae	<i>Melolobium canescens</i>	LC					x
Fabaceae	<i>Melolobium</i> cf. <i>microphyllum</i>	LC				x	
Fabaceae	<i>Prosopis glandulosa</i> var. <i>glandulosa</i>	NE			1b		x
Fabaceae	<i>Psoralea aphylla</i>	LC					x
Fabaceae	<i>Vachellia karroo</i>	LC				x	

Gentianaceae	<i>Sebaea</i> sp.	-				x	
Geraniaceae	<i>Erodium cicutarium</i>	NE			x	x	x
Geraniaceae	<i>Monsonia camdeboensis</i>	LC				x	x
Geraniaceae	<i>Monsonia crassicaule</i>	LC				x	
Geraniaceae	<i>Monsonia salmoniflora</i>	LC					x
Geraniaceae	<i>Pelargonium carnosum</i> subsp. <i>carnosum</i>	LC		x		x	x
Geraniaceae	<i>Pelargonium laxum</i>	LC		x		x	
Geraniaceae	<i>Pelargonium malacoides</i>	LC		x			x
Hyacinthaceae	<i>Albuca canadensis</i>	LC					x
Hyacinthaceae	<i>Albuca exuviata</i>	LC					x
Hyacinthaceae	<i>Albuca maxima</i>	LC				x	
Hyacinthaceae	<i>Albuca secunda</i>	LC					x
Hyacinthaceae	<i>Albuca</i> sp.	-				x	
Hyacinthaceae	<i>Albuca unifolia</i>	LC					x
Hyacinthaceae	<i>Dipcadi</i> sp.	-				x	
Hyacinthaceae	<i>Drimia anomala</i>	LC					x
Hyacinthaceae	<i>Drimia intricata</i>	LC				x	
Hyacinthaceae	<i>Drimia physodes</i>	LC					x
Hyacinthaceae	<i>Drimia</i> sp.	-				x	
Hyacinthaceae	<i>Drimia toxicaria</i>	LC					x
Hyacinthaceae	<i>Lachenalia aurioliae</i>	LC		x			x
Hyacinthaceae	<i>Lachenalia bowkeri</i>	LC		x			x
Hyacinthaceae	<i>Lachenalia</i> sp.	-					x
Hyacinthaceae	<i>Ledebouria</i> sp.	-				x	
Hyacinthaceae	<i>Ornithogalum</i> sp.	-				x	
Iridaceae	<i>Babiana sambucina</i> subsp. <i>sambucina</i>	LC	x	x			x
Iridaceae	<i>Ixia orientalis</i>	LC	x	x			x
Iridaceae	<i>Moraea</i> sp.	-	x			x	
Iridaceae	<i>Romulea fibrosa</i>	LC	x	x			x
Iridaceae	<i>Tritonia florentiae</i>	LC	x	x			x
Iridaceae	<i>Tritonia tugwelliae</i>	LC	x	x			x
Kewaceae	<i>Kewa bowkeriana</i>	LC					x
Kewaceae	<i>Kewa salsoloides</i>	LC				x	
Lamiaceae	<i>Salvia verbenaca</i>	LC					x
Limeaceae	<i>Limeum aethiopicum</i> var. <i>aethiopicum</i>	NE				x	x
Loranthaceae	<i>Moquiniella rubra</i>	LC					x
Malvaceae	<i>Grewia robusta</i>	LC				x	x
Malvaceae	<i>Hermannia burkei</i>	LC					x
Malvaceae	<i>Hermannia coccocarpa</i>	LC				x	x
Malvaceae	<i>Hermannia comosa</i>	LC				x	
Malvaceae	<i>Hermannia cuneifolia</i> var. <i>cuneifolia</i>	LC				x	x
Malvaceae	<i>Hermannia cuneifolia</i> var. <i>glabrescens</i>	LC					x
Malvaceae	<i>Hermannia desertorum</i>	LC				x	x
Malvaceae	<i>Hermannia grandiflora</i>	LC				x	x
Malvaceae	<i>Hermannia jacobaeifolia</i>	LC					x
Malvaceae	<i>Hermannia linearifolia</i>	LC				x	x
Malvaceae	<i>Hermannia</i> sp.	-				x	
Malvaceae	<i>Hermannia spinosa</i>	LC				x	
Malvaceae	<i>Hermannia vestita</i>	LC				x	
Malvaceae	<i>Hibiscus pusillus</i>	LC					x
Malvaceae	<i>Malva parviflora</i> var. <i>parviflora</i>	NE			x	x	x
Malvaceae	<i>Radyera urens</i>	LC					x
Meliantaceae	<i>Melianthus comosus</i>	LC				x	x
Molluginaceae	<i>Pharnaceum</i> sp.	-				x	
Papaveraceae	<i>Argemone ochroleuca</i>	NE			x	x	
Pedaliaceae	<i>Sesamum capense</i>	LC				x	
Plantaginaceae	<i>Plantago cafra</i>	LC					x
Poaceae	<i>Aristida adscensionis</i>	LC				x	
Poaceae	<i>Aristida congesta</i> subsp. <i>congesta</i>	LC				x	x
Poaceae	<i>Aristida diffusa</i>	LC				x	
Poaceae	<i>Bromus pectinatus</i>	LC				x	x
Poaceae	<i>Cenchrus ciliaris</i>	LC				x	
Poaceae	<i>Chloris virgata</i>	LC				x	
Poaceae	<i>Cynodon incompletus</i>	LC				x	
Poaceae	<i>Digitaria argyrograpta</i>	LC				x	x
Poaceae	<i>Digitaria eriantha</i>	LC				x	
Poaceae	<i>Ehrharta</i> sp.	-				x	
Poaceae	<i>Enneapogon cenchroides</i>	LC				x	
Poaceae	<i>Enneapogon desvauxii</i>	LC				x	x
Poaceae	<i>Eragrostis curvula</i>	LC					x

