SCREENING REPORT FOR AN ENVIRONMENTAL AUTHORIZATION AS REQUIRED BY THE 2014 EIA REGULATIONS – PROPOSED SITE ENVIRONMENTAL SENSITIVITY

EIA Reference number: TBC

Project name: Emvelo WEF

Project title: Emvelo WEF

Date screening report generated: 07/06/2023 09:01:16

Applicant: Emvelo WInd Energy Facility (Pty) Ltd

Compiler: Arcus

Compiler signature: ……………………………………………………………………………………

Application Category: Utilities Infrastructure|Electricity|Generation|Renewable|Wind

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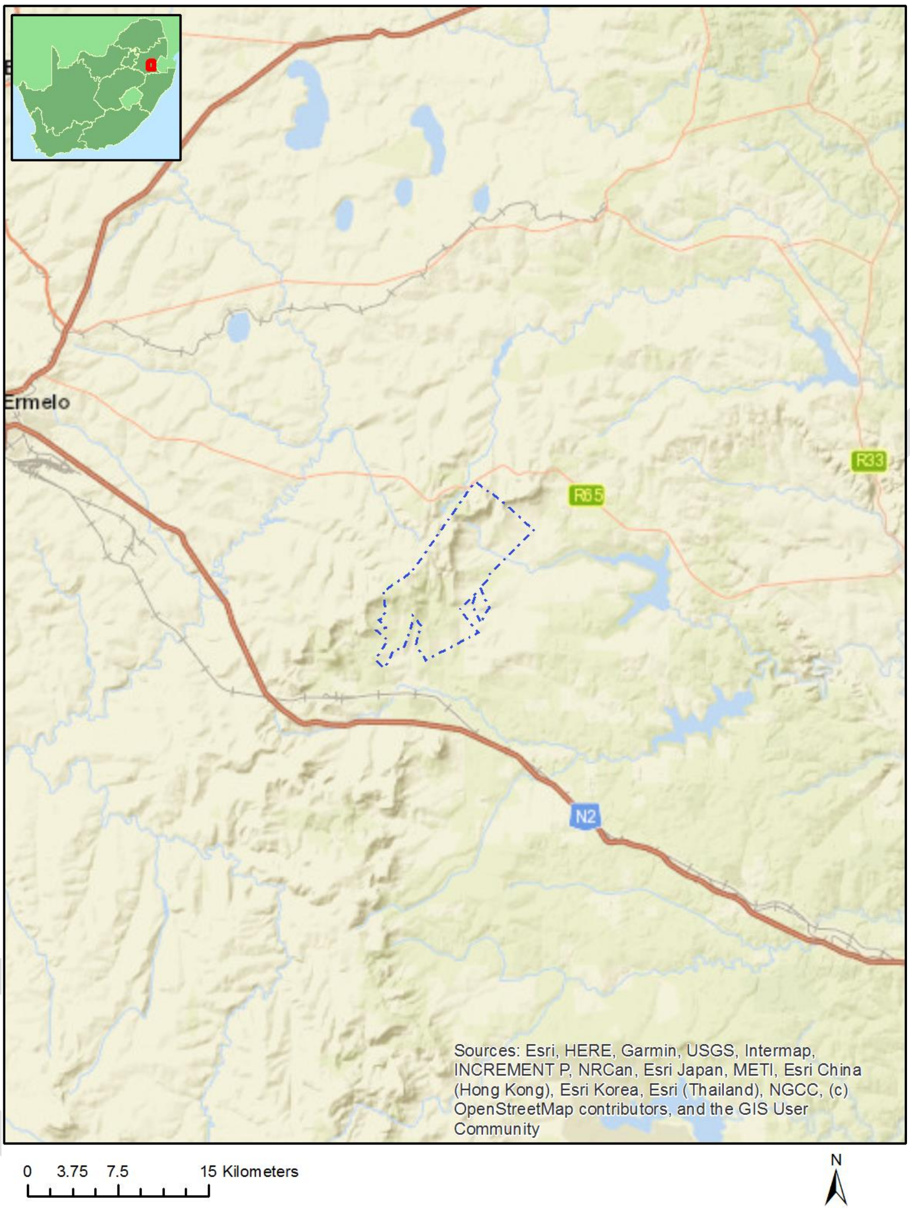
Proposed Project Location

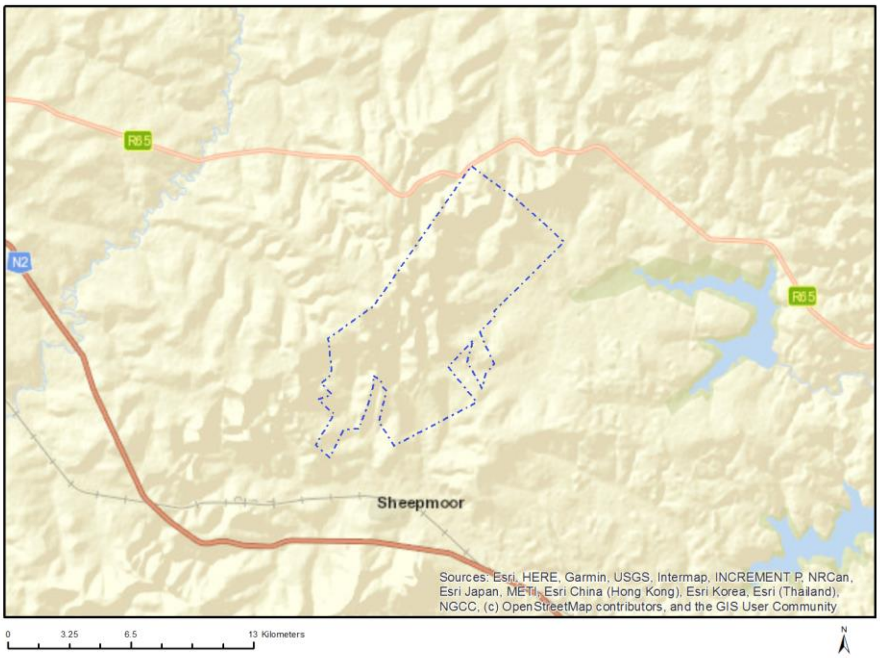
Orientation map 1: General location

General Orientation: Emvelo WEF



Disclaimer applies
07/06/2023

Map of proposed site and relevant area(s)



Cadastral details of the proposed site

Property details:

No	Farm Name	Farm/ Erf No	Portion	Latitude	Longitude	Property Type
1	ONVERWACHT	273	0	26°35'13.21S	30°17'24.72E	Farm
2	WINDHOEK	291	0	26°40'51.25S	30°15'48.66E	Farm
3	ONVERWACHT	287	0	26°38'10.31S	30°15'20.14E	Farm
4	VLAKPLAATS	284	0	26°38'42.72S	30°23'21.97E	Farm
5	WITBANK	300	0	26°42'1.64S	30°19'40.41E	Farm
6	STEENKOOLSPRUIT	275	0	26°33'10.05S	30°21'39.51E	Farm
7	KLIPFONTEIN	283	0	26°40'43.81S	30°16'43.82E	Farm
8	WAAIHOEK	286	0	26°39'34.2S	30°18'2.49E	Farm
9	SCHIEDAM	274	0	26°36'44.74S	30°20'21.23E	Farm
10	VAALBANK	285	0	26°39'56.44S	30°21'1.94E	Farm
11	SCHIEDAM	274	0	26°35'37.25S	30°21'11.32E	Farm Portion
12	WAAIHOEK	286	15	26°39'36.27S	30°19'25.75E	Farm Portion
13	WAAIHOEK	286	4	26°39'16.83S	30°16'1.41E	Farm Portion
14	WAAIHOEK	286	10	26°40'28.4S	30°19'3.97E	Farm Portion
15	WINDHOEK	291	3	26°41'37.99S	30°17'10.92E	Farm Portion
16	ONVERWACHT	273	1	26°36'18.65S	30°18'19.66E	Farm Portion
17	STEENKOOLSPRUIT	275	0	26°34'2.08S	30°20'38.08E	Farm Portion
18	VLAKPLAATS	284	6	26°37'33.94S	30°22'23.44E	Farm Portion
19	WAAIHOEK	286	14	26°38'6.98S	30°17'41.64E	Farm Portion
20	WITBANK	300	14	26°41'12.99S	30°19'2.57E	Farm Portion
21	KLIPFONTEIN	283	1	26°40'33.14S	30°16'25.8E	Farm Portion
22	KLIPFONTEIN	283	0	26°40'43.89S	30°16'43.94E	Farm Portion
23	WAAIHOEK	286	5	26°40'40.76S	30°18'19.97E	Farm Portion
24	WITBANK	300	4	26°41'27.39S	30°18'29.56E	Farm Portion
25	SCHIEDAM	274	1	26°37'26.07S	30°20'14.24E	Farm Portion
26	VAALBANK	285	2	26°40'20S	30°20'53.09E	Farm Portion
27	VAALBANK	285	7	26°39'21.9S	30°20'13.76E	Farm Portion

28	WINDHOEK	291	4	26°40'31.97S	30°15'48.92E	Farm Portion
29	ONVERWACHT	273	5	26°34'57.32S	30°19'22.24E	Farm Portion
30	SCHIEDAM	274	5	26°38'15.99S	30°19'12.47E	Farm Portion
31	STEENKOOLSPRUIT	275	6	26°34'34.38S	30°21'53.97E	Farm Portion
32	VAALBANK	285	1	26°39'1.61S	30°20'31.42E	Farm Portion
33	WAAIHOEK	286	11	26°40'43.1S	30°17'39.13E	Farm Portion
34	WAAIHOEK	286	13	26°39'2.14S	30°18'18.47E	Farm Portion
35	WAAIHOEK	286	9	26°38'41.1S	30°18'54.54E	Farm Portion
36	SCHIEDAM	274	2	26°36'34.77S	30°20'18.54E	Farm Portion
37	SCHIEDAM	274	6	26°37'47.53S	30°19'39.79E	Farm Portion
38	VAALBANK	285	6	26°39'47.62S	30°20'12.41E	Farm Portion
39	VAALBANK	285	3	26°38'43.2S	30°21'2.37E	Farm Portion
40	ONVERWACHT	287	4	26°38'19.86S	30°16'22.47E	Farm Portion
41	ONVERWACHT	273	14	26°34'21.15S	30°20'1.02E	Farm Portion
42	KLIPFONTEIN	283	2	26°40'31.1S	30°16'27.32E	Farm Portion
43	VAALBANK	285	5	26°39'25.69S	30°20'42.45E	Farm Portion
44	WAAIHOEK	286	12	26°39'20.43S	30°16'28.91E	Farm Portion
45	WAAIHOEK	286	7	26°40'28.73S	30°19'48.34E	Farm Portion
46	WAAIHOEK	286	0	26°39'5.53S	30°17'40.49E	Farm Portion
47	WINDHOEK	291	7	26°40'15.01S	30°16'14.71E	Farm Portion
48	WITBANK	300	19	26°41'15.27S	30°19'55.83E	Farm Portion
49	WAAIHOEK	286	3	26°39'30.45S	30°17'2.68E	Farm Portion
50	WAAIHOEK	286	6	26°39'30.29S	30°19'12.38E	Farm Portion
51	WINDHOEK	291	11	26°40'34.38S	30°16'23.34E	Farm Portion

Development footprint[1] vertices:
No development footprint(s) specified.

Wind and Solar developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed area

No nearby wind or solar developments found.

Environmental Management Frameworks relevant to the application

No intersections with EMF areas found.

Environmental screening results and assessment outcomes

The following sections contain a summary of any development incentives, restrictions, exclusions or prohibitions that apply to the proposed development site as well as the most environmental sensitive features on the site based on the site sensitivity screening results for the application classification that was selected. The application classification selected for this report is:
Utilities Infrastructure|Electricity|Generation|Renewable|Wind.

[1] "development footprint", means the area within the site on which the development will take place and incudes all ancillary developments for example roads, power lines, boundary walls, paving etc. which require vegetation clearance or which will be disturbed and for which the application has been submitted.

Relevant development incentives, restrictions, exclusions or prohibitions

The following development incentives, restrictions, exclusions or prohibitions and their implications that apply to this site are indicated below.

Incentive, restriction or prohibition	Implication
Air Quality-Highveld Priority Area	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/HIGHVELD_PRIORITY_AREA_AQMP.pdf

Proposed Development Area Environmental Sensitivity

The following summary of the development site environmental sensitivities is identified. Only the highest environmental sensitivity is indicated. The footprint environmental sensitivities for the proposed development footprint as identified, are indicative only and must be verified on site by a suitably qualified person before the specialist assessments identified below can be confirmed.

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Agriculture Theme	X			
Animal Species Theme		X		
Aquatic Biodiversity Theme	X			
Archaeological and Cultural Heritage Theme				X
Avian (Wind) Theme				X
Bats (Wind) Theme		X		
Civil Aviation (Wind) Theme			X	
Defence (Wind) Theme				X
Flicker Theme	X			
Landscape (Wind) Theme	X			
Paleontology Theme	X			
Noise Theme	X			
Plant Species Theme			X	
RFI (Wind) Theme		X		
Terrestrial Biodiversity Theme	X			

Specialist assessments identified

Based on the selected classification, and the known impacts associated with the proposed development, the following list of specialist assessments have been identified for inclusion in the assessment report. It is the responsibility of the EAP to confirm this list and to motivate in the assessment report, the reason for not including any of the identified specialist study including the provision of photographic evidence of the site situation.

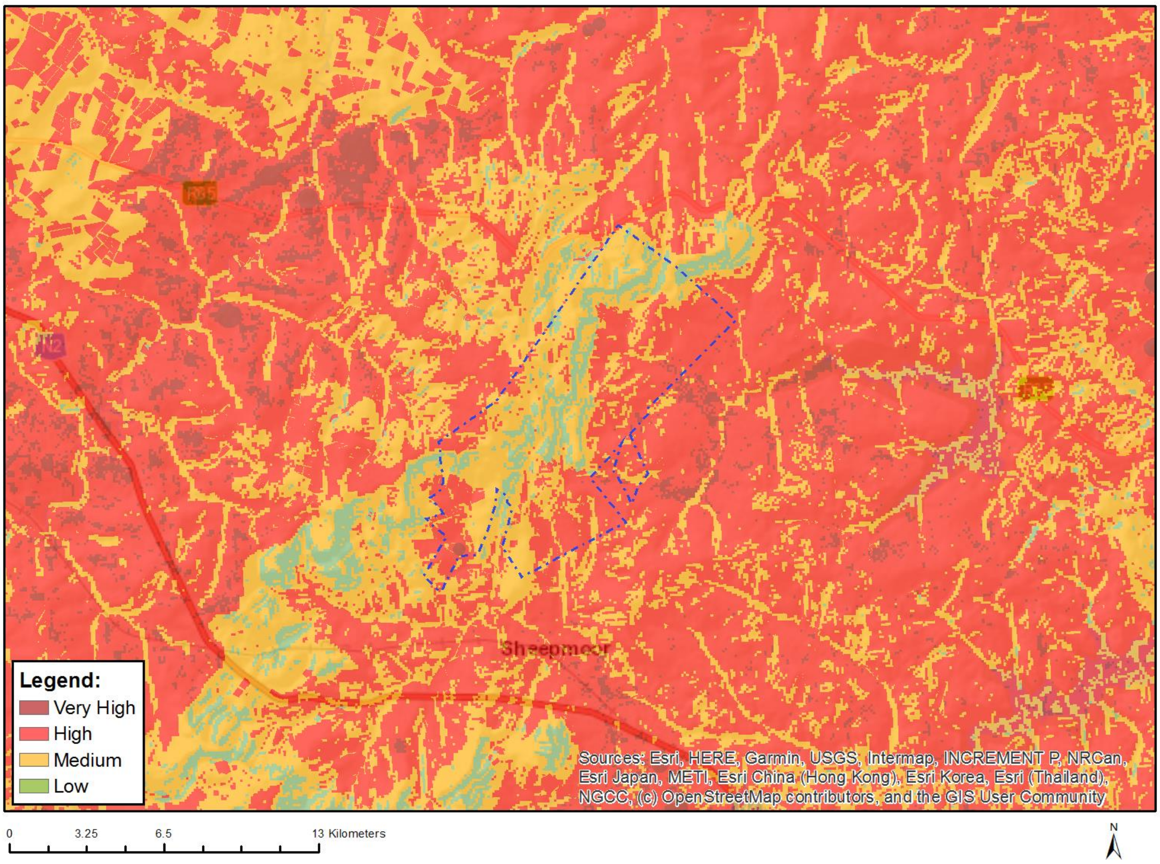
No	Specialist assessment	Assessment Protocol
1	Agricultural Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_WindAndSolar_Agriculture_Assessment_Protocols.pdf
2	Landscape/Visual Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf

3	Archaeological and Cultural Heritage Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
4	Palaeontology Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
5	Terrestrial Biodiversity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Terrestrial_Biodiversity_Assessment_Protocols.pdf
6	Aquatic Biodiversity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Aquatic_Biodiversity_Assessment_Protocols.pdf
7	Avian Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Avifauna_Assessment_Protocols.pdf
8	Civil Aviation Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Civil_Aviation_Installations_Assessment_Protocols.pdf
9	Defense Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Defence_Installations_Assessment_Protocols.pdf
10	RFI Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
11	Noise Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Noise_Impacts_Assessment_Protocol.pdf
12	Flicker Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
13	Traffic Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
14	Geotechnical Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
15	Socio-Economic Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
16	Plant Species Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Plant_Species_Assessment_Protocols.pdf
17	Animal Species Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Animal_Species_Assessment_Protocols.pdf

Results of the environmental sensitivity of the proposed area.

The following section represents the results of the screening for environmental sensitivity of the proposed site for relevant environmental themes associated with the project classification. It is the duty of the EAP to ensure that the environmental themes provided by the screening tool are comprehensive and complete for the project. Refer to the disclaimer.

MAP OF RELATIVE AGRICULTURE THEME SENSITIVITY



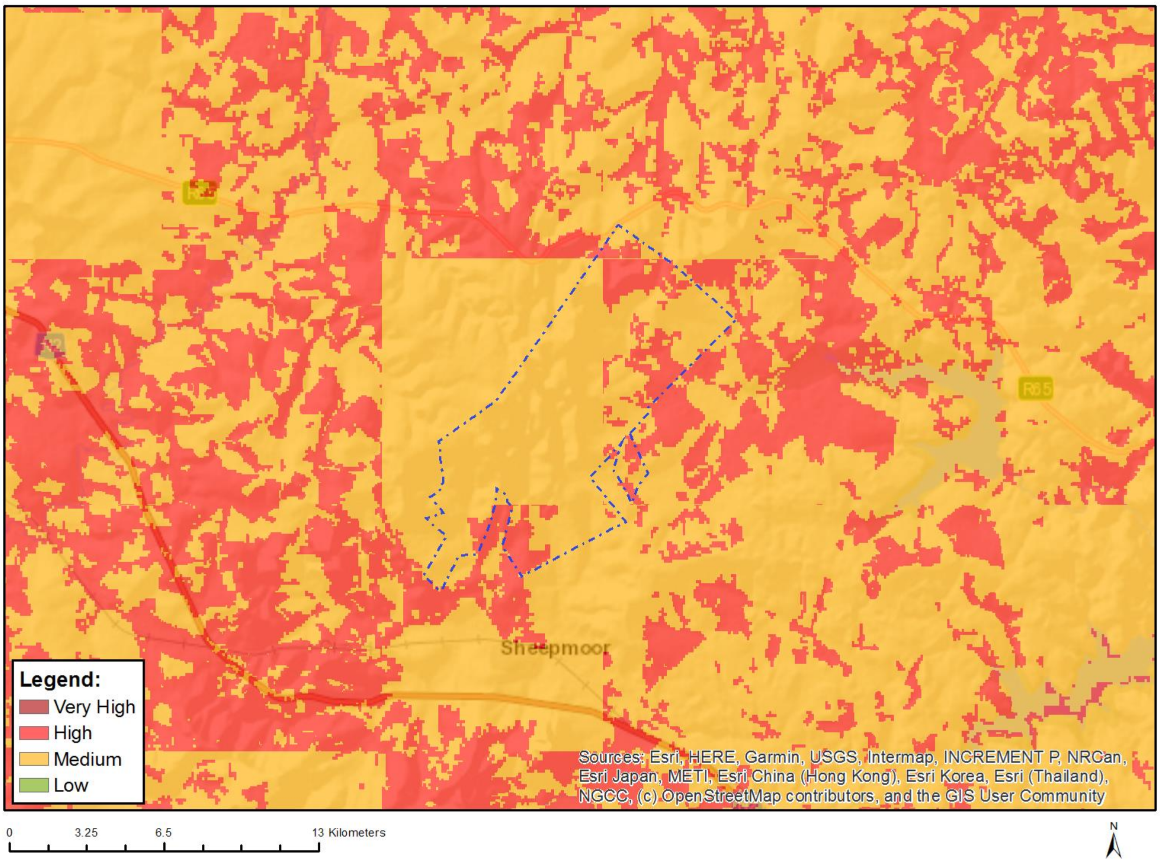
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
High	Land capability;09. Moderate-High/10. Moderate-High
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;09. Moderate-High/10. Moderate-High
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
High	Old Fields;Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
High	Old Fields;Land capability;09. Moderate-High/10. Moderate-High
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
High	Old Fields;Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low

Low	Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
Medium	Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
Very High	Land capability;11. High/12. High-Very high/13. High-Very high/14. Very high/15. Very high
Very High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;11. High/12. High-Very high/13. High-Very high/14. Very high/15. Very high
Very High	Pivot Irrigation;Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
Very High	Pivot Irrigation;Land capability;09. Moderate-High/10. Moderate-High

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

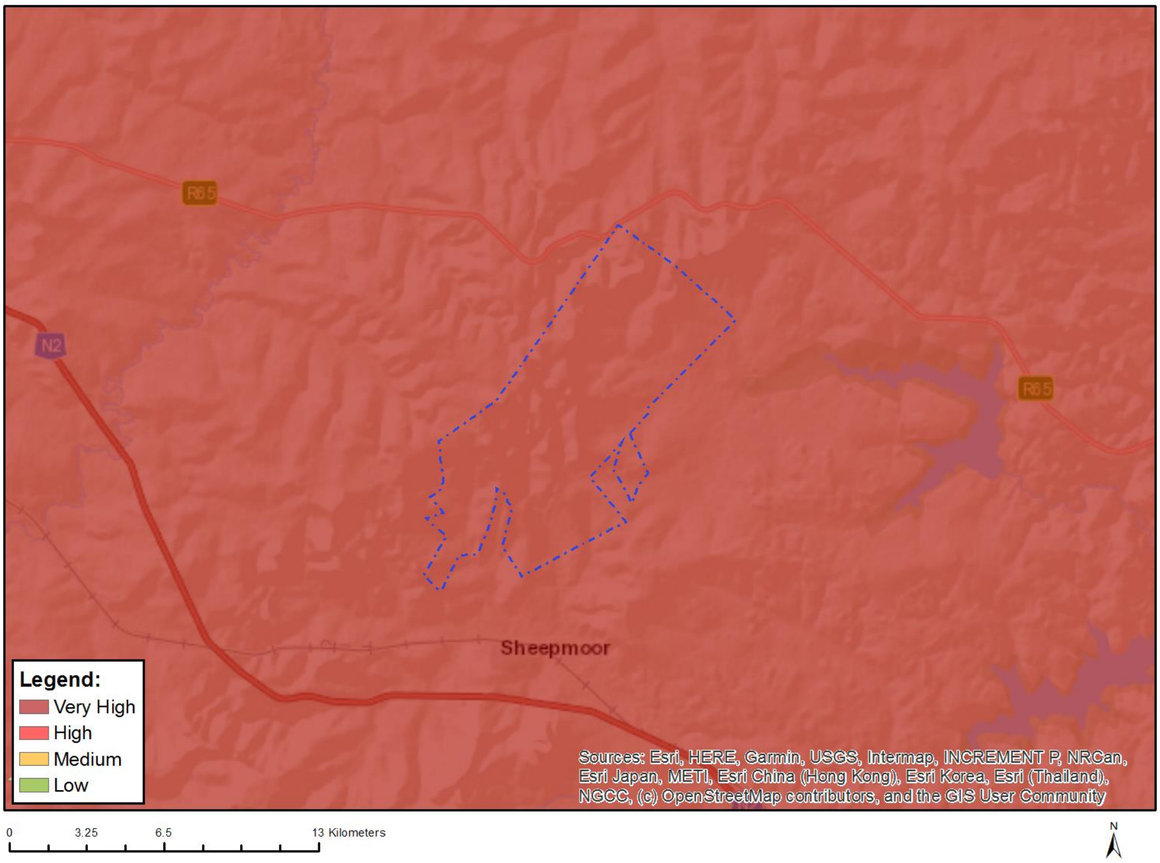
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Geronticus calvus
High	Aves-Balearica regulorum
High	Aves-Sagittarius serpentarius
Medium	Aves-Hydroprogne caspia
Medium	Aves-Neotis denhami

Medium	Aves-Balearica regulorum
Medium	Aves-Sagittarius serpentarius
Medium	Aves-Geronticus calvus
Medium	Aves-Eupodotis senegalensis
Medium	Aves-Tyto capensis
Medium	Mammalia-Ourebia ourebi ourebi
Medium	Invertebrate-Clonia lalandei

MAP OF RELATIVE AQUATIC BIODIVERSITY THEME SENSITIVITY



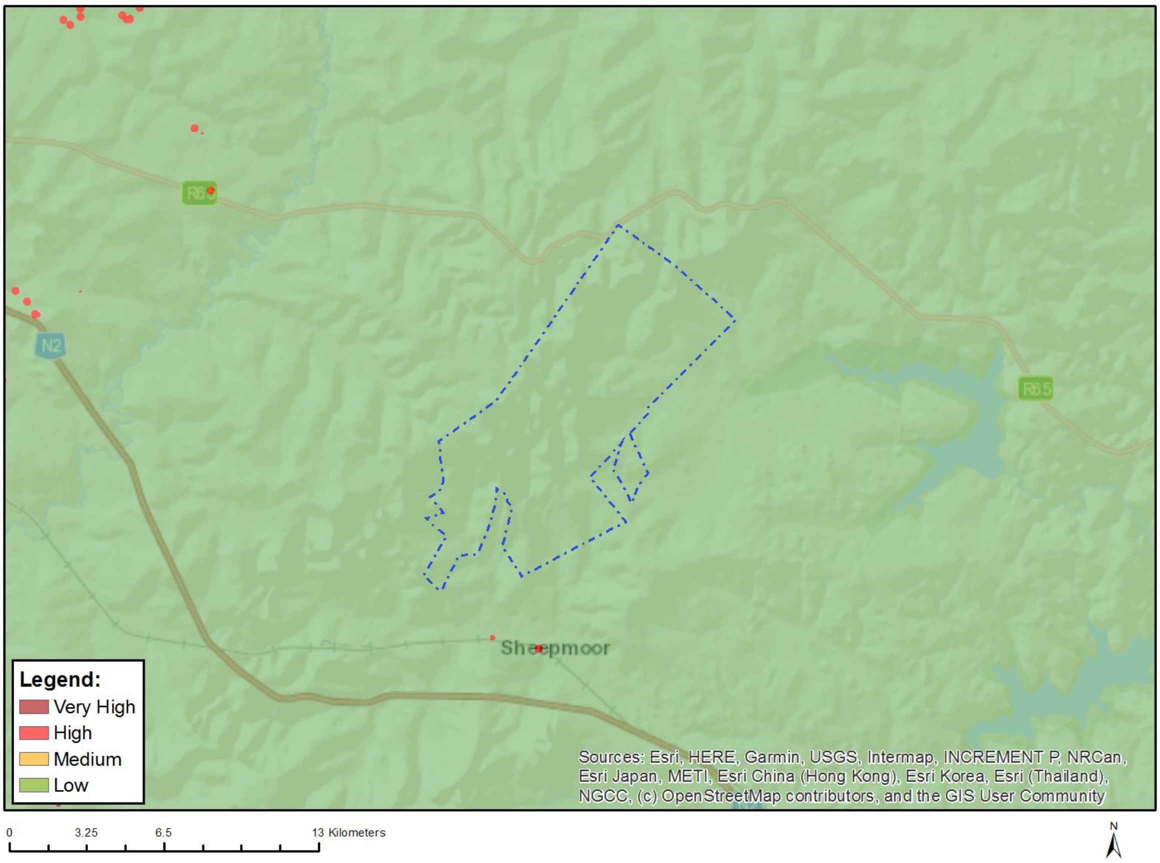
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	CBA: Aquatic rivers
Very High	CBA: Wetlands
Very High	ESA: Important subcatchments
Very High	ESA: Strategic Water Source Area
Very High	ESA: Wetland clusters
Very High	ESA: Wetlands
Very High	FEPA Subcatchment
Very High	Rivers_C
Very High	SWSA (SW) _Upper Usutu
Very High	SWSA (SW) _Upper Vaal

Very High	Wetlands_Mesic Highveld Grassland Bioregion (Depression)
Very High	Wetlands_Mesic Highveld Grassland Bioregion (Seep)
Very High	Wetlands_Mesic Highveld Grassland Bioregion (Valley-bottom)

MAP OF RELATIVE ARCHAEOLOGICAL AND CULTURAL HERITAGE THEME SENSITIVITY

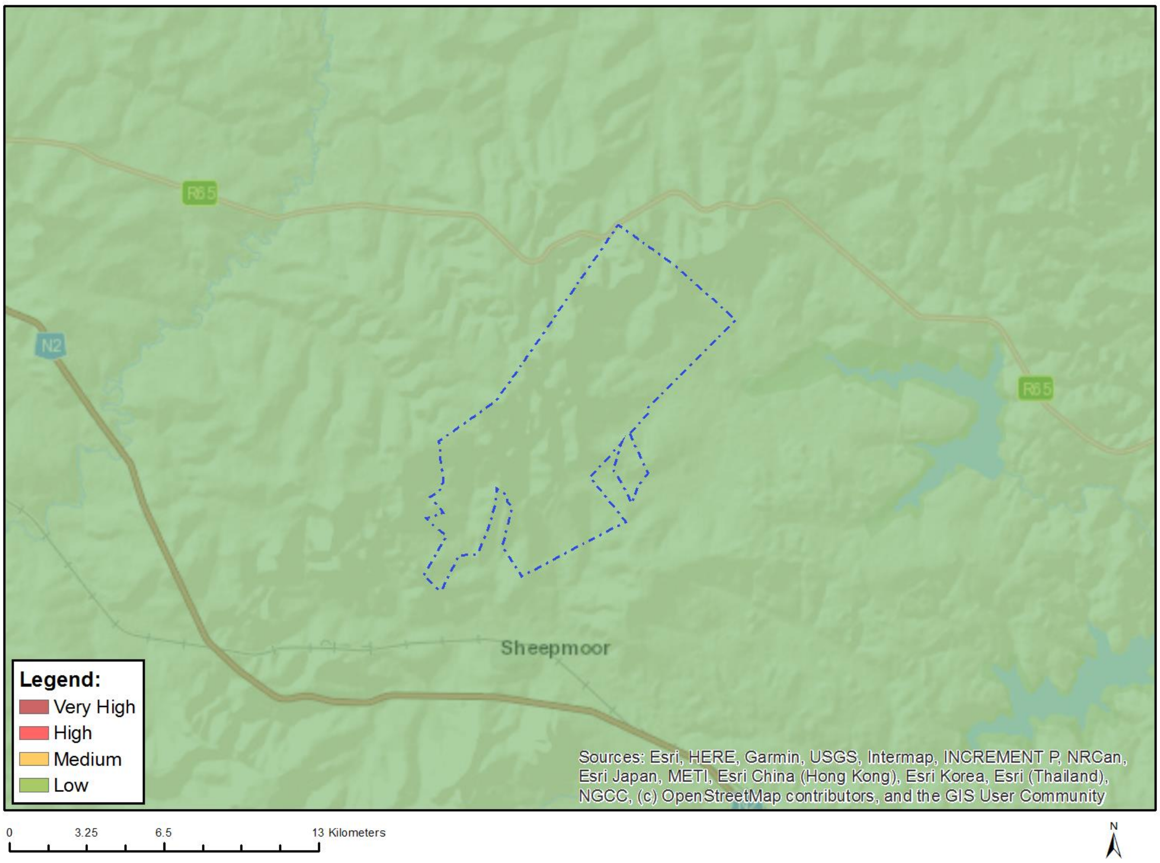


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity

MAP OF RELATIVE AVIAN (WIND) THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Area Outside Sensitivities

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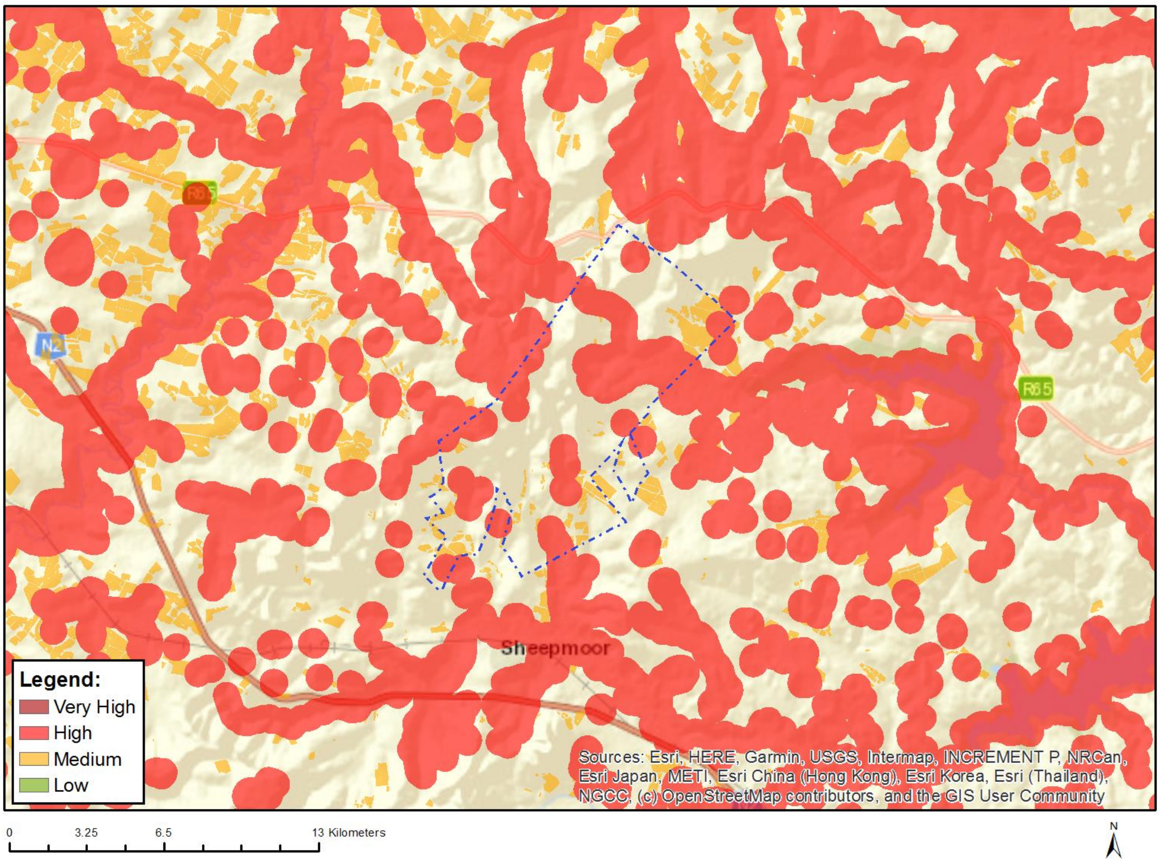
MAP OF RELATIVE BATS (WIND) THEME SENSITIVITY

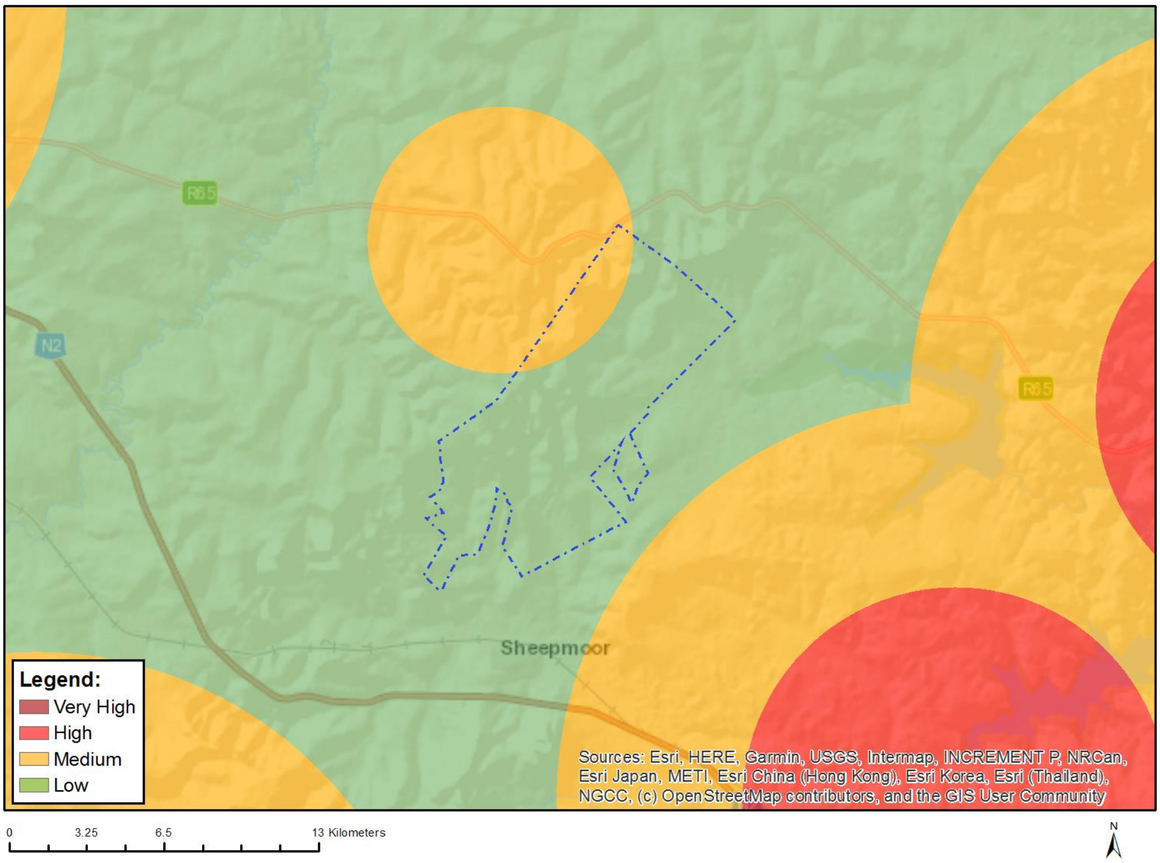


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Within 500 m of a river
High	Wetland
High	Within 500 m of a wetland
Medium	Croplands

MAP OF RELATIVE CIVIL AVIATION (WIND) THEME SENSITIVITY

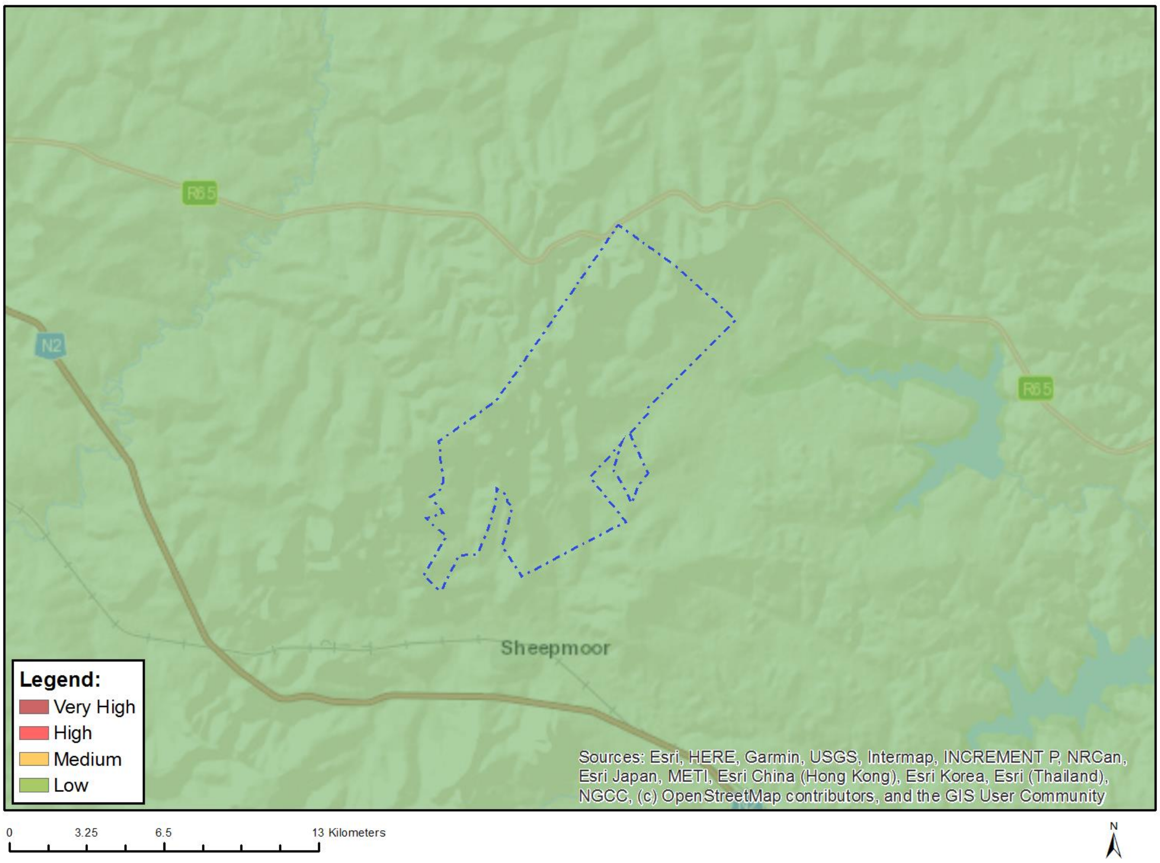


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity
Medium	Within 5 km of an air traffic control or navigation site

MAP OF RELATIVE DEFENCE (WIND) THEME SENSITIVITY

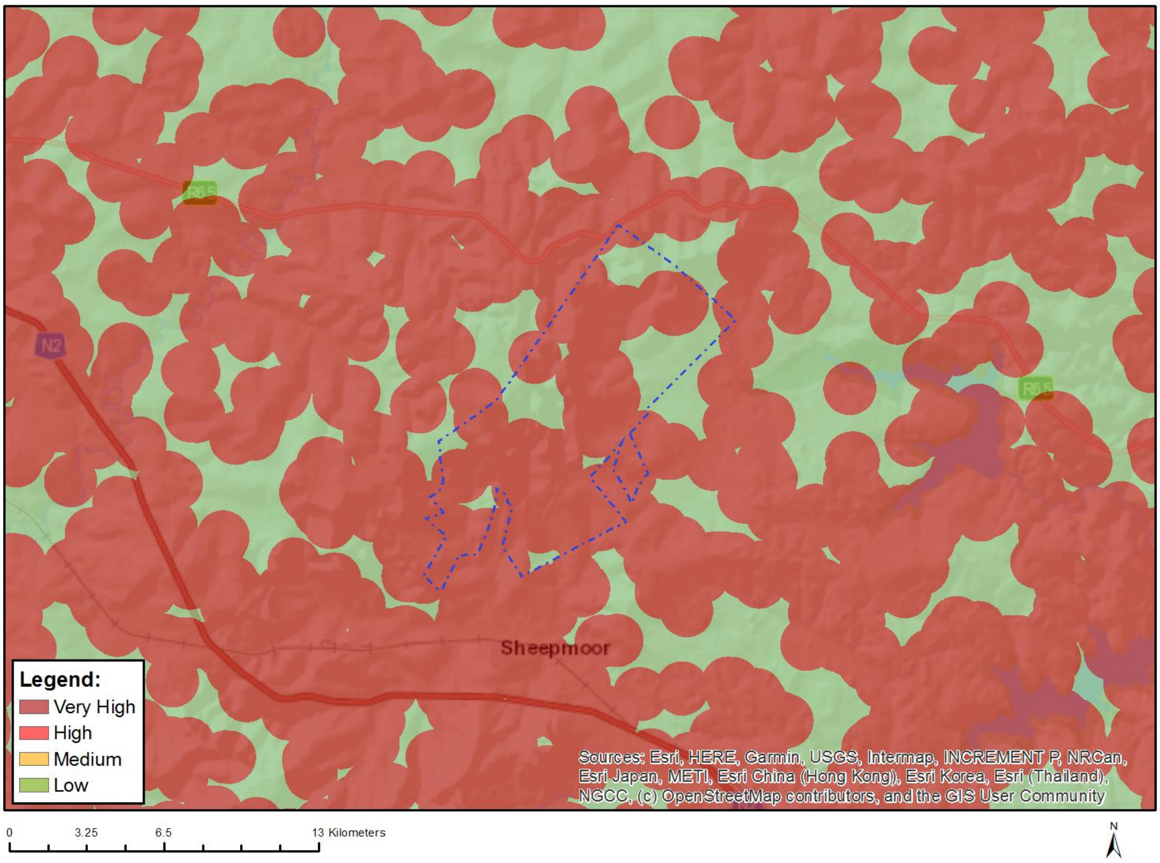


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity

MAP OF RELATIVE FLICKER THEME SENSITIVITY

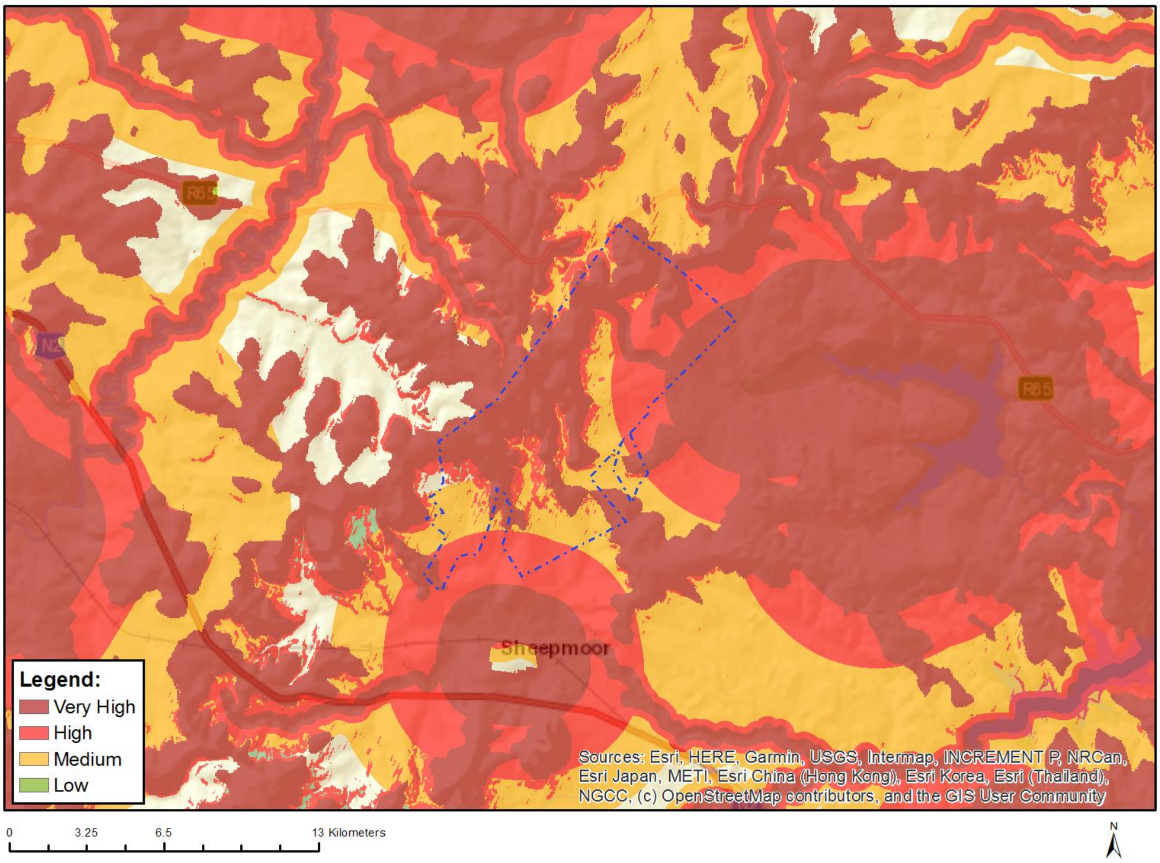


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Area of low sensitivity
Very High	Potential temporarily or permanently inhabited residence

MAP OF RELATIVE LANDSCAPE (WIND) THEME SENSITIVITY

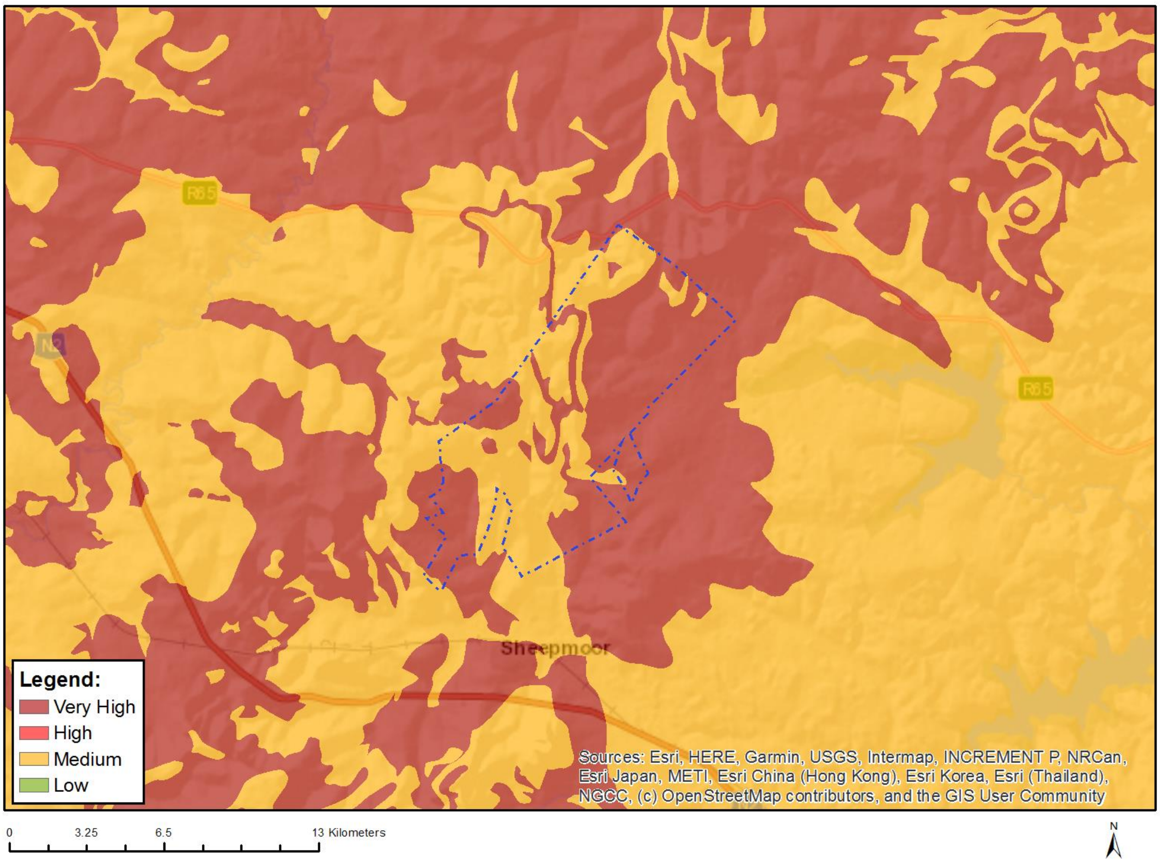


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
High	Between 2 and 4 km of a town or village
High	Slope between 1:4 and 1:10
High	Between 3 and 5 km of a nature reserve, botanical garden or other protected area
High	Within 500 m of a river
Low	Slope less than 1:10
Medium	Between 4 and 6 km of a town or village
Medium	Between 5 and 10 km of a nature reserve, botanical garden or other protected area
Medium	Within 1000 m of a wetland
Very High	Mountain tops and high ridges
Very High	Slope more than 1:4
Very High	Within 3 km of a nature reserve, botanical garden or other protected area
Very High	Within 250 m of a river

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY

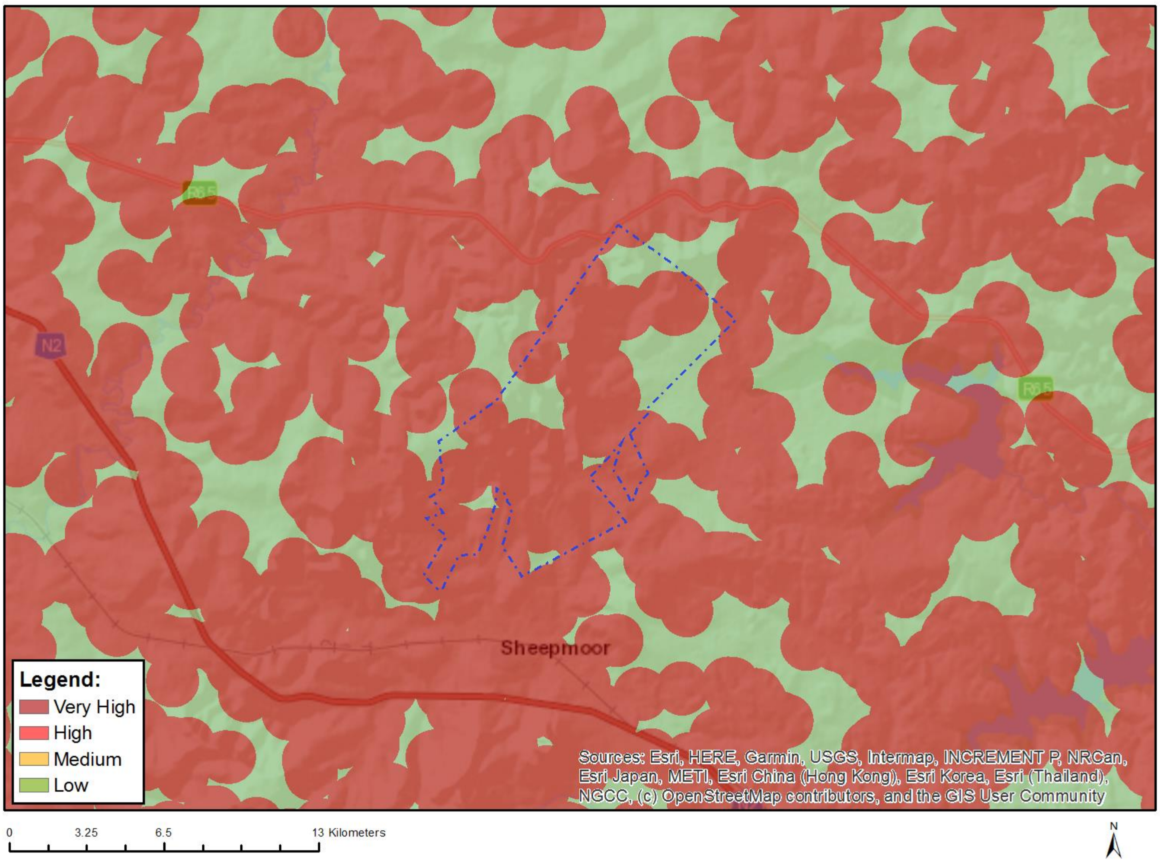


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Medium	Features with a Medium paleontological sensitivity
Very High	Features with a Very High paleontological sensitivity

MAP OF RELATIVE NOISE THEME SENSITIVITY

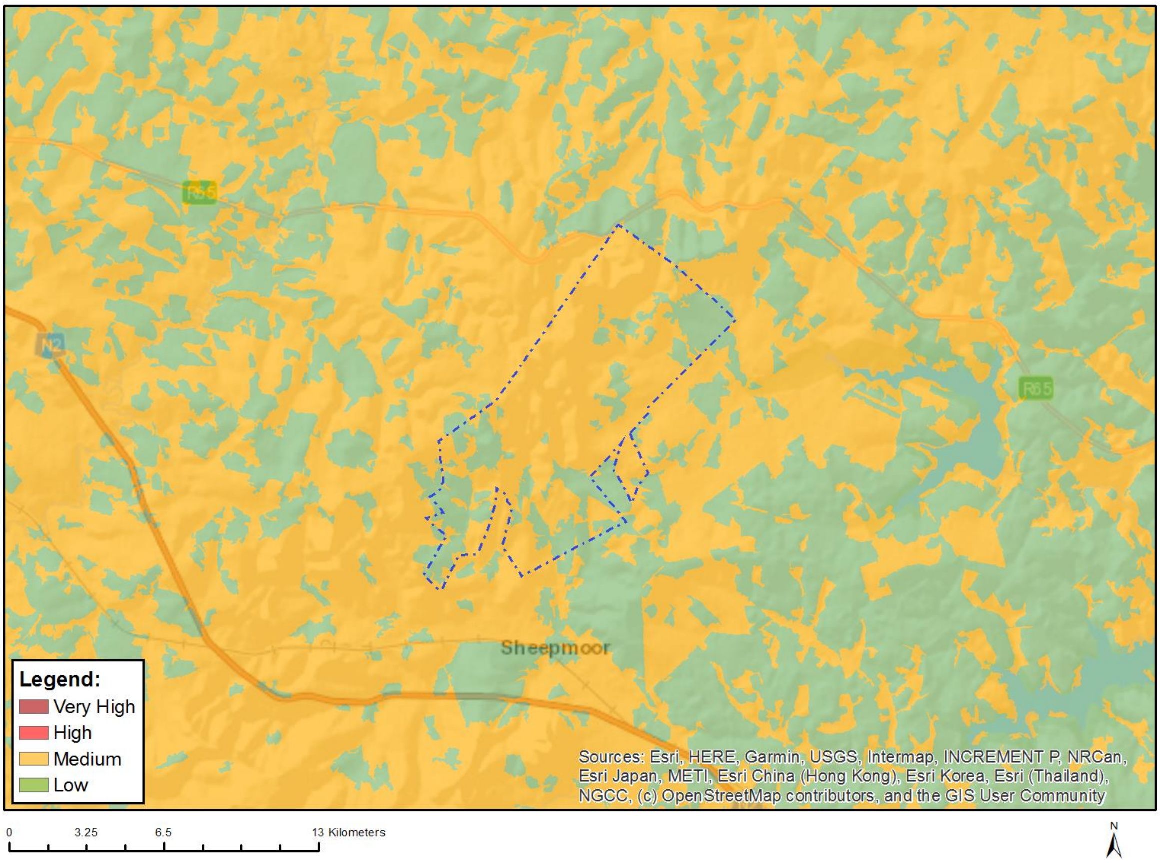


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Area of low sensitivity
Very High	Potential temporarily or permanently inhabited residence

MAP OF RELATIVE PLANT SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

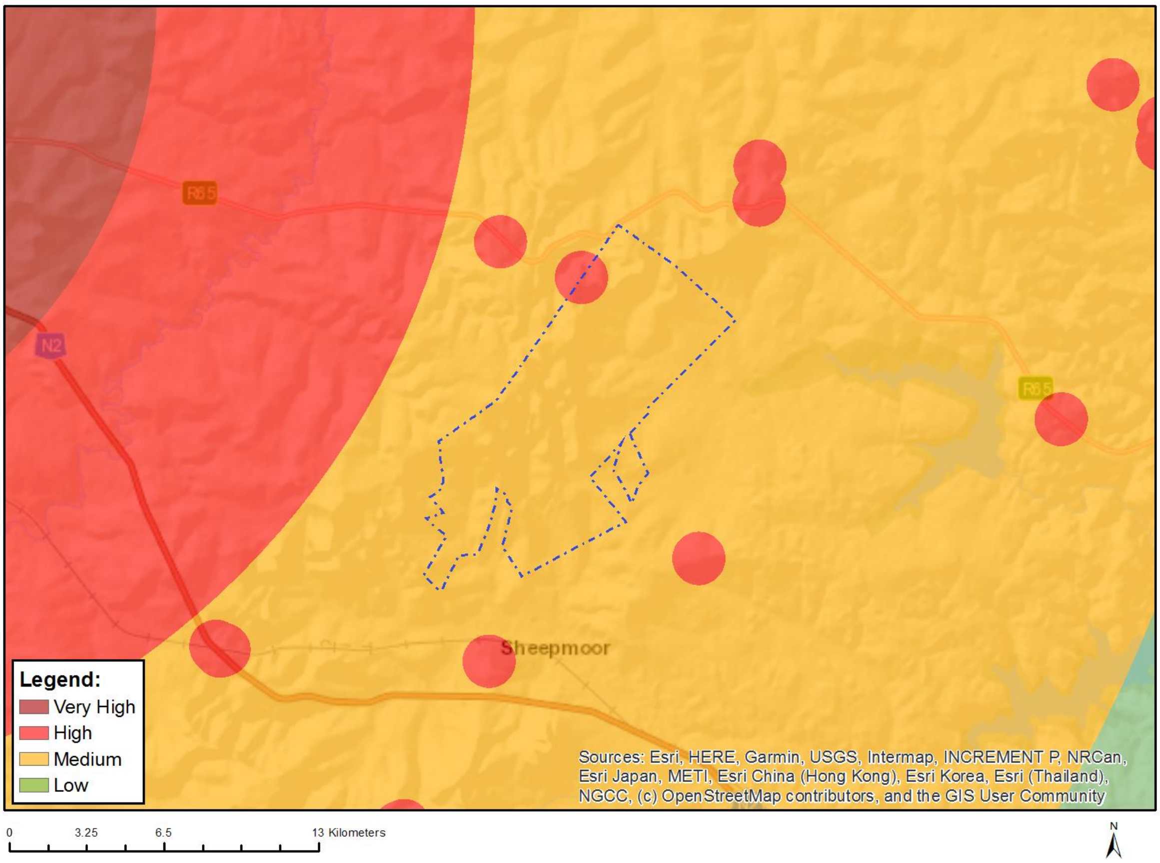
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Medium	Sensitive species 1252
Medium	Indigofera hybrida
Medium	Asparagus fractiflexus
Medium	Aspidoglossum xanthosphaerum
Medium	Khadia alticola
Medium	Sensitive species 41
Medium	Sensitive species 691
Medium	Sensitive species 998
Medium	Sensitive species 1219
Medium	Pachycarpus suaveolens
Medium	Sensitive species 321
Medium	Gerbera aurantiaca

Medium	Sensitive species 851
Medium	Zaluzianskya distans

MAP OF RELATIVE RFI (WIND) THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Within 1 km of a telecommunication facility;None;Between 30 and 60 km from a Weather Radar installation and within the radar's line of sight
Medium	Low sensitivity for telecommunications;None;Between 30 and 60 km from a Weather Radar installation and within the radar's line of sight

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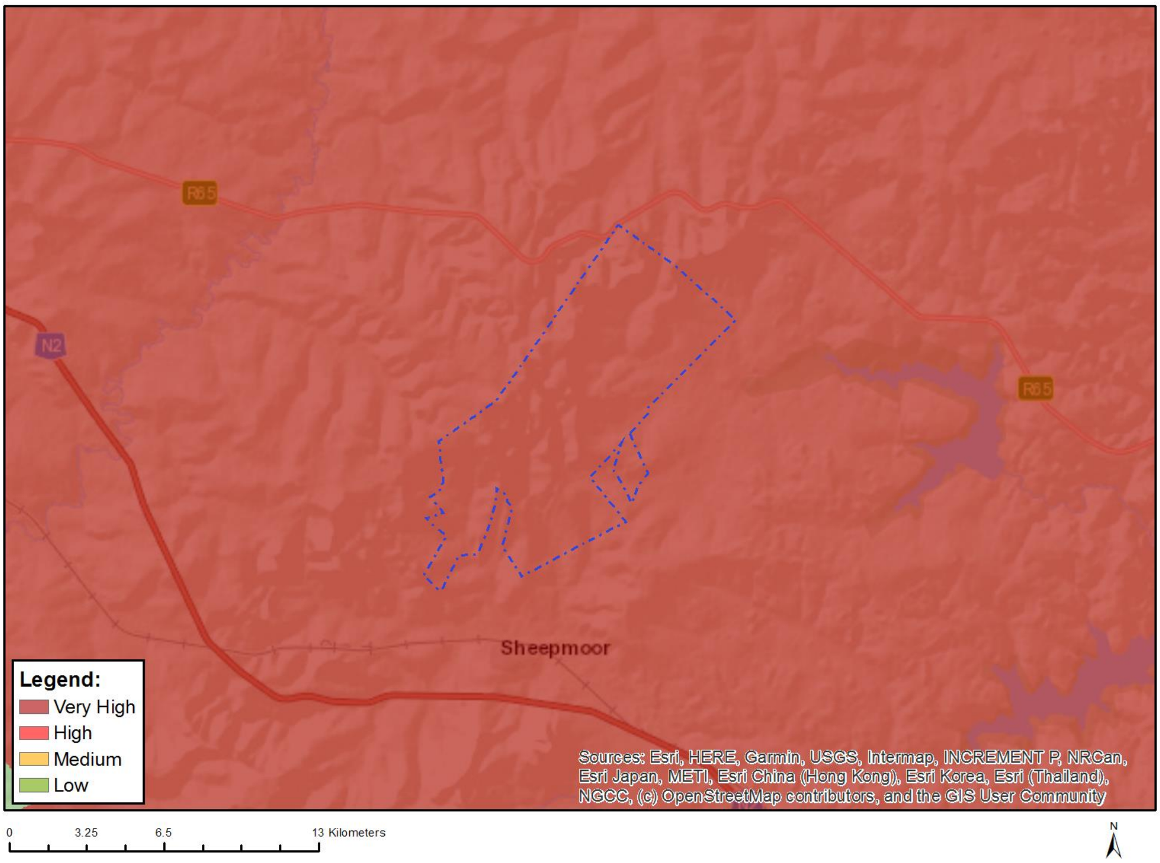
MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	CBA 1
Very High	CBA 2
Very High	ESA: Landscape corridor
Very High	ESA: Local corridor
Very High	FEPA Subcatchment
Very High	National Protected Area Expansion Strategy (NPAES)
Very High	SWSA (SW) _Upper Usutu
Very High	SWSA (SW) _Upper Vaal
Very High	EN_Eastern Highveld Grassland

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SITE SENSITIVITY VERIFICATION
AND
AGRICULTURAL AGRO-ECOSYSTEM SPECIALIST ASSESSMENT
FOR
THE PROPOSED EMVELO WIND ENERGY FACILITY
NEAR ERMELO IN MPUMALANGA PROVINCE

Report by
Johann Lanz

21 November 2023

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EXECUTIVE SUMMARY

South Africa urgently needs electricity generation, and renewable energy offers good potential for that, but requires land. Inevitably agriculturally zoned land will need to be used for much of the renewable energy generation that the country requires. However, to ensure food security, energy facilities should not result in a loss of crop production.

The overall conclusion of this assessment is that the proposed development offers a valuable opportunity for integrating renewable energy with agricultural production in a way that provides benefits to agriculture but leads to insignificant loss of future agricultural production potential.

The site is classified as ranging from low to very high agricultural sensitivity by the screening tool. This site sensitivity verification verifies those parts of the site that are indicated as cropland in this assessment as being of high agricultural sensitivity (or very high for irrigated cropland), and the rest of the site as being of medium agricultural sensitivity.

In general, the soils across more than half of the site have insufficient capability for viable crop production and those on the remaining proportion are suitable for viable cropping. Soil limitations that prevent crop production are predominantly the result of limited depth due to underlying bedrock, clay, or hardpan, or the result of poor drainage. The crop-suitable versus unsuitable soils have been identified over time through trial and error. All the deep, well-drained, suitable soils are generally cropped and uncropped soils that are used for grazing can fairly reliably be considered to have various limitations that make them unsuitable for crop production.

In general, the agricultural production potential of the site is high, and it is within an area that makes a significant contribution to food production in the country. Due to the favourable climate, crop yields are high on the suitable soils with average maize yields of around 7 tons per hectare according to the farmers on site.

An agricultural impact is a change to the future agricultural production potential of land. This is primarily caused by the exclusion of agriculture from the footprint of a development. In the case of wind farms, the amount of land excluded from agriculture is so small that the total extent of the loss of future agricultural production potential is insignificantly small, regardless of how much production potential the land has, and regardless of the duration of the impact. Furthermore, wind farms have both positive and negative effects on the production potential of land, and it is the net sum of these positive and negative effects that determines the extent of the change in future production potential. The positive effects are:

1. increased financial security for farming
2. improved security against stock theft and other crime

3. an improved road network, with associated storm water handling system

Due to the facts that the proposed development will exclude agricultural production from only a very small area of land, and that its negative impact is offset by economic and other benefits to farming, the overall negative agricultural impact of the development (loss of future agricultural production potential) is assessed here as being of low significance and as acceptable.

Its acceptability is further substantiated by the following points:

1. The proposed development will also have the wider societal benefits of generating additional income and employment in the local economy.
2. In addition, the proposed development will contribute to the country's urgent need for energy generation, particularly renewable energy that has much lower environmental and agricultural impact than existing, coal powered energy generation.
3. All renewable energy development in South Africa decreases the need for coal power and thereby contributes to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land throughout the coal mining areas of the country. Furthermore, a reduction in coal power saves water resources and therefore potentially makes more water available for irrigated agriculture.

1 INTRODUCTION

Environmental and change of land use authorisation is being sought for the Emvelo Wind Energy Facility near Ermelo in Mpumalanga Province (see location in Figure 1). In terms of the National Environmental Management Act (Act No 107 of 1998 - NEMA), an application for environmental authorisation requires an agricultural assessment. In this case, because the assessed area includes high agricultural sensitivity land (see Section 7), the level of agricultural assessment required by the agricultural protocol is an Agricultural Agro-Ecosystem Specialist Assessment.

The purpose of an agricultural assessment is to answer the question:

> **Will the proposed development cause a significant reduction in agricultural production potential, and most importantly, will it result in a loss of arable land?**

Section 9 of this report unpacks this question, particularly with respect to what constitutes a significant reduction. To answer the above question, it is necessary to determine the existing agricultural production potential of the land that will be impacted, and specifically whether it is viable arable land or not. This is done in Section 8 of this report. Section 8, 9, and the conclusion of this report directly address the above question and therefore contain the essence of the agricultural impact assessment.

As is shown in Section 9, this assessed development will not result in a significant loss of viable arable land and therefore poses minimal threat to agricultural production potential.

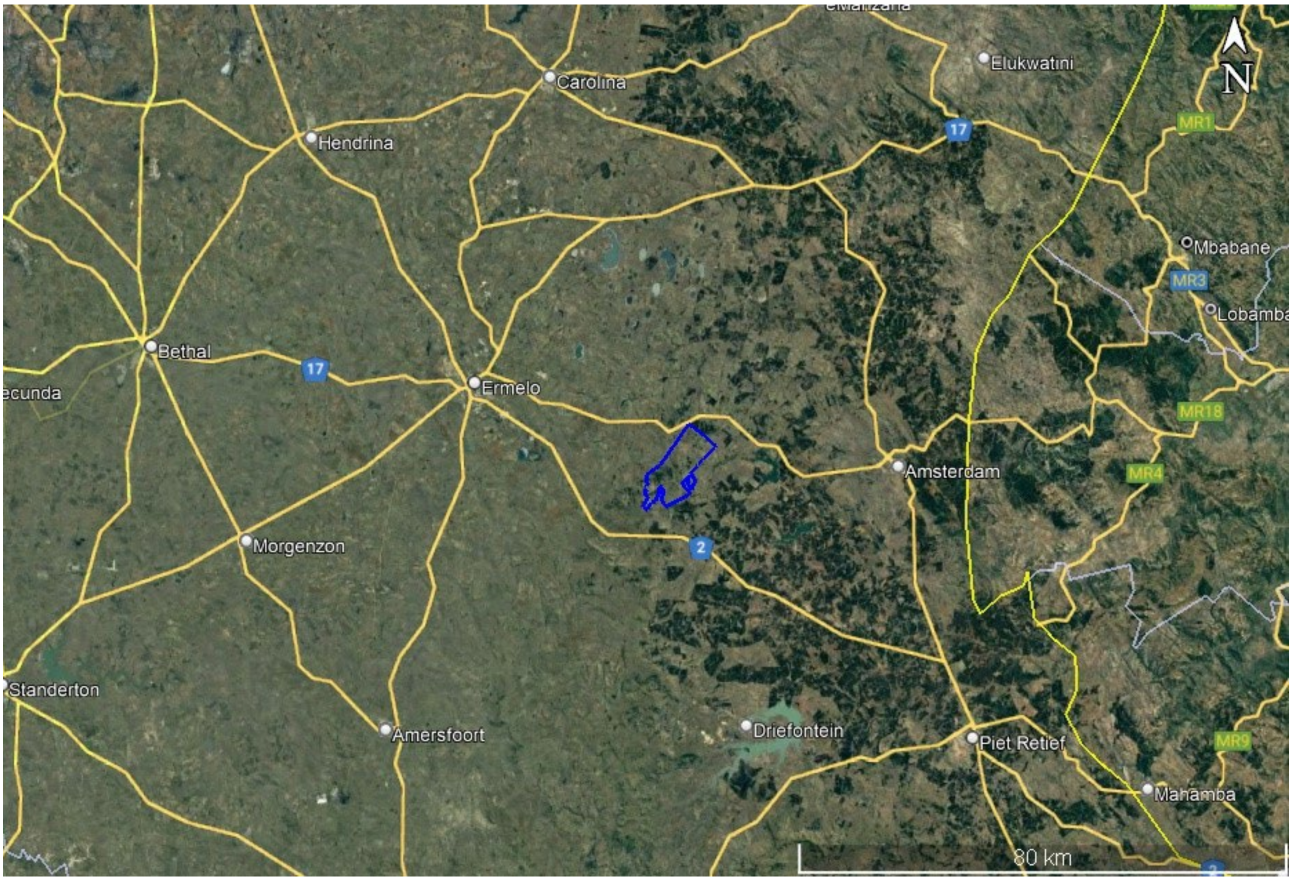

Figure 1. *Locality map of the cadastral boundary of the proposed energy facility (blue outline) to the south-east of the town of Ermelo.*

2 PROJECT DESCRIPTION

The proposed facility will consist of the standard infrastructure of a wind energy facility including, turbines with foundations; crane pads per turbine; cabling; battery energy storage system (BESS); auxiliary buildings; access and internal roads; on-site IPP substation; 132kV grid connection, including an Eskom switching station and overhead power line; and temporary construction laydown areas.

What is relevant for agricultural impact in a wind energy facility layout is the extent of the total agricultural footprint – that is the very small and widely distributed footprint of land from which agriculture is actually excluded. The largest components of this footprint are the crane pads and the roads. The identification of individual components within this footprint is irrelevant to agricultural impact because all components have the same impact, namely occupation of agricultural land. Therefore, it is simply the location of the total footprint that matters. The agricultural footprint of the facility will be shown and assessed in the EIA phase.

This assessment includes the impact of the grid connection. However, a power line has negligible agricultural impact and is therefore not considered to be part of the agricultural footprint of a renewable energy facility in NEMA's agricultural protocol. The associated Eskom switching station is entirely located within the facility fence and therefore does not add in any way to the agricultural impact of the facility as assessed in this report. It is therefore not necessary to detail the grid connection design any further in this assessment.

3 TERMS OF REFERENCE

The terms of reference for this study are to fulfill the requirements of the *Protocol for the specialist assessment and minimum report content requirements of environmental impacts on agricultural resources by onshore wind and/or solar photovoltaic energy generation facilities where the electricity output is 20 megawatts or more*, gazetted on 20 March 2020 in GN 320 (in terms of Sections 24(5)(A) and (H) and 44 of NEMA, 1998).

The terms of reference for an Agricultural Agro-Ecosystem Specialist Assessment, as stipulated in the protocol, are listed below, and the section number of this report which fulfils each stipulation is given after it in brackets.

1. The assessment must be undertaken by a soil scientist or agricultural specialist registered with the South African Council for Natural Scientific Professions (SACNASP). (**Appendix 3**)
2. The assessment must be undertaken on the preferred site and within the proposed development footprint. (**Figures 2 and 3**)
3. The assessment must be undertaken based on a site inspection as well as an investigation of the current production figures, where the land is under cultivation or has been within the past 5 years, and must identify:
    1. the extent of the impact of the proposed development on the agricultural resources (**Section 9.1**);
    2. whether or not the proposed development will have an unacceptable negative impact on the agricultural production capability of the site (**Section 12**), and in the event where it does, whether such a negative impact is outweighed by the positive impact of the proposed development on agricultural resources.
4. The status quo of the site must be described, including the following aspects which must be considered as a minimum in the baseline description of the agro-ecosystem:
    1. The soil form/s, soil depth (effective and total soil depth), top and sub-soil clay percentage, terrain unit and slope (**Section 8**);
    2. Where applicable, the vegetation composition, available water sources as well as agro-climatic information (**Section 8**);
    3. The current productivity of the land based on production figures for all agricultural activities undertaken on the land for the past 5 years, expressed as an annual figure and broken down into production units (**Section 8**);
    4. The current employment figures (both permanent and casual) for the land for the past 3

years, expressed as an annual figure (**Section 8**);

5. Existing impacts on the site, located on a map where relevant (e.g. erosion, alien vegetation, non-agricultural infrastructure, waste, etc **Section 8**).

5. Assessment of Impacts, including the following which must be considered as a minimum in the predicted impact of the proposed development on the agro-ecosystem:
    1. Change in productivity for all agricultural activities based on the figures of the past 5 years, expressed as an annual figure and broken down into production units (**Section 9.1**);
    2. Change in employment figures (both permanent and casual) for the past 5 years expressed as an annual figure (**Section 9.1**);
    3. Any alternative development footprints within the preferred site which would be of "medium" or "low" sensitivity for agricultural resources as identified by the screening tool and verified through the site sensitivity verification (**Section 9.3**).
6. The findings of the Agricultural Agro-Ecosystem Specialist Assessment must be written up in an Agricultural Agro-Ecosystem Specialist Report that contains as a minimum the following information:
    1. Details and relevant experience as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the assessment including a curriculum vita (**Appendix 1);**
    2. A signed statement of independence by the specialist (**Appendix 2**);
    3. The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment (**Section 4**);
    4. A description of the methodology used to undertake the on-site assessment inclusive of the equipment and models used, as relevant (**Section 4**);
    5. A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool (**Figure 2**);
    6. An indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development **Section 9.1**);
    7. an indication of possible long-term benefits that will be generated by the project in comparison to the benefits of the agricultural activities on the affected land (**Section 11.4**);
    8. Additional environmental impacts expected from the proposed development based on the current status quo of the land including erosion, alien vegetation, waste, etc. (**Section 11.5**);
    9. Information on the current agricultural activities being undertaken on adjacent land parcels (**Section 8**);
    10. a motivation must be provided if there were development footprints identified as per point 5.3 above that were identified as having a medium or low agricultural sensitivity and that were not considered appropriate (**Section 9.3**);
    11. Confirmation from the soil scientist or agricultural specialist that all reasonable measures

have been considered in the micro-siting of the proposed development to minimise fragmentation and disturbance of agricultural activities (**Section 11.1**);

12. A substantiated statement from the soil scientist or agricultural specialist with regards to agricultural resources on the acceptability or not of the proposed development and a recommendation on the approval or not of the proposed development (**Section 12**);
13. Any conditions to which this statement is subjected (**Section 12**);
14. Where identified, proposed impact management outcomes or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr) (**Section 10**);
15. A description of the assumptions made and any uncertainties or gaps in knowledge or data (**Section 5**).
16. calculations of the physical development footprint area for each land parcel as well as the total physical development footprint area of the proposed development (including supporting infrastructure) (**Section 11.3**);
17. confirmation whether the development footprint is in line with the allowable development limits set in Table 1 above, including where applicable any deviation from the set development limits and motivation to support the deviation, including (**Section 11.3**):
    a. where relevant, reasons why the proposed development footprint is required to exceed the limit; (not applicable)
    b. where relevant, reasons why this exceedance will be in the national interest; (not applicable) and
    c. where relevant, reasons why there are no alternative options available including evidence of alternatives considered; (not applicable) and
18. a map showing the renewable energy facilities within a 50km radius of the proposed development (**will be provided in EIA phase**)

4 METHODOLOGY OF STUDY

The assessment was based on a verification of current agricultural land use on the site and was informed by existing climate, soil, and agricultural potential data for the site (see references). The level of agricultural assessment is considered entirely adequate for an understanding of on-site agricultural production potential for the purposes of this assessment.

This level of soil assessment is considered entirely adequate for an understanding of on-site soil potential for the purposes of a wind farm assessment. For this purpose, only an understanding of the general range and distribution patterns of different soil conditions across the site is required. A more detailed soil survey would be extremely time consuming and impractical to conduct, given the very large assessment area, and would not provide any additional data that would add value to the assessment of the agricultural impact of a wind farm.

This is because a wind farm extends over a very large surface area. The layout design of a wind farm is complex and there are multiple interacting factors that determine the turbine locations that will ensure the viability of the wind farm. Each turbine influences the amount of wind that the other turbines receive. Therefore, the location of one turbine cannot simply be shifted without requiring other turbines to be shifted as well, to retain the viability of all the turbines. To shift turbines to account for variation in soil conditions would be extremely complex and would require a level of soil mapping detail across the whole wind farm area that would be practically impossible to achieve.

5 ASSUMPTIONS, UNCERTAINTIES OR GAPS IN KNOWLEDGE OR DATA

There are no specific assumptions, uncertainties or gaps in knowledge or data that affect the findings of this study.

6 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

The development requires approval from the National Department of Agriculture, Land Reform and Rural Development (DALRRD) because it is on agriculturally zoned land. This approval is separate to the Environmental Authorisation. There are two approvals that apply. The first is a No Objection Letter for the change in land use. This letter is one of the requirements for receiving municipal rezoning. This application requires a motivation backed by good evidence that the development is acceptable in terms of its impact on the agricultural production potential of the development site. This agricultural assessment report will serve that purpose.

The second approval is a consent for long-term lease required in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA). SALA approval is not required if the lease is over the entire farm portion. If DALRRD approval for the development has already been obtained in the form of the No Objection letter, then SALA approval is likely to be readily forthcoming. SALA approval can only be applied for once the Municipal Rezoning Certificate and Environmental Authorisation has been obtained.

Rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural Resources Act (Act 43 of 1983 - CARA). A consent in terms of CARA is required for the cultivation of virgin land. Cultivation is defined in CARA as “any act by means of which the topsoil is disturbed mechanically”. The purpose of this consent for the cultivation of virgin land is to ensure that only land that is suitable as arable land is cultivated. Therefore, despite the above definition of cultivation, disturbance to the topsoil that results from construction of infrastructure does not constitute cultivation as it is understood in CARA. This has been corroborated by Anneliza Collett (Acting Scientific Manager: Natural Resources Inventories and Assessments in the Directorate: Land and Soil Management of the Department of Agriculture, Land Reform and Rural Development (DALRRD)).

The construction and operation of the facility will therefore not require consent from the Department of Agriculture, Land Reform and Rural Development in terms of this provision of CARA.

7 SITE SENSITIVITY VERIFICATION

A specialist agricultural assessment is required to verify the agricultural sensitivity of the development site as per the sensitivity categories used by the web-based environmental screening tool of the Department of Forestry, Fisheries and the Environment (DFFE). However, such an exercise is of very limited value once the agricultural assessment, which supersedes any screening tool result, has been done. What is of importance to this assessment, rather than the site sensitivity verification, is its assessment of the cropping potential (see Section 8) and its assessment of the impact significance (see Section 9).

The screening tool classifies agricultural sensitivity according to two independent criteria, from two independent data sets, both of which may be indicators of the land's agricultural production potential but are limited in that the first is outdated and the second relies on fairly course data. The two criteria are:

1. whether the land is classified as cropland or not on the field crop boundary data set, and
2. its land capability rating on the land capability data set

All classified cropland is, by definition, either high or very high sensitivity. Land capability is defined as the combination of soil, climate, and terrain suitability factors for supporting rain-fed agricultural production. It is rated by the Department of Agriculture's updated and refined, country-wide land capability mapping (DAFF, 2017). The higher land capability values (≥8 to 15) are likely to indicate suitability as arable land for crop production, while lower values (<8) are only likely to be suitable as non-arable grazing land. The direct relationship between land capability rating and the screening tool's agricultural sensitivity is shown in Table 1.

Table 1. Relationship between land capability and agricultural sensitivity as given by the screening tool.

Land capability value	Agricultural sensitivity
1 - 5	low
6 - 8	medium
9 - 10	high
11 - 15	very high

The agricultural sensitivity of the site, as classified by the screening tool, is shown in Figure 2.