Poaceae	<i>Eragrostis homomalla</i>	LC		x
Poaceae	<i>Eragrostis obtusa</i>	LC	x	
Poaceae	<i>Eragrostis procumbens</i>	LC		x
Poaceae	<i>Eragrostis rotifer</i>	LC	x	
Poaceae	<i>Eragrostis</i> sp.	-	x	
Poaceae	<i>Fingerhuthia africana</i>	LC	x	x
Poaceae	<i>Hordeum murinum</i> subsp. <i>leporinum</i>	NE	x	x
Poaceae	<i>Leptochloa fusca</i>	LC	x	
Poaceae	<i>Melica decumbens</i>	LC	x	
Poaceae	<i>Oropetium capense</i>	LC	x	
Poaceae	<i>Pentameris</i> cf. <i>airoides</i>	LC	x	
Poaceae	<i>Polypogon monspeliensis</i>	NE	x	x
Poaceae	<i>Schismus barbatus</i>	LC		x
Poaceae	<i>Setaria verticillata</i>	LC	x	
Poaceae	<i>Sporobolus fimbriatus</i>	LC	x	
Poaceae	<i>Sporobolus ioclados</i>	LC	x	x
Poaceae	<i>Sporobolus</i> sp.	-	x	
Poaceae	<i>Stipagrostis ciliata</i>	LC	x	
Poaceae	<i>Stipagrostis namaquensis</i>	LC	x	x
Poaceae	<i>Stipagrostis obtusa</i>	LC	x	x
Poaceae	<i>Stipagrostis uniplumis</i>	LC	x	
Poaceae	<i>Tragus berteronianus</i>	LC	x	x
Poaceae	<i>Tragus koelerioides</i>	LC	x	x
Poaceae	<i>Tragus racemosus</i>	LC		x
Polygalaceae	<i>Polygala myrtifolia</i> var. <i>myrtifolia</i>	LC		x
Polygonaceae	<i>Emex australis</i>	LC	x	x
Polygonaceae	<i>Persicaria lapathifolia</i>	LC		x
Restionaceae	<i>Elegia filacea</i>	LC		x
Restionaceae	<i>Thamnochortus cinereus</i>	LC		x
Rosaceae	<i>Cliffortia</i> sp.	-		x
Rubiaceae	<i>Kohautia cynanchica</i>	LC		x
Rubiaceae	<i>Nenax microphylla</i>	LC	x	
Salicaceae	<i>Dovyalis caffra</i>	LC		x
Santalaceae	<i>Thesium lacinulatum</i>	LC		x
Santalaceae	<i>Viscum rotundifolium</i>	LC	x	x
Scrophulariaceae	<i>Aptosimum indivisum</i>	LC	x	x
Scrophulariaceae	<i>Chaenostoma archeri</i>	LC		x
Scrophulariaceae	<i>Chaenostoma halimifolium</i>	LC		x
Scrophulariaceae	<i>Diascia decipiens</i>	LC		x
Scrophulariaceae	<i>Diascia runcinata</i>	LC		x
Scrophulariaceae	<i>Jamesbrittenia atropurpurea</i> subsp. <i>atropurpurea</i>	LC		x
Scrophulariaceae	<i>Jamesbrittenia</i> sp.	-	x	
Scrophulariaceae	<i>Jamesbrittenia tenuifolia</i>	LC		x
Scrophulariaceae	<i>Jamesbrittenia tortuosa</i>	LC		x
Scrophulariaceae	<i>Limosella africana</i> var. <i>africana</i>	LC		x
Scrophulariaceae	<i>Lyperia tristis</i>	LC		x
Scrophulariaceae	<i>Manulea chrysantha</i>	LC		x
Scrophulariaceae	<i>Manulea</i> sp.	-	x	
Scrophulariaceae	<i>Nemesia linearis</i>	LC		x
Scrophulariaceae	<i>Nemesia</i> sp.	-	x	
Scrophulariaceae	<i>Peliostomum leucorrhizum</i>	LC	x	x
Scrophulariaceae	<i>Selago divaricata</i>	LC		x
Scrophulariaceae	<i>Selago</i> sp.	-	x	
Scrophulariaceae	<i>Zaluzianskya venusta</i>	LC		x
Solanaceae	<i>Datura ferox</i>	NE	1b	x
Solanaceae	<i>Lycium cinereum</i>	LC		x
Solanaceae	<i>Lycium horridum</i>	LC		x
Solanaceae	<i>Lycium oxycarpum</i>	LC	x	
Solanaceae	<i>Lycium pumilum</i>	LC		x
Solanaceae	<i>Solanum giftbergense</i>	LC	x	
Solanaceae	<i>Solanum</i> sp.	-	x	
Thesiaceae	<i>Lacomucinaea lineatum</i>	LC	x	
Thymelaeaceae	<i>Gnidia deserticola</i>	LC	x	
Thymelaeaceae	<i>Lasiosiphon deserticola</i>	LC		x
Urticaceae	<i>Forsskaolea candida</i>	LC		x
Zygophyllaceae	<i>Augea capensis</i>	LC		x
Zygophyllaceae	<i>Roepera incrustata</i>	LC		x
Zygophyllaceae	<i>Roepera lichtensteiniana</i>	LC		x
Zygophyllaceae	<i>Roepera microphyllum</i>	LC		x
Zygophyllaceae	<i>Roepera sessilifolia</i>	LC		x

Zygophyllaceae	<i>Tetraena chrysopteron</i>	LC	x	x
Zygophyllaceae	<i>Tetraena lichtensteiniana</i>	LC	x	
Zygophyllaceae	<i>Tetraena rigida</i>	LC	x	

## APPENDIX C

# ANIMAL SPECIES CHECKLISTS (ADU DATABASE)

Database: 3222 CB, CD, DA, DB, DC, DD; 3322 AB, BA, BB

IUCN red list category

Western Cape Nature and Environmental Conservation Ordinance (WCNECO)

CITES

NEMBA (ToPS) - Threatened or Protected Species

Family	Scientific name	Common name	IUCN RSA	WCNCO Sch2	CITES (ToPS)
<b>MAMMALS</b>					
ORDER: ARTIODACTYLA					
Bovidae	<i>Antidorcas marsupialis</i>	Springbok	LC	x	
Bovidae	<i>Kobus ellipsiprymnus</i>	Waterbuck	LC	x	
Bovidae	<i>Oreotragus oreotragus</i>	Klipspringer	LC	x	
Bovidae	<i>Raphicerus campestris</i>	Steenbok	LC	x	
Bovidae	<i>Raphicerus melanotis</i>	Cape grysbok	LC	x	
Bovidae	<i>Taurotragus oryx</i>	Cape eland	LC	x	
ORDER: CARNIVORA (CARNIVORES)					
Canidae	<i>Vulpes chama</i>	Cape fox	LC	x	x
Hyaenidae	<i>Proteles cristata</i>	Aardwolf	LC	x	
Viverridae	<i>Genetta genetta</i>	Small-spotted genet	LC		
ORDER: PRIMATES					
Cercopithecidae	<i>Papio ursinus</i>	Chacma baboon	LC		
ORDER: RODENTIA (RODENTS)					
Hystricidae	<i>Hystrix africaeaustralis</i>	Cape porcupine	LC		
Muridae	<i>Desmodillus auricularis</i>	Cape short-tailed gerbil	LC		
Muridae	<i>Otomys unisulcatus</i>	Karoo bush rat	LC		
Muridae	<i>Parotomys brantsii</i>	Brants's whistling rat	LC		
Muridae	<i>Parotomys littledalei</i>	Littledale's whistling rat	NT		
ORDER: TUBULIDENTATA					
Orycteropodidae	<i>Orycteropus afer</i>	Aardvark	LC	x	
ORDER: HYRACOIDEA (HYRAXES)					

Procaviidae	<i>Procavia capensis</i>	Rock hyrax	LC		
ORDER: LAGOMORPHA (HARES AND RABBITS)					
Leporidae	<i>Lepus saxatilis</i>	Scrub hare	LC		
ORDER: MACROSCELIDAE (ELEPHANT SHREWS)					
Macroscelididae	<i>Elephantulus edwardii</i>	Cape elephant shrew	LC		
ORDER: EULIPOTYPHIA (SHREWS)					
Soricidae	<i>Myosorex varius</i>	Forest shrew	LC		
<b>REPTILES</b>					
ORDER: SQUAMATA					
SUB-ORDER: LACERTILIA (LIZARDS)					
Agamidae	<i>Agama aculeata aculeata</i>	Common ground agama	LC	x	
Agamidae	<i>Agama atra</i>	Southern rock agama	LC	x	
Chamaeleonidae	<i>Chamaeleo namaquensis</i>	Namaqua chameleon	LC	x	
Cordylidae	<i>Cordylus aridus</i>	Eastern dwarf girdled lizard	LC	x	
Cordylidae	<i>Karusasaurus polyzonus</i>	Karoo girdled lizard	LC	x	
Gekkonidae	<i>Chondrodactylus angulifer angulifer</i>	Common giant ground gecko	LC	x	
Gekkonidae	<i>Chondrodactylus bibronii</i>	Bibron's gecko	LC	x	
Gekkonidae	<i>Pachydactylus capensis</i>	Cape gecko	LC	x	
Gekkonidae	<i>Pachydactylus geitje</i>	Ocellated gecko	LC	x	
Gekkonidae	<i>Pachydactylus maculatus</i>	Spotted gecko	LC	x	
Gekkonidae	<i>Pachydactylus mariquensis</i>	Marico gecko	LC	x	
Gekkonidae	<i>Pachydactylus purcelli</i>	Purcell's gecko	LC	x	
Gekkonidae	<i>Ptenopus garrulus maculatus</i>	Spotted barking gecko	LC	x	
Lacertidae	<i>Meroles suborbitalis</i>	Spotted desert lizard	LC	x	
Lacertidae	<i>Nucras livida</i>	Karoo sandveld lizard	LC	x	
Lacertidae	<i>Pedioplanis laticeps</i>	Karoo sand lizard	LC	x	
Lacertidae	<i>Pedioplanis lineoocellata pulchella</i>	Common sand lizard	LC	x	
Lacertidae	<i>Pedioplanis namaquensis</i>	Namaqua sand lizard	LC	x	
Scincidae	<i>Trachylepis capensis</i>	Cape skink	LC	x	
Scincidae	<i>Trachylepis occidentalis</i>	Western three-striped skink	LC	x	
Scincidae	<i>Trachylepis sulcata sulcata</i>	Western rock skink	LC	x	
Scincidae	<i>Trachylepis variegata</i>	Variegated skink	LC	x	
SUB-ORDER: SERPENTES (SNAKES)					
Elapidae	<i>Aspidelaps lubricus lubricus</i>	Coral shield cobra	LC		
Elapidae	<i>Naja nivea</i>	Cape cobra	LC		
Lamprophiidae	<i>Psammophis notostictus</i>	Karoo sand snake	LC		
Viperidae	<i>Bitis arietans arietans</i>	Puff adder	LC		
ORDER: TESTUDINATA (CHELONIANS)					
Testudinidae	<i>Chersina angulata</i>	Angulate tortoise	LC	x	App II
Testudinidae	<i>Chersobius boulengeri</i>	Karoo padloper/Karoo dwarf tortoise	EN	x	App II
Testudinidae	<i>Psammobates tentorius tentorius</i>	Karoo tent tortoise	-	x	App II
Testudinidae	<i>Psammobates tentorius verroxii</i>	Verrox's tent tortoise	-	x	App II
Testudinidae	<i>Stigmochelys pardalis</i>	Leopard tortoise	LC	x	App II
Pelomedusidae	<i>Pelomedusa galeata</i>	SA helmeted terrapin	NE		
<b>Frogs</b>					
Bufoidea	<i>Vandijkophrynus garipeensis</i>	Karoo toad	LC	x	
Pipidae	<i>Xenopus laevis</i>	Common platanna	LC	x	
Pyxicephalidae	<i>Amietia fuscigula</i>	Cape river frog	LC	x	
Pyxicephalidae	<i>Cacosternum boettgeri</i>	Common caco	LC	x	
Pyxicephalidae	<i>Pyxicephalus adspersus</i>	Giant bull frog	NT	x	x
Pyxicephalidae	<i>Tomopterna delalandii</i>	Cape sand frog	LC	x	
<b>Dung beetles</b>					
Scarabaeidae	<i>Digitonthophagus gazella</i>				
Scarabaeidae	<i>Epirinus aeneus</i>				
Scarabaeidae	<i>Epirinus striatus</i>				
Scarabaeidae	<i>Euonthophagus vicarius</i>				
Scarabaeidae	<i>Gymnopleurus humanus</i>				
Scarabaeidae	<i>Onthophagus albipennis</i>				
Scarabaeidae	<i>Onthophagus cameloides</i>				
Scarabaeidae	<i>Onthophagus peringueyi</i>				