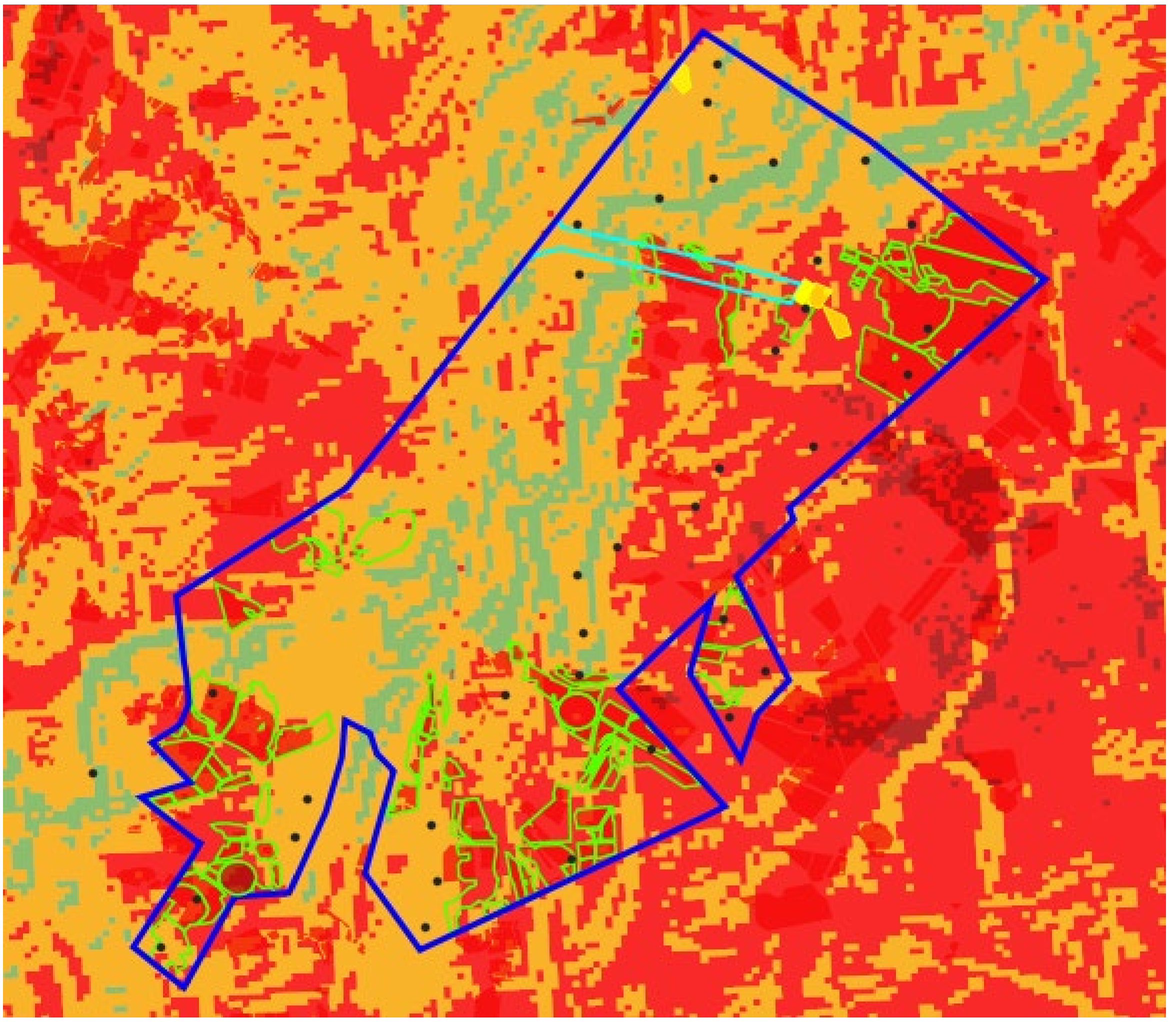

Figure 2. *The assessed area (dark blue outline), turbine locations (black circles), grid corridor (light blue outline) and other project infrastructure (yellow outlines) overlaid on agricultural sensitivity, as given by the screening tool (green = low; yellow = medium; red = high; dark red = very high). The field-verified and updated indication of croplands are shown in bright green outline.*

The screening tool classifies the assessed area as ranging from low to very high agricultural sensitivity. The high and very high sensitivity classification is due to a combination of some land being classified by the screening tool as cropland (irrigated cropland = very high sensitivity) and some being classified with a land capability of between 9 and 11.

The data set used by the screening tool to classify cropland is outdated. The field-verified and updated indication of croplands are shown in Figures 2 and 3.

The classified land capability of the site ranges from 3 to 11. Soil capability is determined in the land capability data largely by an average soil capability value attributed to each land type. However, there are a range of soil capabilities within each land type, which the land capability data is unable to take account of and map. On the ground, the soils (and therefore the land capability) vary in a complex pattern across the landscape, which is not reflected at the scale of the land capability data.

The most reliable indication of soil cropping potential or soil capability is current and historical land use. The suitable versus the unsuitable soils have been identified over time through trial and error. In an agricultural environment like the one being assessed, all the suitable soils are generally cropped. Cropped soils have a real land capability of ≥8 because the relationship between land capability and agricultural production potential is such that a land capability of ≥8 should denote land that is suitable for viable rain-fed crop production. Uncropped soils can fairly reliably be considered to have limitations that make them unsuitable for crop production with the result that their real land capability is less than 8.

This site sensitivity verification verifies those parts of the site that are indicated as cropland in Figures 2 and 3 as being of high agricultural sensitivity (or very high for irrigated cropland), and the rest of the site as being of medium agricultural sensitivity with a maximum land capability of 7.

8 BASELINE DESCRIPTION OF THE AGRO-ECOSYSTEM

The purpose of this section of an agricultural assessment report is to present the baseline information that controls the agricultural production potential of the site so that an assessment of that potential can be made. Agricultural production potential, and particularly cropping potential, is one of three factors that determines the significance of an agricultural impact, together with size of footprint and duration of impact (see Section 9).

All the important parameters that control the agricultural production potential of the site are given in Table 2, and a satellite image map of the assessed area is shown in Figure 3.

The site falls within an area that is classified as a Protected Agricultural Area. A Protected Agricultural Area is a demarcated area in which the climate, terrain, and soil are generally conducive for agricultural production and which, historically, has made important contributions to the production of the various crops that are grown across South Africa. Within Protected Agricultural Areas, the protection, particularly of arable land, is considered a priority for the protection of food security in South Africa. However, there may be much variation within a Protected Agricultural Area and all land within it is not necessarily of sufficient agricultural potential to be suitable for crop production, due to site-specific terrain, soil, and other constraints. All land within a Protected Agricultural Area is therefore not necessarily worthy of prioritised protection as agricultural production land.

There are no existing impacts on the site that are relevant to agricultural impact.

Table 2: Parameters that control and/or describe the agricultural production potential of the site.

	Parameter	Value
Climate	Köppen-Geiger climate description (Beck *et al*, 2018)	Temperate, dry winter, hot summer
	Mean Annual Rainfall (mm) (Schulze, 2009)	667
	Reference Crop Evaporation Annual Total (mm) (Schulze, 2009)	1207
	Climate capability classification (out of 9) (DAFF, 2017)	6 (moderate-high)
Terrain	Terrain type	Low hills
	Terrain morphological unit	Varied
	Slope gradients (%)	0-20
	Altitude (m)	1650
	Terrain capability classification (out of 9) (DAFF, 2017)	Between 3 (low) and 7 (high)
Soil	Geology (DAFF, 2002)	Shale and sandstone of the Vryheid Formation, Ecca Group, and dolerite; Granitic gneiss
	Land type (DAFF, 2002)	Bb35, Ac39, Fa169
	Description of the soils	Predominantly very shallow to deep, medium to heavy textured soils based on underlying rock, clay or hardpan
	Dominant soil forms	Av, Cf, Lo, Wa, Ms, Hu, Gf, Gs, My, R
	Soil capability classification (out of 9) (DAFF, 2017)	Between 4 (low-medium) and 6 (medium-high)
	Soil limitations	Limited soil depth, drainage
Land use	Agricultural land use in the surrounding area	Irrigation, dry land crop production, grazing
	Agricultural land use on the site	Irrigation, dry land crop production, grazing
General	Long-term grazing capacity (ha/LSU) (DAFF, 2018)	4 (very high)
	Land capability classification (out of 15) (DAFF, 2017))	Between 3 (low-very low) and 11 (high)
	Within Protected Agricultural Area (DALRRD, 2020)	Yes

The agricultural protocol requires the current productivity of the land based on detailed production figures and it requires the current employment figures. This detail is entirely irrelevant to the assessment of the agricultural impact, given that the expected losses in production and employment will be zero (see Section 9.1). It is therefore unnecessary to include this detail.

8.1 Assessment of the agricultural production potential

This assessment of the agricultural production potential of the site is based on an integration of the different parameters in Table 2 above and the on-site investigation.

In general, the soils across more than half of the site have insufficient capability for viable crop production and those on the remaining proportion are suitable for viable cropping. Soil limitations that prevent crop production are predominantly the result of limited depth due to underlying bedrock, clay, or hardpan, or the result of poor drainage. As discussed in Section 7, the crop-suitable versus unsuitable soils have been identified over time through trial and error. All the deep, well-drained, suitable soils are generally cropped and uncropped soils that are used for grazing can fairly reliably be considered to have various limitations that make them unsuitable for crop production.

In general, the agricultural production potential of the site is high, and it is within an area that makes a significant contribution to food production in the country. Due to the favourable climate, crop yields are high on the suitable soils with average maize yields of around 7 tons per hectare according to the farmers on site.

It should be noted that cropping potential changes with a changing agricultural economy over time. Poorer soils that may have been cropped with economic viability in the past, are abandoned as cropland because they become too marginal for viable crop production in a more challenging agricultural economy, with increased input costs.

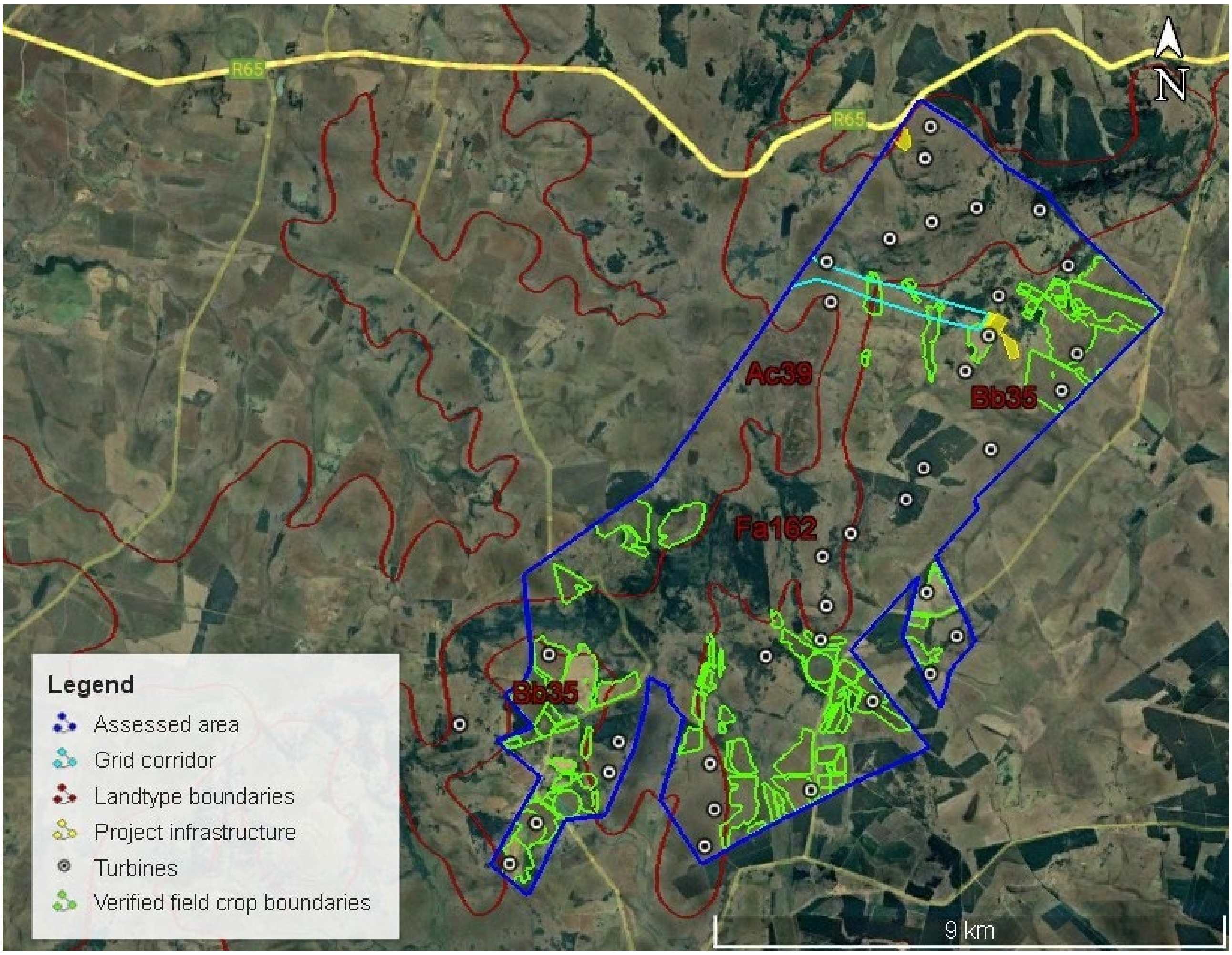

Figure 3. *Satellite image map of the assessed area*

9 ASSESSMENT OF AGRICULTURAL IMPACT

9.1 Impact identification and assessment

An agricultural impact is a change to the future agricultural production potential of land. In most developments, this is primarily caused by the exclusion of agriculture from the footprint of the development. Soil erosion and degradation may also contribute to loss of agricultural production potential. The significance of the impact is a direct function of the following three factors:

1. the size of the footprint of land from which agriculture will be excluded (or the footprint that will have its potential decreased)
2. the baseline production potential (particularly cropping potential) of that land
3. the length of time for which agriculture will be excluded (or for which potential will be decreased).

In the case of wind farms, the first factor, size of footprint, is so small that the total extent of the loss of future agricultural production potential is insignificantly small, regardless of how much production potential the land has, and regardless of the duration of the impact. This is because the required spacing between turbines means that the amount of land excluded from agricultural use is extremely small in relation to the surface area over which a wind farm is distributed. Wind farm infrastructure (including all associated infrastructure and roads) typically occupies less than 2% of the surface area, according to the typical surface area requirements of wind farms in South Africa (DEA, 2015). Most wind energy facilities, for which I have recently done assessments, occupy less than 1% of the surface area. All agricultural activities can continue unaffectedly on all parts of the farmland other than this small footprint, from which agriculture is excluded, and the actual loss of production potential is therefore insignificant.

A study done to measure the impact of existing wind farms on agricultural production potential (Lanz, 2018) is highly informative of the extent of the agricultural impact that is likely for this proposed development. Although the study was done in a different agricultural environment, it is similar in terms of being a highly productive and intensively farmed environment with cultivation. There is no reason that the results obtained in that study would not be applicable to the area in this assessment. The overall conclusion of the study was that, although wind farms have been established within an area of cultivated farmland that supports intensive and productive farming, it is highly unlikely that this has caused a reduction in agricultural production. Small amounts of production land have been lost, but the consequence of this for agricultural production has been negligible. It is likely that the positive financial impacts of wind farming have outweighed the negative impacts, and that wind farming has benefited agriculture and agricultural production in the area.

As identified in the study, it is important to note that wind farms have both positive and negative effects on the production potential of land. It is the net sum of these positive and negative effects that determines the extent of the change in future production potential. The positive effects are:

1. **increased financial security for farming operations -** Reliable and predictable income will be generated by the farming enterprises through the lease of land to the energy facility. This will increase financial security and could improve farming operations and productivity through increased investment into farming.
2. **improved security against stock theft and other crime** due to the presence of security infrastructure and security personnel at the energy facility.
3. **an improved road network**, with associated storm water handling system. The wind farm will construct turbine access roads of a higher standard than the existing farm roads which will give farming vehicles better access to farmlands. This will be especially relevant during wet periods when access to croplands for spraying etc is limited by the current farm roads.

There are two additional effects, but because they are highly unlikely to influence agricultural production, they are not considered further. They are:

- **Prevention of crop spraying by aircraft over land occupied by turbines** – ground based or using drones for spraying are effective, alternative methods that can be used without implications for production or profitability.
- **Interference with farming operations** - Construction (and decommissioning) activities are likely to have some nuisance impact for farming operations but are highly unlikely to have an impact on agricultural production.

The loss of agricultural potential by soil degradation can effectively be prevented for renewable energy developments by generic mitigation measures that are all inherent in the project engineering and/or are standard, best-practice for construction sites. Soil degradation does not therefore pose a significant impact risk.

Due to the facts that the proposed development will exclude agricultural production from only a very small area of land, and that its negative impact is offset by economic and other benefits to farming, the overall negative agricultural impact of the development (loss of future agricultural production potential) is assessed here as being of low significance and as acceptable.

The agricultural protocol requires an indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development. As this assessment has shown, the agricultural use of the land will be integrated with the renewable energy facility, and it will continue with no discernible change in terms of production. The expected losses in production and employment will therefore be zero.

9.2 Cumulative impact assessment

Specialist assessments for environmental authorisation are required to assess cumulative impacts. The cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present, or reasonably foreseeable future activities that will affect the same environment.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of future agricultural production potential. The defining question for assessing the cumulative agricultural impact is this:

What loss of future agricultural production potential is acceptable in the area, and will the loss associated with the proposed development, when considered in the context of all past, present, or reasonably foreseeable future impacts, cause that level in the area to be exceeded?

The Department of Forestry, Fisheries and the Environment (DFFE) requires compliance with a specified methodology for the assessment of cumulative impacts. This is positive in that it ensures engagement with the important issue of cumulative impacts. However, the required compliance has some limitations and can, in the opinion of the author, result in an over-focus on methodological compliance, while missing the more important task of effectively answering the above defining question.

This cumulative impact assessment will determine the quantitative loss of agricultural land if all renewable energy project applications within a 30 km radius become operational. The quantification of the cumulative impact will be done in detail in the EIA phase. This is highly likely to confirm that the cumulative impact of loss of future agricultural production potential is low. The development is highly likely to have an acceptable impact on the agricultural production capability of the area and therefore be recommended for approval from a cumulative agricultural impact point of view.

Due to its negligible agricultural impact, the assessed power line cannot exceed acceptable levels of change in terms of agricultural land loss, no matter how much grid infrastructure exists. In reality, the landscape could be covered with power lines and agricultural production would continue, largely unaffected. It therefore makes no sense to conduct a more formal assessment of cumulative power line impacts as per DFFE requirements. The cumulative impact of the power line can confidently be assessed as being of very low significance and therefore as acceptable. It will not have an unacceptable negative impact on the agricultural production capability of the area, and it is therefore recommended, from a cumulative agricultural impact perspective, that the development be approved.

9.3 Assessment of alternatives

The agricultural protocol requires identification of any alternative development footprints within the preferred site which would be of “medium” or “low” sensitivity for agricultural resources as identified by the screening tool and verified through the site sensitivity verification.

The site includes croplands, and it is highly likely that some of the turbines will need to be located within these. The positioning of turbines in a wind farm is complex and there are multiple, interacting factors that determine the locations that will ensure the viability of the wind farm. Each turbine influences the amount of wind that the other turbines receive. Therefore, the location of one turbine cannot simply be shifted without requiring other turbines to be shifted as well, to retain the viability of all the turbines. Turbines cannot therefore simply be shifted off the cropland. However, as has been discussed above, the agricultural impact of these turbines within croplands is so small that it does not make sense to compromise the viability of the wind farm, to make only an insignificant change to the agricultural impact.

Specialist assessments for environmental authorisation are required to assess the impacts of alternatives, including the no-go alternative. The no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. There are no agricultural impacts of the no-go alternative. The development, on the other hand, offers an additional income source to agriculture, without excluding agriculture from the land. Therefore, the negative agricultural impact of the no-go alternative is more significant than that of the development, and so, from an agricultural impact perspective, the proposed development is the preferred alternative between the development and the no-go. In addition, the no-go option would prevent the proposed development from contributing to the environmental, social, and economic benefits associated with the development of renewable energy.

10 MITIGATION MEASURES

Generic mitigation measures that are effective in preventing soil degradation are all inherent in the engineering of such a project and/or are standard, best-practice for construction sites.

- A system of storm water management, which will prevent erosion on and downstream of the site, will be an inherent part of the engineering design on site. Any occurrences of erosion must be attended to immediately and the integrity of the erosion control system at that point must be amended to prevent further erosion from occurring there. As part of the system, the integrity of the existing contour bank systems of erosion control on croplands, where they occur on steeper slopes, must be kept intact.
- Any excavations done during the construction phase, in areas that will be re-vegetated at the end of the construction phase, must separate the upper 40 cm of topsoil from the rest of the excavation spoils and store it in a separate stockpile. When the excavation is back-filled, the topsoil must be back-filled last, so that it is at the surface. Topsoil should only be stripped in areas that are excavated. Across the majority of the site, including construction lay down areas, it will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire cut surface.

11 ADDITIONAL ASPECTS REQUIRED IN AN AGRICULTURAL ASSESSMENT

11.1 Micro siting

The agricultural protocol requires confirmation that all reasonable measures have been taken through micro-siting to minimize fragmentation and disturbance of agricultural activities. An aspect of wind farm layout that can cause unnecessary fragmentation of croplands is the location of turbine access roads within croplands. This will be assessed in the EIA phase.

11.2 Confirmation of linear activity impact

The protocol requires confirmation, in the case of a linear activity, that the land can be returned to the current state within two years of completion of the construction phase. This is not relevant in this case because the proposed development is not limited to being a linear one.

11.3 Compliance with the allowable development limits

Compliance with the allowable development limits will be assessed in the EIA phase, once the footprint of the facility has been finalised.

11.4 Long term benefits versus agricultural benefits

The development will generate a significant and reliable additional income for the farming enterprises, without compromising the existing farming income. It will also generate additional income and employment in the local economy. In addition, it will contribute to the country's need for energy generation, particularly renewable energy that has lower environmental and agricultural impact than existing, coal powered energy generation.

11.5 Additional environmental impacts

There are no additional environmental impacts of the proposed development that are relevant to agriculture.

12 CONCLUSION

The overall conclusion of this assessment is that the proposed development offers a valuable opportunity for integrating renewable energy with agricultural production in a way that provides benefits to agriculture but leads to insignificant loss of future agricultural production potential.

The site is classified as ranging from low to very high agricultural sensitivity by the screening tool. This site sensitivity verification verifies those parts of the site that are indicated as cropland in this assessment as being of high agricultural sensitivity (or very high for irrigated cropland), and the rest of the site as being of medium agricultural sensitivity.

In general, the soils across more than half of the site have insufficient capability for viable crop production and those on the remaining proportion are suitable for viable cropping. Soil limitations that prevent crop production are predominantly the result of limited depth due to underlying bedrock, clay, or hardpan, or the result of poor drainage. The crop-suitable versus unsuitable soils have been identified over time through trial and error. All the deep, well-drained, suitable soils are generally cropped and uncropped soils that are used for grazing can fairly reliably be considered to have various limitations that make them unsuitable for crop production.

In general, the agricultural production potential of the site is high, and it is within an area that makes a significant contribution to food production in the country. Due to the favourable climate, crop yields are high on the suitable soils with average maize yields of around 7 tons per hectare according to the farmers on site.

An agricultural impact is a change to the future agricultural production potential of land. This is primarily caused by the exclusion of agriculture from the footprint of a development. In the case of wind farms, the amount of land excluded from agriculture is so small that the total extent of the loss of future agricultural production potential is insignificantly small, regardless of how much production potential the land has, and regardless of the duration of the impact. Furthermore, wind farms have both positive and negative effects on the production potential of land, and it is the net sum of these positive and negative effects that determines the extent of the change in future production potential. The positive effects are:

1. increased financial security for farming
2. improved security against stock theft and other crime
3. an improved road network, with associated storm water handling system

Due to the facts that the proposed development will exclude agricultural production from only a very small area of land, and that its negative impact is offset by economic and other benefits to farming, the overall negative agricultural impact of the development (loss of future agricultural production potential) is assessed here as being of low significance and as acceptable.

Its acceptability is further substantiated by the following points:

1. The proposed development will also have the wider societal benefits of generating additional income and employment in the local economy.
2. In addition, the proposed development will contribute to the country's urgent need for energy generation, particularly renewable energy that has much lower environmental and agricultural impact than existing, coal powered energy generation.
3. All renewable energy development in South Africa decreases the need for coal power and thereby contributes to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land throughout the coal mining areas of the country. Furthermore, a reduction in coal power saves water resources and therefore potentially makes more water available for irrigated agriculture.

13 REFERENCES

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Lanz, J. 2018. The impact of wind farms on agricultural resources and production: a case study from the Humansdorp area, Eastern Cape. Unpublished Report.

Schulze, R.E. 2009. South African Atlas of Agrohydrology and Climatology, available on Cape Farm Mapper. Available at: https://gis.elsenburg.com/apps/cfm/

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APPENDIX 1: SPECIALIST CURRICULUM VITAE

Johann Lanz
Curriculum Vitae

Education

M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - 1997
B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I have been registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science since 2012 (registration number 400268/12) and am a member of the Soil Science Society of South Africa.

Soil & Agricultural Consulting Self employed 2002 - present

Within the past 5 years of running my soil and agricultural consulting business, I have completed more than 170 agricultural assessments (EIAs, SEAs, EMPRs) in all 9 provinces for renewable energy, mining, electrical grid infrastructure, urban, and agricultural developments. I was the appointed agricultural specialist for the nation-wide SEAs for wind and solar PV developments, electrical grid infrastructure, and gas pipelines. My regular clients include: Zutari; CSIR; SiVEST; SLR; WSP; Arcus; SRK; Environamics; Royal Haskoning DHV; ABO; Enertrag; WKN-Windcurrent; JG Afrika; Mainstream; Redcap; G7; Mulilo; and Tiptrans. Recent agricultural clients for soil resource evaluations and mapping include Cederberg Wines; Western Cape Department of Agriculture; Vogelfontein Citrus; De Grendel Estate; Zewenwacht Wine Estate; and Goedgedacht Olives.

In 2018 I completed a ground-breaking case study that measured the agricultural impact of existing wind farms in the Eastern Cape.

Soil Science Consultant Agricultural Consultors International (Tinie du Preez) 1998 - 2001

Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

Contracting Soil Scientist De Beers Namaqualand Mines July 1997 - Jan 1998

Completed a contract to advise soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
- Lanz, J. 2009. Soil health constraints. *South African Fruit Journal*, August / September 2009 issue.
- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

forestry, fisheries & the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002 Tel: +27 12 399 9000, Fax: +27 86 625 1042

APPENDIX 2: SPECIALIST DECLARATION FORM AUGUST 2023

Specialist Declaration form for assessments undertaken for 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)

REPORT TITLE

SITE SENSITIVITY VERIFICATION AND AGRICULTURAL AGRO-ECOSYSTEM SPECIALIST ASSESSMENT FOR THE PROPOSED EMVELO WIND ENERGY FACILITY NEAR ERMELO IN MPUMALANGA PROVINCE

Kindly note the following:

7. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
8. This form is current as of August 2023. 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.dffe.gov.za/documents/forms.
9. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
10. The specialist must be aware of and comply with 't*he 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 act, when applying for environmental authorisation - GN 320/2020)'*, where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Agricultural Assessment
Specialist Company Name	Not applicable – sole proprietor
Specialist Name	Johann Lanz
Specialist Identity Number	6607045174089
Specialist Qualifications:	M.Sc. (Environmental Geochemistry)
Professional affiliation/registration:	Registered Professional Natural Scientist (Pr.Sci.Nat.) Reg. no. 400268/12 Member of the Soil Science Society of South Africa
Physical address:	1a Wolfe Street, Wynberg, Cape Town, 7800
Postal address:	1a Wolfe Street, Wynberg, Cape Town, 7800
Telephone	Not applicable
Cell phone	+27 82 927 9018
E-mail	johann@johannlanz.co.za

2. DECLARATION BY THE SPECIALIST

I, **Johann Lanz** declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements 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 National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. “the Protocols”) and in Government Notice No. 1150 of 30 October 2020.
- 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 –
    1. any decision to be taken with respect to the application by the competent authority; and;
    2. 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 NEMA Act.

Signature of the Specialist

Name of Company: Johann Lanz – Soil Scientist (sole proprietor)

Date: 19 September 2023

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Johann Lanz**, swear under oath that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Johann Lanz – Soil Scientist – sole proprietor

Name of Company

2023/09/19

Date

0441868-9
Warrant Officer Johann Kotze

Signature of the Commissioner of Oaths

2023.09.19.

Date

SUID-AFRIKAANSE POLISIEDIENS
COMMUNITY SERVICE CENTRE
BOTHASIG
2023 -09- 19
COMMUNITY SERVICE CENTRE
BOTHASIG
SOUTH AFRICAN POLICE SERVICE

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Johan Lanz

Registration Number: 400268/12

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Soil Science (Professional Natural Scientist)

Effective **15 August 2012** Expires **31 March 2024**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

APPENDIX 4: PROJECTS INCLUDED IN CUMULATIVE IMPACT ASSESSMENT

The table below will be completed in the EIA phase.

Table 2**:** Table of all projects that were included in the cumulative impact assessment.

DFFE Reference	Project name	Technology	Capacity (MW)
Total solar			
Total wind			
Total			

APPENDIX 5: SOIL DATA

Table of land type soil data

Land type	Soil series (forms)	Depth (mm)			Clay % A horizon			Clay % B horizon			Depth limiting layer	% of land type
Bb35	Cv17Cv18Cv16	450	-	900	25	-	45	30	-	60	so	18,0
Bb35	Av	600	-	1200	20	-	30	30	-	40	sp	13,3
Bb35	Cf, Lo, Wa	400	-	900	12	-	25				so,sp,hp	12,3
Bb35	Ms	100	-	450	12	-	25				hp	9,5
Bb35	Hu	600	>	1200	30	-	45	35	-	60	so,hp	9,0
Bb35	Gf		>	1200	30	-	45	35	-	60		7,3
Bb35	Gs	300	-	450	15	-	25				lc	6,3
Bb35	Gs	300	-	450	15	-	25				lc	6,0
Bb35	Ka		>	1200	25	-	40				gc	5,0
Bb35	Ms	100	-	300	12	-	25				hp	4,3
Bb35	Gc	450	-	900	20	-	30	20	-	30	hp	3,5
Bb35	S											3,0
Bb35	R											2,8
Ac39	Hu	450	-	1200	20	-	35	30	-	45	so,hp	36,8
Ac39	My	300	-	450	30	-	45				lc	7,8
Ac39	R											7,5
Ac39	Ms	200	-	450	15	-	25				R	7,4
Ac39	Sd	400	-	800	30	-	45	35	-	60	so	7,4
Ac39	Cv	500	-	1200	20	-	35	25	-	45	so	7,3
Ac39	Gc	500	-	1200	20	-	30	25	-	35	hp	4,9
Ac39	Gs	300	-	450	15	-	25				lc	4,9
Ac39	Bo		>	1200	30	-	50	35	-	60		3,0
Ac39	Sw, Va	200	-	450	30	-	40	40	-	55	vp	2,8
Ac39	Mw	300	-	450	30	-	45				R	2,7
Ac39	Lo	450	-	900	15	-	25	30	-	40	sp	2,6
Ac39	Ms	200	-	450	15	-	25				hp	2,5
Ac39	Gf		>	1200	30	-	45	35	-	60		2,4

Land type	Soil series (forms)	Depth (mm)			Clay % A horizon			Clay % B horizon			Depth limiting layer	% of land type
Fa162	Ms, Gs	200	-	450	15	-	25				R,lc	25,0
Fa162	R											24,8
Fa162	Sd	400	-	600	30	-	35	30	-	45	so	15,6
Fa162	My	300	-	500	30	-	45				lc	9,3
Fa162	Hu	400	-	600	20	-	30	25	-	35	so	8,9
Fa162	Cv	400	-	600	15	-	25	20	-	30	so	5,7
Fa162	Sw	400	-	500	30	-	35	35	-	50	so	4,1
Fa162	Hu	450	>	1200	25	-	30	25	-	40	so,hp	3,8
Fa162	Bo	900	>	1200	35	-	45	40	-	50	so	2,2
Fa162	Sd	450	>	1200	30	-	35	30	-	40	so	0,8

forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

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SPECIALIST DECLARATION FORM AUGUST 2023

Specialist Declaration form for assessments undertaken for 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)

REPORT TITLE: Mulilo Amsterdam Sheepmoor, Rochdale and Emvelo WEFs

Kindly note the following:

1. This form must always be used for assessment that are in support of 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 August 2023. 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.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with ‘t*he 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 act, when applying for environmental authorisation - GN 320/2020)’*, where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Agricultural Assessment
Specialist Company Name	SoilZA (sole proprietor)
Specialist Name	Johann Lanz
Specialist Identity Number	6607045174089
Specialist Qualifications:	M.Sc. (Environmental Geochemistry)
Professional affiliation/registration:	Registered Professional Natural Scientist (Pr.Sci.Nat.) Reg. no. 400268/12 Member of the Soil Science Society of South Africa
Physical address:	1a Wolfe Street, Wynberg, Cape Town, 7800
Postal address:	1a Wolfe Street, Wynberg, Cape Town, 7800
Telephone	Not applicable
Cell phone	+27 82 927 9018
E-mail	johann@soilza.co.za

2. DECLARATION BY THE SPECIALIST

I, **Johann Lanz** declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements 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 National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 NEMA Act.

Signature of the Specialist

SoilZA (sole proprietor)

Name of Company:

18 September 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Johann Lanz**, swear under oath that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

SoilZA – sole proprietor

Name of Company

18 September

Date

7174061-9

WS MADUBELA

Signature of the Commissioner of Oaths

2024-09-18

Date

SUID-AFRIKAANSE POLISIEDIENS
GEMEENSKAPSDIENSSENTRUM
18 SEP 2024
COMMUNITY SERVICE CENTRE
MELKBOSSTRAND
SOUTH AFRICAN POLICE SERVICE

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Johan Lanz

Registration Number: 400268/12

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule 1 of the Act)

Soil Science (Professional Natural Scientist)

Effective **15 August 2012** Expires **31 March 2025**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

Faunal Scoping Report: Site sensitivity Verification and Compliance Statement

PROPOSED MULILO CLUSTER WEF, ERMELO, MPUMALANGA PROVINCE

Compiled for: Arcus Consultancy Services South Africa (Pty) Limited (an ERM Group Company)

Applicant: Emvelo WEF

Emvelo

Report Information

Document name	**Emvelo WEF: Faunal Scoping Report**
Number of pages:	**40**
Authors involved in compiling this report:	Jonathan Colville (PhD) – Terrestrial Ecologist & Faunal Surveys Callan Cohen (PhD) – Birding Africa
Authors contact details:	**Email:** jonathan.colville@gmail.com | **Phone:** +27 83 564 5050 **Email:** callan@birdingafrica.com | **Phone:** +27 83 256 0491
Document version:	1.0

Citation

Colville, J.F. & Cohen, C. 2023. Faunal Scoping Report: Site Sensitivity verification and Compliance Statement for Proposed Mulilo Cluster WEF, Ermelo, Mpumalanga Province: Emvelo WEF. Prepared for Arcus Consultancy Services South Africa (Pty) Limited (an ERM Group Company), 12 July 2023.

Table of Contents

List of Figures

Specialist Details

Specialist Details | Jonathan Colville -- Terrestrial Ecologist & Faunal Surveys	
Company Name	Jonathan Colville -- Terrestrial Ecologist & Faunal Surveys
Email Address	jonathan.colville@gmail.com
Telephone	+27 (0) 83 564 5050
Highest Qualification	PhD Zoology | University of Cape Town | 2009
SACNASP Reg. No.	134759
Areas of Specialisation	Terrestrial faunal ecology and conservation

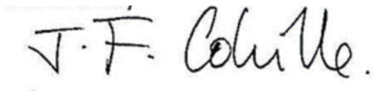
Jonathan Colville of Terrestrial Ecologist & Faunal Surveys has over fourteen years post-PhD experience in the fields of terrestrial ecology, including investigating the spatial patterns of South Africa's animal and plant diversity. Between 2009 and 2019, Jonathan was involved with the South African National Biodiversity Institute's (SANBI) Biodiversity, Research, Assessment and Monitoring Division (BRAM) undertaking ecological research on South Africa's animal and plant diversity. Since 2020 Jonathan has been operating as a specialist faunal consultant for EIAs and conservation projects. An abridged CV is provided below in Appendix 1.

Specialist Details | Callan Cohen -- Birding Africa	
Company Name	Birding Africa
Email Address	callan@birdingafrica.con
Telephone	+27 83 256 0491
Highest Qualification	PhD Ornithology | University of Cape Town | 2011
Areas of Specialisation	Ornithology, Ecology, Odonata

Callan Cohen (Director of Birding Africa) has extensive knowledge of Cape birds and is a recognised international expert on African birds. He has a PhD in Ornithology from the University of Cape Town where he is a Research Associate of the FitzPatrick Institute of African Ornithology. He has co-authored two books on South African birds and contributed to five others, including the Red Data Book of Birds of South Africa, Lesotho, and Swaziland (Barnes, 2000). He has also published several books, articles, and reports on Odonata, Lepidoptera, Herpetology and Botany. He has over 30 years of experience of bird field surveys. An abridged CV is provided below in Appendix 2.

Signed Statement of Independence:
In terms of Chapter 5 of the National Environmental Management Act of 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment Regulations, 2014, specialists involved in Environment Assessment Processes must declare their independence and provide their contact details, relevant experience, and a curriculum vitae. I, Jonathan F. Colville, as the appointed independent specialists, do hereby declare that I am financially and otherwise independent of the client and their EAP, and that all opinions expressed

in this document are my own and based on my scientific and professional knowledge, and available information.



Jonathan F. Colville

Conditions Pertaining to this Report

The content of this report is based on my best scientific and professional knowledge, and available information. Jonathan Colville reserves the right to modify the report in any way deemed fit should new, relevant, or previously unavailable or undisclosed information becomes known to him from on-going research or further work in this field, or pertaining to this investigation, and he will inform ARCUS accordingly. This report must not be altered or added to without the prior written consent of Jonathan Colville. This also refers to electronic copies of the report, which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must refer to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

Introduction

ARCUS has been engaged by Mulilo Renewable Energy Developments (Pty) Ltd to undertake a Basic Assessment for the proposed development of a commercial wind farm cluster that is expected to comprise three separate (~200 MW to 360 MW) Wind Energy Facilities (WEFs). This faunal scoping report covers the Emvelo WEF, the first of the three WEFs, and covers the non-avifaunal component of the animal species theme.

ARCUS utilised the National Web based Environmental Screening Tool (https://screening.environment.gov.za/screeningtool/) to generate an online site sensitivity report. The screening tool uses faunal species data provided by the South African National Biodiversity Institute (SANBI).

The Screening Tool rated the development footprint of the above project as of "**High**" sensitivity for the animal species sensitivity theme, mostly based on several avifaunal species. Two non-avifaunal Species of Conservation Concern (SCC) were flagged, with possible suitable habitat for:

- One katydid species:
    - Lalande's Black-winged Clonia (*Clonia lalandei*): Medium sensitivity
- One mammal species:
    - Oribi (*Ourebia ourebi ourebi*): Medium sensitivity

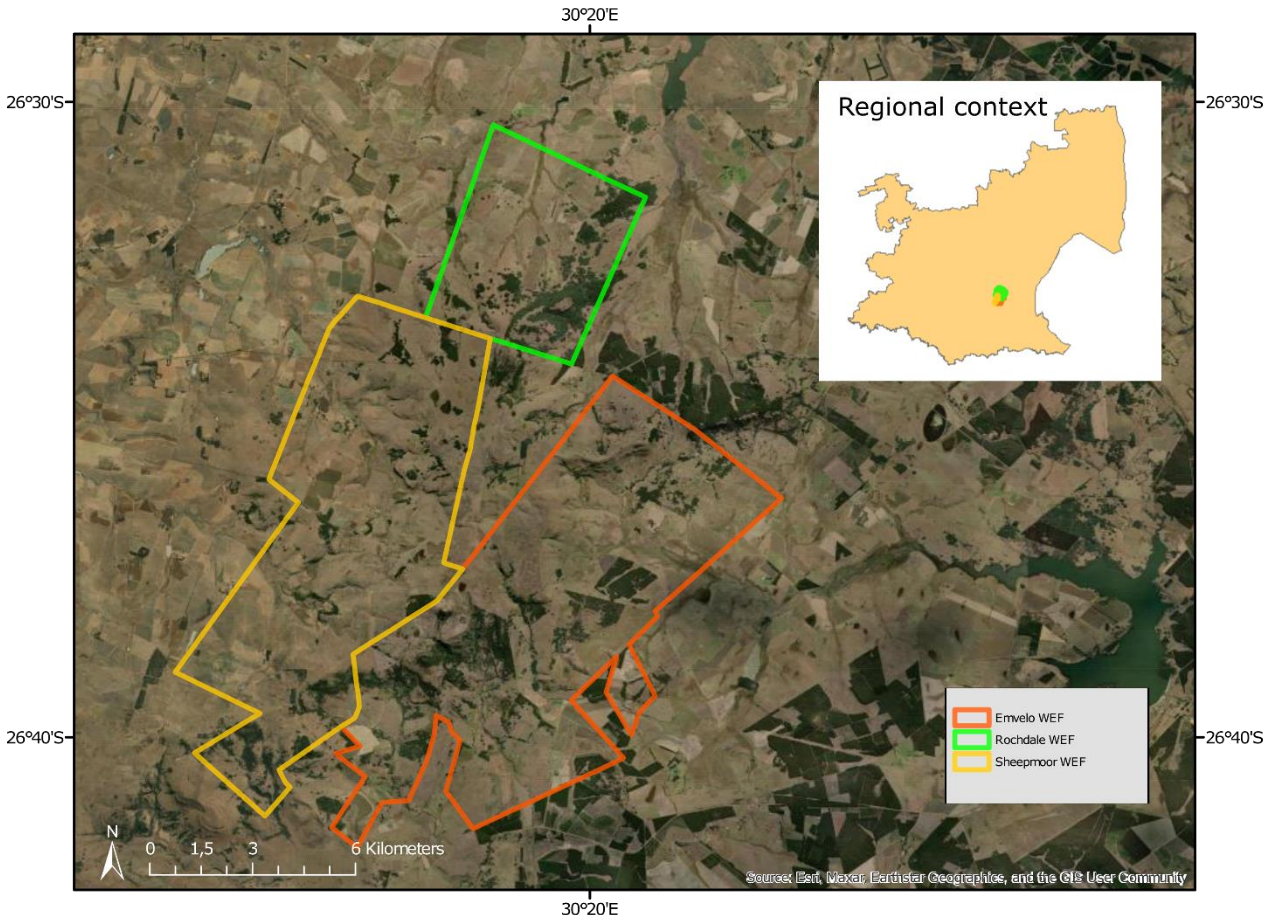


Figure 1: Location of the proposed development area of Emvelo WEF (red block), and its regional context in the Mpumalanga Province.

Terms of Reference

I, Jonathan Colville, was appointed by ARCUS on 17 April 2023 to conduct a Scoping Report, including a site sensitivity verification, in two phases, a desktop study and a site visit to assess the site sensitivity and the possibility of suitable available habitat for the faunal SCC at the Emvelo WEF development area. Based on the information obtained from these two phases, either a Terrestrial Animal Species Compliance Statement would then be issued, or a Terrestrial Animal Species Specialist Assessment would subsequently be required, as stipulated in the Government Gazette, No. 43855 (Published in Government Notice No. 1150) of 30 October 2020: "Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species".

1. Carry out a desktop study to determine if the two faunal SCC have been recorded at or near the project area and to ascertain the habitat requirements of the SCC.
2. Conduct a site visit of the project area to assess the physical and biological characteristics of the site with regards to habitat suitability for the faunal SCC and identify any sensitive areas, buffer zones, no-go areas, and possible alternatives.
3. Prepare a report detailing the findings of the desktop study and site visit, with conclusions and the issuing of a Terrestrial Animal Species Compliance Statement or a recommendation that a Terrestrial Animal Species Specialist Assessment would be required.

Assumptions and Limitations

The following limitations and assumptions apply to this assessment:

- It is assumed that all third-party information used (e.g. GIS data and species historical records) was correct at the time of generating this report.
- A three-day site visit was undertaken during autumn (9–11 May 2023). Undertaking a site visit in autumn limits the detection of the katydid SCC at the project site, as this SCC is active during the summer months. For the mammal SCC, autumn is a suitable time to detect this species. However, due to the large and extensive area the project covers, this assessment relied on surveying and assessing broad habitat features and utilising ecosystem-level data, such as intact vegetation type, geographical features, and ecological corridors.
- This scoping assessment was undertaken based on the information provided to date by ARCUS for the proposed development. Information such as numbers of turbines and their site placement, and length and site placement of internal access roads was not provided.

Site Sensitivity Verification

The screening tool indicated "**Medium**" sensitivity for the two faunal SCC species. Considering the known habitat preferences for the two SCC species, it is the opinion of the specialists that the project area ranges from **Low to High sensitivity**; several areas representative of important habitat are considered **High sensitivity** and should ideally be excluded within the development footprint, and/or a process of micro-siting would be required if development occurs in these areas. The nature of the site and its suitability as habitat for the two species is discussed in the remainder of the report. The High sensitive areas are indicated in the figures below, and shown on a constraints map.

Methodology

The methodology used in this report, including a background desktop study and site visit, is outlined in the subsections below.

Desktop Study

- Distributional records for the invertebrate SCC were extracted from digitized databases of several South African museums (e.g., Iziko Museum of South Africa, Ditsong National Museum of Natural History, South African National Collections of Insects).
- For both faunal SCC, online resources, such as the IUCN Red List of Threatened Species (https://www.iucnredlist.org/), the Orthoptera Species File Online (http://orthoptera.speciesfile.org/HomePage/Orthoptera/HomePage.aspx), and iNaturalist (https://www.inaturalist.org/) were also consulted for information on geographic distributions and habitat requirements.
- Published information on the two faunal SCC were investigated to further assess their distribution range, ecology, habitat, and any life history requirements.
- Ecosystem-level data and broad-scale habitat was assessed using the following resources:
    - Vegetation Map of South Africa (SANBI, 2018; Skowno et al., 2019).
    - Mpumalanga Biodiversity Sector Plan (MBSP) terrestrial assessment (MTPA, 2014a, 2014b; Lötter, 2015).
    - Ecosystem Threat Status and Protection level of South Africa's ecosystems (Skowno *et al.*, 2019; South African National Biodiversity Institute and Department of Forestry, 2021).
    - Land cover based habitat modification (Skowno, 2020).
    - South Africa's Important Bird Areas (IBA) (Marnewick *et al.*, 2015): IBAs are selected using the presence of globally threatened species, groups of species with a restricted range (<50 000 km2), species assemblages confined to a single biome, and congregations of one or more species.

Site Visit

- The project area (Figure 1) was surveyed on 9–11 May 2023 to assess habitat quality, in terms of the type and amount of natural vegetation remaining. The extent of disturbance that the project area has experienced, in terms of changes to its vegetation and physical properties (e.g. soil) was also considered.
- Season: Autumn.
- Areas at and around selected points on the track surveyed by the specialists were investigated across the project area and photographed (Figure 2).

- At each picture site the surrounding habitat was characterised and the likelihood of any of the SCC being present was assessed.
- Within the project area, visual searching from viewing points using binoculars was used to detect the mammal SCC.
- Seasonal Relevance:
  - For the katydid SCC summer is the most appropriate time for detection (SANBI, 2020).
  - Autumn is an appropriate time for field detection of the mammal SCC.
  - It must be noted that this scoping report focussed primarily on surveying the state of the habitat quality at the project area and its connectivity to surrounding natural vegetation and to areas of known biodiversity and conservation importance. In addition, the project site sits in an area of historically high land use activity and falls outside of any protective area. Seasonality need only be considered for surveys of animal SCC species should the required habitat be present.

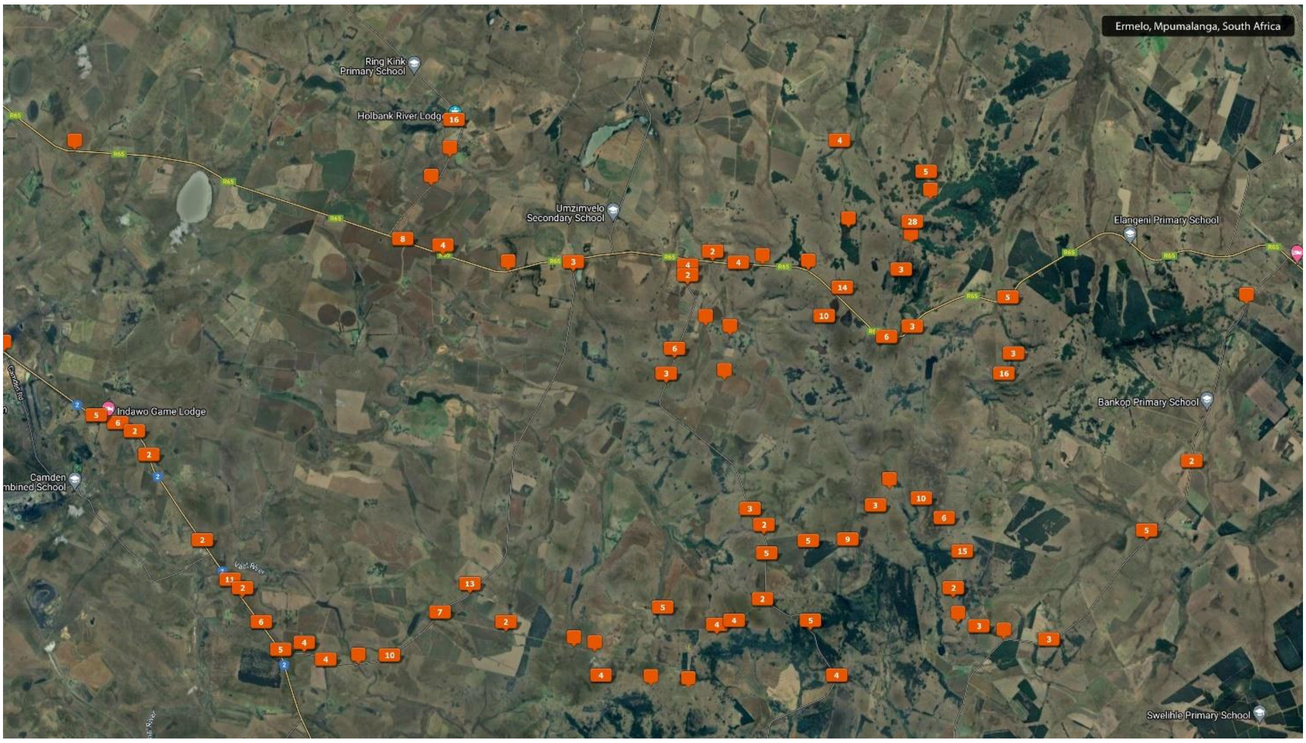


Figure 2: Site overview with the track surveyed by the specialists and photo locations shown.

Results

Desktop Study

The main vegetation types found at the project site (Figure 3) are:

- Eastern Highveld Grassland (**Endangered**)
- Wakkerstroom Montane Grassland (**Least Concern**)

The project area bisects large fragments of both natural vegetation, particularly of grassland escarpment, and areas of habitat that have been moderately to heavily transformed over several decades (Figure 4). The project area falls more-or-less equally across ecosystem types with a **South African Red List of Ecosystems Status** of **Least Concern** and **Endangered** (South African National Biodiversity Institute and Department of Forestry, 2021). Importantly, most of these areas still retain their natural extent. Of particular importance is the area falling over Wakkerstroom Montane Grassland which represents a large and contiguous piece of and an ecologically functional area of montane grassland.

The conservation importance of these areas, and several other areas of the project site, are further highlighted in the Mpumalanga Biodiversity Sector Plan (MTPA, 2014a). Several small areas of the project site are classed as **Critical Biodiversity Areas** (Irreplaceable and optimal) (Figure 5). As detailed in Lötter,(2015), CBAs are required to meet biodiversity targets for species and ecosystems and ecological processes. They should remain in a natural state that is maintained in good ecological condition. CBAs are areas of high biodiversity value and include Critically Endangered Ecosystems and critical linkages (ecological corridors). Irreplaceable CBAs are recognised as the most important biodiversity areas in the Mpumalanga Province and are considered essential for meeting biodiversity targets. They are at high risk of being lost due to their remaining extent being near to or lower than the required biodiversity target. If Irreplaceable CBAs suffer additional losses, it is likely that species losses and breakdown of ecological processes will occur. CBA Optimal areas are the best localities (out of a potentially larger selection of available planning units) that are most optimally located to meet biodiversity targets. These areas have an irreplaceability <80%, and often represent the optimal solution for meeting biodiversity targets. They collectively reflect the most cost-efficient and smallest spatial extent required to meet biodiversity targets.

Lötter (2015) details the classification of **Ecological support areas** (ESA) in the Mpumalanga Biodiversity Sector Plan. ESAs play an important role in supporting the ecological functioning of critical biodiversity areas and/or provide important ecosystem services. They support landscape connectivity and resilience to climate change adaptation, and the Mpumalanga Biodiversity Sector Plan stressed the need for ESAs to be maintained in an ecologically functional state. Four sub-categories of ESA are recognised in the Mpumalanga Biodiversity Sector Plan: ESA: Landscape-scale Corridors; ESA: Local-scale corridors; ESA: Species Specific; and ESA: Protected Area Buffers. Two ESAs are seen in the project site: A large track of ESA: Local and a smaller track of ESA Landscape corridors; importantly the latter links the project site to the Sheepmoor WEF. Both ESA corridors should be considered, from a faunal perspective, as areas of ecological importance and sensitivity.

The Mpumalanga Biodiversity Sector Plan also recognises **Other Natural Areas** (ONA), which are natural areas that have not currently been selected to meet biodiversity or ecosystem process targets (see Lötter, 2015 for full details). However, ONAs are still recognised as of high conservation importance as they retain a natural state and potentially can contribute to the maintenance of species populations, natural ecosystem functioning, and provisioning of ecosystem services. They are not currently prioritized for immediate conservation action, unless CBAs or ESAs are lost, or impacting activities within the ONAs impact negatively on other areas. ONAs are therefore of importance when considering the potential direct and indirect impacts of the proposed Emvelo WEF, and the two other WEF developments. A large ONA is seen across the north-western and central area of the project site (Figure 4 and constraints map). From a faunal perspective, this area is considered of High sensitivity and offers ideal habitat for both SCC. It is also a large contiguous area representing an ecological functional montane grassland habitat. It also lies next two the ESA ecological corridors and therefore links in with a broader network of ecological corridors across the three WEFs.

Most of the north, and parts of the southern area of the project site is classed as a '**priority focus area'** by the national protected areas expansion strategy for South Africa (NPAES) (Figure 7) (Balfour *et al.*, 2018). These areas represent large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation and/or expansion of large, protected areas. They present the best opportunities for meeting the ecosystem-specific protected area targets of the NPAES and were modelled with emphasis on climate change resilience and requirements for protecting freshwater ecosystems.

The northern part of project area falls over an **Important Bird Area** (IBA): Grasslands (Marnewick et al., 2015). It also falls close to two other IBAs (Figure 8). IBAs are areas of high importance for bird conservation and are selected on the presence bird species of global or regional conservation concern; assemblages of restricted-range bird species; assemblages of biome-restricted bird species; and concentrations of numbers of congregatory bird species.

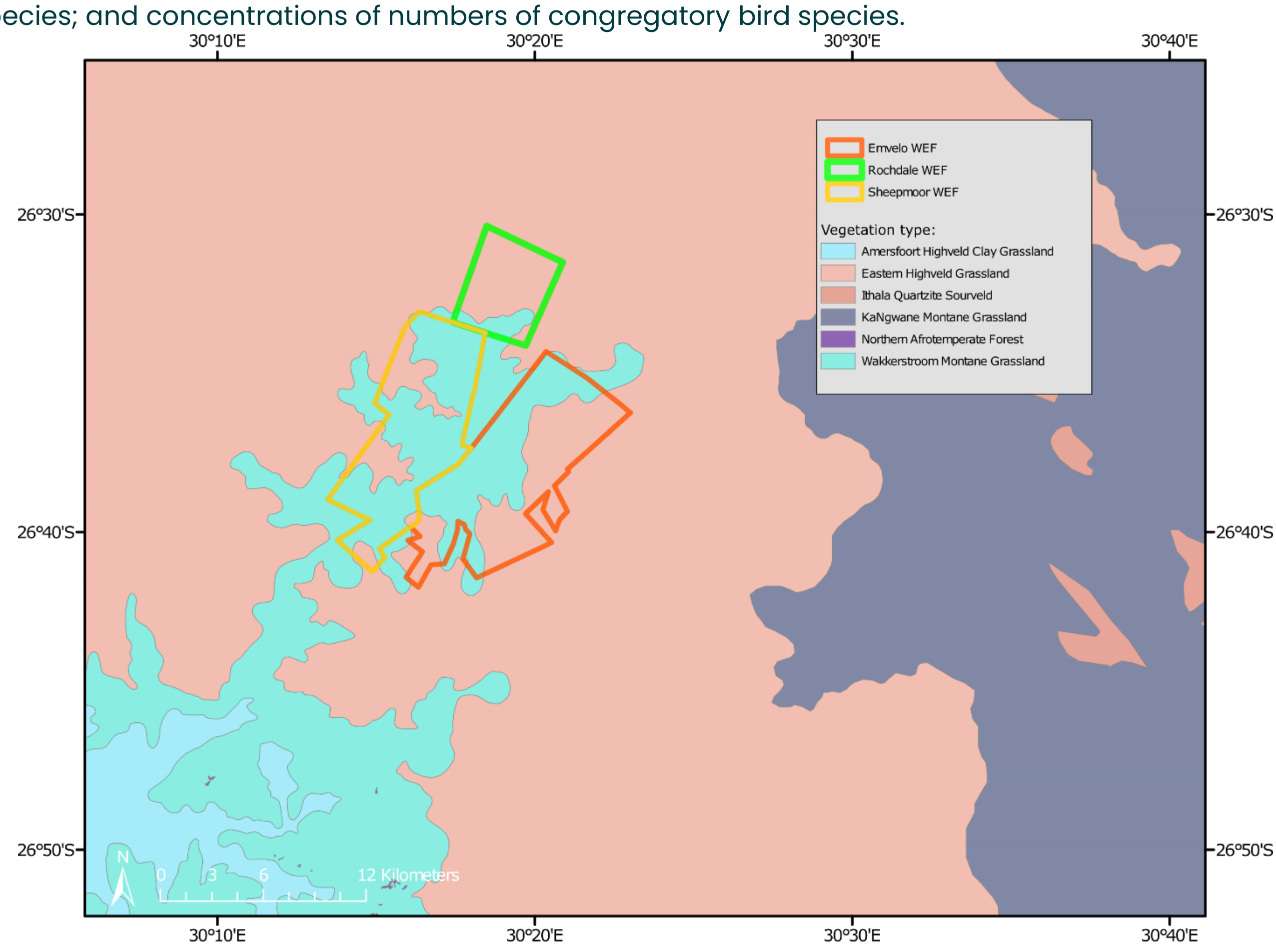


Figure 3: The vegetation types found at, and bordering, the project area (red block) (SANBI, 2018; Skowno et al., 2019).

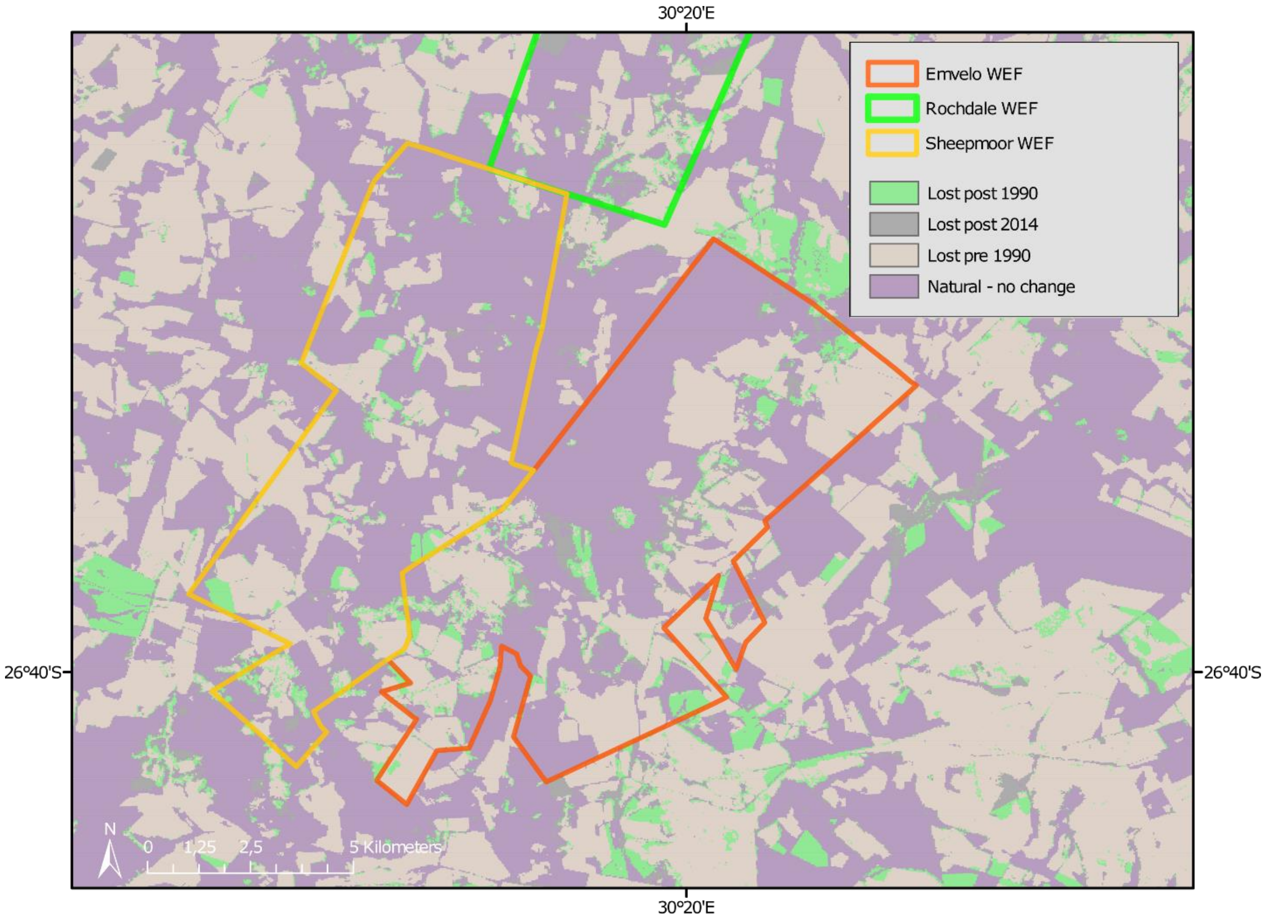


Figure 4. Land cover derived terrestrial habitat change layer showing that large areas of natural vegetation are found across the project site (red block). Areas of natural vegetation that have been transformed where altered pre-1990 (Skowno, 2020).

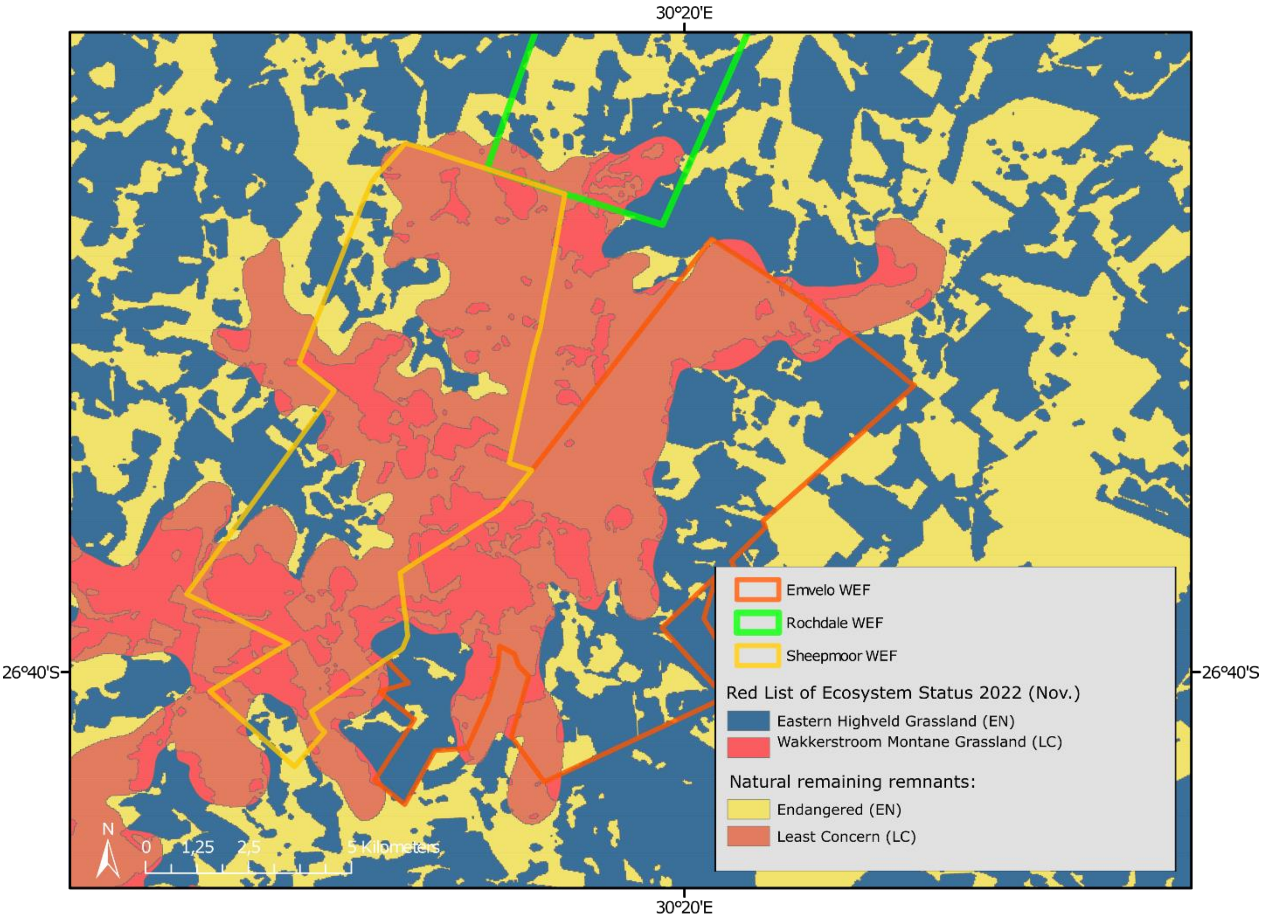


Figure 5. **Red List of Ecosystems Status for the terrestrial realm of South Africa and the current remaining natural extent (ca. 2018) of an ecosystem type (South African National Biodiversity Institute and Department of Forestry, 2021).**

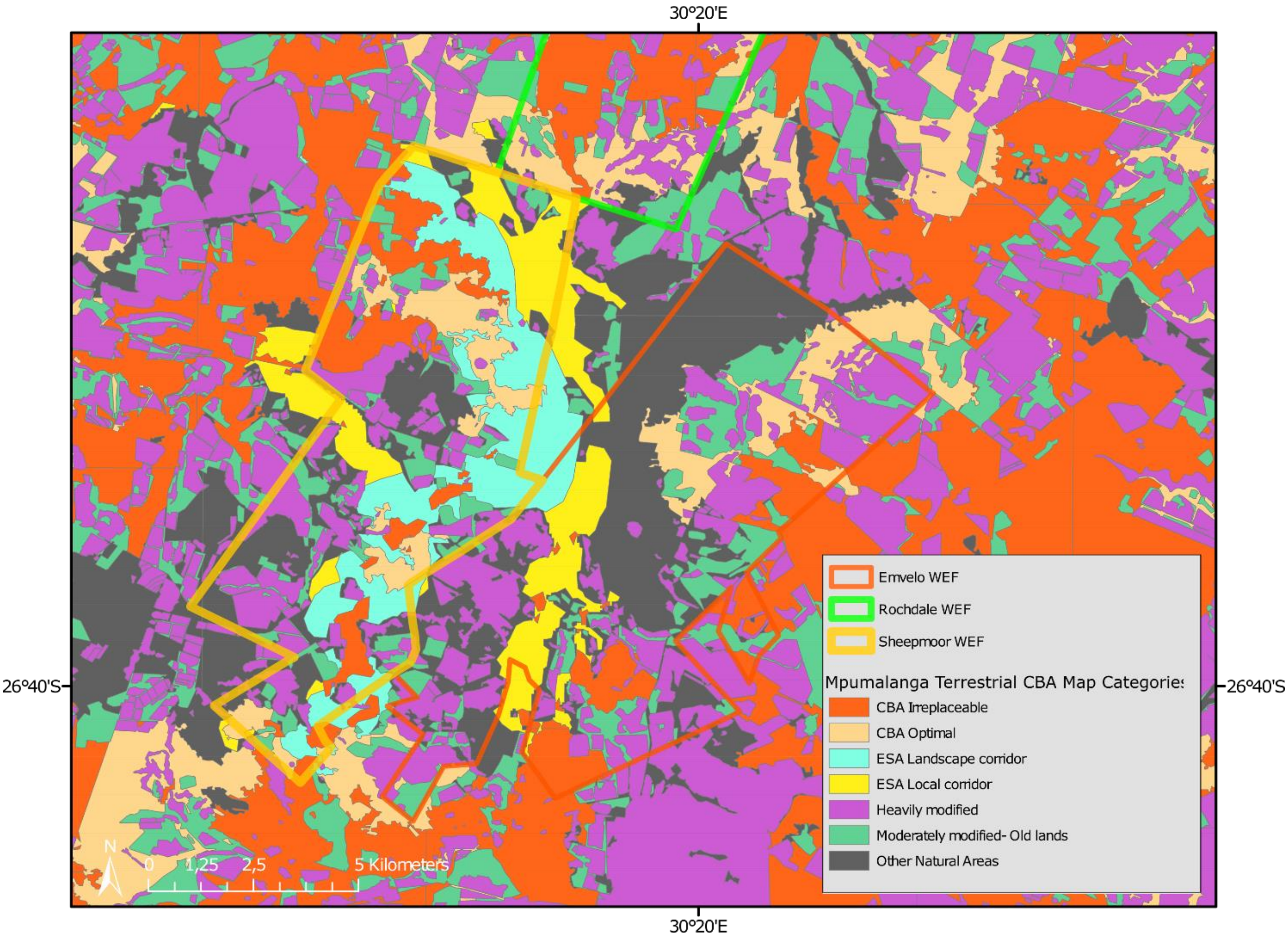


Figure 6. Critical Biodiversity Area (CBA) sub-categories of the Mpumalanga Biodiversity Sector Plan (MTPA, 2014b; Lötter, 2015) that bisect the project area.

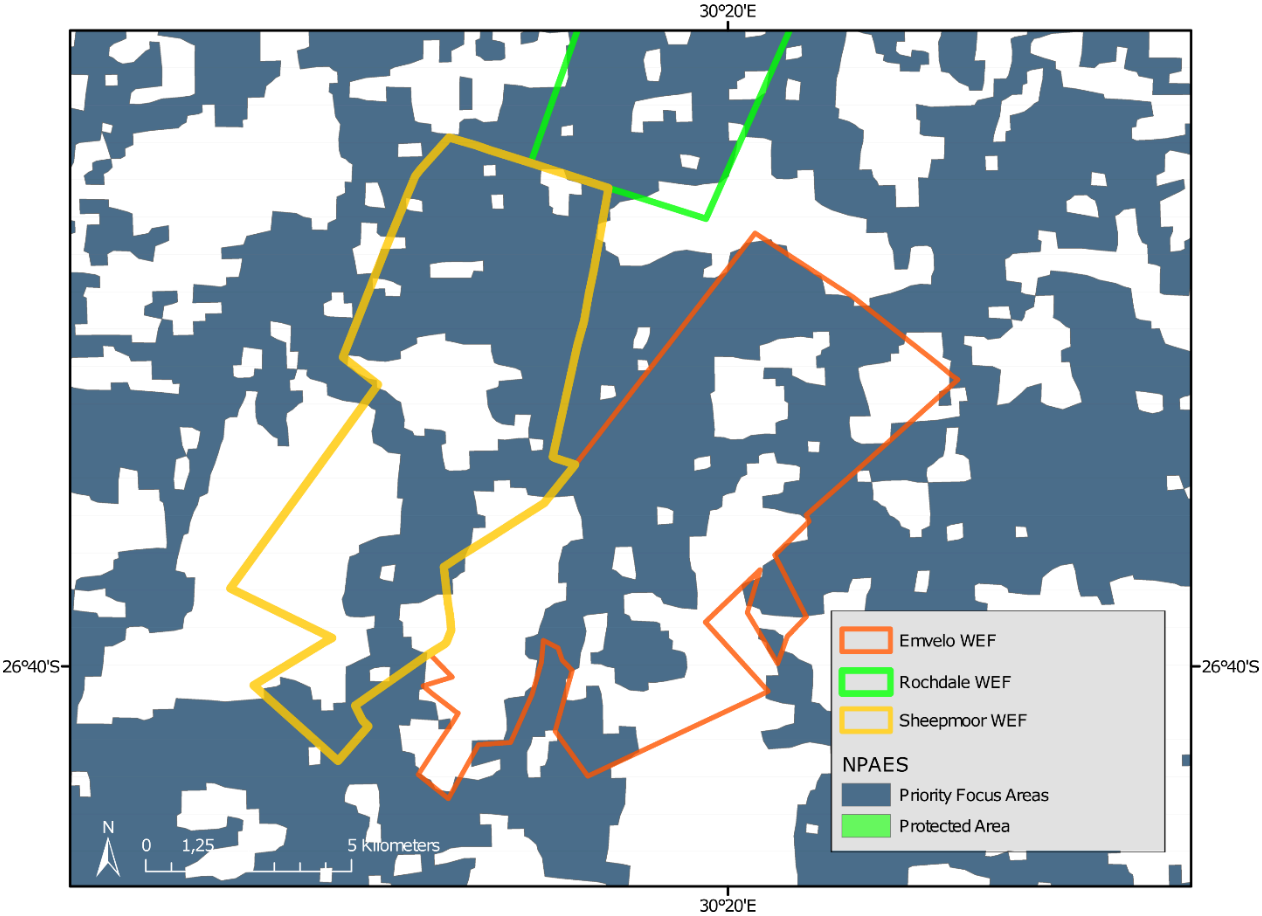


Figure 7. Priority focus area, identified by the national protected areas expansion strategy (NPAES) for South Africa (Balfour *et al.*, 2018), covers most of the project area.

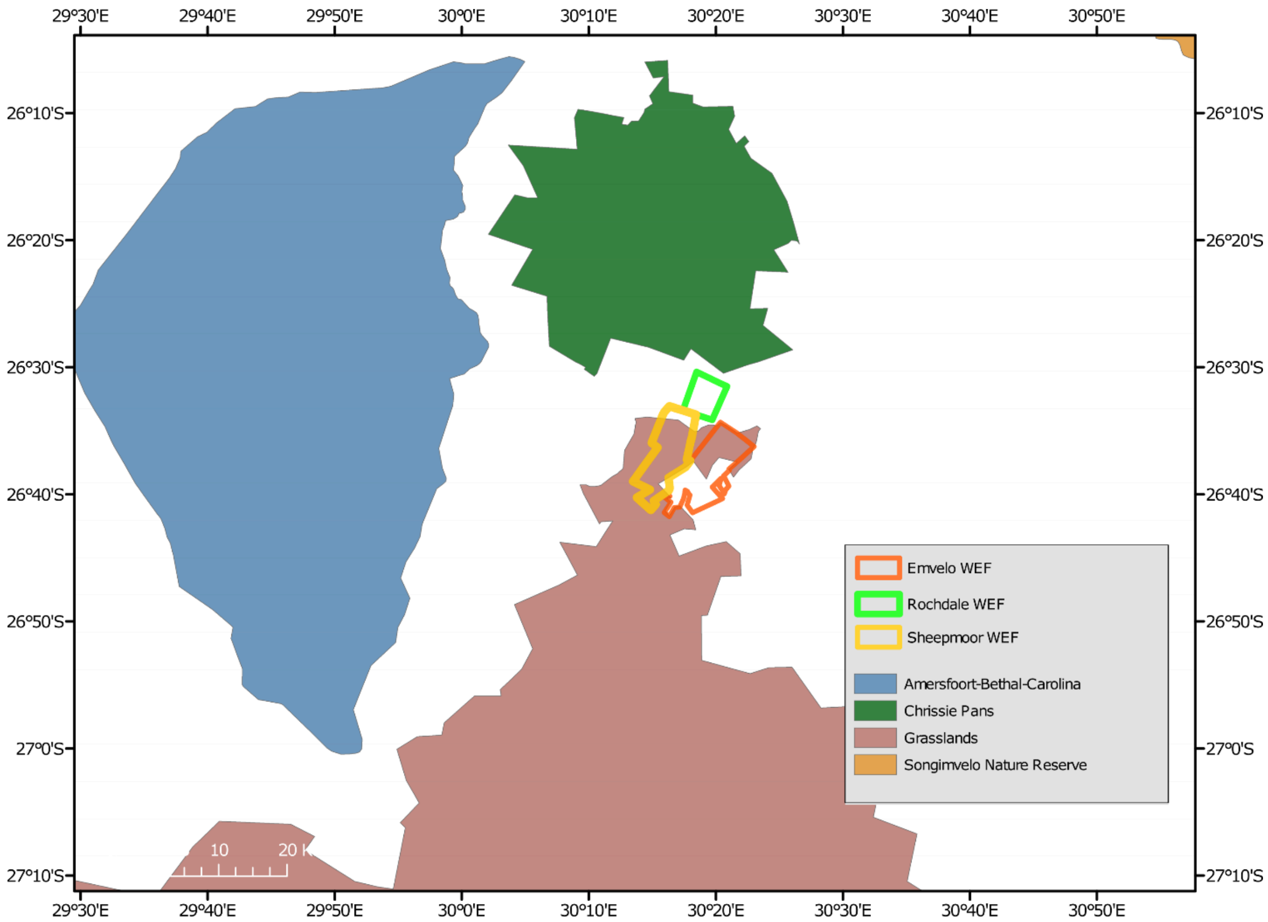


Figure 8. The project site in relation to several different Important Bird Areas identified for South Africa (Marnewick et al., 2015).

Invertebrate Species of Conservation Concern

Clonia lalandei (Saussure, 1888) Lalande's Black-winged Clonia

- This species of katydid is endemic to South Africa and has an IUCN Red List Category and Criteria of **Vulnerable** B1ab(i,iii) (Bazelet and Naskrecki, 2014). Within South Africa, the species has a broad distribution occurring across the central parts of South Africa, having been recorded from the Free State, KwaZulu-Natal, and Mpumalanga Provinces.
- It occurs in grassland and savanna habitats but has only been collected from four localities with almost nothing known about its specific habitat requirements or ecology.
- It has an estimated extent of occurrence of 15397 km^2 and its estimated geographic range falls just outside of the project area, approximately 12 km to the east (Bazelet and Naskrecki, 2014).
- The species has not been recorded from the project area; the closest known record is approximately ~92 kms north-east for a specimen collected from Barberton Montane Grassland habitat.

Mammal SCC

Ourebia ourebi ourebi (Zimmermann, 1783) Oribi

- The oribi (*Ourebia ourebi*) is a small, territorial antelope that occurs throughout sub-Saharan Africa where it typically inhabits open temperate grasslands.
- Thirteen subspecies are currently recognised, with the South African subspecies *O. ourebi ourebi* recognised as genetically distinct from other subspecies to the north. As such, oribi in South Africa should be managed as a distinct conservation unit (Jansen van Vuuren, Rushworth and Montgelard, 2017).
- It has a 2016 Regional Red List Status of Endangered C2a(ii) and is considered as the most threatened antelope species in South Africa with a minimum estimated total of approximately 2000 mature individuals remaining (Conservation Breeding Specialist Group Southern Africa *et al.*, 2006; Shrader *et al.*, 2016).
- *Ourebia ourebi ourebi* populations have become restricted to small, isolated populations in grasslands in the eastern half of South Africa, occurring in grasslands in Mpumalanga, Eastern Cape and KwaZulu-Natal provinces. A few subpopulations in southern and north-eastern Free State, and southern Limpopo are also known.
- Fragmentation of populations and declining population numbers (~13% decline between 1996-2014) are the result of several anthropogenic factors, including hunting and poaching, habitat loss and fragmentation, and poor veld management (e.g. fencing, burning, overgrazing).
- Habitat requirements include both short grass for food and long grass for food and shelter. They are selective feeders with several species of grass making up most of their diet, (*Themeda triandra, Hyparrhenia hirta, Panicum natalense,* and *Andropogon chinensis*) (Shrader *et al.*, 2016).
- They also appear to favour north and east facing slopes, with populations showing preferences for gentle slopes (less than ~10 degrees), gentle undulating plateaus, ridge tops, and spurs, and avoiding lowland areas (Conservation Breeding Specialist Group Southern Africa *et al.*, 2006).
- Further loss of grasslands on flat and undulating terrain is considered a very real threat to the survival of this charismatic sub-species.
- Recent postings on iNaturalist indicate that Oribi are relatively frequently encountered within the broader grassland areas around the project site. For example, a 2020 photographic record form approximately 75km south in Wakkerstroom Montane Grassland, a vegetation type found at the project site.

Site Visit

- The project site was investigated spanning the proposed development area (Figure 2).
- Habitat characteristics and likelihood of any of the two SCC being found around each picture site is given below.
- Neither of the two animal SCC were encountered during the site visit.
- From a faunal perspective, it is concerning that several areas of grassland habitat and water courses were observed to show infestations of an alien invasive tree (Black Wattle).

Figure 9. Functionally intact areas of grassland were observed at the project site, as seen with this grassland species of *Cyrtanthus*. From a faunal perspective, such areas are considered as potentially High Sensitivity. [GPS: 26°34'35.91" S 30°20'6.46" E].

Figure 10. Stands of the indigenous *Leucosidea sericea* tree are found on the project site, although these appear under threat from invasive alien trees (Gums and Black Wattle). [GPS: 26°35'31.7" S 30°20'12.46" E].

Figure 11. Large contiguous areas of escarpment grassland are seen across the project site; these areas are considered as High sensitivity from a faunal perspective. [GPS: 26°35'36.22" S 30°19'56.73" E].

Figure 12. The slopes of escarpment grassland habitat are ideal habitat for the Oribi. [GPS: 2 26°35'36.2" S 30°19'56.75" E].

Figure 13. **Dense stands of Black wattle are seen across several drainage lines; such areas would need to be cleared of alien plants as they typically serve as corridors for faunal movement. [GPS: 26°35'35.13" S 30°20'9" E].**

Figure 14. **Spike-heeled Lark (*Chersomanes albofasciata*) is a social grassland species that roosts in underground burrows. [GPS: 26°35'35.13" S 30°20'9" E].**

Figure 15. From a faunal perspective, Low sensitive areas, such as maize fields (foreground) could be target areas for development. In contrast, grassland escarpment areas (background) are considered areas of potentially High sensitivity. [GPS: 26°36'46.47" S 30°22'50.87" E].

Figure 16. From a faunal perspective, Low sensitive areas, such as pine plantations and maize fields could be target areas for development. [GPS: 26°39'4.24" S 30°20'44.32" E].

Figure 17. Slopes of areas of grassland escarpment offer suitable habitat for Oribi. [GPS: 26°38'24.8228" S 30°19'18.4358" E].

Figure 18. Grassland escarpment habitat is used by several faunal elements, as seen by this Aardvark (*Orycteropus afer*) burrow. [GPS: 26°38'24.8228" S 30°19'18.4358" E].

Figure 19. Large tracks of good quality grassland habitat are seen along the high-altitude areas of the project site. [GPS: 26°38'24.8228" S 30°19'18.4358" E].

Figure 20. Other important faunal habitat, such as mountain streams, are associated with high-altitude grassland areas. [GPS: 26°38'24.8228" S 30°19'18.4358" E].

Figure 21. **Grassland slopes such as these are ideal habitat for the Oribi and are considered as High sensitive areas. [GPS: 26°38'24.8228" S 30°19'18.4358" E].**

Figure 22. **A Secretarybird (*Sagittarius serpentarius*) hunting in grassland habitat on the project site. [GPS: 26°37'3.5" S 30°18'21.96" E].**

Figure 23. Other important faunal habitat, such as a Southern Bald Ibis colony, are associated with high-altitude grassland areas of the project site. [GPS: 26°37'3.5" S 30°18'21.96" E].

Figure 24. Extensive areas of grasslands offer ideal habitat for Oribi and such habitat is considered as High sensitivity. [GPS: 26°38'24.8228" S 30°19'18.4358" E].

Figure 25. **Large areas just below the escarpment on the project site are densely covered in the alien invasive Black wattle tree. [GPS: 26°38'24.8228" S 30°19'18.4358" E].**

Figure 26. **Lower areas off the escarpment are heavily transformed and considered as areas of Low faunal sensitivity. [GPS: 26°38'24.8228" S 30°19'18.4358" E].**

Constraints Map

Based on the available ecosystem-level data for habitat and important biodiversity areas and from habitat assessment during the field site visit, the following constraints map showing areas of **High faunal sensitivity** was produced for the project site (Figure 27).

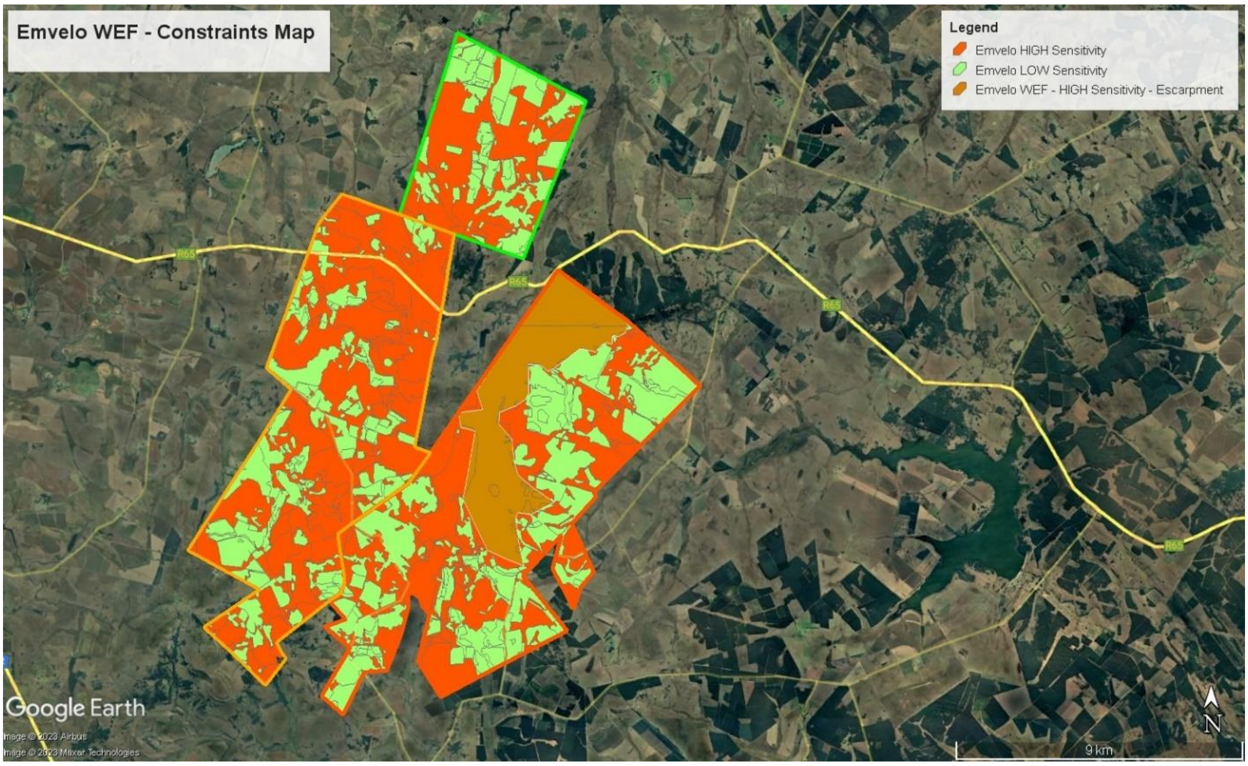


Figure 27. Constraints map for the project area (red block) showing areas of potentially High faunal sensitivity (shaded red, brown, and orange areas); areas falling outside of these are considered Low sensitivity (green) and ideally the development should be focussed within these areas.