Scarabaeidae	<i>Phalops rufosignatus</i>		
Scarabaeidae	<i>Scarabaeus sp.</i>		
Scarabaeidae	<i>Scarabaeus (Sceliages) gagates</i>		
Scarabaeidae	<i>Scarabaeus bohemani</i>		
Scarabaeidae	<i>Scarabaeus kalaharicus</i>		
Scarabaeidae	<i>Scarabaeus karrooensis</i>		
Scarabaeidae	<i>Scarabaeus megaparvulus</i>		
Scarabaeidae	<i>Scarabaeus satyrus</i>		
Scarabaeidae	<i>Scarabaeus viator</i>		
<b>Lepidoptera</b>			
Geometridae	<i>Acanthovalva focularia</i>		LC
Hesperiidae	<i>Spialia asterodia</i>	Star sandman	LC
Hesperiidae	<i>Spialia nanus</i>	Dwarf sandman	LC
Hesperiidae	<i>Tsitana tulbagha kaplani</i>	Tulbagh sylph	LC
Lycaenidae	<i>Aloeides damarensis damarensis</i>	Damara russet	LC
Lycaenidae	<i>Aloeides depicta</i>	Depicta russet	LC
Lycaenidae	<i>Aloeides pierus</i>	Veined russet	LC
Lycaenidae	<i>Aloeides vansoni</i>	Roggeveld russet	LC
Lycaenidae	<i>Anthene definita definita</i>	Steel-blue-ciliate blue	LC
Lycaenidae	<i>Argyraspodes argyraspis</i>	Warrior silver-spotted copper	LC
Lycaenidae	<i>Azanius ubaldus</i>	Velvet-spotted babul blue	LC
Lycaenidae	<i>Brephidium metophis</i>	Tinktinkie pygmy blue	LC
Lycaenidae	<i>Cacyreus dicksoni</i>	Karoo geranium bronze	LC
Lycaenidae	<i>Chrysoritis chrysaor</i>	Burnished opal	LC
Lycaenidae	<i>Chrysoritis midas</i>	Midas opal	LC
Lycaenidae	<i>Chrysoritis pan lysander</i>	Lysander opal	LC
Lycaenidae	<i>Chrysoritis turneri turneri</i>	Karoo opal	LC
Lycaenidae	<i>Crudaria leroma</i>	Silver-spotted grey	LC
Lycaenidae	<i>Iolais mimosae mimosae</i>	Mimosa sapphire	LC
Lycaenidae	<i>Lepidochrysops australis</i>	Southern giant cupid	LC
Lycaenidae	<i>Lepidochrysops ketsi ketsi</i>	Ketsi giant cupid	LC
Lycaenidae	<i>Lepidochrysops ortygia</i>	Koppie giant cupid	LC
Lycaenidae	<i>Lepidochrysops robertsoni</i>	Robertson's giant cupid	LC
Lycaenidae	<i>Leptomyrina lara</i>	Cape black-eye	LC
Lycaenidae	<i>Leptotes brevidentatus</i>	Short-toothed zebra blue	LC
Lycaenidae	<i>Phasis clavum clavum</i>	Namaqua arrowhead	LC
Lycaenidae	<i>Stugeta bowkeri bowkeri</i>	Bowker's marbled sapphire	LC
Lycaenidae	<i>Thestor brachycerus dukei</i>	Duke's skolly	LC
Lycaenidae	<i>Trimenia argyroplaga argyroplaga</i>	Large silver-spotted copper	LC
Lycaenidae	<i>Tylopaedia sardonix sardonix</i>	King copper	LC
Noctuidae	<i>Helicoverpa armigera</i>		
Nymphalidae	<i>Charaxes pelias</i>	Protea charaxes	LC
Nymphalidae	<i>Danaus chrysippus orientis</i>	African plain tiger	LC
Nymphalidae	<i>Pseudonympha trimenii trimenii</i>	White-netted brown	LC
Nymphalidae	<i>Stygionympha irrorata</i>	Karoo hillside brown	LC
Nymphalidae	<i>Tarsocera fulvina</i>	Karoo spring widow	LC
Nymphalidae	<i>Vanessa cardui</i>	Painted lady	LC
Pieridae	<i>Belenois aurota</i>	Pioneer caper white	LC
Pieridae	<i>Pontia helice helice</i>	Southern meadow white	LC
Saturniidae	<i>Imbrasia tyrrhea</i>		
Spingidae	<i>Agrius convolvuli</i>		
<b>Odonata</b>			
Libellulidae	<i>Sympetrum fonscolombii</i>	Red-veined Darter or Nomad	LC
<b>Scorpions</b>			
Buthidae	<i>Parabuthus schlechteri</i>		
Buthidae	<i>Uroplectes gracilior</i>		
Hormuridae	<i>Hadogenes trichiurus</i>		
Scorpionidae	<i>Opisthophthalmus karrooensis</i>		
<b>Spiders</b>			
Theraphosidae	<i>Harpactira namaquensis</i>	Baboon spider	

# APPENDIX D

## *Curriculum vitae*: DR NOEL VAN ROOYEN

### 1. Biographical information

Surname	<b>Van Rooyen</b>
First names	<b>Noel</b>
ID number	<b>501225 5034 084</b>
Citizenship	<b>South African</b>
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e-mail	<a href="mailto:noel@ekotrust.co.za">noel@ekotrust.co.za</a>
Current position	<b>Member of Ekotrust cc</b>
Professional registration	<b>Botanical Scientist : Pr.Sci.Nat; Reg no. 401430/83</b>

Academic qualifications include BSc (Agric), BSc (Honours), MSc (1978) and DSc degrees (1984) in Plant Ecology at the University of Pretoria, South Africa. Until 1999 I was Professor in Plant Ecology at the University of Pretoria and at present I am a member of Ekotrust cc.

### 2. Publications

I am the author/co-author of 128 peer reviewed research publications in national and international scientific journals and was supervisor or co-supervisor of 9 PhD and 33 MSc students. More than 350 projects were undertaken by Ekotrust cc as consultant over a period of more than 40 years.

#### Books

VAN ROOYEN, N. 2001. *Flowering plants of the Kalahari dunes*. Ekotrust CC, Pretoria. (In collaboration with H. Bezuidenhout & E. de Kock).

VAN ROOYEN, N. & VAN ROOYEN, M.W. 2019. *Flowering plants of the southern Kalahari*. Somerset West.

Author / co-author of various chapters on the Savanna and Grassland Biomes in:

LOW, B. & REBELO, A.R. 1996. *Vegetation types of South Africa, Lesotho and Swaziland*, Department of Environmental Affairs and Tourism, Pretoria.

KNOBEL, J. (Ed.) 1999, 2006. *The Magnificent Natural Heritage of South Africa*. (Chapters on the Kalahari and Lowveld).

VAN DER WALT, P.T. 2010. *Bushveld*. Briza, Pretoria. (Chapter on Sour Bushveld).

Contributed to chapters on vegetation, habitat evaluation and veld management in the book:

BOTHMA, J. du P. & DU TOIT, J.G. (Eds). 2016. *Game Ranch Management*. 5th edition. Van Schaik, Pretoria.

Co-editor of the book:

BOTHMA, J. du P. & VAN ROOYEN, N. (eds). 2005. *Intensive wildlife production in southern Africa*. Van Schaik, Pretoria.

### 3. Ekotruster CC: Core Services

Ekotruster CC specializes in vegetation surveys, classification and mapping, wildlife management, wildlife production and economic assessments, vegetation ecology, veld condition assessment, carrying capacity, biodiversity assessments, rare species assessments, carbon pool assessments and alien plant management.

### 4. Examples of projects previously undertaken

Numerous vegetation surveys and vegetation impact assessments for Baseline, Scoping and Environmental Impact Assessments (BAs & EIA's) were made both locally and internationally.

Numerous projects have been undertaken in game ranches and conservation areas covering aspects such as vegetation surveys, range condition assessments and wildlife management. Of note is the Kgalagadi Transfrontier Park; iSimangaliso Wetland Park, Ithala Game Reserve, Phinda Private Game Reserve, Mabula Game Reserve, Tswalu Kalahari Desert Reserve, Maremani Nature Reserve and Associate Private Nature Reserve (previously Timbavati, Klaserie & Umbabat Private Game Reserve).

Involvement in various research programmes: vegetation of the northern Kruger National Park, Savanna Ecosystem Project at Nylsvley, Limpopo; Kuiseb River Project (Namibia); Grassland Biome Project; Namaqualand and Kruger Park Rivers Ecosystem research programme.

### 5. Selected references of other projects done by Ekotruster CC

- VAN ROOYEN, N., THERON, G.K., BREDENKAMP, G.J., VAN ROOYEN, M.W., DEUTSCHLÄNDER, M. & STEYN, H.M. 1996. *Phytosociology, vegetation dynamics and conservation of the southern Kalahari*. Final report: Department of Environmental Affairs & Tourism, Pretoria.
- VAN ROOYEN, N. 1999 & 2017. The vegetation types, veld condition and game of Tswalu Kalahari Desert Reserve.
- VAN ROOYEN, N. 2000. Vegetation survey and mapping of the Kgalagadi Transfrontier Park. Peace Parks Foundation, Stellenbosch.
- VAN ROOYEN, N., VAN ROOYEN, M.W. & GROBLER, A. 2004. Habitat evaluation and stocking rates for wildlife and livestock - PAN TRUST Ranch, Ghanzi, Botswana.
- VAN ROOYEN, N. 2004. Vegetation and wildlife of the Greater St Lucia Wetland Park, KZN.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2008. Vegetation classification, habitat evaluation and wildlife management of the proposed Royal Big Six Nsubane-Pongola Transfrontier Park, Swaziland. Ekotruster cc.
- VAN ROOYEN, N., VAN DER MERWE, H. & VAN ROOYEN, M.W. 2011. The vegetation of the NECSA Vaalputs site. Report to NECSA.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2014. Ecological evaluation and wildlife management on Ndzalama Nature Reserve and adjacent farms, Gravelotte, Limpopo province.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2016. Ecological evaluation of the farm Springbokoog in the Van Wyksvlei region of Northern Cape, including a habitat assessment for the introduction of black rhinoceros. Ekotruster.
- VAN ROOYEN, M.W. & VAN ROOYEN, N. & VAN DEN BERG, H. 2016. Kathu Bushveld study: Research offset for first development phase of Adams Solor Energy Facility. Project conducted for Department of Environment and Nature Conservation Northern Cape (DENC) and the Department of Agriculture, Forestry and Fisheries (DAFF).
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2018. Environmental screening study for the proposed essential oils and Moringa oil enterprise on Ferndale farm, Bathurst, Eastern Cape. Ekotruster cc, Somerset West.
- VAN ROOYEN, M.W., GAUGRIS, J.Y. & VAN ROOYEN, N. 2018. Dish Mountain gold project, Republic of Ethiopia: Natural resource use evaluation - baseline report. FFMES, Report to SRK Consulting.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2018. Report on the terrestrial ecology (flora & fauna). Basic assessment report for the proposed development of the 325 MW Kudusberg Wind Energy Facility in the Northern and Western Cape. Ekotruster cc, Somerset West.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2019. Proposed amendments to the Ishwati Emoyeni Wind Energy Facility (WEF) of Special Energy Project (PTY) LTD, a subsidiary of Windlab Systems (PTY) LTD. Ekotruster cc, Somerset West.

### 6. Selected peer-reviewed research publications



- VAN ROOYEN, N. 1978. A supplementary list of plant species for the Kruger National Park from the Pafuri area. *Koedoe* 21: 37 - 46.
- VAN ROOYEN, N., THERON, G.K. & GROBBELAAR, N. 1981. A floristic description and structural analysis of the plant communities of the Punda Milia - Pafuri - Wambiya area in the Kruger National Park, Republic of South Africa. 2. The sandveld communities. *Jl S. Afr. Bot.* 47: 405 - 449.
- VAN ROOYEN, N., THERON, G.K. & GROBBELAAR, N. 1986. The vegetation of the Roodeplaat Dam Nature Reserve. 4. Phenology and climate. *S. Afr. J. Bot.* 52: 159 - 166.
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- JELTSCH, F., MILTON, S.J., DEAN, W.R.J. & VAN ROOYEN, N. 1997. Analyzing shrub encroachment in the southern Kalahari: a grid-based modelling approach. *Journal of Applied Ecology* 34 (6): 1497 - 1509.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 1998. Vegetation of the south-western arid Kalahari: an overview. *Trans. Roy. Soc. S. Afr.* 53: 113 -140.
- DE VILLIERS, A.J., VAN ROOYEN, M.W., THERON, G.K. & VAN ROOYEN, N. 1999. Vegetation diversity of the Brandse-Baai coastal dune area, West Coast, South Africa: a pre-mining benchmark survey for rehabilitation. *Land Degradation & Development* 10: 207 - 224.
- VAN ESSEN, L.D., BOTHMA, J. DU P., VAN ROOYEN, N. & TROLLOPE, W.S.W. 2002. Assessment of the woody vegetation of Ol Choro Oiroua, Masai Mara, Kenya. *Afr. J. Ecol.* 40: 76 - 83.
- MATTHEWS, W.S., VAN WYK, A.E., VAN ROOYEN, N. & BOTHA, G.A. 2003. Vegetation of the Tembe Elephant Park, Maputaland, South Africa. *South African Journal of Botany* 67: 573-594.
- BOTHMA, J. DU P., VAN ROOYEN, N. & VAN ROOYEN, M.W. 2004. Using diet and plant resources to set wildlife stocking densities in African savannas. *Wildlife Society Bulletin* 32 (3): 840-851.
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# Curriculum vitae: PROF GRETEL VAN ROOYEN

## 1. Biographical information

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Current position	<b>Honorary Professor in Plant Ecology Scientific advisor - Ekotrust</b>
Academic qualifications	<b>BSc; BSc (Hons), HNOD, MSc (Botany), PhD (Plant ecology)</b>

## 2. Publications

I am author / co-author of more than 100 peer reviewed research publications and have presented / co-presented more than 100 posters or papers at international and national conferences. Five PhD-students and 29 Masters students have completed their studies under my supervision / co-supervision. I have co-authored a book as part of a series on the Adaptations of Desert Organisms by Springer Verlag (Van Rheede van Oudtshoorn, K. & Van Rooyen, M.W. 1999. **Dispersal biology of desert plants**. Springer Verlag, Berlin) and two wildflower guides (Van Rooyen, G., Steyn, H. & De Villiers, R. 1999. **Cederberg, Clanwilliam and Biedouw Valley**. Wild Flower Guide of South Africa no 10. Botanical Society of South Africa, Kirstenbosch, and Van der Merwe, H. & Van Rooyen, G. **Wild flowers of the Roggeveld and Tanqua**). I have also contributed to six chapters in the following books: (i) Dean, W.R.J. & Milton, S.J. (Eds) *The Karoo: Ecological patterns and processes*. Cambridge University Press, Cambridge. pp. 107-122; (ii) Knobel, J. (ed.) *The magnificent heritage of South Africa*. Sunbird Publishing, Llandudno. pp. 94-107; (iii) Hoffman, M.T., Schmiedel, U., Jürgens, N. [Eds]: *Biodiversity in southern Africa. Vol. 3: Implications for landuse and management*: pp. 109–150, Klaus Hess Publishers, Göttingen & Windhoek; (iv) Schmiedel, U., Jürgens, N. [Eds]: *Biodiversity in southern Africa. Vol. 2: Patterns and processes at regional scale*: pp. 222-232, Klaus Hess Publishers, Göttingen & Windhoek; (v) Stoffberg, H., Hindes, C. & Muller, L. *South African Landscape Architecture: A Compendium and A Reader*. Chapter 10, pp. 129 – 140; and (vi) Stoffberg, H., Hindes, C. & Muller, L. *South African Landscape Architecture: A Compendium and A Reader*. Chapter 11, pp. 141 – 146.