Conclusions

- This statement concerning the Scoping Report (Site Sensitivity Verification and Terrestrial Animal Species Compliance Statement) is applicable to the project area shown in **Figure 1**, and as described in the documentation provided to date to us by ARCUS.
- Based on available ecosystem-level data for habitat and important biodiversity areas falling within the project development site, it is considered that the project will range from **low to high sensitivity** for the faunal SCC assessed.
- Based on the available species-level information on the two SCCs' distributions, their known habitat preferences, the intact and natural to heavily transformed habitat of the project development site, it is considered that the project will range from **low to high sensitivity** for the faunal SCC assessed.
- The proposed development will most likely have a **low impact** within areas of low sensitivity (transformed areas), and a **medium to high impact** within areas of potentially high faunal sensitivity (intact natural habitat, ecological corridors, and certain landscape features).

- National and regional strategic biodiversity plans indicate that areas of the project site are of high faunal importance:
    - The project area falls over **CBAs** of different sub-categories, including **ONAs** and **ESAs** (local and landscape ecological corridors), classed by the Mpumalanga Biodiversity Sector Plan. The most important and optimal CBAs have been classed using, amongst other biodiversity datasets, several different animal datasets (e.g. butterfly, dragonfly, reptile, amphibian, and bird) and therefore are considered as an accurate representative of areas of general faunal importance.
    - The project area also bisects ecosystem types with a **South African Red List of Ecosystems Status** of **Endangered** and that still retain much of their natural extent.
    - The project area also bisects a **priority focus area** identified by the national protected areas expansion strategy for South Africa (NPAES).
    - The project area is also falls over a recognised South African **Important Bird Area**.
- The project area has vegetation and habitat (topography) that should support both the katydid and Oribi. In addition, the sighting of the Oribi by the avifaunal specialists, and after speaking with local landowners, confirms that this SCC mosy likely occurs at the project area and surrounding areas.
- Full impacts and site sensitivities for turbine and access roads are not possible at this stage due to the uncertainty related to the number of turbines and their exact placement, and the exact placement and length of access roads, and the placement/size/number of any associated developments (e.g. transmission lines).
- As such, site sensitivities and potential impacts, particularly on high sensitive areas, would ideally need to be assessed through micro-siting once footprint area and sizes for turbines and access roads are finalised.
- In addition, micro-siting, and surveys should ideally be undertaken at the correct seasonal time (summer).
- If the development is focussed on Low sensitive areas, then potentially the development will only have small, localised impacts on the two SCC and additional surveys, such as micro-siting, and full impact assessments will likely not be necessary.
- Within the proposed development, areas of **High** sensitivity (see constraints map; Figure 27) are associated with:
    - Intact areas of natural vegetation suitable for the SCC (e.g. Figure 13, 18, 22, 26): These areas, and areas that have also been classed as of high importance within biodiversity spatial plans, should ideally be excluded from development and a ~100m proposed buffer line is recommended to prevent undue disturbance.
    - Areas that provide important habitat features associated with altitude and topography, particularly for the Oribi (e.g. Figures 11, 12). These areas should ideally be excluded from development and a ~100m proposed buffer line is recommended to prevent undue disturbance of these areas.
    - Areas that provide faunal connectivity through ecological/habitat corridors (e.g. Figure 6). These areas should ideally be excluded from development and a ~100m proposed buffer line is recommended for all corridors. In addition, these

corridors would need to be considered within the broader context of the three planned WEFs to ensure that connectivity is maintained across the three development areas and surrounding areas.

- Invasive alien plants should be cleared from the project site and a management and monitoring plan should be stipulated as part of the EMPr for the Emvelo WEF project. The threat from alien invasive plants constitutes a potentially greater threat and impact on faunal SCC than the impacts from the development. Removal and management of the invasive plants could potentially have a **high positive** impact for the SCC and other fauna within the project area.

- If the above concerns can be accommodated, then a compliance statement of low sensitivity will potentially hold for Emvelo WEF.

Acknowledgments

Avifaunal specialist Robert Wienand is thanked for his generous help in providing valuable information on local habitat quality and features and in navigating and accessing the project area.

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Appendix-1

CURRICULUM VITAE – JONATHAN F. COLVILLE

EDUCATION

PhD (Zoology): University of Cape Town, 2009. Thesis title: "*Understanding the evolutionary radiation of the megadiverse monkey beetle fauna (Scarabaeidae: Hopliini) of South Africa*".

Postdoctoral research fellowship: South African National Biodiversity Institute, 2009-2010.

PRIOR EMPLOYMENT

National Research Foundation Research Career Advancement Fellow: South African National Biodiversity Institute (2014-2019).

Researcher, South African National Biodiversity Institute, GEF/UNEP/FAO Global Pollination Project – South Africa (2010-2014).

PUBLICATIONS

Books edited:

- Allsopp, N., **Colville, J.F.**, Verboom, G.T. (2014). *Fynbos: Ecology, Evolution, and Conservation of a Megadiverse Region* (16 chapters; pp 1-377). Oxford University Press.

Book chapters:

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- **Colville, J.F.**, and Cohen, C. (2022). Terrestrial Animal Species Specialist Assessment. Dana Bay Access Road. Prepared for Sharples Environmental Services cc (SES).
- **Colville, J.F.**, and Cohen, C. (2022). Terrestrial Biodiversity Specialist Assessment. Duyker Eiland Prospecting Rights. Prepared for Elemental Sustainability (Pty) Ltd.
- **Colville, J.F.**, and Cohen, C. (2022). Terrestrial Animal Species Specialist Assessment. Proposed mixed use housing development. Prepared for EcoSense CC.
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- **Colville, J.F.**, and Cohen, C. (2022). Terrestrial Animal Species Specialist Assessment. Blue Sky's Project Prepared for Doug Jeffery – Environmental Consultants.
- **Colville, J.F.**, and Cohen, C. (2022). Terrestrial Animal Species Specialist Assessment. Proposed Expansion of Nature's View Dam near Citrusdal. Prepared for Earth Grace Environmental Consultancy.
- **Colville, J.F.** (2021). Terrestrial Animal Species Specialist Assessment. Proposed enlargement of existing Kleigat Dam. Prepared for Earth Grace Environmental Consultancy.
- **Colville, J.F.** (2021). Terrestrial Animal Species Specialist Assessment. Moorreesburg Wastewater Treatment Works Upgrade Project. Prepared for Zutari (Pty) Ltd.
- **Colville, J.F.** (2021). Terrestrial Animal Species Specialist Assessment. Maxnau Citrus Development. Prepared for Charl de Villiers Environmental Consulting.
- **Colville, J.F.** (2021). Terrestrial Animal Species Specialist Assessment. Gletwyn Estate Mixed Use Development. Prepared for Johan Neethling Environmental Services cc.
- **Colville, J.F.** (2021). Terrestrial Animal Species Specialist Assessment. Moorreesburg Wastewater Treatment Works Upgrade Project. Prepared for Zutari (Pty) Ltd.
- **Colville, J.F.** (2021). Terrestrial Animal Species Specialist Assessment. Proposed Development of Solar Photo-Voltaic Renewable Energy Power Station. Prepared for Resource Management Services (RMS).
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- **Colville, J.F.** (2001) *Scoping and faunal assessment for proposed housing development, Skapenberg, Somerset West*. Prepared for Design consultants CNdV Africa.

MEMBERSHIPS/RESEARCH ASSOCIATE

- Membership of Entomological Society of Southern Africa (2007-current).
- Membership of Lepidopterists Society of Southern Africa (2014-current).
- Honorary Research Associate (HRA), Statistics in Ecology, Environment and Conservation (SEEC), Department of Statistical Sciences, UCT (2014-current).
- SACNASP registration for Ecological Science (Professional Natural Scientist) (member#: 134759).

PROFESSIONAL SERVICES

- Editorial board *African Entomology* (2010-current).
- Editorial board *Metamorphosis* (2017-current).
- Editorial board *PeerJ* (2019-current).
- CAPE Invasive Alien Animal (IAA) Working Group (2016-2018).

Appendix-2

ABRIDGED CURRICULUM VITAE DR CALLAN COHEN

Education

PhD in Ornithology (Zoology), University of Cape Town, 2011.

Positions held:

Director: Birding Africa. 1997 – present.

Research Associate: FitzPatrick Institute of African Ornithology, Department of Biological Sciences, University of Cape Town. 2012 – present.

Experience

Acknowledged expert on African birds, based on over 1000 field trips, research studies and surveys from 1990 to present, in over 25 African countries, but focused largely across South Africa. First author of 2 books on African birds, and contributor to almost 10 others. Also publications and reports on Odonata, Lepidoptera, Herpetology and Botany.

Selected Books

Cohen, C., Spottiswoode, C. & Rossouw, J. 2006. **Southern African Birdfinder: where to find 1400 species in southern Africa and Madagascar**. Cape Town: Struik New Holland Publishers, 456 pp. Reprinted 2007, 2012, 2022.

Cohen, C. & Spottiswoode, C. 2000. **Essential Birding in Western South Africa: Key routes from Cape Town to the Kalahari.** Cape Town: Struik New Holland Publishers, 136 pp. Reprinted 2001.

Klaas-Douwe B. Dijkstra & **Callan Cohen**. 2021. **Dragonflies and Damselflies of Madagascar and the western Indian Ocean Islands**. Association Vahatra Antananarivo, Madagascar. 198 pages.

Contributed 20 species accounts in: Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. (Eds). 1997. **The Atlas of Southern African Birds**. Johannesburg: BirdLife South Africa.

Contributed 10 species accounts in: Hockey, P.A.R., Dean, W.R.J. & Ryan, P.G. (Eds). 2005. **Roberts' Birds of Southern Africa**. Seventh edition. Cape Town: John Voelcker Bird Book Fund.

Contributor to Red Data Book on Birds: BARNES, K.N. (ed.) 2000. **Threatened Birds of South Africa, Lesotho and Swaziland**. Johannesburg: BirdLife South Africa.

Species account written: African Marsh Harrier

Other Publications

About 100 journal articles and over 50 reports, e.g. most recent:

Cohen, C. 2021. **Deciphering South Africa's first Crested Honey Buzzard**. African Birdlife 9(4): 26-29.

Cohen, C., N. J. Collar, A. Dagnee, L. D. C. Fishpool, S. J. Marsden, C. N. Spottiswoode & S. R. Wotton. 2021. **Status of Taita Falcon Falco fasciinucha in Ethiopia and the identification problem posed by African Hobby F. cuvierii**. Bull ABC Vol 28 No 2: 225-233

Mills, Michael S. L., Julian Francis, Nik Borrow, Nigel Redman, Washington Wachira and **Callan Cohen**. 2021. **English bird names in common use: a framework to achieve a stable world list despite ongoing taxonomic changes, and a call to establish a broad-based African Bird Names Committee.** Bull ABC Vol 28 No 1: 93-98.

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Terrestrial Biodiversity Risk Assessment

Mulilo Amsterdam WEF Complex: Emvelo

Date: 31/10/2023
Version: Draft Scoping Report
Author: J. Pote

Terrestrial Biodiversity Risk Assessment

Mulilo Amsterdam WEF Complex: Emvelo

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Date of report: **31/10/2023**

Draft Scoping Report

Revisions

Report/Revision Version:	Date:	Approved by:
First Draft	31/10/2023	Jamie Pote
Revisions/Comments		
Final Report		

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1 Introduction & Background

1.1 Background

Respective Special Purpose Vehicles (SPV's) are proposing the development of a commercial wind farm cluster that is expected to comprise three separate (up to 360 MW) Wind Energy Facilities (WEFs). Each WEFs will apply for its own grid connection route to connect to the existing Eskom Uitkoms Substation, via approximately 20 – 32 km long 132 kV overhead transmission lines. The powerlines are proposed and should be assessed within a 300 m assessment corridor each.

The proposed development sites are located near Ermelo and fall within the Msukaligwa Local Municipality and the Gert Sibande District Municipality, in the Mpumalanga Province. The three WEF facilities are **Rochdale WEF**, **Sheepmoor WEF** and **Emvelo WEF** with the respective SPV's being Rochdale Wind Energy Facility (Pty) LTD, Sheepmoor Wind Energy Facility (Pty) LTD and Emvelo Wind Energy Facility (Pty) LTD. This specific Scoping Report, which provides a high-level background and risk assessment of the site as well as the terms of reference for the full assessment in specific to the **Emvelo WEF**.

The purpose of this report is to undertake a high-level terrestrial biodiversity screening and scoping of the sites including infrastructure to assess potential terrestrial biodiversity risks to the proposed project and to identify the terms of reference for the full terrestrial biodiversity assessment that will follow during the EIA phase.

1.2 Purpose of Report

The purpose of this report is to undertake and ecological and biodiversity scoping of the site to determine the condition of the remnant natural vegetation and flora and fauna and to inform environmental requirements of the proposed project.

This scoping report has been compiled with reference to the reporting requirement for:

- **Terrestrial Biodiversity Assessment** as per the 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 NEMA (GNR 320), **as gazetted on 20 March 2020.**
- **Terrestrial Plant and Animal (species)** themes as per the 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 NEMA, **gazetted** on **30 October 2020.**

The principles that guide this process include protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources which are fundamental to sustainable development.

1.2.1 Report Structure

This report has been structured and written to provide background information relating to the various topics, primarily for the for the unfamiliar reader. Specific observations and analyses of the project in relation to the various topic are indicated in green text. Text boxes at the end of each section summarise the implications of the aspect under consideration in relation to the specific project. Summary information tables are provided, including a synopsis of applicable regional planning aspects (Table 2). A general description of the systematic conservation planning components is provided in Appendix C: Systematic Conservation Planning for reference purposes.

1.3 Project Description

1.3.1 Activity Location and Description

The WEF cluster is situated between approximately 25 and 40 km east of Ermelo within the Mpumalanga Province (Figure 1). The specific **Emvelo** facility assessed in this report is indicated purple in Figure 1 below and further technical information is contained in Table 1. The proposed activity will be to construct three separate wind energy facilities, which will feed into the national grid, being accessible in proximity as the site is near coal power generating facilities and existing transmission powerlines at Camden.

The proposed **Emvelo** site is comprised of several farm portions with a total area of approximately 7 020 Ha, of which the approximate total anticipated WEF footprint of 180 Ha will constitute 2.6 % of the farm area. The site is situated within a predominantly commercial farming area, generally comprising beef farming with dryland grazing and dryland pastures and crops including maize. Several coal mines are present in the broader area, as well as coal fired power stations. The area falls within a moderate to high summer rainfall area.

Table 1: Technical Specifications.

Developer / Applicant	Emvelo Wind Energy Facility (Pty) LTD
DFFE Reference	To be confirmed
WEF Generation Capacity	Up to 200 MW
Site Access	Locality to be confirmed. Total width up to 15 m (12 m after rehabilitation) consisting of up to 3 m width for underground 33 kV reticulation.
Farm portion extent	7 020 Ha
Total WEF footprint (approximate)	180 Ha (2.6 %)
Number of Turbines	Up to 45
Hub Height from ground level	Up to 150 m
Blade Length	Up to 110 m
Rotor Diameter	Up to 220 m
Length of internal roads	Unknown at this point.
Width of internal roads	Up to 12 m to be rehabilitated to up to 9 m.
On-site substation capacity	Up to 132 kV
Proximity to grid connection	Approximately 30 km
Grid Connection Capacity	Up to 132 kV
Temporary turbine construction laydown and storage areas.	Crane platforms and hardstand laydown area up to 36 ha (Up to 0.8 ha per turbine)
Permanent footprint area dimensions, including roads, turbine hardstand areas, O&M buildings and battery pad.	O&M: Up to 0.5 ha Hardstand areas: Up to 0.75 ha Total area of final footprint (including roads): up to 180 ha
Operations and maintenance buildings (O&M building) with parking area	Up to 0.5 ha
BESS Area	Approximately 400 x 400 m
Height of fencing	2.8 m
Type of fencing	Where site offices are required, temporary screen fencing used to screen offices from the wider landscape.

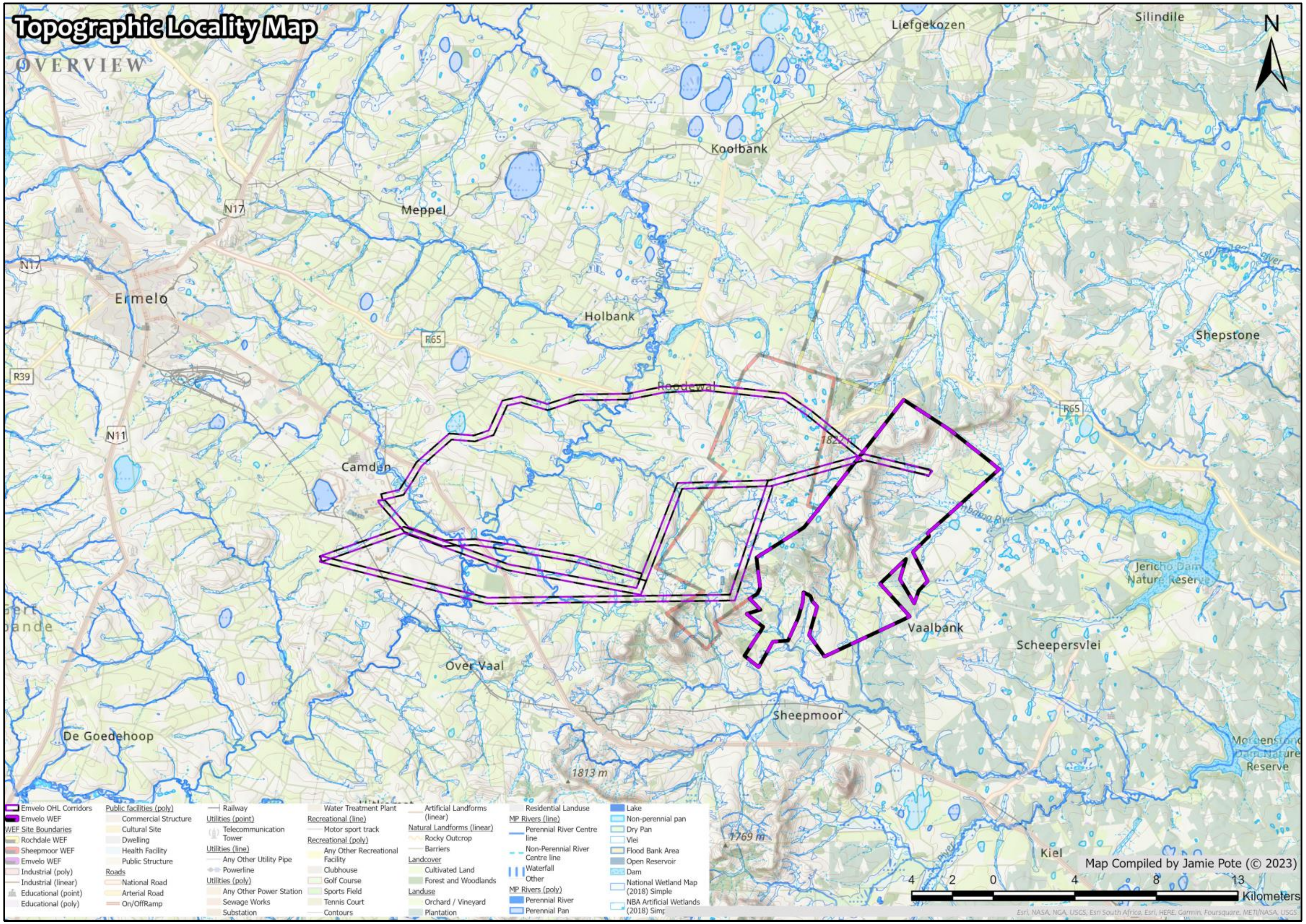

Figure 1: Site location, surrounded commercial farmland, with a fragmented mozaic of cultivated lands and natural vegetation.

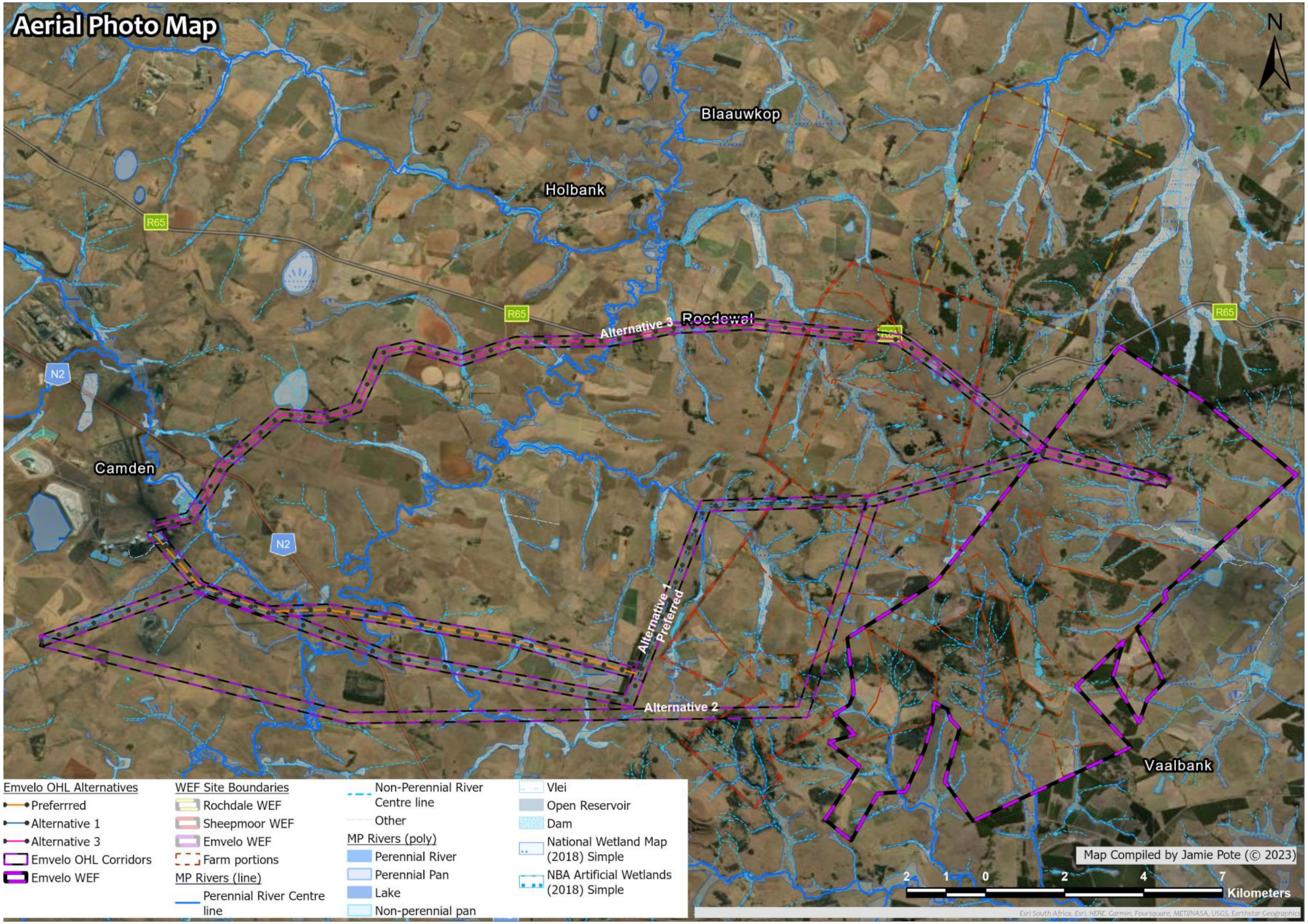

Figure 2: Aerial Photo of the WEF site and grid connection route.

Emvelo WEF

Emvelo WEF is proposed to comprise up to 45 turbines with a maximum output capacity of up to 200 MW. The WEF will be located on nineteen (19) land parcels and will have an anticipated lifespan of 20 – 25 years. The final design which will be requested for approval in the EA, will be determined based on the outcome of the specialist studies undertaken for the EIA phase of the development. The proposed turbine footprints and associated facility infrastructure will cover an area of up to 180 ha after rehabilitation, depending on final layout design.

It is proposed that an on-site substation with a capacity up 132 kV and an up to 132 kV Overhead Powerline (OHPL) of approximately 30 km (300 m corridor) in distance, traversing eighteen (18) land parcels, be constructed to connect the proposed WEF to the Eskom Uitkoms Substation.

1.3.2 Aspects of the project that could potentially have Biodiversity related Impacts

The proposed project will require clearing of vegetation for construction of the WEF facility as well as infrastructure including access roads and grid connections (substation and powerlines).

1.4 Scoping Report Methodology and Approach

This scoping report is based on a comprehensive desktop study to identify potential risks to terrestrial biodiversity inclusive of the DFFE National Environmental Screening Tool, relevant regional biodiversity planning frameworks, any previous studies as well as interrogation of applicable databases.

1.4.1 Data sources and references

A comprehensive list of references, including data sources is provided in Section 3.1. Data sources that were utilised for this report include the following:

- National (DFFE) Web Based Screening Tool – to generate the sites potential environmental sensitivity.
- National Vegetation Map 2018 (NVM, 2018), Mucina & Rutherford (2006) and Red List of Ecosystem Status (RLE, 2022) – description of vegetation types, species (including endemic) and vegetation unit conservation status.
- National and Regional Legislation including Provincial Conservation Acts and Ordinances. NEM:BA Threatened or Protected Species (ToPS).
- Regional Systematic and Bioregional Planning frameworks, guidelines and GIS data sources.
- Botanical Database of Southern Africa (BODATSA) and New Plants of Southern Africa (POSA) – lists of plant species and potential species of concern found in the general area (SANBI).
- International Union for Conservation of Nature (IUCN) - Red List of Threatened Species.
- Animal Demography Unit Virtual Museum (VM) – potential faunal species.
- Global Biodiversity Information Facility (GBIF) – potential faunal species.
- Southern African Bird Atlas Project 2 (SABAP2) – for bird species records.
- National Red Books and Lists - mammals, reptiles, frogs, dragonflies & butterflies.
- National Freshwater Ecosystem Priority Areas assessment (NFEPA, 2011) - important catchments.
- National Biodiversity Assessment (NBA, 2018) – South African Inventory of Inland Aquatic Ecosystems (SAIIAE), Ecosystem types, threat status and protection level.
- National Protected Areas Expansion Strategy (NPAES, 2010 & 2018) and South Africa Protected Area database (2020) – protected area information.
- Sub-Topical Ecosystem Planning (STEP, 2002) – Bioregional Plan.
- SANBI BGIS – All other biodiversity GIS datasets.
- Aerial Imagery – Google Earth, Esri, Chief Surveyor General (http://csg.dla.gov.za).
- Cadastral and other topographical country data - Chief Surveyor General (http://csg.dla.gov.za).

- Other sources include peer-reviewed journals, regional and local assessments, and studies in the general location of the project and its area of influence, landscape prioritization schemes (Key Biodiversity Areas), systematic conservation planning assessments and plans (as above), and any pertinent masters and doctoral theses, among others.

1.4.2 Assumptions, Uncertainties and Gaps in Knowledge

The findings and recommendations of this report may be susceptible to the following uncertainties and limitation:

- This preliminary scoping report is primarily desktop based and relies on most recent available information including literature, online and other databases and aerial photography as well as a limited time site visit, in the late mid-autumn and mid-winter season.
- This initial scoping process reporting does not include comprehensive site survey, species investigations or sampling.

2 Legislation Framework

In terms of NEMA EIA Regulations (07 April 2014, as amended), the following specific listing notices have bearing on the proposed activity and terrestrial biodiversity[1]:

Listing Notice 1 (GNR):

1. The development of facilities or infrastructure for the generation of electricity from a renewable resource where—
(i) the electricity output is more than 10 megawatts but less than 20 megawatts; or
(ii) the output is 10 megawatts or less, but the total extent of the facility covers an area in excess of 1 hectare.

Activity 1 could apply relating to facilities or infrastructure for the generation of electricity more than 10 megawatts but less than 20 megawatts from a renewable resource but is not related to terrestrial biodiversity unless additional activities are triggered, as below.

11. The development of facilities or infrastructure for the transmission and distribution of electricity—
(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts;
~~(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more.~~

The proposed 132 kV grid connection and associated infrastructure will trigger this listed activity.

12. The development of:
(ii) infrastructure or structures with a physical footprint of 100 square metres or more.
where such development occurs—
(a) within a watercourse.
~~(b) in front of a development setback; or~~
(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse: —

Watercourses are present on site and the listed activity would be triggered if such an activity was to take place, which is likely in order to accommodate site access.

1 *The listed activities itemized are only those with Biodiversity relevance to this report and is not a complete list of potential triggers.*

19. The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles, or rock of more than 10 cubic metres from a watercourse.

Watercourses are present on site and the listed activity would be triggered if such an activity was to take place, which is likely in order to accommodate site access.

27. The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for—
(i) the undertaking of a linear activity; or

Indigenous vegetation is present on site and the listed activity will likely be triggered as clearing of natural vegetation will exceed 1 Ha.

Listing Notice 2 (GNR):

15. The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for—
~~(i) the undertaking of a linear activity; or~~
~~(ii) maintenance purposes undertaken in accordance with a maintenance management plan.~~

The proposed WEF footprints will likely require the clearing of greater than 20 Ha of indigenous vegetation, hence Activity 15 will likely be triggered, which will require a full Scoping and EIA process. The site does not fall within ant=y designated REDZ area, the closest being the Emalahleni REDZ to the north-west, hence the reduced BA process will not be applicable.

Listing Notice 3 (GNR):

4. The development of a road wider than 4 metres with a reserve less than 13,5 metres
(f) Mpumalanga
i. Outside urban areas:
~~(aa) A protected area identified in terms of NEMPAA, excluding disturbed areas; (bb) National Protected Area Expansion Strategy Focus areas;~~
~~(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;~~
~~(dd) Sites or areas identified in terms of an international convention;~~
(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;
~~(ff) Core areas in biosphere reserves; or~~
~~(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas, where such areas comprise indigenous vegetation; or~~
~~ii. Inside urban areas:~~
~~(aa) Areas zoned for use as public open space; or~~
~~(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose.~~

The listed activity would be triggered if access roads exceed the threshold (wider than 4 m) and occur within designated critical biodiversity areas.

12. The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.
(f) Mpumalanga

~~i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;~~
ii. Within critical biodiversity areas identified in bioregional plans; or
~~iii. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning or proclamation in terms of NEMPAA.~~

The listed activity would be triggered if clearing of indigenous vegetation (natural areas) exceeds 300 m^2 and occurs within designated critical biodiversity areas.

14. The development of -
(ii) infrastructure or structures with a physical footprint of 10 square metres or more.
where such development occurs -
(a) within a watercourse.
(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse.
(f) Mpumalanga
i. Outside urban areas:
~~(aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas;~~
~~(cc) World Heritage Sites;~~
~~(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;~~
~~(ee) Sites or areas identified in terms of an international convention;~~
(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;
~~(gg) Core areas in biosphere reserves; or~~
~~(hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation; or~~
~~ii. Inside urban areas:~~
~~(aa) Areas zoned for use as public open space; or~~
~~(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority, zoned for a conservation purpose.~~

Watercourses are present on site and the listed activity could be triggered if such an activity was to take place.

Implications:

- It is likely that the proposed activity will require the clearing of more than 300 m^2 within a designated Critical Biodiversity Area and/or more than 1 Ha of indigenous vegetation and/or an activity in a watercourse in terms of EIA listing notices 1 and 3, hence as a minimum would trigger a Basic Assessment process.
- The project will also likely require clearing of more than 20 Ha of indigenous vegetation in terms of EIA listing notice 2, hence triggering a full Scoping and EIA process, as the site is not within any designated Renewable Energy Development Zone (REDZ).
- Additional listed activities that may pertain to the type of activity (WEF & OHL) rather than directly to terrestrial biodiversity features have not been considered in depth.

Other potentially relevant legislation, which will be evaluated as required, includes the following:

- NEMA: Environmental management principles set out in NEMA, and other Specific Environmental Management Acts (SEMA's) should guide decision making throughout the project life cycle to reflect the objective of sustainable development. One of the most important and relevant principles is that disturbance of ecosystems, loss of biodiversity, pollution and degradation of environment and sites that constitute the nation's cultural heritage should be avoided, minimised or as a last option remedied. This is supported by the Biodiversity Act as it relates to loss of biodiversity.
- Liability for any environmental damage, pollution, or ecological degradation: Arising from all - related activities occurring inside or outside the area to which the permission/right/permit relates is the responsibility of the rights holder. The National Water Act and NEMA both oblige any person to take all reasonable measures to prevent pollution or degradation from occurring, continuing, or reoccurring (polluter pays principle). Where a person/company fails to take such measures, a relevant authority may direct specific measures to be taken and, failing that, may carry out such measures and recover costs from the person responsible.
- Public participation: Public consultation and participation processes prior to granting licences or authorisations can be an effective way of ensuring that the range of ways in which the activities impact on the environment, social and economic conditions are addressed, and considered when the administrative discretion to grant or refuse the licence is made.
- Constitution of Republic of South Africa (1996): Section 24(a) of the Constitution states that everyone has the right *'to an environment that is not harmful to their health or well-being'*. Construction activities must comply with South African constitutional law by conducting their activities with due diligence and care for the rights of others.
- National Forests Act 84 of 1998 with Amendments: Lists Protected trees, requiring permits for removal Department of Agriculture, Forestry and Fisheries). Section (3)(a) of the National Forests Act stipulate that '*natural forests must not be destroyed save in exceptional circumstances where, in the opinion of the Minister, a proposed new land use is preferable in terms of its economic, social, or environmental benefits*'.
- Water Use Authorisations: The National Water Act (No. 36 of 1998): Requires that provision is made both in terms of water quantity and quality for 'the reserve', namely, to meet the ecological requirements of freshwater systems and basic human needs of downstream communities. It is essential in preparing an EMP that any impacts on water resources be they surface water or groundwater resources, and/ or impacts on water quality or flow, are carefully assessed, and evaluated against both the reserve requirement and information on biodiversity priorities. This information will be required in applications for water use licenses or permits and/or in relation to waste disposal authorisations.
- Conservation of Agricultural Resources Act 43 of 1993: Lists Alien invasive species requiring removal.
- National Environmental Management Act, 1998 (Act No. 107 of 1998): DARDLEA and DEA are the Competent Authority for the implementation of the National Environmental Impact Assessment Regulations, promulgated under the National Environmental Management Act NEMA], as amended.

2.1 Systematic Planning Frameworks

A screening of Systematic Planning Framework for the region was undertaken (summarised in Table 2), that included the following features:

- Critically Endangered and Endangered Ecosystems
- Critical Biodiversity Areas & Ecological Support Areas
- Vulnerable Ecosystems
- Rivers, Watercourses, Estuaries, Wetland Freshwater Ecosystem Priority Areas (FEPAs), Strategic Water Souce Areas (SWSA's) as well as any associated buffers

- Protected Areas (and buffers) and Protected Area Expansion Strategy Area (PAES)
- Critical Habitat for listed endemic, protected or species of conservation concern.

Table 2: Summary of Regional Planning Biodiversity features.

FEATURE[2]	DESCRIPTION	IMPLICATIONS/COMMENT
National Environmental Screening Tool (Terrestrial Biodiversity)	Very High Terrestrial Biodiversity High & Medium Animal Species Medium & Low Plant Species Very High & Low Aquatic Very High, High, Medium & Low Agriculture	Several high sensitivity biodiversity and aquatic indicators. Refer to relevant sections.
National Vegetation Map (NVM, 2018)	Eastern Highveld Grassland Wakkerstroom Montane Grassland	Endangered Least Concern
Critically Endangered and Endangered Ecosystems: Terrestrial (RLE, 2022)	Eastern Highveld Grassland	Endangered
Vulnerable Ecosystems (RLE, 2022)		N/A
Mpumalanga Biodiversity Sector Plan (2014): Terrestrial	CBA (Irreplaceable); CBA (Optimal); ESA Local & Landscape corridor; ESA species specific; Other Natural Areas (ONA); Moderately Modified (Old Lands) & Highly Modified (Cultivated)	Specific flagged areas to preferably be avoided, including CBA (Irreplaceable), ESA Local & Landscape corridor. Limited footprints within CBA (Optimal) & ESA may be possible, depending on more comprehensive site-specific assessment.
Mpumalanga Biodiversity Sector Plan (2014): Aquatic	Aquatic CBAs & ESAs, Strategic water source area, Wetlands, Freshwater ecosystem priority area quinary catchments.	Any activities that may impact on CBA rivers, even upstream or in sub-catchments, need to be avoided, or impacts mitigated if they cannot be avoided. Any damaging activities within CBA river buffers must be avoided.
Protected Areas (SAPAD)	The Jericho Dam Nature Reserve lies 2,6 km; and the Josua Moolman Private Nature Reserve 20,2 km, to east, the Langcarel Private Nature Reserve lies 3,2 km west, north of the site lies the Chrissiesmeer Protected Environment (2,1 km), the Laughing Waters Private Nature Reserve (27 km), the Maffia Private Nature Reserve (38 km), the Bewerwyk Private Nature Reserve (42 km), the St. Louis Private Nature Reserve (41 km) and the Rentia Kritzinger Private Nature Reserve (43 km). To the north-west lies the Ahlers Private Nature Reserve (22 km) and the Rietvlei Private Nature Reserve (28 km).	No protected areas nor any ecological processes associated with them are likely to be affected by the proposed project other than some transient faunal species from the Jericho Dam Nature Reserve & Langcarel Private Nature Reserve and/or linked ecological processes.
NPAES	The entire project footprint/boundary is situated within an NPAES (2018) Priority Focus Area.	
Strategic Water Source Areas (SWSA)	Portion of site is situated within a designated SWSA areas; Upper Usutu SWSA and a small portion designated to Upper Vaal SWSA.	Specific activity unlikely to have any significant impact to downstream water resources, based on elevated baseline levels of transformation. .
Freshwater Ecosystem Priority Areas (FEPA's)	Several rivers and wetlands falling within and surrounding the project footprint including Onverwagspruit, Vaal, Witpuntspruit, Mpama, and the	Specific activity unlikely to have any significant impact to nearby rivers. No land-use practices that lead to deterioration of condition of FEPA

[2] Refer to Section 2.1.

FEATURE[2]	DESCRIPTION	IMPLICATIONS/COMMENT
	uSuthu River. Several channelled valley-bottom wetlands, seepage wetlands, floodplains, wetland flats, wetland depressions, and unchanneled valley-bottom wetlands occur within and surrounding the site.	rivers and wetland FEPA's as well as associated sub-quaternary catchments should take place.
Regional Hotspots & Regions of Endemism	Outside of any endemism hotspots.	N/A.
Important Bird Areas (IBA's)	A large portion of the Grassland IBA is located within the project boundary, the Chrissie Pans IBA is located 1,5 km north of the boundary, and the Amersfoort-Bethal-Carlina District IBA is located 12,5 km west of the project Boundary.	Birds associated with these IBA's may be present and further avifaunal assessment will be required.
Key Biodiversity Areas (KBA's)	None	N/A
Marine/Coastal areas	The site is not located within 1 km of any coastal area.	N/A
Estuaries	The site is not located within 1 km of any estuary.	N/A
RAMSAR sites	None	N/A
Within 32 m of Watercourse	Several non-perennial watercourses are present.	Watercourses will only be affected if proposed activity is undertaken in proximity.
Within 100 m of River	Site is within 100 m of several perennial rivers.	Development of the site is unlikely to significantly impact any watercourse.
Within 100 m of Wetland	Site is within 100 m of extensive natural wetlands.	Wetlands will only be affected if proposed activity is undertaken in proximity.
Forest	None	N/A
Surrounding Land Uses	Mostly commercial agriculture including dryland grazing and commercial agriculture including pastures and crops including fodder crops and maize.	Site is generally significantly disturbed overall within a patchy mosaic of remnant natural vegetation
Critical Habitat for listed endemic/ protected species	There are several red listed species in the surrounding area and vegetation units that are known to have limited distributions, however none were recorded on the footprint at the time of the preliminary site visit (refer to Section 2.3). Furthermore, optimal seasonal assessment will be required.	

Implications:

- One of the vegetation units (Eastern Highveld Grassland) present, is significantly transformed and highly fragmented regionally, because of agriculture, mining and rural/urban development and has an Endangered status; hence remnant intact vegetation patches will have an elevated sensitivity status.
- Irreplaceable and Optimal CBA areas are also present as well as ESA local and landscape corridors. Irreplaceable CBA areas should be avoided as per the applicable regional planning guidelines.
- Several rivers and wetlands surround the site or are present within the site boundary. Appropriate buffers to be considered, as per aquatic specialist assessment.
- The site is also in proximity to several nature reserves and portions of the site are also designated as NPAES (National Protected Areas Expansion Strategy).
- Several Species of Conservation Concern are also potentially present that would require appropriate seasonal sampling.
- The specific type of development (Wind Energy Facility with grid connection and other associated infrastructure) tends to have a dispersed and relatively low footprint area in

proportion to the overall project area, in comparison to for example an intensive project such as cultivation where larger areas require clearing.

2.1.1 National Environmental Screening Tool

Since all three sites are situated within a localised and adjacent area, for the purposes of this scoping phase, it will be assumed that the flagged sensitivities across all sites may have influence or relevance.

WEF Site

The DFFE Screening Tool indicates the following sensitivities, which may have terrestrial biodiversity and/or ecological implications or considerations.

- Terrestrial Biodiversity is *Very High* (Figure 3).
- Plant species sensitivity is Low & Medium (Figure 4).
- Animal Species sensitivity is Medium & High (Figure 5).
- Aquatic Sensitivity is *Very High* (Figure 6).
- Agricultural Sensitivity is *High & Medium* (Figure 7).
- Landscape Sensitivity is Very High, *High, Medium & Low* (Figure 8).

SENSITIVITY	FEATURE(S) IN PROXIMITY
Terrestrial Sensitivity	
Very High	CBA 1 & 2, ESA: landscape corridor & local corridor, FEPA Sub-catchments, Protected Areas Expansion Strategy, Critically Endangered Ecosystem, Vulnerable Ecosystem.
High	None
Medium	None
Low	None
Plant Sensitivity	
Very High	None
High	None
Medium	Sensitive species 1252, 1201, 41, 691, 998, 1219, 321, 851; *Khadia carolinensis, Indigofera hybrida, asparagus fractiflexus, Aspidoglossum zanthosphaerum, Khadia alticola, Pachycarpus suaveolens, Gerbera aurantiaca, Zaluzianskya distans.*
Low	Present
Animal Sensitivity	
Very High	None
High	*Geronticus calvus, Balearica regulorum, Sagittarius serpentarius, Eupodotis senegalensis* (Aves)
Medium	*Hydroprogne caspia, Neotis denhami, Balearica regulorum, Sagittarius serpentarius, Geronticus calvus, Eupodotis senegalensis, Tyto capensis* (Aves) *Crocidura maquassiensus, Ourebia ourebi ourebi* (Mammal) *Clonia lalandei* (Invertebrate)
Low	*None*
Aquatic Sensitivity	
Very High	Aquatic CBAs, SWSA, Wetlands, Freshwater Ecosystem Priority Area quinary catchments
High	None
Medium	None
Low	Present
Agricultural Sensitivity	
Very High	Land capability; 11. High/12. High-Very high/13. High-Very high/14. Very high/15. Very high Annual Crop Cultivation / Planted Pastures Rotation; Land capability; 11. High/12. High-Very high/13. High-Very high/14. Very high/15. Very high
High	Land capability; 09. Moderate-High/10. Moderate-High. Annual Crop Cultivation / Planted Pastures Rotation; Land capability ;09. Moderate High/10. Moderate-High. Annual Crop Cultivation / Planted Pastures Rotation; Land capability; 06. Low-Moderate/07. Low-Moderate/08. Moderate. Annual Crop Cultivation / Planted Pastures Rotation; Land

SENSITIVITY	FEATURE(S) IN PROXIMITY
	capability; 01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low. Old Fields; Land capability; 06. Low-Moderate/07. Low-Moderate/08. Moderate. Old Fields; Land capability; 09. Moderate-High/10. Moderate-High. Old Fields; Land capability; 01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
Medium	Land capability; 06. Low-Moderate/07. Low-Moderate/08. Moderate
Low	Land capability; 01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
Landscape Sensitivity	
Very High	Mountain tops and high ridges, Slope more than 1:4, Within 3 km of a nature reserve, botanical garden or other protected area & Within 250 m of a river
High	Slope between 1:4 and 1:10, Between 3 and 5 km of a nature reserve, botanical garden or other protected area & Within 500 m of a river.
Medium	Between 5 and 10 km of a nature reserve, botanical garden or other protected area & Within 1000 m of a wetland.
Low	Slope less than 1:10

Figure 3: Terrestrial Biodiversity Sensitivity.

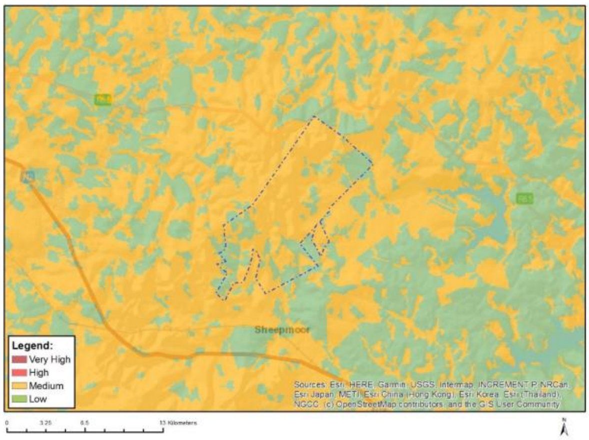

Figure 4: Plant Species Sensitivity.

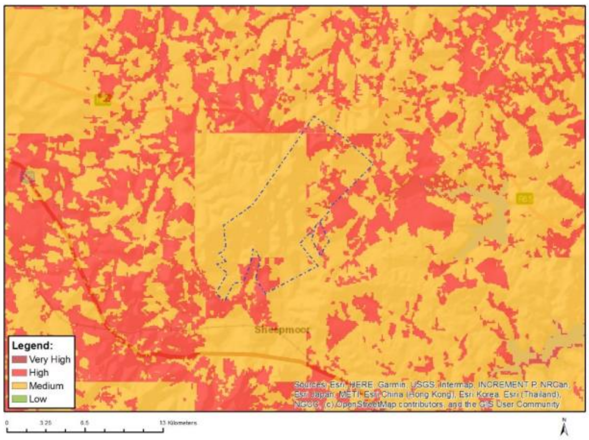

Figure 5: Animal Species Sensitivity.

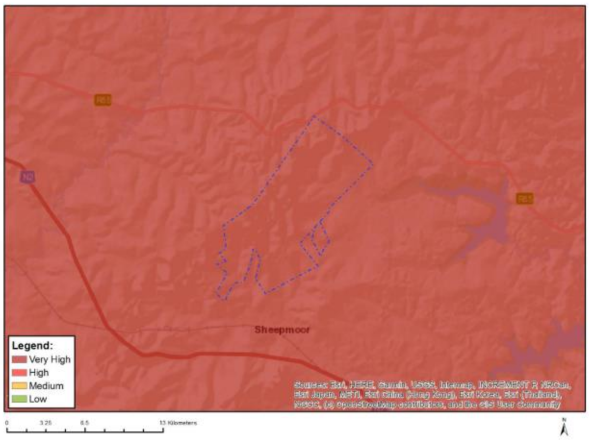

Figure 6: Aquatic Sensitivity.

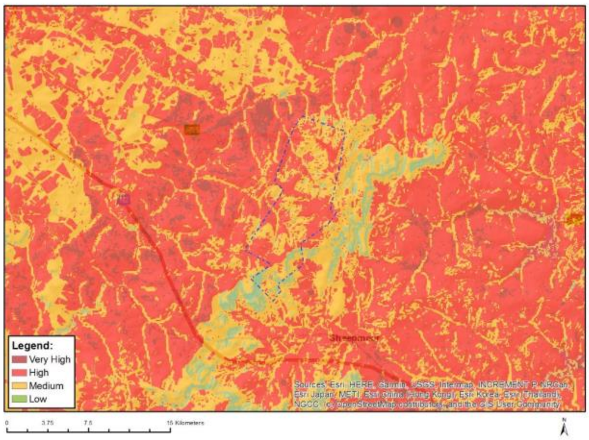

Figure 7: Agricultural Sensitivity.

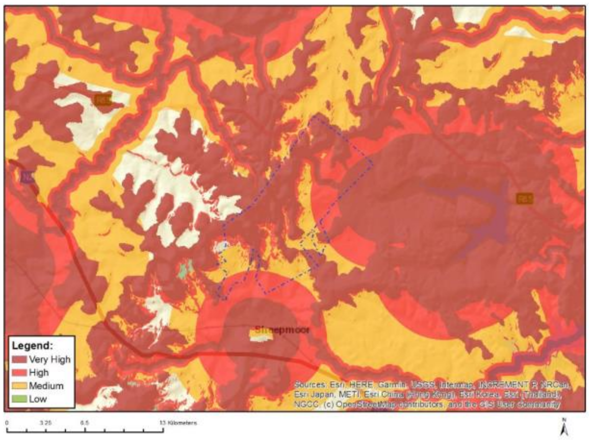

Figure 8: Landscape Sensitivity.

Grid Connection

The DFFE Screening Tool indicates the following sensitivities for the grid connection area, which may have terrestrial biodiversity and/or ecological implications or considerations.

- Terrestrial Biodiversity is *Very High* (*Figure 9*).
- Plant species sensitivity is Low & Medium (*Figure 10*).
- Animal Species sensitivity is Medium & High (*Figure 11*).
- Aquatic Sensitivity is *Very High* (*Figure 12*).

SENSITIVITY	FEATURE(S) IN PROXIMITY
Terrestrial Sensitivity	
Very High	CBA 1 & 2, ESA: Landscape corridor, Local corridor, Protected Area buffer, FEPA Sub-catchment, National Protected Area Expansion Strategy (NPAES), Langcarel Private Nature Reserve, SWSA (SW) _Upper Usutu, Upper Vaal, EN: Eastern Highveld Grassland
High	None
Medium	None
Low	None
Plant Sensitivity	
Very High	None
High	None
Medium	*Khadia carolinensis, Indigofera hybrida, Asparagus fractiflexus, Aspidoglossum xanthosphaerum, Khadia alticola, Pachycarpus suaveolens, Gerbera aurantiaca, Zaluzianskya distans, Sensitive species 1252, 1201, 41, 691, 998, 1219, 321 & 851*
Low	Present
Animal Sensitivity	
Very High	None
High	*Aves-Geronticus calvus, Balearica regulorum, Sagittarius serpentarius & Eupodotis senegalensis* (Aves)
Medium	*Hydroprogne caspia, Balearica regulorum, Sagittarius serpentarius, Geronticus calvus, Eupodotis senegalensis, Tyto capensis* (Aves) *Crocidura maquassiensus, Ourebia ourebi ourebi* (Mammal) *Clonia lalandei* (Invertebrate)
Low	*None*
Aquatic Sensitivity	
Very High	CBA: Wetlands, ESA: Important sub-catchments, Strategic Water Source Area, Wetland clusters, Wetlands, Very High FEPA Sub-catchment, Rivers_AB, B, C, SWSA (SW) Upper Usutu, Upper Vaal, Wetlands (River), Wetlands: Mesic Highveld Grassland Bioregion (Depression, Floodplain, Seep & Valley-bottom)
High	None
Medium	None

SENSITIVITY	FEATURE(S) IN PROXIMITY
Low	Present

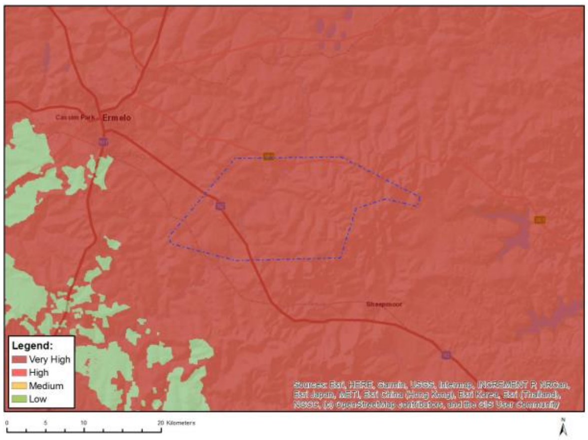

Figure 9: Terrestrial Biodiversity Sensitivity (OHL).

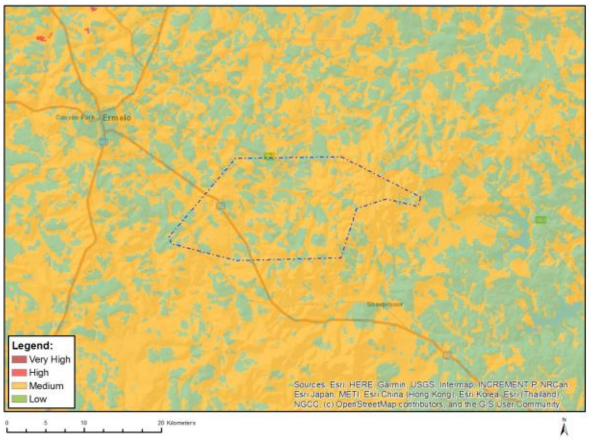

Figure 10: Plant Species Sensitivity (OHL).

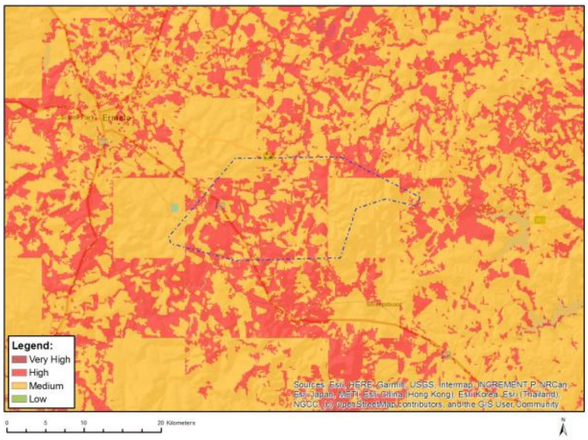

Figure 11: Animal Species Sensitivity (OHL).

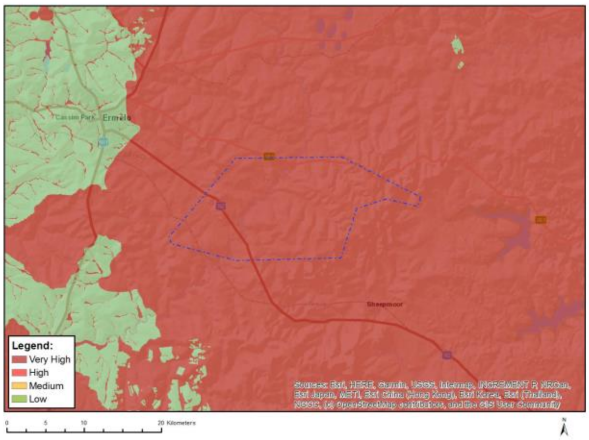

Figure 12: Aquatic Sensitivity (OHL).

In summary, the site is located within a rural commercial farming area and has a history of being used for commercial agriculture with associated infrastructure including buildings, dams and other infrastructure. Uncultivated vegetation is most near natural to natural with secondary vegetation also common where old lands are no longer cultivated and transformed where currently cultivated. The broader area, in particular the Eastern Highveld Grassland vegetation unit tends to be significantly fragmented in areas where cultivation is extensive. Mining (opencast coal) is also present in the broader surrounding area but not in close proximity to the WEF site & grid connection route.

2.1.2 Vegetation of Southern Africa

Two vegetation units (Table 2, Figure 13) are primarily affected by the proposed project (Mucina & Rutherford, 2006). The site is located within Eastern Highveld Grassland (currently having an *Endangered* conservation status) and Wakkerstroom Montane Grassland (currently having a *Least Concern* conservation status). The Eastern Highveld Grassland tends to be associated with lower lying relatively flat areas, while the Wakkerstroom Montane Grassland is associated with higher elevation mountainous areas, particularly towards the central and south-east of the WEF cluster formed by a series of mountainous ridges as well as the eastern portions of the southern grid connection routes. Being situated on relatively flat areas with good soils and rainfall, the eastern highveld grassland has been subject to significant historical clearing for agricultural activities including pastures, fodder and crops.

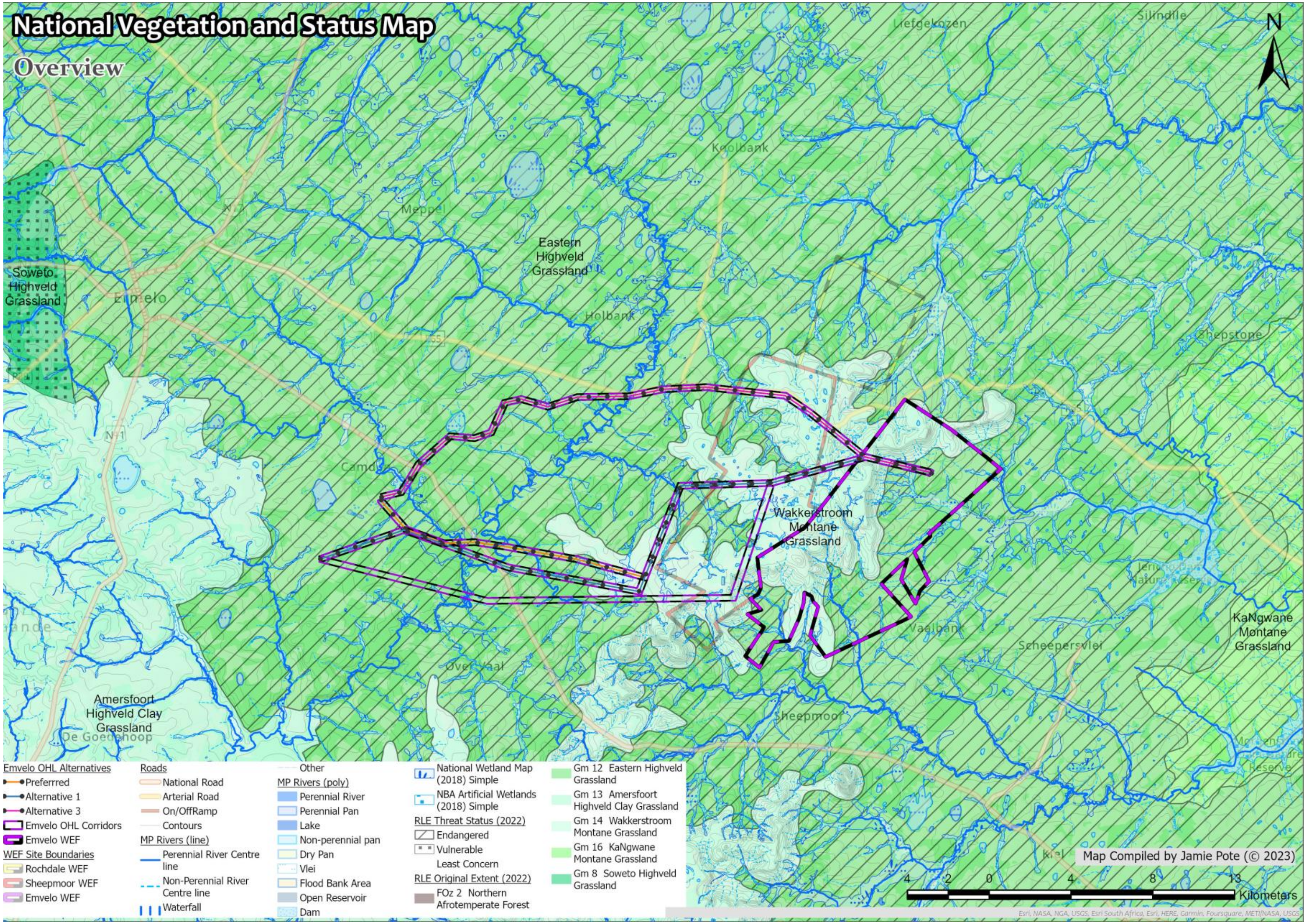

Figure 13: National Vegetation Map (2018) and National Biodiversity Assessment Status (2022).

2.1.3 Red List of Ecosystem Status and National Biodiversity Assessment

The Red List of Ecosystem Status (RLE, 2022) is currently the primary tools for monitoring and reporting on the state of biodiversity in` South Africa and informs policies, strategic objectives, and activities for managing and conserving biodiversity more effectively. The RLE is preceded by the National Biodiversity Assessment (NBA, 2018) The RLE/NBA is especially important for informing the National Biodiversity Strategy and Action Plan (NBSAP), the National Biodiversity Framework (NBF) and the National Protected Area Expansion Strategy (NPAES) and informs other national strategies and frameworks across a range of sectors, such as the National Spatial Development Framework, the National Water and Sanitation Master Plan and the National Biodiversity Economy Strategy. Ecosystem protection level is an indicator that tracks how well represented an ecosystem type is in the protected area network. It has been used as a headline indicator in national reporting in South Africa since 2005. It is computed by intersecting maps of ecosystem types and ecological condition with the map of protected areas. Ecosystem types are then categorised based on the proportion of the biodiversity target for each ecosystem type that is included in one or more protected areas. For terrestrial ecosystems, biodiversity targets are set for each ecosystem type using established species–area accumulation curves (ranging between 16 and 34%).

The outcome of the most recent Red List of Ecosystem Status (2022) indicate that Eastern Highveld Grassland has an Endangered conservation status (Table 2), which is an elevated threat status elevation. This indicates that the vegetation unit has lost significant amounts (~less than 40 % remains) of their original natural habitat, so their overall ecological functioning is likely compromised to some extent through loss of habitat and fragmentation. There is a widespread high level of utilization of this unit leading to degradation and transformation. Shifting cultivation and the effects of development have caused continuous disturbance of the soil surface, which can lead to secondary succession changes in the grassland. Wakkerstroom Montane Grassland has a Least Concern conservation status which is the lowest threat status elevation. This indicates that more than 60 % of the unit remains, and ecosystem functioning is unlikely significantly compromised.

Implications:

- The Eastern Highveld Grassland vegetation unit has an *Endangered* status, indicating that more than 40% has been transformed and there will likely already be some loss or disruptions to ecological functioning which will be exacerbated by further loss. Further loss in remnant areas is not advisable as per the respective guidelines.
- Much of the indicated Eastern Highveld Grassland, comprising a portion of the historical coverage on the Emvelo site in lower lying valleys, is already transformed as a result and/or comprised of secondary grassland due to historical cultivation, with a small portion of Wakkerstroom Montane Grassland along the southern boundary.
- As is evident from land-use coverages, the wider area is highly fragmented because of land-use, including agriculture, mining and urbanisation.

2.1.4 Mpumalanga Biodiversity Conservation Plan (MBCP, 2006)

The Mpumalanga Biodiversity Conservation Plan (2006) is superseded by the Mpumalanga Biodiversity Conservation Plan (2014) and thus not considered further.

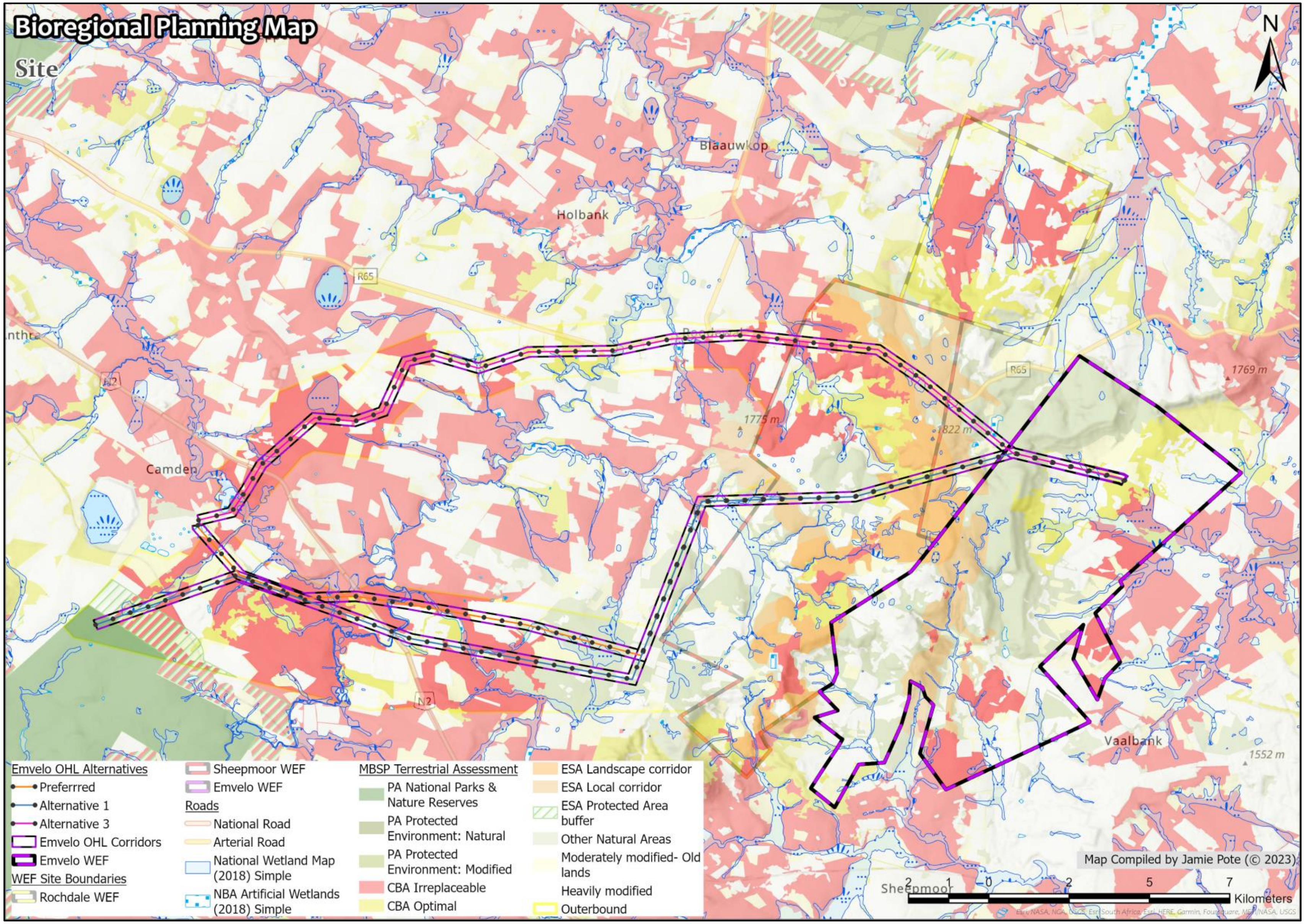

Figure 14: Mpumalanga Biodiversity Sector Plan (MBSP, 2014) – Terrestrial Overview.

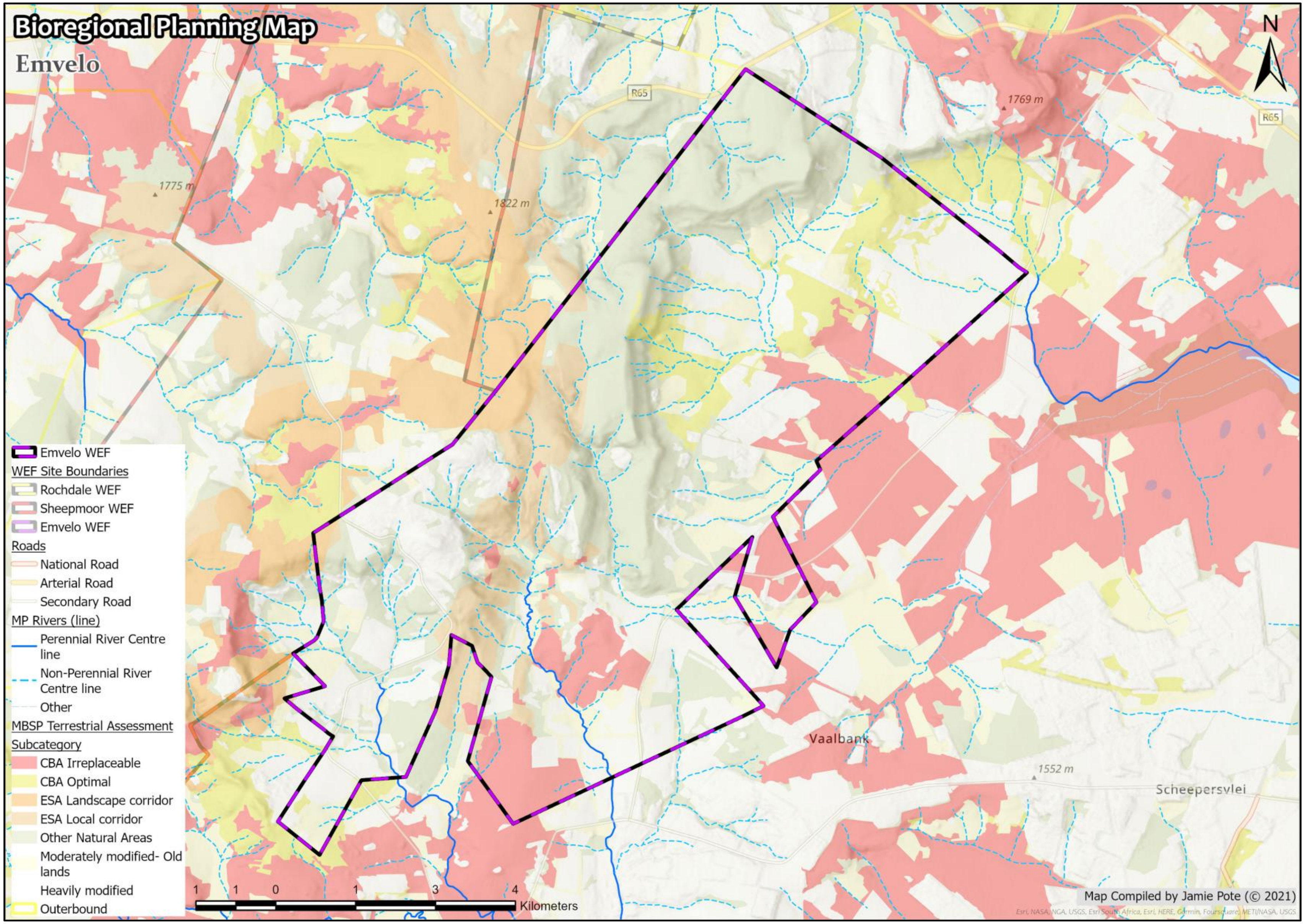

Figure 15: Mpumalanga Biodiversity Sector Plan (MBSP, 2014) – Terrestrial (site).

2.1.5 Mpumalanga Biodiversity Sector Plan (MBSP, 2014): Terrestrial

A Biodiversity Sector Plan can be used to guide conservation action (such as identifying priority sites for expansion of protected areas), or to feed spatial biodiversity priorities into planning and decision-making in a wide range of cross-sectoral planning processes and instruments such as provincial and municipal integrated development plans and spatial development frameworks, land-use management schemes, environmental management frameworks and environmental management plans. Figure 14 indicates the Terrestrial MBSP categorisation of the site and surrounding area.

Implications:

- As is evident from land-use coverages, the wider area is highly fragmented because of land-use, including agriculture, mining, and urbanisation.
- Intact vegetation on the Emvelo and surrounding sites is considered to be of conservation value, being generally designated either Irreplaceable or Optimal CBA with Other Natural Area (ONA) associated with transformed (cultivated) land, mostly associated with remnant Eastern Highveld Grassland, being designated Irreplaceable CBA.
- The degraded, secondary vegetation (old lands) and cultivated areas are generally not designated a CBA status but in some cases are designated ESA: local corridor or ESA: species specific. Specific reasons or sensitivities for these designations are not known at this stage but would require further investigation during the assessment phase to confirm current status and condition of designated areas.
- Land use guidelines indicates that Irreplaceable CBA sites must be avoided in terms of the mitigation hierarchy, however for Optimal CBA (referred to as Important and necessary in MBCP), the guidelines indicate that, although not desirable, if small-scale land-use change is unavoidable, it must be located and designed to be as biodiversity-sensitive as possible.
- Portions of the proposed grid connection corridors will also traverse some more extensive designated CBA: Irreplaceable areas. It is not anticipated that the actual footprint or loss within these areas will be significant due to the limited footprint of pylons.
- ESA areas can accommodate loss, but ecological processes and connectivity must be given consideration.

2.1.6 Other Biodiversity Sector Plans

The site is outside of the planning domain of any other Biodiversity Sector Plans.

2.1.7 Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Areas (NFEPA) project responds to the high levels of threat prevalent in river, wetland, and estuary ecosystems of South Africa (Figure 16). It provides strategic spatial priorities for conserving the country’s freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or ‘*FEPAs*’.

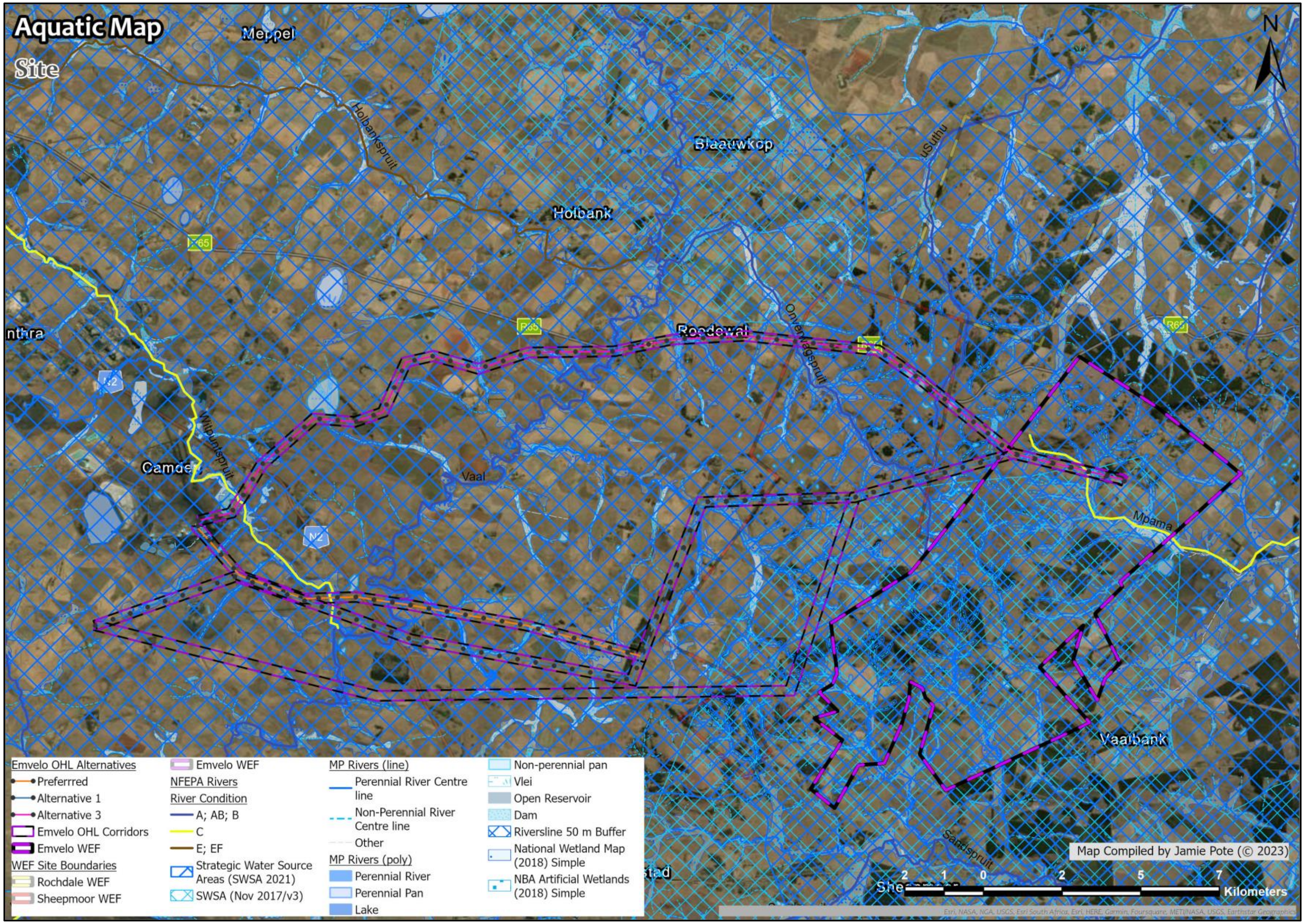

Figure 16: Aquatic Resources Map indicating Rivers, Watercourses, Wetlands, NFEPA and SWSA.

Biodiversity targets set minimum, quantitative requirements for biodiversity conservation. They reflect scientific best judgement and will need to be refined as knowledge evolves. Quantitative biodiversity targets were set for fish species, river ecosystem types, wetland ecosystem types, priority estuaries, wetland clusters and free-flowing rivers:

1. Threatened and near-threatened freshwater fish species – all populations (100%) of considered to be critically endangered or endangered species, and at least ten populations of species that are in the International Union for Conservation of Nature (IUCN) vulnerable or near threatened categories and some populations of special concern (e.g., very restricted distributions in South Africa)
2. River ecosystem types – 20% of total length per type
3. Wetland ecosystem types – 20% of total area per type
4. Wetland clusters – 20% of total area per wetland vegetation group
5. Free-flowing rivers – 20% of total length per ecoregion group
6. Priority estuaries – 100% of all priority estuaries, which already considered biodiversity targets of 20% for estuary ecosystem types and habitat, 50% of the populations of threatened species; 40% of the populations of exploited estuarine species; 30% of the populations of all other estuarine species.

Terrestrial and aquatic resources are interdependent, with one affecting the other. For example, to ensure the healthy functioning of rivers, wetlands, and estuaries, it is essential to protect mountain catchment areas where the water originates, and to safeguard riverside vegetation because these plants prevent soil erosion, sedimentation and water pollution (Vromans et al., 2012).

The health of a river ecosystem is largely dependent on the presence of natural vegetation or "riparian habitat" along its banks, including good vegetative cover within the surrounding landscape (catchment area). Riparian bank vegetation filters pollutants, helps maintain water temperatures, supplies organic matter ('food') in support of aquatic life (fish, insects etc.) and acts as a buffer to adjacent land-uses. The roots of the riparian plants also reduce the effects of floods, by binding riverbanks and thus preventing erosion. Furthermore, bank storage is increased by slowing run off during floods. For these reasons, it is essential that new developments are separated from a river and its "riparian habitat" by a buffer area.

The NFEPA Implementation Manual for Freshwater Ecosystem Priority Areas (2011) provides recommendations, guidelines and management measures for activities within wetland FEPAs (including wetland clusters), river FEPAs, sub-quaternary catchments associated with river FEPAs, and Upstream Management Areas.

Several perennial and non-perennial river, watercourses and wetland features occur within the site.

Wetland classification:

Several channelled valley-bottom wetlands, seepage wetlands, wetland flats and unchanneled valley-bottom wetlands occur within and surrounding the site. These were considered final wetland FEPA's.

Several wetland clusters were identified within the project site according to NFEPA.

Implications:

- No land-use practices that lead to deterioration of condition of FEPA rivers and wetland FEPA's as well as associated sub-quaternary catchments should take place.
- A generic buffer of 100m should be applied around FEPA rivers and wetland FEPA's and rivers and streams which drain into these areas, or as per recommendations of the aqiuatic specialist.

2.1.8 Strategic Water Source Areas

Strategic Water Source Areas (SWSA, Figure 16) are those that supply substantial downstream economies and urban centres. These water source areas are vital to the national economy. Strategic water source areas are those that supply substantial downstream economies and urban centres. These water source areas are vital to the national economy. Strategic water source areas can be regarded as natural "*water factories*", supporting growth and development needs that are often far away. Deterioration of water quality and quantity in these areas can have a disproportionately large negative effect on the functioning of downstream ecosystems and the overall sustainability of growth and development in the regions they support. Appropriate management of these areas, which often occupy only a small fraction of the land surface area, can greatly support downstream sustainability of water quality and quantity.

In South Africa, such management is particularly important for enhancing downstream water quality and quantity. Not only are the country's surface water resources extremely limited – South Africa is one of the driest countries (per capita), with 98 per cent of its surface water already developed – but the country also has a growing water quality problem.

The site falls within a small section of the Upper Vaal Surface Water Strategic Water Source Area (Figure 16) and the southern portion of the site falls within the Upper uSutu SWSA.

Implications:

- The site is overlaps with designated SWSA areas.
- There is unlikely to be a significant impact to any critical water supply to downstream economies and urban centres because of the development of this site.
- Alien invasive vegetation management control programme should be prepared in alignment with the guidelines in the Strategic Water Source Areas: Management Framework and Implementation Guidelines for Planners and Managers (WRC, 2018).

2.1.9 Regional Hotspots and Centres of Endemism

The site is not situated within any Centre of Endemism.

2.1.10 Key Biodiversity Areas

Important Bird Areas

Important Bird and Biodiversity Areas (IBA's) are sites of international significance for the conservation of the world's birds and other biodiversity. They also provide essential benefits to people, such as food, materials, water, climate regulation and flood attenuation, as well as opportunities for recreation and spiritual fulfilment. By conserving IBA's, we look after all the ecosystem goods and services they provide, which means in effect that we support a meaningful component of the South African economy (such as water management and agriculture). Since the late 1970s, more than 12 000 IBA's have been identified in virtually all the world's countries and territories, both on land and at sea. In 1998, 122 South African IBA's were identified and listed in Barnes (1998). This inventory was revised to 112 IBA's in 2015. IBA's have also had considerable and increasing relevance when responses have been developed to several wider environmental issues, such as habitat loss, ecosystem degradation, climate change and the sustainable use of resources. The core aims of the IBA Programme are:

- To identify, monitor and conserve the sites and habitats that support South Africa's priority bird species.

- To develop a network of partners, from grassroots to national level, who collaborate to conserve IBA's.
- To gather new data regularly and monitor IBA's to track status and trends across the network and so that up-to-date information can be passed on to decision-makers, enabling them to take appropriate conservation action.
- To confirm periodically that existing IBA's continue to meet the selection criteria and to identify other critical sites that may qualify for recognition as IBA's as new information becomes available.
- To build capacity in the IBA Programme by sourcing funding, and to acquire and develop appropriate skills in staff and volunteers so that these objectives can be implemented at a regional scale.

The extension of the IBA approach to several other wildlife groups has led to the identification of Important Plant Areas, Prime Butterfly Areas, Important Mammal Areas and Key Biodiversity Areas for Freshwater Biodiversity. South Africa is also the first mega diverse country to practically test the Key Biodiversity Areas (KBA's) standards across a full range of species groups and ecosystems but is not yet published.

A large portion of the Grassland IBA is located within the project boundary, the Chrissie Pans IBA is located 1,5 km north of the boundary, and the Amersfoort-Bethal-Carlina District IBA is located 12,5 km west of the project Boundary. The National Screening Tool identifies several bird species that would require further assessment by avifaunal specialist.

Implications:

- Refer to applicable bird specialist reporting relating to avifauna.
- While avifauna are generally not considered at length in terrestrial biodiversity reporting, they do play an integral and critical role in terrestrial ecological processes.

2.1.11 Protected Areas

The South Africa Protected Areas Database (SAPAD) database, a comprehensive database of various protected area categories, is updated on a quarterly basis, and provides a comprehensive source of all national and private nature reserves, world heritage sites and other formal legally protected conservation areas situated within South Africa. Protected areas in the vicinity include the Chrissiesmeer Protected Environment, Jericho Dam Nature and Langcarel Private Nature Reserve (Figure 17).

No other protected areas are situated within 10 km of the site. No NPAES are situated within 50 km of the site; however, PAES areas are indicated for all CBA and ESA designated areas for the region in the screening tool, which will likely require further investigation and/or consultation with the respective authorities.