## 3. Research interests

My primary research interests lie in population biology and vegetation dynamics. The main aim of the research is to gain an understanding of ecosystem dynamics and to use this understanding to develop strategies to conserve, manage, use sustainably or restore ecosystems. Geographically the focus of the studies has been primarily in Namaqualand (Northern Cape Province, South Africa; classified as Succulent Karoo) and the Kalahari although several studies were conducted in Maputaland (Northern KwaZulu-Natal) and Namibia.

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## environmental affairs

Department:  
Environmental Affairs  
REPUBLIC OF SOUTH AFRICA

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

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

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

#### PROJECT TITLE

Scoping and Environmental Impact Assessment for the Proposed Development of the 341 MW Wind Energy Facility (i.e. Kwagga WEF 2), near Beaufort West, Western Cape

#### Kindly note the following:

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

#### Departmental Details

##### Postal address:

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0001

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Arcadia

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

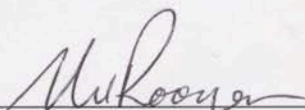
1. SPECIALIST INFORMATION

Specialist Company Name:	EKOTRUST CC		
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition
			100%
Specialist name:	NOEL VAN ROOYEN		
Specialist Qualifications:	DSc		
Professional affiliation/registration:	SACNASP Reg. no. 401430/83		
Physical address:	7 ST GEORGE STREET, LIONVILLE, SOMERSET WEST		
Postal address:	AS ABOVE		
Postal code:	7130	Cell:	082 882 0886
Telephone:		Fax:	
E-mail:	noel@ekotrust.co.za		

2. DECLARATION BY THE SPECIALIST

I, NOEL VAN ROOYEN, declare that -

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

  
 Signature of the Specialist

EKOTRUST CC  
 Name of Company:

26 MAY 2021  
 Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

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

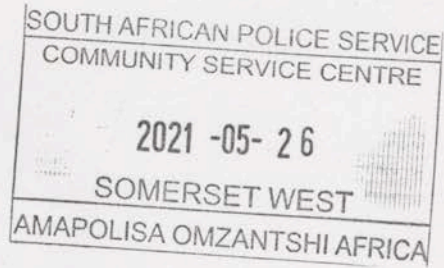
Noel van Rooyen  
Signature of the Specialist

EKO TRUST CC  
Name of Company

26 MAY 2021  
Date

71595689  
Mbantshu  
Signature of the Commissioner of Oaths

2021-05-26  
Date





# APPENDIX F.7

## Noise



## Site Sensitivity Verification Report

for the Kwagga Wind Energy Facility 2 (Pty) Ltd  
Near Beaufort West, South Africa



Date of Site Visit: 20<sup>th</sup> – 22<sup>nd</sup> October 2020  
Specialist Name: Dr Brett Williams  
Professional Registration Number: SAIOH 0962  
Specialist Affiliation / Company: Safetech  
Specialist Topic: Noise Impact Assessment  
Proposed WEF Project Name: Kwagga Wind Energy Facility 2 (Pty) Ltd

31<sup>st</sup> October 2020

## 1. Introduction

ABO Wind Renewable Energies (Pty) Ltd proposes to develop a Wind Energy Farm (WEF) located to the south of Beaufort West in the Western Cape. Safetech has been appointed to conduct the noise impact assessment. The first stage in the assessment is to conduct a site sensitivity verification report as per the requirements of the Environmental Assessment Protocols of the NEMA EIA Regulations (2014, as amended), and the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Noise Impacts (GG 43110 / GNR 320, 20 March 2020).

The potential noise impacts from the construction and operation of the proposed development of the Kwagga Wind Energy Facility 2 (Pty) Ltd will include the following:

- Construction equipment and vehicle noise;
- Mechanical and aerodynamic noise from the operation of the wind turbine components.

The noise emissions could have an impact on the local residents. Figure 1 below illustrates the noise sensitive areas identified by satellite imagery and during the site visit in October 2020.

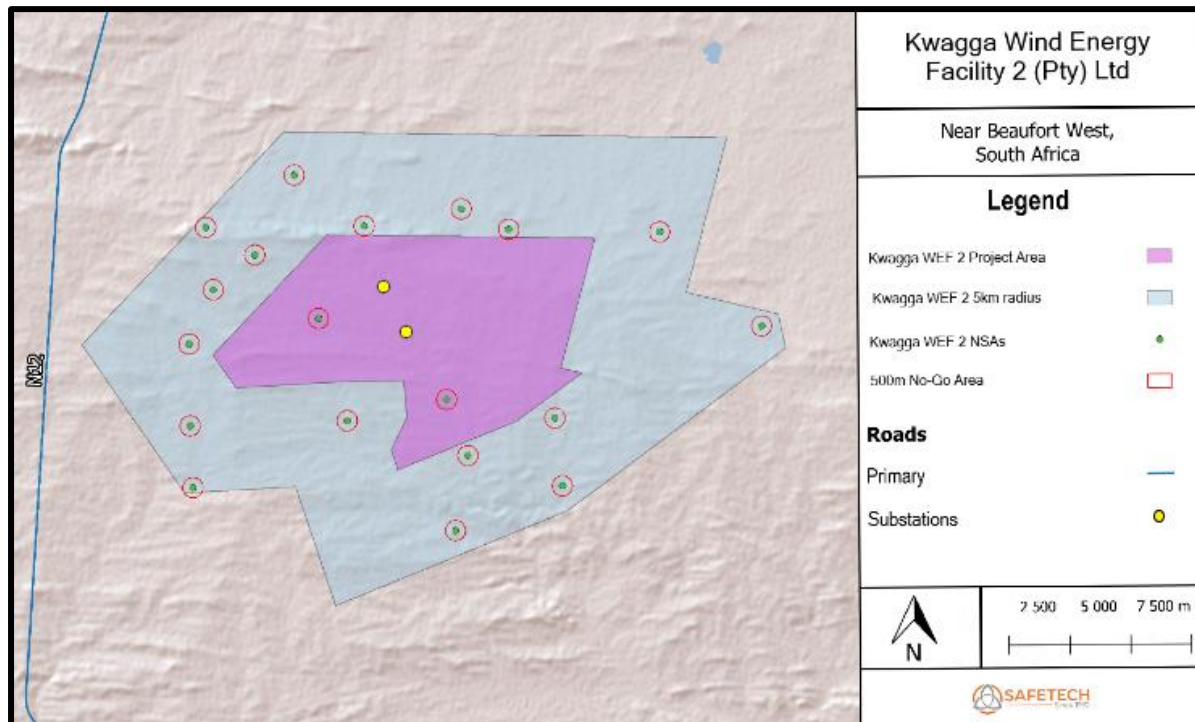


Figure 1: Kwagga WEF 2 Noise Sensitive Areas

In addition to the wind turbines, Kwagga WEF 2 will have 2 substations, as illustrated in Figure 1 above, these substations operate at low noise levels and will thus have no impact on the receptors from a noise perspective.

## 2. Field Study

The field study validated the classification of the study area as a rural district. Table 1 below shows the SANS 10103:2008 guidelines for day and night noise limits. National and provincial standards classify noise levels exceeding 7dB(A) above the ambient noise levels as a disturbing noise.

Table 1: Noise limits for rural districts

Type of District	Equivalent Continuous Rating Level, LReq.T for Noise					
	Outdoors (dB(A))			Indoors, with open windows (dB(A))		
	Day-night	Daytime	Night-time	Day-night	Daytime	Night-time
Rural Districts	45	45	35	35	35	25

The field study was conducted from the 20<sup>th</sup> of October 2020 to the 22<sup>nd</sup> of October 2020 in accordance with SANS 10103:2008. The guidelines to determine the ambient noise levels of the area are described in the methodology below:

*A long-term measurement was taken by placing a noise meter on a tripod and ensuring that it was placed at least 1.2 m from floor level and 3.5 m from any large flat reflecting surface. The 36-hour measurement time encompassed one "day" period (06:00-22:00) and two "night" periods (22:00-06:00). The noise meter was calibrated before and after the survey. At no time was the difference more than one decibel (dB) (Note: If the difference between measurements at the same point under the same conditions is more than 1 dB, then this is an indication that the noise meter is not properly calibrated). The weighting used was on the A scale and the meter was placed on "fast", which is the preferred method as per SANS 10103:2008, the measurement and rating of environmental noise. The meter was fitted with a windscreen, which is supplied by the manufacturer. The windscreen is designed so as to reduce wind noise around the microphone and not bias the measurements.*

The results of the ambient monitoring are illustrated in Figure 2 below. The low values represent periods of low temperature whereby the measuring equipment is outside of its design parameters. The results below 20dB(A) do however still give a good indication of the low ambient noise levels when the windspeed is low. As the windspeed data was measured at 60m on the mast, the windspeed at ground level was most likely calm.

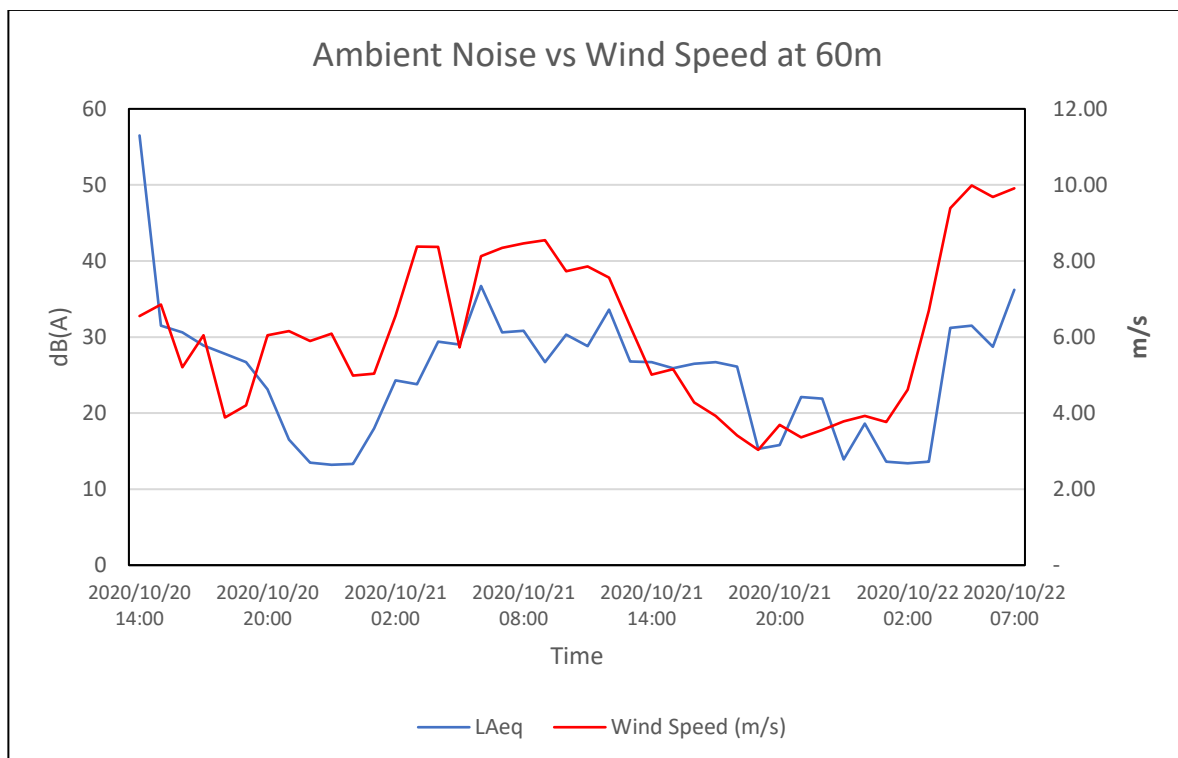


Figure 2: Ambient Noise Levels vs Weather Conditions

The weather data for the monitoring period was supplied by the client from a weather station located at 32° 57' 40.14" S; 22° 46' 12.57" E, which is approximately 6km away from the monitoring point. The wind data is taken at 60m above ground level which is the lowest monitoring point on the mast.

### 3. Cumulative Impact Study

The cumulative noise impacts of surrounding developments should also be considered. Figure 3 below shows projects that are within a 50km radius of the Kwagga WEF 2 that may contribute to the overall noise levels experienced by the identified receptors. Due to the close proximity to the NSAs identified in this study, it is expected that Kwagga WEF 1 (K1), Kwagga WEF 3 (K3) and the proposed development directly to the south-west of Kwagga WEF 1 (A1) may have an impact on the NSAs from a noise perspective.