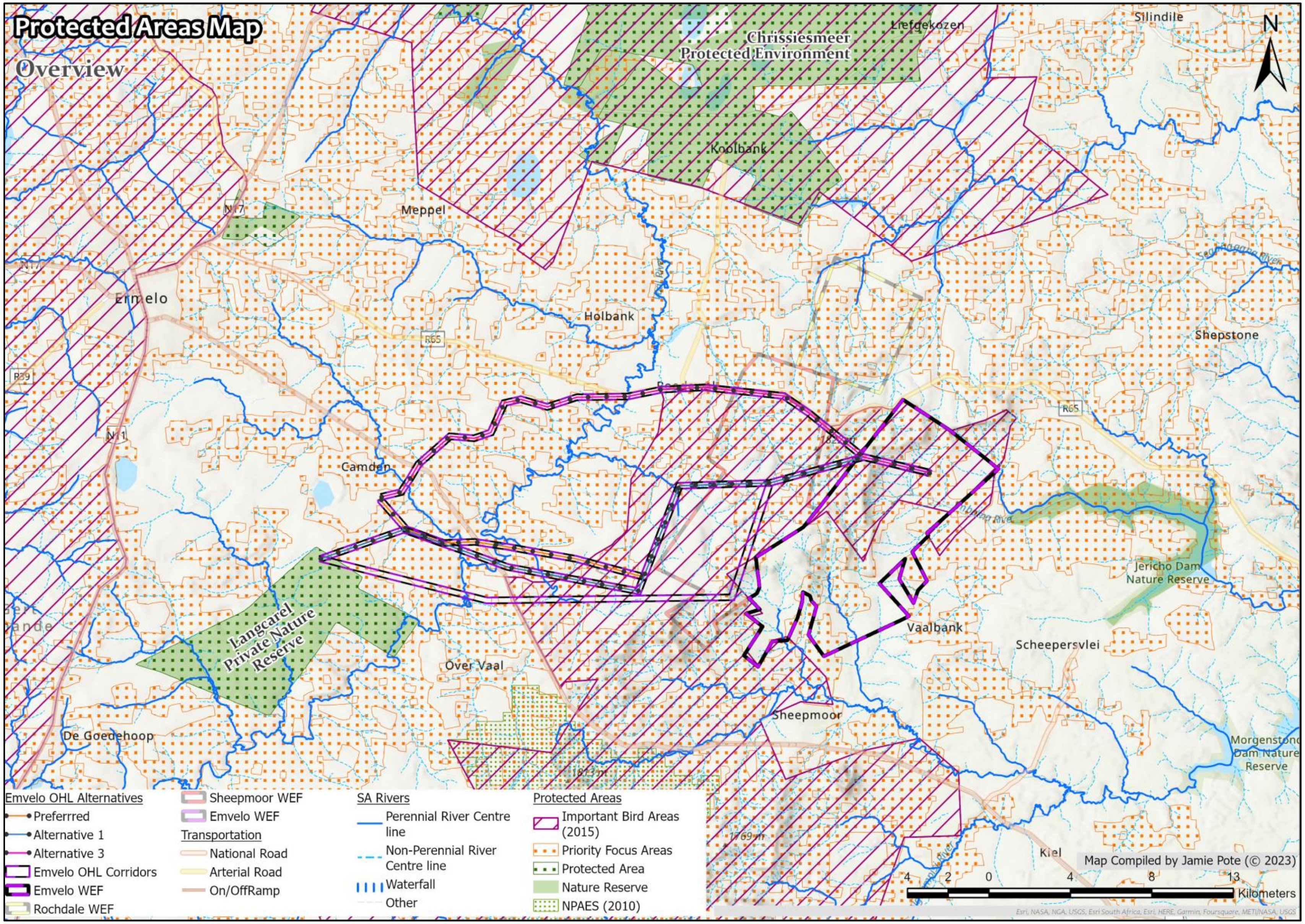

Figure 17: Protected Areas and designated NPAES areas in proximity to and within the site.

Table 3: List of Protected Areas in vicinity

NAME	DISTANCE
Chrissiesmeer Protected Environment	< 3 km North
Jericho Dam Nature Reserve	<5 km East
Langcarel Private Nature Reserve	<5 km West
Josua Moolman Private Nature Reserve	< 25 km East
Laughing Waters Private Nature Reserve	< 30 km North
Ahlers Private Nature Reserve	< 30 km North-west
Rietvlei Private Nature Reserve	< 30 km North-west
Maffia Private Nature Reserve	
Rentia Kritzinger Private Nature Reserve	< 45 km North
Bewerwyk Private Nature Reserve	
St. Louis Private Nature Reserve	< 45 km North-west

When projects are in legally protected and internationally recognized areas, it should be ensured that project activities are consistent with any national land use, resource use, and management criteria (including Protected Area Management Plans, National Biodiversity Strategy and Action Plans (NBSAP's), or similar documents).

No protected areas nor any terrestrial ecological processes associated with them are likely to be affected significantly by the proposed WEF project other than some transient faunal species, and ecological connectivity with the Chrissiesmeer protected environment. NPAES areas are indicated for all CBA and ESA designated areas in the latest draft NPAES (2018). The south-western end of the grid connection will fall within a designated Langcarel Private Nature Reserve, where the substation is situated within this private nature reserve. The footprint is not expected to be significant.

Implications:

- The activity will unlikely have any direct impact on any protected environment, other than where the grid connection will feed into the substation at the south-western end. Indirect and cumulative impacts may require further assessment relating to species and processes associated with protected areas in proximity to the site.
- NPAES areas will be directly or indirectly affected in terms of the draft NPAES (2018).

2.2 Vegetation, Flora & Fauna and Ecological Processes

2.2.1 Critical Biodiversity Areas: Terrestrial

Given that the objective of CBAs is to identify biodiversity priority areas which should be maintained in a natural to near natural state, development within these areas is not encouraged. Several Critical Biodiversity Areas are identified within and directly adjacent to the site.

2.2.2 Ecological Support Areas: Terrestrial

These include supporting zones required to prevent the degradation of Critical Biodiversity Areas and Protected Areas. An ESA may be an ecological process area that connects and therefore sustains Critical Biodiversity Areas or a terrestrial feature. ESAs are generally extensions to the CBA area incorporating small areas that are perhaps no longer natural, or are comprised of secondary vegetation, generally following the drainage line ecological corridors within the wider surrounding landscape that will improve connectivity.

2.2.3 Critical/Important Terrestrial Habitats

Special Habitats include areas that are rare within a region, or which support important species, ecosystems, or ecological processes. Species of Special Concern refers to red data species and important habitats include the locations where these species are known to occur. Red data species are plant, animal, or other organisms (e.g., reptiles, insects etc) that have been assessed and classified according to their potential for extinction in the near future. All known species are listed in the Red Data Book and classified as Extinct, Critically Endangered, Endangered, Vulnerable, Near Threatened or Least Concern. Red Data species are those species classified as Extinct, Critically Endangered, Endangered or Vulnerable. Some of the red data species are listed within the NEMBA Threatened or Protected Species (ToPS), and some are protected by provincial ordinances. Critical habitats include those areas that are known locations for such red data species that are under threat of extinction.

Rocky Outcrops

Rocky outcrops can provide habitat for geophytic species that often have limited distributions. Rocky areas may be present in higher lying areas within the grassland unit, most likely in areas that have not been cultivated, as they would have marginal suitability for agriculture (i.e., poor rocky soils). Such habitat is not common within the site other than a few outcrop areas, usually in steeper areas not suitable. Some localised ground truthing and layout adjustments may require consideration at later stages.

Riparian and Wetland habitat

Several major rivers and associated non-perennial tributaries occur within the site and are largely within wetland areas. Wetlands are special habitats as they provide a refuge for birds and other organism, such as frogs and insects. They are important hydrological process areas that are linked to ground or surface water flows. Natural wetlands are all considered to be Critical Biodiversity Areas. Wetlands are protected by the National Water Act and the Conservation of Agricultural Resources Act.

Several wetland systems are present within and surrounding the site. These wetland systems include floodplain wetlands and channelled valley-bottom wetlands associated with major rivers as well as numerous seepage wetlands associated with the tributaries and headwater streams of these major systems. Several depression wetlands occur. While not directly associated with terrestrial biodiversity these wetland habitats are any integral component of terrestrial ecological processes, in particular relating to habitat for faunal species.

Numerous water storage dams (artificial wetlands) occur within and surrounding the site. Although artificial in nature, they largely form part of natural riverine or wetland systems where they occur in-stream.

Priority Estuaries

No Estuaries are affected by the proposed activity.

Forest

No forest if present.

Fynbos

No Fynbos is associated with the area.

Colonies or Populations of Threatened or Protected Species

Further assessment would be required including surveys for populations of terrestrial fauna and flora species of concern within the site. As per the initial desktop assessment no known colonies are flagged.

Implications:

- The land use of the immediate area is commercial agriculture, with cultivated lands and a mozaic of pockets of natural vegetation intersected by a network of non-perennial watercourses and channel valley bottom wetlands (vleis). In the broader area coal mining is present.
- The site is encompassing a mozaic of natural vegetation with portions designated as critical biodiversity, ecological support and other natural areas.
- Habitat fragmentation surrounding the site is relatively high, and while the specific site has notable areas designated elevated CBA or ESA status, these tend to form contiguous connectivity corridors with the broader landscape and should be preserved or any disturbance limited.
- Wetland habitat and rocky outcrops may be present and would require further investigation to determine possible species of conservation concern and overall sensitivity.
- Pylons will require micro-siting to avoid such sensitive areas.

2.3 Preliminary Baseline Biodiversity Description

2.3.1 Topography and Drainage

Gently to moderately undulating landscape on the Highveld plateau supporting short to medium-high, dense, tufted grassland. Where not disturbed scattered small wetlands, narrow stream alluvia, pans and occasional ridges or rocky outcrops are present.

2.3.2 Aquatic and Wetland Habitat

Aquatic systems do not function in isolation and in terms of ecological processes, the aquatic systems are very closely linked to the terrestrial system. Perennial, non-perennial watercourses, and wetlands are present within and surrounding the site. Any aquatic habitat should be excluded from further development.

The following rivers and wetland areas occur within and surrounding the site:

- **Natural wetlands** – Several floodplain and channelled valley-bottom wetland systems occur within the site and are associated with major rivers and their perennial tributaries. Seepage wetlands predominantly occur on hillslopes and are associated with non-perennial tributaries/headwater streams of major rivers. Depression wetlands occur along plains and hilltops. These wetlands traverse or fall within transformed areas/cultivated lands and are traverses by several road crossings.
- **Artificial wetlands** – Water storage dams and artificial wetland areas associated with old borrow pit/mining areas. The water storage dams occur both instream (predominantly along non-perennial tributaries or upper reaches of major rivers) and off-channel.
- **Rivers and riparian areas** – Perennial and non-perennial rivers including major river systems Suikerbosrant, Xspruit and Waterval rivers. Rivers and riparian areas largely associated with wetland systems.

The rivers and wetlands were mapped based on available desktop data (NFEPA, NBA, MBSP) and a high level (limited) site verification exercise whereby they were further refined and desktop modelled.

2.3.3 Terrestrial Landscape Features (Habitat)

Overview

The lower lying areas of the site and surrounding area fall within a gently to moderately undulating plains supporting short dense grassland (Eastern Highveld Grassland) dominated by the usual highveld grass composition (*Aristida*, *Digitaria*, *Eragrostis*, *Themeda*, *Tristachya* etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra*, *Celtis africana*, *Diospyros lycioides* subsp *lycioides*, *Parinari capensis*, *Protea caffra*, *P. welwitschii* `and *Rhus magalismontanum*). Several herbs and forbs are also common to the unit. The area has high levels of transformation, primarily agriculture and mining (coal) with small wetlands, narrow stream alluvia, pans.

The above plains are interspersed with a mountainous escarpment just north of Sheepmoor to the south-east, west and east, comprised of low mountains and undulating plains with the vegetation comprising predominantly short montane grasslands (Wakkerstroom Montane Grassland) on the plateaus and the relatively flat areas, with short forest and *Leucosidea* thickets occurring along steep, mainly east-facing slopes and drainage areas. *Leucosidea sericea* is the dominant woody-pioneer species that invades areas because of grazing mismanagement. *Acacia* (wattle) and *Eucalyptus* thickets are also prevalent as well as commercial forestry across the units.

2.3.4 Primary Vegetation and Habitat

Vegetation has provisionally been mapped from most recent available aerial photography and is likely comprised of the following:

- Natural Grassland – Natural/Near Natural Eastern Highveld Grassland and Wakkerstroom Montane Grassland at higher altitudes, mostly used for grazing and crops, particularly the Eastern Highveld Grassland. Wakkerstroom Montane Grassland is generally more prevalent in rocky mountainous areas, so transformation levels are significantly lower. Well represented on the site, with near natural to pristine being present, but most of the area has been disturbed at some time, including areas that are mowed periodically for hay and other fodder resources.
- Riparian/Alluvial – Natural vegetation surrounding watercourses and seeps, most likely having riparian elements with some seep functionality. Grassland vegetation but having riparian elements, would not be suitable due to ecological importance. This category overlaps with the aquatic assessment designated delineated rivers and floodplain and channelled valley-bottom wetland systems.
- Secondary/Degraded/Old Lands –Old lands or other disturbed areas, where grasses regenerate from the surrounding landscape. These areas typically have lower species diversity. Such areas would most likely be the most suitable for the proposed activity having lower conservation priority and most likely having marginal agricultural suitability.
- Cultivated – Extensive areas have been transformed for agricultural use either as pastures or crops. No irrigated pivots are present and lack of a large water supply in the area suggests that these are dryland crops (i.e., not irrigated). Several currently cultivated areas are present. Areas that are currently old lands, may be used in the future, as crop rotation does appear to occur in the area, based on analysis of historicl aerial photographs.
- Transformed – Generally where all indigenous vegetation has been removed and replaced with hardened surfaces such as houses, access roads, other infrastructure. Includes areas that are not currently used for agriculture. Transformed areas are present, including several dwellings.
- Dams - Water storage dams and artificial wetland areas sometimes associated with old borrow pit/mining areas. *This category overlaps with the aquatic assessment designated artificial wetlands.*

This landscape offers suitable habitat for a limited suite of animal species, although many animals have likely been displaced significantly by people and activities in the grassland areas. Other more cosmopolitan species are likely less affected.

2.3.5 Flora

Several threatened or protected, endemic and range restricted species are known from the surrounding area. Due to the localised nature of the impact, as well as the level of degradation of the site, the risk of a species suffering any significant loss is low to medium. The preliminary site screening to not specifically assess species composition, being undertaken during the winter months.

Potential Red Listed, Endemic and Protected Flora

The site falls within the general distribution range of several endemic species and other species of conservation concern, some with a highly localised distribution and/or some of which may be Critically Endangered, Endangered, Vulnerable or Rare. Some of these species are also only from a single or a few populations. As per Table 4, Critically Endangered flora species are likely not present, but two Endangered species are known to occur in the vicinity. Seasonal site verification will be required to confirm presence or absence, which may include follow up at final walkdown stage for micro-siting. *Sensitive species names have not been included as per reporting protocols.*

*Table 4: Flora including Species of Special Concern (Endangered species in **bold**) flagged for the WEF site and grid connection route.*

SCIENTIFIC NAME	FAMILY	STATUS	COMMENT/PRESENCE[3]
Asparagus fractiflexus	**Asparagaceae**	**EN A2c; B1ab(iii)**	**Possibly present, nearby records**
Aspidoglossum xanthosphaerum	Apocynaceae	VU D2	Possibly present, nearby records
Gerbera aurantiaca	**Asteraceae**	**EN A2ac**	**Possibly present, nearby records**
Indigofera hybrida	Fabaceae	VU D2	Possibly present, nearby records
Khadia alticola	Aizoaceae	Rare	Possibly present, within range but no confirmed records nearby.
Khadia carolinensis	Aizoaceae	VU A3c	Possibly present, nearby records
Lotononis amajubica	Fabaceae	Rare	Possibly present, nearby records
Pachycarpus suaveolens	Apocynaceae	VU B1ab(iii)	Possibly present, within range but no confirmed records nearby.
Sensitive species 1201		VU B1ab(i,ii,iii,iv,v)	Possibly present, nearby records
Sensitive species 1219		VU B1ab(iii)+2ab(iii), PNCO	Possibly present, within range but no confirmed records nearby.
Sensitive species 1252		VU A2cd, PNCO	Possibly present, within range but no confirmed records nearby.
Sensitive species 321		Rare, PNCO	Possibly present, within range but no confirmed records nearby.
Sensitive species 41		VU B1ab(i,ii,iii,iv,v)+ 2ab(i,ii,iii,iv,v)	Possibly present, nearby records
Sensitive species 691		VU B1ab(ii,iii,v)	Possibly present, within range but no confirmed records nearby.
Sensitive species 851		VU B1ab(iii)	Possibly present, within range but no confirmed records nearby.
Sensitive species 998		**EN A2bd**	**Possibly present, within range but no confirmed records nearby.**
Zaluzianskya distans	Scrophulariaceae	Rare	Possibly present, within range but no confirmed records nearby.

[3] To be confirmed during site assessment – Based on available online records for indicative scoping purposes only.

Further site investigations would be required to ascertain if the flagged species are present or if suitable habitat is present and/or any other species of conservation concern are present or potentially present.

2.3.6 Fauna

The habitats and microhabitats present on the project site are not unique and although highly fragmented, are widespread in the broader area, hence the local impact associated with the footprint would be of low significance if mitigation measures are adhered to. The site falls within the general distribution range of several flagged faunal species.

Mammals

National Environmental Screening Tool identifies several mammal species as possibly occurring in the area. Site survey and assessment by respective specialist would be required to confirm.

Avifauna and Bats

No assessment undertaken. National Environmental Screening Tool identifies several species as possibly being in the area. Further assessment would be required by respective avifaunal specialist.

Reptiles

Reptiles such as lizards, snakes and tortoises may be present. Site survey and assessment would be required to confirm, however no specific species flagged.

Amphibians

Amphibians are likely to be present due to the prevalence of watercourses and wetlands. Site assessment would be required to confirm, however no specific species flagged.

Invertebrates

National Environmental Screening Tool identifies a single invertebrate species as possibly occurring in the area. Site assessment by respective specialist would be required to confirm.

Potential Red Listed and Protected Fauna

As per Table 5, Endangered or Critically terrestrial fauna species are flagged for the site. The site falls within the potential distribution range of a few faunal species of concern. No further avifaunal investigations have been undertaken but the single mammal and insect species that is flagged both have significantly more widespread distribution than the site. Since the project footprint is likely to be relatively contained, any disturbance or displacement associated with habitat destruction as a direct result of the activity is unlikely to pose a significant negative impact to terrestrial faunal species above background disturbance levels that are already present. Seasonal assessments of the fauna recommended for clarification of risk.

Table 5: Fauna Species of Special Concern

SCIENTIFIC NAME	COMMON NAME	STATUS[4]	COMMENT/PRESENCE
Mammals			
Crocidura maquassiensis	Makwassie musk shrew	VU, NEST (M)	Possibly present, within range but no confirmed records nearby.
Ourebia ourebi ourebi	**Oribi**	**EN, NEST (M)**	Possibly present, within range but no confirmed records nearby. **May be a transient species to the site, unlikely to be significantly affected**

4 IUCN: LC – Least Concern; VU – Vulnerable; EN – Endangered; CR – Critically Endangered; NT – Near Threatened.

SCIENTIFIC NAME	COMMON NAME	STATUS[4]	COMMENT/PRESENCE
			by the proposed WEF due to dispersed nature of layout and suitable available habitat in the area,
Birds			
Balearica regulorum	Grey Crowned Crane	EN, NEST (H)	Refer to Avifaunal Assessment
Eupodotis senegalensis	White-bellied Bustard / Korhaan	VU, NEST (H, M)	Refer to Avifaunal Assessment
Hydroprogne caspia	Caspian Tern	VU, NEST (M)	Refer to Avifaunal Assessment
Sagittarius serpentarius	Secretary Bird	VU, NEST (H, M)	Refer to Avifaunal Assessment
Tyto capensis	African Grass Owl	VU, NEST (M)	Refer to Avifaunal Assessment
Geronticus calvus	Southern Bald Ibis	VU C1+2a(ii), NEST (H,M)	Refer to Avifaunal Assessment
Neotis denhami	Denhams Bustard	NEST (M)	Refer to Avifaunal Assessment
Reptiles			
None of concern	-	-	-
Amphibians			
None of concern	-	-	-
Invertebrates			
Clonia lalandei	Lalande's *Black-winged Clonia*	VU B1ab*(i,iii)*	Possibly present, within range but no confirmed records nearby.

Further site investigations would be required to ascertain if the flagged species are present or if suitable habitat is present and/or any other species of conservation concern are present or potentially present.

Alien Invasive Species

Alien invasive species cannot be investigated without site visit, but the nature of the site (cultivated and grazing) would suggest that several common local weed species are likely present in disturbed areas.

2.3.7 Critical Habitat

Possible Critical Habitat features including the following would require site verification to confirm:

- Criterion 1: Habitat for Critically Endangered (CR) and/or Endangered (EN) species
- Criterion 2: Habitat for Endemic or restricted-range species
- Criterion 3: Habitat for Migratory or congregatory species
- Criterion 4: Habitat for Highly threatened and/or unique ecosystems
- Criterion 5: Habitat for Key evolutionary processes

Further site investigations would be required to confirm presence of critical habitat but at a desktop screening level, no specific areas are currently flagged.

2.3.8 No-Go Areas

Potential No-Go areas would include all designated CBA (Irreplaceable) areas that are confirmed to be pristine, as well as watercourses and wetlands, including any adjacent intact vegetation and associated buffers. Any populations of Endangered or Critically Endangered species and/or important populations of r Vulnerable species, where relocation is not feasible, would also potentially be considered No-Go areas. In general, WEF footprints are limited in extend and are not likely to incur significant losses.

2.3.9 Potential Development Footprints

It is feasible that a development footprint can be identified within the site. Most suitable areas to minimise biodiversity impacts would be transformed areas, including old lands and currently cultivated areas.

2.4 Risks and Potential Impacts to Biodiversity

2.4.1 Potential Terrestrial Biodiversity Impacts (Direct)

The main impacts likely to result from the proposed activity are summarised in Table 6 below.

Table 6: Potential Impacts to Terrestrial Biodiversity

IMPACT	NATURE OF IMPACT
Vegetation	Permanent or temporary loss of indigenous vegetation cover because of site clearing. Site clearing before construction will result in the blanket clearing of vegetation within the affected footprint.
Flora Species	Loss of flora species of special concern during pre-construction site clearing activities.
Alien Invasive Species	Susceptibility of post construction disturbed areas to invasion by exotic and alien invasive species and removal of exotic and alien invasive species during construction. Post construction disturbed areas having no vegetation cover are often susceptible to invasion by weedy and alien species, which can not only become invasive but also prevent natural flora from becoming established.
Erosion	Susceptibility of some areas to erosion because of construction related disturbances. Removal of vegetation cover and soil disturbance may result in some areas being susceptible to soil erosion after completion of the activity.
Ecological Processes	Disturbances to ecological processes: Activity may result in disturbances to ecological processes.
Aquatic and Riparian processes	Aquatic and Riparian processes: Aquatic habitat is present and could be affected.
Faunal Habitat	Loss of Faunal Habitat: Activity will result in the loss of habitat for faunal species.
Faunal Processes	Impacts to faunal processes because of the activity.
Faunal Species	Loss of faunal SSC due to construction activities: Activities associated with bush clearing, killing of perceived dangerous fauna, may lead to increased mortalities among faunal species.

2.4.2 Residual Risks and Uncertainties

Further site investigations would be required to confirm the state of the habitat, as well as species composition to confirm various aspects that cannot be determined in the preliminary assessments. Due to the extensive coverage of the site, it is not feasible to survey the entire are for populations of Threatened or Protected Species. Once the preliminary layout is compiled, which will be guided largely by landscape level sensitivities, a smaller footprint can then be assessed for critical habitat and/or populations of Species of Conservation Concern (SCC). Should any such populations be located, minor layout adjustments can be made accordingly. Furthermore, the standard practice with all Wind Energy facilities including grid connection infrastructure is to undertake a final walkdown of the approved footprint, at which point further layout changes or additional mitigation measures can be made, should any sensitive features be identified which were not identified during the preliminary assessment stages.

2.5 Findings and Recommendations

2.5.1 Overview of Findings

Further to the above assessment, analysis of the site and surrounding area (Figure 2), indicates that the area is generally highly fragmented from historical and present agriculture in the wider area. The surrounding landscape is typically comprised of a mozaic of cultivated fields, pastures, dryland pastures and other rural infrastructure interspersed with natural or intact vegetated (undeveloped) areas. A network of watercourses and vleis also bisect the landscape, generally providing the most undisturbed habitat as well as key ecological corridors. The specific site is comprised of a mix of natural vegetation, secondary vegetation (old lands) and cultivated lands as well as areas that are periodically mowed for harvesting of hay.

Although highly fragmented, functionally speaking, ecological connectively is indirectly maintained in such areas, functioning as a broader ecologically connected unit through the mozaic of remnant intact patches as well as old lands where ecological processes will persist. Watercourses appear to form the primary connection as they are generally less modified and in a more natural state. It is likely that large natural vegetation patches are used as grazing and are likely to exhibit some level of degradation. Such areas more than likely also have marginal agricultural value, otherwise they would more than likely have been cultivated. Extensive areas are also maintained as dryland pastures that are periodically mowed for pastures. Old lands, having secondary vegetation, more than likely also have marginal agriculture value, hence they are no longer used. Such areas are potentially either rocky or exhibit seasonal waterlogging (i.e., wetlands or watercourses), both of which could provide habitat for a suite of flora and fauna that are not characteristic of the surrounding homogenous grassland. In other instances, some areas are likely also rested periodically for a few years, before being used again.

Intact vegetation on site is of conservation value, being designated Optimal CBA, with some corridors associated with watercourses being designated Irreplaceable CBA, due to the elevated conservation status of the vegetation unit (Vulnerable). Several areas have also been designated ESA (local corridor or species). As is evident from land-use coverages, the wider area is highly fragmented because of land-use, including agriculture, mining, industrial and urbanisation. The degraded, secondary vegetation (old lands) and cultivated areas are not any designated CBA status. Land use guidelines for the various categories indicate the following:

1. Irreplaceable Terrestrial CBA sites must be avoided in terms of the mitigation hierarchy.
2. Aquatic ESA: Important sub-catchments: Not recommended and should be avoided, unless not aquatic impact is confirmed.
3. Aquatic: All rivers, wetlands, dams to be avoided including respective 32 m and 100 m buffers. Limited linear activities such as roads and powerlines may be required in these areas and should be assessed accordingly on a case-by-case basis in order to minimise impacts.
4. Terrestrial ESA: local corridor and species areas must also be avoided in terms of the mitigation hierarchy. Further investigation may be required in the species area, to ascertain species and processes, which may or may not accommodate certain infrastructure.
5. Terrestrial Optimal CBA (referred to as Important and necessary in MBCP), the guidelines indicate that, although not desirable, if small-scale land-use change is unavoidable, it must be located and designed to be as biodiversity-sensitive as possible. It is thus feasible that a portion of the natural vegetation within the designated CBA (optimal) areas could be developed, in a biodiversity sensitive manner if combined with use of ONA or transformed areas. This would entail identifying any areas that are less sensitive as well as maintaining ecological connectivity across the site and with surrounding landscape, as well as adhering to conservation targets for the vegetation unit.

6. Terrestrial ONA and modified sites would provide the most suitable footprint for the proposed WEF facility. Old lands and current lands as well as areas where hay harvesting is periodically undertaken may require assessment by an agricultural specialist in order to determine an optimised footprint where agricultural sustainability of the site is not significantly altered, outside of the scope of this screening.

Preferred areas would thus be low aquatic and/or terrestrial sensitivity areas, flowed by moderate sensitivity areas (where strategic footprints would need to follow a clear mitigation process and rationale). With reference to Figure 14 & Figure 15, connectivity to the surrounding landscape is complex, and generally follows the watercourses and/or remnant vegetation pockets of Eastern Highveld Grassland. Other Natural areas, generally moderate sensitivity, would provide the most suitable footprint, but a blended approach is recommended, which will spread the footprint strategically over other natural areas and perhaps more marginal agricultural areas or partially overlapping with cultivated areas. Several smaller footprints having a low/moderate sensitivity are not delineated, but these may be most suited for small footprints (i.e., WEF, substation or BESS infrastructure) Connectivity with surrounding landscape should none-the-less be retained, which may include a buffer along any boundaries. NOTE: Any aquatic corridors should be avoided. Connectivity between the site and surrounding area is somewhat tenuous and contiguous connectivity is limited to a few narrow corridors.

The recently published Biodiversity Offset Guidelines may have implications regarding the extent to which there are footprints within the CBA/ESA designated areas (red, orange and yellow on the MBSP map). Specifically relating to WEF projects, impact significance after mitigation tends to be low due to the dispersed nature of the footprint. In general ESA would be more accommodating to loss than CBA for a WEF.

Eastern Highveld Grassland has an Endangered status, with some remnant but fragmented patches on the site, the largest area being on Rochdale to the north, but also patches mostly around the western edges of Sheepmoor and the Eastern Edges of Emvelo. As above, Biodiversity Offsets may be applicable, the red CBA areas on the map generally correspond to the remnant pockets of this unit, which are deemed Irreplaceable. Depending on final loss, Biodiversity Offe=sets may be applicable, but unlikely due to negligible footprint size of WEF turbines in relation to the remaining extent of the vegetation unit coupled with on-site degradation. Large areas of invaded wattle thicket are present and would provide opportunity for development as these would be considered significantly degraded.

The other vegetation unit which comprises most of the central and mountainous part of the site is Wakkerstroom Montane Grassland which has a least concern status. Intact areas have been designated a Moderate sensitivity.

2.6 Proposed Assessment Methodology and Approach

The approach to be implemented during the assessment phase will include the following, as well as in accordance with the respective terrestrial biodiversity and species reporting protocols:

1. Undertake a comprehensive desktop study to identify potential risks for terrestrial biodiversity inclusive of the national screening tool, relevant regional biodiversity planning frameworks, any previous studies as well as interrogation of applicable databases.
2. Undertake seasonal site visits including a preliminary site visit to inform layout design, specifically in terms of broader landscape processes, followed by a more comprehensive site visit in order to assess the specific layout, and to provide recommendations accordingly.

3. Detailed reporting will be comprised of a *Terrestrial Biodiversity and Aquatic Screening Report*. The screening report will address the following (in line with the gazetted Assessment Protocol requirements):
    a. Indicate any assumptions made and gaps in available information. Assessment of all the vegetation types and habitat units within the relevant Regional Planning Frameworks.
    b. A desktop-based species list (flora and fauna) highlighting any potential species of special concern categories (endemic, threatened, Red Data species and other protected species requiring permits for destruction/relocation and invasive/exotic weeds) that could be present. Indicate the need for any permitting/licensing or detailed studies that may be required. Site visit will include limited screening for species, but being out of season, it will be limited.
    c. Aquatic screening will serve to identify and preliminarily assess aquatic features and processes including watercourses and wetlands and recommend no-go areas associated with these features.
    d. Description and assessment of the vegetation/habitat units and site sensitivities ranked into very high, high, medium, low, or very low classes based on potential sensitivity and conservation importance using a standardised methodology (desktop based).
    e. A site ecological sensitivity map will be compiled, indicting the sensitivities as described above, inclusive of any aquatic features as far as possible using most recent available aerial photography. No site verification will be conducted.
    f. A map indicating any buffers to accommodate Regional Planning requirements (if required).
    g. Recommendations based on the findings of the assessment.

This terrestrial biodiversity Scoping Report is aligned with the requirements of the 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 National Environmental Management Act, 1998, when applying for environmental authorisation (GN 320, 20 March 2020).

3 Appendices

3.1 Appendix 1: References

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3.2 Appendix 2: Bioregional Planning: Further Information

3.2.1 Vegetation of Southern Africa

A general description of the vegetation unit is provided below (as per Mucina & Rutherford, 2006) as a reference point for the baseline vegetation composition.

Gm 12 Eastern Highveld Grassland

VT 61 Bankenveld (42%), VT 57 North-Eastern Sandy Highveld (33%) (Acocks 1953). LR 38 Moist Sandy Highveld Grassland (69%) (Low & Rebelo 1996).

Distribution Mpumalanga and Gauteng Provinces: Plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief. Altitude 1 520–1 780 m, but also as low as 1 300 m.

Vegetation & Landscape Features Slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grass composition (*Aristida*, *Digitaria*, *Eragrostis*, *Themeda*, *Tristachya* etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra*, *Celtis africana*, *Diospyros lycioides* subsp *lycioides*, *Parinari capensis*, *Protea caffra*, *P. welwitschii* and *Rhus magalismontanum*).

Geology & Soils Red to yellow sandy soils of the Ba and Bb land types found on shales and sandstones of the Madzaringwe Formation (Karoo Supergroup). Land types Bb (65%) and Ba (30%).

Climate Strongly seasonal summer rainfall, with very dry winters. MAP 650–900 mm (overall average: 726 mm), MAP relatively uniform across most of this unit, but increases significantly in the extreme southeast. The coefficient of variation in MAP is 25% across most of the unit but drops to 21% in the east and southeast. Incidence of frost from 13–42 days, but higher at higher elevations. See also climate diagram for Gm 12 Eastern Highveld Grassland (Figure 8.36).

Important Taxa Graminoids: *Aristida aequiglumis* (d), *A. congesta* (d), *A. junciformis* subsp. *galpinii* (d), *Brachiaria serrata* (d), *Cynodon dactylon* (d), *Digitaria monodactyla* (d), *D. tricholaenoides* (d), *Elionurus muticus* (d), *Eragrostis chloromelas* (d), *E. curvula* (d), *E. plana* (d), *E. racemosa* (d), *E. sclerantha* (d), *Heteropogon contortus* (d), *Loudetia simplex* (d), *Microchloa caffra* (d), *Monocymbium ceresiiforme* (d), *Setaria sphacelata* (d), *Sporobolus africanus* (d), *S. pectinatus* (d), *Themeda triandra* (d), *Trachypogon spicatus* (d), *Tristachya leucothrix* (d), *T. rehmannii* (d), *Alloteropsis semialata* subsp. *eckloniana*, *Andropogon appendiculatus*, *A. schirensis*, *Bewsia biflora*, *Ctenium concinnum*, *Diheteropogon amplectens*, *Eragrostis capensis*, *E. gummiflua*, *E. patentissima*, *Harpochloa falx*, *Panicum natalense*, *Rendlia altera*, *Schizachyrium sanguineum*, *Setaria nigrirostris*, *Urelytrum agropyroides*. Herbs: *Berkheya setifera* (d), *Haplocarpha scaposa* (d), *Justicia anagalloides* (d), *Pelargonium luridum* (d), *Acalypha angustata*, *Chamaecrista mimosoides*, *Dicoma anomala*, *Euryops gilfillanii*, *E. transvaalensis* subsp. *setilobus*, *Helichrysum aureonitens*, *H. caespititium*, *H. callicomum*, *H. oreophilum*, *H. rugulosum*, *Ipomoea crassipes*, *Pentanisia prunelloides* subsp. *latifolia*, *Selago densiflora*, *Senecio coronatus*, *Vernonia oligocephala*, *Wahlenbergia undulata*. Geophytic Herbs: *Gladiolus crassifolius*, *Haemanthus humilis* subsp. *hirsutus*, *Hypoxis rigidula* var. *pilosissima*, *Ledebouria ovatifolia*. Succulent Herb: *Aloe ecklonis*. Low Shrubs: *Anthospermum rigidum* subsp. *pumilum*, *Stoebe plumosa*.

Conservation Endangered. Target 24%. Only very small fraction conserved in statutory reserves (Nooitgedacht Dam and Jericho Dam Nature Reserves) and in private reserves (Holkranse, Kransbank, Morgenstond). Some 44% transformed primarily by cultivation, plantations, mines, urbanisation and by building of dams. Cultivation may have had a more extensive impact, indicated by land-cover data. No serious alien invasions are reported, but *Acacia mearnsii* can become dominant in disturbed sites. Erosion is very low.

References Acocks (1953, 1988), Turner (1989), Coetzee (1993), Coetzee et al. (1994, 1995), Smit et al. (1997).

Gm 14 Wakkerstroom Montane Grassland

VT 57 North-Eastern Sandy Highveld (57%) (Acocks 1953). LR 38 Moist Sandy Highveld Grassland (49%), LR 41 Wet Cold Highveld Grassland (27%) (Low & Rebelo 1996).

Distribution KwaZulu-Natal and Mpumalanga Provinces: Occurring from the Escarpment just north of Sheepmoor (north), to southeast of Utrecht, and then from the vicinity of Volksrust in the west to Mandhlangampisi Mountain near Luneburg in the east. Altitude 1 440–2 200 m.

Vegetation & Landscape Features This unit is a less obvious continuation of the Escarpment that links the southern and northern Drakensberg escarpments. It straddles this divide and is comprised of low mountains and undulating plains. The vegetation comprises predominantly short montane grasslands on the plateaus and the relatively flat areas, with short forest and *Leucosidea* thickets occurring along steep, mainly east-facing slopes and drainage areas. *L. sericea* is the dominant woody pioneer species that invades areas as a result of grazing mismanagement.

Geology & Soils The mudstones, sandstones and shale of the Madzaringwe and Volksrust Formations (Karoo Supergroup) were intruded by voluminous Jurassic dolerite dykes and sills. Ac land type is dominant, while Fa and Ca are of subordinate importance.

Climate Rainfall peaks in midsummer. Rainfall 800–1 250 mm per year (MAP 902 mm). This unit experiences an orographic effect which results in a locally higher precipitation than the adjacent areas. Winters are very cold and summers mild (MAT 14°C). See also climate diagram for Gm 14 Wakkerstroom Montane Grassland (Figure 8.36).

Important Taxa Small Trees: *Canthium ciliatum*, *Protea subvestita*. Tall Shrubs: *Buddleja salviifolia* (d), *Leucosidea sericea* (d), *Buddleja auriculata*, *Diospyros lycioides* subsp. *guerkei*, *Euclea crispa* subsp. *crispa*, *Rhus montana*, *R. rehmanniana*, *R. transvaalensis*. Low Shrubs: *Asparagus devenishii* (d), *Cliffortia linearifolia* (d), *Helichrysum melanacme* (d), *H. splendidum* (d), *Anthospermum rigidum* subsp. *pumilum*, *Clutia natalensis*, *Erica oatesii*, *Felicia filifolia* subsp. *filifolia*, *Gymnosporia heterophylla*, *Helichrysum hypoleucum*, *Hermannia geniculata*, *Inulanthera dregeana*, *Metalasia densa*, *Printzia pyrifolia*, *Rhus discolor*, *Rubus ludwigii* subsp. *ludwigii*. Graminoids: *Andropogon schirensis* (d), *Ctenium concinnum* (d), *Cymbopogon caesius* (d), *Digitaria tricholaenoides* (d), *Diheteropogon amplectens* (d), *Eragrostis chloromelas* (d), *E. plana* (d), *E. racemosa* (d), *Harpochloa falx* (d), *Heteropogon contortus* (d), *Hyparrhenia hirta* (d), *Microchloa caffra* (d), *Themeda triandra* (d), *Trachypogon spicatus* (d), *Tristachya leucothrix* (d), *Alloteropsis semialata* subsp. *eckloniana*, *Aristida junciformis* subsp. *galpinii*, *Brachiaria serrata*, *Diheteropogon filifolius*, *Elionurus muticus*, *Eragrostis capensis*, *Eulalia villosa*, *Festuca scabra*, *Loudetia simplex*, *Rendlia altera*, *Setaria nigrirostris*. Herbs: *Berkheya onopordifolia* var. *glabra* (d), *Cephalaria natalensis* (d), *Pelargonium luridum* (d), *Acalypha depressinerva*, *A. peduncularis*, *A. wilmsii*, *Aster bakerianus*, *Berkheya setifera*, *Euryops transvaalensis* subsp. *setilobus*, *Galium thunbergianum* var. *thunbergianum*, *Geranium ornithopodioides*, *Helichrysum cephaloideum*, *H. cooperi*, *H. monticola*, *H. nudifolium* var. *nudifolium*, *H. oreophilum*, *H. simillimum*, *Pentanisia prunelloides* subsp. *latifolia*, *Plectranthus laxiflorus*, *Sebaea leiostyla*, *S. sedoides* var. *sedoides*, *Selago densiflora*, *Vernonia hirsuta*, *V. natalensis*, *Wahlenbergia cuspidata*. Geophytic Herbs: *Hypoxis costata* (d), *Agapanthus inapertus* subsp. *intermedius*, *Asclepias aurea*, *Cheilanthes hirta*, *Corycium dracomontanum*, *C. nigrescens*, *Cyrtanthus tuckii* var. *transvaalensis*, *Disa versicolor*, *Eriospermum cooperi* var. *cooperi*, *Eucomis bicolor*, *Geum capense*, *Gladiolus ecklonii*, *G. sericeovillosus* subsp. *sericeovillosus*, *Hesperantha coccinea*, *Hypoxis rigidula* var. *pilosissima*, *Moraea brevistyla*, *Rhodohypoxis baurii* var. *confecta*. Semiparasitic Herb: *Striga bilabiata* subsp. *bilabiata*.

Biogeographically Important Taxa ([L]Low Escarpment endemic, [N]Northern sourveld endemic) Low Shrubs: *Bowkeria citrina*[L], *Lotononis amajubica*[L], *Protea parvula*[N] . Succulent Herb: *Aloe modesta*[N].

Endemic Taxa Herbs: *Helichrysum aureum* var. *argenteum*, *Selago longicalyx*. Geophytic Herbs: *Kniphofia* sp. nov. (‘*laxiflora* Form C’), *Nerine platypetala*. Woody Climber: *Asparagus fractiflexus*.

Conservation Least threatened. Conservation target 27%, less than 1% is statutorily protected in the Paardeplaats Nature Reserve. There are 10 South African Natural Heritage Sites in this unit, although very little of it is formally protected. Land use pressures from agriculture are low (5% cultivated) probably owing to the colder climate and shallower soils. The area is also suited to afforestation, with more than 1% under *Acacia mearnsii* and *Eucalyptus* plantations. The black wattle (*Acacia mearnsii*) is an aggressive invader of riparian areas. Erosion is very low (78%) and low (19%).

Remarks This unit represents the northernmost distribution limit for many plant taxa that occur on the Drakensberg Escarpment (e.g., *Helichrysum hypoleucum* and *Protea subvestita*) to the south, as well as the southernmost limit for plants occurring on the Northern Escarpment (e.g., *Protea parvula*). It also contains many of its own endemics and is under investigation as a possible centre of endemism. The higher rainfall and more temperate climate on a somewhat raised escarpment have possibly been conducive to the evolution of local endemics. Unlike its adjacent units, the Wakkerstroom Montane Grassland is largely devoid of *Pteridium aquilinum*.

References Acocks (1953, 1988), Codd (1968), Eckhardt et al. (1997).

3.2.2 Mpumalanga Biodiversity Sector Plan (MBSP, 2014)

Much of the current conservation effort in South Africa is focused on promoting land-use practices that reconcile development opportunities and spatial planning at a landscape scale, with the over-arching goal of maintaining and increasing the resilience of ecosystems, especially in the face of climate change. This landscape approach to biodiversity conservation involves working within and beyond the boundaries of protected areas to manage biodiversity within a mosaic of land-uses.

One of the primary aims is to achieve economic goals whilst the health of ecosystems is maintained, and the loss of important or threatened species or habitats is avoided. Creating functional connectivity in landscapes is a key aspect of promoting ecosystem resilience (the ability of the ecosystem to absorb a certain amount of change yet remain functional). Ecosystem resilience can be maintained or built through an approach that focuses on intact areas, maintaining biodiversity priority areas in a natural or near-natural state, maximising connectivity between these areas and maximising the diversity of species and ecosystems. Resilient ecosystems can:

- Maintain the ecological and evolutionary processes that allow biodiversity to persist in these ecosystems;
- Better-withstand human-induced pressures (from, for example, too frequent fires);
- Adapt to the impacts of climate change, such as increased rainfall variability;
- Mitigate the effects of climate change by continuing to capture and store carbon;
- Deliver ecosystem services, such as the provision of clean water and flood attenuation.

The main purpose of a biodiversity sector plan is to ensure that the most recent and best quality spatial biodiversity information can be accessed and used to inform land-use and development planning, environmental assessments and authorisations, and natural resource management. A biodiversity sector plan achieves this by providing a map (or maps) of terrestrial and freshwater areas that are important for conserving biodiversity pattern and ecological processes – these areas are called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). The maps are provided together with contextual information on biodiversity, and land-use guidelines that can be incorporated into the policies and decisions of a wide range of sectors. A Biodiversity Sector Plan is based on a fine-scale systematic biodiversity plan (1:50 000 or finer), and has boundaries aligned with administrative boundaries (such as a municipality or groups of municipalities).

A Biodiversity Sector Plan can be used to guide conservation action (such as identifying priority sites for expansion of protected areas), or to feed spatial biodiversity priorities into planning and decision-making in a wide range of cross-sectoral planning processes and instruments such as provincial and municipal integrated development plans and spatial development frameworks, land-use management schemes, environmental management frameworks and environmental management plans. The flowing core categories are designated:

- Protected Areas: Areas that are formally protected by law and recognised in terms of the Protected Areas Act (this includes contract protected areas declared through the biodiversity stewardship programme).
- Critical Biodiversity Areas (CBAs): Areas that are required to meet biodiversity targets for species, ecosystems or ecological processes. These include:
  - All areas required to meet biodiversity pattern targets and to ensure continued existence and functioning of species and ecosystems, special habitats and species of conservation concern;
  - Critically Endangered ecosystems; and
  - Critical linkages (corridor 'pinch-points') to maintain connectivity.

CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species.

- Ecological Support Areas (ESAs): Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of protected areas or CBAs and for delivering ecosystem services. In the terrestrial assessment they support landscape connectivity and strengthen resilience to climate change. ESAs need to be maintained in at least a functional and often natural state, supporting the purpose for which they were identified. They include features such as riparian habitat surrounding rivers or wetlands, corridors, over-wintering sites for Blue Cranes, and so on.
- Other Natural Areas (ONAs): Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions.
- Moderately or Heavily Modified Areas (sometimes called 'transformed'): Areas that have been heavily modified by human activity so that they are by-and-large no longer natural, and do not contribute to biodiversity targets. Some of these areas may still provide limited biodiversity and ecological infrastructural functions but, their biodiversity value has been significantly and in many cases irreversibly compromised.

Table 7: Summary of map categories shown in the terrestrial CBA map for Mpumalanga, and their meanings.

Map Category	Description	Sub- Category	Description
Protected Areas	Areas that are formally protected by law and recognised in terms of the Protected Areas Act, including contract protected areas declared through the biodiversity stewardship programme.	National Parks & nature Reserves	Includes formally proclaimed national Parks, nature Reserves, Special nature Reserve, and Forest nature Reserves.
		Protected Environments: Natural	Includes Protected Environments, declared in terms of Protected Areas Act (Act 57 of 2003, as amended).
		Protected Environments: Modified	Heavily modified areas in formally proclaimed Protected Environments.
Critical Biodiversity Areas (CBA)	All areas required to meet biodiversity pattern and process targets; critically Endangered ecosystems, critical linkages (corridor pinch-points) to maintain connectivity; CBAs are areas of high biodiversity value that must be maintained in a natural state.	CBA: Irreplaceable	This category includes: (1) Areas required to meet targets and with irreplaceability values of more than 80%. (2) critical linkages or pinch-points in the landscape that must remain natural; (3) critically Endangered Ecosystems.
		CBA: Optimal	The CBA Optimal Areas (previously called 'important and necessary' in the MBCP) are the areas optimally located to meet both the various biodiversity targets and other criteria defined in the analysis. Although these areas are not 'irreplaceable' they are the most efficient land configuration to meet all biodiversity targets and design criteria.
Ecological Support Areas (ESA)	Areas that are not essential for meeting targets, but that play an important role in supporting the functioning of CBAs and that deliver important ecosystem services	ESA: Landscape corridor	The best option to support landscape-scale ecological processes, especially allowing for adaptation to the impacts of climate change.
		ESA: Local corridor	Finer-scale alternative pathways that build resilience into the corridor network by ensuring connectivity between climate change focal areas, reducing reliance on single landscape-scale corridors.
		ESA: Species Specific	Areas required for the persistence of particular species. Although these may be production landscapes, a change in land-use may result in loss of this species from the area. (Only one species-specific ESA was included in the analysis — an over-wintering site for blue cranes).
		ESA: Protected Area Buffers	Areas surrounding protected areas that moderate the impacts of undesirable land-uses that may affect the ecological functioning or tourism potential of PA's. Buffer distance varies according to reserve status: national Parks — 10 km; nature Reserves — 5 km buffer; Protected Environments — 1 km buffer.
Other Natural Areas (ONA)	Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions.		
Moderately or Heavily Modified Areas	Areas in which significant or complete loss of natural habitat and ecological function has taken place due to activities such as	Heavily Modified	All areas currently modified to such an extent that any valuable biodiversity and ecological functions have been lost.
		Moderately Modified: Old lands	Old, cultivated lands that have been allowed to recover (within the last 80 years), and support some natural vegetation. Although biodiversity pattern and ecological functioning may have been compromised, the areas may still play a role in supporting

Map Category	Description	Sub- Category	Description
	ploughing, hardening of surfaces, open-cast mining, cultivation and so on.		biodiversity and providing ecosystem services.

Networks of ecological corridors

Ecological corridors of natural and near-natural land ensure connectivity between various spatial elements in the land- scape. They link key protected areas with climate change refugia and other features of the landscape that promote adaptation to the effects of climate change. Two types of ecological corridors were identified in the MBSP:

- Landscape corridors, which are the best large-scale options for linking areas that are important for climate change resilience across Mpumalanga and adjacent provinces.
- Local corridors, which take effect at a finer scale to make the network of landscape corridors more robust to disturbance; they provide alternative pathways and critical linkages that should not be lost in the land- scape.

Because of the technology used in the development of the MBSP it was possible to minimise the presence of 'narrow bottlenecks' and avoid including large areas of modified land in the network of ecological corridors, wherever possible. Special attention was also paid to ensuring seamless alignment with ecological corridors that have been identified in the biodiversity plans of KwaZulu-Natal, Free State and Gauteng.

Areas important for climate change resilience

The spatial analysis undertaken for the MBSP identified parts of the landscape where it is likely that ecosystems will be most able to maintain a stable ecological composition and structure in the face of climate change, based on a range of possible future climate change scenarios (NBA 2011; Holness, pers. comm.). These areas are referred to as areas important for climate change resilience. They include diverse landscapes such as:

- Local refugia (e.g. kloofs and south facing slopes): Areas important for landscape connectivity (e.g. riparian corridors)
- Areas with steep temperature, precipitation and altitude gradients (e.g. south-facing slopes);
- Areas of high biotic diversity where many different habitat and biome types are found in close proximity and plant endemism is high.

Desired Management Objectives

The desired management objective for a parcel of land, or freshwater feature, refers to the ecological condition in which it should be maintained. These not only determine the ecological state or condition in which the land or freshwater feature should be maintained, but also provide the broad direction for appropriate land- or resource-use activities and management practices. Only those land- or resource-use activities that are compatible with maintaining the desired management objective should be encouraged. Different categories on the CBA maps have specific desired management objectives, according to their biodiversity priority (Table 8). In broad terms, the biodiversity priority areas need to be maintained in a healthy and functioning condition, whilst those that are less important for biodiversity can be used for a variety of other land-uses.

Table 8: Map categories, definitions, and desired management objectives

Map Category	Definition	Desired Management Objectives
Protected Areas	Those areas that are proclaimed as protected areas under national or provincial legislation, including gazetted Protected Environments.	Areas that are meeting biodiversity targets and therefore must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity.

Map Category	Definition	Desired Management Objectives
Critical Biodiversity Areas (CBAs)	Areas that are required to meet biodiversity targets, for species, ecosystems, or ecological processes.	Must be kept in a natural state, with no further loss of habitat. Only low-impact, biodiversity-sensitive land-uses are appropriate.
Ecological Support Areas (ESAs)	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of protected areas or CBAs and for delivering ecosystem services.	Maintain in a functional, near-natural state, but some habitat loss is acceptable. A greater range of land-uses over wider areas is appropriate, subject to an authorisation process that ensures the underlying biodiversity objectives are not compromised.
Other natural Areas (OnAs)	Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions. Although they have not been prioritised for biodiversity, they are still an important part of the natural ecosystem.	An overall management objective should be to minimise habitat and species loss and ensure ecosystem functionality through strategic landscape planning. These areas offer the greatest flexibility in terms of management objectives and permissible land-uses, but some authorisation may still be required for high-impact land-uses.
Heavily or Moderately Modified Areas	Areas that have been modified by human activity to the extent that they are no longer natural, and do not contribute to biodiversity targets. These areas may still provide limited biodiversity and ecological infrastructural functions, even if they are never prioritised for conservation action.	Such areas offer the most flexibility regarding potential land-uses, but these should be managed in a biodiversity-sensitive manner, aiming to maximise ecological functionality and authorisation is still required for high-impact land-uses. Moderately modified areas (old lands) should be stabilised and restored where possible, especially for soil carbon and water-related functionality.

The MBSP Guideline recommendations for these categorisations are described below:

Land-use guidelines for terrestrial Critical Biodiversity Areas (CBAs)

Critical Biodiversity Areas are required to meet biodiversity targets and need to be maintained in a healthy natural state.

Irreplaceable CBAs are the most important biodiversity areas in the province, outside of the protected area network. They represent the last remaining options for securing critical biodiversity and ecosystems and for achieving biodiversity targets. If these areas suffer any further loss of habitat or ecological function, it is likely that the biodiversity targets will not be met, and the status of species and ecosystems will decline.

Some CBAs are considered irreplaceable because they form what are called ‘critical linkages or pinch-points, or because they incorporate threatened ecosystems. critical linkages are highly constrained areas within a natural landscape that are vital for maintaining the linkage and ecological integrity of the corridor network. If these critical linkages are lost, it would result in disruption of the corridor network.

Optimal CBAs (previously referred to as ‘Important & necessary’ in the MBCP) have an irreplaceability of less than 80% but are the most optimally located and the most efficient solution (i.e., occupying the smallest possible area) to meet biodiversity targets as well as other criteria such as avoiding high-cost areas where there are competing land-uses. There may be options to achieve the targets elsewhere, but these will require more land or may lead to increasing conflict between competing land uses.

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. Some low-intensity agricultural land-uses, such as grazing of livestock, may be acceptable in CBAs, on condition that best-practice guidelines aimed at benefiting the biodiversity assets and reducing the vulnerability of each site are implemented. An example of such best-practice guidelines is the recently released grazing and burning guidelines for managing grasslands for biodiversity and livestock production (SANBI, 2014).

Land uses that should not be in terrestrial CBAs because they cause loss of natural habitat or ecosystem functionality, include:

- Any form of mining or prospecting.
- Extensive or intensive grazing that results in species diversity being lost through selective- or over-grazing.
- conversion of natural habitat for intensive agriculture (cultivation) or plantation forestry.
- Expansion of existing settlements or residential, commercial or industrial infrastructure.
- new hard infrastructure, and linear developments such as roads, railways and pipelines.
- complete-barrier fencing (i.e. game-proof fences) in in CBA (or ESA) corridors.
- Linear infrastructure of any sort that disrupts the connectivity of CBA (or ESA) corridors.

More detailed land-use guidelines for working in terrestrial CBAs are provided in Table 9.

Land-use guidelines for terrestrial Ecological Support Areas

- Ecological support areas (ESAs) are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of CBAs and deliver important ecosystem services. They facilitate landscape connectivity, promote resilience to climate change, and buffer elements of the landscape including protected areas and sites that are important for the survival of individual species.

ESA: Landscape and Local Corridors: The purpose of ecological corridors is to provide intact pathways for
long-term biological movement. Landscape-scale corridors represent the best option for promoting resilience to climate change and the persistence of biodiversity as they provide pathways for the movement of plants and animals in response to environmental change. They also support the natural movement of species between populations to ensure population viability. Landscape corridors are aligned with areas that have maximum amounts of remaining natural habitat. Local corridors are fine-scale corridors that contribute to connectivity between climate change refugia. They represent alternative pathways for movement of species, and thus lessen impacts on critical linkages and landscape-scale corridors and provide networks that are more resistant to disturbance.

ESA: Species-Specific Sites: These are areas required for the persistence of specific species. Only one area, an important over-wintering site for blue cranes, that is shared with Gauteng, and which comprises a matrix of natural and cultivated lands, was identified as an ESA in the MBSP.

ESA: Protected Area Buffers: These are areas around protected areas where changes in land-use may affect the ecological functioning or tourism potential of the adjacent protected area. The purpose of buffer zones is to reduce the impacts of undesirable land-uses on the environment, and to provide opportunities for tourism. Modification of the natural habitat within the buffer zones may have negative impacts on the zonation and management plan of the adjacent protected area.

Permissible land-uses: There is more flexibility in terms of options for compatible land-uses in ESAs than there is in CBAs. However, ESAs do need to remain ecologically functional, which means that they need to be maintained in at least a near-natural state, although some loss of biodiversity pattern through a variety of land uses is acceptable. Details of land-use guidelines for working within ESAs are provided in Table 16.

Land-use guidelines for terrestrial Other Natural Areas

The overall purpose of these land-use guidelines is to promote the effective management of biodiversity as required in Section 41(a) of the Biodiversity Act (Act 10 of 2004, as amended) and in terms of the National Environmental Management Act (Act 107 of 1998, as amended). The guidelines provide advice on which land-uses and activities are most compatible with maintaining the ecological integrity of CBAs and ESAs, and other parts of the landscape, based on the desired management objectives for the land and the anticipated impact of each land-use activity on biodiversity patterns and ecological processes. The land-use guidelines have been developed in consultation with some planners from other sectors, and in a way that aims to minimise potential conflict between land uses. However, their focus is on identifying land-uses that are biodiversity compatible. They should, therefore, be used in conjunction with any other sector-specific guidelines that may be available for the province.

Land-use guidelines are presented below for terrestrial and freshwater ecosystems. These guidelines are intended primarily to guide planning and decision-making in terrestrial and freshwater Critical Biodiversity Areas and Ecological Support Areas on land outside of protected areas. However, brief guidelines are also provided for certain categories of protected areas, such as Protected Environments, in which a range of land uses other than biodiversity conservation is possible. In the sections that follow, general recommendations are given for each category on the CBA maps, relating to desired management objectives and appropriate land uses, and more detailed guidelines are provided in the accompanying tables (Table 9).
Other natural Areas (OnAs) are not required to meet biodiversity targets, and so are not identified as a priority in the MBSP. They do, however, retain much of their natural character. The biodiversity in these non-priority landscapes may still be of value and contribute to maintenance of viable species populations and natural ecosystem functioning and Other natural Areas may provide essential ecological infrastructure and ecosystem services.

Permissible land uses: OnAs offer the greatest flexibility in terms of management objectives and permissible land-uses and are generally recommended (along with Modified Areas) as the sites for higher-impact land-uses. However, because ONAs may still have significant ecological, aesthetic and social value, they should not be regarded as 'ecological wastelands or areas where 'anything goes.' Planners are still required to give due consideration to assessing environmental factors, socio-economic efficiency, aesthetics and impacts on the sense-of-place in making decisions about the location of land uses in these areas. Environmental authorisation may still be required for high-impact land-us- es in terms of the listed activities in the EIA Regulations, and other relevant legislation.

Land-use guidelines for terrestrial Heavily or Moderately Modified Areas

Heavily modified areas are those in which significant or complete loss of natural habitat and ecological functioning has taken place due to activities such as ploughing,
hardening of surfaces, mining, cultivation, and other activities that modify natural habitat. Even so, they may include small remnants of natural habitat such as the patches or strips of natural habitat that survive between cultivated lands, along river-lines and ridges and in open spaces in towns. These disconnected remnants are often biologically impoverished, highly vulnerable to damage and have

limited likelihood of being able to persist but may contain residual biodiversity value or may provide ecological infrastructure or certain ecosystem services.

Moderately Modified - Old Lands (sometimes called 'old fields' in other documents) are those areas that were used for cultivation or mining in the past (within the last 80 years) but are no longer used for these purposes and have been left to re-vegetate. These old lands are areas where biodiversity pattern and ecological function have been seriously compromised in the past, but they may still play an important role in the provision of ecosystem services or may provide important habitats for certain animal species. For example, old lands can provide important feeding grounds for birds such as blue cranes, and disused mine shafts can provide suitable habitats for certain bats.

Permissible land-uses: Heavily modified areas are those preferred for intensive land-uses such as the construction of settlements, industrial development and other.
land-uses that have a high impact. These land-uses should still be located and managed in ways that maintain any residual ecological functionality, and that does not impact negatively on species for which these modified sites may be important. In some cases, restoration may be advisable.

All land-use sectors will benefit from applying the guidelines in this handbook, in conjunction with other codes of best practice such as those that have been developed in the timber growing industry and the Mining and Biodiversity Guidelines (SANBI, 2013) and Grassland Ecosystem Guidelines (SANBI 2013a), to reduce impacts on biodiversity.

Table 9: Land-use guidelines for terrestrial Critical Biodiversity Areas

Map Category	Desired Management Objective	General guidelines	Specific guidelines for meeting minimum requirements
Protected Areas	Must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity. A benchmark for biodiversity.	All operational aspects of managing these areas must be subject to their main purpose, which is to protect and maintain biodiversity and ecological integrity and should be governed by a formally approved management plan and land-use activities that support the primary function of these areas as primary sites for biodiversity conservation. The management plan must identify allowable activities, which should be consistent at least with the CBA Irreplaceable category; the location of these allowable activities should be captured in a zonation plan in the management plan. Activities relating to the construction of roads, administrative or tourism infrastructure and services (such as water reticulation systems, power lines and the likes) that are required to support the primary function of the protected area and its allowable activities, must be subject to at least a basic scoping report, or a full EIA, as specified by NEMA, and the protected area management plan. In the case of Protected Environments, a variety of agricultural land uses may be allowed, such as livestock grazing, plantation forestry and some cultivation. The location of these land-use activities must be informed by the CBA maps and should be specified in the zonation plan of the management plan for the protected environment. All areas of natural habitat that are zoned for conservation use, should be subject to implementation of the land-use guidelines for protected areas, CBAs, and ESAs.	
Critical Biodiversity Areas (CBAs)	Maintain in a natural state with no further loss of natural habitat.	Allow low-impact land-uses that are compatible with maintaining CBAs in a natural state, with no loss of habitat or species. Earmark CBAs as priority sites for land care projects such as Working for Water, Working for Wetlands, and Working on Fire and other compatible, conservation activities. Avoid activities identified in the three Listing notices (R544, R545 and R546), if possible, as they conflict with the desired management objectives for terrestrial CBAs. Where they cannot be avoided, the impacts of these activities should be	

Map Category	Desired Management Objective	General guidelines	Specific guidelines for meeting minimum requirements
		minimised and remedied, and EIA conditions should be strictly applied by the competent authority. In larger geographically sensitive areas, environmental management frameworks (provided for under sections 24 (5)(i) and 44 of NEMA) should be developed and implemented to inform environmental authorisations, promote sustainability, secure biodiversity, and ecological functionality, and promote co-operative governance. The information and maps of the MBSP should be used to promote and support compilation of any Environmental Management Frameworks.	
Irreplaceable CBAs	Maintain in a natural state with no further loss of natural habitat.	Biodiversity loss and land-use change in Irreplaceable CBAs should be monitored as a matter of priority, to prevent unauthorised land-use change or degradation by neglect or ignorance. Where appropriate, these areas should be incorporated into the formal Protected Area system through biodiversity stewardship agreements (contract nature Reserves or Protected Environments). Ideally, conservation management activities should be the primary land-use in all irreplaceable areas, or they should at least be managed in ways that have no negative impact on species, ecosystems, or ecosystem services. Extensive (widespread, low intensity) livestock or game ranching, if well-managed, is compatible with the desired management objectives for these areas. These land-uses are acceptable if they consider the specific biodiversity features (e.g., rare species or vegetation remnants) and vulnerabilities (e.g., infestation by invasive alien plants) at each site, if they comply with recommended stocking rates, if any associated infrastructure (required to support the ranching activities) is kept to low levels.	In general, Irreplaceable sites must be avoided in terms of the mitigation hierarchy. A specialist study must be part of the Scoping and EIA process for all land-use applications in these areas, using the services of an experienced and locally knowledgeable biodiversity expert who is approved by the MTPA. Applications for land use of any kind should be referred to the biodiversity specialists in MTPA and DARDLEA for evaluation. Degraded areas included in the land parcel, but not the land-use proposal, should be restored to natural ecosystem functioning where possible. Provision of alternative land as a 'biodiversity offset' in exchange for biodiversity loss in these areas cannot be considered except in exceptional circumstances and would need to be considered on a case-by-case basis.
Optimal CBAs (referred to as Important and necessary in MBCP)	Maintain in a natural state with no further loss of natural habitat.	Acceptable land uses are those that are least harmful to biodiversity, such as conservation management, or extensive livestock or game farming. Large-scale cultivation, mining and urban or industrial development are not appropriate. Extensive (widespread, low intensity) livestock and game ranching, if well-managed (see above), is compatible with the desired management objectives for these areas.	If small-scale land-use change is unavoidable, it must be located and designed to be as biodiversity-sensitive as possible. A specialist study must be part of the scoping and EIA process for all land-use applications in these areas, using the services of an experienced and locally knowledgeable biodiversity expert who is SACNASP registered. Provision for biodiversity offsets in exchange for biodiversity loss should only be considered as a last resort and at a ratio consistent with national policy.
Ecological Support Areas (ESAs)	The desired management objective for all ESAs is to maintain the land in a near-natural and ecologically functional state, even if some loss of ecosystem composition or structure takes place		
ESA: Landscape	Maintain ecological	A greater range of land uses over wider	certain activities covered under Listing

Map Category	Desired Management Objective	General guidelines	Specific guidelines for meeting minimum requirements
and Local-scale corridors	functionality in support of biodiversity connectivity by retaining the existing natural vegetation cover in a healthy ecological state and restore 'critical linkages' where necessary.	areas is appropriate, subject to an authorisation process that ensures the underlying biodiversity objectives are not compromised.	notice 3 trigger the EIA process in ESA corridors. Restoration of corridors is important, particularly in terms of the Working for Water programs. The impact of land-use proposals on the functionality of ecological corridors must be assessed by the relevant biodiversity specialist as part of the EIA/Scoping report. Impenetrable fences that restrict animal movement should be discouraged.
ESA: Species Specific Sites	Maintain the prevailing ecological processes that support the specific species and manage for no further habitat loss.	Although these areas may be in production landscapes, and may be heavily modified in parts, a change in land use to anything other than conservation management should be discouraged as it would most likely result in a loss of the target species from the area.	The impact of any changes in land use on the population viability of listed species, such as blue cranes, should be assessed by a registered specialist. Restoration of degraded areas and invasive alien plant control is recommended, particularly clearing the small wattle 'jungles' that large birds avoid.
ESA: Protected Area Buffers	To minimise the impacts of surrounding land-uses on the ecological integrity, character, and tourism potential of protected areas.	When assessing the impacts of proposed land uses in protected area buffers, consideration needs to be given to both direct (e.g., plantation forestry blocking view-sheds and reducing water flows into a Protected Area) and indirect impacts (e.g., light and noise pollution).	Buffer distances vary according to the nature of the Protected Area, as follows: national Parks: 10 km buffer as indicated in Listing notice 3. nature Reserves: 5 km buffer as indicated in Listing notice 3. Protected Environments: 1 km buffer as these may include production landscapes. Land-use change applications within the buffer zone may be referred to the protected area manager or ecologist for evaluation. A viewshed analysis of the potential visual impact of the proposed land-use on adjacent protected areas should be undertaken where necessary.
Other Natural Areas (ONAs)	The overall objective should be to ensure ecosystem functionality and minimise loss of natural habitat and species through strategic landscape planning.	These areas have the greatest flexibility in terms of management objectives and permissible land-uses. Where possible, avoid modifying any remaining natural habitat by locating land-uses, including cultivation and plantations, in already-modified areas. Authorisation may be required for high-impact land-uses (such as intensive industry or urban development) and standard application of EIA regulations and other planning procedures is required. note: These areas may still contain species of conservation concern but either have not yet been surveyed, or the data were not available for incorporation into the MBSP. The presence or absence of important species should always be established through site visits before proceeding with a land-use change.	
Heavily or Moderately Modified Areas	Manage land-use in a biodiversity-friendly manner, aiming to maximise ecological functionality. In old lands, stabilise ecosystems and manage them to restore ecological functionality, particularly soil	Areas with no natural habitat remaining are preferred sites for higher-impact land-uses, and new projects should be in these areas before modifying any remaining natural habitat. Restoration and re-vegetation should be prioritised where heavily modified areas occur close to land of high biodiversity value or are located such that they could potentially serve useful ecological connectivity functions (such as in ecological corridors). For individual parcels of land identified as having specific actual or potential biodiversity values, develop incentives to restore lost biodiversity and connectivity. When locating land-uses in these modified areas, consider the off-site impacts they may have on neighbouring areas of natural habitat, especially if these are of high biodiversity value. For example, controlling use of pesticides in modified areas,	

Map Category	Desired Management Objective	General guidelines	Specific guidelines for meeting minimum requirements
	carbon and water-related functionality, using indigenous plant cover. Old lands should be burnt and grazed appropriately.	because of the impacts on neighbouring areas of natural habitat. Encourage landowners and developers to use indigenous plants, especially trees, where aesthetic or functional options exist.	

3.2.3 Mpumalanga Biodiversity Sector Plan (MBSP, 2014): Aquatic

Mpumalanga contains over 4 000 wetlands, numerous river systems (including five major catchment areas) and a large proportion of South Africa's Strategic Water Source Areas (areas accounting for more than 50% of annual run-off). Most of the wetlands occur in grasslands of the wetter highveld and escarpment regions, with the greatest concentration of pans in the Chrissiesmeer area near Ermelo. These wetlands represent high value ecological infrastructure for securing water for human use.

The vigorous plant cover of intact wetlands slows run-off, filters and purifies water and reduces the impacts of droughts and floods by behaving like giant sponges. Wetlands are also home to important biodiversity, providing special habitats and breeding grounds for many species of plants and animals. They play a vital role in agro-pastoral production systems and local livelihoods by providing renewable economic resources such as grazing, food, medicinal plants and natural fibre for thatch and craft making.

Most of the wetlands in Mpumalanga fall into the category commonly referred to as 'palustrine', which includes seepage wetlands and pans (See Box 2.2). Although all of them are of high biodiversity and ecological value, there are three wet- land areas that are of particular significance in Mpumalanga:

- The Wakkerstroom wetland complex in the south-east of the province.
- Verloren Valei, on the Steenkampsberg plateau near the town of Dullstroom.
- Chrissiesmeer Pan Area, near Ermelo (also called the Mpumalanga Lake District).

Freshwater Ecosystems

Freshwater Ecosystems comprise the following:

- **Seepage wetlands (sometimes called 'sponges')**: these are generally seasonal, small and widely scattered wetlands formed at valley heads or on hillslopes, largely by the discharge of sub-surface water.
- **Valley-bottom wetlands**: these occur in valley bottoms and are usually wetter.
- for longer periods than seeps. They may be channelled (with at least one or more clearly defined steam channels, but lacking floodplain features), or un-channelled (with no clearly defined stream channel).
- **Floodplain wetlands**: gently sloped, with floodplain features and a distinct stream channel.
- **Pans** (depressions and 'flats'): areas that accumulate surface water, either in depressions, or extensive areas characterised by level, gently undulating or uniformly sloping land; pans are shallow, seasonal or permanent bodies of water that are not directly connected to river systems by surface flow (for example, pans in the Chrissiesmeer area).
- **Lakes and dams**: there are no true lakes in Mpumalanga. Strictly speaking, lakes are natural impoundments within the continuous river line. Dams are artificial impoundments that are not

considered as typical wetlands. The small 'lakes' in the Chrissiesmeer area are technically, pans, occasionally interconnected by wet-season overflows.

Aquatic Critical Biodiversity Areas

Development of the freshwater CBA map relied on the recently completed national Freshwater Ecosystems Priority Areas (NFEPA) project (Nel et al., 2011). Because the NFEPA project has been well received in the scientific community, selected data products were incorporated directly (i.e., without further analysis) into the MBSP freshwater assessment.

The freshwater CBA map shows three sub-categories of CBA (CBA Aquatic Species, CBA Rivers and CBA Wetlands) and five sub-categories of ESA (Wetlands, Wetland clusters, Important Sub-catchments, Fish Support Areas and Strategic Water Source Areas). These are described below.

Some of the key improvements that have been made in the development of the CBA maps for the MBSP are, the use of new ecologically based planning units, more recent and accurate land cover data, more and better-quality biodiversity data, an improved ecological corridor network and the inclusion of several new features such as those that are important for landscape connectivity and climate change adaptation.

The MBCP (2008) used uniformly sized hexagons as the planning units, as was standard practice at the time, but this held several disadvantages. In the MBSP (2014), a system of more ecologically based, segmented planning units was used. The planning units were primarily delineated by land cover categories derived automatically from high-definition 2010 satellite imagery of Mpumalanga, but were nested within protected areas, farm boundaries and NFEPA catchments giving them an ecological as well as a real-world character. A total of 90 866 planning units (with areas ranging between 10 and 495 ha, with a mean of 84.2 ha) were used. Importantly, very few planning units included mixtures of modified and unmodified land and their boundaries intuitively make sense when overlain on an aerial or satellite image.

Land-use guidelines for Freshwater CBAs

Freshwater Critical Biodiversity Areas (CBAs) are those freshwater ecosystems required to meet freshwater biodiversity targets as defined in the national Freshwater Ecosystems Priority Areas project (NFEPA, Nel et al., 2011). Freshwater CBAs include CBA Rivers, CBA Wetlands, and CBAs for specific freshwater species not used in NFEPA (such as threatened freshwater-dependent invertebrates).

- CBA Rivers: These are rivers that need to be maintained in a good ecological state in order to meet biodiversity targets for freshwater ecosystems. They include FEPA rivers and all free-flowing rivers (of which there is only a handful left in Mpumalanga).
- CBA Wetlands: These are wetlands that have been identified as freshwater ecosystem priority areas (referred to as FEPA wetlands) that are important for meeting biodiversity targets for freshwater ecosystems. Healthy examples are scarce.
- CBA Aquatic species: These are areas considered critical for meeting the habitat requirements of selected aquatic invertebrate species. These species are all known from only one or two localities and are at risk of extinction if their habitat is lost.

Each of the subcategories of freshwater CBA has unique land-use guidelines and planning requirements (summarised in Table 10). The most common impacts on river and wetland systems, which may also impact on the CBA freshwater species are summarised below:

- Water extraction: cumulative reduction of river flow.
- Open-cast and strip mining (especially of coal): destruction of water table, acid mine drainage, toxic ground-water discharge.
- Planting high water-demand crops (e.g., timber and sugarcane): lowers water table, stream flow reduction, complex soil changes.

- Industrial-scale agriculture causes widespread changes to soil and vegetation cover, with major impacts on soil erosion, infiltration of rainfall, water-table recharge and sedimentation of rivers. A particular goal is the banning of pesticides in the vicinity of the CBA freshwater species areas.
- Atmospheric pollution: changes the chemistry of rainwater (acid rain).
- Hard paving and built structures (urban development): reduced infiltration and water-table recharge, enhanced flooding, erosion and sedimentation of riverbeds, pollution and changes to overall river ecology.
- Point-source pollution from sewage, industrial and mining discharges: toxic to biodiversity and humans, damages ecosystem health.
- Dams and weirs: change downstream hydrology: flow characteristics, water temperature, turbidity and dissolved nutrients; provide a physical barrier to fish.
- Non-point-source pollution (e.g., groundwater and seepage): from dumps (mine, industrial and rubbish), surface runoff (agricultural, mine, industrial and urban), irrigation seepage.
- Engineering/construction/earth moving causes accelerated soil erosion, turbidity (suspended solids) and sedimentation.
- Structures such as bridges, causeways (+ weirs and dams): can change the natural erosion and sedimentation characteristics of a river, causing local and downstream channel modification.

Broad guidelines for locating land-uses relative to freshwater CBAs are provided in Table 17. The NFEPA guidelines for specific land-use practices and activities that impact on water quantity, water quality, or habitat and biota in freshwater CBAs are summarised in Appendix 7.4.

Land-use guidelines for Freshwater ESAs

Ecological Support Areas are not required to meet freshwater biodiversity targets but support the ecological functioning of freshwater CBAs. They are sub-divided into four sub- categories, including: ESA Important sub-catchments and fish support areas; ESA Wetlands; ESA Wetland clusters and ESA Strategic Water Source Areas. These are described briefly below.

- **ESA Wetlands**: This sub-category includes all non-FEPA wetlands. Wetlands in Mpumalanga have been extensively degraded and, in many cases, irreversibly modified and lost through a combination of inappropriate land-use practices. Wetlands represent high value infrastructure for delivering, managing and storing good quality water for human use, and they are vulnerable to harmful impacts. It is therefore in the interests of national water security that all wetlands are protected by law (national Water Act, 36 of 1998).
- **ESA Wetland Clusters**: These are clusters of wetlands embedded within a largely natural landscape that function as a unit, and allow for the migration of species such as
- frogs and insects between individual wetlands. They also support other ecological processes that operate at a broader, landscape scale.
- **ESA**: Important Sub-Catchments and Fish Support Areas: This sub-category includes FEPA sub-catchments and Fish Support Areas. A river FEPA is the river reach that is required for meeting biodiversity targets for river ecosystems and threatened fish species. In managing the condition of a river FEPA, it is important to manage not only the river itself, but also the network of streams and wetlands as well as land- based activities in the sub-catchment that supports the river FEPA. A proportion of tributaries and wetlands need to remain healthy and functional for the river FEPA to be kept in a good ecological condition. This requires that management activities are focussed on maintaining water quantity and quality and the integrity of natural habitat in the sub-catchment.
- **Fish support areas** (that are not already FEPAs) are sub- quaternary catchments that are not in top ecological condition but are still important for supporting threatened and near-threatened indigenous freshwater fish populations that are of conservation concern. This category is

similar to FEPAs, except that Fish Support Areas may not always be required to meet proportional targets.

- The fish populations may also not always be present in the main stem river, but in the tributaries within these sub- catchments and are thus able to re-populate main stem rivers after pollution events.
- **ESA - Strategic Water Source Areas**: Strategic Water Source areas produce more than 50% of Mpumalanga's runoff in only 10% of the land surface area. Any land uses that place the continued delivery of an adequate volume of good quality water at risk should be avoided or, at least, mitigated.

Guidelines for locating land-uses in relation to these ESAs are provided below and in Table 17. More detailed guidelines for managing land-use activities that impact on water quantity in sub-quaternary catchments associated with river FEPAs, can be found in the NFEPA Implementation Manual (Driver et al., 2011).

Land-use guidelines for Other Natural Areas and Heavily Modified Freshwater Ecosystems

- **Other Natural Areas**: These are natural areas that are potentially available to changes in land-use, subject to environmental authorisation processes. Although they are not identified to support freshwater CBAs or ESAs, they still provide important ecosystem services. Freshwater ONA's are particularly important in buffers around rivers and wetlands to reduce siltation and improve water quality. Old lands were included under Freshwater OnAs because of their functional importance in supporting and maintaining freshwater CBAs.
- **Heavily Modified areas**: All areas currently modified to such an extent that any valuable biodiversity and ecological function has been lost. Indirect polluting effects from modified surfaces or land-uses need to be assessed, particularly where modified areas occur with freshwater CBAs and ESA sub-catchments.
- **Heavily Modified – Dams**: Although dams are not natural water bodies, they may still have a recharge effect on wetlands, groundwater and river systems and may support river- or water-dependent fauna and flora, such as waterbirds and wetland vegetation. For this reason, it is important to manage them carefully and avoid negative impacts on water quantity and quality in particular.

Table 10: Land-use guidelines for aquatic Critical Biodiversity Areas.

Map Category	Desired Management Objective	General guidelines	Specific guidelines for meeting minimum requirements
All freshwater CBAs	Maintain in a natural state with no loss of ecosystems, functionality or species. Where they are currently degraded, they should be rehabilitated, with no further degradation of ecosystem condition.	Freshwater CBAs should be maintained in good ecological condition, and those that are degraded should ideally be rehabilitated to a good condition. Land-use practices or activities that will lead to deterioration in the current condition of a freshwater CBA, or that will make rehabilitation difficult, are not acceptable. Any proposed land-use change must be subject to an EIA as it is likely to impact on the ecological drivers of the river or wetland ecosystem and can, potentially, alter its functioning or lead to loss of species. Specialist studies by a freshwater ecologist should beconducted if there	All questions about land-use change and its impact on water supplies must be referred to the Department of Water Affairs and Sanitation (DWS). national Water Quality Standards are set by DWS and return flows (of effluent) from any land-use, are subject to these. The process of determining the 'Ecological Reserve' flow, developed by DWS, is an essential tool in managing water use so that rivers can survive as ecosystems. All land-use activities should also be subject to the accepted standards set for construction of structures like bridges, culverts and dams. Ideally, effluent should be reflective of Resource Quality Objectives, as determined by a Reserve Determination,

Map Category	Desired Management Objective	General guidelines	Specific guidelines for meeting minimum requirements
		is a watercourse that is likely to be affected.	or determined on the basis of species sensitivities. A buffer of 100 m should be used to buffer rivers and wetlands, unless DWS's river / wetland buffer tool has been applied. Mining should not take place within 1 000 m of a freshwater CBA buffer.
CBA Rivers	Maintain in a natural state with no loss of ecosystems, functionality or species.	There is no flexibility in land-use options in this category. Any activities that may impact on CBA rivers, even upstream or in sub-catchments, need to be avoided, or impacts mitigated if they cannot be avoided. Any damaging activities within CBA river buffers must be avoided. A 100 m buffer is the greater of the delineated riparian area or 100 m measured from the top of bank.	
CBA Aquatic species	Maintain in a natural state with no loss of species or ecosystems.	Avoid the use of pollutants such as pesticides and other agricultural toxins. There are few appropriate land-use options as any loss of habitat could result in extinction of threatened freshwater - dependent invertebrate species.	
CBA Wetlands	Maintain in a natural state with no loss of species or ecosystems.	If the current ecological condition is good (either natural and unmodified, or largely natural with only small change in habitats and biota), then this condition needs to be maintained. If the current ecological condition is fair to poor (i.e., moderately to severely degraded with significant loss of natural habitat, biota and ecosystem functions), then this needs to be improved through rehabilitation measures. Refer to the NFEPA Implementation Manual for specific guidelines (for example, mining should not take place within 1 km of the boundary of the buffer around a wetland). note that the generic buffer is 100 m measured from the outside edge of the wetland.	
ESA Important Sub-catchments and Fish Support Areas	Minimise habitat and species loss through judicious planning and maintain basic ecosystem functionality and ecological condition within the surrounding landscape (sub catchment).	Manage the cumulative impacts of land-use activities in the sub-catchment (including land-based activities), ensuring no further deterioration of the ecological state of river or wetland CBAs. In the case of Fish Support Areas, apply authorisation requirements more stringently. Ensure that aquatic specialist studies are conducted in ESA Fish Support Areas. Maintain flow rates in streams in agricultural catchments in good condition, by managing land-use practices to mitigate the impacts of stream-flow reduction and ensuring that the extent of agriculture in the catchment does not exceed. 30-50% of land surface areas. Generic buffers of 100 m should be established around streams and wetlands within these catchments. These buff- ers can be refined based on a site visit and applying DWS's wetland delineation tool. Land-use practices or activities that are not consistent with keeping natural habitat and biota intact in ESA Important sub- catchments are not acceptable.	
ESA Wetland clusters	Manage to maximise potential for movements of species between wetlands in the cluster, and maintenance of landscape-scale ecological processes; avoid fragmentation of natural habitat within which the	Wetland clusters should not be further fragmented but should be managed as a unit. Land-uses that disrupt the possibility of migration, or the functioning of other ecological processes, across the cluster should not be allowed and sensitivity to disruption must be assessed in the EIA process. Delineate all wetlands within 500 m of a land-use activity and apply for a Water Use Licence if needed. conduct a buffer determination assessment around all wetlands, regardless of ecological condition or ecosystem threat status.	

Map Category	Desired Management Objective	General guidelines	Specific guidelines for meeting minimum requirements
	wetlands are embedded.		
ESA Wetlands	Maintain in a natural, functional state. Limited loss of ecosystems or functionality is acceptable, as long as the present ecological state is not lowered.	All wetlands are protected under the national Water Act (Act 36 of 1998). In terms of the national Water Act, freshwater ecosystems (all wetlands included) should not be allowed to degrade to an unacceptably modified condition (E or F ecological category). conduct a buffer determination assessment around all wetlands, regardless of ecological condition or ecosystem threat status. Any further loss of area or ecological condition must be avoided, including if needed, a 100 m generic buffer around the wetland.	
ESA Strategic Water Source Areas	Maintain ecological integrity across the entire sub-catchment, paying particular attention to maintaining water quantity, water quality and habitat integrity	Strategic Water Source Areas tend to be favoured for plantation forestry and the application of best-practice management is encouraged. Mining places the delivery of good quality water in adequate quantities at risk, and any cumulative impact of mines needs to be assessed and considered when processing mining applications. The clearing of invasive alien plants from drainage lines and wetlands within these areas must be a provincial priority. Restoration of wetlands and degraded areas within these catchments is encouraged	

3.3 Vegetation and Ecological Processes and Corridors

3.3.1 Critical Biodiversity Areas

Given that the objective of CBAs is to identify biodiversity priority areas which should be maintained in a natural to near natural state, development within these areas is not encouraged. The following issues need to be considered when considering development within a CBA:

- Are there alternative areas within the site but outside of the CBA that could be developed?
- Does the project undermine the overall ecological functioning of the broad CBA area?
- Can mitigation measures reduce the impact of the development on ecological processes?

3.3.2 Ecosystem Processes

Distinct ecological processes are generally associated with surface geology and soils, climate, topography, drainage systems, and the make-up of the remaining native vegetation. These features could be missed or only partly incorporated into land use plans unless they are specifically identified and targeted. Ideally, areas maintaining adaptive diversification (e.g., environmental gradients) or containing historically isolated populations should be identified and protected. The spatial aspect of ecological processes also needs to be determined and such insights incorporated in conservation planning. Finally, connectivity within these areas should be ensured to maintain species migration and gene flow. However, the spatial components of processes have rarely been considered in conservation planning – an approach that is also especially useful for development planning in biodiversity hotspots. Three types of ecological processes are discussed below.

3.3.3 Ecosystem Services

"Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fibre; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services, recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling". (Millennium Ecosystem Assessment (MEA),

2005). Terrestrial (or land) ecosystems provide valuable ecosystem services that contribute to human well-being. They can provide[5]:

- buffers against natural hazards such as fire and floods
- carbon sequestration (storage), important for reducing the impacts of climate change.
- regulation of water supply[(e)]
- grazing for wild animals and livestock
- natural spaces for recreation & tourism
- the air we breathe[(e)]
- spiritual, ritual and ceremonies
- horticultural & wildflower industries
- natural heritage
- food, timber, fibre, and medicinal plants

Rivers are central to human welfare and economic development. They provide:

- water for agricultural, industrial, and domestic uses
- flood attenuation and regulation[(e)]
- food and medicinal plants
- transport and/or purification of biodegradable wastes[(e)]
- tourism, recreational and cultural use
- enhanced property values

Estuaries, together with an associated buffer of natural vegetation, perform several valuable functions, especially in relation to:

- subsistence fishing
- commercial fisheries (as they provide a refuge for commercial fishes when they are young)
- wildlife habitat e.g., nursery and refuge (providing habitat for amphibians, birds, fish and mammals for all or portions of their life cycles)
- tourism, recreational, cultural use, and craft materials
- enhanced property values

Ecological corridors provide valuable ecosystem services that are often impossible or very costly to replicate or offset. For example, they:

- support the migration (movement) and long-term survival of plant and animal species and their ecological processes (e.g., fire, pollination, seed dispersal), in response to global climate change.
- are important areas for storing carbon to reduce the impacts of global climate change?
- are important areas for regulating water supply (e.g., filtering and storing drinking water, keeping excess nutrients out of wetlands and rivers, ensuring a high-water yield from mountain catchments)
- supply good quality water from mountain catchment areas, both surface and groundwater.
- the supply of water quality and quantity is not only for human consumption but for ensuring the survival of downstream estuaries, wetlands (vleis) and streams (which in turn provide us with other ecosystem services).
- are of important scenic value, contributing to tourism and the ‘sense of place’.
- Coastal & marine areas
- Subsistence & commercial fishing (food)

[5] Within the study area, terrestrial ecosystem services that are likely provided are marked [(e)].

- Medicinal & Cosmetic resources e.g., kelp & microscopic plants for the feed, food, cosmetics, & pharmaceutical industries.
- Mining (sand and heavy mineral)
- Recreational value (sport and fishing)
- Retail value (market-value of housing)

Net Primary production: This critical ecological process involves the process of photosynthesis – which translates into the amount of carbon plants can fix on an annual basis. This is important for each LM within the district as the amount of carbon fixed translates directly into the amount of forage produced and thus made available for grazing. Consequently, livestock management directly impacts upon forage production as overgrazing reduces the vegetations' ability to maintain this ecosystem process. This ecological process is especially significant for the ORT, as the main land use comprises of livestock grazing. Therefore, this factor has a direct bearing on both the amount of food available for livestock, and the amount of plant material available regarding reducing runoff in wetland areas.

Water production: In more arid areas, many municipalities and towns rely on groundwater or local water resources to supply to town with drinking water. Thus, the higher rainfall areas are key recharge zones for these groundwater resources. Consequently, land use management of these catchment areas are critical for the maintenance of the quality and quantity of water sourced from each area. For example, water courses and wetlands that have been cleared for agricultural purposes, or overgrazed, will not only cause soil erosion, but most importantly cause increased water runoff, thus reducing the amount of water that feeds back into the water table for consumption. Groundwater is also a critical resource for agriculture and food production.

Species movement corridors and climatic refuges: Global climate change is undoubtedly a threat in the coming decades. A key action to mitigate its effects is the maintenance of species' ability to migrate to new locations as the climatic conditions which they require move across the landscape. These corridor and refuge migration strategies occur on both a micro and macro level. On the macro scale corridors provide for species movement at landscape scales. This entails the ability of fauna and flora to undertake large scale movements towards areas which continue to provide the conditions required by a species for growth and reproduction. Movements could entail migrations of up to hundreds of kilometres, and corridors of mostly natural or near natural vegetation across the landscape are needed to permit this to occur. Climactic refuges can be localized areas that have moderated climates – such as mountain kloofs and south facing slopes. These areas provide cooler habitats where species under threat from changing climates can colonise or species and vegetation not widely found in surrounding area.

3.3.4 Ecological Support Areas

These include supporting zones required to prevent the degradation of Critical Biodiversity Areas and Protected Areas. An ESA may be an ecological process area that connects and therefore sustains Critical Biodiversity Areas or a terrestrial feature. ESAs are generally extensions to the CBA area incorporating small areas that are perhaps no longer natural, or are comprised of secondary vegetation, generally following the drainage line ecological corridors within the wider surrounding landscape that will improve connectivity.

3.4 Appendix 3: Abbreviations & Glossary

3.4.1 Abbreviations

CARA	Conservation of Agricultural Resources Act, Act 43 of 1983
CBA	Critical Biodiversity Area
DARDLEA	Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs
DEA	Department of Environmental Affairs (*now DFFE, see below*)
DFFE	The Department of Environmental Affairs (DEA) was renamed the Department of Forestry and Fisheries and the Environment (DFFE), incorporating the forestry and fisheries functions from the previous Department of Agriculture, Forestry and Fisheries.
DEMC	Desired Ecological Management Class
DWS	Department of Water Affairs and Sanitation
DWAF	Department of Water Affairs and Forestry (former department name)
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMC	Ecological Management Class
EMP	Environmental Management Plan
EMPr	Environmental Management Programme report
ER	Environmental Representative
ESS	Ecosystem Services
IAP's	Interested and Affected Parties
IEM	Integrated Environmental Management
LM	Local Municipality
masl	meters above sea level
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act, Act 107 of 1998
NFA	National Forests Act
NEM:BA	National Environmental Management: Biodiversity Act 10 of 2004
NFA	National Forest Act, Act 84 of 1998
PEMC	Present Ecological Management Class
PES	Present Ecological State
PNCO	Provincial Nature and Environment Conservation Ordinance (No. 19 of 1974).
RDL	Red Data List
RHS	Right Hand Side
RoD	Record of Decision
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
SoER	State of the Environment Report
SSC	Species of Special Concern
ToPS	Threatened of Protected Species
ToR	Terms of Reference
+ve	Positive
-ve	Negative

3.4.2 Glossary

Alien Invasive Species (AIS)	An alien species whose introduction and/or spread threaten biological diversity (Convention on Biological Diversity). Note: "*Alien invasive species*" is considered to be equivalent to "*invasive alien species*". An alien species which becomes established in natural or semi-natural ecosystems or habitat, is an agent of change, and threatens native biological diversity (*IUCN*).
Best Environmental Practice	The application of the most appropriate combination of environmental control measures and strategies (Stockholm Convention).
Best Management Practice	Established techniques or methodologies that, through experience and research, have proven to lead to a desired result (BBOP).
Biodiversity	Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems.
Biodiversity Offset	Measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure and ecosystem function and people's use and cultural values associated with biodiversity (BBOP).
Bioremediation	The use of organisms such as plants or microorganisms to aid in removing hazardous substances from an area. Any process that uses microorganisms, fungi, green plants, or their enzymes to return the natural environment altered by contaminants to its original condition.
Boundary	Landscape patches have a boundary between them which can be defined or fuzzy (Sanderson and Harris, 2000). The zone composed of the edges of adjacent ecosystems is the boundary.
Connectivity	The measure of how connected or spatially continuous a corridor, network, or matrix is. For example, a forested landscape (the matrix) with fewer gaps in forest cover (open patches) will have higher connectivity.
Corridors	Have important functions as strips of a landscape differing from adjacent land on both sides. Habitat, ecosystems, or undeveloped areas that physically connect habitat patches. Smaller, intervening patches of surviving habitat can also serve as "steppingstones" that link fragmented ecosystems by ensuring that certain ecological processes are maintained within and between groups of habitat fragments.
Critically Endangered (CR)	A category on the IUCN Red List of Threatened Species which indicates a taxon is facing an extremely high risk of extinction in the wild (*IUCN*).
Cultural Ecosystem Services	The non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experience, including, e.g., knowledge systems, social relations, and aesthetic values (Millennium Ecosystem Assessment).
Cumulative Impacts	The total impact arising from the project (under the control of the developer), other activities (that may be under the control of others, including other developers, local communities, government) and other background pressures and trends which may be unregulated. The project's impact is therefore one part of the total cumulative impact on the environment. The analysis of a project's incremental impacts combined with the effects of other projects can often give a more accurate understanding of the likely results of the project's presence than just considering its impacts in isolation (BBOP).
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well

	known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat(IUCN).
Degraded Habitat/Land	Land that has been impacted upon by human activities (including introduction of invasive alien plants, light to moderate overgrazing, accelerated soil erosion, dumping of waste), but still retains a degree of its original structure and species composition (although some species loss would have occurred) and where ecological processes still occur (albeit in an altered way). Degraded land is capable of being restored to a near-natural state with appropriate ecological management.
Disturbance	An event that significantly alters the pattern of variation in the structure or function of a system, while fragmentation is the breaking up of a habitat, ecosystem, or land-use type into smaller parcels. Disturbance is generally considered a natural process.
Ecological Processes	Ecological processes typically only function well where natural vegetation remains, and where the remaining vegetation is well-connected with other nearby patches of natural vegetation. Loss and fragmentation of natural habitat severely threatens the integrity of ecological processes. Where basic processes are intact, ecosystems are likely to recover more easily from disturbances or inappropriate actions if the actions themselves are not permanent. Conversely, the more interference there has been with basic processes, the greater the severity (and longevity) of effects. Natural processes are complex and interdependent, and it is not possible to predict all the consequences of loss of biodiversity or ecosystem integrity. When a region's natural or historic level of diversity and integrity is maintained, higher levels of system productivity are supported in the long run and the overall effects of disturbances may be dampened.
Ecosystem Status	Ecosystem status of terrestrial ecosystems is based on the degree of habitat loss that has occurred in each ecosystem, relative to two thresholds: one for maintaining healthy ecosystem functioning, and one for conserving most species associated with the ecosystem. As natural habitat is lost in an ecosystem, its functioning is increasingly compromised, leading eventually to the collapse of the ecosystem and to loss of species associated with that ecosystem (Millennium Ecosystem Assessment).
Ecosystem Services	A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit. Supporting Ecosystem services are those that are necessary for the maintenance of all other ecosystem services. Some examples include biomass production, production of atmospheric oxygen, soil formation and retention, nutrient cycling, water cycling, and provisioning of habitat.
Ecosystem	All the organisms of a habitat, such as a lake or forest, together with the physical environment in which they live. A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.
Ecotone	The transitional zone between two communities. Ecotones can arise naturally, such as a lakeshore, or can be human created, such as a cleared agricultural field from a forest. The ecotonal community retains characteristics of each bordering community and often contains species not found in the adjacent communities. Classic examples of ecotones include fencerows; forest to marshlands transitions; forest to grassland transitions; or land-water interfaces such as riparian zones in forests. Characteristics of ecotones include vegetational sharpness, physiognomic change, and occurrence of a spatial community mosaic, many exotic species, ecotonal species, spatial mass effect, and species richness higher or lower than either side of the ecotone.
Edge	The portion of an ecosystem near its perimeter, where influences of the adjacent patches can cause an environmental difference between the interior of the patch and its edge. This edge effect includes a distinctive species composition or abundance in the outer part of the landscape patch. For example, when a landscape is a mosaic of perceptibly different types, such as a forest adjacent to a grassland, the edge is the location where the two types adjoin. In a continuous landscape, such as a forest giving way to open woodland, the exact edge location is fuzzy and is sometimes determined by a local gradient exceeding a threshold, as an example, the point where the tree cover falls below thirty-five percent.

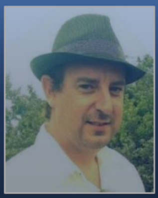
Emergent Tree	Trees that grow above the top of the canopy
Endangered (En)	Endangered terrestrial ecosystems have lost significant amounts (more than 60 % lost) of their original natural habitat, so their functioning is compromised. A taxon (species) is Endangered when the best available evidence indicates that it meets any of the criteria for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild (*IUCN*).
Endemic	A plant or animal species, or a vegetation type, which is naturally restricted to a defined region or limited geographical area. Many endemic species have widespread distributions and are common and thus are not considered to be under any threat. They are however noted to be unique to a region, which can include South Africa, a specific province or a bioregion, vegetation type, or a localised area. In cases where it is highly localised or known only from a few or a few localities, and is under threat, it may be red listed either in terms of the South Africa Threatened Species Programme, NEMBA Threatened or Protected Species (ToPS) or the IUCN Red List of Threated Species.
Environment	The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group. These circumstances include biophysical, social, economic, historical and cultural aspects.
Exotic	Non-indigenous; introduced from elsewhere, may also be a *weed* or alien *invasive* species. Exotic species may be invasive or non-invasive.
Ecological Structure	The composition, or configuration, and the proportion of different patches across the landscape. Relates to species diversity, the greater the diversity, the more complex the structure. A description of the organisms and physical features of environment including nutrients and climatic conditions.
Ecological Function	How each of the elements in the landscape interacts based on its life cycle events [Producers, Consumers, Decomposers Transformers]. Includes the capacity of natural processes and components to provide goods and services that satisfy human needs, either directly or indirectly.
Ecological Pattern	The contents and internal order of the landscape, or its spatial (and temporal) components. May be homogenous or heterogenous. Result from the ecological processes that produce them.
Ecological Process	Includes *Physical processes* [Climate (precipitation, insolation), hydrology, geomorphology]; *Biological processes* [Photosynthesis, respiration, reproduction]; *Ecological processes* [Competition, predator-prey interactions, environmental gradients, life histories]
Fragmentation (Habitat Fragmentation)	The 'breaking apart' of continuous habitat into distinct pieces. Causes land transformation, an important current process in landscapes as more and more development occurs.
Habitat Banking	A market where credits from actions with beneficial biodiversity outcomes can be purchased to offset the debit from environmental damage. Credits can be produced in advance of, and without ex-ante links to, the debits they compensate for, and stored over time (IEEP).
Habitat	The home of a plant or animal species. Generally, those features of an area inhabited by animal or plant which are essential to its survival.
IFC PS6	International Finance Corporation Performance Standard 6 – A standard guiding biodiversity conservation and sustainable management of living natural resources for projects financed by the International Finance Corporation (IFC)
Indicator	Information based on measured data used to represent an attribute, characteristic, or property of a system.
Indicator species	A species whose status provides information on the overall condition of the ecosystem and of other species in that ecosystem. They reflect the quality and changes in environmental conditions as well as aspects of community composition.
Indigenous	Native; occurring naturally in a defined area.
Indigenous Species	A species that has been observed in the form of a naturally occurring and self-sustaining population in historical times (*Bern Convention* 1979).

(Native species)	A species or lower taxon living within its natural range (past or present) including the area which it can reach and occupy using its natural dispersal systems (*modified after the Convention on Biological Diversity*)
Indirect Impact	Impacts triggered in response to the presence of a project, rather than being directly caused by the project's own operations (BBOP)
Intact Habitat / Vegetation	Land that has not been significantly impacted upon by man's activities. These are ecosystems that are in a near-pristine condition in terms of structure, species composition and functioning of ecological processes.
Intrinsic Value	The inherent worth of something, independent of its value to anyone or anything else.
Keystone Species	Species whose influence on ecosystem function and diversity are disproportionate to their numerical abundance. Although all species interact, the interactions of some species are more profound and far-reaching than others, such that their elimination from an ecosystem often triggers cascades of direct and indirect changes on more than a single trophic level, leading eventually to losses of habitats and extirpation of other species in the food web.
Landscape	An area of land that contains a mosaic of ecosystems, including human-dominated ecosystems (Millennium Ecosystem Assessment).
Landscape Approach	Dealing with large-scale processes in an integrated and multidisciplinary manner, combining natural resources management with environmental and livelihood considerations (FAO).
Landscape connectivity	The degree to which the landscape facilitates or impedes movement among resource patches.
Least threatened / Least Concern (LC)	These ecosystems have lost only a small proportion (more than 80 % remains) of their original natural habitat and are largely intact (although they may be degraded to varying degrees, for example by invasive alien species, overgrazing, or overharvesting from the wild). A taxon (species) is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category (*IUCN*).
Matrix	The "*background ecological system*" of a landscape with a high degree of connectivity.
Natural Forest (Indigenous Forest)	The definition of "*natural forest*" in the National Forests Act of 1998 (NFA) Section 2(1)(xx) is as follows: 'A natural forest means a group of indigenous trees • whose crowns are largely contiguous • or which have been declared by the Minister to be a natural forest under section 7(2) This definition should be read in conjunction with Section 2(1)(x) which states that 'Forest' includes: • A natural forest, a woodland, and a plantation • The forest-produce in it; and • The ecosystems which it makes up. The legal definition must be supported by a technical definition, as demonstrated by a court case in the Umzimkulu magisterial district, relating to the illegal felling of Yellowwood (*Podocarpus latifolius*) and other species in the Gonqogonqo forest. From scientific definitions (also see Appendix B) we can define natural forest as: • A generally multi-layered vegetation unit • Dominated by trees that are largely evergreen or semi-deciduous. • The combined tree strata have overlapping crowns, and crown cover is >75% • Grasses in the herbaceous stratum (if present) are generally rare. • Fire does not normally play a major role in forest function and dynamics except at the fringes. • The species of all plant growth forms must be typical of natural forest (check for indicator species)

	• The forest must be one of the national forest types
Near Threatened (NT)	A taxon (species) is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future (*IUCN*).
Patch	A term fundamental to landscape ecology, is defined as a relatively homogeneous area that differs from its surroundings. Patches are the basic unit of the landscape that change and fluctuate, a process called patch dynamics. Patches have a definite shape and spatial configuration and can be described compositionally by internal variables such as number of trees, number of tree species, height of trees, or other similar measurements.
Protected Area	A clearly defined geographical space, recognised, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.
Range restricted species	Species with a geographically restricted area of distribution. Note: Within the IFC PS6, restricted range refers to a limited extent of occurrence (EOO): • For terrestrial vertebrates and plants, restricted-range species are defined as those species that have an EOO less than 50,000 square kilometres (km2).
Refugia	A location which supports an isolated or relict population of a once more widespread species. This isolation can be due to climatic changes, geography, or human activities such as deforestation and overhunting.
Resilience	The capacity of a natural system to recover from disturbance (OECD).
Rehabilitation	Measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/ or minimised. Rehabilitation emphasizes the reparation of ecosystem processes, productivity, and services, whereas the goals of restoration also include the re-establishment of the pre-existing biotic integrity in terms of species composition and community structure (BBOP).
Restoration	The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. An ecosystem has recovered when it contains sufficient biotic and abiotic resources to continue its development without further assistance or subsidy. It would sustain itself structurally and functionally, demonstrate resilience to normal ranges of environmental stress and disturbance, and interact with contiguous ecosystems in terms of biotic and abiotic flows and cultural interactions (IFC).
Riparian	Pertaining to, situated on, or associated with the banks of a watercourse, usually a river or stream.
River Corridors	River corridors perform several ecological functions such as modulating stream flow, storing water, removing harmful materials from water, and providing habitat for aquatic and terrestrial plants and animals. These corridors also have vegetation and soil characteristics distinctly different from surrounding uplands and support higher levels of species diversity, species densities, and rates of biological productivity than most other landscape elements. Rivers provide for migration and exchange between inland and coastal biotas.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED).
Terrestrial	Occurring on, or inhabiting, land.
Threatened Species	Umbrella term for any species categorised as Critically Endangered, Endangered or Vulnerable by the IUCN Red List of Threatened Species (*IUCN*). Any species that is likely to become extinct within the foreseeable future throughout all or part of its range and whose survival is unlikely if the factors causing numerical decline or habitat degradation continue to operate (EU).

Traditional Ecological Knowledge	Knowledge, innovations, and practices of indigenous and local communities around the world. Developed from experience gained over the centuries and adapted to the local culture and environment, traditional knowledge is transmitted orally from generation to generation. It tends to be collectively owned and takes the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language, and agricultural practices, including the development of plant species and animal breeds. Traditional knowledge is mainly of a practical nature, particularly in such fields as agriculture, fisheries, health, horticulture, and forestry (CBD).
Transformation	In ecology, transformation refers to adverse changes to biodiversity, typically habitats or ecosystems, through processes such as cultivation, forestry, drainage of wetlands, urban development or invasion by alien plants or animals. Transformation results in habitat fragmentation – the breaking up of a continuous habitat, ecosystem, or land-use type into smaller fragments.
Transformed Habitat/Land	Land that has been significantly impacted upon because of human interferences/disturbances (such as cultivation, urban development, mining, landscaping, severe overgrazing), and where the original structure, species composition and functioning of ecological processes have been irreversibly altered. Transformed habitats are not capable of being restored to their original states.
Tributary	A small stream or river flowing into a larger one.
Untransformed Habitat/Land	Land that has not been significantly impacted upon by man's activities. These are ecosystems that are in a near-pristine condition in terms of structure, species composition and functioning of ecological processes.
Vulnerable (Vu)	Vulnerable terrestrial ecosystems have lost some (more than 60 % remains) of their original natural habitat and their functioning will be compromised if they continue to lose natural habitat. A taxon (species) is Vulnerable when the best available evidence indicates that it meets any of the criteria for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild (*IUCN*).
Watercourse	Natural or man-made channel through or along which water may flow. A river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake, or dam into which, or from which, water flows. and a reference to a watercourse includes, where relevant, its bed and banks;
Weed	An indigenous or non-indigenous plant that grows and reproduces aggressively, usually a ruderal pioneer of disturbed areas. Weeds may be unwanted because they are unsightly, or they limit the growth of other plants by blocking light or using up nutrients from the soil. They can also harbour and spread plant pathogens. Weeds are generally known to proliferate through the production of large quantities of seed.
Wetlands	A collective term used to describe lands that are sometimes or always covered by shallow water or have saturated soils, and where plants adapted for life in wet conditions usually grow.
Catchment	In relation to a watercourse or watercourses or part of a watercourse, means the area from which any rainfall will drain into the watercourse or watercourses or part of a watercourse, through surface flow to a common point or common points.
Estuary	a partially or fully enclosed body of water - (a) which is open to the sea permanently or periodically; and (b) within which the sea water can be diluted, to an extent that is measurable, with fresh water drained from land.
Instream habitat	Includes the physical structure of a watercourse and the associated vegetation in relation to the bed of the watercourse;
Riparian Habitat	Includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

3.5 Appendix 4: Specialist Profile & Professional Registration



Jamie Pote

BIODIVERSITY ADVISOR, ECOLOGIST AND ENVIRONMENTAL SCIENTIST

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Port Elizabeth, South Africa

Linkedin.com

Jamiepote

Bluesky-SA

ABOUT ME

18 years broad professional experience in Biodiversity, Ecological and Vegetation Assessments on over 250 projects in southern, western and central Africa. Environmental Assessment Practitioner on over 50 projects in the mining, infrastructure, housing and agricultural sectors. Environmental monitoring and auditing on over 50 civil infrastructure and construction projects. Have managed all aspects of projects from inception through to implementation. Advanced GIS mapping tools and Analysis.

EDUCATION

Bachelor of Science
Rhodes University
2002 (Botany & Environmental Science)

Bachelor of Science (Honours)
Rhodes University
2003 (Botany)

Professional Natural Scientist
SACNASP: 2016 (Ecological Science)

SERVICES

Terrestrial Biodiversity Specialist Assessments
IFC PS6 Biodiversity & Critical Habitat Assessments
Terrestrial Biodiversity Compliance Statements
Geographic Information Systems
Environmental Management Plans & Programmes
Environmental Compliance & Monitoring
Independent Environmental & Ecological reviews
Bioremediation, Restoration & Rehabilitation Plans
Permit and License applications (Flora & Fauna)
Flora Search & Rescue Plans & Relocations
Invasive Alien Plant Control & Management Plans
Environmental & Mining Applications

EXPERIENCE AND CLIENTS

Key Sectors

- *Wind, Solar Energy Facilities*
- *Infrastructure and Housing*
- *Agriculture and Forestry*
- *Mining and Industrial*

Key Projects

- *Over 250 independent Biodiversity/Ecological Assessments throughout southern, western and central Africa.*
- *Basic Assessments, Mining applications and compliance monitoring on over 50 projects for various clients including the Eastern Cape Department of Roads and Public Works, Department of Transport and the South African National Roads Agency (SANRAL) throughout the Eastern Cape, including over 300 individual borrow pits.*
- *South-End Precinct Mixed Use Development for Mandela Bay Development Agency - Environmental application, Ecological assessments and Pre-Construction compliance.*
- *Coega Development Corporation IDZ projects – Ecological assessments, Flora search & rescue and Construction monitoring.*
- *Environmental applications, construction monitoring and auditing for a wide range of projects, including infrastructure and housing clients.*
- *Various agricultural expansion and infrastructure projects.*
- *Various wind and solar energy and associated infrastructure projects.*
- *Numerous infrastructure projects including electrical, water and roads.*
- *Various Environmental Management and Rehabilitation Plans.*

24/06/2021

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Jamie Robert Claude Pote

Registration Number: 115233

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Ecological Science (Professional Natural Scientist)

Effective **20 July 2016** Expires **31 March 2024**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

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SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for 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)

REPORT TITLE

Mulilo Ermelo, Rochdale & Sheepmoor WEF

Kindly note the following:

1. This form must always be used for assessment that are in support of 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 August 2023. 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.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the 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 act, when applying for environmental authorisation - GN 320/2020)'*, where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Terrestrial Biodiversity Assessment
Specialist Company Name	
Specialist Name	Jamie Pote
Specialist Identity Number	740515 5152 089
Specialist Qualifications:	BSc (Hons)
Professional affiliation/registration:	SACNASP
Physical address:	
Postal address:	Postnet Suite 57, P Bag X13130, Humewood
Postal address	Port Elizabeth
Telephone	
Cell phone	076 888 9890
E-mail	jamiepote@gmail.com

2. DECLARATION BY THE SPECIALIST

I, Jamie Pote declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements 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 National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 NEMA Act.

Signature of the Specialist

N/A

Name of Company:

27 Sep 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Mr Jamie Pote __________, 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

N/A

Name of Company

27/09/2024.

Date

Signature of the Commissioner of Oaths

2024-09-27

Date

SOUTH AFRICAN POLICE SERVICE
CSC
27 -09- 2024
NOTTINGHAM RD
KWAZULU-NATAL

Jamie Pote

BIODIVERSITY ADVISOR, ECOLOGIST AND ENVIRONMENTAL SCIENTIST

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Independent Environmental & Ecological reviews
Bioremediation, Restoration & Rehabilitation Plans
Permit and License applications (Flora & Fauna)
Flora Search & Rescue Plans & Relocations
Invasive Alien Plant Control & Management Plans
Environmental & Mining Applications

ABOUT ME

20 years broad professional experience in Terrestrial Biodiversity, Ecological and Vegetation Assessments on over 350 projects in southern, western and central Africa. Environmental Assessment Practitioner on over 50 projects in the mining, infrastructure, housing and agricultural sectors. Environmental monitoring and auditing on over 50 civil infrastructure and construction projects. Have managed all aspects of projects from inception through to implementation. Advanced GIS mapping and analysis.

EXPERIENCE AND CLIENTS

Key Sectors

- *Wind, Solar Energy Facilities*
- *Infrastructure and Housing*
- *Agriculture and Forestry*
- *Mining and Industrial*

Key Projects

- *Over 350 independent Biodiversity/Ecological Assessments throughout southern, western and central Africa across all sectors.*
- *Basic Assessments, Mining applications and compliance monitoring on over 50 projects for various clients including the Eastern Cape Department of Roads and Public Works, Department of Transport and the South African National Roads Agency (SANRAL) throughout the Eastern Cape, including over 300 individual borrow pits.*
- *Environmental applications, construction monitoring and auditing for a wide range of projects, including infrastructure and housing clients.*
- *Various agricultural expansion and infrastructure projects.*
- *Various wind and solar energy and associated infrastructure projects.*
- *Numerous infrastructure projects including electrical, water and roads.*
- *Environmental Screening and Risk Assessments for several projects, including Wind Energy and Solar.*
- *Various Environmental Management and Rehabilitation Plans.*

PROJECT EXPERIENCE

ENERGY PROJECTS (WIND FARM AND PHOTOVOLTAIC INFRASTRUCTURE)

- Terrestrial Biodiversity Screening for proposed WEF, Beaufort West, Western Cape (ZA) 2023
- Terrestrial Biodiversity Walkdown for Koup 1 & 2 WEF, Beaufort West, Western Cape (ZA) 2023
- Terrestrial Biodiversity Assessment for Harmony Kalgold PV, Mahikeng, North West (ZA) 2022
- Terrestrial Biodiversity Assessment for Bonsmara PV, Kroonstad, Free State (ZA) 2023
- Terrestrial Biodiversity Screening for proposed WEF, Springbok, Northern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for Harmony Chemwes PV, Klerksdorp, North West (ZA) 2022
- Terrestrial Biodiversity Assessment for Harmony Target PV, Welkom, Free State (ZA) 2022
- Terrestrial Biodiversity Assessment for MTN Mast, Louterwater, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for MTN Mast, Mount Stewart, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for MTN Mast, Pearston, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for MTN Mast, Roussouw, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Screening for proposed PV & WEF, Beaufort West, Western Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for WKN Soutrivier WEF, Victoria West, Northern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for WKN Taaibos WEF, Victoria West, Northern Cape (ZA) 2022
- Terrestrial Biodiversity Screening for proposed PV, Beaufort West, Western Cape (ZA) 2022
- Terrestrial Biodiversity Screening for proposed WEF & PV, Secunda, Mpumalanga (ZA) 2022
- Terrestrial Biodiversity Screening for proposed WEF, Standerton, Mpumalanga (ZA) 2022
- Terrestrial Biodiversity Walkdown for Phezukomoya WEF, Noupoort, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Walkdown for San Kraal WEF, Noupoort, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Walkdown for Hartebeeshoek WEF, Noupoort, Eastern Cape (ZA) 2023
- Terrestrial Biodiversity Amendment for Banna ba Pifhu WEF, Humansdorp, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for Seekoei PV, Middleburg, Northern Cape (ZA) 2022
- Terrestrial Biodiversity Screening for proposed PV, Kroonstad, Free State (ZA) 2022
- Terrestrial Biodiversity Assessment for Paulputs WEF, Pofadder, NC (ZA) 2021
- Terrestrial Biodiversity Assessment for Komas WEF, Kleinsee, NC (ZA) 2021
- Preliminary Biodiversity Screening and GIS mapping for Balekani Photovoltaic Solar Project (SZ) 2020
- Preliminary Biodiversity Screening and GIS mapping for Sihhoye Photovoltaic Solar Project (SZ) 2020
- Preliminary Biodiversity Screening and GIS mapping Mpaka Photovoltaic Solar Project (SZ) 2020
- Preliminary Biodiversity Screening and GIS mapping for Chiwelwa Hydroelectric project (ZM) 2020
- Ecological Assessment for Vermaak Boerdery Hydro Turbine (Cookhouse), Eastern Cape 2020
- Ecological Assessment for Windcurrent Wind Farm, Eastern Cape 2012
- Ecological Assessment for Universal Windfarm, NMB (ZA) 2011
- Ecological Assessment for Inca Energy Windfarm, Northern Cape 2011
- Ecological Assessment for Broadlands Photovoltaic Farm, Eastern Cape 2011
- Botanical Assessment for Electrawinds Windfarm Coega, NMB 2010

TERRESTRIAL BIODIVERSITY ASSESSMENTS AND COMPLIANCE STATEMENTS

- Terrestrial Biodiversity Assessment for Glen Ewan Private School, Komani (ZA) 2023
- Terrestrial Biodiversity Assessment for Hard Rock Agriculture, Addo, EC (ZA) 2022
- Terrestrial Biodiversity Assessment for Coegakammakloof Chicken Houses, Addo, EC (ZA) 2022
- Terrestrial Biodiversity Assessment for Umziwabantu Agriculture, Addo, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Compliance Statement for Middledrift PV, Addo, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Compliance Statement for Disco PV, Addo, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for Mbashe AmaXhosa Royal House, Mbashe, Eastern Cape 2022
- Terrestrial Biodiversity Assessment for Nordex Roggeveld CTF, Western Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for Erf 805 Amsterdamhoek, Eastern Cape (ZA) 2022

- Terrestrial Biodiversity Assessment for Addo Fuel Depot, Addo, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for Tsomo WTW, CHDM, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for Beacon Bay Memorial Park, Buffalo City, Eastern Cape 2022
- Terrestrial Biodiversity Assessment for Ph 5 Nxamagele Reservoir & Pipeline, CHDM, EC (ZA) 2022
- Terrestrial Biodiversity Assessment for Ph 9 Water Pipeline to Sada WTW, Hewu, Eastern Cape 2022
- Terrestrial Biodiversity Assessment for Erf 5707 Beacon Bay, Buffalo City, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for Erf 8077 Uitenhage Fuel Station, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for Farm 3/599 Buffalo City, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for Sontule Citrus expansion, Addo, Eastern Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for Kurland WTW and Pipeline, Western Cape (ZA) 2022
- Terrestrial Biodiversity Assessment for Addo Offices, Addo, Eastern Cape (ZA) 2021
- Terrestrial Biodiversity Assessment for Blaauwater Farms, Eastern Cape 2021
- Terrestrial Biodiversity Assessment for Buffelshoek Farm, Loerie, Eastern Cape 2021
- Terrestrial Biodiversity & Aquatic Assessment & Review, Falcon Ridge Dam, Addo, EC 2021
- Terrestrial Biodiversity Assessment for Gubenxa Valley Deciduous Fruit, Eastern Cape 2021
- Terrestrial Biodiversity Assessment (Little Chelsea Mixed-use) 2021
- Terrestrial Biodiversity Compliance Statement (Maidenhead Farm) 2021
- Terrestrial Biodiversity Review, Mulilo Total Hydra Storage Project Grid Interconnection 2021
- Terrestrial Biodiversity Compliance Statement (Lahlangubo River Bridge) 2021
- Terrestrial Biodiversity Assessment (Mbashe access roads - 3 sites) 2021
- Terrestrial Biodiversity Assessment for Burlington Farm Citrus Development, Cookhouse, EC 2020
- Terrestrial Biodiversity Compliance Statement: CHDM Cluster 9 Phase 3D Pipeline 2020
- Terrestrial Biodiversity Review, Mulilo Total Hydra Storage Project BESS 2020
- Terrestrial Biodiversity Assessment (Mbashe housing projects, Dutywa & Willowvale) 2020
- Terrestrial Biodiversity Assessment (Helpmekaar Dam, Tarkastad) 2020
- Terrestrial Biodiversity Assessment (Herbertsdale pipeline, Mossel Bay) 2020
- Terrestrial Biodiversity Assessment (Keurbooms Erf 155, Keurboomstrand) 2020
- Terrestrial Biodiversity Assessment (Lowmar Hydroelectric Project, Cradock) 2020
- Terrestrial Biodiversity Assessment (Mossel Bay Gas Power Plant) 2020
- Terrestrial Biodiversity Assessment (Erf 1820, Mthatha) 2020
- Terrestrial Biodiversity Assessment (Newlyn Manganese Terminal, Coega SEZ) 2020
- Terrestrial Biodiversity Assessment Thornhill Phase 2 Sanitation Link 2020
- Botanical Assessment and Open Space Management Plan for Mainstream WEF Phase 2, Eastern Cape 2010

<u>PERFORMANCE STANDARD BIODIVERSITY AND CRITICAL HABITAT ASSESSMENTS (IFC PS6)</u>

- DBSA Environmental & Social Safeguards Standards 9: Biodiversity Conservation and Sustainable Management Assessment: The Ilitha Fibre Project, Ethekwini 2021
- Critical Habitat & Biodiversity Assessment - KruiseVallei Hydroelectrical Energy Project 2020
- Critical Habitat & Biodiversity Assessment & Walkdown- Brandvallei WEF, Northern Cape 2021
- Critical Habitat & Biodiversity Assessment & Walkdown- Rietkloof WEF, Northern Cape 2021
- Critical Habitat & Biodiversity Assessment & Walkdown- Karreebosch Grid Connection, NC 2021
- Critical Habitat & Biodiversity Assessment & Walkdown- Karreebosch WEF, Northern Cape 2021
- Critical Habitat & Biodiversity Assessment - Roggeveld Wind Energy Project 2020
- Biodiversity Assessment for Kalukundi Copper/Cobalt Mine, Democratic Republic of Congo 2008

<u>SPECIALISED ECOLOGICAL REPORTS AND REVIEWS</u>

- Section 24G Assessment and Rehabilitation Plan for Burlington Farm, Cookhouse, Eastern Cape 2022
- Alien Invasive Plant (AIP) Compliance Screening, Astron Depot, Cape Town, Western Cape (ZA) 2022
- Alien Invasive Plant (AIP) Compliance Screening, Astron Depot, Buffalo City, Eastern Cape (ZA) 2022
- Alien Invasive Plant (AIP) Compliance Screening, Astron Depot, Gqeberha, Eastern Cape (ZA) 2022

- Rebels Vlei Riparian delineation, Kirkwood, Eastern Cape 2021
- Buck Kraal Dam Rehabilitation Plan Review, Addo, Eastern Cape 2020
- Rehabilitation Plan for Hitgeheim Farm (Farm 960), Sunland, Eastern Cape 2017
- Green Star Rating Ecological Assessment for SANRAL office, Bay West City, NMB 2015
- Section 24G Assessment and Rehabilitation Plan for Bingo Farm, Eastern Cape 2014
- Mapping and Ecological services for Congo Agriculture, Republic of Congo 2013
- Rehabilitation Plan for Nieu Bethesda, Eastern Cape 2011
- Mapping of pipeline for Kenton Water Board, Eastern Cape 2010
- Rehabilitation Plan for N2 Upgrade - Coega to Colchester, NMB 2010
- Representative for landowner group for Seaview burial Park, NMB 2010
- Botanical Sensitivity Analysis for LSDF, Greenbushes-Hunters Retreat, NMB 2008
- Forestry Rehabilitation Assessment Report for Amahlathi Forest Rehabilitation, Eastern Cape 2007
- Botanical & Riparian Assessment for Orange River Weirs-Boegoeberg, Douglas Dam and Sendelingsdrif, Northern Cape 2006
- Botanical Assessment for State of the Environment Report for Chris Hani District Municipality SoER, Eastern Cape 2003

<u>ROAD AND RAILWAY INFRASTRUCTURE PROJECTS</u>

- Terrestrial Biodiversity Amendment for Transnet/Portnet CDC SEZ Mn Terminal 2023
- Terrestrial Biodiversity Assessment for Machani to Taleni SPS Access Road (SPM) 2022
- Terrestrial Biodiversity Assessment for Matonga to Mantlaneni Access Road (SPM) 2022
- Terrestrial Biodiversity Assessment for Newlyn Mn Terminal & conveyor (CDC IDZ), NMB 2021
- Ecological Assessment for CDC IDZ Mn Terminal, conveyor and railway line, NMB 2013
- Ecological Assessment Review for Penhoek Road widening, Eastern Cape 2012
- Ecological Assessment for R61 road widening, Eastern Cape 2012
- Botanical Assessment for Chelsea RD - Walker Drive Ext., NMB 2010
- Botanical Assessment for Motherwell - Blue Water Bay Road, NMB 2010
- Ecological Assessment for Port St John Road, Eastern Cape 2010
- Botanical Basic Assessment for Bholani Village Rd, Port St Johns, Eastern Cape 2009
- Botanical Report, EMP and Rehab Plan for Coega-Colchester N2 Upgrade, NMB 2009
- Botanical Assessment for Manganese Conveyor Screening Report, NMB 2008
- Ecological Assessment for Road Layout for Whiskey Creek- Kenton, Eastern Cape 2006

<u>MINING PROJECTS</u>

- Ecological Assessment for Bochum Borrow Pits, Limpopo 2013
- Ecological Assessment and Mining and Rehabilitation Plan for Greater Soutpansberg Mining Project, Limpopo (3 proposed Mines) 2013
- Ecological Assessment for Thulwe Road Borrow Pits, Limpopo 2013
- Ecological Assessment and Mining and Rehabilitation Plan for Baghana Mining, Ghana 2010
- Botanical Assessment for Zwartenbosch Quarry, Eastern Cape 2008
- Botanical description & map production for Quarry - Rudman Quarry, Eastern Cape 2008
- Botanical Basic Assessment, Rehab Plan & Maps for Borrow Pit - Rocklands/Patensie, Eastern Cape 2008
- Botanical Assessment & Maps for Sandman Sand Gravel Mine, Eastern Cape 2008
- Botanical Assessment & GIS maps for Shamwari Borrow Pit, Eastern Cape 2008
- Detailed Botanical Assessment, EMP and Rehab Plan for Kalukundi Copper/Cobalt Mine, Democratic Republic of Congo 2008
- Botanical Assessment, Rehab Plan & Maps for Borrow Pit Humansdorp/Oyster Bay, Eastern Cape 2008
- Botanical Assessment, Rehab Plan & Maps for AWRM - Cala, Eastern Cape 2008

- Botanical Assessment, Rehab Plan & Maps for AWRM - Camdeboo, Eastern Cape 2008
- Botanical Assessment, Rehab Plan & Maps for AWRM - Somerset East, Eastern Cape 2008
- Botanical Assessment, Rehab Plan & Maps for AWRM - Nkonkobe, Eastern Cape 2008
- Botanical Assessment, Rehab Plan & Maps for AWRM - Ndlambe, Eastern Cape 2008
- Botanical Assessment, Rehab Plan & Maps for AWRM - Blue Crane Route, Eastern Cape 2008
- Botanical Assessment, EMP and Rehabilitation Plan for AWRM - Cathcart, Eastern Cape 2008
- Botanical Assessment, GIS maps and Rehab Plan for Mthatha Prospecting, Eastern Cape 2008
- Regional Botanical Map for mining prospecting permit, Welkom 2008
- Botanical Assessment for Scoping Report and Detailed Botanical Assessment and Rehab Plan for Elitheni Coal Mine, Eastern Cape 2007
- Botanical Assessment, Rehab Plan & Maps for Borrow Pit - Oyster Bay, Eastern Cape 2007
- Botanical Assessment, Rehab Plan & Maps for Borrow Pit - Bathurst/GHT, Eastern Cape 2007
- Botanical Assessment, Rehab Plan & Maps for Borrow Pit – Jeffreys Bay, Eastern Cape 2007
- Botanical Assessment, Rehab Plan & Maps for Borrow Pit - Storms River/Kareedouw, Eastern Cape 2007
- Biophysical Assessment for Humansdorp Quarry, Eastern Cape 2006
- Botanical Assessment, Rehab Plan & Maps for Quarry-Cathcart & Somerset East, Eastern Cape 2006
- Botanical Assessment, Rehab Plan & Maps for Quarry - Despatch Quarry, NMB 2006
- GIS Mapping & Botanical Assessment and Rehab Plan for Quarry - JBay Crushers, Eastern Cape 2006
- Botanical Assessment, EMP and Rehabilitation Plan for Polokwane Silicon Smelter, Limpopo 2006
- Application for Mining Permit for Bruce Howarth Quarry, Eastern Cape 2006

POWERLINE INFRASTRUCTURE PROJECTS

- Terrestrial Biodiversity Assessment for Paulputs WEF Grid connection, Pofadder, NC (ZA) 2021
- Terrestrial Biodiversity Assessment for Komas WEF Grid connection, Kleinsee, NC (ZA) 2021
- Ecological Assessment: Dieprivier-Karreedouw 132kV Powerline realignment, Kouga LM 2016
- Eskom Ecological Walkdown: Dieprivier-Karreedouw 132 kV Powerline, Kouga LM 2016
- Eskom Solar one Ecological Walkdown: Nieuwehoop 400 kV powerline, NC 2015
- Rehabilitation Plan and Auditing for Grassridge-Poseidon Powerline Rehab, Eastern Cape 2013
- Ecological Assessment for Dieprivier Karreedouw 132kV Powerline, EC 2012
- Flora and Fauna search and Rescue plan for Van Stadens Windfarm Powerline, NMB 2012
- Botanical Assessment for Dedisa-Grassridge Powerline, EC 2010
- Ecological Assessment for Grahamstown-Kowie Powerline, EC 2010
- Species of Special Concern Mapping Transmission Line for San Souci to Nivens Drift 132kV powerline, NMB 2009
- Botanical Assessment for Eskom Powerline - Albany-Kowie, EC 2009
- Botanical Assessment for Eskom 132 kV Dedisa Grassridge Power line-Coega, NMB 2006
- Botanical Assessment for Eskom Power line – Tyalara-Wilo, Eastern Cape 2006
- Botanical Assessment for Steynsburg - Teebus 132 kV powerline, Eastern Cape 2004

PIPELINE INFRASTRUCTURE PROJECTS

- Terrestrial Biodiversity Assessment for Hewu Phase 9 Raw Water Pipeline to Sada WTW 2022
- Terrestrial Biodiversity Assessment for CHDM Ph 5 Nxamagele Reservoir & Pipeline (ZA) 2022
- Terrestrial Biodiversity Assessment for Thornhill Phase 2 Sanitation Link, Ndlambe, Eastern Cape 2020
- Botanical Assessment for Ngqamakhwe Regional Water Supply Scheme (Phase 3) 2018
- Ecological Assessment for Butterworth Emergency Bulk Water Supply Scheme 2017
- Ecological Assessment for Karringmelkspruit Emergency Bulk Water Supply (Lady Grey) 2017
- Ecological Assessment for Wanhoop-Willowmore Bulk Water Supply, Eastern Cape 2016
- Ecological Assessment for Steytlerville Bulk Water Supply, Eastern Cape (Phase 4) 2013

- Ecological Assessment for Steytlerville Bulk Water Supply, Eastern Cape (Phase 5) 2013
- Detailed Ecological Assessment for Suikerbos Pipeline, Gauteng 2012
- Basic Botanical Assessment for Wanhoop farm pipeline, Eastern Cape 2010
- Basic Botanical Assessment for Chatty Sewer, NMB 2010
- Species of Special Concern Mapping for Seaview Pipeline, NMB 2009
- Species of Special Concern Mapping for Chelsea Bulk Water Pipeline, NMB 2009
- Map Production for Russell Rd Stormwater, NMB 2008
- Basic Botanical Assessment for Albany Pipeline, Eastern Cape 2008
- Environmental Risk Assessment for Elands River pipeline, Eastern Cape 2007
- Detailed Botanical Assessment for Motherwell Pipeline, NMB 2007
- Detailed Botanical Assessment, GIS maps for Erasmuskloof Pipeline, Eastern Cape 2007
- Botanical & Floristic Report for Hankey pipeline, Eastern Cape 2006
- Detailed Botanical Assessment for Port Alfred water pipeline, Eastern Cape 2004

GENERAL INFRASTRUCTURE DEVELOPMENT PROJECTS

- Ecological Assessment for Amalinda crossing, BCM, Eastern Cape 2019
- Ecological Assessment for Cookhouse Bridge rehabilitation and temporary deviation, Eastern Cape 2019
- Ecological Assessment for Nelson Mandela University Access Road, NMB 2019
- Botanical Assessment for Zachtevlei Dam (Lady Grey), Eastern Cape 2017
- Botanical Assessment for Gcebula River bridge (Peddie), Eastern Cape 2017
- Botanical Assessment for Kouga Dam wall upgrade, Eastern Cape 2012
- Botanical Assessment for Jansenville Cemetery, Eastern Cape 2009
- Botanical Assessment for Radar Mast construction for South African Weather Service – BCM & NMB 2008
- Botanical Assessment and GIS mapping for golf course realignment for East London Golf Course, BCM, Eastern Cape 2007
- Botanical Assessment for PE Airport Extention, NMB 2006
- Botanical Assessment for Kidd's Beach Desalination Plant, BCM, Eastern Cape 2006

HOUSING DEVELOPMENT PROJECTS

- Terrestrial Biodiversity Assessment for Erf 1820 Mthatha, KSDM, Eastern Cape 2020
- Ecological Assessment for Erf 599 Walmer Mixed Use Development, Nelson Mandela Bay 2019
- Ecological Assessment Portion 21-23 and 41 of Farm 807, Gonubie, Buffalo City 2019
- Ecological Assessment for Emerald Sky Housing Project, BCMM 2019
- Ecological Assessment for Erf 14, Kabega, Port Elizabeth 2017
- Ecological Assessment for Fairwest Rental Housing, Port Elizabeth 2017
- Ecological Assessment for Hankey Housing, Kouga District Municipality 2015
- Ecological Assessment for Lebowakgoma Housing, Limpopo 2013
- Ecological Assessment for Giyani Development, Limpopo 2013
- Ecological Assessment for Palmietfontein Development, Limpopo 2013
- Ecological Assessment for Seshego Development, Limpopo 2013
- Botanical Assessment for Sheerness Road, BCM, Eastern Cape 2013
- Ecological Assessment for Ethembeni Housing, NMB 2012
- Ecological Assessment for Pelana Housing, Limpopo 2012
- Flora Search and Rescue Plan for Kwanobuhle Housing, Western Cape 2011
- Botanical Assessment for The Crags 288/03, Western Cape 2010
- Ecological Assessment Revision Report for Fairview Housing, NMB 2010

- Botanical Assessment, EMP and Open Space Management Plan for Hornlee Housing Development, Western Cape 2010
- Botanical Assessment for Little Ladywood, Western Cape 2010
- Botanical Assessment and Open Space Management Plan for Motherwell NU31, NMB 2010
- Botanical Assessment and Open Space Management Plan for Plett 443/07, Western Cape 2010
- Botanical Assessment for Willow Tree Farm, NMB 2010
- Botanical Assessment for Kouga RDP Housing, Eastern Cape 2009
- Botanical Assessment for Fairview Erf 1226 (Wonderwonings), NMB 2009
- Species List Compilation for Zeekoerivier Humansdorp, Eastern Cape 2009
- Botanical Assessment for Woodlands Golf Estate (Farm 858), BCM, Eastern Cape 2009
- Botanical Assessment for Plettenberg Bay - 438/4, Western Cape 2009
- Vegetation Assessment for Kwanokuthula RDP housing project, Western Cape 2008
- Site screening assessment for Greenbushes Site screening, NMB 2008
- Botanical Assessment for Fairfax development, Eastern Cape 2008
- Botanical Assessment for Plettenberg Bay Brakkloof 50&51, Western Cape 2008
- Botanical Assessment, GIS mapping for Theescombe Erf 325, NMB 2008
- Site Screening for Mount Road, NMB 2008
- Botanical Assessment for Greenbushes Farm 40 Swinburne 404, NMB 2008
- Botanical Assessment for Greenbushes 130, NMB 2008
- Botanical Assessment for Greenbushes Kuyga no. 10, NMB 2008
- Botanical Assessment for Plettenberg Bay - 438/24, Western Cape 2007
- Botanical Assessment for Plettenberg Bay - Olive Hills 438/7, Western Cape 2007
- Botanical Assessment for Gonubie Portion 809/9, BCM, Eastern Cape 2006
- Botanical Assessment for Glengariff Farm 723, BCM, Eastern Cape 2006
- Botanical Assessment for Gonubie Portion 809/10, BCM, Eastern Cape 2006
- Botanical Assessment for Gonubie Portion 809/4 & 5, BCM, Eastern Cape 2006
- Botanical Assessment for Plettenberg bay - Ladywood 438/1&3, Western Cape 2006
- Botanical Assessment and Rehab Plan for Winterstrand Desalination Plant, BCM 2006
- Botanical Assessment for Bosch Hoogte, NMB 2006
- Botanical Assessment for Plettenberg bay Farm 444/38, Western Cape 2006
- Botanical Assessment for Plettenberg Bay - 444/27, Western Cape 2006
- Botanical Assessment for Leisure Homes, BCM, Eastern Cape 2006
- Botanical Basic Assessment for Trailees Wetland Assessment, Eastern Cape 2005
- Botanical Assessment and Rehab Plan for Arlington Racecourse - PE, NMB 2005
- Botanical Assessment for Smart Stone, NMB 2005
- Botanical Assessment for Peninsular Farm (Port Alfred), Eastern Cape 2005
- Botanical Assessment for Mount Pleasant - Bathurst, Eastern Cape 2005
- Botanical Assessment and RoD amendments for Colchester Erven 1617 & 1618 (Riverside), NMB 2005
- Basic Botanical Assessment for Parsonsvlei 3/4, Eastern Cape 2005
- Botanical Assessment for Bridgemead – Malabar PE, NMB 2004

AGRICULTURAL PROJECTS

- Preliminary Biodiversity Screening for Chrisdelina Ranch Agricultural Project, Kizenga District • 2020
- Ecological Assessment for Vermaak Boerdery Hydro Turbine (Cookhouse)2020 2020
- Thornhill Eggland Specialist Ecological Assessment 2020
- Ecological Assessment for Citrus expansion on Hitgeheim Farm, Sunland, Eastern Cape 2015
- Ecological Assessment for Citrus expansion on farm 960, Patensie (AIN du Preez Boerdery) 2014
- Ecological Assessment for Doornkraal Pivot (Hankey), Eastern Cape 2014
- Ecological Assessment for Tzaneen Chicken Farm, Limpopo 2013
- Botanical Assessment and Open Space Management Plan for Kudukloof, NMB 2010

- Botanical Assessment and Open Space Management Plan for Landros Veeplaats, NMB 2010
- Botanical Assessment and Flora Relocation Plan for Wildemans Plaas, NMB 2006

GOLF ESTATE AND RESORT DEVELOPMENT PROJECTS

- Species List& Comments Report for Kidds Beach Golf Course, BCM, Eastern Cape 2009
- Botanical Assessment for Plettenberg Bay -Farm 288/03, Western Cape 2009
- Botanical Assessment for Rockcliff Golf Course, BCM, Eastern Cape 2008
- Botanical Assessment for Rockcliff Resort Development, BCM, Eastern Cape 2007
- Botanical Assessment, EMP and Rehabilitation Plan for Tiffendel Ski Resort, Eastern Cape 2006

MIXED USE DEVELOPMENT PROJECTS

- Ecological Assessment for South-End Precinct Mixed Use Development, Nelson Mandela Bay 2018
- Botanical Assessment, EMP and Open Space Management Plan for Bay West City, NMB 2010
- Botanical Assessment, GIS maps, Open Space and Rehab Plans for Fairview Erf 1082, NMB 2009
- Botanical Assessment and GIS maps for Utopia Estate PE, NMB 2008
- Botanical Assessment and GIS mapping for Madiba Bay Leisure Park, NMB 2007
- Botanical Assessment and GIS mapping for Madiba Bay Leisure Park, NMB 2007
- Botanical Basic Assessment for Cuyler Manor (Farm 320), Uitenhage, NMB 2007

BUSINESS AND INDUSTRIAL DEVELOPMENT PROJECTS

- Ecological Assessment for Parsonsvlei Erf 984 & 1134 Parsonsvlei, NMB 2020
- Mthatha Retails and Service Center 2020
- Ecological Assessment for Walmer Erf 11667 - Bidfood Warehousing Development, NMB 2020
- Ecological Assessment for Portion 87 of the Farm Little Chelsea No 10, NMB 2020
- Ecological Assessment for Bay West City ENGEN Service Station, NMB 2015
- Ecological Assessment for Green Star grading for SANRAL, NMB 2014
- Ecological Assessment for OTGC Tank Farm, NMB 2012
- Botanical Assessment and Open Space Management Plan for Petro SA Refinery, Coega IDZ, NMB 2010
- Botanical Assessment for Bluewater Bay Erf 805, NMB 2009
- Ecological Assessment for Bay West City, NMB 2007
- Botanical Assessment for Kenton Petrol Station, Eastern Cape 2005
- Botanical Assessment and RoD amendments for Colchester Petrol Station, NMB 2005

ECO-ESTATE DEVELOPMENT PROJECTS

- Botanical Re-Assessment of Swanlake Eco Estate, Aston Bay, Eastern Cape 2018
- Detailed Botanical Assessment and Open Space Management Plan for Olive Hills, Western Cape 2010
- Botanical Assessment and EMP for Zwartenbosch Road, Eastern Cape 2010
- Botanical Assessment - Poultry Farm for Coega Kammaskloof Farm 191, NMB 2008
- Botanical Assessment - Housing development for Coega Ridge, NMB 2008
- Botanical Assessment, Rehabilitation Plan, EMP and GIS maps for Amanzi Estate, NMB, 2008
- Botanical Assessment for Roydon Game farm, Queenstown, Eastern Cape 2007
- Botanical Assessment for Winterstrand Estate (Farm 1008), BCM, Eastern Cape 2007
- Botanical Assessment for Homeleigh Farm 820, BCM, Eastern Cape 2007
- Botanical Basic Assessment, Rehab Plan & Maps for Candlewood, Tsitsikamma, Western Cape 2007
- Botanical Assessment, EMP and Rehab Plan for Carpe Diem Eco development, Eastern Cape 2007
- Botanical Assessment, EMP and Rehabilitation Plan for Seaview Eco-estate, NMB 2006

- Botanical Assessment for Kidd's Beach portion 1076, BCM, Eastern Cape 2006
- Botanical Assessment for Palm Springs, Kidds Beach East London, BCM, Eastern Cape 2006
- Botanical Assessment for Nahoon Farm 29082, BCM, Eastern Cape 2006
- Botanical Assessment for Rosehill Farm, Eastern Cape 2005
- Botanical Assessment for Resolution Game Farm, Eastern Cape 2005
- Botanical Assessment for Gonubie Portion 809/11, BCM, Eastern Cape 2005
- Botanical Assessment for Kidd's Beach portion 1075, BCM, Eastern Cape 2005

FLORA AND FAUNA RELOCATION PLANS, PERMITS AND IMPLEMENTATION

- Flora Search and Rescue for Nelson Mandela University Phase 2 & 3 Residences, Eastern Cape 2020
- Flora Search and Rescue for Fairwest Housing Estate, Nelson Mandela Bay, Eastern Cape 2019
- Flora Search and Rescue for Utopia Estate, Nelson Mandela Bay, Eastern Cape 2019
- Flora Search and Rescue for Citrus expansion on Boschkraal Citrus Farm, Sunland, Eastern Cape 2018
- Flora Search and Rescue for Wanhoop pipeline, Willowmore, Eastern Cape 2018
- Flora Search and Rescue for Wilgekloof pipeline, Willowmore, Eastern Cape 2018
- Flora Search and Rescue for Citrus expansion on Hitgeheim Farm (Farm 960), Sunland, Eastern Cape 2017
- Flora Search and Rescue for Steytlerville Bulk Water Supply, Eastern Cape (Phase 5) 2016
- Flora Search and Rescue for Citrus expansion on Farm 960, Patensie (AIN du Preez Boerdery) 2016
- Flora Search and Rescue for Steytlerville Bulk Water Supply & WTW, Eastern Cape (Phase 4) 2015
- Flora and Fauna Search and Rescue for Riversbend Citrus Farm, NMB 2014
- Flora and Fauna Search and Rescue for Mainstream Windfarm, Eastern Cape 2013
- Flora Search and Rescue for Steytlerville Bulk Water Supply, Eastern Cape (Phase 1, 2 & 3) 2013
- Flora and Fauna Search and Rescue for OTGC Tank Farm, Coega IDZ, NMB 2013
- Flora and Fauna Search and Rescue for Jeffreys Bay School, Eastern Cape 2013
- Flora Search and Rescue Plan for Red Cap Wind Farm, Eastern Cape 2012
- Flora Relocation for Disco Poultry Farm, NMB 2010
- Flora Relocation for Mainstream Windfarm, Eastern Cape 2010

ENVIRONMENTAL MANAGEMENT PLANS

- Final Environmental Management Programme (EMPr) and Maintenance Management Plan for South End Precinct Mixed Use Zone, Nelson Mandala Bay Municipality 2020
- Final Environmental Management Programme (EMPr) for Coega Land-Based Aquaculture Development Zone (ADZ), Coega Industrial Development Zone (IDZ), Nelson Mandela Bay Municipality 2019
- Basic Botanical Assessment for Kromensee EMP (Jeffries Bay), Eastern Cape 2010
- Wetland Management Plan for NMB Portnet, NMB 2010
- Baseline Botanical Study, Vegetation mapping and EMP for Local Nature Reserve for Plettenberg Bay Lookout LNA, Western Cape 2009
- Biodiversity & Ecological Processes for Bathurst-Commonage, Eastern Cape 2006
- EMP for Kromensee EMP (Jeffries Bay), Eastern Cape 2006
- Floral Survey for Mbotyi Conservation Assessment, Eastern Cape 2005
- Identifying and Assessment on Aquatic Weeds for Pumba Private Game Reserve, Eastern Cape 2005

BASIC ASSESSMENT APPLICATION PROJECTS (DEDEAT)

- Basic Assessment Application for Parsonsvlei Erf 984 & 1134 Parsonsvlei 2020
- Construction of Deviation and Rehabilitation of Bridge along DR02481 road 2020
- Basic Assessment Application for Vermaak Boerdery Hydro Turbine (Cookhouse) 2020

- Basic Assessment Application for Walmer Erf 11667 Bidfood Warehousing Development 2020
- Basic Assessment Application for Portion 87 of the Farm Little Chelsea No 10 2020
- Basic Assessment Application for Nelson Mandela University Access Road, NMB 2019
- Basic Assessment, WULA and Borrow Pit/Quarry Mining Application, Clarkebury Rd, Idutywa 2019

- Basic Assessment Application for Erf 599 Walmer Mixed Use Development, Nelson Mandela Bay 2019
- Basic Assessment Application for Cookhouse Bridge rehabilitation and temporary deviation 2019
- Basic Assessment Application for Erf 14 Kabega, NMBM 2017
- Basic Assessment Application for Hankey Housing, Kouga District Municipality 2017
- Basic Assessment Application for Fairwest Rental Housing, Nelson Mandela Bay 2017
- Basic Assessment Application for Citrus expansion on Hitgeheim Farm, Sunland, Eastern Cape 2015
- Basic Assessment Application for Hankey Housing, Kouga District Municipality 2015
- Basic Assessment Application for Citrus expansion on farm 960, Patensie (AIN du Preez Boerdery) 2014
- Basic Assessment Application for South-End Precinct Mixed Use Development, Nelson Mandela Bay 2018

MINING PERMIT/ENVIRONMENTAL MANAGEMENT PROGRAMME APPLICATIONS (DMR)

- Mining BAR/EMP's for 24 Borrow Pits in 6 districts within the Eastern Cape– (SANRAL) 2019
- Mining BAR/EMP's for Ingquza Hill LM Borrow Pits – (SANRAL) 2018
- Mining BAR/EMP's for Baviaans LM Borrow Pits – (DRPW) 2017
- Mining BAR/EMP's for Senqu LM Borrow Pits – (DRPW) 2017
- Mining BAR/EMP's for Kouga/Koukamma LM Borrow Pits – (DRPW) 2017
- Mining BAR/EMP's for Inkwanca (Enoch Mgijima) LM Borrow Pits – (DRPW) 2017
- Mining BAR/EMP's for Kouga/Koukamma LM Borrow Pits – (DRPW) 2017
- Mining BAR/EMP's for Sakhisizwe/Engcobo LM Borrow Pits – (DRPW) 2017
- Mining BAR/EMP's for Raymond Mahlaba LM Borrow Pits – (DRPW) 2017
- Mining BAR/EMP's for Camdeboo LM Borrow Pits – (DRPW) 2017
- Mining BAR/EMP's for Elundini LM Borrow Pits – (DRPW) 2017
- Mining BAR/EMP's for Emalahleni/Intsika Yethu LM Borrow Pits – (DRPW) 2017
- Mining BAR/EMP's for Blue Crane Route & Camdeboo LM 12 Borrow Pits – (DoT) 2016
- Mining BAR/EMP's for Elundini LM 6 Borrow Pits (DoT) 2016
- Mining BAR/EMP's for Baviaans LM 6 Borrow Pits (DoT) 2016
- Mining BAR/EMP's for Kouga & Koukamma LM 12 Borrow Pits (DoT) 2016
- Mining BAR/EMP's for Sakhisizwe & Engcobo LM 12 Borrow Pits (DoT) 2016
- Mining BAR/EMP's for Senqu LM 12 Borrow Pits (DoT) 2016
- Mining BAR/EMP's for Nkonkobe LM Borrow Pits – (SANRAL) 2016
- Mining BAR/EMP's for Mbhashe LM Borrow Pits – (SANRAL) 2016
- Mining BAR/EMP's for Mbizana LM Borrow Pits – (SANRAL) 2016
- Mining BAR/EMP's for Senqu LM Borrow Pits – (SANRAL) 2016
- Mining BAR/EMP's for Elundini LM Borrow Pits – (SANRAL) 2016
- Mining BAR/EMP's for Emalahleni LM Borrow Pits – (SANRAL) 2016
- Mining BAR/EMP's for Emalahleni LM Borrow Pits – (DRPW) 2016
- Mining BAR/EMP's for Ikwezi/Baviaans LM Borrow Pits – (DRPW) 2016
- Mining BAR/EMP's for Chris Hani DM Borrow Pits - MR00716 (Tarkastad) (DRPW) 2015
- Mining BAR/EMP's for Chris Hani DM Borrow Pits – Intsika Yethu and Emalahleni (DRPW) 2015
- Mining BAR/EMP's for Joe Gqabi DM Borrow Pits – Senqu (DRPW) 2015
- Mining BAR/EMP's for Makana/Ndlambe LM Borrow Pits – Sarah Baartman (DRPW) 2015
- Mining BAR/EMP's for Amahlathi LM Borrow Pits – Amatole (DRPW) 2015
- Mining BAR/EMP's for Mbashe/Mqume LM Borrow Pits – Amatole (DRPW) 2015

- Mining BAR/EMP's for Sundays River Valley LM Borrow Pits – Sarah Baartman (DRPW) 2015
- Mining BAR/EMP's for Kouga LM Borrow Pits – Sarah Baartman (DRPW) 2015
- Mining BAR/EMP's for Chris Hani DM Borrow Pits - MR00716 (DRPW) 2014
- Mining BAR/EMP's for Chris Hani DM Borrow Pits - DR02581 (DRPW) 2014
- Mining BAR/EMP's for Chris Hani DM Borrow Pits - DR08041, DR08247, DR08248 & DR08504 (DRPW) 2014
- Mining BAR/EMP's for Chris Hani DM Borrow Pits - DR08599, DR08601 & DR08570 (DRPW) 2014
- Mining BAR/EMP's for Chris Hani DM Borrow Pits - DR08235, DR08551 & DR08038 (DRPW) 2014
- Mining BAR/EMP's for Alfred Nzo DM Borrow Pits - DR08092, DR08093 & DR08649 (DRPW) 2014
- Mining BAR/EMP's for Alfred Nzo DM Borrow Pits - DR08090, DR08412, DR08425, DR08129, DR08109, DR08106, DR08104 & DR08099 – Matatiele (DRPW) 2014

ENVIRONMENTAL COMPLIANCE AUDITING

- Environmental Compliance Audit (Habata Boerdery) 2021
- Environmental Compliance Audit (Sontule Farm) 2021

ENVIRONMENTAL MANAGEMENT, AUDITING, COMPLIANCE AND MONITORING PROJECTS

- Environmental Auditing Services Construction (Intsomi Citrus) 2021
- Environmental Auditing Services Pre-construction and Construction (Rocky Coast Farm) 2021
- Environmental Auditing Services (Middledrift Breeder Facility) 2021
- Coega Aquaculture Development Zone Environmental Compliance and Monitoring for Construction (24 Months) 2020
- Construction of NMU West End Student Residences Phases 1 & 3 Environmental Control Office (30 Months) 2020
- Environmental Auditing and construction monitoring for construction of Phase 1 River Park (South End Precinct) 2020
- Waste Management License audit for Bedford Recycling project 2020
- Auditing for Construction of Fairwest Village Housing Project 2019
- Auditing for Construction of Utopia Estate monthly auditing 2019
- ECO for DRPW IRM Road Maintenance projects, Baviaans LM 2019
- ECO for DRPW IRM Road Maintenance projects, Senqu LM 2019
- ECO for DRPW IRM Road Maintenance projects, Kouga/Koukamma LM 2019
- ECO for DRPW IRM Road Maintenance projects, Sakhisizwe/Engcobo LM 2019
- ECO for DRPW IRM Road Maintenance projects, Elundini LM 2019
- ECO for DRPW IRM Road Maintenance projects, Emalahleni/Intsika Yethu LM 2019
- ECO for Construction of Fairwest Village Housing Project 2019
- ECO for Construction of Utopia Estate Mixed Use Project 2019
- ECO for Construction of NMU West End Student Residences Phases 1 & 3 2019
- ECO for Construction of Eco-Pullets pullet rearing facility, Paterson 2018
- ECO for DRPW IRM Road Maintenance projects, Raymond Mahlaba LM 2018
- ECO for DRPW IRM Road Maintenance projects, Inkwanca (Enoch Mgijima) LM 2018
- ECO for Citrus expansion on Farm 960, Patensie (AIN du Preez Boerdery) 2017
- ECO for Citrus expansion on Hitgeheim Farm (Farm 960), Sunland, Eastern Cape 2017
- DEO for improvement of national route R67 section 5 from Whittlesea (km 0.00) to Swart Kei river (km 15.40) – Murray & Roberts 2017
- ECO for SANRAL RRP Road Maintenance projects, Mbizana LM 2017
- ECO and Botanical Specialist for the special maintenance of national route R61 Section 2 from Elinus Farm (km 42.2) to N10 (km 85.0) (SANRAL) 2016
- Environmental Control Officer (ECO): Construction of NSRI Slipway - Port Elizabeth Harbour 2016
- ECO for SANRAL RRP Road Maintenance projects, Mbashe LM 2016

- ECO for SANRAL RRP Road Maintenance projects, Nkonkobe LM 2016
- ECO for SANRAL RRP Road Maintenance projects, Mbizana LM 2016
- ECO for SANRAL RRP Road Maintenance projects, Senqu LM 2016
- ECO for SANRAL RRP Road Maintenance projects, Elundini LM 2016
- ECO and Environmental Management for closure of Bushmans River Landfill site 2016
- ECO for DRPW IRM Road Maintenance projects, Amahlathi Municipality 2015
- ECO for DRPW IRM Road Maintenance projects, Makana/Ndlambe Municipality 2015
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- ECO for Riversbend Citrus Farm, NMB 2014
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- ECO Audits for Koukamma Flood Damage Road Repairs – Hatch Goba 2014
- EMP and ECO for Utopia Estate, NMB 2013
- Final EMPr submission for Seaview Garden Estate, NMB 2012
- ECO audits for NMB Road surfacing, NMB (multiple contacts) 2011
- EMPr submission and ECO for Seaview Garden Estate, NMB 2010
- ECO for Mainstream Windfarm wind monitoring mast installation, Eastern Cape 2010
- EMP and ECO for Sinati Golf Estate EMP, BCM, Eastern Cape 2009
- Flora Relocation Plan and Permit application for Wildemans Plaas, NMB 2006

<u>ENVIRONMENTAL SCREENING PROJECTS</u>

- Somerset East Stormwater Environmental Screening Report 2021
- Woodlands Diary Road Upgrade Environmental Screening Report, Kouga LM 2021
- Risk Assessment and Screening for proposed Heatherbank access road, NMB 2020
- Environmental Screening Report for Proposed Life Hospital parking expansion, NMB 2019
- Environmental Screening Report for Erf 984 & 1134 development, Parsonsvlei, NMB 2019
- Environmental Screening Report for proposed Khayalethu School, Buffalo City 2018
- Environmental Screening Report for Proposed Housing Development of Erf 8700, Kabega Park, NMB 2017
- Environmental Screening Report for Proposed Housing Development of Erf 14, Kabega Park, NMB 2017
- Environmental Screening Report for Proposed Fairwest Social Housing project, Fairview, NMB 2016
- Environmental Screening Report for Development of Little Chelsea No 25, NMB 2016
- Terrestrial Vegetation Risk Assessment for proposed Skietnek Citrus Farm development (Kirkwood) 2015
- Preliminary Environmental Risk Assessment: NSRI Slipway Port Elizabeth 2015
- Environmental Screening Report for Proposed Development of a Dwelling on Erf 899, Theescombe 2015
- Environmental Screening Report for Proposed Development on Erf 559, Walmer, Port Elizabeth 2015
- Environmental Screening Report for Proposed Housing Scheme Development of Erf 8709, Wells Estate 2015
- Environmental Screening Report for Development of Portion 10 of Little Chelsea No 87, NMB 2015

<u>SECTION 24G APPLICATIONS</u>

- 12 000 ML Dam constructed on farm 960, Patensie (MGM Trust) 2015
- Illegal clearing of 20 Ha of lands on Hitgeheim Farm, Sunland, Eastern Cape 2015

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OTHER RESEARCH EXPERIENCE

- Resource assessment of bark stripped trees in indigenous forests in Weza/Kokstad area (June 2000; Dr C. Geldenhuis & Mr. M. Kaplin).
- Working for Water research project for indigenous trees for woodlots (December 2000/January 2001; Prof R.A. Lubke, Rhodes University).
- Project coordinator and leader of the REFYN project – A BP conservation gold award: Conservation and Restoration of Grassy-Fynbos. A multidisciplinary project focusing on management, restoration and public awareness/education (2001 – 2002).
- Conservation Project Management Training Workshops: Royal Geographical Society, London 2001 – Fieldwork Techniques, Habitat Assessment, Biological Surveys, Project Planning, Public Relations and Communications, Risk Assessment, Conservation Education
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SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Jamie Robert Claude Pote

Registration Number: 115233

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule 1 of the Act)

Ecological Science (Professional Natural Scientist)

Effective **20 July 2016** Expires **31 March 2025**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

RHODES UNIVERSITY

THIS IS TO CERTIFY THAT

JAMIE ROBERT CLAUDE POTE

WAS THIS DAY AT A CONGREGATION OF THE UNIVERSITY
ADMITTED TO THE DEGREE OF

BACHELOR OF SCIENCE

WITH HONOURS

VICE CHANCELLOR

DEAN OF THE FACULTY OF SCIENCE

GRAHAMSTOWN

11 APRIL 2003

REGISTRAR

RHODES UNIVERSITY

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David Woods.
VICE CHANCELLOR

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GRAHAMSTOWN

5 APRIL 2002

Stephen Fourie
REGISTRAR

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PROPOSED CONSTRUCTION OF THE EMVELO WIND ENERGY FACILITY AND ASSOCIATED GRID INFRASTRUCTURE, NEAR ERMELO, MPUMALANGA PROVINCE, SOUTH AFRICA

AVIFAUNAL SPECIALIST ASSESSMENT REPORT - SCOPING

MAY 2024

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1. EXECUTIVE SUMMARY

Respective Special Purpose Vehicles (SPVs) are proposing the development of a commercial wind farm cluster that is expected to comprise three separate Wind Energy Facilities (WEFs) namely, Rochdale WEF (up to 240 MW), Sheepmoor WEF (up to 360 MW), and Emvelo WEF (up to 200 MW). Each WEF will apply for its own grid connection route to connect to the existing Eskom Uitkoms Substation, via approximately 20 – 32 km long 132 kV overhead transmission lines. The powerlines are proposed and are assessed within a 300 m assessment corridor each. The proposed development sites are located near Ermelo and falls within the Msukaligwa Local Municipality and the Gert Sibande District Municipality, in the Mpumalanga Province.

It is intended that these projects would be bid in the seventh bidding window of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) with the aim of evacuating the generated power from the WEFs into the National Eskom Grid. This will aid in the diversification and stabilisation of the country's electricity supply in line with the objectives of the Integrated Resource Plan (IRP).

This report serves as the **Avifaunal Specialist Study (Scoping Phase)** for the proposed **Emvelo WEF**.

Emvelo WEF is proposed to comprise up to 45 turbines with a maximum output capacity of up to 200 MW. The WEF will be located on nineteen (19) land parcels and will have an anticipated lifespan of 20–25 years. The final design which will be requested for approval in the EA, will be determined based on the outcome of the specialist studies undertaken for the EIA phase of the development. The proposed turbine footprints and associated facility infrastructure will cover an area of up to 180 ha after rehabilitation, depending on final layout design. It is proposed that an on-site substation with a capacity up 132 kV and an up to 132 kV Overhead Powerline (OHPL) of approximately 30 km (300 m corridor) in distance, traversing eighteen (18) land parcels, be constructed to connect the proposed WEF to the Eskom Uitkoms Substation.

According to the Southern African Bird Atlas Project (SABAP2) a total of 253 bird species could potentially occur in the Broader Area where the proposed Emvelo WEF and Gird Connection Infrastructure are located. Of the 253 species, 38 species are classified as priority species for wind energy developments. Of the wind energy development priority species in the Broader Area, 32 (84%) have been recorded during the pre-construction monitoring conducted thus far. Of the 253 species, 76 are considered power line sensitive species and 57 (75%) of the power line sensitive species have been recorded during the pre-construction monitoring.

1.1 Summary of Findings

1.1.3 Wind Energy Facility

The proposed Emvelo WEF will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of priority species due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the construction phase.
- Collision mortality caused by the wind turbines in the operational phase.
- Electrocution on the 33kV MV overhead lines (if any) in the operational phase.
- Collisions with the 33kV MV overhead lines (if any) in the operational phase.
- Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

1.1.3.1 Displacement of priority species due to disturbance linked to construction activities in the construction phase.

A measure of displacement will inevitably take place for all priority species as a result of disturbance from construction activities during the construction phase. This will primarily affect ground-nesting species in the remaining high-quality grassland, wetlands, and wetland fringes. In addition, the Southern Bald Ibises that roost and breed on the Project Site could face a disruption of their reproductive cycle. Some species could recolonise the area after the completion of construction. However, as a result of habitat fragmentation and operational turbines causing disturbance, other species could only partially return to their previous habitat, resulting in lower densities than before. In summary, the following species could be impacted by disturbance during the construction phase: African Fish Eagle, African Grass Owl, African Harrier-Hawk, African Marsh Harrier, Black Sparrowhawk, Black-rumped Buttonquail, Black-winged Kite, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Greater Kestrel, Grey Crowned Crane, Grey-winged Francolin, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Rudd's Lark, Rufous-breasted Sparrowhawk, Secretarybird, Southern Bald Ibis, Spotted Eagle-Owl, White-bellied Bustard, and Yellow-breasted Pipit. The impact is rated as **Medium** pre- and post-mitigation.

1.1.3.2 Displacement due to habitat transformation in the construction phase.

The construction of additional roads will result in further habitat fragmentation; however, the site already has many access roads, most of which will be upgraded and utilised for the wind farm development. It is noted that some of the upgraded roads will infringe on the habitat classified as very high sensitivity through habitat suitability modelling, however these infringements will mostly be along the edges of these grassland areas. This, together with the disturbance of the operating turbines, could influence the density of several species. This is the case for larger terrestrial species that utilise the remaining natural grassland, wetlands, and wetland fringes as breeding habitat, and also for smaller, range-restricted species for which the area is considered to provide suitable habitat. It is not expected that priority species will be permanently displaced from the development site, but densities may be reduced. In summary, the following terrestrial species and raptors are likely to be most affected by habitat transformation: African Grass Owl, Black-rumped Buttonquail, Black-winged Lapwing, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Rudd's Lark, Secretarybird, White-bellied Bustard, and Yellow-breasted Pipit. The impact is rated as **Medium** pre- and post-mitigation.

1.1.3.3 Collision mortality caused by the wind turbines in the operational phase.

The proposed WEF will pose a collision risk to several priority species which could regularly occur at the site. Species exposed to this risk are large terrestrial species, occasional long-distance fliers, and small passerines during display flight activities i.e., bustards, cranes, storks, Southern Bald Ibis and Secretarybird, although bustards and cranes generally seem to be less vulnerable to turbine collisions than originally anticipated (Ralston-Paton & Camagu 2019). Soaring priority species such as Cape Vulture and a variety of raptors, including several species of eagles, are highly vulnerable to the risk of collisions. The regularly occurring priority species that could be at risk of collisions with the turbines are the following: African Fish Eagle, African Grass Owl, African Harrier-Hawk, African Marsh Harrier, Amur Falcon, Black Sparrowhawk, Black-winged Kite, Black-winged Lapwing, Black-winged Pratincole, Blue Crane, Blue Korhaan, Common Buzzard, Denham's Bustard, Greater Kestrel, Grey Crowned Crane, Grey-winged Francolin, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Montagu's Harrier, Pallid Harrier, Red-footed Falcon, Rudd's Lark, Rufous-breasted Sparrowhawk, Secretarybird, Southern Bald Ibis, Spotted Eagle-Owl, White Stork, White-bellied Bustard, Yellow-billed Stork, and Yellow-breasted Pipit. The impact is rated as **High** pre-mitigation and **Medium** post-mitigation.

1.1.3.4 Electrocution on the 33kV MV overhead lines (if any) in the operational phase.

The following priority species are potentially vulnerable to electrocution on the 33kV overhead lines: African Fish Eagle, African Grass Owl, African Harrier-Hawk, African Marsh Harrier, Amur Falcon, Black Sparrowhawk, Black-winged Kite, Common Buzzard, Greater Kestrel, Grey Crowned Crane, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Montagu's Harrier, Pallid Harrier, Red-footed Falcon, Rufous-breasted Sparrowhawk, Southern Bald Ibis and Spotted Eagle-Owl. The impact is rated as **Medium** pre-mitigation and **Low** post-mitigation.

1.1.3.5 Collisions with the 33kV MV overhead lines (if any) in the operational phase.

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines may have to run above ground for technical reasons. These spans could pose a collision risk to priority avifauna, depending on where those spans are located. Priority species potentially at risk are African Grass Owl, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Marsh Owl, Secretarybird, Southern Bald Ibis, Spotted Eagle-Owl, White Stork, White-bellied Bustard, and Yellow-billed Stork. The impact is rated as **Medium** pre-mitigation and **Low** post-mitigation.

1.1.3.6 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

The impact is likely to be similar in nature to the construction phase.

1.1.3.7 Cumulative Impacts.

The maximum number of wind turbines which are currently proposed for the other wind farms which are located within a 35km radius (i.e., Rochdale WEF and Sheepmoor WEF Camden I WEF and Camden II WEF) in similar habitat around the proposed Emvelo WEF is 157. None of these have been constructed to date, and each of the planned projects will still be subject to a bidding process where only the most competitive projects will obtain a power purchase agreement required for the project to proceed to construction. The Emvelo WEF will consist of up to 45 turbines, which brings the total number of potential turbines within the 35km radius to 202. The 45 turbines of Emvelo WEF constitute 22% of the total number of planned turbines. As such, its contribution to the total number of turbines, and by implication the cumulative impact of all the planned turbines, is considered **moderate to high**.

The total land parcel area where renewable energy developments are planned, including the Emvelo WEF, amounts to approximately 268.3km² (26,830 ha), which constitutes about 7% of the total area of similar habitat available to birds in the 35km radius around the project. The cumulative impact of the planned wind energy projects at the time of writing is considered **moderate** as far as the creation of high-risk zones are concerned within the area contained in the 35km radius.

The land parcel area of the proposed Emvelo WEF (70.3 km2) amounts to about 26% of the total amount of land parcel area designated for renewable energy developments, but less than 2% of the total area available (3848 km^2) in the 35km radius. The contribution of the Emvelo WEF to the cumulative impact of all the renewable energy facilities is therefore **medium to low** as far as potential displacement of priority species due to habitat transformation is concerned.

Table 1 summarises the expected impacts of the proposed WEF and proposed mitigation measures per impact.

Table 1: Overall Impact Significance for the WEF (Pre- and Post-Mitigation).

Nature of Impact and Phase	Overall Impact Significance (Pre-Mitigation)	Proposed Mitigation	Overall Impact Significance (Post-Mitigation)
Construction: Displacement due to disturbance	Medium	(1) Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry. (3) No construction should take place in the All-Infrastructure Exclusion Zones as indicated in Section 6.5 unless existing roads are to be upgraded. (4) No construction activities within 2.5km of the Martial Eagle nest (coordinates on request) should take place in the period March to December, which is the breeding season for these eagles.	Medium
Construction: Displacement due to habitat transformation	Medium	(1) Removal of vegetation must be restricted to a minimum and must be rehabilitated to its former state where possible after construction. (2) Construction of new roads should only be considered if existing roads cannot be upgraded. (3) The recommendations of the biodiversity and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned to limit the impact of habitat transformation on priority species. (4) No construction should take place in All Infrastructure Exclusion Zones as indicated in Section 6.5.	Medium
Operational: Collisions with the turbines	High	(1) No turbines (including the rotor swept area) should be located in the Turbine Exclusion Zones as indicated in Section 6.5. (2) Pro-active mitigation in the form of Shutdown on Demand (SDoD) or automated curtailment must be implemented in the medium risk zones as indicated in Section 6.5. (3) Live-bird monitoring and carcass searches should be implemented in the operational phase, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins et al. 2015) to assess collision rates.	Medium

Nature of Impact and Phase	Overall Impact Significance (Pre-Mitigation)	Proposed Mitigation	Overall Impact Significance (Post-Mitigation)
		(4) All wind turbines must have one blade painted according to a CAA approved pattern to reduce the risk of raptor collisions. It is acknowledged that blade painting as a mitigation strategy is still in an experimental phase in South Africa, but research indicates that it has a very good chance of reducing raptor mortality, based on research conducted in Norway (see Simmons et al. 2021 (Appendix 12) for an explanation of the science and research behind this mitigation method). (5) If at any time estimated collision rates to be determined by Collision Risk Modelling during the EIA phase of the project indicate unacceptable mortality levels of priority species, i.e., if during operation it exceeds these mortality thresholds, additional measures will have to be considered as part of an adaptive management strategy.	
Operational: Electrocutions on the 33kV MV network	Medium	(1) Underground cabling should be used as much as is practically possible. (2) If the use of overhead lines is unavoidable due to technical reasons, the Avifaunal Specialist must be consulted timeously to ensure that a raptor friendly pole design is used, and that appropriate mitigation is implemented pro-actively for complicated pole structures e.g., insulation of live components to prevent electrocutions on terminal structures and pole transformers. (3) Regular inspections of the overhead sections of the internal reticulation network must be conducted during the operational phase to look for carcasses, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins *et al.* 2015).	Low
Operational: Collisions with the 33kV MV network	Medium	Bird flight diverters (design specification should conform to types of devices that will be visible at night e.g. LED type bird flight diverters) should be installed on all the overhead line sections for the full span length directly associated with the proposed WEF according to the applicable Eskom standard at the time.	Low
Decommissioning: Displacement due to disturbance	Medium	(1) Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should	Low

Nature of Impact and Phase	Overall Impact Significance (Pre-Mitigation)	Proposed Mitigation	Overall Impact Significance (Post-Mitigation)
		be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry. (3) No off-road driving should be allowed. (4) No dismantling activities within 2.5km of the Martial Eagle nest (coordinates on request) should take place in the period March to December, which is the breeding season for these eagles.	

1.1.4 Grid Connection Components

The proposed Emvelo WEF grid connection will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of priority species due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the construction phase.
- Collisions with the overhead line in the operational phase.
- Mortality due to electrocutions on the proposed grid connection infrastructure in the operational phase.
- Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

1.1.4.1 Displacement of priority species due to disturbance linked to construction activities in the construction phase.

Construction activities could impact birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although this is often impractical to implement due to tight construction schedules. Powerline-sensitive species which are potentially most vulnerable to displacement due to disturbance are mostly ground-nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl, and White-bellied Bustard. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

1.1.4.2 Displacement due to habitat transformation in the construction phase.

During the construction of powerlines, service roads (jeep tracks), substations and other associated infrastructure, habitat destruction/transformation inevitably takes place. These activities could impact birds breeding, foraging, and roosting in, or in close proximity to the proposed OHL grid connection, when the habitat is transformed. Relevant to this development, very little mitigation can be applied to reduce this impact as the total permanent transformation of the natural habitat within the construction footprint of the on-site substation is unavoidable. In the case of the OHL, the direct habitat transformation is limited to the on-site substation and pole/tower footprints and the narrow access road/track under the proposed OHL. The loss of habitat in the substation footprint (1,5 ha will cover a small percentage of the habitat that regularly supports powerline sensitive species, and the resultant impact is likely to be minimal. Powerline sensitive species which are potentially most vulnerable to displacement due to habitat transformation are mostly ground-nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl and, White-bellied Bustard. The impact is rated as **medium** pre-mitigation, and it will decrease to **low** post-mitigation.