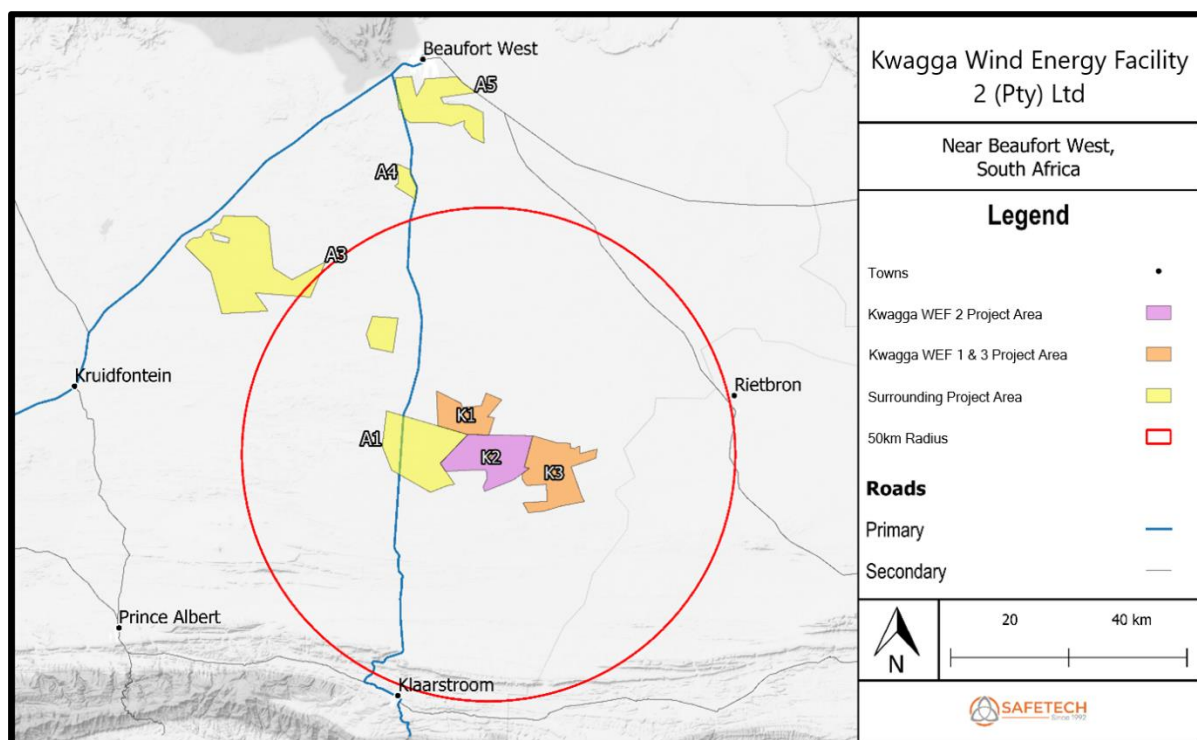


Figure 3: Developments within a 50km radius of Kwagga WEF 2.

### 4. Legal Requirements

Relevant noise related legislation will be identified. Where applicable the following standards will also be consulted:

- South Africa - GNR.154 of January 1992: Noise control regulations in terms of section 25 of the Environment Conservation Act (ECA), 1989 (Act No. 73 of 1989).
- South Africa - GNR.155 of 10 January 1992: Application of noise control regulations made under section 25 of the Environment Conservation Act, 1989 (Act No. 73 of 1989).
- South Africa – GNR. 320 of 20 March 2020: Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes under Sections 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act no. 107 of 1998).

- Province of the Western Cape: Provincial Gazette Extraordinary 7141 – Western Cape Noise Control Regulations - PN 200/2013 (20<sup>th</sup> June 2013).
- SANS 10103:2008 Version 6 - The measurement and rating of environmental noise with respect to annoyance and to speech communication.
- SANS 10357:2004 Version 2.1 - The calculation of sound propagation by the Concawe method.
- International Finance Corporation – 2007 General EHS Guidelines: Environmental Noise.

## 5. Conclusion

The following is concluded and verified:

- The project site is situated in a rural district, with the main activity in the area being agriculture (i.e. sheep farming). Several homesteads containing both permanent and temporary occupants were identified.
- The project could impact on several noise sensitive areas.
- It is recommended that a 500m buffer be placed around all noise sensitive receptors for planning purposes. No wind turbines should be placed within the 500m buffer.
- The noise impacts from the construction and operation of the substations will be negligible.
- The cumulative impacts of other windfarms in the area should be assessed.

It is recommended that a full noise impact assessment that includes emission modelling be conducted. A comprehensive report will be provided that will include noise mitigation measures to be included in the environmental management plan as well as predicted noise levels during the construction and operation phase.



**Dr Brett Williams**

**APPENDIX 1 – Specialist Declaration**



## environmental affairs

Department:  
Environmental Affairs  
REPUBLIC OF SOUTH AFRICA

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

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

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

#### PROJECT TITLE

**Scoping and Environmental Impact Assessment for the Proposed Development of the 341 MW Wind Energy Facility (i.e. Kwagga WEF 2), near Beaufort West, Western Cape**

#### Kindly note the following:

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

#### Departmental Details

##### Postal address:

Department of Environmental Affairs  
Attention: Chief Director: Integrated Environmental Authorisations  
Private Bag X447  
Pretoria  
0001

##### Physical address:

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

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



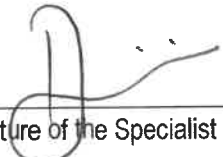
1. SPECIALIST INFORMATION

Specialist Company Name:	SAFETECH			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	NON-COMPLIANT	Percentage Procurement recognition	0%
Specialist name:	DR BRETT WILLIAMS			
Specialist Qualifications:	PHD ENVIRONMENTAL MANAGEMENT – OCCUPATIONAL HYGIENIST			
Professional affiliation/registration:	MEMBER SA INSTITUTE OF OCCUPATIONAL HYGIENISTS			
Physical address:	64 WORRAKER STREET, NEWTON PARK, PORT ELIZABETH			
Postal address:	PO BOX 27607, GREENACRES			
Postal code:	6057	Cell:	0825502137	
Telephone:	041-3656846	Fax:	041-3652123	
E-mail:	Brett.williams@safetech.co.za			

2. DECLARATION BY THE SPECIALIST

I, Brett Williams, declare that –

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

  
Signature of the Specialist

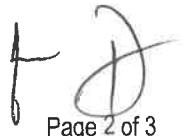
Safetech

Name of Company:

25<sup>th</sup> May 2021


Date

Details of Specialist, Declaration and Undertaking Under Oath

  
Page 2 of 3

3. UNDERTAKING UNDER OATH/ AFFIRMATION

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

  
\_\_\_\_\_  
Signature of the Specialist

Safetech  
\_\_\_\_\_  
Name of Company

25<sup>th</sup> May 2021  
\_\_\_\_\_  
Date

  
\_\_\_\_\_  
Signature of the Commissioner of Oaths

25 May 2021  
\_\_\_\_\_  
Date

**Roger Charles Hannington**  
Commissioner of Oaths  
Practising Attorney - Hannington @ Law  
43 Wychwood Avenue, Port Elizabeth  
South Africa