1.1.4.3 Collisions with the overhead line in the operational phase.

The up to 132kV OHL could pose a collision risk to virtually all power line sensitive avifauna, depending on where the spans are located. Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions, power line configuration, and visual capacity. Species potentially at risk are African Black Duck, African Darter, African Grass Owl, African Sacred Ibis, African Spoonbill, Black Heron, Black-bellied Bustard, Black-crowned Night Heron, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Blue-billed Teal, Cape Shoveler, Cape Teal, Cape Vulture, Denham's

Bustard, Egyptian Goose, Fulvous Whistling Duck, Glossy Ibis, Goliath Heron, Great Egret, Greater Flamingo, Grey Crowned Crane, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Mallard, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Bald Ibis, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Wattled Crane, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-bellied Bustard, White-breasted Cormorant, White-faced Whistling Duck, Yellow-billed Duck and other sensitive wetland species. The impact is rated as **high** pre-mitigation, and it will decrease to **medium** post-mitigation.

1.1.4.4 Mortality due to electrocutions on the proposed grid connection infrastructure in the operational phase

Electrocution refers to the scenario where a bird is perched, or attempts to perch, on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the voltage size of the proposed powerline and the pole/tower design. Should the proposed OHL be constructed using a 132kV tower specification, the electrocution impact for the majority of priority species will be negligible. The only priority species capable of bridging the clearance distances of an OHL constructed using this specification due to their size and gregarious nature is the Cape Vulture. The impact is rated as **medium** pre-mitigation, and it will decrease to **low** post-mitigation.

Electrocutions within the proposed on-site substation are possible, however, the likelihood of this impact on the more sensitive Species of Conservation Concern (SCC) is remote, as these species are unlikely to regularly utilise the infrastructure within the on-site substation station for perching or roosting. Powerline sensitive species that are more vulnerable to electrocutions are medium-sized raptors, corvids, owls, and certain species of waterbirds. As far as the substation is concerned, the following species are potentially at risk of electrocution: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey, and Yellow-billed Kite. The impact is rated as **low** pre- and post-mitigation.

1.1.4.5 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

The impact is likely to be similar to that during the construction phase.

1.1.4.6 Cumulative Impacts.

The are several existing HV lines in the 35km radius around the proposed Grid Connection Project, of which about 300km worth of OHL is contained in the 35km radius. The sum total of all the existing and planned HV lines in the 35km radius amounts to an estimated 383km, of which the proposed Emvelo WEF Grid Connection will constitute 30km, or about 8%. The contribution of the Emvelo WEF Grid Connection to the cumulative impact of all the grid connections and existing HV lines is thus low. However, the combined contribution of all the grid connections to the cumulative impact of the HV lines in the 35km radius, which is mainly collision mortality of priority species with the powerlines is high. The cumulative collision impact of all the grid connections and existing HV lines in the 35km radius is assessed to be **high** pre-mitigation and **medium** post-mitigation.

Table 2 summarises the expected impacts of the proposed grid connection and proposed mitigation measures per impact.

Table 2: Overall Impact Significance for the Grid Connection (Pre- and Post-Mitigation)

Nature of Impact and Phase	Overall Impact Significance (Pre-Mitigation)	Proposed Mitigation	Overall Impact Significance (Post-Mitigation)
Construction: Displacement due to disturbance	Medium	(1) Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry. (3) No construction should take place in the All-Infrastructure Exclusion Zones as indicated in Section 6.5 unless existing roads are to be upgraded. (4) No construction activities within 2.5km of the Martial Eagle nest (coordinates on request) should take place in the period March to December, which is the breeding season for these eagles.	Low
Construction: Displacement due to habitat transformation	Medium	(1) Removal of vegetation must be restricted to a minimum and must be rehabilitated to its former state where possible after construction. (2) Construction of new roads should only be considered if existing roads cannot be upgraded. (3) The recommendations of the biodiversity and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned to limit the impact of habitat transformation on priority species. (4) No construction should take place in All Infrastructure Exclusion Zones as indicated in Section 6.5.	Low
Operational: Electrocutions on the grid connection infrastructure	Medium	(1) A Vulture-friendly pole design should be used. (2) Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is also recommended. (3) Monitor the electrocution mortality in the substations. Apply mitigation if electrocution happens regularly.	Low

Nature of Impact and Phase	Overall Impact Significance (Pre-Mitigation)	Proposed Mitigation	Overall Impact Significance (Post-Mitigation)
Operational: Collisions with the overhead 132kV grid connection	High	(1) Mitigation in the form of Bird Flight Diverters on the OHL is required. The entire length of the OHL should be fitted with Eskom approved Bird Flight Diverters. Design specification should conform to types of devices that will be visible at night e.g. LED type bird flight diverters. (2) The operational monitoring programme must include regular monitoring (i.e. quarterly) of the power lines for collision mortalities.	Medium
Decommissioning: Displacement due to disturbance	Medium	(1) Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry. (3) No off-road driving should be allowed. (4) No dismantling activities within 2.5km of the Martial Eagle nest (coordinates on request) should take place in the period March to December, which is the breeding season for these eagles.	Low

1.2 Conclusions

1.2.1 Wind Energy Facility

It is imperative that the proposed 45-turbine layout be revised to avoid the recommended avifaunal no-go areas and turbine exclusion zones, including the rotor-swept areas. For detailed information on the exclusion areas, please refer to Section 6.5. The proposed Emvelo WEF is expected to have high and medium impacts on avifauna, which must be addressed through appropriate mitigation measures to reduce the impact to a medium and low level.

1.2.2 Grid Connection Components

The proposed Emvelo WEF Grid Connection will have a moderate impact on avifauna which, in most instances, could be reduced to a low impact through appropriate mitigation. From an avifaunal perspective OHL Alternatives 1 and 2 are least preferred as they have the longest span length and therefore pose a higher collision risk to birds. The Preferred OHL Alternative is preferred over OHL Alternative 3 as it avoids the 2.5km No Disturbance Buffer around the Martial Eagle nest (coordinates provided on request). The development is supported, provided the mitigation measures listed in this report are strictly implemented.

2. ENVIRONMENTAL SENSITIVITIES

According to the DFFE Screening Tool Animal Species Theme, the WEF Project Site and the Grid Connection PAOI are classified as having a **Medium to High** sensitivity. The Medium and High sensitivity rating for avifauna is due to the possible occurrence of several species of conservation concern (SCC) namely: Grey Crowned Crane (Globally and Regionally Endangered), Martial Eagle (Globally and Regionally Endangered), Southern Bald Ibis (Globally and Regionally Vulnerable), White-bellied Bustard (Regionally Vulnerable), Secretarybird (Globally Endangered and Regionally Vulnerable) and African Grass Owl (Regionally Vulnerable).

A **High** sensitivity classification for the WEF Project Site and the Grid Connection PAOI was confirmed during the on-site surveys. The following SCC were recorded on site and their distribution, conservation status and current threats will be discussed during the EIA phase:

- African Marsh Harrier (Regionally Endangered)
- Denham's Bustard (Globally Near Threatened, Regionally Vulnerable)
- Secretarybird (Globally Endangered, Regionally Vulnerable)
- White-bellied Bustard (Regionally Vulnerable),
- Blue Crane (Globally Vulnerable, Regionally Near Threatened)
- Grey Crowned Crane (Globally and Regionally Endangered)
- Martial Eagle (Globally and Regionally Endangered)
- Lanner Falcon (Regionally Vulnerable),
- Greater Flamingo (Regionally Near Threatened)
- Southern Bald Ibis (Regionally and Globally Vulnerable)
- Cape Vulture (Globally Vulnerable and Regionally Endangered)
- Yellow-breasted Pipit (Regionally and Globally Vulnerable)

Specialist Sensitivity Analysis and Verification

The following avifaunal sensitivities were identified in and near the WEF Project Site and the Grid Connection PAOI (Refer to Section 6.5 and 6.6 for more details):

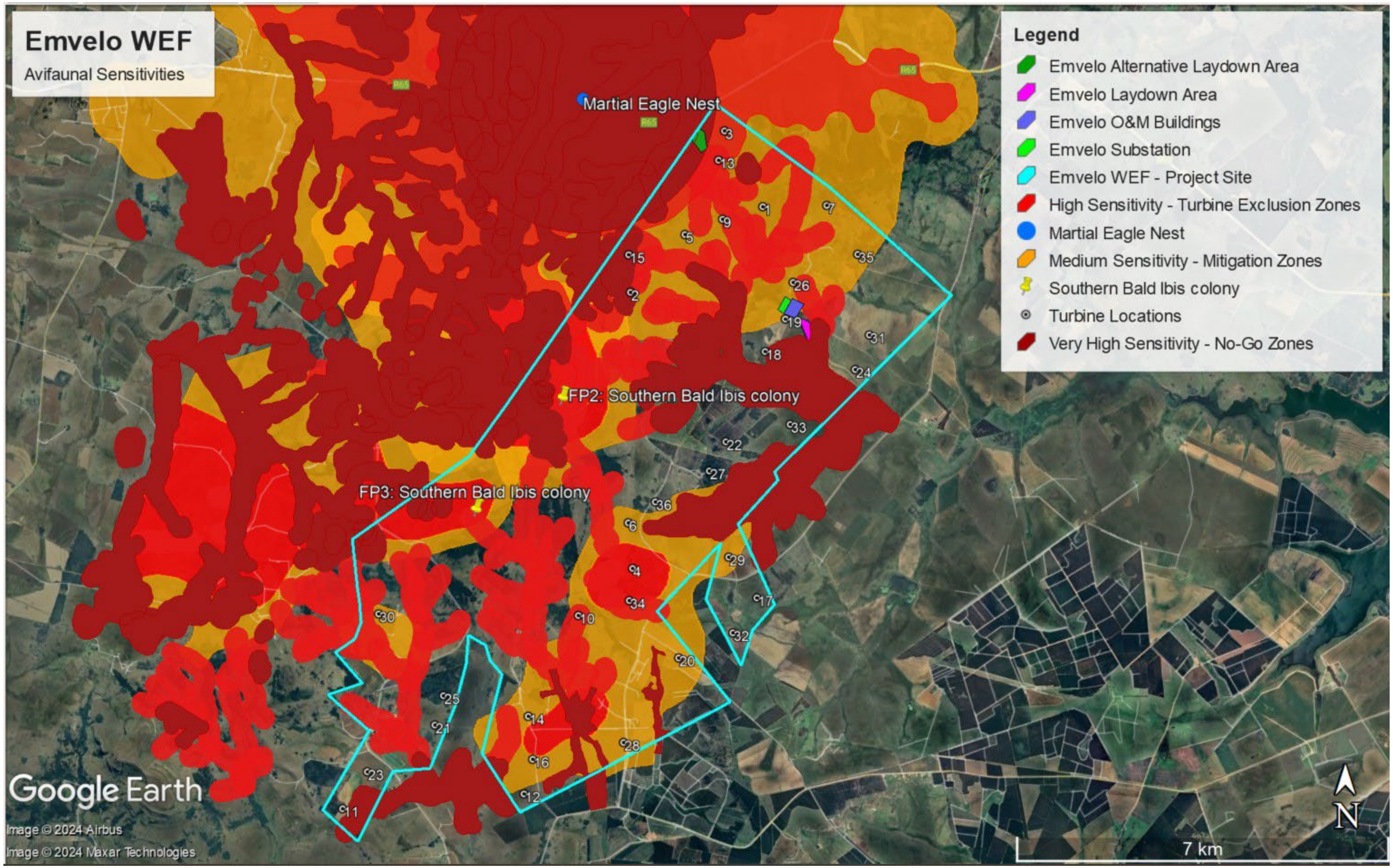

Figure (i): Avifaunal Sensitivities identified for the Emvelo WEF Project.

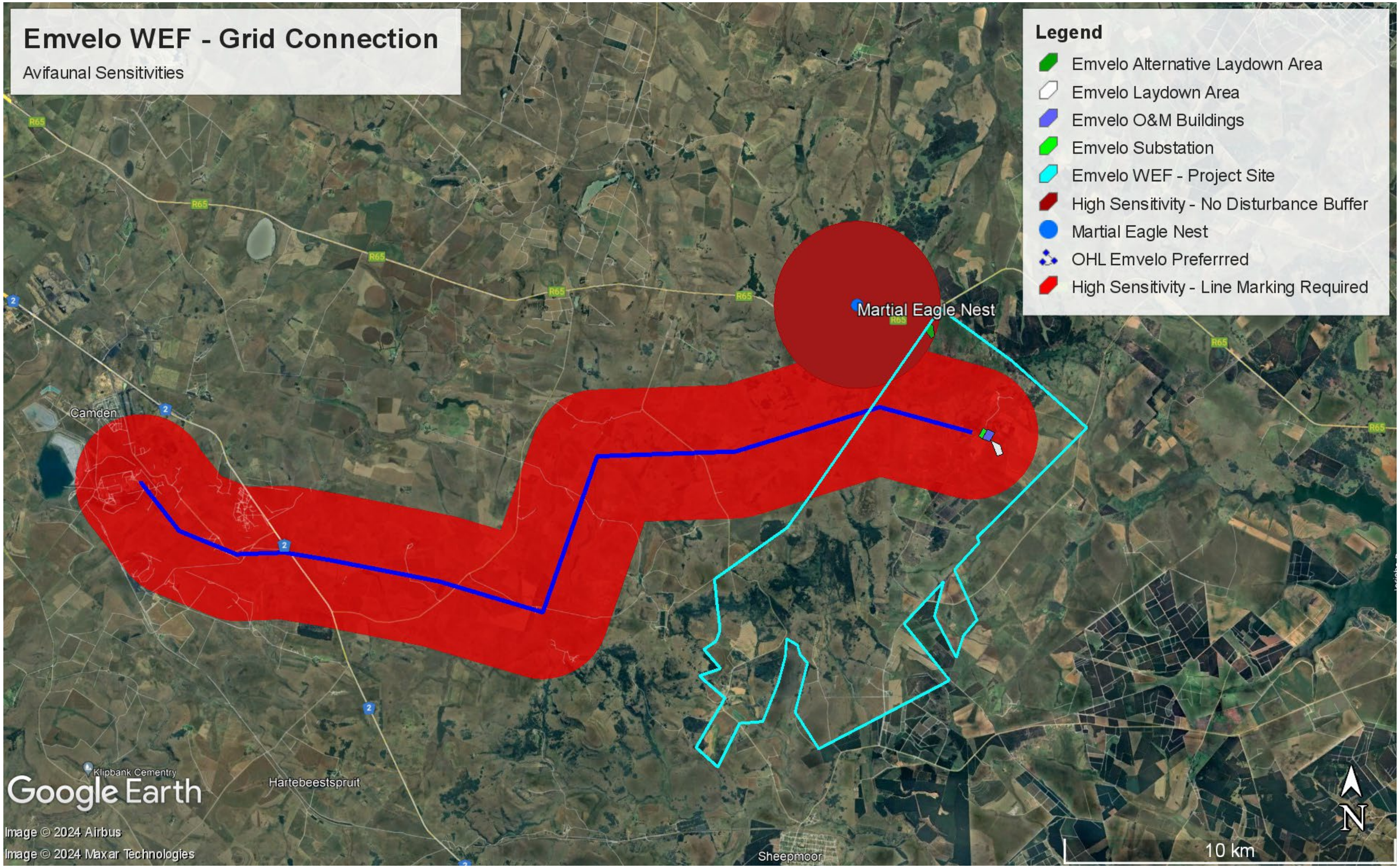

Figure (ii): Avifaunal Sensitivities identified for the Emvelo Grid Connection. NOTE: Due to the large amount of wetlands/drainage lines and natural grasslands in the area it is recommended that the entire OHL be fitted with Bird Flight Diverters.

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix 2
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	
c) an indication of the scope of, and the purpose for which, the report was prepared;	Sections 1 & 2
(cA) an indication of the quality and age of base data used for the specialist report;	Sections 1 & 2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 5 & 6
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Appendices 10 & 11
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Sections 1 & 2
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 6
g) an identification of any areas to be avoided, including buffers;	Section 6
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 6
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Section 6
k) any mitigation measures for inclusion in the EMPr;	Sections 6.5 & 6.6, Appendices 7 & 8
l) any conditions for inclusion in the environmental authorisation;	Sections 6.5 & 6.6, Appendices 7 & 8
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Sections 6.5 & 6.6, Appendices 7 & 8

n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities, or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 8
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
q) any other information requested by the competent authority.	Not applicable
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	All sections

AVIFAUNAL SPECIALIST ASSESSMENT

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

GLOSSARY OF TERMS

Definitions	
Broader Area	A consolidated data set for a total of 12 pentads where the application sites are located.
Powerline Priority Species	Priority species were defined as species which could potentially be impacted by power line collisions or electrocutions, based on specific morphological and/or behavioural characteristics[1]. Priority species were further subdivided into raptors, waterbirds, terrestrial birds, and corvids.
Wind Priority Species	Priority species for wind energy development were identified from the most recent (November 2014) list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Retief et al. 2012).

[1] Other species were also considered in the case of potential displacement due to disturbance associated with the construction of the grid.

LIST OF ABBREVIATIONS

BA	Basic Assessment
BGIS	Biodiversity Geographic Information System
BLSA	BirdLife South Africa
DEFF	Department of Forestry, Fisheries and the Environment
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
HV	High Voltage
IBA	Important Bird Area
IKA	Index of Kilometric Abundance
IUCN	International Union for Conservation of Nature
kV	Kilovolt
MV	Medium Voltage
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
OHL	Overhead line
PV	Photovoltaic
REDZ	Renewable Energy Development Zone
SABAP1	First Southern African Bird Atlas Project
SABAP2	Second Southern African Bird Atlas Project
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African Biodiversity Institute
SAPAD	South Africa Protected Areas Database
WEF	Wind Energy Facility

1. INTRODUCTION

Respective Special Purpose Vehicles (SPVs) are proposing the development of a commercial wind farm cluster that is expected to comprise three separate Wind Energy Facilities (WEFs) namely Rochdale WEF (up to 240 MW), Sheepmoor WEF (up to 360 MW) and Emvelo WEF (up to 200 MW). Each WEF will apply for its own grid connection route to connect to the existing Eskom Uitkoms Substation, via approximately 20 – 32 km long 132 kV overhead transmission lines. The powerlines are proposed and are assessed within a 300 m assessment corridor each. The proposed development sites are located near Ermelo and falls within the Msukaligwa Local Municipality and the Gert Sibande District Municipality, in the Mpumalanga Province.

It is intended that these projects would be bid in the seventh bidding window of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) with the aim of evacuating the generated power from the WEFs into the National Eskom Grid. This will aid in the diversification and stabilisation of the country's electricity supply in line with the objectives of the Integrated Resource Plan (IRP).

This report serves as the **Avifaunal Specialist Study (Scoping Phase)** for the proposed **Emvelo WEF**.

Emvelo WEF is proposed to comprise up to 45 turbines with a maximum output capacity of up to 200 MW. The WEF will be located on nineteen (19) land parcels and will have an anticipated lifespan of 20 – 25 years. The final design which will be requested for approval in the EA, will be determined based on the outcome of the specialist studies undertaken for the EIA phase of the development. The proposed turbine footprints and associated facility infrastructure will cover an area of up to 180 ha after rehabilitation, depending on final layout design. It is proposed that an on-site substation with a capacity up 132 kV and an up to 132 kV Overhead Powerline (OHPL) of approximately 30 km (300 m corridor) in distance, traversing eighteen (18) land parcels, be constructed to connect the proposed WEF to the Eskom Uitkoms Substation.

According to the Southern African Bird Atlas Project (SABAP2) a total of 253 bird species could potentially occur in the Broader Area where the proposed Emvelo WEF and Gird Connection Infrastructure are located. Of the 253 species, 38 species are classified as priority species for wind energy developments. Of the wind energy development priority species in the Broader Area, 32 (84%) have been recorded during the pre-construction monitoring conducted thus far. Of the 253 species, 76 are considered power line sensitive species and 57 (75%) of the power line sensitive species have been recorded during the pre-construction monitoring.

1.1 Terms of Reference

The terms of reference for this report are the following:

- Describe the affected environment from an avifaunal perspective;
- Discuss gaps in baseline data and other limitations;
- List and describe the expected impacts;
- Assess and evaluate the potential impacts;
- Give a considered opinion whether the project is fatally flawed from an avifaunal perspective; and
- If not fatally flawed, recommend mitigation measures to reduce the expected impacts.

For the general Terms of Reference for all specialist report, please see **Appendix 1.**

1.2 Specialist Credentials

Please see **Appendix 2** Specialist CVs.

1.3 Assessment Methodology

The following methods and sources were used to compile this report:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP2) was obtained from the University of Cape Town (https://sabap2.birdmap.africa/), to ascertain which species occur within the **Broader Area** i.e. within a block consisting of 12 pentads (**Table 1**, **Figure 1**). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 9 km. From 2007 to date, a total of 179 full protocol lists (i.e., surveys lasting a minimum of two hours each) have been completed for this area. In addition, 218 ad hoc protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2022.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation in the WEF application site was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2012 beta2) from the South African National Biodiversity Institute website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org).
- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2023) was used in order to view the Broader Area on a landscape level and to help identify sensitive bird habitat.
- Priority species for wind energy developments were identified from the most recent (November 2014) list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Retief *et al.* 2012).
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the WEF and Grid application site.
- The primary source of information on avifaunal diversity, abundance and flight patterns at the site were the results of a pre-construction programme conducted over four seasons (2022–2023) at the proposed Mulilo WEF Cluster (Emvelo WEF, Rochdale WEF and Sheepmoor WEF application sites). The primary methods of data capturing were walk transect counts, drive transect counts, focal point monitoring, vantage point counts and incidental sightings (see **Appendix 3** for a detailed explanation of the monitoring methods).
- Information gained from pre-construction monitoring at four potential wind farm sites in close proximity to the current site, namely Ujekamanzi WEFs 1–2 and Camden WEFs 1–2 also assisted in providing a comprehensive picture of avifaunal abundance and diversity in the greater area, including the current study area.

Table 3: The number of SABAP2 lists completed for the Broader Area

Pentad	Full protocol lists	Ad hoc protocol lists
2630_3005	22	11
2630_3010	17	15
2630_3015	10	17
2630_3020	5	10

Pentad	Full protocol lists	Ad hoc protocol lists
2635_3005	23	44
2635_3010	13	5
2635_3015	23	8
2635_3020	15	1
2640_3005	26	14
2640_3010	6	32
2640_3015	15	36
2640_3020	4	25
Total	**179**	**218**

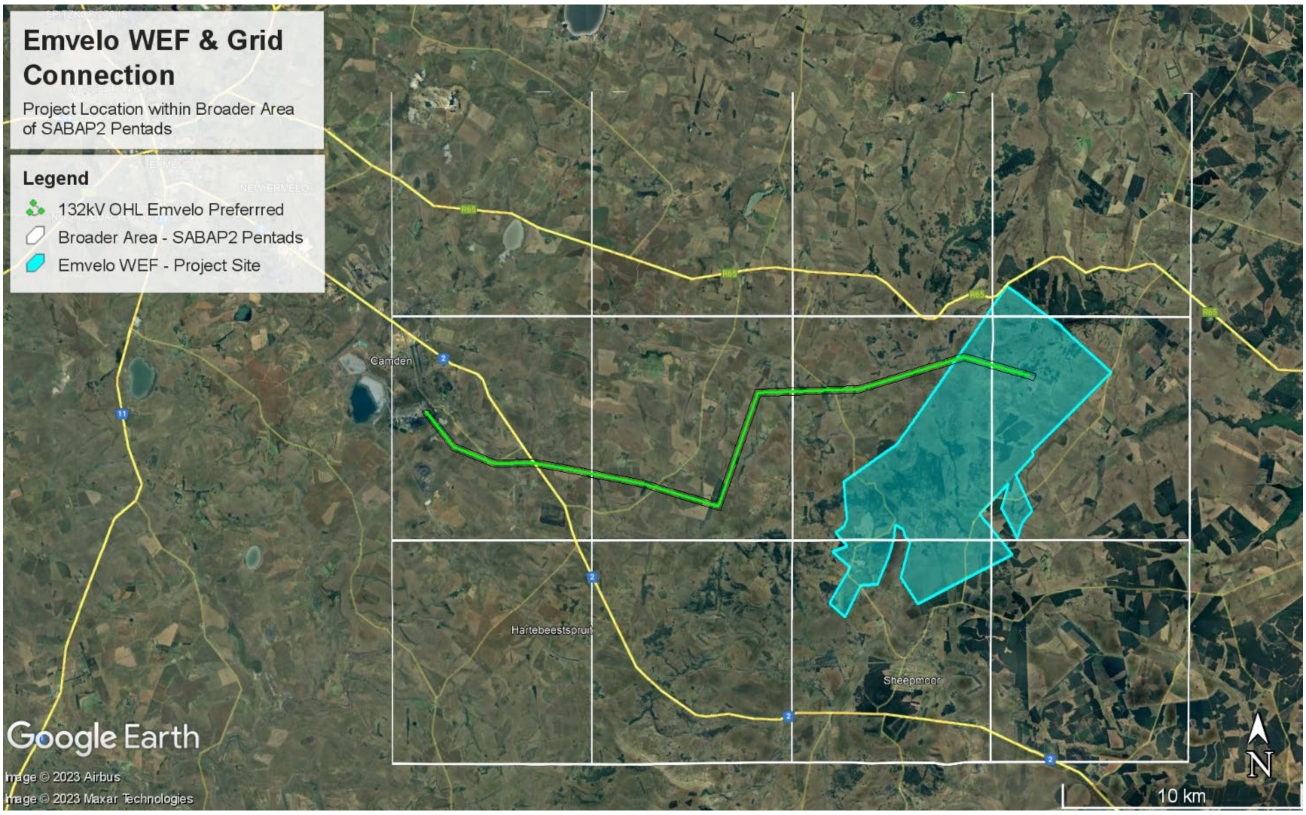

Figure 1: Project Location within Broader Area of 12 SABAP2 Pentads.

2. ASSUMPTIONS AND LIMITATIONS

This study made the basic assumption that the sources of information used are reliable and accurate. The following must be noted:

- The SABAP2 dataset is a comprehensive dataset which provides a reasonably accurate snapshot of the avifauna which could occur at the proposed site. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, general knowledge of the area, and the results of the pre-construction monitoring conducted over four seasons.
- Conclusions in this study are based on experience of these and similar species at wind farm developments in different parts of South Africa. However, bird behaviour can never be predicted with absolute certainty.

- To date, only one peer-reviewed scientific paper has been published on the impacts wind farms have on birds in South Africa (Perold *et al*. 2020). The precautionary principle was therefore applied throughout. The World Charter for Nature, which was adopted by the UN General Assembly in 1982, was the first international endorsement of the precautionary principle. The principle was implemented in an international treaty as early as the 1987 Montreal Protocol and, among other international treaties and declarations, is reflected in the 1992 Rio Declaration on Environment and Development. Principle 15 of the 1992 Rio Declaration states that: "in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation."
- According to the specifications received from the proponent, the 33kV medium-voltage lines will be buried next to the roads where practically feasible. It was therefore assumed that there could be 33kV overhead lines which could pose an electrocution risk to priority species.
- **Priority species for wind energy developments** were identified from the updated list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Retief *et al*. 2012).
- Priority species for powerline developments (i.e., **power line sensitive species**) were defined as species which could potentially be impacted by power line collisions or electrocutions, based on specific morphological and/or behavioural characteristics. Species classes which fall under these categories are raptors, large terrestrial birds, waterbirds, and crows.
- The **Project Area of Impact (PAOI)** of the proposed 132kV grid connection was assumed to be a 2km area around the proposed alignments.

3. TECHNICAL DESCRIPTION

3.1 Project Location

Respective Special Purpose Vehicles (SPVs) are proposing the development of a commercial wind farm cluster, Mulilo WEF Cluster, that is expected to comprise three separate Wind Energy Facilities (WEFs) namely, Rochdale WEF (up to 240 MW), Sheepmoor WEF (up to 360 MW) and Emvelo WEF (up to 200 MW). Each WEF will apply for its own grid connection route to connect to the existing Eskom Uitkoms Substation, via approximately 20 – 32 km long 132 kV overhead transmission lines. The powerlines are proposed and are assessed within a 300 m assessment corridor each.

The proposed development sites are located near Ermelo and falls within the Msukaligwa Local Municipality and the Gert Sibande District Municipality, in the Mpumalanga Province (**Figure 2**).

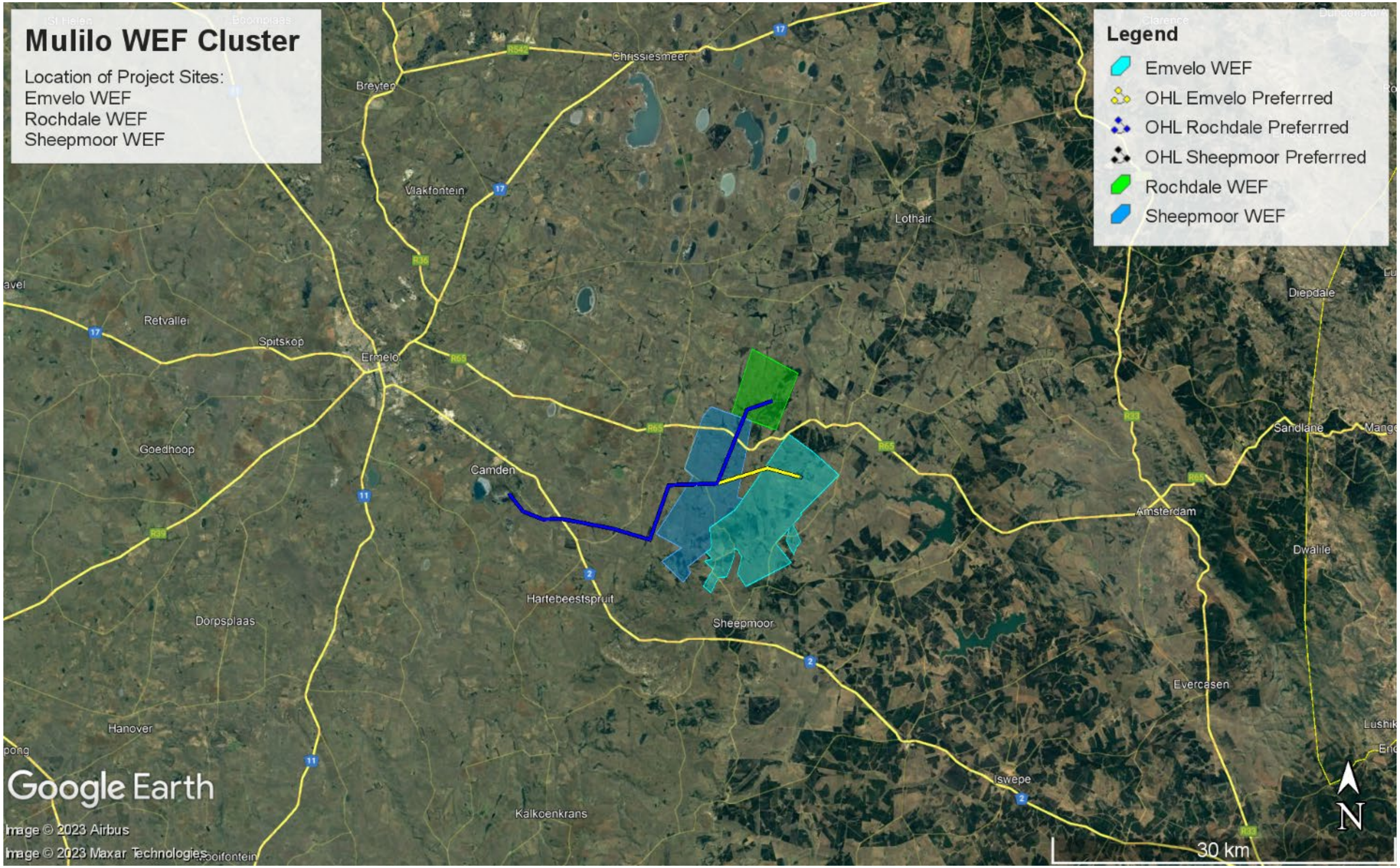

Figure 2: Regional Context Map

3.1.1 WEF

The **Emvelo WEF** application site as shown on the locality map below (**Figure 3**) is approximately 7031 hectares (ha) in extent and incorporates the following farm portions:

Emvelo WEF			
Landowner	**Farm Name**	**Farm No.**	**Portion No.**
DC Geldenhuys Family Trust	Remainder of the Farm Schiedam No. 274	274	RE
Randell's Ranch Trust (Philip Randall)	Portion 2 of the Farm Schiedam No. 274	274	2
Antonette Swart	Remainder Portion 1 of the Farm Schiedam No. 274	274	1
Henry Goodwin Geldenhuys	Portion 6 of the Farm Schiedam No. 274	274	6
Loufried Testamentere Trust	Portion 5 of the Farm Schiedam No. 274	274	5
Josef & Merinda Loraine Benjamin van Tonder	Remaining Extent Ptn 1 of the Farm Vaalbank No. 285	285	1
Josef & Merinda Loraine Benjamin van Tonder	Portion 5 of the Farm Vaalbank No. 285	285	5
Johan Saaiman Trust	Portion 9 of the Farm Waaihoek No. 286	286	9
Johannes Stephanus Roberts	Remainder Portion 2 of the Farm Waaihoek No. 286	286	2
Johannes Stephanus Roberts	Remainder Portion 6 of the Farm Waaihoek No. 286	286	6
Johannes Stephanus Roberts	Remainder Portion 13 of the Farm Waaihoek No. 286	286	13
JMJ Trust	Portion 7 of the Farm Waaihoek No. 286	286	7
JMJ Trust	Portion 10 of the Farm Waaihoek No. 286	286	10
JMJ Trust	Portion 5 of the Farm Waaihoek No. 286	286	5
Josua Meyer Trust	Waaihoek	286	14
Josua Meyer Trust	Waaihoek	286	3
Josua Meyer Trust	Waaihoek	286	12
NWJ Vorster Trust	Remaining Extent of the Farm Klipfontein No. 283	283	RE
Josua Meyer Trust	Bosjesspruit	291	7

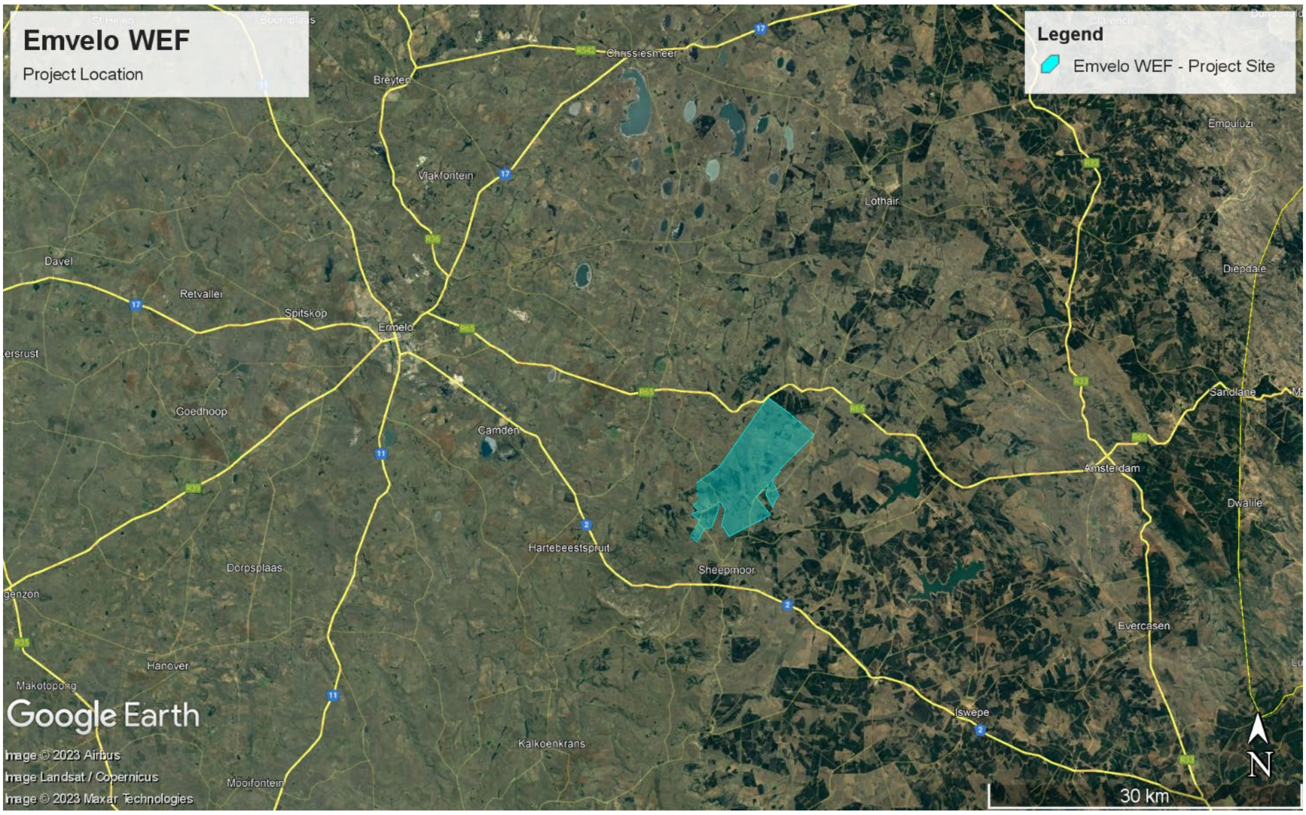

Figure 3: Emvelo WEF Site Locality.

3.1.2 Grid Connection

It is proposed that an on-site substation with a capacity up 132 kV and an up to 132 kV Overhead Powerline (OHPL) of approximately 30 km (300 m corridor) in distance, traversing eighteen (18) land parcels, be constructed to connect the proposed WEF to the Eskom Uitkoms Substation. The preferred 132kV OHL route alignment and Project Area of Impact (PAOI) are shown in **Figure 4**.

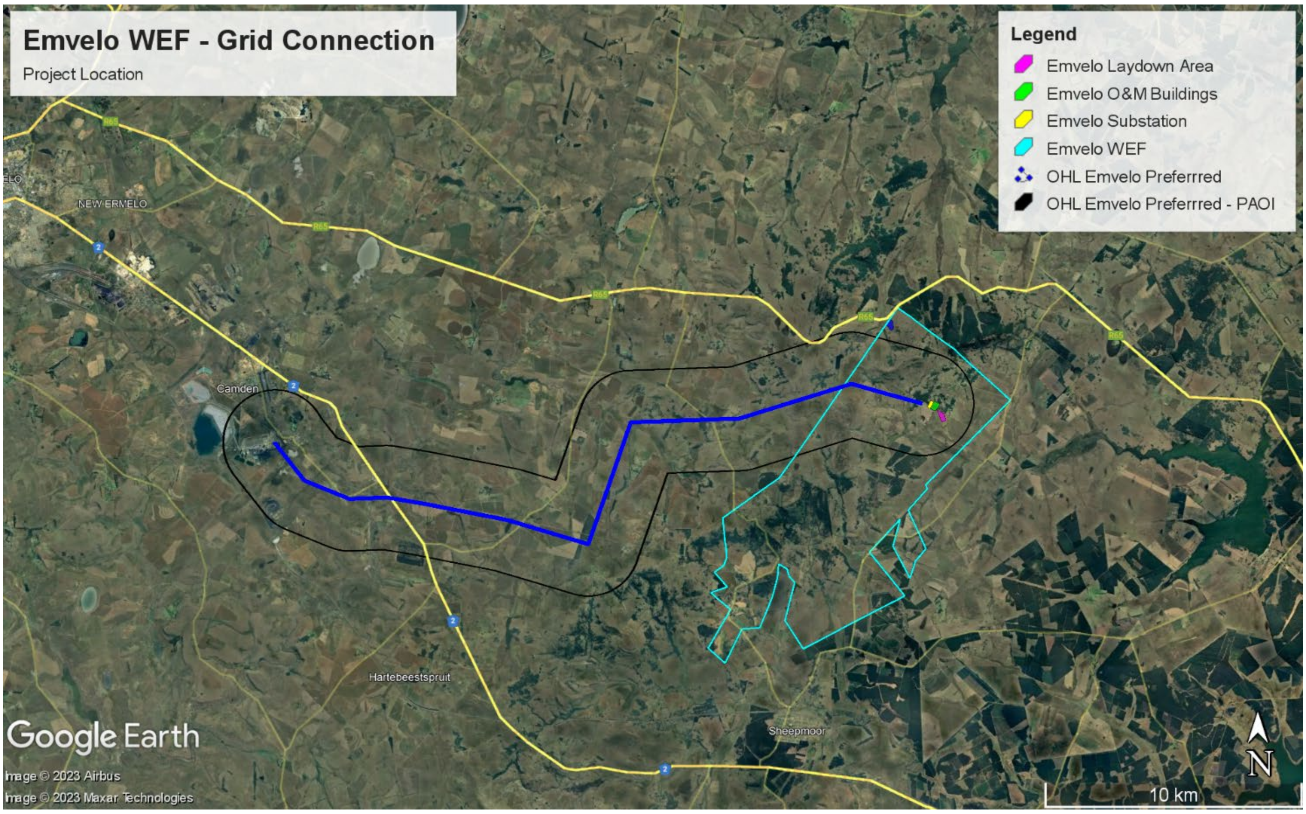

Figure 4: Proposed 132kV Power Line Route Alignment.

Emvelo WEF Grid Connection			
Landowner	**Farm Name**	**Farm No.**	**Portion No.**
Randell's Ranch Trust (Philip Randall)	Schiedam	274	2
National Government - of the Republic of South Africa	Onverwacht	273	1
Shammah Trust	Portion 7 of the Farm Onverwacht No. 273	273	7
Harrob Beleggings Pty Ltd (Jan Roberts)	Portion 8 of the Farm Onverwacht No. 273	273	8
Harrob Beleggings Pty Ltd (Jan Roberts)	Portion 3 of the Farm Onverwacht No. 287	287	3
Van Der Merwe Broers Trust	Portion 9 of the Farm Zwartwater No. 288	288	9
Merwe Johannes Jacobus Van Der	Portion 10 of the Farm Zwartwater No. 288	288	10
Kansvat Beleggings Pty Ltd	Zwartwater	288	2
National Government of SA	Zwartwater	288	1
Dream World Inv 450 Pty Ltd	Weltevreden	289	10
Dream World Inv 450 Pty Ltd	Weltevreden	289	11
Dream World Inv 450 Pty Ltd	Weltevreden	289	6
Van Der Merwe Broers Trust	Weltevreden	289	RE/3
National Government of SA	Witpunt	267	RE/7

Emvelo WEF Grid Connection			
National Government of SA	Mooiplaats	290	7
National Government of SA	Mooiplaats	290	8
Kayipheli Trust	Witpunt	267	29
Eskom Holdings Ltd	Camden Power Station	329	RE

3.2 Project Description

Emvelo WEF is proposed to comprise up to 45 turbines with a maximum output capacity of up to 200 MW. The WEF will be located on nineteen (19) land parcels and will have an anticipated lifespan of 20 – 25 years. The final design which will be requested for approval in the EA, will be determined based on the outcome of the specialist studies undertaken for the EIA phase of the development. The proposed turbine footprints and associated facility infrastructure will cover an area of up to 180 ha after rehabilitation, depending on final layout design.

It is proposed that an on-site substation with a capacity up 132 kV and an up to 132 kV Overhead Powerline (OHPL) of approximately 30 km (300 m corridor) in distance, traversing eighteen (18) land parcels, be constructed to connect the proposed WEF to the Eskom Uitkoms Substation.

The proposed technical details of each WEF are presented in the table below:

Developer / Applicant	**Rochdale Wind Energy Facility (Pty) LTD**	**Sheepmoor Wind Energy Facility (Pty) LTD**	**Emvelo Wind Energy Facility (Pty) LTD**
DFFE Reference	To be confirmed	To be confirmed	To be confirmed
WEF Generation Capacity	Up to 240 MW	Up to 360 MW	Up to 200 MW
Site Access	Locality to be confirmed. Total width up to 15 m (12 m after rehabilitation) consisting of up to 3m width for underground 33 kV reticulation.	Locality to be confirmed. Total width up to 15 m (12 m after rehabilitation) consisting of up to 3m width for underground 33 kV reticulation.	Locality to be confirmed. Total width up to 15 m (12 m after rehabilitation) consisting of up to 3m width for underground 33 kV reticulation.
Number of Turbines	Up to 30	Up to 45	Up to 45
Hub Height from ground level	Up to 150 m	Up to 150 m	Up to 150 m
Blade Length	Up to 110 m	Up to 110 m	Up to 110 m
Rotor Diameter	Up to 220 m	Up to 220 m	Up to 220 m
Length of internal roads	Unknown at this point.	Unknown at this point.	Unknown at this point.
Width of internal roads	Up to 12 m to be rehabilitated to up to 9 m.	Up to 12 m to be rehabilitated to up to 9 m.	Up to 12 m to be rehabilitated to up to 9 m.
On-site substation capacity	Up to 132 kV	Up to 132 kV	Up to 132 kV
Proximity to grid connection	Approximately 31.5 km	Approximately 22.3 km	Approximately 30 km

Grid Connection Capacity	Up to 132 kV	Up to 132 kV	Up to 132 kV
Temporary turbine construction laydown and storage areas.	Crane platforms and hardstand laydown area up to 24 ha (Up to 0.8 ha per turbine)	Crane platforms and hardstand laydown area up to 36 ha (Up to 0.8 ha per turbine)	Crane platforms and hardstand laydown area up to 36 ha (Up to 0.8 ha per turbine)
Permanent footprint area dimensions, including roads, turbine hardstand areas, O&M buildings, and battery pad.	O&M: Up to 0.5 ha Hardstand areas: Up to 0.75 ha Total area of final footprint (including roads): up to 180 ha	O&M: Up to 0.5 ha Hardstand areas: Up to 0.75 ha Total area of final footprint (including roads): up to 180 ha	O&M: Up to 0.5 ha Hardstand areas: Up to 0.75 ha Total area of final footprint (including roads): up to 180 ha
Operations and maintenance buildings (O&M building) with parking area	Up to 0.5 ha	Up to 0.5 ha	Up to 0.5 ha
BESS Area	Approximately 400 x 400 m	Approximately 400 x 400 m	Approximately 400 x 400 m
Height of fencing	2.8 m	2.8 m	2.8 m
Type of fencing	Where site offices are required, temporary screen fencing used to screen offices from the wider landscape.	Where site offices are required, temporary screen fencing used to screen offices from the wider landscape.	Where site offices are required, temporary screen fencing used to screen offices from the wider landscape.

3.3 Layout Alternatives

3.3.1 Wind Energy Facility

Design and layout alternatives will be considered and assessed as part of the EIA Phase. These include alternatives for the laydown areas. The proposed WEF layout is shown in **Figure 5** below.

Figure 5: Proposed Layout of Emvelo WEF.

3.3.2 Grid Components

The grid connection infrastructure proposal includes four (4) power line route alignment alternatives (**Figure 6**), each within a 300m wide assessment corridor (150m on either side of power line). These alternatives will be considered and assessed as part of the EIA process and will be amended or refined to avoid identified environmental sensitivities.

The four options are:

- 132kV OHL Preferred – 30 km
- 132kV OHL Alternative 1 – 33 km
- 132kV OHL Alternative 2 – 33 km
- 132kV OHL Alternative 3 – 29.3 km

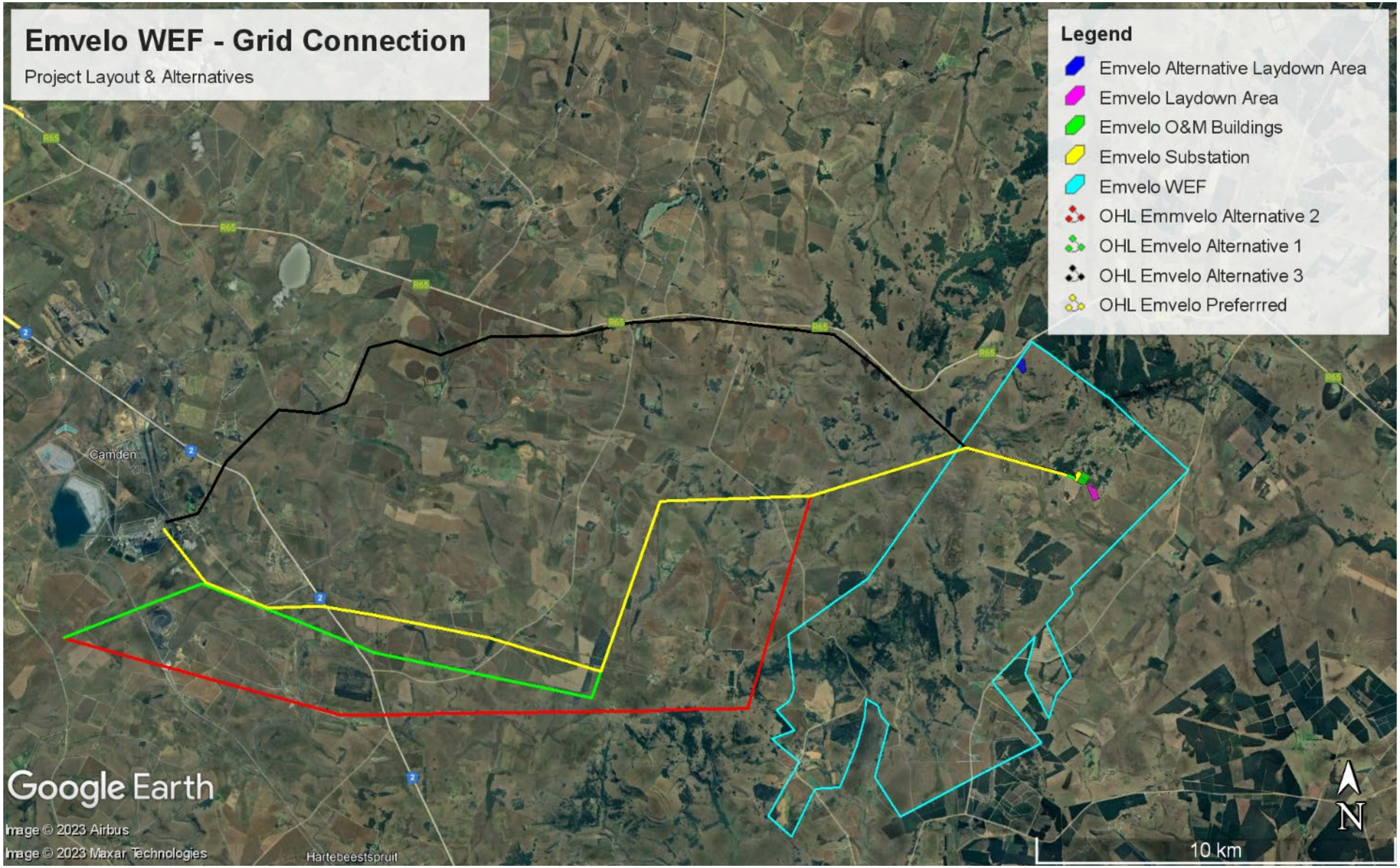

Figure 6: Proposed layout alternatives for the Emvelo WEF Grid Connection.

3.3.3 *No-go Alternative*

The 'no-go' alternative is the option of not undertaking the proposed WEF and / or Grid Connection Infrastructure projects. Hence, if the 'no-go' option is implemented, there would be no development. This alternative would result in no environmental impacts from the proposed projects on the site or surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report.

4. LEGAL REQUIREMENT AND GUIDELINES

4.1 Agreements and Conventions

Table 4 below lists agreements and conventions which South Africa is party to, and which is directly relevant to the conservation of avifauna (BirdLife International 2020).

Table 4: Agreements and conventions which South Africa is party to, and which is relevant to the conservation of avifauna.

Convention	Description	Geographic Scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland, and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: The conservation of biological diversity The sustainable use of the components of biological diversity The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the United Nations Environment Programme, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global

Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

4.2 National Legislation

4.2.3 Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –
(a) to an environment that is not harmful to their health or well-being; and
(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
(i) prevent pollution and ecological degradation;
(ii) promote conservation; and
(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

4.2.4 The National Environmental Management Act (Act No. 107 of 1998) (NEMA)

The National Environmental Management Act (Act No. 107 of 1998) (NEMA) creates the legislative framework for environmental protection in South Africa and is aimed at giving effect to the environmental right in the Constitution. It sets out several guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally, and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated.

NEMA also provides that a wide variety of listed developmental activities, which may significantly affect the environment, may be performed only after an environmental impact assessment has been done and authorization has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020) is applicable in the case of powerline developments. In the case of wind energy developments, the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species where the output is 20MW or more (Government Gazette No 43110, 20 March 2020) is applicable.

4.2.5 The National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) and the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations)

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act 10 of 2004 read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals. The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

4.3 Provincial Legislation

4.3.1 Mpumalanga Nature Conservation Act 10 of 1998

The current legislation applicable to the conservation of fauna and flora in the province is the Mpumalanga Nature Conservation Act 10 of 1998. It consolidated and amended the laws relating to nature conservation within the province and provides for matters connected therewith. All birds are classified as Protected Game (Section 4 (1) (b)), except those listed in Schedule 3, which are classified as Ordinary Game (Section 4 (1)(c)).

4.4 Best Practice Guidelines

The South African “Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa” (Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2011) are followed for this study. This document was published by the Endangered Wildlife Trust (EWT) and Birdlife South Africa (BLSA) in March 2011, and subsequently revised in 2011, 2012 and 2015.

5. DESCRIPTION OF THE RECEIVING ENVIRONMENT

5.1 Natural Environment

The WEF and Grid Connection Project Site is situated in the Grassland Biome, in the Mesic Highveld Grassland Bioregion (Mucina & Rutherford 2006). The proposed site is comprised of undulating grassland plains, with small, scattered patches of dolerite outcrops in areas, low hills, pan depressions and drainage lines with associated wetland areas. Vegetation on site consists predominantly of Wakkerstroom Montane Grassland and Eastern Highveld Grassland. Wakkerstroom Montane Grassland comprises predominantly short montane grasslands on the plateaus and the relatively flat areas, with short forest and *Leucosidea* (ouhout) thickets occurring along steep, mainly east-facing slopes, and drainage areas (Mucina & Rutherford 2006). Eastern Highveld Grassland vegetation is comprised of a short, closed grassland cover, largely dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn (Mucina & Rutherford 2006). The black wattle *Acacia mearnsii* is an aggressive invader of riparian areas. Stands of alien *Eucalyptus* and *Pinus* species are scattered throughout the proposed development area.

Ermelo has a temperate climate. January is the warmest month with a maximum temperature of 24.4 C°. June and July are the coldest months, with a minimum temperature of 0.2 C°. The driest month is June with an average of 3 mm of precipitation. Most of the precipitation falls in December, averaging 151 mm. The average annual precipitation is around 756 mm (Climate – data.org 2021). The topography in the project area is characterised by gentle undulating plains. The predominant land use for this area is livestock grazing with some crop farming, mostly maize, soya beans and pastures. The livestock in the study area is a combination of mostly sheep and cattle, with a few horses.

5.2 Modified Environment

Whilst the distribution and abundance of the bird species in the Broader Area are mostly associated with natural vegetation, as this comprises virtually all the habitat, it is also necessary to examine the few external modifications to the environment that have relevance for birds.

The following avifaunal-relevant anthropogenic habitat modifications were recorded within the Broader Area:

- **Surface Water:** The WEF Project Site and Grid Connection PAOI contains several man-made sources of surface water such as ground dams and boreholes. These sources of water are important for birds for drinking and bathing.
- **Alien Trees:** There are clumps and stands of alien trees throughout the WEF Project Site and Grid Connection PAOI. Alien trees could attract a variety of bird species for the purposes of nesting and roosting.
- **Agriculture:** The predominant land use for this area is livestock grazing with some crop farming, mostly maize, soya beans and pastures. Birds could be attracted to these areas in search of food.

Appendix 4 provides a photographic record of the habitat at the application site.

5.3 Important Bird Areas (IBAs)

The Project Site partially overlaps with one Important Bird Area (IBA), namely the Grasslands IBA SA020 (**Figure 7**). Due to the proximity of the IBA, it is possible that some priority species that are also IBA trigger species, and occur either permanently or sporadically in the IBA, might be impacted by the project. Species recorded in the Broader Area that fall in this category include the following:

- Secretarybird
- Pied Avocet
- Denham's Bustard
- Blue Crane
- Grey Crowned Crane
- Wattled Crane
- White-backed Duck
- Yellow-billed Duck
- Martial Eagle
- Lanner Falcon
- Greater Flamingo
- Lesser Flamingo
- Black-necked Grebe
- Little Grebe
- African Marsh Harrier
- Black Harrier
- Southern Bald Ibis
- African Grass Owl
- Southern Pochard
- Cape Shoveler
- White-winged Tern

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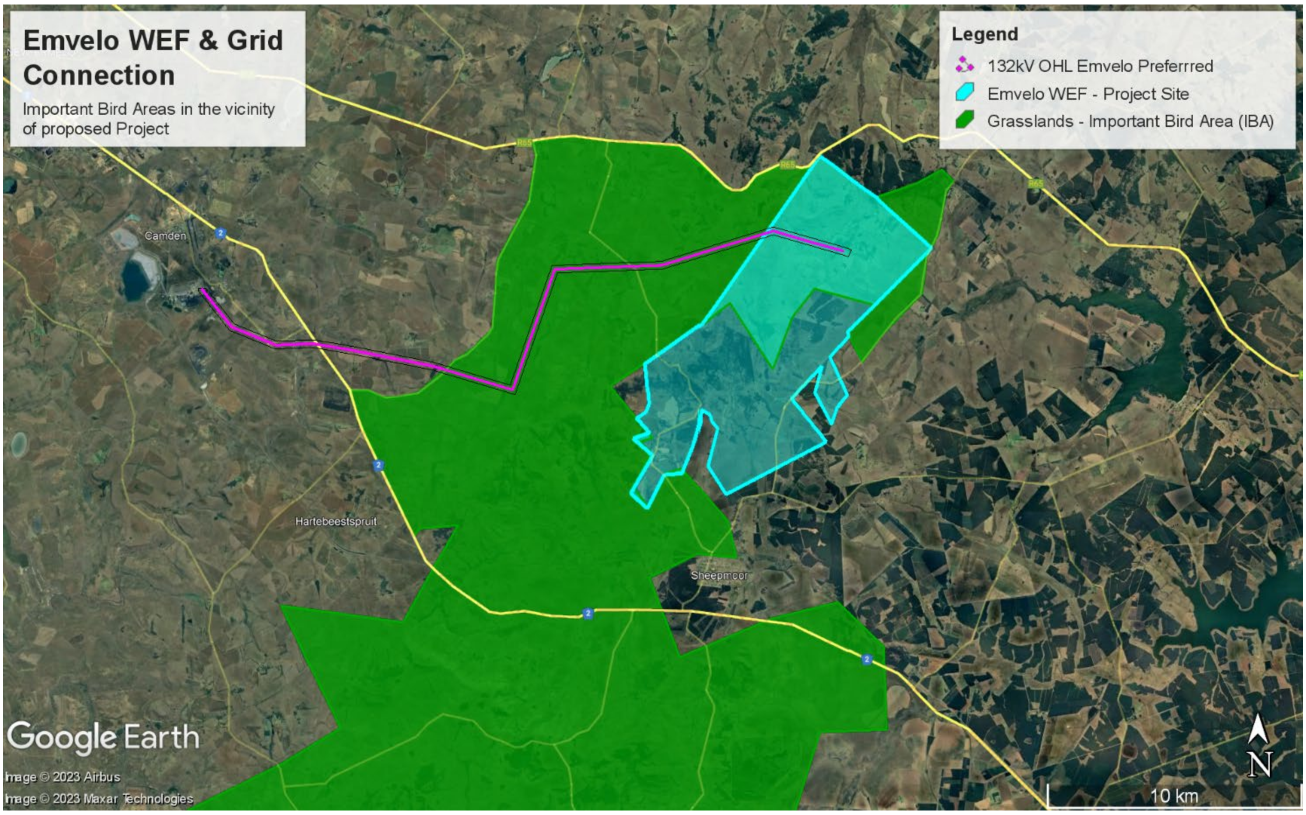

Figure 7: Important Bird Areas in the vicinity of the proposed Project.

5.4 The DFFE National Screening Tool

5.4.1 Wind Energy Facility

The WEF Project Site and immediate environment is classified as **Medium** and **High Sensitivity** for bird species according to the Animal Species Theme (**Figure 8**). The Medium and/or High sensitivity classification is linked to the potential occurrence of Denham's Bustard *Neotis denhami* (Globally Near-Threatened and Regionally Vulnerable), Secretarybird *Sagittarius serpentarius* (Globally Endangered and Regionally Vulnerable), Southern Bald Ibis *Geronticus calvus* (Globally and Regionally Vulnerable), African Grass Owl *Tyto capensis* (Regionally Vulnerable), Grey-crowned Crane *Balearica regulorum* (Globally and Regionally Endangered), White-bellied Bustard *Eupodotis senegalensis* (Regionally Vulnerable), and Caspian Tern *Hydroprogne caspia* (Regionally Vulnerable).

The Project Site contains confirmed habitat for Species of Conservation Concern (SCC), primarily for Southern Bald Ibis, Yellow-breasted Pipit, and Secretarybird (Globally Endangered and Regionally Vulnerable), as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020).

The WEF Project Site and immediate environment is classified as Medium and Low Sensitivity for vultures according to the Vulture Species Theme (**Figure 9**). The Medium sensitivity is due to the Project Site possibly affecting an area with between 5%–10% of the vulture population, according to the Screening Tool. During the pre-construction monitoring 48 minutes of Cape Vulture flights were recorded at medium height (i.e., within rotor-swept height). The passage rate for Cape Vultures after 756 hours of monitoring was 0.06 birds per day which amounts to about one Cape Vulture every two weeks. According to the Cervantes Population Utilization Distribution outputs the Emvelo WEF Project Site is rated low sensitivity (Cervantes et al 2023).

Twelve (12) wind energy development priority SCC have been recorded during the on-site field surveys thus far. The recorded species are listed in the table below (NT = Near Threatened, VU = Vulnerable, EN = Endangered):

Species name	Scientific name	Global Conservation Status	Regional Conservation Status
African Marsh Harrier	*Circus ranivorus*	-	EN
Blue Crane	*Grus paradisea*	VU	NT
Cape Vulture	*Gyps coprotheres*	VU	EN
Denham's Bustard	*Neotis denhami*	NT	VU
Greater Flamingo	*Phoenicopterus roseus*	-	NT
Grey Crowned Crane	*Balearica regulorum*	EN	EN
Lanner Falcon	*Falco biarmicus*	-	VU
Martial Eagle	*Polemaetus bellicosus*	EN	EN
Secretarybird	*Sagittarius serpentarius*	EN	VU
Southern Bald Ibis	*Geronticus calvus*	VU	VU
White-bellied Bustard	*Eupodotis senegalensis*	-	VU
Yellow-breasted Pipit	*Anthus chloris*	VU	VU

Based on the available SABAP2 data, the Site Sensitivity Verification survey, and the integrated pre-construction monitoring surveys conducted at the WEF Project Site, a classification of **High Sensitivity** for avifauna (for the **Animal Species Theme**) is confirmed for the Emvelo WEF and a classification of **Low Sensitivity** is suggested for the **Vulture Species Theme**.

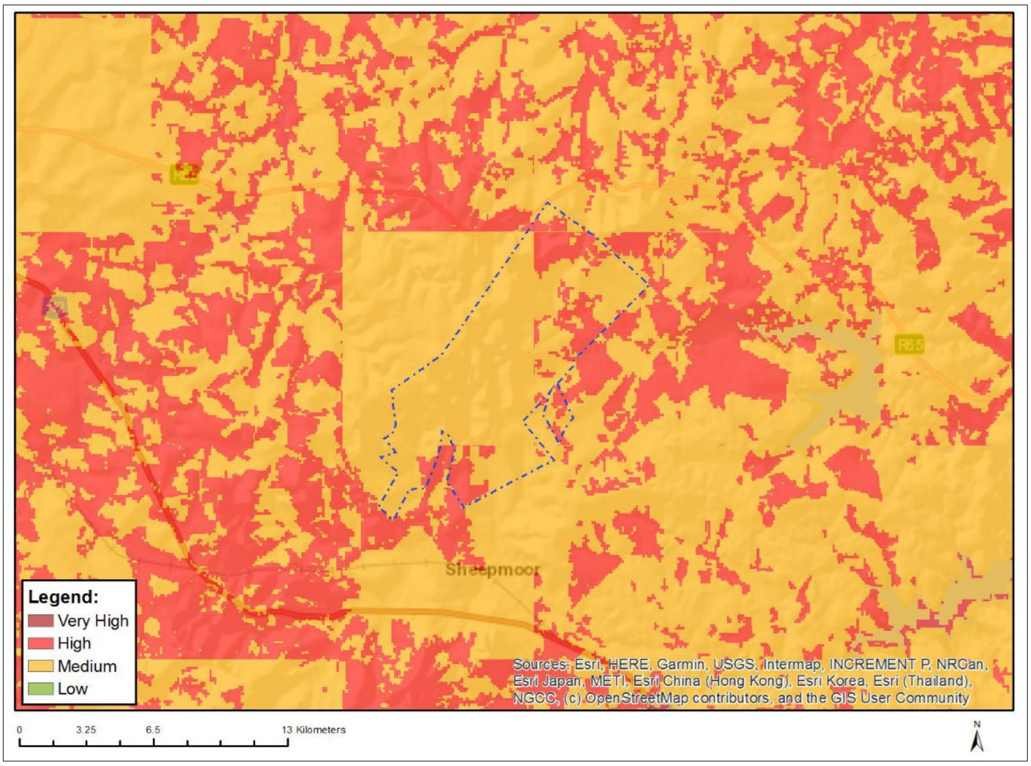

Figure 8: The classification of the Emvelo WEF Project Site according to the Animal Species Theme in the DFFE National Screening Tool.

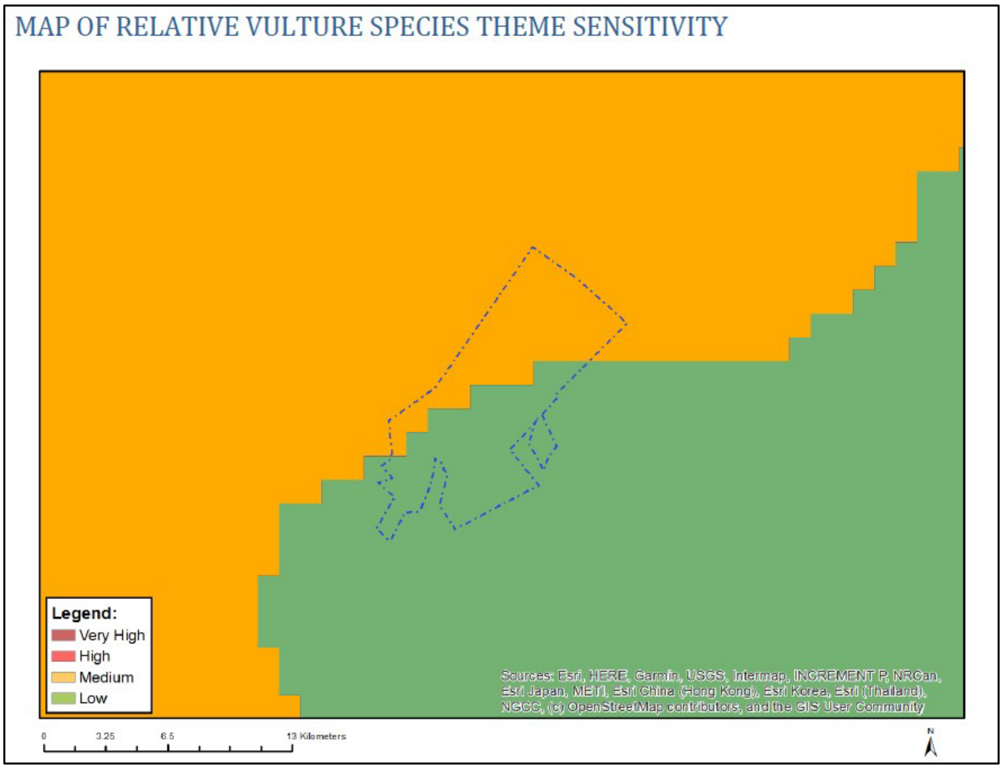

Figure 9: The classification of the Emvelo WEF Project Site according to the Vulture Species Theme in the DFFE National Screening Tool.

5.4.2 Grid Components

According to the DFFE national screening tool, the habitat within the Grid Connection PAOI is classified as **Medium** and **High** sensitivity for birds according to the Animal Species Theme (**Figure 10**). The Medium and/or High sensitivity classification is linked to the potential occurrence of Denham's Bustard *Neotis denhami* (Globally Near-Threatened and Regionally Vulnerable), Secretarybird *Sagittarius serpentarius* (Globally Endangered and Regionally Vulnerable), Southern Bald Ibis *Geronticus calvus* (Globally and Regionally Vulnerable), Grey-crowned Crane *Balearica regulorum* (Globally and Regionally Endangered), White-bellied Bustard *Eupodotis senegalensis* (Regionally Vulnerable), and Caspian Tern *Hydroprogne caspia* (Regionally Vulnerable). The PAOI contains confirmed habitat for Species of Conservation Concern (SCC), primarily for Southern Bald Ibis and Secretarybird (Globally Endangered and Regionally Vulnerable), as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020).

Eleven (11) power line sensitive SCC have been recorded during the on-site field surveys thus far. The recorded species are listed in the table below (NT = Near Threatened, VU = Vulnerable, EN = Endangered):

Species name	Scientific name	Global Conservation Status	Regional Conservation Status
African Marsh Harrier	*Circus ranivorus*	-	EN
Blue Crane	*Grus paradisea*	VU	NT
Cape Vulture	*Gyps coprotheres*	VU	EN
Denham's Bustard	*Neotis denhami*	NT	VU
Greater Flamingo	*Phoenicopterus roseus*	-	NT
Grey Crowned Crane	*Balearica regulorum*	EN	EN

Lanner Falcon	*Falco biarmicus*	-	VU
Martial Eagle	*Polemaetus bellicosus*	EN	EN
Secretarybird	*Sagittarius serpentarius*	EN	VU
Southern Bald Ibis	*Geronticus calvus*	VU	VU
White-bellied Bustard	*Eupodotis senegalensis*	-	VU

Based on the Site Sensitivity Verification survey and the integrated pre-construction monitoring conducted at the Project Site thus far, the classification of **High Sensitivity** for avifauna is supported for the Emvelo WEF Grid Connection PAOI. See **Appendix 11** for the Site Sensitivity Verification Report.

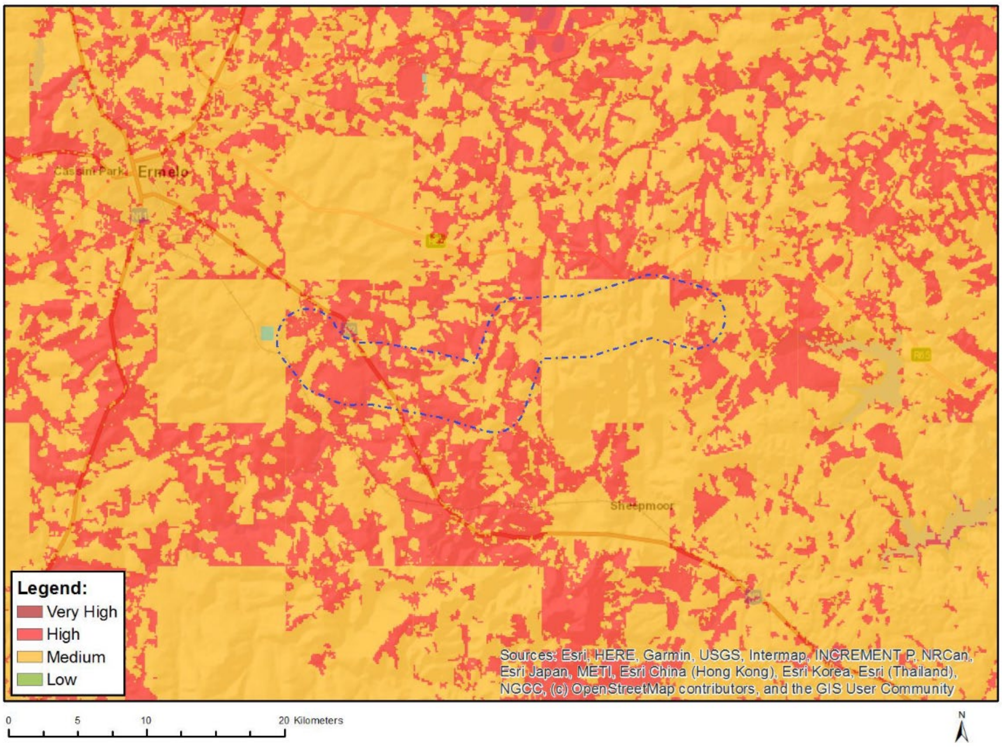

Figure 10: The National Web-Based Environmental Screening Tool map of the Grid PAOI, indicating sensitivities for the Animal Species Theme.

5.5 National Protected Areas

The closest protected area to the proposed development is the Nooitgedacht Dam Nature Reserve (70km). The avifauna in this protected area is not expected to be impacted by the proposed development due to the distance from the WEF and Grid project sites.

5.6 Avifauna in the Broader Area

According to the Southern African Bird Atlas Project (SABAP2) a total of 253 bird species could potentially occur in the Broader Area where the proposed Emvelo WEF and Gird Connection Infrastructure are located. Of the 253 species, 38 species are classified as priority species for wind energy developments. The wind priority species include all species of conservation concern and although a few IBA trigger species are not included in this list the exclusion areas recommended for other similar species included as priority species offer adequate protection for these additional (particularly wetland associated) species. Of the wind energy development priority species in the Broader Area, 32 (84%) have been recorded during the pre-construction monitoring conducted thus far. Of the 253 species, 76 are considered power line sensitive species and 57 (75%) of the power line sensitive species have been recorded during the pre-construction monitoring.

Table 5 and **Table 6** below list all the priority species and the possible impact on the respective species by the proposed WEF and Grid Connection.

LC = Least Concern	H = High
NT = Near Threatened	M = Medium
VU = Vulnerable	L = Low
EN = Endangered	

Table 5: Wind Energy Priority Species Recorded in The Broader Area.

Species Name	Scientific Name	Full Protocol	Ad Hoc Protocol	Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Regular Occurrence	Grassland	Woodland & Alien Trees	Drainage Lines & Wetlands	Dams	Agriculture	Collision With Turbines	Displacement - Habitat Transformation	Displacement - Disturbance	Electrocution MV Network	Collision MV Network
African Fish Eagle	*Haliaeetus vocifer*	7,26	0,92	-	-	x	M			x	x		x		x	x	
African Harrier-Hawk	*Polyboroides typus*	15,64	2,29	-	-	x	H		x		x		x		x	x	
African Marsh Harrier	*Circus ranivorus*	4,47	0,46	-	EN	x	M	x		x	x		x		x	x	
Amur Falcon	*Falco amurensis*	26,26	9,63	-	-	x	H	x	x		x	x	x			x	
Black Harrier	*Circus maurus*	0,00	0,46	EN	EN		L	x			x		x		x	x	
Black Sparrowhawk	*Accipiter melanoleucus*	15,08	1,38	-	-	x	M		x		x		x		x	x	
Black-bellied Bustard	*Lissotis melanogaster*	4,47	0,00	-	-	x	M	x				x	x	x	x		x
Black-chested Snake Eagle	*Circaetus pectoralis*	4,47	0,46	-	-	x	M		x		x		x		x	x	
Black-rumped Buttonquail	*Turnix nanus*	2,79	0,00	-	EN		L	x		x				x	x		
Black-winged Kite	*Elanus caeruleus*	65,92	14,22	-	-	x	H	x	x		x		x		x	x	
Black-winged Lapwing	*Vanellus melanopterus*	21,23	1,38	-	-	x	H	x		x		x	x	x			
Blue Crane	*Grus paradisea*	12,85	0,46	VU	NT	x	M	x		x	x	x	x	x	x		x
Blue Korhaan	*Eupodotis caerulescens*	0,56	0,00	NT	LC		L	x					x	x	x		x
Brown Snake Eagle	*Circaetus cinereus*	2,79	0,00	-	-	x	M		x		x		x		x	x	
Buff-streaked Chat	*Campicoloides bifasciatus*	7,82	0,00	-	-	x	M	x						x	x		

Species Name	**Scientific Name**	**Full Protocol**	**Ad Hoc Protocol**	**Global Conservation Status**	**Regional Conservation Status**	**Recorded During Monitoring**	**Likelihood Of Regular Occurrence**	**Grassland**	**Woodland & Alien Trees**	**Drainage Lines & Wetlands**	**Dams**	**Agriculture**	**Collision With Turbines**	**Displacement - Habitat Transformation**	**Displacement - Disturbance**	**Electrocution MV Network**	**Collision MV Network**
Cape Eagle-Owl	*Bubo capensis*	-[2]	-	-	-	x	M	x	x	x		x	x	x	x	x	x
Cape Vulture	*Gyps coprotheres*	3,35	0,00	VU	EN	x	M	x			x		x		x	x	x
Common Buzzard	*Buteo buteo*	39,11	16,97	-	-	x	H	x	x		x	x	x			x	
Denham's Bustard	*Neotis denhami*	5,03	0,00	NT	VU	x	M	x				x	x	x	x		x
Forest Buzzard	*Buteo trizonatus*	-	-	NT	LC	x	M		x	x	x		x	x	x	x	x
Greater Flamingo	*Phoenicopterus roseus*	1,68	0,00	-	NT	x	M			x	x		x				x
Grey Crowned Crane	*Balearica regulorum*	15,64	0,46	EN	EN	x	H	x			x		x	x	x	x	x
Grey-winged Francolin	*Scleroptila afra*	15,08	0,00	-	-	x	M	x				x	x	x	x		
Jackal Buzzard	*Buteo rufofuscus*	32,40	8,72	-	-	x	H	x	x		x	x	x		x	x	
Lanner Falcon	*Falco biarmicus*	12,85	0,46	-	VU	x	M	x			x		x		x	x	
Lesser Flamingo	*Phoeniconaias minor*	1,12	0,00	NT	NT		L			x	x		x				x
Long-crested Eagle	*Lophaetus occipitalis*	13,97	14,22	-	-	x	M		x		x		x		x	x	
Marsh Owl	*Asio capensis*	1,68	0,46	-	-	x	M	x		x	x		x	x	x	x	x
Martial Eagle	*Polemaetus bellicosus*	5,59	0,00	EN	EN	x	M	x	x		x		x		x	x	
Northern Black Korhaan	*Afrotis afraoides*	0,56	0,00	-	-		L	x				x	x	x	x		x
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	1,68	0,00	-	-	x	M		x		x		x		x	x	

[2] No Reporting Rate as this species was recorded during monitoring only and not through SABAP2.

Species Name	Scientific Name	Full Protocol	Ad Hoc Protocol	Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Regular Occurrence	Grassland	Woodland & Alien Trees	Drainage Lines & Wetlands	Dams	Agriculture	Collision With Turbines	Displacement - Habitat Transformation	Displacement - Disturbance	Electrocution MV Network	Collision MV Network
Secretarybird	*Sagittarius serpentarius*	24,02	2,29	EN	VU	x	H	x					x	x	x		x
Southern Bald Ibis	*Geronticus calvus*	26,82	4,13	VU	VU	x	H	x			x	x	x		x	x	x
Spotted Eagle-Owl	*Bubo africanus*	11,73	1,38	-	-	x	M		x	x			x		x	x	x
Western Osprey	*Pandion haliaetus*	0,56	0,00	-	-		L				x		x		x	x	
White Stork	*Ciconia ciconia*	10,61	2,29	-	-	x	M	x		x	x	x	x				x
White-bellied Bustard	*Eupodotis senegalensis*	12,29	0,00	-	VU	x	H	x				x	x	x	x		x
Yellow-breasted Pipit	*Anthus chloris*	1,12	0,00	VU	VU	x	M	x					x	x	x		

Table 6: Powerline Sensitive Species Recorded in The Broader Area.

Species Name	Scientific Name	Full Protocol	Ad Hoc Protocol	Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Regular Occurrence	Grassland	Woodland & Alien Trees	Drainage Lines & Wetlands	Dams	Agriculture	Power line - Electrocution HV	Power line - Collision
African Black Duck	*Anas sparsa*	4,47	0,00	-	-		L			x	x			x
African Darter	*Anhinga rufa*	14,53	3,21	-	-	x	M			x	x			x
African Fish Eagle	*Haliaeetus vocifer*	7,26	0,92	-	-	x	M			x	x			
African Goshawk	*Accipiter tachiro*	0,56	0,00	-	-	x	M		x					
African Harrier-Hawk	*Polyboroides typus*	15,64	2,29	-	-	x	H		x		x			
African Marsh Harrier	*Circus ranivorus*	4,47	0,46	-	EN	x	M	x		x	x			
African Sacred Ibis	*Threskiornis aethiopicus*	37,43	5,50	-	-	x	H			x	x	x		x
African Spoonbill	*Platalea alba*	22,91	1,83	-	-	x	H			x	x			x
African Swamphen	*Porphyrio madagascariensis*	6,15	2,75	-	-		M			x	x			
Amur Falcon	*Falco amurensis*	26,26	9,63	-	-	x	H	x	x		x	x		
Black Harrier	*Circus maurus*	0,00	0,46	EN	EN		L	x			x			
Black Heron	*Egretta ardesiaca*	0,56	0,00	-	-		L			x	x			x
Black Sparrowhawk	*Accipiter melanoleucus*	15,08	1,38	-	-	x	M		x		x			
Black-bellied Bustard	*Lissotis melanogaster*	4,47	0,00	-	-	x	M	x				x		x
Black-chested Snake Eagle	*Circaetus pectoralis*	4,47	0,46	-	-	x	M		x		x			
Black-headed Heron	*Ardea melanocephala*	50,28	2,75	-	-	x	H	x		x	x	x		x
Black-necked Grebe	*Podiceps nigricollis*	0,56	0,46	-	-		L			x	x			x
Black-winged Kite	*Elanus caeruleus*	65,92	14,22	-	-	x	H	x	x		x			
Blue Crane	*Grus paradisea*	12,85	0,46	VU	NT	x	M	x		x	x	x		x

Species Name	**Scientific Name**	**Full Protocol**	**Ad Hoc Protocol**	**Global Conservation Status**	**Regional Conservation Status**	**Recorded During Monitoring**	**Likelihood Of Regular Occurrence**	**Grassland**	**Woodland & Alien Trees**	**Drainage Lines & Wetlands**	**Dams**	**Agriculture**	**Power line - Electrocution HV**	**Power line - Collision**
Blue Korhaan	*Eupodotis caerulescens*	0,56	0,00	NT	LC		L	x						x
Blue-billed Teal	*Spatula hottentota*	0,56	0,00	-	-		L			x	x			x
Brown Snake Eagle	*Circaetus cinereus*	2,79	0,00	-	-	x	M		x		x			
Cape Crow	*Corvus capensis*	12,85	0,00	-	-		M	x	x			x		
Cape Eagle-Owl	*Bubo capensis*	-	-	-	-	x	M	x	x	x		x		x
Cape Shoveler	*Spatula smithii*	15,08	0,46	-	-	x	H			x	x			x
Cape Teal	*Anas capensis*	0,56	0,00	-	-		L			x	x			x
Cape Vulture	*Gyps coprotheres*	3,35	0,00	VU	EN	x	M	x			x		x	x
Common Buzzard	*Buteo buteo*	39,11	16,97	-	-	x	H	x	x		x	x		
Common Moorhen	*Gallinula chloropus*	29,61	4,13	-	-	x	H			x	x			
Denham's Bustard	*Neotis denhami*	5,03	0,00	NT	VU	x	M	x				x		x
Egyptian Goose	*Alopochen aegyptiaca*	69,27	9,63	-	-	x	H	x		x	x	x		x
Forest Buzzard	*Buteo trizonatus*	-	-	NT	LC	x	M		x	x	x			x
Fulvous Whistling Duck	*Dendrocygna bicolor*	0,00	0,46	-	-		L			x	x			x
Glossy Ibis	*Plegadis falcinellus*	4,47	0,92	-	-	x	M			x	x			x
Goliath Heron	*Ardea goliath*	1,68	0,00	-	-		L			x	x			x
Great Egret	*Ardea alba*	8,94	1,38	-	-	x	M			x	x			x
Greater Flamingo	*Phoenicopterus roseus*	1,68	0,00	-	NT	x	M			x	x			x
Grey Crowned Crane	*Balearica regulorum*	15,64	0,46	EN	EN	x	H	x		x	x	x		x
Grey Heron	*Ardea cinerea*	20,67	1,83	-	-	x	H			x	x			x

Species Name	Scientific Name	Full Protocol	Ad Hoc Protocol	Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Regular Occurrence	Grassland	Woodland & Alien Trees	Drainage Lines & Wetlands	Dams	Agriculture	Power line - Electrocution HV	Power line - Collision
Hadada Ibis	*Bostrychia hagedash*	83,24	12,84	-	-	x	H	x		x	x	x		x
Hamerkop	*Scopus umbretta*	16,76	0,46	-	-	x	H			x	x			x
Helmeted Guineafowl	*Numida meleagris*	54,19	3,67	-	-	x	H	x	x	x	x	x		
Intermediate Egret	*Ardea intermedia*	16,76	1,83	-	-	x	H			x	x			x
Jackal Buzzard	*Buteo rufofuscus*	32,40	8,72	-	-	x	H	x	x		x	x		
Lanner Falcon	*Falco biarmicus*	12,85	0,46	-	VU	x	M	x			x			
Lesser Flamingo	*Phoeniconaias minor*	1,12	0,00	NT	NT		L			x	x			x
Little Egret	*Egretta garzetta*	1,68	0,92	-	-		L			x	x			x
Little Grebe	*Tachybaptus ruficollis*	51,96	5,96	-	-	x	H			x	x			x
Long-crested Eagle	*Lophaetus occipitalis*	13,97	14,22	-	-	x	M		x		x			
Marsh Owl	*Asio capensis*	1,68	0,46	-	-	x	M	x		x	x	x		x
Martial Eagle	*Polemaetus bellicosus*	5,59	0,00	EN	EN	x	M	x	x		x	x		
Northern Black Korhaan	*Afrotis afraoides*	0,56	0,00	-	-		L	x				x		x
Pied Crow	*Corvus albus*	11,73	3,67	-	-	x	M	x	x	x	x	x		
Purple Heron	*Ardea purpurea*	10,06	0,00	-	-	x	M			x	x			x
Red-billed Teal	*Anas erythrorhyncha*	21,79	2,29	-	-	x	H			x	x			x
Red-knobbed Coot	*Fulica cristata*	58,10	8,26	-	-	x	H			x	x			x
Reed Cormorant	*Microcarbo africanus*	56,98	6,88	-	-	x	H			x	x			x
Rock Kestrel	*Falco rupicolus*	7,26	0,92	-	-		M	x	x			x		
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	1,68	0,00	-	-	x	M		x		x			

Species Name	Scientific Name	Full Protocol	Ad Hoc Protocol	Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Regular Occurrence	Grassland	Woodland & Alien Trees	Drainage Lines & Wetlands	Dams	Agriculture	Power line - Electrocution HV	Power line - Collision
Secretarybird	*Sagittarius serpentarius*	24,02	2,29	EN	VU	x	H	x						x
South African Shelduck	*Tadorna cana*	30,73	4,59	-	-	x	H			x	x			x
Southern Bald Ibis	*Geronticus calvus*	26,82	4,13	VU	VU	x	H	x						x
Southern Pochard	*Netta erythrophthalma*	3,91	0,00	-	-	x	L			x	x			x
Spotted Eagle-Owl	*Bubo africanus*	11,73	1,38	-	-	x	M		x	x				x
Spur-winged Goose	*Plectropterus gambensis*	57,54	5,50	-	-	x	H	x		x	x	x		x
Squacco Heron	*Ardeola ralloides*	1,12	0,00	-	-		L			x	x			x
Western Barn Owl	*Tyto alba*	5,03	0,92	-	-		M	x	x			x		x
Western Cattle Egret	*Bubulcus ibis*	34,08	6,88	-	-	x	H	x		x	x	x		x
Western Osprey	*Pandion haliaetus*	0,56	0,00	-	-		L				x			
White Stork	*Ciconia ciconia*	10,61	2,29	-	-	x	M			x	x			x
White-backed Duck	*Thalassornis leuconotus*	5,59	0,46	-	-	x	M			x	x			x
White-bellied Bustard	*Eupodotis senegalensis*	12,29	0,00	-	VU	x	H	x				x		x
White-breasted Cormorant	*Phalacrocorax lucidus*	8,94	1,38	-	-	x	M			x	x			x
White-faced Whistling Duck	*Dendrocygna viduata*	1,68	0,00	-	-		L			x	x			x
Yellow-billed Duck	*Anas undulata*	60,89	6,88	-	-	x	H			x	x			x
Yellow-billed Kite	*Milvus aegyptius*	3,91	0,46	-	-	x	M	x	x	x	x	x		

5.7 Results of Pre-Construction Bird Monitoring

The objective of the pre-construction monitoring at the proposed Emvelo WEF was to gather baseline data over a period of four seasons (seven surveys) on the following aspects pertaining to avifauna:

- The abundance and diversity of birds at the proposed WEF site and at a suitable control site, to measure the potential displacement effect of the wind farm.
- Flight patterns of priority species to assess the potential collision risk with the turbines and associated power line infrastructure.

Monitoring at the WEF sites and a Control Site were conducted by a team of monitors during the following time envelopes:

- 21 February–03 March 2022
- 21–27 April 2022
- 01–16 June 2022
- 06–21 October 2022
- 14–17 January 2023 (Transect counts only)
- 05–09 May 2023
- 28–30 June 2023
- 22–26 August 2023

Additional Vantage Point and Transect Count monitoring was conducted near the identified Martial Eagle nest to gain a better understanding of their flight behaviour. Five surveys were conducted, in addition to the seven surveys completed as part of the pre-construction monitoring.

The five additional surveys were conducted during the following time envelopes:

- 17–22 October 2023
- 15–23 November 2023
- 30 November–05 December 2023
- 17–22 January 2024
- 14–20 February 2024

Table 7 and **Figure 11–12** below present the results of the pre-construction monitoring conducted at the WEF site and control area.

5.7.1 Transects

The results of the transect counts after seven surveys are presented in Table 7:

Table 7: The Results of The Walk and Drive Transects.

TURBINE SITE	
Species Composition	**Number**
All Species	180
Priority Species	19 (11%)
Non-Priority Species	161
Total Count	
Drive Transects	10 583
Walk Transects	8095
Total	18 678
CONTROL SITE	

Species Composition	Number
All Species	110
Priority Species	9 (8%)
Non-Priority Species	101
Total Count	
Drive Transects	3309
Walk Transects	1870
Total	5179

An Index of Kilometric Abundance (IKA = birds/km) was calculated for each priority species recorded during transects across four seasons and seven surveys (**Figures 11–12**).

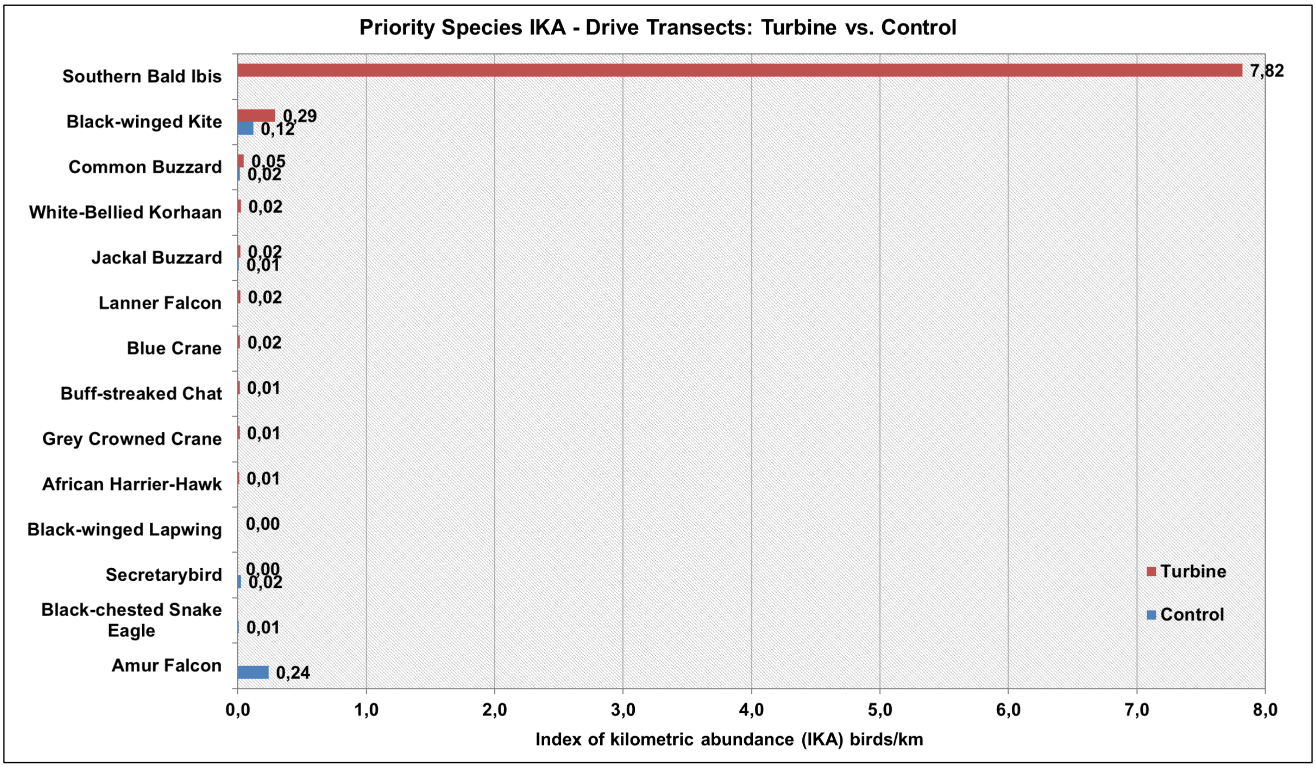

Figure 11: Index of kilometric abundance of priority species recorded at the WEF and control site during drive transect surveys (seven surveys).

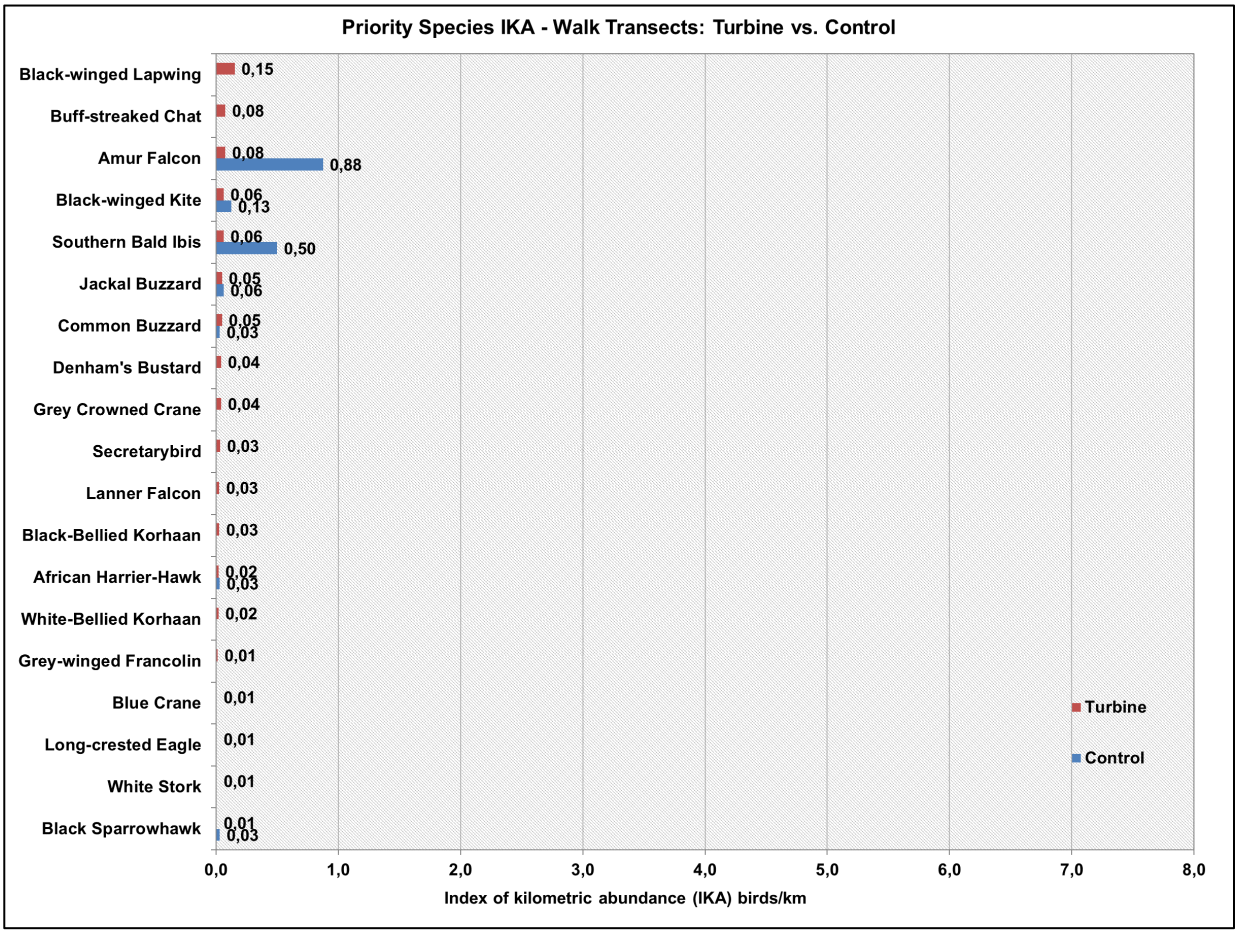

Figure 12: Index of kilometric abundance of priority species recorded at the WEF during walk transect surveys (seven surveys).

Figure 13 below shows the spatial distribution of the priority species recorded during transect counts and incidental sightings over all four seasons.

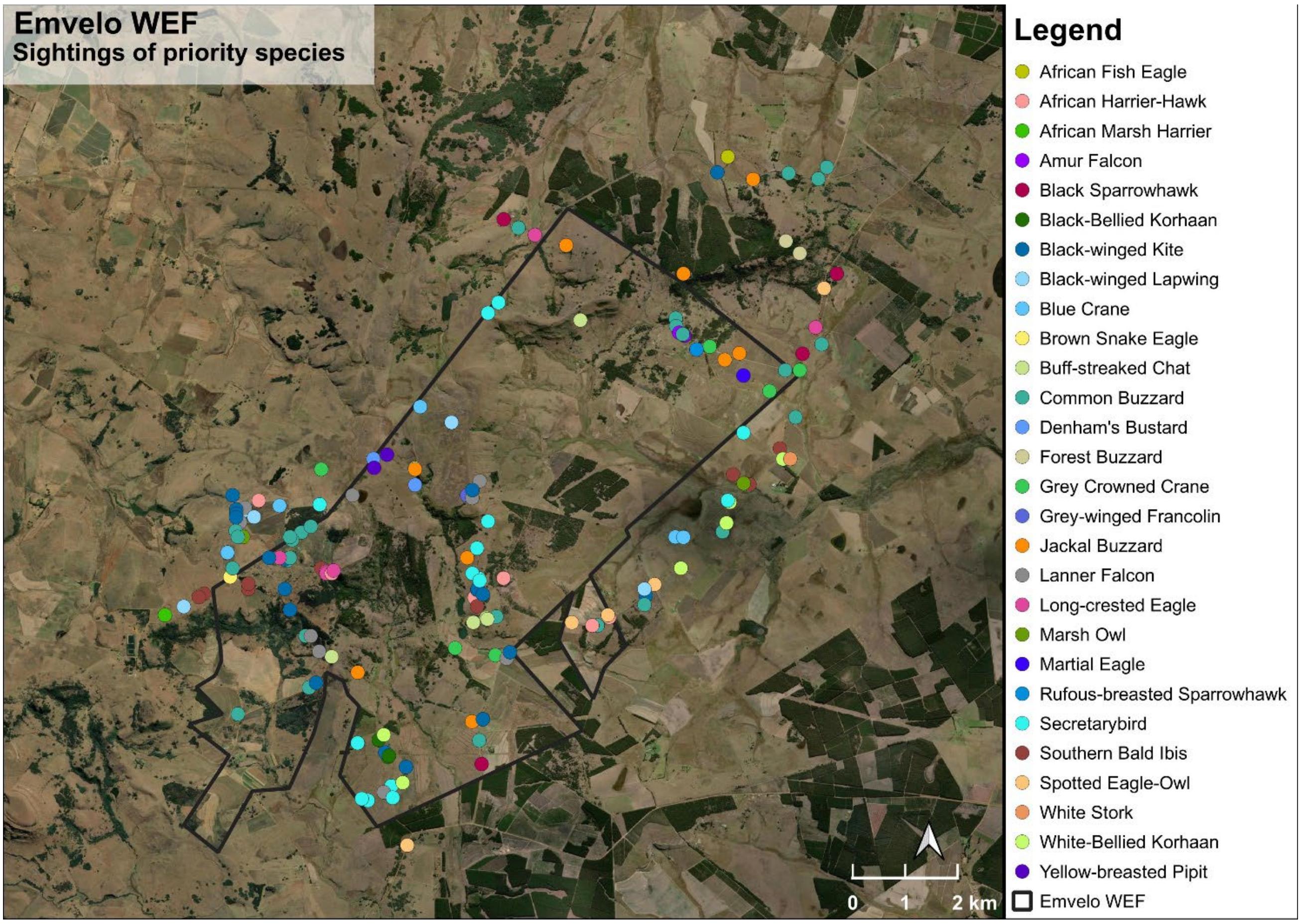

Figure 13: The location of priority species recorded at the proposed Emvelo WEF through transect counts and incidental sightings.

5.7.2 Focal Points

Three focal points (FP) of bird activity have been identified thus far:

- FP1: A large farm dam in a drainage line. This FP was surveyed once during each survey.
- FP2: Southern Bald Ibis colony (26°37'20.82" South, 30°18'36.43" East)
- FP3: Southern Bald Ibis colony (26°38'28.47" South, 30°17'37.67" East)

- A Martial Eagle nest was discovered towards the end of the initial pre-construction monitoring campaign and subsequent additional monitoring effort was devoted to the nest to better understand the flight risk of the eagles around the nest.

See **Appendix 3** for the location of the focal points.

Table 8: Results of Focal Point Surveys

Focal Points	Survey 1	Survey 2	Survey 3	Survey 4	Survey 5	Survey 6	Survey 7
	Priority Species Recorded						
FP1	Southern Bald Ibis (SBI), Grey Crowned	No Priority Species	Southern Bald Ibis	Southern Bald Ibis	47 SBIs seen	36 SBIs seen	2 SBIs seen and Black Sparrowhawk seen hunting in area

Focal Points	Survey 1	Survey 2	Survey 3	Survey 4	Survey 5	Survey 6	Survey 7
	Crane Roost						
FP2: SBI Colony	NA	NA	NA	Southern Bald Ibis (nesting with chicks), Long-crested Eagle, African Harrier Hawk and African Goshawk	No Priority Species	more than 8 SBI seen, no nests or remnants of nests seen	8 SBIs and Lanner Falcon seen
FP3: SBI Colony	NA	NA	NA	Southern Bald Ibis (2 confirmed active nests), Buff-streaked Chat, Jackal Buzzard and Denham's Bustard	No SBIs, no nests and no whitewash seen. Long-Crested Eagle flew past	3 SBI nests with guano, 1 Jackal Buzzard seen, and 1 Cape Eagle-Owl heard	No SBIs, nests nor remnants seen

5.7.3 Incidental Counts

Table 9 provides an overview of the incidental sightings of priority species during the four seasonal surveys.

Table 9: Incidental sightings of priority species made during the seasonal surveys (seven surveys) at the WEF Cluster (Rochdale, Emvelo, and Sheepmoor WEFs).

Priority Species – Incidental Sightings		S1	S2	S3	S4	S5	S6	S7	Total
Southern Bald Ibis	*Geronticus calvus*	70	28	0	24	3	0	1	126
Black-winged Kite	*Elanus caeruleus*	6	3	8	18	5	2	2	44
Common Buzzard	*Buteo buteo*	12	0	0	18	0	0	0	30
Black-winged Lapwing	*Vanellus melanopterus*	4	1	0	11	0	3	9	28
Jackal Buzzard	*Buteo rufofuscus*	5	5	2	4	4	0	3	23
Grey-winged Francolin	*Scleroptila afra*	0	0	0	1	1	18	0	20
Grey Crowned Crane	*Balearica regulorum*	12	2	0	4	0	0	0	18
Spotted Eagle-Owl	*Bubo africanus*	1	5	3	4	1	1	2	17
White Stork	*Ciconia ciconia*	0	0	0	16	0	0	0	16
Secretarybird	*Sagittarius serpentarius*	0	7	1	1	6	0	0	15
Long-crested Eagle	*Lophaetus occipitalis*	7	2	0	2	2	0	0	13
Amur Falcon	*Falco amurensis*	6	0	0	1	0	0	0	7
Yellow-breasted Pipit	*Anthus chloris*	0	0	0	7	0	0	0	7
Lanner Falcon	*Falco biarmicus*	2	3	0	0	0	1	0	6
Black Sparrowhawk	*Accipiter melanoleucus*	0	3	0	1	0	0	1	5
Buff-streaked Chat	*Campicoloides bifasciatus*	0	0	0	3	0	0	2	5
African Harrier-Hawk	*Polyboroides typus*	0	0	1	2	0	1	0	4
Denham's Bustard	*Neotis denhami*	0	0	0	3	1	0	0	4
Marsh Owl	*Asio capensis*	0	1	3	0	0	0	0	4
Blue Crane	*Grus paradisea*	0	0	0	3	0	0	0	3
African Marsh Harrier	*Circus ranivorus*	0	0	0	2	0	0	0	2
Forest Buzzard	*Buteo trizonatus*	0	0	0	0	0	0	2	2

Priority Species – Incidental Sightings		S1	S2	S3	S4	S5	S6	S7	Total
White-bellied Korhaan	*Eupodotis senegalensis*	2	0	0	0	0	0	0	2
African Fish Eagle	*Haliaeetus vocifer*	0	0	0	1	0	0	0	1
Brown Snake Eagle	*Circaetus cinereus*	1	0	0	0	0	0	0	1
Martial Eagle	*Polemaetus bellicosus*	0	1	0	0	0	0	0	1
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0	0	0	1	0	0	0	1

See **Appendix 5** for a list of all species recorded during the pre-construction monitoring.

5.7.4 Vantage Point Observations

A total of 756 hours of Vantage Point watches were completed at nine (9) vantage points, at the WEF Cluster (Rochdale, Emvelo, and Sheepmoor WEFs), to record flight patterns of priority species. In the seven (7) sampling periods, the duration of priority species flights amounted to 22 hours, 19 minutes, and 34 seconds. A total of 488 individual flights were recorded. The passage rate for priority species was 0.65 birds/hour[3]. This amounts to about 8–9 birds per day.[4] See **Figure 14** below for the duration of flights for each priority species[5].

[3] A distinction was drawn between passages and flights. A passage may consist of several flights e.g. every time an individual bird changes height or mode of flight, this was recorded as an individual flight, although it still forms part of the same passage.
[4] Assuming 13 hours daylight averaged over all four seasons.
[5] Flight duration was calculated by multiplying the flight time with the number of individuals in the flight e.g. if the flight time was 30 seconds and it contained two individuals, the flight duration was 30 seconds x 2 = 60 seconds.

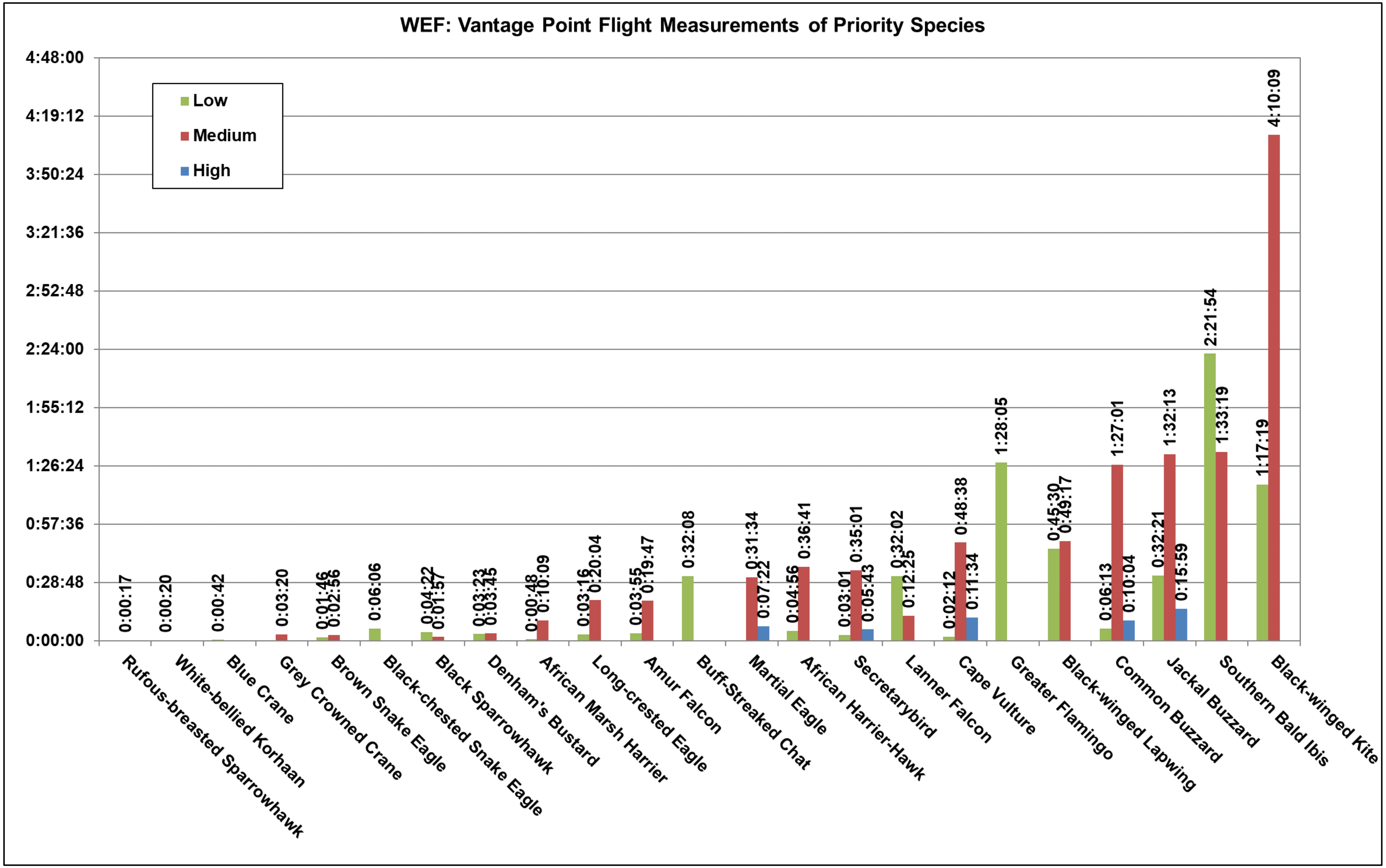

Figure 14: Recorded Flight Times (in Hours: Minutes: Seconds) and Flight Altitudes of Priority Species (during the first seven surveys, excluding the additional five surveys conducted as part of the Martial Eagle monitoring).

5.7.5 Flight Risk Modelling

Due to the discovery of a Martial Eagle nest within the proposed WEF project footprints, extensive additional monitoring was performed to collect flight data of the adult eagles and the juvenile in the area. 37 hours, 34 minutes and 11 seconds of Martial Eagle flight time was recorded during an additional 60 hours of observation time conducted in the area. The extensive dataset of Martial Eagle flight data was used to develop a flight risk model.

We scripted and used R and python workflows to prepare, pre-process and analyse all predictor variables. Predictors variables represented various facets of topography, drainage, and vegetation productivity. Topographical features included ruggedness, drainage, TWI, and topographical relief, whilst aspects of vegetation productivity were derived from remote sensing indices. We utilised an Artificial Neural Network (ANN) predictive modelling workflow to train and develop the flight risk model (FRM). ANNs are capable of learning complex patterns and relationships in data, making them suitable for a wide range of classification problems. The modelling workflow included data partitioning, model training, optimization of algorithms and hyperparameters, and model testing and validation.

Model training suggested that certain topographical features related to slope and ruggedness increased flight risk. Undulating slopes, wide gorges and valleys, particularly less steep features such as back-slopes, foot-slopes, toe-slopes, and terrace/floodplains positively influence flight risk. Additionally, the presence and quantity of perch structures in the form of linear power infrastructure and/or woody vegetation positively influenced flight risk, along with cumulative and minimum vegetation productivity.

The raw predictive FRM surface was further processed to derive two risk classes, namely high and medium risk classes around the nest (Section 6.5). The risk classes were derived by the quantity of observed high risk flights being accommodated by each respective risk envelope. The high-risk class encompassed approximately $79km^2$, which is very comparable to the area covered by a 5km circular buffer ($78.5km^2$).

5.7.6 Spatial Distribution of Flights Over the Turbine Area

Flight lines of priority species were recorded during Vantage Point watches to determine the flight activity and distribution of flight across the WEF site. The results after seven (7) surveys are presented in **Figure 15**.

Additional monitoring (another five surveys) was conducted to gather additional data on the flight activity and distribution of flight across the WEF site, with particular focus given to Martial Eagles due to the active nest near the Project Site. The results after the additional five (5) surveys are presented in **Figures 16 and 17**.

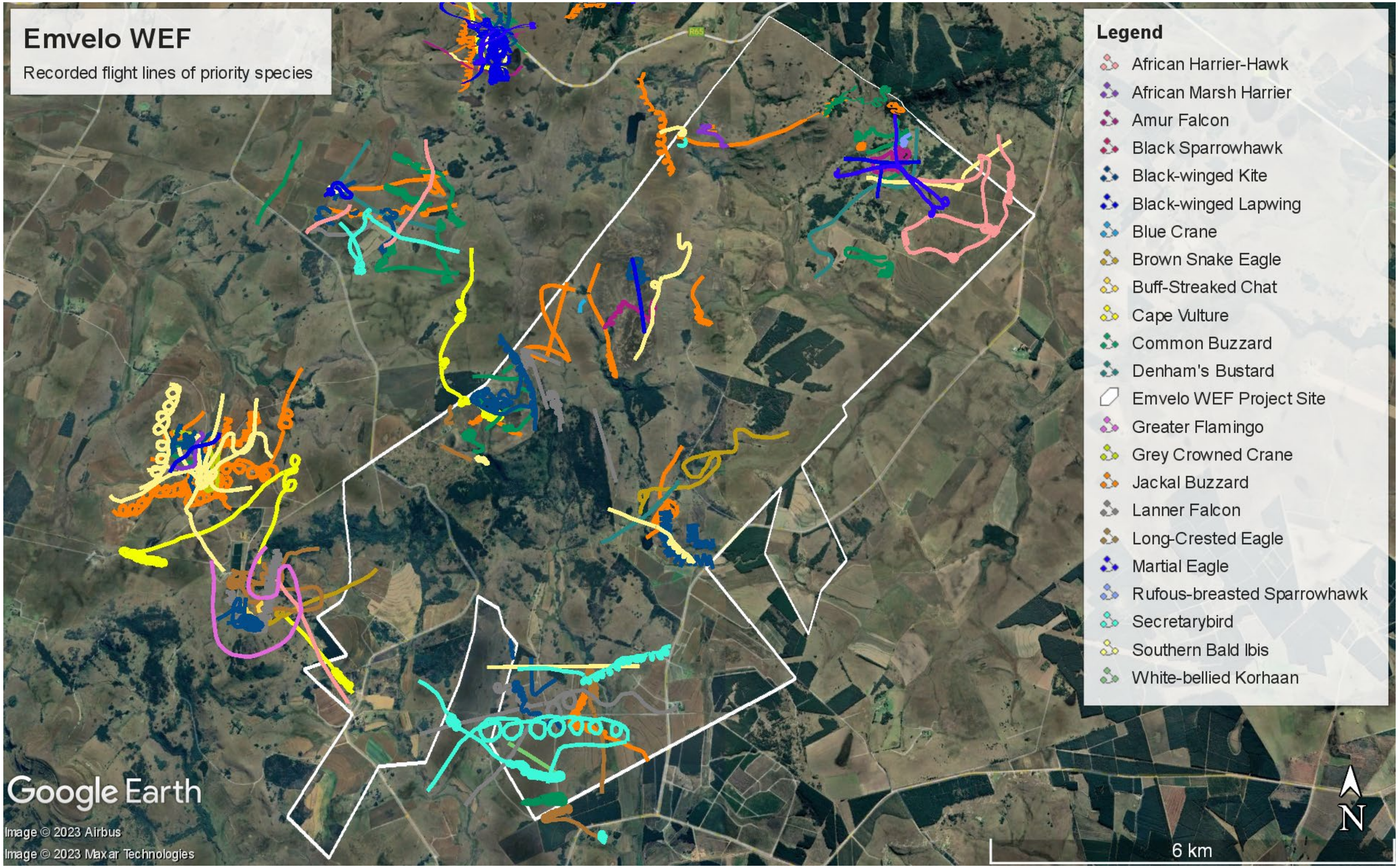

Figure 15: Recorded flight lines of priority species in and near the Emvelo WEF Project Site (seven surveys).

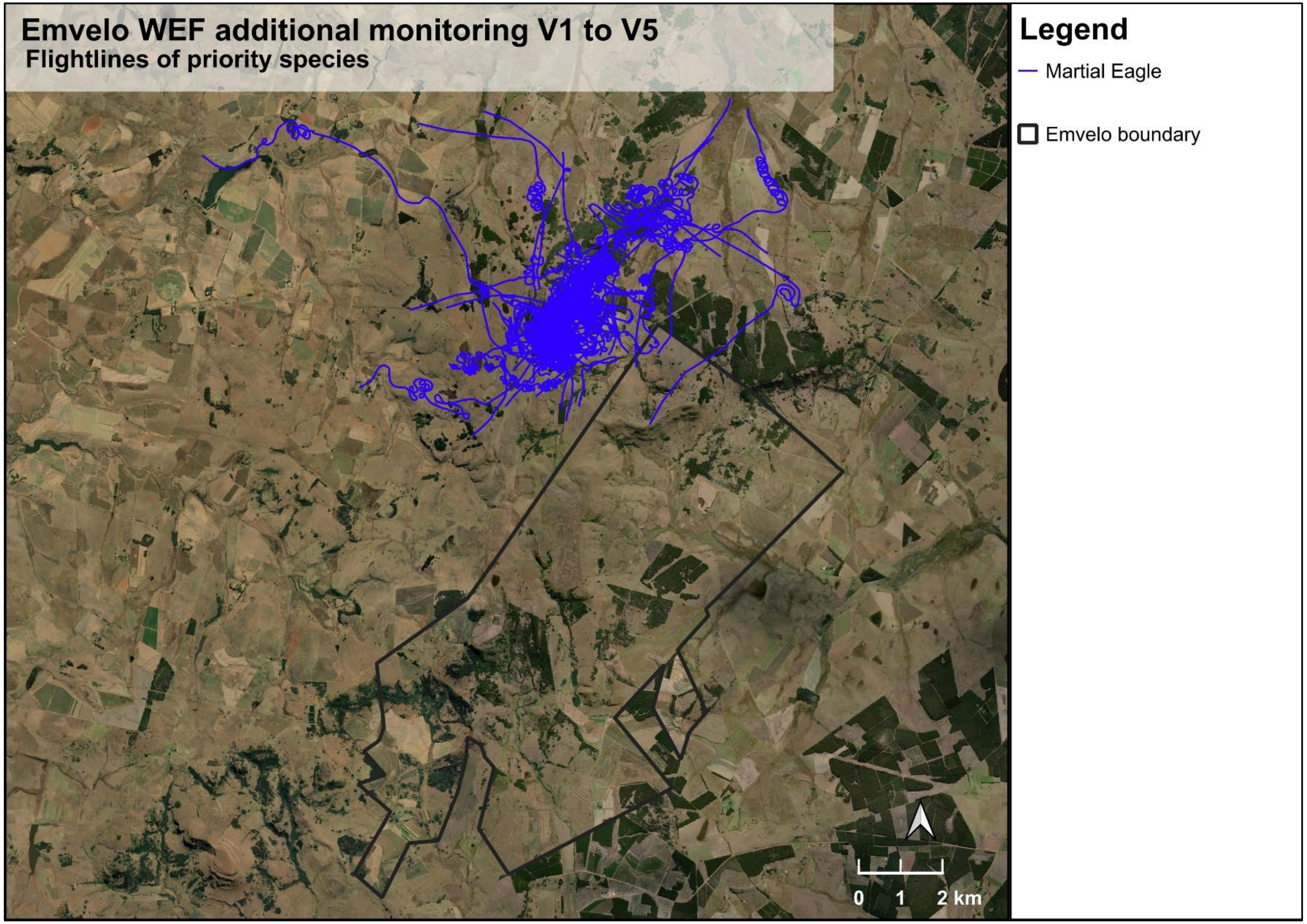

Figure 16: Recorded flight lines for Martial Eagle in and near the Emvelo WEF Project Site (additional five surveys).

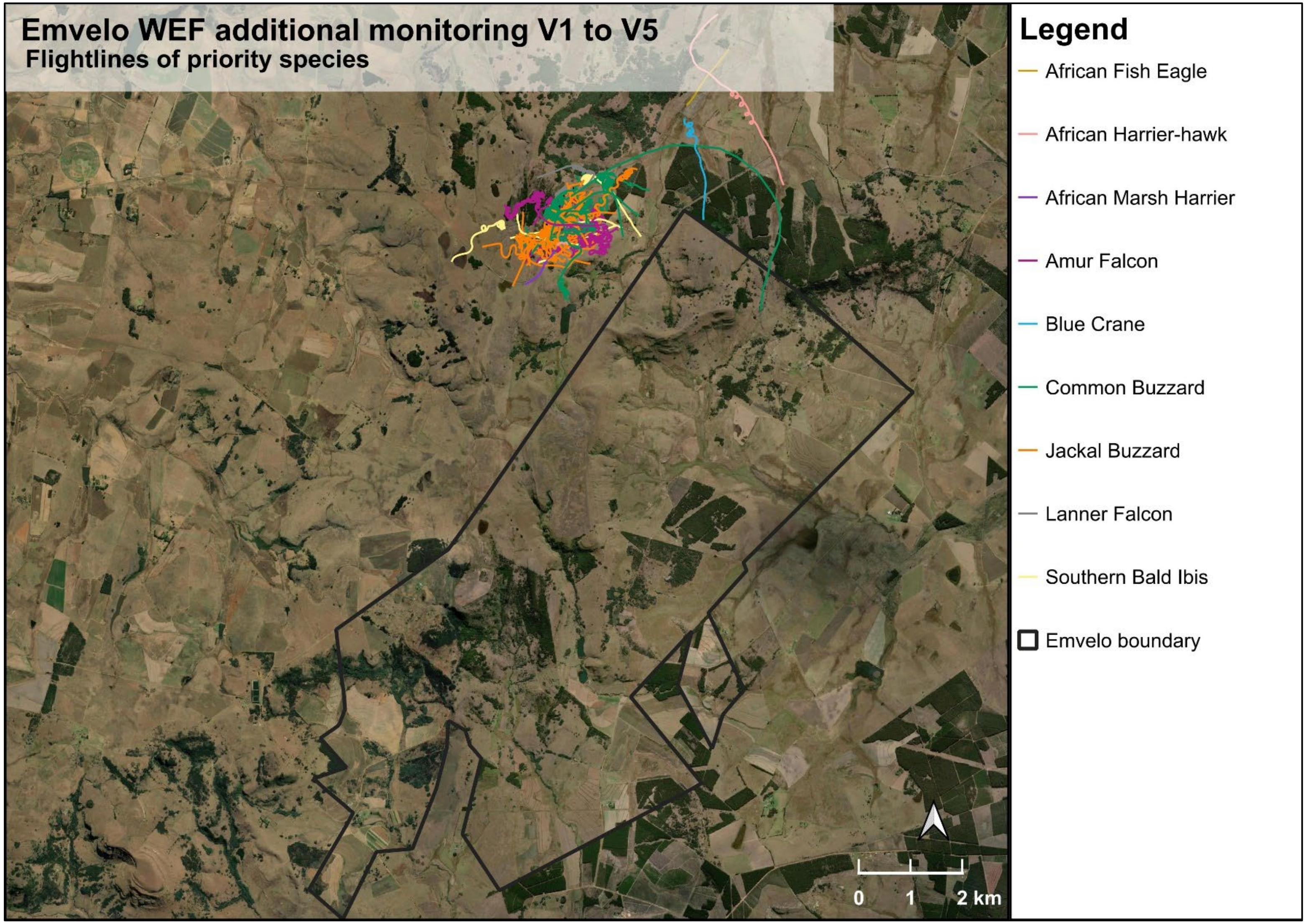

Figure 17: Recorded flight lines of all other priority species (excluding Martial Eagle) in and near the Emvelo WEF Project Site (additional five surveys).

5.7.7 Additional Martial Eagle Monitoring

Additional Vantage Point monitoring was conducted near the identified Martial Eagle nest to gain a better understanding of flight behaviour. Five surveys were conducted, in addition to the seven surveys completed as part of the pre-construction monitoring.

The five additional surveys were conducted during the following time envelopes:

- 17–22 October 2023
- 15–23 November 2023
- 30 November–05 December 2023
- 17–22 January 2024
- 14–20 February 2024

A total of 60 hours of Vantage Point watches were completed to record flight patterns of Martial Eagles as well as other priority species. Observations were primarily concentrated in the vicinity of the Martial Eagle nest, but where feasible, the eagles were followed to collect as much flight data in the landscape around the nest as possible.

During the five (5) sampling periods, the duration of priority species flights amounted to 73 hours, 46 minutes, and 18 seconds, with 42 hours, 54 minutes and 19 seconds (almost 60%) of the flights being at medium height (at turbine blade height). See **Figure 18** below for the duration of flights for each priority species.

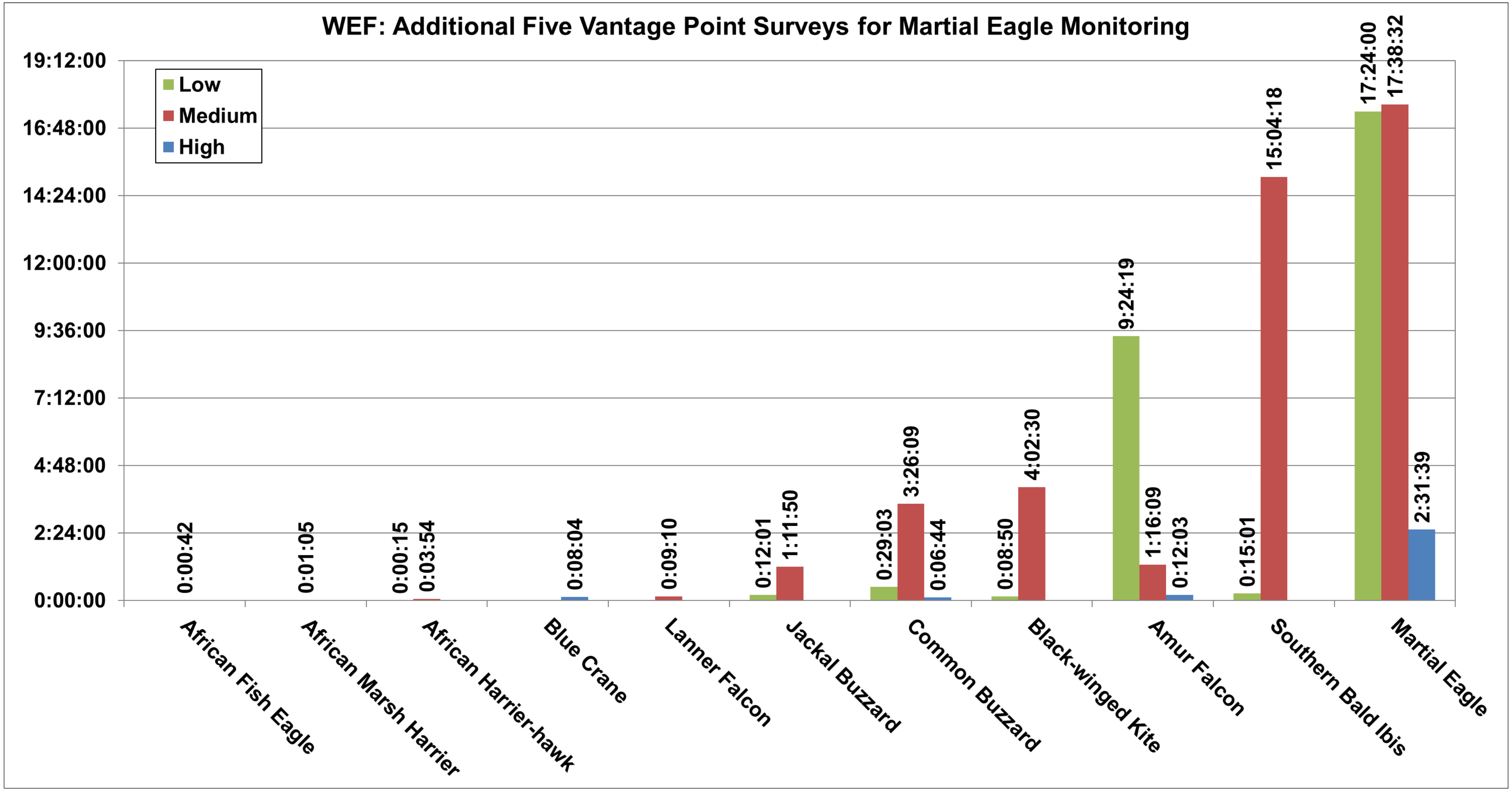

Figure 18: Recorded Flight Times (in Hours: Minutes: Seconds) and Flight Altitudes of Priority Species.

6. SPECIALIST FINDINGS AND ASSESSMENT OF IMPACTS

6.1 Wind Energy Facility (WEF)

The effects of a wind farm on birds are highly variable and depend on a wide range of factors, including the specification of the development, the topography of the surrounding land, the habitats affected and the number and species of birds present. With so many variables involved, the impacts of each wind farm must be assessed individually. The principal areas of concern with regard to effects on birds are listed below. Each of these potential effects can interact with each other, either increasing the overall impact on birds or, in some cases, reducing a particular impact (for example where habitat loss or displacement causes a reduction in birds using an area which might then reduce the risk of collision):

- Mortality of priority avifauna due to collisions with the wind turbines
- Displacement of priority avifauna due to disturbance during construction and operation of the wind farm
- Displacement of priority avifauna due to habitat change and loss at the wind farm
- Mortality of priority avifauna due to electrocution on the medium voltage overhead lines
- Mortality of priority avifauna due to collisions with the medium voltage overhead lines

It should be noted that the assessment is made on the *status quo* as it is currently on site. The possible change in land use in the broader development site has not been considered because the extent and nature of future developments (not only wind energy development) are unknown at this stage. It is possible that there could be changes in the foreseeable future in the form of mining.

6.1.1 Collision Mortality on Wind Turbines[6]

Wind energy generation has experienced rapid worldwide development over recent decades as its environmental impacts are considered to be relatively lower than those caused by traditional energy sources, with reduced environmental pollution and water consumption (Saidur *et al.*, 2011). However, bird fatalities due to collisions with wind turbines have been consistently identified as a main ecological drawback to wind energy (Drewitt and Langston, 2006).

Collisions with wind turbines appear to kill fewer birds than collisions with other man-made infrastructures, such as power lines, buildings or even traffic (Calvert *et al.* 2013; Erickson *et al.* 2005). Nevertheless, estimates of bird deaths from collisions with wind turbines worldwide range from 0 to almost 40 deaths per turbine per year (Sovacool, 2009). The number of birds killed varies greatly between sites, with some sites posing a higher collision risk than others, and with some species being more vulnerable (e.g. Hull *et al.* 2013; May *et al.* 2012a). These numbers may not reflect the true magnitude of the problem, as some studies do not account for detectability biases such as those caused by scavenging, searching efficiency and search radius (Bernardino *et al.* 2013; Erickson *et al.* 2005; Huso and Dalthorp 2014). Additionally, even for low fatality rates, collisions with wind turbines may have a disproportionate effect on some species. For long-lived species with low productivity and slow maturation rates (e.g. raptors), even low mortality rates can have a significant impact at the population level (e.g. Carrete *et al.* 2009; De Lucas *et al.* 2012a; Drewitt and Langston, 2006). The situation is even more critical for species of conservation concern, which sometimes are most at risk (e.g. Osborn *et al.* 1998).

High bird fatality rates at several wind farms have raised concerns among the industry and scientific community. High profile examples include the Altamont Pass Wind Resource Area (APWRA) in California because of high fatality of Golden eagles (*Aquila chrysaetos*), Tarifa in Southern Spain for Griffon vultures (*Gyps fulvus*), Smøla

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[6] This section is based largely on a (2014) review paper by Ana Teresa Marques, Helena Batalha, Sandra Rodrigues, Hugo Costa, Maria João Ramos Pereira,Carlos Fonseca, Miguel Mascarenhas, Joana Bernardino. ***Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies***. Biological Conservation 179 (2014) 40– 52.

in Norway for White-tailed eagles (*Haliaatus albicilla*), and the port of Zeebrugge in Belgium for gulls (*Larus* sp.) and terns (*Sterna* sp.) (Barrios and Rodríguez, 2004; Drewitt and Langston, 2006; Everaert and Stienen, 2008; May *et al.* 2012a; Thelander *et al.* 2003). Due to their specific features and location, and characteristics of their bird communities, these wind farms have been responsible for a large number of fatalities that culminated in the deployment of additional measures to minimize or compensate for bird collisions. However, currently, no simple formula can be applied to all sites; in fact, mitigation measures must inevitably be defined according to the characteristics of each wind farm and the diversity of species occurring there (Hull *et al.* 2013; May *et al.* 2012b). An understanding of the factors that explain bird collision risk and how they interact with one another is therefore crucial to proposing and implementing valid mitigation measures.

Species-Specific Factors

- Morphological Features

Certain morphological traits of birds, especially those related to size, are known to influence collision risk with structures such as power lines and wind turbines. Janss (2000) identified weight, wing length, tail length and total bird length as being collision risk determinant. Wing loading (ratio of body weight to wing area) and aspect ratio (ratio of wingspan squared to wing area) are particularly relevant, as they influence flight type and thus collision risk (Bevanger, 1994; De Lucas *et al.* 2008; Herrera-Alsina *et al.* 2013; Janss, 2000). Birds with high wing loading, such as the Griffon Vulture (*Gyps fulvus*), seem to collide more frequently with wind turbines at the same sites than birds with lower wing loadings, such as Common Buzzards (*Buteo buteo*) and Short-toed Eagles (*Circaetus gallicus*), and this pattern is not related with their local abundance (Barrios and Rodríguez, 2004; De Lucas *et al.* 2008). High wing-loading is associated with low flight manoeuvrability (De Lucas *et al.* 2008), which determines whether a bird can escape an encountered object fast enough to avoid collision.

Information on the wing loading of the priority species potentially occurring regularly at the proposed WEF was not available at the time of writing. However, based on general observations, and research on related species, it can be confidently assumed that priority species that could potentially be vulnerable to wind turbine collisions due to morphological features (high wing loading) are bustards and cranes making them less manoeuvrable (Keskin et al. 2019).

- Visual Perception

Birds are assumed to have excellent visual acuity, but this assumption is contradicted by the large numbers of birds killed by collisions with man-made structures (Drewitt and Langston, 2008; Erickson *et al.* 2005). A common explanation is that birds collide more often with these structures in conditions of low visibility, but recent studies have shown that this is not always the case (Krijgsveld *et al.* 2009). The visual acuity of birds seems to be slightly superior to that of other vertebrates (Martin, 2011; McIsaac, 2001). Unlike humans, who have a broad horizontal binocular field of 120°, some birds have two high acuity areas that overlap in a very narrow horizontal binocular field (Martin, 2011). Relatively small frontal binocular fields have been described for several species that are particularly vulnerable to power line collisions, such as vultures (Gyps sp.) cranes and bustards (Martin and Katzir, 1999; Martin et.al, 2010; Martin, 2012, 2011; O'Rourke *et al.* 2010). Furthermore, for some species, their high-resolution vision areas are often found in the lateral fields of view, rather than frontally (e.g. Martin et.al, 2010; Martin, 2012, 2011; O'Rourke *et al.* 2010). Finally, some birds tend to look downwards when in flight, searching for conspecifics or food, which puts the direction of flight completely inside the blind zone of some species (Martin et.al, 2010; Martin, 2011).

Some of the regularly occurring priority species at the proposed WEF have high resolution vision areas found in the lateral fields of view, rather than frontally, e.g., the ibises, bustards, and cranes. The exceptions to this are the priority raptors which all have wider binocular fields, although as pointed out by Martin (2011, 2012), this does not necessarily result in these species being able to avoid obstacles better.

- Phenology

Recent studies have shown that, within a wind farm, raptor collision risk and fatalities are higher for resident than for migrating birds of the same species. An explanation for this may be that resident birds generally use the wind farm area several times while a migrant bird crosses it just once (Krijgsveld *et al.* 2009). However, other factors like bird behaviour are certainly relevant. Katzner *et al.* (2012) showed that Golden Eagles performing local movements fly at lower altitudes, putting them at a greater risk of collision than migratory eagles. Resident eagles flew more frequently over cliffs and steep slopes, using low altitude slope updrafts, while migratory eagles flew more frequently over flat areas and gentle slopes where thermals are generated, enabling the birds to use them to gain lift and fly at higher altitudes.

South Africa is at the end of the migration path for summer migrants; therefore, the phenomenon of migratory flyways where birds are concentrated in large numbers for a limited period of time, e.g. the African Rift Valley or Mediterranean Red Sea flyways, is not a feature of the national landscape. The migratory priority species which could occur at the proposed WEF with some regularity, e.g., White Stork, Amur Falcon, and Common Buzzard will behave much the same as the resident birds once they arrive in the area. The same is valid for local migrants such as the Denham's Bustard. It is expected that, for the period when they are present, these species will be exposed to the same risks as resident species.

- Bird Behaviour

Flight type seems to play an important role in collision risk, especially when associated with hunting and foraging strategies. Kiting flight (hanging in the wind with almost motionless wings), which is used in strong winds and occurs in rotor swept zones, has been highlighted as a factor explaining the high collision rate of Red-tailed Hawks *Buteo jamaicensis* at APWRA (Hoover and Morrison, 2005), and could also be a factor in contributing to the high collision rate for Jackal Buzzards in South Africa (Ralston-Paton & Camagu 2019). The hovering behaviour exhibited by Common Kestrels *Falco tinnunculus* when hunting may also explain the fatality levels of this species at wind farms in the Strait of Gibraltar (Barrios and Rodríguez, 2004). This may also explain the high mortality rate of Rock Kestrels *Falco rupicolus* at wind farms in South Africa (Ralston-Paton & Camagu 2019). Kiting and hovering are associated with strong winds, which often produce unpredictable gusts that may suddenly change a bird's position (Hoover and Morrison, 2005). Additionally, while birds are hunting and focused on prey, they might lose track of wind turbine positions (Krijgsveld *et al.* 2009; Smallwood *et al.* 2009). In the case of raptors, aggressive interactions may play an important role in turbine fatalities, in that birds involved in these interactions are momentarily distracted, putting them at risk. At least one eye-witness account of a Martial Eagle getting killed by a turbine in South Africa in this fashion is on record (Simmons & Martins 2016)

Social behaviour may also result in a greater collision risk with wind turbines due to a decreased awareness of the surroundings. Several authors have reported that flocking behaviour increases collision risk with power lines as opposed to solitary flights (e.g. Janss, 2000). However, caution must be exercised when comparing the particularities of wind farms with power lines, as some species appear to be vulnerable to collisions with power lines but not with wind turbines, e.g. indications are that bustards, which are highly vulnerable to power line collisions, are not prone to wind turbine collisions – a Spanish database of over 7000 recorded turbine collisions contains no Great Bustards *Otis tarda* (A. Camiña 2012a). Similarly, in South Africa, only two bustard collisions with wind turbines have been reported to date, both Ludwig's Bustards (Ralston-Paton & Camagu 2019). No Denham's Bustards *Neotis denhami* turbine fatalities have been reported to date, despite the species occurring at several wind farm sites.

The priority species which could occur with some regularity at the proposed WEF can be classified as either: terrestrial species, soaring species, or occasional long-distance fliers. Terrestrial species spend most of the time foraging on the ground. They do not fly often and when they do, they generally fly for short distances at low to medium altitude. At the application site bustards and korhaans are included in this category. Occasional long-distance fliers generally behave as terrestrial species but can and do undertake long distance flights on occasion. Species in this category are White Stork, Denham's Bustard, Blue Crane, Grey Crowned Crane, Southern Bald Ibis, and Secretarybird. Soaring species spend a significant time on the wing in a variety of flight modes including soaring, kiting, hovering, and gliding at medium to high altitudes. At the project site, these include all the raptors.

- Avoidance Behaviours

Two types of avoidance have been described (Furness *et al.*, 2013): 'macro-avoidance' whereby birds alter their flight path to keep clear of the entire wind farm (e.g. Desholm and Kahlert, 2005; Plonczkier and Simms, 2012; Villegas-Patraca *et al.* 2014), and 'micro-avoidance' whereby birds enter the wind farm but take evasive actions to avoid individual wind turbines (Band *et al.* 2007). This may differ between species and may have a significant impact on the size of the risk associated with a specific species. It is generally assumed that 95-98% of birds will successfully avoid the turbines (SNH 2010).

It is anticipated that most birds at the proposed WEF will avoid the wind turbines, as is generally the case at all wind farms (SNH 2010). Exceptions already mentioned are raptors that engage in hunting which might serve to distract them and place them at risk of collision, birds engaged in display behaviour or inter- and intraspecific aggressive interaction. Complete macro-avoidance of the wind farm is unlikely for any of the priority species likely to occur at the proposed WEF.

- Bird Abundance

Some authors suggest that fatality rates are related to bird abundance, density or utilization rates (Carrete *et al.* 2012; Kitano and Shiraki, 2013; Smallwood and Karas, 2009), whereas others point out that, as birds use their territories in a non-random way, fatality rates do not depend on bird abundance alone (e.g. Ferrer *et al.* 2012; Hull *et al.* 2013). Instead, fatality rates depend on other factors such as differential use of specific areas within a wind farm (De Lucas *et al.* 2008). For example, at Smøla, White-tailed Eagle flight activity is correlated with collision fatalities (Dahl *et al.* 2013). In the APWRA, Golden Eagles, Red-tailed Hawks and American Kestrels (*Falco spaverius*) have higher collision fatality rates than Turkey Vultures (*Cathartes aura*) and Common Raven (*Corvus corax*), even though the latter are more abundant in the area (Smallwood *et al.* 2009), indicating that fatalities are more influenced by each species' flight behaviour and turbine perception. Also, in southern Spain, bird fatality was higher in the winter, even though bird abundance was higher during the pre-breeding season (De Lucas *et al.* 2008).

The abundance of priority species at the proposed WEF will fluctuate depending on the season of the year. Greater numbers are expected during the rainy season, when foraging conditions are better and certain migratory species are present.

Site-Specific Factors

- Landscape Features

Susceptibility to collision can also heavily depend on landscape features at a wind farm site, particularly for soaring birds that predominantly rely on wind updrafts to fly. Some landforms such as ridges, steep slopes and valleys may be more frequently used by some birds, for example for hunting or during migration (Barrios and Rodríguez, 2004; Drewitt and Langston, 2008; Katzner *et al.* 2012; Thelander *et al.* 2003). In APWRA, Red-tailed Hawk fatalities occur more frequently than expected by chance at wind turbines located on ridge tops and swales, whereas Golden Eagle fatalities are higher at wind turbines located on slopes (Thelander *et al.* 2003). Other birds may follow other landscape features, such as peninsulas and shorelines, during dispersal and migration periods. Kitano and Shiraki (2013) found that the collision rate of White-tailed Eagles along a coastal cliff was extremely high, suggesting an effect of these landscape features on fatality rates.

The project site does not contain many landscape features as it is situated on a slightly undulating plain. The most significant landscape features from a collision risk perspective are some of the low ridges which may be utilised by some species for lift especially during soaring flight behaviour.

- Flight Paths

For territorial raptors like Golden Eagles (and Verreaux's Eagles – see Ralston-Patton 2017), foraging areas are located closer to the nest. For example, in Scotland Golden Eagles have ranges of about 6 km around the nest, however the core areas where feeding takes place were typically within a 2 - 3 km radius around the nest (McGrady *et al.* 2002). These results, combined with the terrain features selected by Golden Eagles to forage such as areas close to ridges, can be used to predict the areas used by the species to forage (McLeod *et al.* 2002), and therefore provide a sensitivity map and guidance to the development of new wind farms (Bright *et al.* 2006).

The Martial Eagle nest (coordinates provided on request) is the hub of the flight activity for the pair of eagles. A No-Go buffer zone of at least 5km should be implemented around the nest to reduce the risk of collisions.

Some of the wetlands and dams act as a focal point for flight activity as birds converge on the wetlands and dams, e.g. Grey Crowned Crane in some of the wetlands, and some dams with dead trees used as roosts by Southern Bald Ibis. The same could be said for the roosts and colonies of Southern bald Ibis on low cliffs which are focal points for flight activity.

- Food Availability

Factors that increase the use of a certain area or that attract birds, like food availability; also play a role in collision risk. For example, the high density of raptors at the APWRA and the high collision fatality due to collision with turbines is thought to result, at least in part, from high prey availability in certain areas (Hoover and Morrison, 2005; Smallwood *et al.* 2001). This may be particularly relevant for birds that are less aware of obstructions such as wind turbines while foraging (Krijgsveld *et al.* 2009; Smallwood *et al.* 2009). It is speculated that the mortality of three Verreaux's Eagles in 2015 at a wind farm site in South Africa may have been linked to the availability of food (Smallie 2015).

The agricultural activity is an attractant for Southern Bald Ibis during certain times of the year. Natural grassland is the foraging habitat of choice for a range of priority species, including Secretarybird, Southern Bald Ibis, Yellow-breasted Pipit, Rudd's Lark, Blue Korhaan, Denham's Bustard and White-bellied Bustard.

- Summary

The proposed Emvelo WEF will pose a collision risk to several priority species which could occur regularly at the site. Species exposed to this risk are large terrestrial species i.e., mostly bustards such as Blue Korhaan, Denham's Bustard, Ludwig's Bustard, and Blue Crane[7], although bustards and cranes generally seem to be not as vulnerable to turbine collisions as was originally anticipated (Ralston-Paton & Camagu 2019). Soaring priority species, i.e., raptors such as Martial Eagle, Cape Vulture, Lanner Falcon, Brown Snake Eagle, and Common Buzzard are most at risk of all the priority species likely to occur regularly at the project site.

In summary, the following priority species could be at risk of collisions with the turbines: African Fish Eagle, African Harrier-Hawk, African Marsh Harrier, Amur Falcon, Black Harrier, Black Sparrowhawk, Black-bellied Bustard, Black-chested Snake Eagle, Black-winged Kite, Black-winged Lapwing, Blue Crane, Blue Korhaan, Brown Snake Eagle, Cape Vulture, Common Buzzard, Denham's Bustard, Greater Flamingo, Grey Crowned Crane, Grey-winged Francolin, Jackal Buzzard, Lanner Falcon, Lesser Flamingo, Long-crested Eagle, Marsh Owl, Martial Eagle, Northern Black Korhaan, Rufous-breasted Sparrowhawk, Secretarybird, Southern Bald Ibis, Spotted Eagle-Owl, Cape Eagle-Owl, Western Osprey, White Stork, White-bellied Bustard, and Yellow-breasted Pipit.

[7] Although the species is unlikely to occur regularly.

6.1.2 Displacement Due to Disturbance

The displacement of birds from areas within and surrounding wind farms due to visual intrusion and disturbance can in effect amount to habitat loss. Displacement may occur during both the construction and operation phases of wind farms and may be caused by the presence of the turbines themselves through visual, noise and vibration impacts, or as a result of vehicle and personnel movements related to site maintenance. The scale and degree of disturbance will vary according to site- and species-specific factors and must be assessed on a site-by-site basis (Drewitt & Langston 2006).

Unfortunately, few studies of displacement due to disturbance are conclusive, often because of the lack of before-and-after and control-impact (BACI) assessments. Indications are that Great Bustard *Otis tarda* could be displaced by wind farms up to one kilometre from the facility (Langgemach 2008). An Austrian study found displacement for Great Bustards up to 600m (Wurm & Kollar as quoted by Raab *et al.* 2009). However, there is also evidence to the contrary; information on Great Bustard received from Spain points to the possibility of continued use of leks at operational wind farms (Camiña 2012b). The same situation seems to prevail at wind farms in the Eastern Cape where Denham's Bustard is still using wind farm sites as leks.[8] Research on small grassland species in North America indicates that permanent displacement is uncommon and is very species specific (e.g. see Stevens et.al 2013, Hale et.al 2014). There also seems to be little evidence for a persistent decline in passerine populations at wind farm sites in the United Kingdom (despite some evidence of turbine avoidance), with some species, including Skylark, showing increased populations after wind farm construction (see Pierce-Higgins et. al 2012). Populations of Thekla Lark *Galerida theklae* were found to be unaffected by wind farm developments in Southern Spain (see Farfan *et al*. 2009).

The consequences of displacement for breeding productivity and survival are crucial to whether or not there is likely to be a significant impact on population size. However, studies of the impact of wind farms on breeding birds are also largely inconclusive or suggest lower disturbance distances, though this apparent lack of effect may be due to the high site fidelity and long lifespan of the breeding species studied. This might mean that the true impacts of disturbance on breeding birds will only be evident in the longer term, when new recruits replace existing breeding birds. Few studies have considered the possibility of displacement for short-lived passerines (such as larks), although Leddy *et al.* (1999) found increased densities of breeding grassland passerines with increased distance from wind turbines, and higher densities in the reference area than within 80m of the turbines. A review of minimum avoidance distances of 11 breeding passerines were found to be generally <100m from a wind turbine ranging from 14 – 93m (Hötker *et al.* 2006). A comparative study of nine wind farms in Scotland (Pearce-Higgens *et al.* 2009) found unequivocal evidence of displacement: Seven of the 12 species studied exhibited significantly lower frequencies of occurrence close to the turbines, after accounting for habitat variation, with equivocal evidence of turbine avoidance in a further two. No species were more likely to occur close to the turbines. Levels of turbine avoidance suggest breeding bird densities may be reduced within a 500m buffer of the turbines by 15–53%, with Common Buzzard *Buteo buteo*, Hen Harrier *Circus cyaneus*, Golden Plover *Pluvialis apricaria*, Snipe *Gallinago gallinago*, Curlew *Numenius arquata* and Wheatear *Oenanthe oenanthe* most affected. In a follow-up study, monitoring data from wind farms located on unenclosed upland habitats in the United Kingdom were collated to test whether breeding densities of upland birds were reduced as a result of wind farm construction or during wind farm operation. Red Grouse *Lagopus lagopus scoticus*, Snipe *Gallinago gallinago* and Curlew *Numenius arquata* breeding densities all declined on wind farms during construction. Red Grouse breeding densities recovered after construction, but Snipe and Curlew densities did not. Post-construction Curlew breeding densities on wind farms were also significantly lower than reference sites. Conversely, breeding densities of Skylark *Alauda arvensis* and Stonechat *Saxicola torquata* increased on wind farms during construction. Overall, there was little evidence for consistent post-construction population declines in any species, suggesting that wind farm construction can have greater impacts upon birds than wind farm operation (Pierce-Higgens *et al.* 2012).

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[8] Personal communication by Wessel Rossouw, bird monitor based in Jeffreys Bay, from personal observations in the Kouga municipal area.

A measure of displacement will inevitably take place for all priority species as a result of disturbance from construction activities during the construction phase. This will primarily affect ground-nesting species in the remaining high-quality grassland, wetlands, and wetland fringes. In addition, the Southern Bald Ibises that roost and breed on the Project Site could face a disruption of their reproductive cycle. Some species could recolonise the area after the completion of construction. However, as a result of habitat fragmentation and operational turbines causing disturbance, other species could only partially return to their previous habitat, resulting in lower densities than before. In summary, the following species could be impacted by disturbance during the construction phase: African Fish Eagle, African Grass Owl, African Harrier-Hawk, African Marsh Harrier, Black Sparrowhawk, Black-rumped Buttonquail, Black-winged Kite, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Greater Kestrel, Grey Crowned Crane, Grey-winged Francolin, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Rudd's Lark, Rufous-breasted Sparrowhawk, Secretarybird, Southern Bald Ibis, Spotted Eagle-Owl, White-bellied Bustard, and Yellow-breasted Pipit.

6.1.3 Displacement due to Habitat Loss

The scale of permanent habitat loss resulting from the construction of a wind farm and associated infrastructure depends on the size of the project but, in general, it is likely to be small per turbine base. Typically, actual habitat loss amounts to 2–5% of the total development site (Fox *et al.* 2006 as cited by Drewitt & Langston 2006), though effects could be more widespread where developments interfere with hydrological patterns or flows on wetland or peatland sites (unpublished data). Some changes could also be beneficial. For example, habitat changes following the development of the Altamont Pass wind farm in California led to increased mammal prey availability for some species of raptor (for example through greater availability of burrows for Pocket Gophers *Thomomys bottae* around turbine bases), though this may also have increased collision risk (Thelander *et al.* 2003 as cited by Drewitt & Langston 2006).

However, the results of habitat transformation may be more subtle, whereas the actual footprint of the wind farm may be small in absolute terms; the effects of the habitat fragmentation brought about by the associated infrastructure (e.g. power lines and roads) may be more significant. Sometimes Great Bustard can be seen close to or under power lines, but a study done in Spain (Lane *et al.* 2001 as cited by Raab *et al.* 2009) indicates that the total observation of Great Bustard flocks was significantly higher further from power lines than at control points. Shaw (2013) found that Ludwig's Bustard generally avoids the immediate proximity of roads within a 500m buffer. Bidwell (2004) found that Blue Cranes select nesting sites away from roads. This means that power lines and roads also cause loss and fragmentation of the habitat used by the population in addition to the potential direct mortality. The physical encroachment increases the disturbance and barrier effects that contribute to the overall habitat fragmentation effect of the infrastructure (Raab *et al.* 2010). It has been shown that fragmentation of natural grassland in Mpumalanga (in that case by afforestation) has had a detrimental impact on the densities and diversity of grassland species (Allan *et al.* 1997).

The construction of additional roads is likely to result in habitat fragmentation, although the site already has a large number of access roads, most of which will be upgraded and utilised for the wind farm development. This, together with the disturbance factor of the operating turbines, could have an effect on the density of several species, particularly larger terrestrial species which would utilise the remaining natural grassland, wetlands, and wetland fringes as breeding habitat. It is not expected that any priority species will be permanently displaced from the development site, but densities may be reduced. In summary, the following terrestrial species and raptors are likely to be most affected by habitat transformation: African Grass Owl, Black-rumped Buttonquail, Black-winged Lapwing, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Rudd's Lark, Secretarybird, White-bellied Bustard, and Yellow-breasted Pipit.

6.1.4 *Electrocution on the 33kV Medium Voltage Network*

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2000). The electrocution risk is largely determined by the design of the electrical hardware.

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the electricity could potentially pose an electrocution risk to several power line sensitive species that could on occasion perch on these poles.

In summary, the following priority species are expected to be vulnerable to electrocution[9]: African Fish Eagle, African Goshawk, African Harrier-Hawk, African Marsh Harrier, African Sacred Ibis, Amur Falcon, Black Harrier, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Egyptian Goose, Grey Crowned Crane, Hadada Ibis, Hamerkop, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Pied Crow, Rock Kestrel, Rufous-breasted Sparrowhawk, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Cattle Egret, Western Osprey, and Yellow-billed Kite.

6.1.5 *Collisions with the 33kV medium voltage network*

While the intention is to place the 33kV reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the line could potentially pose a collision risk to various species. The topic of collisions is extensively covered under 6.2.2 below and will not be repeated here.

In summary, the following priority species could be vulnerable to collisions with the 33kV medium voltage lines[10]: African Black Duck, African Darter, African Sacred Ibis, African Spoonbill, Black Heron, Black-bellied Bustard, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Blue-billed Teal, Cape Shoveler, Cape Teal, Cape Vulture, Denham's Bustard, Egyptian Goose, Fulvous Whistling Duck, Glossy Ibis, Goliath Heron, Great Egret, Greater Flamingo, Grey Crowned Crane, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Bald Ibis, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-bellied Bustard, White-breasted Cormorant, White-faced Whistling Duck, and Yellow-billed Duck.

6.2 Grid Connection Components

Negative impacts on avifauna by electricity infrastructure generally take two main forms namely electrocution and collisions (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Van Rooyen 2004; Jenkins *et al*. 2010). Displacement due to habitat transformation and disturbance associated with the construction of the electricity infrastructure is another impact that could potentially impact on avifauna.

[9] These include both wind and powerline priority species

[10] These include both wind and powerline priority species.

6.2.1 Electrocutions

Electrocution refers to the scenario where a bird is perched, or attempts to perch, on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the voltage size of the proposed powerline and the pole/tower design. Should the proposed OHL be constructed using a 132kV tower specification, the electrocution impact for the majority of priority species will be negligible. The Cape Vulture is the only priority species, due to their size and gregarious nature, capable of bridging the clearance distances of an OHL constructed using this specification.

Ordinarily, the construction of a single circuit powerline using the approved vulture friendly pole/tower design D-DT-7649 in accordance with the Distribution Technical Bulletin titled *Refurbishment of 66/88kV line kite type frames with D-DT-7649 type top configuration* - *Reference Number 240-170000467* will eliminate the electrocution risk. The configuration of the insulators and the clearance distances between the live and earthed components on this structure can comfortably accommodate a perching vulture. However, if the OHL will be built on lattice structures, it is imperative that there is a minimum clearance of 1.8m between the jumper cables and/or insulators and the horizontal earthed component on the lattice structure (pers.comm. Lourens Leeuwner - Eskom-EWT Strategic Partnership Manager). Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is also recommended (if suitable insulation material is readily available); alternatively, all jumper cables must be suspended below the crossarms.

Electrocutions within the proposed on-site substation are possible, however, the likelihood of this impact on the more sensitive SCC is remote, as these species are unlikely to regularly utilise the infrastructure within the on-site substation station for perching or roosting. Species that are more vulnerable to this impact are medium-sized raptors, corvids, owls, and certain species of waterbirds.

It is assumed that the OHL will be built with 132kV pole/tower designs therefore the powerline-sensitive species potentially vulnerable to electrocution on the actual towers/poles is Cape Vulture. As far as the substation is concerned, the following species are potentially at risk of electrocution: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey, and Yellow-billed Kite.

6.2.2 Collisions

Collisions are the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes, and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001). In a PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with transmission lines:

"The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological, and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes, and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini et al. 2005, Jenkins et al. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high *wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the lower-resolution, and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin et al. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown et al. 1987, Henderson et al. 1996).*

Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power lines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 2012).

The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines on a common servitude or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins et al. 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on power lines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown et al. 1987, Faanes 1987, Alonso et al. 1994a, Bevanger 1994).”

From incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are generally susceptible to power line collisions in South Africa (**Figure 19**).

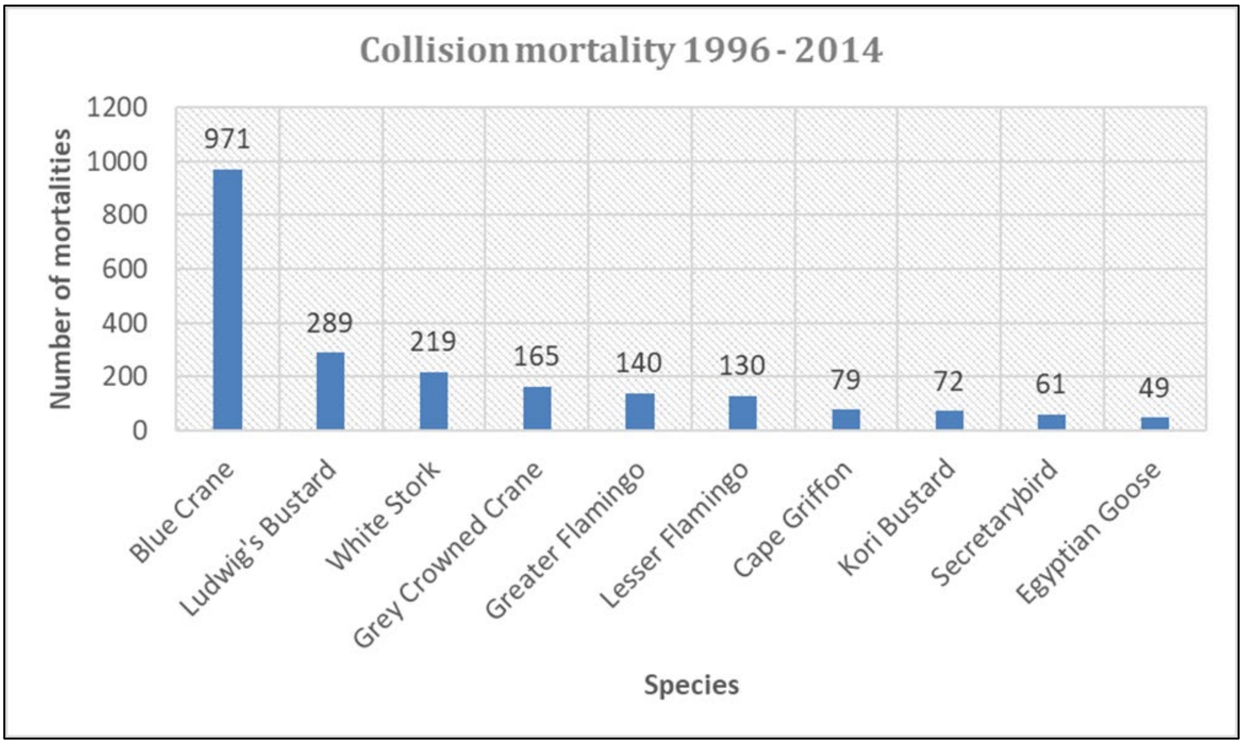

Figure 19: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data)

Power line collisions are generally accepted as a key threat to bustards (Raab *et al*. 2009; Raab *et al*. 2010; Jenkins & Smallie 2009; Barrientos *et al*. 2012, Shaw 2013). In a recent study, carcass surveys were performed under high voltage transmission lines in the Karoo for two years, and low voltage distribution lines for one year (Shaw 2013). Ludwig's Bustard was the most common collision victim (69% of carcasses), with bustards generally comprising 87% of mortalities recovered. Karoo Korhaan was also recorded, but to a much lesser extent than Ludwig's Bustard. The reasons for the relatively low collision risk of this species probably include their smaller size (and hence greater agility in flight) as well as their more sedentary lifestyles, as local birds are familiar with their territory and are less likely to collide with power lines (Shaw 2013).

Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is key to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards *Ardeotis kori*, Blue Cranes *Anthropoides paradiseus* and White Storks *Ciconia ciconia*. In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35°, respectively, are sufficient to render the birds blind in the direction of travel; in storks, head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (A*ccipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes and are also known to be vulnerable to power line collisions.

Despite doubts about the efficacy of line marking to reduce the collision risk for bustards (Jenkins *et al*. 2010; Martin *et al.* 2010), there are numerous studies which prove that marking a line with PVC spiral type Bird Flight Diverters (BFDs) generally reduce mortality rates (e.g. Bernardino *et al.* 2018; Sporer *et al.* 2013, Barrientos *et al*. 2011; Jenkins *et al*. 2010; Alonso & Alonso 1999; Koops & De Jong 1982), including to some extent for bustards (Barrientos *et al*. 2012; Hoogstad 2015 pers.comm). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. Barrientos *et al.* (2011) reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease of 55–94% in bird mortalities. Koops and De Jong (1982) found that the spacing of the BFDs was critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5m, whereas using the same devices at 10m intervals only reduces the mortality by 57%. Barrientos *et al*. (2012) found that larger BFDs were more effective in reducing Great Bustard collisions than smaller ones. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al*. 2010).

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the Endangered Wildlife Trust (EWT) and Eskom tested the effectiveness of two types of line markers in reducing power line collision mortalities of large birds on three 400kV transmission lines near Hydra substation in the Karoo. Marking was highly effective for Blue Cranes, with a 92% reduction in mortality, and large birds in general with a 56% reduction in mortality, but not for bustards, including the endangered Ludwig's Bustard. The two different marking devices were approximately equally effective, namely spirals and bird flappers, they found no evidence supporting the preferential use of one type of marker over the other (Shaw *et al*. 2017).

The up to 132kV OHL could pose a collision risk to virtually all powerline sensitive avifauna, depending on where those spans are located. Species potentially at risk are African Black Duck, African Darter, African Grass Owl, African Sacred Ibis, African Spoonbill, Black Heron, Black-bellied Bustard, Black-crowned Night Heron, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Blue-billed Teal, Cape Shoveler, Cape Teal, Cape Vulture, Denham's Bustard, Egyptian Goose, Fulvous Whistling Duck, Glossy Ibis, Goliath Heron, Great Egret, Greater Flamingo, Grey Crowned Crane, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Mallard, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Bald Ibis, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Wattled Crane, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-bellied Bustard, White-breasted Cormorant, White-faced Whistling Duck, and Yellow-billed Duck.

6.2.3 Displacement due to Habitat Transformation

During the construction of power lines, service roads (jeep tracks) and substations, habitat destruction/transformation inevitably takes place. The construction activities will constitute the following:

- Site clearance and preparation;
- Construction of the infrastructure (i.e. the on-site substation, OHL, and service road);
- Transportation of personnel, construction material and equipment to the site, and personnel away from the site;
- Removal of vegetation for the proposed substation and stockpiling of topsoil and cleared vegetation;
- Excavations for infrastructure;

These activities could impact on birds breeding, foraging, and roosting in or in close proximity of the proposed onsite substations through **transformation of habitat**, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the substation yard is unavoidable. Fortunately, due to the nature of the vegetation, and judged by the existing power lines, very little if any vegetation clearing will be required in the power line servitudes. The habitat in the study area is extensive, very uniform, and largely untransformed from a bird impact perspective; therefore, the loss of a few hectares of habitat for priority species due to direct habitat transformation associated with the construction of the proposed substation is likely to have a low impact on them. The species most likely to be more heavily impacted would be small, common, non-Red Data species which happen to be resident in those few hectares of Karoo habitat.

Powerline sensitive species which are potentially vulnerable to displacement due to habitat transformation are mostly ground nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl, and White-bellied Bustard.

6.2.4 *Displacement due to Disturbance*

Apart from direct habitat destruction, the above-mentioned activities also impact on birds through **disturbance**; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be very challenging to implement. Large terrestrial species are most likely to be affected by displacement due to disturbance.

There is a Martial Eagle nest located approximately 1.8km north-east of Grid Corridor Alternative 3. Should Grid Corridor Alternative 3 be utilised, the chances of the birds being temporary displaced due to disturbance by the construction activities are very high. Powerline sensitive species which are potentially vulnerable to displacement due to disturbance are mostly ground nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl, and White-bellied Bustard.

6.3 The Identification and Assessment of Potential Impacts: Wind Energy Facility

The potential impacts on avifauna identified in the course of the study are listed and assessed in the tables below. The impact criteria are explained in Appendix 6.

6.3.1 *Construction Phase*

- Displacement of priority species due to disturbance associated with the construction of the wind turbines and associated infrastructure.
- Displacement of priority species due to habitat transformation associated with the construction of the wind turbines and associated infrastructure.

Table 10: Rating of impacts: Construction Phase

Impact Phase: Construction							
Potential impact description: Habitat Transformation							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	H	Negative	M	M	H
With Mitigation	L	M	H	Negative	M	M	H
Can the impact be reversed?			Partially, with rehabilitation				
Will impact cause irreplaceable loss of resources?			No				
Can impact be avoided, managed, or mitigated?			Yes				
Mitigation measures to reduce residual risk or enhance opportunities: • Removal of vegetation must be restricted to a minimum and must be rehabilitated to its former state where possible after construction. • Construction of new roads should only be considered if existing roads cannot be upgraded. • The recommendations of the biodiversity and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned to limit the impact of habitat transformation on priority species.							

• No construction should take place in all infrastructure exclusion zones as indicated in Section 6.5. • Following construction, rehabilitation of all disturbed areas (e.g., temporary access tracks and laydown areas) must be undertaken. A habitat restoration plan is to be developed by a specialist and included within the EMPr.	
Residual impact	Medium, given the sensitivity of the grassland and wetland habitats in the area.

Impact Phase: Construction							
Potential impact description: Displacement due to Disturbance							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	H	Negative	M	M	H
With Mitigation	L	M	H	Negative	M	M	H
Can the impact be reversed?			Yes				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, or mitigated?			Yes				
Mitigation measures to reduce residual risk or enhance opportunities: • Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • No construction should take place in all infrastructure exclusion zones as indicated in Section 6.5 unless existing roads are to be upgraded.							
Residual impact	Medium, given the sensitivity of the grassland and wetland habitats in the area.						

6.3.2 Operational Phase

- Mortality due to collisions with the wind turbines.
- Mortality due to electrocutions on the overhead sections of the internal 33kV cables.
- Mortality due to collisions with the overhead sections of the internal 33kV cables.

Table 11: Rating of impacts: Operational Phase

IMPACT PHASE: OPERATIONAL							
Potential impact description: Mortality due to Collisions with Wind Turbines							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	H	Negative	H	H	M
With Mitigation	M	M	H	Negative	M	M	M
Can the impact be reversed?			No				
Will impact cause irreplaceable loss or resources?			Potentially yes (breeding SCC)				
Can impact be avoided, managed, or mitigated?			Yes				

Mitigation measures to reduce residual risk or enhance opportunities: • No turbines (including the rotor swept area) should be located in turbine exclusion zones as indicated in Section 6.5. • Pro-active mitigation in the form of Shutdown on Demand (SDoD) or automated curtailment must be implemented in the medium risk zones as indicated in Section 6.5. • Live-bird monitoring and carcass searches should be implemented in the operational phase, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins et al. 2015) to assess collision rates. • All wind turbines must have one blade painted according to a CAA approved pattern to reduce the risk of raptor collisions. It is acknowledged that blade painting as a mitigation strategy is still in an experimental phase in South Africa, but research indicates that it has a very good chance of reducing raptor mortality, based on research conducted in Norway (see Simmons et al. 2021 (Appendix 8) for an explanation of the science and research behind this mitigation method). • If at any time estimated collision rates to be determined by Collision Risk Modelling during the EIA phase of the project indicate unacceptable mortality levels of priority species, i.e., if during operation it exceeds these mortality thresholds, additional measures will have to be considered as part of an adaptive management strategy.

Residual risk	A residual risk of mortality through collisions remains, however with appropriate mitigations measures detailed above the significance of this risk is expected to be medium.

IMPACT PHASE: OPERATIONAL							
Potential impact description: Mortality due to Collisions with Power Lines (internal 33kV cables)							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	H	Negative	H	H	H
With Mitigation	L	H	H	Negative	M	L	M
Can the impact be reversed?			No				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, or mitigated?			Yes				
Mitigation measures to reduce residual risk or enhance opportunities: • Bird flight diverters should be installed on all the overhead line sections for the full span length directly associated with the proposed WEF according to the applicable Eskom standard at the time. • Design specification should conform to types of devices that will be visible at night e.g. LED type bird flight diverters.							
Residual impact	There will be a residual impact which is potentially of medium negative significance with the implementation of mitigation measures						

IMPACT PHASE: OPERATIONAL							
Potential impact description: Mortality due to Electrocution (internal 33kV cables)							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	M	Negative	M	M	H
With Mitigation	L	H	M	Negative	L	L	H
Can the impact be reversed?			No				

Will impact cause irreplaceable loss or resources?	No
Can impact be avoided, managed, or mitigated?	Yes
Mitigation measures to reduce residual risk or enhance opportunities: • Underground cabling should be used as much as is practically possible. • If the use of overhead lines is unavoidable due to technical reasons, the Avifaunal Specialist must be consulted timeously to ensure that a raptor friendly pole design is used, and that appropriate mitigation is implemented pro-actively for complicated pole structures e.g., insulation of live components to prevent electrocutions on terminal structures and pole transformers. • Regular inspections of the overhead sections of the internal reticulation network must be conducted during the operational phase to look for carcasses, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins *et al.* 2015).	
Residual impact	There is a potential residual impact of low significance with mitigation.

6.3.3 Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning (dismantling) of the wind turbines and associated infrastructure.

Table 12: Rating of impacts: Decommissioning Phase

IMPACT PHASE: DECOMMISSIONING							
Potential impact description: Displacement due to Disturbance							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	M	L	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?			Yes				
Will impact cause irreplaceable loss of resources?			No				
Can impact be avoided, managed, or mitigated?			Yes				
Mitigation measures to reduce residual risk or enhance opportunities: • A site specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMPr and should apply good environmental practice during construction; • Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry.							
Residual impact	Yes, but acceptable (low significance) with mitigation						

6.4 The Identification and Assessment of Potential Impacts: Grid Components

The potential impacts on avifauna identified during the study are listed and assessed in the tables below. The impact criteria are explained in **Appendix 6**.

6.4.1 Construction Phase

- Displacement of power line sensitive species due to disturbance
- Displacement of power line sensitive species due to habitat transformation.

Table 13: Rating of impacts: Construction Phase

Impact Phase: Construction							
Potential impact description: Displacement due to Disturbance							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	M	L	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?			Yes				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, or mitigated?			Yes				
Mitigation measures to reduce residual risk or enhance opportunities: • Martial Eagle nest – A 2.5km no disturbance buffer zone must be implemented around the nest. No construction activity should take place in this zone from March to December, which is the breeding season for these eagles. • Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • No construction should take place in all infrastructure exclusion zones as indicated in Section 6.5 unless existing roads are to be upgraded.							
Residual impact	Yes, but acceptable (low significance) with mitigation						
Impact Phase: Construction							
Potential impact description: Habitat Transformation							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	L	Negative	M	L	H
With Mitigation	L	M	L	Negative	L	L	H
Can the impact be reversed?			Partially, with rehabilitation				
Will impact cause irreplaceable loss of resources?			No				
Can impact be avoided, managed, or mitigated?			Yes				
Mitigation measures to reduce residual risk or enhance opportunities: • Removal of vegetation must be restricted to a minimum and must be rehabilitated to its former state where possible after construction. • Construction of new roads should only be considered if existing roads cannot be upgraded. • The recommendations of the biodiversity and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned to limit the impact of habitat transformation on priority species. • No construction should take place in all infrastructure exclusion zones as indicated in Section 6.5.							

• Following construction, rehabilitation of all disturbed areas (e.g., temporary access tracks and laydown areas) must be undertaken. A habitat restoration plan is to be developed by a specialist and included within the EMPr.	
Residual impact	Yes, but acceptable (low significance) with mitigation

6.4.2 Operational Phase

- Mortality of priority species due to collisions with the 132kV OHL
- Electrocutions on the 132kV and/or in the Substation Yard

Table 14: Rating of impacts: Operational Phase

IMPACT PHASE: OPERATIONAL							
Potential impact description: Mortality due to Collisions with Power Lines (132kV)							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	H	Negative	H	H	H
With Mitigation	L	H	H	Negative	M	M	M
Can the impact be reversed?			No				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, or mitigated?			Yes				
Mitigation measures to reduce residual risk or enhance opportunities: • Mitigation in the form of Bird Flight Diverters on the OHL is required. The entire length of the OHL should be fitted with Eskom approved Bird Flight Diverters. Design specification should conform to types of devices that will be visible at night e.g. LED type bird flight diverters. • The operational monitoring programme must include regular monitoring (i.e. quarterly) of the power lines for collision mortalities.							
Residual impact	There will be a residual impact which is potentially of medium negative significance with the implementation of mitigation measures.						
IMPACT PHASE: OPERATIONAL							
Potential impact description: Mortality due to Electrocutions (132kV OHL and/or Substation Yard)							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	M	Negative	M	M	H
With Mitigation	L	H	M	Negative	L	L	H
Can the impact be reversed?			No				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, or mitigated?			Yes				
Mitigation measures to reduce residual risk or enhance opportunities: • A Vulture-friendly pole design should be used.							

• Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is also recommended. • Monitor the electrocution mortality in the substations. Apply mitigation if electrocution happens regularly.	
Residual impact	There is a potential residual impact of low significance with mitigation.

6.4.3 Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning (dismantling) of the grid connection.

Table 15: Rating of impacts: Decommissioning Phase

IMPACT PHASE: DECOMMISSIONING							
Potential impact description: Displacement due to Disturbance							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	M	L	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?			Yes				
Will impact cause irreplaceable loss of resources?			No				
Can impact be avoided, managed, or mitigated?			Yes				
Mitigation measures to reduce residual risk or enhance opportunities: • A site specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMPr and should apply good environmental practice during construction; • Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. • Martial Eagle nest – A 2.5km no disturbance buffer zone must be implemented around the nest. No dismantling activity should take place in this zone from March to December, which is the breeding season for these eagles. • Measures to control noise and dust should be applied according to current best practice in the industry. • No off-road driving should be allowed.							
Residual impact	Yes, but acceptable (low significance) with mitigation						

6.5 The Identification of Environmental Sensitivities: Wind Energy Facility

The following environmental sensitivities were identified from an avifaunal perspective for the proposed wind energy facility:

6.5.1 *Very High Sensitivity – All Infrastructure Exclusion Zones.*

- A **2.5km No-Go zone** around the identified Martial Eagle nest should be implemented and maintained to reduce the risk of collision mortality and displacement due to disturbance.
- All **wetland No-Go areas** as identified by the Aquatic Specialist should be buffered by an additional 110m on either side to reduce the risk of turbine collisions and to prevent the disturbance of priority species breeding and roosting in these areas. Priority species in this category include African Fish Eagle, African Grass Owl, African Marsh Harrier, Black-winged Pratincole, Blue Crane, Grey Crowned Crane, Long-crested Eagle, Marsh Owl, Yellow-billed Stork, and sensitive Species Number 23 (as listed by the National Screening Tool). During the EIA Phase fine scale habitat modelling and identification of wetland corridors for cryptic / low detection probability wetland species will be conducted. Two forms of risk zones will be delineated, namely core breeding habitat, and associated connectivity habitat. Connectivity habitat will include wetland habitats not used for breeding but for movement, as well as wetland/grassland margins. These features will need to be buffered to account for the sensitivity of the respective species involved.
- Modelled **Yellow-breasted Pipit and Rudd's Lark habitat areas** are considered No-Go zones. These high-quality grassland areas were identified to prevent displacement of birds due to disturbance and habitat destruction. The Yellow-breasted Pipit and Rudd's Lark model output represents the habitat patches most suitable for the species' using a multi-year assessment of imagery indices etc. spanning 2019–2023. This is to account for variability related to drivers of habitat suitability for grassland habitat specialist species such as these endemic larks and pipit. Primary drivers of variability include seasonal rainfall across years, burning/fire, and grazing intensity. The model boundaries will extend beyond suitable habitat into other habitats (forest edge, roads, etc.) in some areas as we have accounted for typical blade swept area (BSA) by buffering the habitat output. This output should be considered high sensitivity and avoided (no-go) given habitat loss/degradation is the primary issue. Although Botha's Larks were not observed on site during the extensive surveys conducted, further investigations regarding habitat suitability will be conducted through modelling during the EIA phase of the project. This will be done to understand if the proposed development poses any risk to the species.

6.5.2 *High Sensitivity – Turbine Exclusion Zones.*

- A **Martial Eagle nest** is located in a stand of alien trees north-west of the Project Site. The modelled No-turbine buffer zone must be implemented around the nest to reduce the risk of turbine collisions. Currently Turbines 1–3, 5, 7, 9, 13 and 15 are located within the Turbine Exclusion Zone.
- There are two **Southern Bald Ibis colonies** located within the WEF Project Site. A shaped turbine exclusion zone has been delineated based on modelled flight activity. The modelling workflow incorporated all the flight data collected within the area during the pre-construction monitoring. The model identifies high risk flight areas by considering associations between the underlying habitat and topography in relation to the recorded Southern Bald Ibis flight data and proximity to roosts. Currently Turbines 4, 16, and 34 are located within the Turbine Exclusion Zone.
- **High Sensitivity grassland habitat** for Yellow-breasted Pipit and Rudd's Lark.
- **High Sensitivity wetland habitat** should be defined through detailed habitat modelling and then appropriately buffered, movement corridors should also be determined and buffered to accommodate for nocturnal movement and migration for Sensitive Species 23 (as listed by the National Screening Tool). This will be conducted during the EIA Phase of the Project.
- All **drainage lines** should be buffered by 210m on either side to reduce the risk of turbine collisions.

6.5.3 Medium Sensitivity – Mitigation Zones.

- A **Martial Eagle nest** is located in a stand of alien trees north-west of the Project Site. Pro-active mitigation in the form of Shutdown on Demand (SDoD) or automated curtailment must be implemented in the medium risk zones. There are several turbines located within this zone (**Figure 20**).

- There are two **Southern Bald Ibis colonies** located inside the Project Site. Pro-active mitigation in the form of Shutdown on Demand (SDoD) or automated curtailment must be implemented in the medium risk zones. There are several turbines located within this zone (**Figure 21).**

See **Figures 20–23** for maps of the No-Go Zones, Turbine Exclusion Zones, and Medium Sensitivity Mitigation Zones.

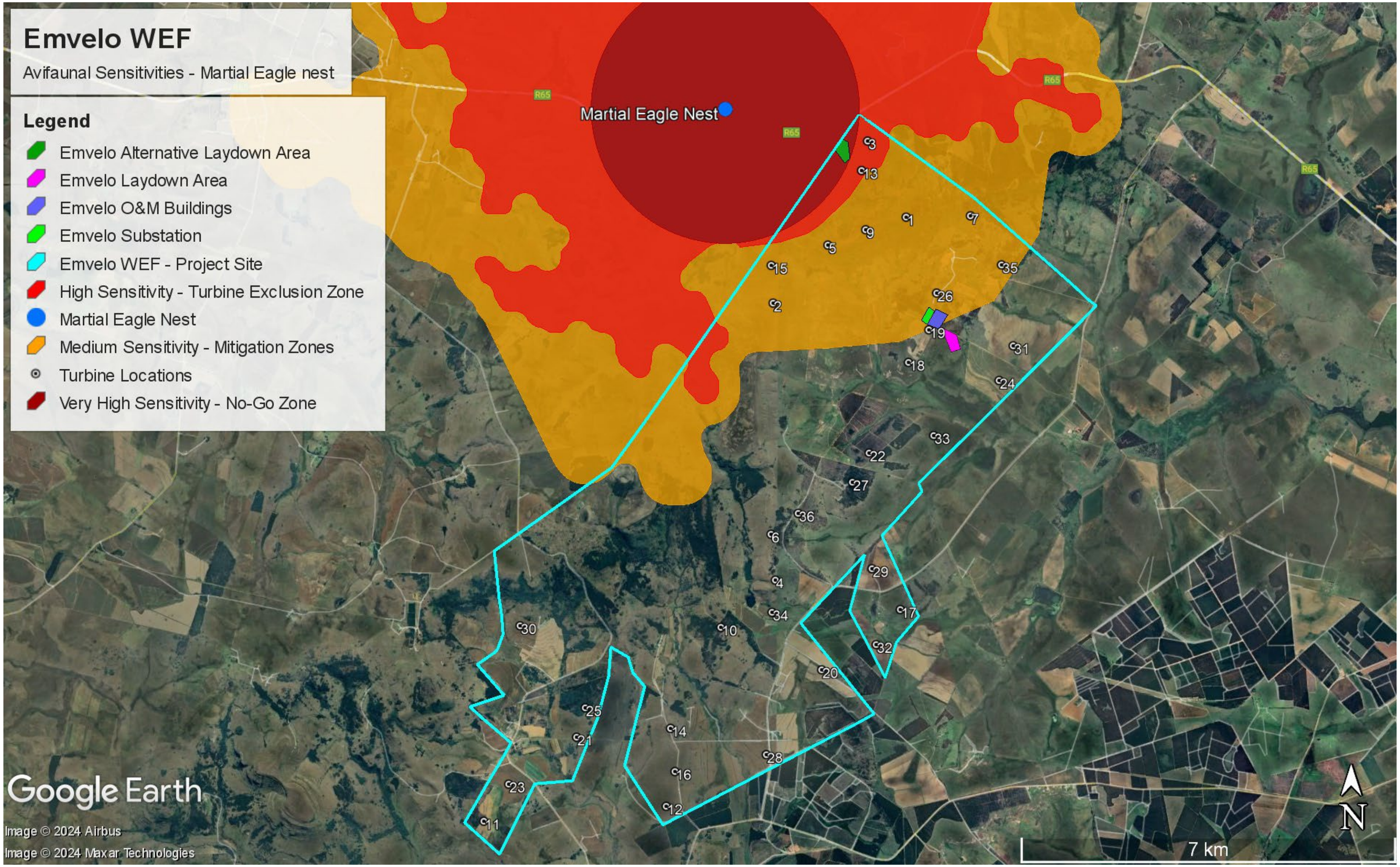

Figure 20: Buffer zones around Martial Eagle nest.

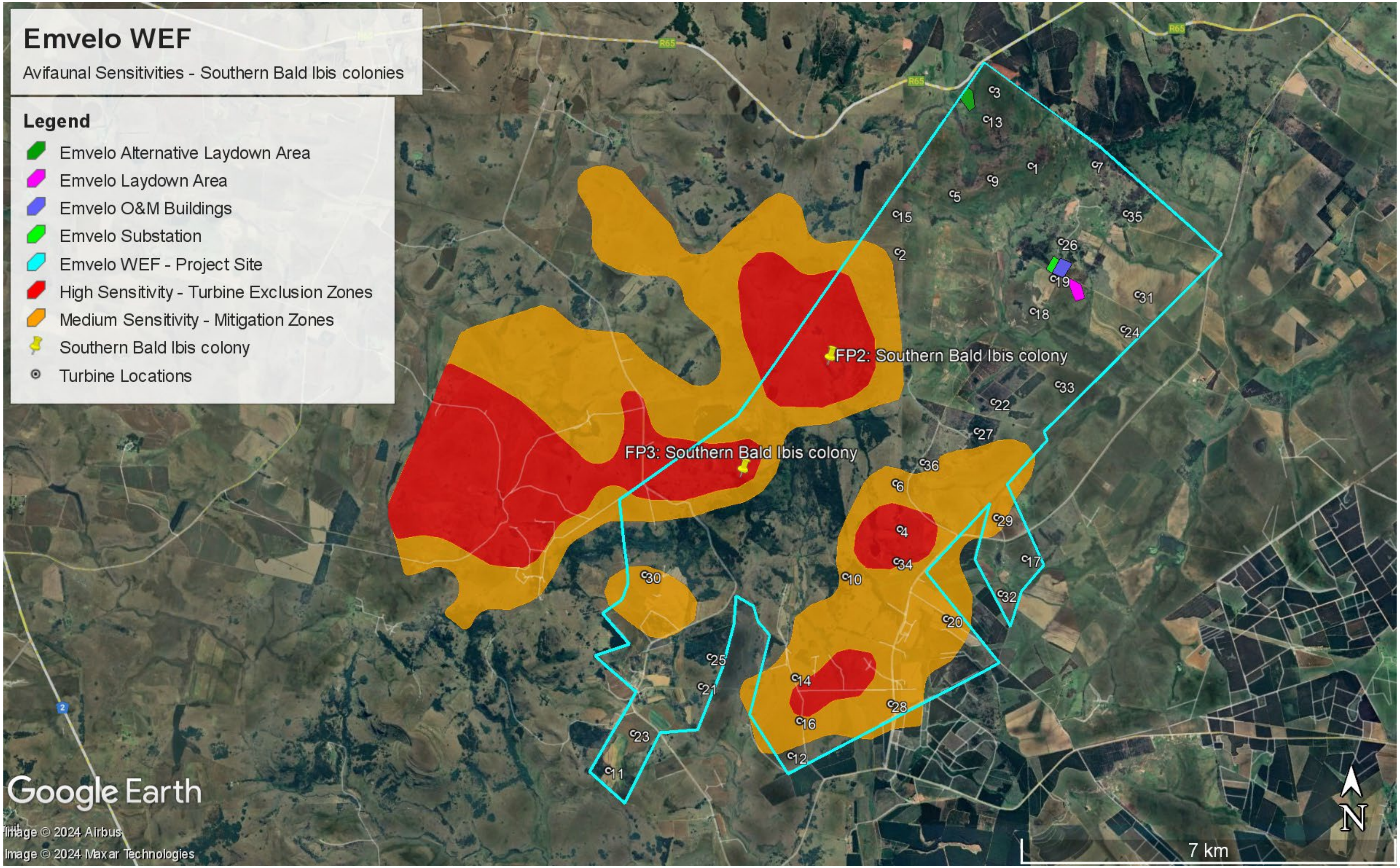

Figure 21: Proposed shaped no-turbine zones and medium sensitivity zones around Southern Bald Ibis colonies/habitat.

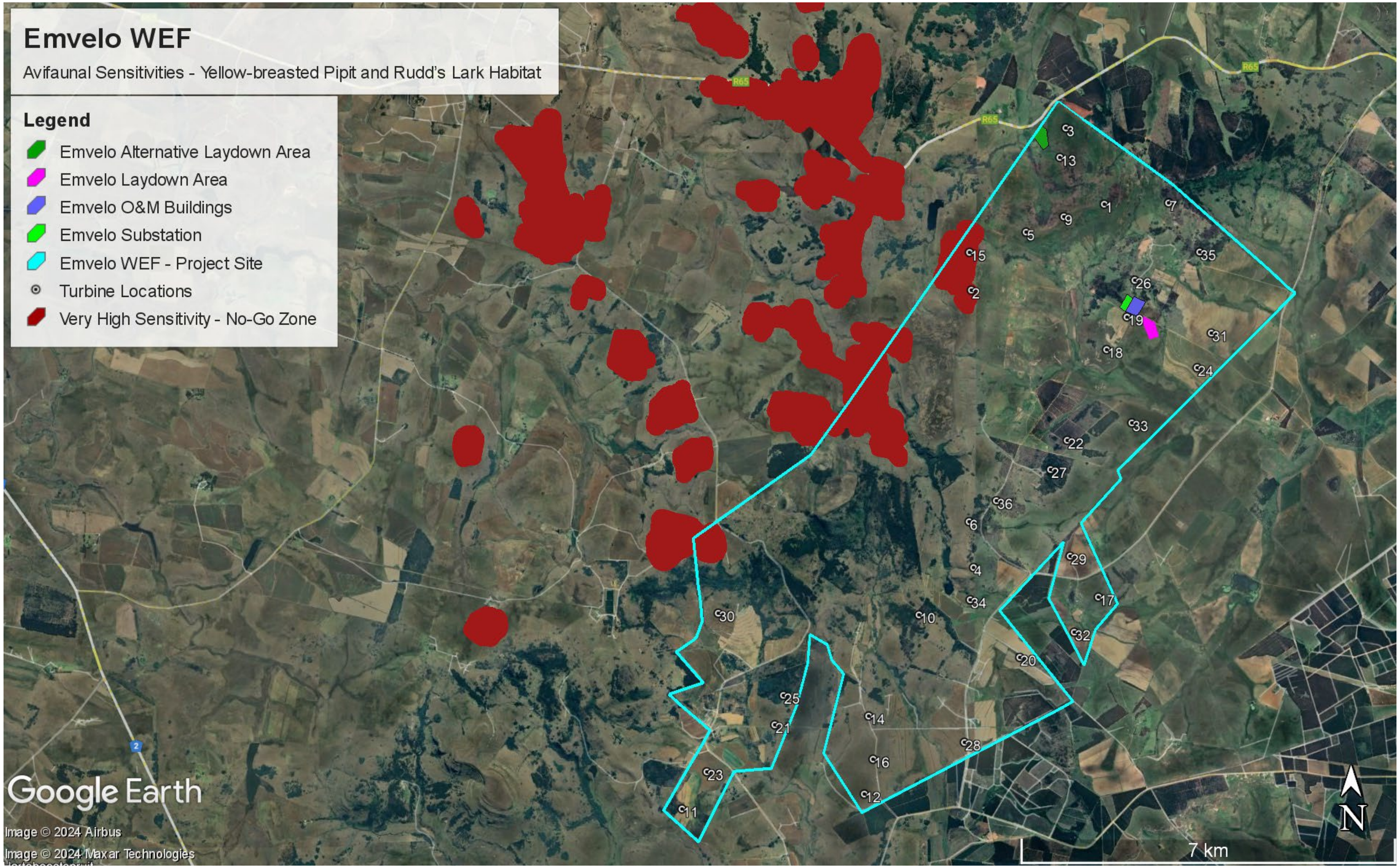

Figure 22: No-Go Zones around Yellow-breasted Pipit and Rudd's Lark Habitat.

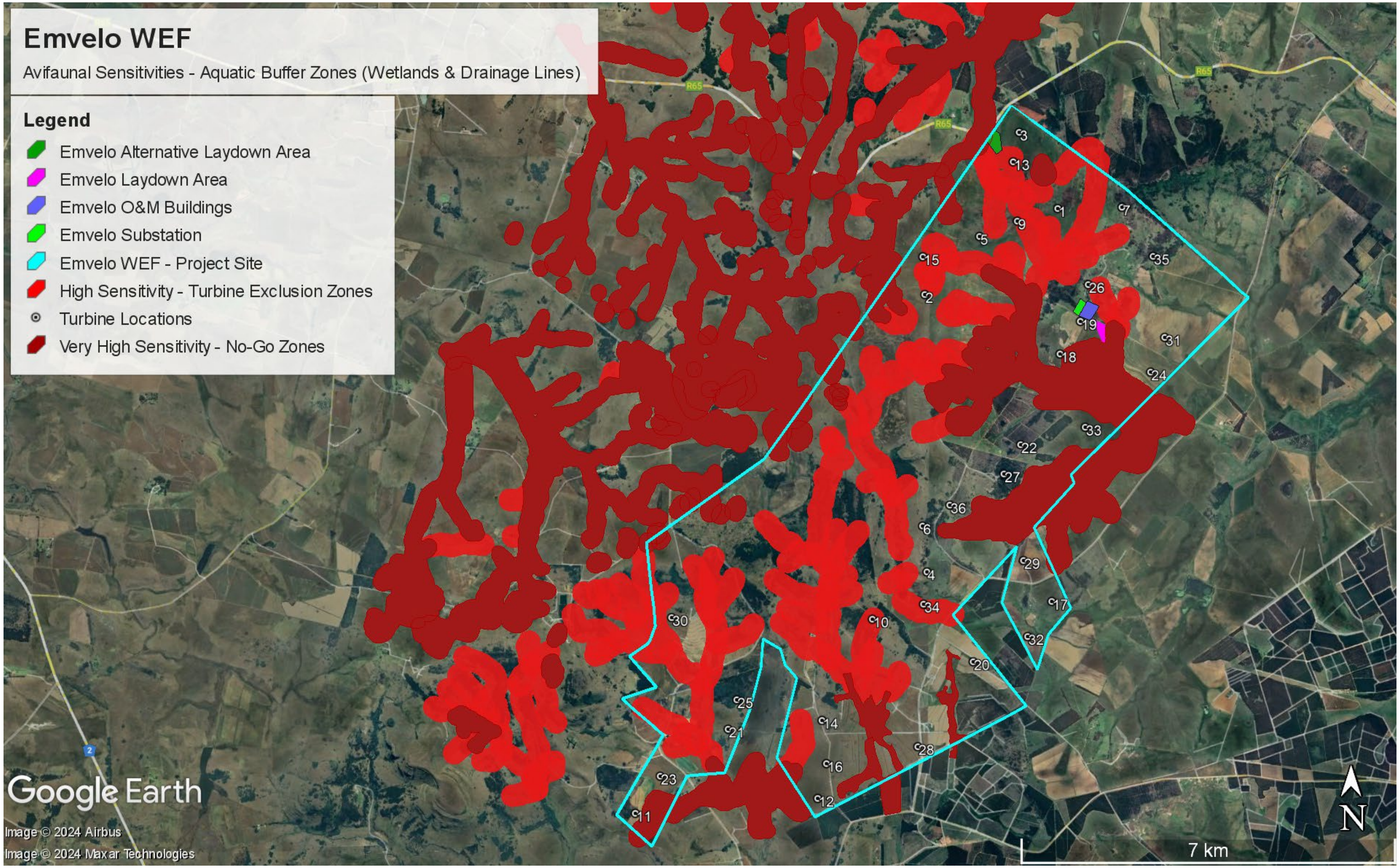

Figure 23: Aquatic buffer zones from an avifaunal perspective.

6.6 The Identification of Environmental Sensitivities: Grid Components

The following environmental sensitivities were identified from an avifaunal perspective for the proposed grid connection **(<u>the identified avifaunal environmental sensitivities are applicable to ALL Grid Connection Alternatives)</u>**:

6.6.1 High Sensitivity: Surface Water & Grasslands – Line Marking Required.

Surface water is crucially important for priority avifauna, including several SCC such as Martial Eagle, Lanner Falcon and Secretarybird, and many non-priority species, including several waterbirds. **Drainage lines, dams, and wetlands** attract waterbirds and several other bird species. Power lines that are placed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing. Drainage lines are also natural flight paths for birds. The **grassland habitat** in the area is crucially important to SCC such as Denham's Bustard, Secretarybird and Southern Bald Ibis, for foraging and roosting, all three SCC have been recorded in the PAOI.

Mitigation in the form of Bird Flight Diverters on the OHL is required. The entire length of the OHL should be fitted with Eskom approved Bird Flight Diverters (Figure 24). BFD design specification should conform to types of devices that will be visible at night e.g. LED type bird flight diverters.

6.6.2 High Sensitivity Seasonal No Disturbance Buffer – Breeding Red Data Species Nests.

Martial Eagle nest – A 2.5km no disturbance buffer zone (**Figure 24**) must be implemented around the nest. No construction activity should take place in this zone from March to December, which is the breeding season for these eagles.

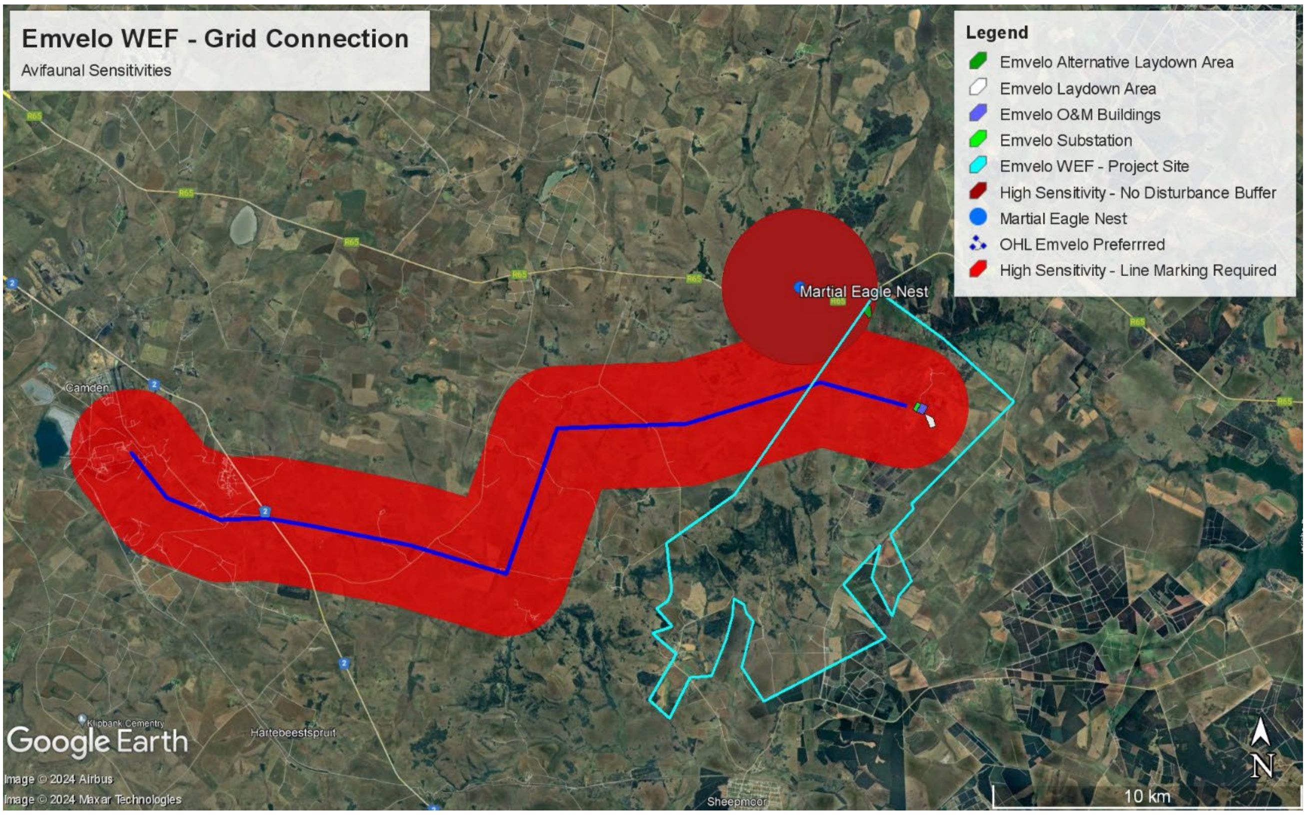

Figure 24: Avifaunal Sensitivities identified for the Emvelo Grid Connection. NOTE: Due to the large amount of wetlands/drainage lines and natural grasslands in the area it is recommended that the entire OHL be fitted with Bird Flight Diverters.

6.7 Cumulative Impacts

In relation to an activity, cumulative impact means "*the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities*" (NEMA EIA Reg GN R982 of 2014).

Specialists are required to assess cumulative impacts associated with similar developments within a 35 km radius of the proposed developments. The purpose of the cumulative assessment is to test if such impacts are relevant to the proposed developments in the proposed locations (i.e., whether the addition of the proposed project in the area will increase the impact). In this regard, specialist studies considered whether the construction of the proposed development will result in:

- Unacceptable risk
- Unacceptable loss
- Complete or whole-scale changes to the environment or sense of place
- Unacceptable increase in impact

There are currently two approved Renewable Energy Facilities within 35 km of the Mulilo WEF Cluster based on the data using the REEA_OR_2023_Q4 (**Figure 25**).

6.7.1 Wind Energy Facility

The maximum number of wind turbines which are currently proposed for the other wind farms which are located within a 35km radius (i.e., Rochdale WEF and Sheepmoor WEF Camden I WEF and Camden II WEF) in similar habitat around the proposed Emvelo WEF is 157. None of these have been constructed to date, and each of the planned projects will still be subject to a bidding process where only the most competitive projects will obtain a power purchase agreement required for the project to proceed to construction. The Emvelo WEF will consist of up to 45 turbines, which brings the total number of potential turbines within the 35km radius to 202. The 45 turbines of Emvelo WEF constitute 22% of the total number of planned turbines. As such, its contribution to the total number of turbines, and by implication the cumulative impact of all the planned turbines, is considered **moderate to high**.

The total land parcel area where renewable energy developments are planned, including the Emvelo WEF, amounts to approximately 268.3km² (26,830 ha), which constitutes about 7% of the total area of similar habitat available to birds in the 35km radius around the project. The cumulative impact of the planned wind energy projects at the time of writing is considered **moderate** as far as the creation of high-risk zones are concerned within the area contained in the 35km radius.

The land parcel area of the proposed Emvelo WEF (70.3 km2) amounts to about 26% of the total amount of land parcel area designated for renewable energy developments, but less than 2% of the total area available (3848 km^2) in the 35km radius. The contribution of the Emvelo WEF to the cumulative impact of all the renewable energy facilities is therefore **medium to low** as far as potential displacement of priority species due to habitat transformation is concerned.

Figure 25 shows the location of all planned renewable energy projects within a 35km radius around the proposed Emvelo WEF.

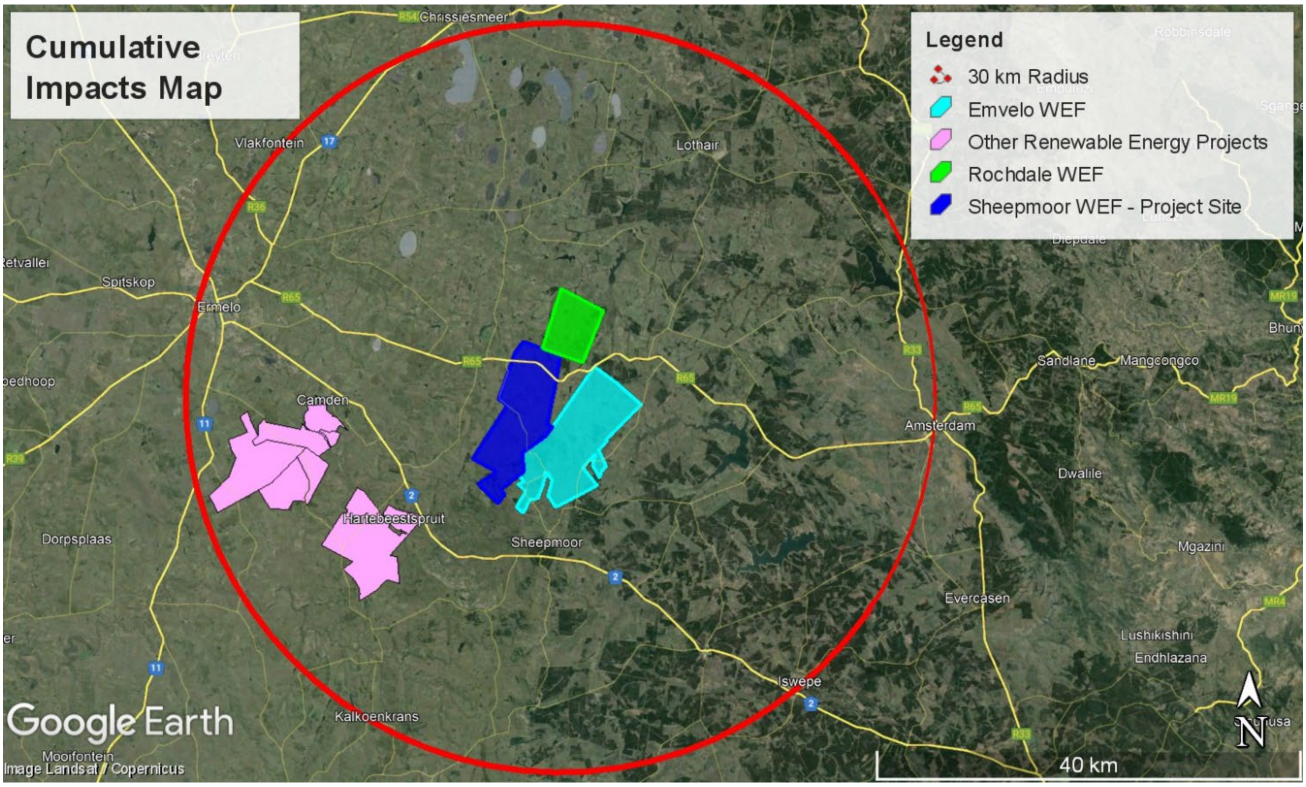

Figure 25: Renewable energy projects within a 35km radius of the proposed Emvelo WEF.

Table 16: Rating of Cumulative Impacts: WEF

Impact Phase: Cumulative							
Potential impact description: Cumulative Impacts on Birds							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	H	M	H	Negative	H	M	M
With Mitigation	H	M	H	Negative	M	M	M
Can the impact be reversed?			Yes				
Will impact cause irreplaceable loss of resources?			No				
Can impact be avoided, managed, or mitigated?			Yes				
Mitigation measures to reduce residual risk or enhance opportunities: • All mitigation measures listed in this report and recommended for other projects must be adhered to. • The applicant and/or operational project company should proactively collaborate with other renewable energy operators in the area. Operational monitoring data must be shared with Birdlife SA.							
Residual impact	A residual impact of medium negative significance is likely, as the cumulative impact is difficult to mitigate.						

6.7.2 *Grid Connection Infrastructure*

The are several existing HV lines in the 35km radius around the proposed Grid Connection Project, of which about 300km worth of OHL is contained in the 35km radius (**Figure 26**). The sum total of all the existing and planned HV lines in the 35km radius amounts to an estimated 383km, of which the proposed Emvelo WEF Grid Connection will constitute 30km, or about 8%. The contribution of the Emvelo WEF Grid Connection to the cumulative impact of all the grid connections and existing HV lines is thus low. However, the combined contribution of all the grid connections to the cumulative impact of the HV lines in the 35km radius, which is mainly collision mortality of priority species with the powerlines is high. The cumulative collision impact of all the grid connections and existing HV lines in the 35km radius is assessed to be **high** pre-mitigation and **medium** post-mitigation.

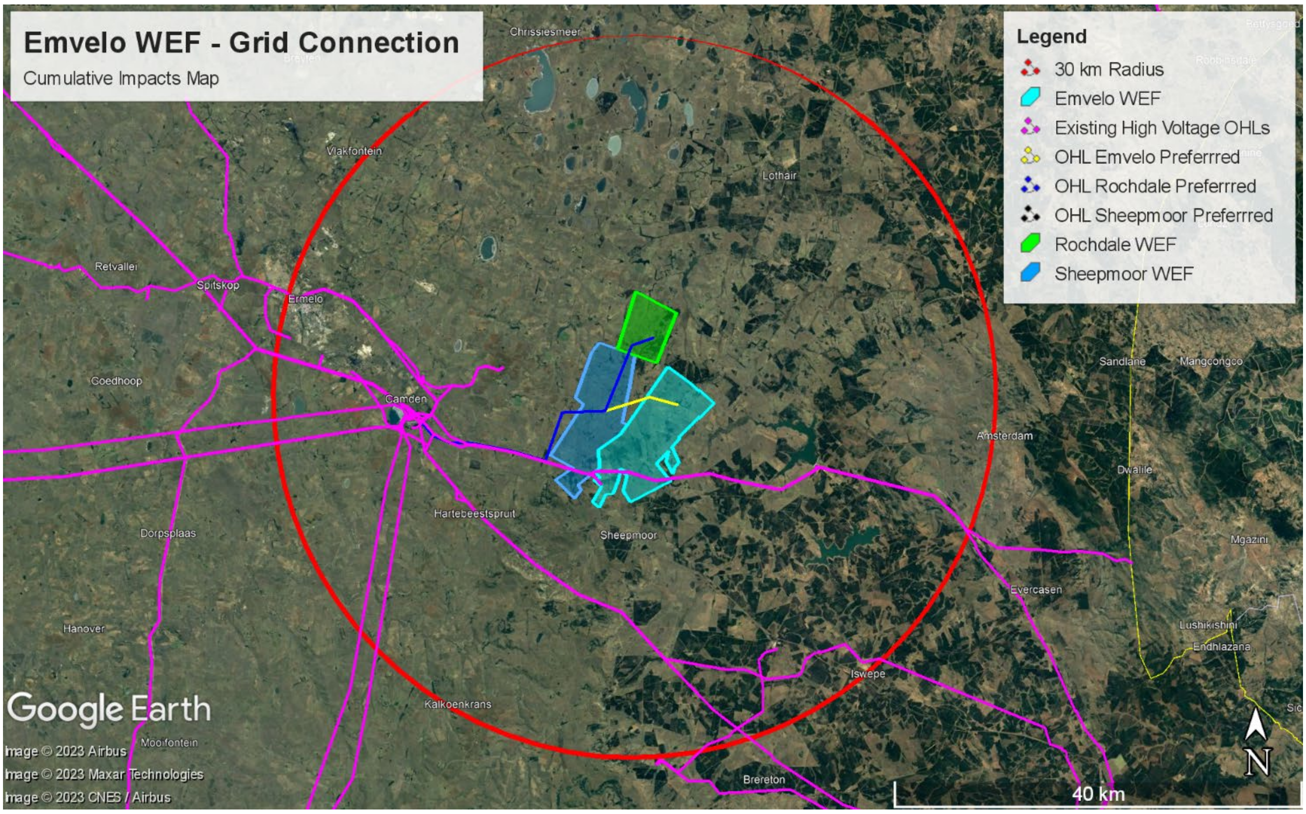

Figure 26: Proposed renewable energy projects within a 35km radius around the proposed Emvelo WEF.

Table 17: Rating of Cumulative Impacts: Grid Connection Components

Impact Phase: Cumulative							
Potential impact description: Cumulative Impacts on Birds							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	H	M	H	Negative	H	M	M
With Mitigation	H	M	H	Negative	M	M	M
Can the impact be reversed?			Yes				
Will impact cause irreplaceable loss of resources?			No				
Can impact be avoided, managed, or mitigated?			Yes				

Mitigation measures to reduce residual risk or enhance opportunities: • All mitigation measures listed in this report and recommended for other projects must be adhered to. • The applicant and/or operational project company should proactively collaborate with other renewable energy operators in the area. Operational monitoring data must be shared with Birdlife SA.	
Residual impact	A residual impact of medium negative significance is likely, as the cumulative impact is difficult to mitigate.

6.8 Conditions for inclusion in the EMPr: WEF

Please see **Appendix 7** for the monitoring requirements to be included in the EMPr for the WEF.

6.9 Conditions for inclusion in the EMPr: Grid Connection Components

Please see **Appendix 8** for the monitoring requirements to be included in the EMPr for the Grid Connection Components.

7. COMPARATIVE ASSESSMENT OF ALTERNATIVES

7.1 Wind Energy Facility

Table 19 below provides a summary of the proposed alternatives relating to the WEF and associated infrastructure, namely the two laydown area options.

Table 18: Comparative assessment of WEF components

Alternative	Preference	Reasons
CONSTRUCTION LAYDOWN AREA SITE ALTERNATIVES		
Construction Laydown Area Option 1	The alternative will result in equal impacts	Both the options are located in similar habitat. There is therefore no specific preference for one site above the other, due to the impacts being identical in scope and nature. Both options are acceptable.
Construction Laydown Area Option 2	The alternative will result in equal impacts	The alternative will result in equal impacts

7.2 Grid Components

The grid connection infrastructure proposal includes four (4) power line route alignment alternatives, each within a 300m wide assessment corridor (150m on either side of power line). These alternatives will be considered and assessed as part of the EIA process and will be amended or refined to avoid identified environmental sensitivities. The four alternatives are:

- 132kV OHL Preferred – 30 km
- 132kV OHL Alternative 1 – 33 km
- 132kV OHL Alternative 2 – 33 km
- 132kV OHL Alternative 3 – 29.3 km

From an avifaunal perspective OHL Alternatives 1 and 2 are least preferred as they have the longest span length and therefore pose a higher collision risk to birds. The Preferred OHL Alternative is preferred over OHL

Alternative 3 as it avoids the 2.5km No Disturbance Buffer around the Martial Eagle nest (coordinates provided on request).

7.3 No-Go Alternative

7.3.1 Wind Energy Facility

The no-go alternative will result in the current *status quo* being maintained as far as the avifauna is concerned. The low human population in the area is definitely advantageous to sensitive avifauna, especially Red Data species. The no-go option would eliminate any additional impact on the ecological integrity of the proposed development site as far as avifauna is concerned.

7.3.2 Grid Connection Components

The no-go alternative will result in the current *status quo* being maintained as far as the avifauna is concerned. The low human population in the area is definitely advantageous to sensitive avifauna, especially Red Data species. The no-go option would eliminate any additional impact on the ecological integrity of the proposed development site as far as avifauna is concerned.

8. CONCLUSION AND SUMMARY

8.1 Summary of Findings

8.1.1 Wind Energy Facility

The proposed Emvelo WEF will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of priority species due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the construction phase.
- Collision mortality caused by the wind turbines in the operational phase.
- Electrocution on the 33kV MV overhead lines (if any) in the operational phase.
- Collisions with the 33kV MV overhead lines (if any) in the operational phase.
- Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

8.1.1.1 Displacement of priority species due to disturbance linked to construction activities in the construction phase.

A measure of displacement will inevitably take place for all priority species as a result of disturbance from construction activities during the construction phase. This will primarily affect ground-nesting species in the remaining high-quality grassland, wetlands, and wetland fringes. In addition, the Southern Bald Ibises that roost and breed on the Project Site could face a disruption of their reproductive cycle. Some species could recolonise the area after the completion of construction. However, as a result of habitat fragmentation and operational turbines causing disturbance, other species could only partially return to their previous habitat, resulting in lower densities than before. In summary, the following species could be impacted by disturbance during the construction phase: African Fish Eagle, African Grass Owl, African Harrier-Hawk, African Marsh Harrier, Black Sparrowhawk, Black-rumped Buttonquail, Black-winged Kite, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Greater Kestrel, Grey Crowned Crane, Grey-winged Francolin, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Rudd's Lark, Rufous-breasted Sparrowhawk, Secretarybird, Southern Bald Ibis, Spotted Eagle-Owl, White-bellied Bustard, and Yellow-breasted Pipit. The impact is rated as **Medium** pre- and post-mitigation.

8.1.1.2 Displacement due to habitat transformation in the construction phase.

The construction of additional roads is likely to result in further habitat fragmentation, although the site already has many access roads, most of which will be upgraded and utilised for the wind farm development. It is noted that some of the upgraded roads will infringe on the habitat classified as very high sensitivity through habitat suitability modelling, these infringements will however mostly be along the edges of these grassland areas. This, together with the disturbance of the operating turbines, could influence the density of several species. This is the case for larger terrestrial species that utilise the remaining natural grassland, wetlands, and wetland fringes as breeding habitat, and also for smaller, range-restricted species for which the area is considered to provide suitable habitat. It is not expected that priority species will be permanently displaced from the development site, but densities may be reduced. In summary, the following terrestrial species and raptors are likely to be most affected by habitat transformation: African Grass Owl, Black-rumped Buttonquail, Black-winged Lapwing, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Rudd's Lark, Secretarybird, White-bellied Bustard, and Yellow-breasted Pipit. The impact is rated as **Medium** pre- and post-mitigation.

8.1.1.3 Collision mortality caused by the wind turbines in the operational phase.

The proposed WEF will pose a collision risk to several priority species which could regularly occur at the site. Species exposed to this risk are large terrestrial species, occasional long-distance fliers, and small passerines during display flight activities i.e., bustards, cranes, storks, Southern Bald Ibis and Secretarybird, although bustards and cranes generally seem to be less vulnerable to turbine collisions than originally anticipated (Ralston-Paton & Camagu 2019). Soaring priority species such as Cape Vulture and a variety of raptors, including several species of eagles, are highly vulnerable to the risk of collisions. The regularly occurring priority species that could be at risk of collisions with the turbines are the following: African Fish Eagle, African Grass Owl, African Harrier-Hawk, African Marsh Harrier, Amur Falcon, Black Sparrowhawk, Black-winged Kite, Black-winged Lapwing, Black-winged Pratincole, Blue Crane, Blue Korhaan, Common Buzzard, Denham's Bustard, Greater Kestrel, Grey Crowned Crane, Grey-winged Francolin, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Montagu's Harrier, Pallid Harrier, Red-footed Falcon, Rudd's Lark, Rufous-breasted Sparrowhawk, Secretarybird, Southern Bald Ibis, Spotted Eagle-Owl, White Stork, White-bellied Bustard, Yellow-billed Stork, and Yellow-breasted Pipit. The impact is rated as **High** pre-mitigation and **Medium** post-mitigation.

8.1.1.4 Electrocution on the 33kV MV overhead lines (if any) in the operational phase.

The following priority species are potentially vulnerable to electrocution on the 33kV overhead lines: African Fish Eagle, African Grass Owl, African Harrier-Hawk, African Marsh Harrier, Amur Falcon, Black Sparrowhawk, Black-winged Kite, Common Buzzard, Greater Kestrel, Grey Crowned Crane, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Montagu's Harrier, Pallid Harrier, Red-footed Falcon, Rufous-breasted Sparrowhawk, Southern Bald Ibis,, and Spotted Eagle-Owl. The impact is rated as **Medium** pre-mitigation and **Low** post-mitigation.

8.1.1.5 Collisions with the 33kV MV overhead lines (if any) in the operational phase.

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines may have to run above ground for technical reasons. These spans could pose a collision risk to priority avifauna, depending on where those spans are located. Priority species potentially at risk are African Grass Owl, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Marsh Owl, Secretarybird, Southern Bald Ibis, Spotted Eagle-Owl, White Stork, White-bellied Bustard, and Yellow-billed Stork. The impact is rated as **Medium** pre-mitigation and **Low** post-mitigation.

8.1.1.6 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

The impact is likely to be similar in nature to the construction phase.

8.1.1.7 Cumulative Impacts.

The maximum number of wind turbines which are currently proposed for the other wind farms which are located within a 35km radius (i.e., Rochdale WEF and Sheepmoor WEF Camden I WEF and Camden II WEF) in similar habitat around the proposed Emvelo WEF is 157. None of these have been constructed to date, and each of the planned projects will still be subject to a bidding process where only the most competitive projects will obtain a power purchase agreement required for the project to proceed to construction. The Emvelo WEF will consist of up to 45 turbines, which brings the total number of potential turbines within the 35km radius to 202. The 45 turbines of Emvelo WEF constitute 22% of the total number of planned turbines. As such, its contribution to the total number of turbines, and by implication the cumulative impact of all the planned turbines, is considered **moderate to high**.

The total land parcel area where renewable energy developments are planned, including the Emvelo WEF, amounts to approximately 268.3km² (26,830 ha), which constitutes about 7% of the total area of similar habitat available to birds in the 35km radius around the project. The cumulative impact of the planned wind energy projects at the time of writing is considered **moderate** as far as the creation of high-risk zones are concerned within the area contained in the 35km radius.

The land parcel area of the proposed Emvelo WEF (70.3 km2) amounts to about 26% of the total amount of land parcel area designated for renewable energy developments, but less than 2% of the total area available (3848 km^2) in the 35km radius. The contribution of the Emvelo WEF to the cumulative impact of all the renewable energy facilities is therefore **medium to low** as far as potential displacement of priority species due to habitat transformation is concerned.

Table 20 summarises the expected impacts of the proposed WEF and proposed mitigation measures per impact.

Table 19: Overall Impact Significance for the WEF (Pre- and Post-Mitigation)

Nature of Impact and Phase	Overall Impact Significance (Pre-Mitigation)	Proposed Mitigation	Overall Impact Significance (Post-Mitigation)
Construction: Displacement due to disturbance	Medium	(1) Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry. (3) No construction should take place in the All-Infrastructure Exclusion Zones as indicated in Section 6.5 unless existing roads are to be upgraded. (4) No construction activities within 2.5km of the Martial Eagle nest (coordinates on request) should take place in the period March to December, which is the breeding season for these eagles.	Medium
Construction: Displacement due to habitat transformation	Medium	(1) Removal of vegetation must be restricted to a minimum and must be rehabilitated to its former state where possible after construction. (2) Construction of new roads should only be considered if existing roads cannot be upgraded. (3) The recommendations of the biodiversity and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned to limit the impact of habitat transformation on priority species. (4) No construction should take place in All Infrastructure Exclusion Zones as indicated in Section 6.5.	Medium
Operational: Collisions with the turbines	High	(1) No turbines (including the rotor swept area) should be located in the Turbine Exclusion Zones as indicated in Section 6.5. (2) Pro-active mitigation in the form of Shutdown on Demand (SDoD) or automated curtailment must be implemented in the medium risk zones as indicated in Section 6.5. (3) Live-bird monitoring and carcass searches should be implemented in the operational phase, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins et al. 2015) to assess collision rates.	Medium

Nature of Impact and Phase	Overall Impact Significance (Pre-Mitigation)	Proposed Mitigation	Overall Impact Significance (Post-Mitigation)
		(4) All wind turbines must have one blade painted according to a CAA approved pattern to reduce the risk of raptor collisions. It is acknowledged that blade painting as a mitigation strategy is still in an experimental phase in South Africa, but research indicates that it has a very good chance of reducing raptor mortality, based on research conducted in Norway (see Simmons et al. 2021 (Appendix 8) for an explanation of the science and research behind this mitigation method). (5) If at any time estimated collision rates indicate unacceptable mortality levels of priority species, i.e., if it exceeds the mortality threshold determined by the avifaunal specialist after consultation with other avifaunal specialists and BirdLife South Africa, additional measures will have to be considered.	
Operational: Electrocutions on the 33kV MV network	Medium	(1) Underground cabling should be used as much as is practically possible. (2) If the use of overhead lines is unavoidable due to technical reasons, the Avifaunal Specialist must be consulted timeously to ensure that a raptor friendly pole design is used, and that appropriate mitigation is implemented pro-actively for complicated pole structures e.g., insulation of live components to prevent electrocutions on terminal structures and pole transformers. (3) Regular inspections of the overhead sections of the internal reticulation network must be conducted during the operational phase to look for carcasses, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins *et al.* 2015).	Low
Operational: Collisions with the 33kV MV network	Medium	Bird flight diverters (design specification should conform to types of devices that will be visible at night e.g. LED type bird flight diverters) should be installed on all the overhead line sections for the full span length directly associated with the proposed WEF according to the applicable Eskom standard at the time.	Low
Decommissioning: Displacement due to disturbance	Medium	(1) Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should	Low

Nature of Impact and Phase	Overall Impact Significance (Pre-Mitigation)	Proposed Mitigation	Overall Impact Significance (Post-Mitigation)
		be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry. (3) No off-road driving should be allowed. (4) No dismantling activities within 2.5km of the Martial Eagle nest (coordinates on request) should take place in the period March to December, which is the breeding season for these eagles.	

8.1.2 Grid Connection Components

The proposed Emvelo WEF grid connection will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of priority species due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the construction phase.
- Collisions with the overhead line in the operational phase.
- Mortality due to electrocution on the proposed overhead line in the operational phase.
- Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

8.1.2.1 Displacement of priority species due to disturbance linked to construction activities in the construction phase.

Construction activities could impact birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although this is often impractical to implement due to tight construction schedules. Powerline-sensitive species which are potentially most vulnerable to displacement due to disturbance are mostly ground-nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl, and White-bellied Bustard. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

8.1.2.2 Displacement due to habitat transformation in the construction phase.

During the construction of powerlines, service roads (jeep tracks), substations and other associated infrastructure, habitat destruction/transformation inevitably takes place. These activities could impact birds breeding, foraging, and roosting in, or in close proximity to the proposed OHL grid connection, through the transformation of habitat. Relevant to this development, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the on-site substation is unavoidable. In the case of the OHL, the direct habitat transformation is limited to the on-site substation and pole/tower footprints and the narrow access road/track under the proposed OHL. The loss of habitat in the substation footprint (1,5 ha will be a relatively insignificant percentage of the habitat that regularly supports powerline sensitive species, and the resultant impact is likely to be fairly minimal. Powerline sensitive species which are potentially most vulnerable to displacement due to habitat transformation are mostly ground-nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl, and White-bellied Bustard. The impact is rated as **medium** pre-mitigation, and it will decrease to **low** post-mitigation.

8.1.2.3 Collisions with the overhead line in the operational phase.

The up to 132kV OHL could pose a collision risk to virtually all power line sensitive avifauna, depending on where the spans are located. Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions, power line configuration, and visual capacity. Species potentially at risk are African Black Duck, African Darter, African Grass Owl, African Sacred Ibis, African Spoonbill, Black Heron, Black-bellied Bustard, Black-crowned Night Heron, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Blue-billed Teal, Cape Shoveler, Cape Teal, Cape Vulture, Denham's

Bustard, Egyptian Goose, Fulvous Whistling Duck, Glossy Ibis, Goliath Heron, Great Egret, Greater Flamingo, Grey Crowned Crane, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Mallard, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Bald Ibis, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Wattled Crane, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-bellied Bustard, White-breasted Cormorant, White-faced Whistling Duck, and Yellow-billed Duck and other sensitive wetland species. The impact is rated as **high** pre-mitigation, and it will decrease to **medium** post-mitigation.

8.1.2.4 Mortality due to electrocutions on the proposed grid connection infrastructure in the operational phase.

Electrocution refers to the scenario where a bird is perched, or attempts to perch, on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the voltage size of the proposed powerline and the pole/tower design. Should the proposed OHL be constructed using a 132kV tower specification, the electrocution impact for the majority of priority species will be negligible. The only priority species capable of bridging the clearance distances of an OHL constructed using this specification due to their size and gregarious nature is the Cape Vulture. The impact is rated as **medium** pre-mitigation, and it will decrease to **low** post-mitigation.

Electrocutions within the proposed on-site substation are possible, however, the likelihood of this impact on the more sensitive Species of Conservation Concern (SCC) is remote, as these species are unlikely to regularly utilise the infrastructure within the on-site substation station for perching or roosting. Powerline sensitive species that are more vulnerable to electrocutions are medium-sized raptors, corvids, owls, and certain species of waterbirds. As far as the substation is concerned, the following species are potentially at risk of electrocution: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey, and Yellow-billed Kite. The impact is rated as **low** pre- and post-mitigation.

8.1.2.5 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

The impact is likely to be similar in nature to that of the construction phase.

8.1.2.6 Cumulative Impacts.

The are several existing HV lines in the 35km radius around the proposed Grid Connection Project, of which about 300km worth of OHL is contained in the 35km radius. The sum total of all the existing and planned HV lines in the 35km radius amounts to an estimated 383km, of which the proposed Emvelo WEF Grid Connection will constitute 30km, or about 8%. The contribution of the Emvelo WEF Grid Connection to the cumulative impact of all the grid connections and existing HV lines is thus fairly low. However, the combined contribution of all the grid connections to the cumulative impact of the HV lines in the 35km radius, which is mainly collision mortality of priority species with the powerlines is high. The cumulative collision impact of all the grid connections and existing HV lines in the 35km radius is assessed to be **high** pre-mitigation and **medium** post-mitigation.

Table 21 summarises the expected impacts of the proposed grid connection and proposed mitigation measures per impact.

Table 21: Overall Impact Significance for the Grid Connection (Pre- and Post-Mitigation)

Nature of impact and Phase	Overall Impact Significance (Pre - Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
Construction: Displacement due to disturbance	Medium	(1) Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry. (3) No construction should take place in the All-Infrastructure Exclusion Zones as indicated in Section 6.5 unless existing roads are to be upgraded. (4) No construction activities within 2.5km of the Martial Eagle nest (coordinates on request) should take place in the period March to December, which is the breeding season for these eagles.	Low
Construction: Displacement due to habitat transformation	Medium	(1) Removal of vegetation must be restricted to a minimum and must be rehabilitated to its former state where possible after construction. (2) Construction of new roads should only be considered if existing roads cannot be upgraded. (3) The recommendations of the biodiversity and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned to limit the impact of habitat transformation on priority species. (4) No construction should take place in All Infrastructure Exclusion Zones as indicated in Section 6.5.	Low

Operational: Collisions with the overhead 132kV grid connection	High	(1) Mitigation in the form of Bird Flight Diverters on the OHL is required. The entire length of the OHL should be fitted with Eskom approved Bird Flight Diverters. Design specification should conform to types of devices that will be visible at night e.g. LED type bird flight diverters. (2) The operational monitoring programme must include regular monitoring (i.e. quarterly) of the power lines for collision mortalities.	Medium
Operational: Electrocutions on the grid connection infrastructure	Medium	(1) A Vulture-friendly pole design should be used. (2) Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is also recommended. (3) Monitor the electrocution mortality in the substations. Apply mitigation if electrocution happens regularly.	Low
Decommissioning: Displacement due to disturbance	Medium	(1) Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry. (3) No off-road driving should be allowed. (4) No dismantling activities within 2.5km of the Martial Eagle nest (coordinates on request) should take place in the period March to December, which is the breeding season for these eagles.	Low

8.2 Conclusions

8.2.1 Wind Energy Facility

It is imperative that the proposed 45-turbine layout be revised to avoid the recommended avifaunal no-go areas and turbine exclusion zones, including the rotor-swept areas. For detailed information on the exclusion areas, please refer to Section 6.5. The proposed Emvelo WEF is expected to have high and medium impacts on avifauna, which must be mitigated through appropriate measures to reduce the impact to a medium and low level.

8.2.2 Grid Connection Components

The proposed Emvelo WEF Grid Connection will have a moderate impact on avifauna which, in most instances, could be reduced to a low impact through appropriate mitigation. From an avifaunal perspective OHL Alternatives 1 and 2 are least preferred as they have the longest span length and therefore pose a higher collision risk to birds. The Preferred OHL Alternative is preferred over OHL Alternative 3 as it avoids the 2.5km No Disturbance Buffer around the Martial Eagle nest at (coordinates provided on request). The development is supported, provided the mitigation measures listed in this report are strictly implemented.

9. ENVIRONMENTAL SENSITIVITIES

According to the DFFE Screening Tool Animal Species Theme, the WEF Project Site and the Grid Connection PAOI are classified as having a **Medium to High** sensitivity. The Medium and High sensitivity rating for avifauna is due to the possible occurrence of several species of conservation concern (SCC) namely: Grey Crowned Crane (Globally and Regionally Endangered), Martial Eagle (Globally and Regionally Endangered), Southern Bald Ibis (Globally and Regionally Vulnerable), White-bellied Bustard (Regionally Vulnerable), Secretarybird (Globally Endangered and Regionally Vulnerable) and African Grass Owl (Regionally Vulnerable).

A **High** sensitivity classification for the WEF Project Site and the Grid Connection PAOI was confirmed during the on-site surveys. The following SCC have been recorded on site and their distribution, conservation status, and current threats will be detailed during the EIA phase:

- African Marsh Harrier (Regionally Endangered)
- Denham’s Bustard (Globally Near Threatened, Regionally Vulnerable)
- Secretarybird (Globally Endangered, Regionally Vulnerable)
- White-bellied Bustard (Regionally Vulnerable),
- Blue Crane (Globally Vulnerable, Regionally Near Threatened)
- Grey Crowned Crane (Globally and Regionally Endangered)
- Martial Eagle (Globally and Regionally Endangered)
- Lanner Falcon (Regionally Vulnerable),
- Greater Flamingo (Regionally Near Threatened)
- Southern Bald Ibis (Regionally and Globally Vulnerable)
- Cape Vulture (Globally Vulnerable and Regionally Endangered)
- Yellow-breasted Pipit (Regionally and Globally Vulnerable)

Specialist Sensitivity Analysis and Verification

The following avifaunal sensitivities were identified in and near the WEF Project Site and the Grid Connection PAOI (Refer to Section 6.5 and 6.6 for more details):

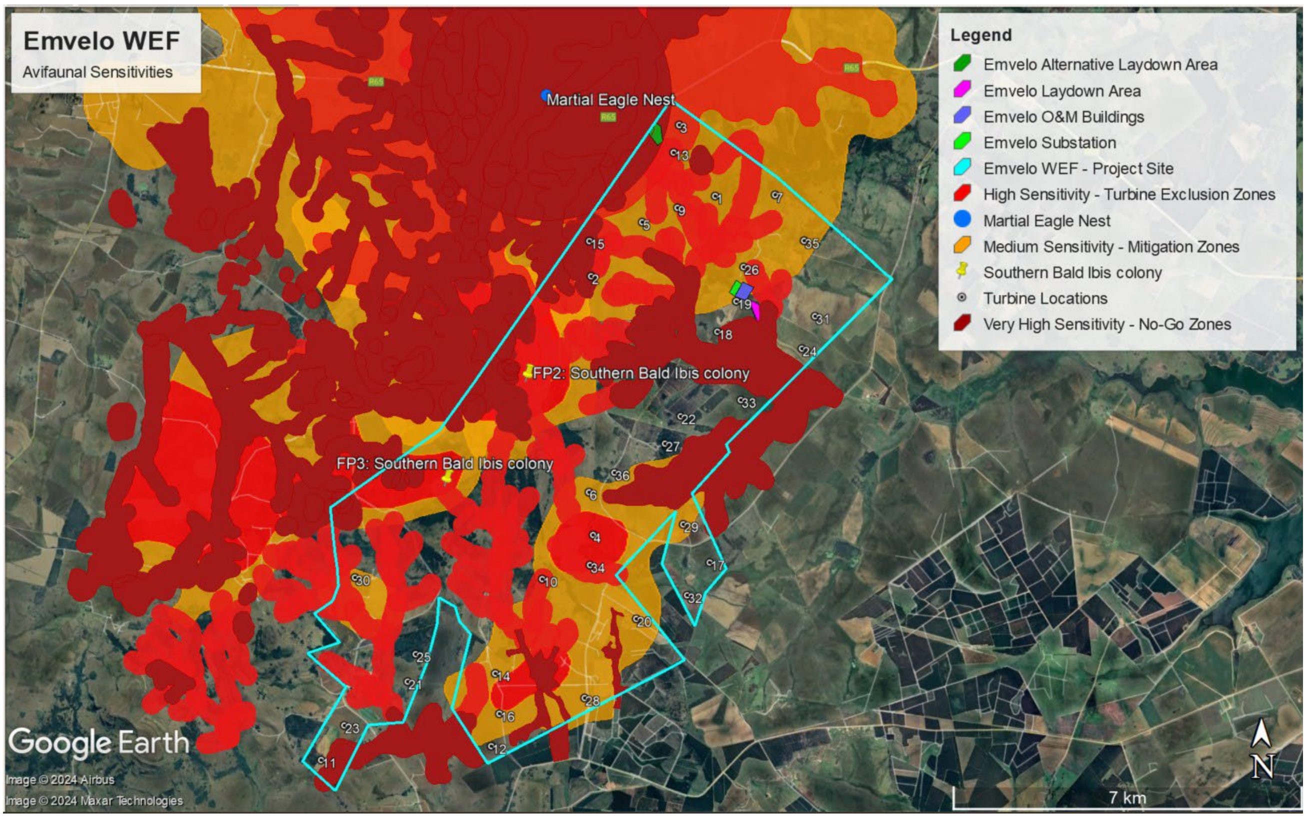

Figure 27: Avifaunal Sensitivities identified for the Emvelo WEF Project.

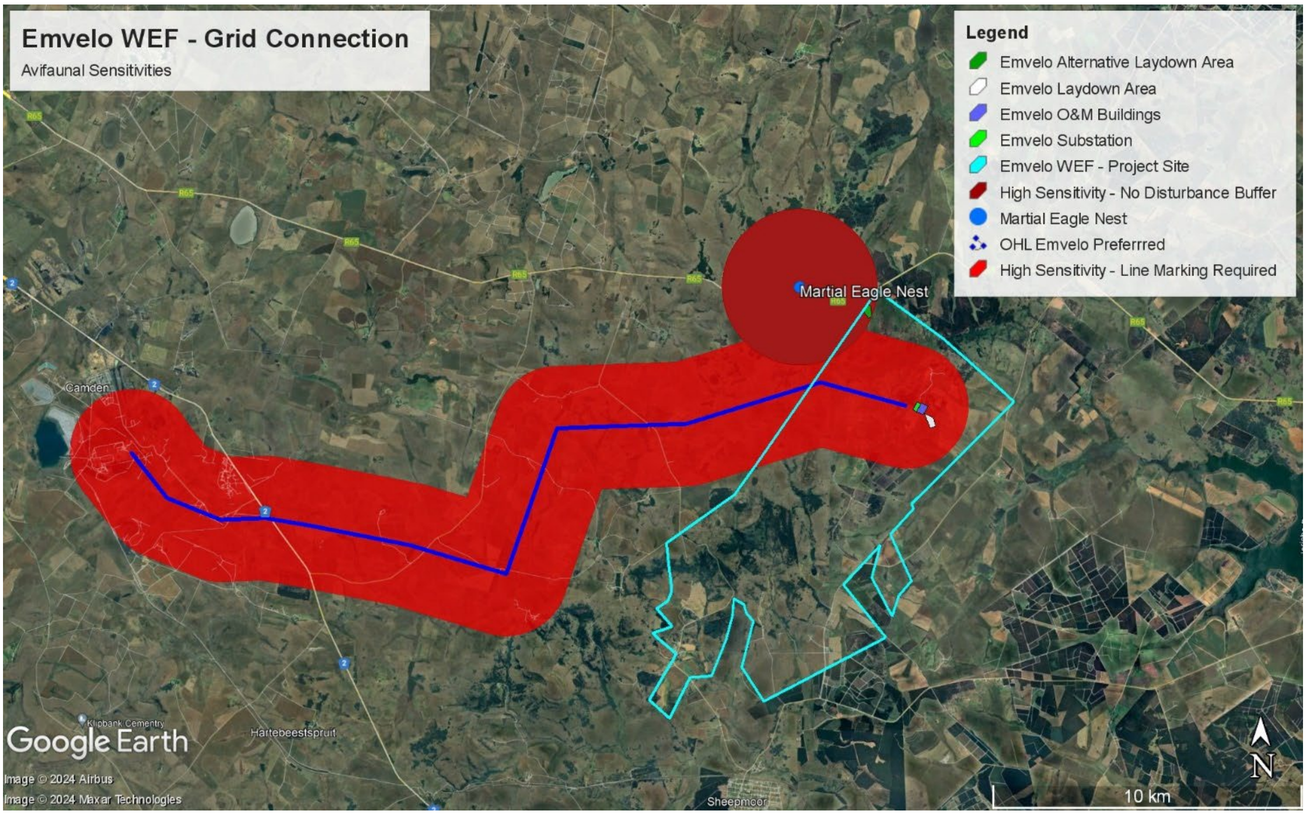

Figure 28: Avifaunal Sensitivities identified for the Emvelo Grid Connection.

10. PLAN OF STUDY – EIA PHASE

The following are proposed for the EIA Phase:

- The implementation of four avifaunal surveys, utilising transects, vantage point watches, focal points, and incidental counts, to inform the assessment of the potential impacts of the planned infrastructure within the development footprint.[11] The monitoring protocol is guided by the following:
  - 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 NEMA when applying for Environmental Authorisation (Gazetted October 2020)
  - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020).
  - Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa. Hereafter referred to as the wind guidelines.
- The avifaunal specialists report will be structured around the following terms of reference:
  - Description of the affected environment from an avifaunal perspective.
  - Discussion of gaps in baseline data and other limitations.
  - Description of the methodology that was used for the field surveys.
  - Comparison of the site sensitivity recorded in the field with the sensitivity classification in the DFFE National Screening Tool and adjustment if necessary.
  - Provision of an overview of all applicable legislation.
  - Provision of an overview of assessment methodology.
  - Identification and assessment of the potential impacts of the proposed development on avifauna including cumulative impacts.
  - Provision of sufficient mitigation measures to include in the Environmental Management Programme (EMPr).
  - Conclusion with an impact statement whether the wind energy facility is fatally flawed or may be authorised.

11. POST CONSTRUCTION PROGRAMME

The new procedures and minimum criteria for reporting on identified environmental themes in terms of Sections 24(5)(a) and (h) and 44 of NEMA came into force in March 2020. According to these regulations, a detailed post-construction monitoring programme must be included as part of the bird specialist study. See Appendix 9 for a proposed programme.

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[11] This has been completed. Details and results will be presented in the Avifaunal Specialist Impact Report.

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- VAN ROOYEN, C.S. 2004. The Management of Wildlife Interactions with overhead lines. In: The fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.
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- VAN ROOYEN, C.S. VOSLOO, H.F. & R.E. HARNESS. 2002. Eliminating bird streamers as a cause of faulting on transmission lines in South Africa. Proceedings of the IEEE 46th Rural Electric Power Conference. Colorado Springs (Colorado), May. 2002.

- VERDOORN, G.H. 1996. Mortality of Cape Griffons *Gyps coprotheres* and African Whitebacked Vultures *Pseudogyps africanus* on 88kV and 132kV power lines in Western Transvaal, South Africa, and mitigation measures to prevent future problems. Proceedings of the 2nd International Conference on Raptors: Urbino (Italy), Oct. 2-5, 1996.

APPENDIX 1: TERMS OF REFERENCE

Scoping and EIA processes will be undertaken for the **proposed WEFs**, in terms of Government Notice (GN) No. R. 983 of 4 December 2014 (as amended to GNR 327), promulgated under the National Environmental Management act, 1998 (Act No. 107 of 1998) (NEMA) EIA Regulations, 2014 (as amended).

You will be required to submit **one S&EIA report per WEF** with impact assessment tables and site verification report as per the dates provided in Section 2 of this document.

- Include the assessment of the grid connection with each respective S&EIA report for the proposed WEFs for submission to the National Department

The specialist report will include the specialist impact assessment of the proposed development(s). You will be required to submit **one S&EIA report per WEF**. The terms of reference for specialist studies includes (but is not limited to):

- Project Description
- Site Sensitivity Verification Report (SSVR)
- Methodology
- Assumptions and Limitations
- Desktop Screening
- Mapping
- Sensitivity Analysis and/or modelling, including sensitivity and no-go features overlain on the development site
- Defining the legal, planning and policy context
- Description of the Baseline Environment
- Determination of potential impacts (direct, indirect, cumulative)
- Determination of residual risks
- Reporting
- Recommendation and input into project design
- Management Plan and/or Monitoring Programme
- Sensitivity Verification Reporting in terms of GN 320 of 20 March 2020 and/or a Compliance Statement in terms of GN 320 / GN 1150 of 20 March 2020
- Incorporate and address Public Comment following PPP
- Submission of Shapefiles

The **Specialist S&EIA Report(s)** must comply with the requirement of GN 43110 of NEMA: Environmental Themes Reporting Criteria and the Relevant Protocols Gazetted, unless no protocol is prescribed, then the Appendix 6 of the EIA Regulations 2014, as amended, must be followed.

APPENDIX 2: SPECIALIST CV

Curriculum vitae: Albert Froneman

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	MSc (Conservation Biology)
Nationality	:	South African
Years of experience	:	22 years

Key Qualifications

Albert Froneman (*Pr. Sci.Nat*) has more than 22 years' experience in the management of avifaunal interactions with industrial infrastructure. He holds a M.Sc. degree in Conservation Biology from the University of Cape Town. He managed the Airports Company South Africa (ACSA) – Endangered Wildlife Trust Strategic Partnership from 1999 to 2008 which has been internationally recognized for its achievements in addressing airport wildlife hazards in an environmentally sensitive manner at ACSA's airports across South Africa. Albert is recognized worldwide as an expert in the field of bird hazard management on airports and has worked in South Africa, Swaziland, Botswana, Namibia, Kenya, Israel, and the USA. He has served as the vice chairman of the International Bird Strike Committee and has presented various papers at international conferences and workshops. At present he is consulting to ACSA with wildlife hazard management on all their airports. He also an accomplished specialist ornithological consultant outside the aviation industry and has completed a wide range of bird impact assessment studies. He has co-authored many avifaunal specialist studies and pre-construction monitoring reports for proposed renewable energy developments across South Africa. He also has vast experience in using Geographic Information Systems to analyse and interpret avifaunal data spatially and derive meaningful conclusions. Since 2009 Albert has been a registered Professional Natural Scientist (reg. nr 400177/09) with The South African Council for Natural Scientific Professions, specialising in Zoological Science.

Key Project Experience

Renewable Energy Facilities – avifaunal monitoring projects in association with Chris van Rooyen Consulting

1. Jeffrey's Bay Wind Farm – 12-months preconstruction avifaunal monitoring project
2. Oyster Bay Wind Energy Project – 12-months preconstruction avifaunal monitoring project
3. Ubuntu Wind Energy Project near Jeffrey's Bay – 12-months preconstruction avifaunal monitoring project
4. Bana-ba-Pifu Wind Energy Project near Humansdorp – 12-months preconstruction avifaunal monitoring project
5. Excelsior Wind Energy Project near Caledon – 12-months preconstruction avifaunal monitoring project
6. Laingsburg Spitskopvlakte Wind Energy Project – 12-months preconstruction avifaunal monitoring project
7. Loeriesfontein Wind Energy Project Phase 1, 2 & 3 – 12-months preconstruction avifaunal monitoring project
8. Noupoort Wind Energy Project – 12-months preconstruction avifaunal monitoring project
9. Vleesbaai Wind Energy Project – 12-months preconstruction avifaunal monitoring project
10. Port Nolloth Wind Energy Project – 12-months preconstruction avifaunal monitoring project
11. Langhoogte Caledon Wind Energy Project – 12-months preconstruction avifaunal monitoring project
12. Lunsklip – Stilbaai Wind Energy Project – 12-months preconstruction avifaunal monitoring project
13. Indwe Wind Energy Project – 12-months preconstruction avifaunal monitoring project
14. Zeeland St Helena bay Wind Energy Project – 12-months preconstruction avifaunal

monitoring project
15. Wolseley Wind Energy Project – 12-months preconstruction avifaunal monitoring project
16. Renosterberg Wind Energy Project – 12-months preconstruction avifaunal monitoring project
17. De Aar – North (Mulilo) Wind Energy Project – 12-months preconstruction avifaunal monitoring project (2014)
18. De Aar – South (Mulilo) Wind Energy Project – 12-months bird monitoring
19. Namies – Aggenys Wind Energy Project – 12-months bird monitoring
20. Pofadder - Wind Energy Project – 12-months bird monitoring
21. Dwarsrug Loeriesfontein - Wind Energy Project – 12-months bird monitoring
22. Waaihoek – Utrecht Wind Energy Project – 12-months bird monitoring
23. Amathole – Butterworth Wind Energy Project – 12-months bird monitoring & EIA specialist study
24. De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
25. Makambako Wind Energy Facility (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
26. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)
27. Aletta Wind Energy Facility 12-month bird monitoring (Biotherm)
28. Maralla Wind Energy Facility 12-month bird monitoring (Biotherm)
29. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
30. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
31. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
32. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
33. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
34. Mañhica Wind Energy Facility 12-month bird monitoring & EIA specialist study (Windlab)
35. Klipheuwel-Dassiefontein Wind Energy Facility, Caledon, Western Cape – Operational phase bird monitoring – Year 5 (Klipheuwel-Dassiefontein Wind Energy Facility)
36. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
37. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO). Emvelo and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
38. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
39. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
40. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
41. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
42. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
43. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
44. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
45. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
46. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
47. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
48. Kappa Solar PV facility, Touwsrivier, Western Cape, pre-construction monitoring (Veroniva)
49. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
50. Pofadder Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)

51. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
52. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
53. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).
54. Iphiko Wind Energy facilities, Laingsburg, Western Cape, screening and pre-construction monitoring (G7 Energies)
55. Kangnas Wind Energy Facility, Northern Cape, Operational Phase 2 years avifaunal monitoring (Mainstream)
56. Perdekraal East Wind Energy Facility, Northern Cape, Operational Phase 2 years avifaunal monitoring (Mainstream)
57. Aberdeen 1, 2 & Aberdeen Kudu (3&4) Wind Energy Facilities, Eastern Cape, 12- month pre-construction monitoring (Atlantic Renewable Energy Partners)
58. Loxton / Beaufort West Wind Energy Facilities, Northern Cape, 12-month pre-construction monitoring (Genesis Eco-Energy Developments)
59. Ermelo & Volksrust Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
60. Aardvark Solar PV facility, Copperton, Northern Cape, 12-month pre-construction monitoring (ABO)
61. Bestwood Solar PV facility, Kathu, Northern Cape, pre-construction monitoring (AMDA)
62. Boundary Solar PV facility, Kimberley, Northern Cape, Site sensitivity verification (Atlantic Renewable Energy Partners)
63. Excelsior Wind Energy Facility, Swellendam, Western Cape, Operational Phase 2 years avifaunal monitoring & implementation of Shut Down on Demand (SDOD) pro-active mitigation strategy (Biotherm)
64. De Aar cluster Solar PV facilities, De Aar, Western Cape, Site sensitivity verification (Atlantic Renewable Energy Partners)
65. Rinkhals Solar PV facilities, Kimberley, Northern Cape, Pre-construction monitoring (ABO)
66. Kolkies Sadawa Solar PV facilities, Touwsrivier, Western Cape, pre-construction monitoring (Mainstream)
67. Leeudoringstad Solar PV facilities, Leeudoringstad, Northwest, Pre-construction monitoring (Upgrade Energy)
68. Noupoort Umsobomvu Solar PV facilities, Noupoort, Northern Cape, Pre-construction monitoring (EDF Renewables)
69. Oya Solar PV facilities, Matjiesfontein, Western Cape, pre-construction monitoring (G7 Energies)
70. Scafell Solar PV facilities, Sasolburg, Free state, pre-construction monitoring (Mainstream)
71. Vrede & Rondawel Solar PV facilities, Kroonstad, Free state, pre-construction monitoring (Mainstream)
72. Gunstfontein Wind Energy Facilities, Sutherland, Northern Cape, additional pre-construction monitoring (ACED)
73. Ezelsjacht Wind Energy Facility, De Doorns, Western Cape, pre-construction monitoring (Mainstream)
74. Klipkraal Wind Energy Facility, Fraserburg, Northern Cape, avifaunal screening (Klipkraal WEF)
75. Pofadder Wind Energy Facility, Pofadder, Northern Cape, pre-construction monitoring (Atlantic Renewable Energy Partners)

Bird Impact Assessment studies and / or GIS analysis:

1. Aviation Bird Hazard Assessment Study for the proposed Madiba Bay Leisure Park adjacent to Port Elizabeth Airport.

2. Extension of Runway and Provision of Parallel Taxiway at Sir Seretse Khama Airport, Botswana Bird / Wildlife Hazard Management Specialist Study
3. Maun Airport Improvements Bird / Wildlife Hazard Management Specialist Study
4. Bird Impact Assessment Study - Bird Helicopter Interaction – The Bitou River, Western Cape Province South Africa
5. Proposed La Mercy Airport – Bird Aircraft interaction specialists study using bird detection radar to assess swallow flocking behaviour
6. KwaZulu Natal Power Line Vulture Mitigation Project – GIS analysis
7. Perseus-Zeus Powerline EIA – GIS Analysis
8. Southern Region Pro-active GIS Blue Crane Collision Project.
9. Specialist advisor ~ Implementation of a bird detection radar system and development of an airport wildlife hazard management and operational environmental management plan for the King Shaka International Airport
10. Matsapha International Airport – bird hazard assessment study with management recommendations
11. Evaluation of aviation bird strike risk at candidate solid waste disposal sites in the Ekurhuleni Metropolitan Municipality
12. Gateway Airport Authority Limited – Gateway International Airport, Polokwane: Bird hazard assessment; Compile a bird hazard management plan for the airport
13. Bird Specialist Study - Evaluation of aviation bird strike risk at the Mwakirunge Landfill site near Mombasa Kenya
14. Bird Impact Assessment Study - Proposed Weltevreden Open Cast Coal Mine Belfast, Mpumalanga
15. Avian biodiversity assessment for the Mafube Colliery Coal mine near Middelburg Mpumalanga
16. Avifaunal Specialist Study - SRVM Volspruit Mining project – Mokopane Limpopo Province
17. Avifaunal Impact Assessment Study (with specific reference to African Grass Owls and other Red List species) Stone Rivers Arch
18. Airport bird and wildlife hazard management plan and training to Swaziland Civil Aviation Authority (SWACAA) for Matsapha and Sikhupe International Airports. Bird Impact Assessment Study - Proposed 60-year Ash Disposal Facility near to the Kusile Power Station
19. Avifaunal pre-feasibility assessment for the proposed Montrose dam, Mpumalanga
20. Bird Impact Assessment Study – Proposed ESKOM Phantom Substation near Knysna, Western Cape
21. Habitat sensitivity map for Denham's Bustard, Blue Crane and White-bellied Korhaan in the Kouga Municipal area of the Eastern Cape Province
22. Swaziland Civil Aviation Authority – Sikhuphe International Airport – Bird hazard management assessment
23. Avifaunal monitoring – extension of Specialist Study - SRVM Volspruit Mining project – Mokopane Limpopo Province
24. Avifaunal Specialist Study – Meerkat Hydro Electric Dam – Hope Town, Northern Cape
25. The Stewards Pan Reclamation Project – Bird Impact Assessment study
26. Airports Company South Africa – Avifaunal Specialist Consultant – Airport Bird and Wildlife Hazard Mitigation
27. Strategic Environmental Assessment for Gas Pipeline Development, CSIR
28. Avifaunal Specialist Assessment - Proposed monopole telecommunications mast – Roodekrans, Roodepoort, Gauteng (Enviroworks)
29. Gromis-Nama-Aggeneis 400kv IPP Integration: Environmental Screening - Avifaunal Specialist Desktop Study
30. Melkspruit - Rouxville 132kV Distribution Line - Avifaunal Amendment and Walk-through Report
31. Gamma - Kappa 2nd 765kV transmission line – Avifaunal impact assessment GIS analysis

Geographic Information System analysis & maps

1. ESKOM Power line Makgalakwena EIA – GIS specialist & map production
2. ESKOM Power line Benficosa EIA – GIS specialist & map production
3. ESKOM Power line Riversong EIA – GIS specialist & map production
4. ESKOM Power line Waterberg NDP EIA – GIS specialist & map production
5. ESKOM Power line Bulge Toulon EIA – GIS specialist & map production
6. ESKOM Power line Bulge DORSET EIA – GIS specialist & map production
7. ESKOM Power lines Marblehall EIA – GIS specialist & map production
8. ESKOM Power line Grootpan Lesedi EIA – GIS specialist & map production
9. ESKOM Power line Tanga EIA – GIS specialist & map production
10. ESKOM Power line Bokmakierie EIA – GIS specialist & map production
11. ESKOM Power line Rietfontein EIA – GIS specialist & map production
12. Power line Anglo Coal EIA – GIS specialist & map production
13. ESKOM Power line Camcoll Jericho EIA – GIS specialist & map production
14. Hartbeespoort Residential Development – GIS specialist & map production
15. ESKOM Power line Mantsole EIA – GIS specialist & map production
16. ESKOM Power line Nokeng Flourspar EIA – GIS specialist & map production
17. ESKOM Power line Greenview EIA – GIS specialist & map production
18. Derdepoort Residential Development – GIS specialist & map production
19. ESKOM Power line Boynton EIA – GIS specialist & map production
20. ESKOM Power line United EIA – GIS specialist & map production
21. ESKOM Power line Gutshwa & Malelane EIA – GIS specialist & map production
22. ESKOM Power line Ohrigstad EIA – GIS specialist & map production
23. Zilkaatsnek Development Public Participation –map production
24. Belfast – Paarde Power line - GIS specialist & map production
25. Solar Park Solar Park Integration Project Bird Impact Assessment Study – avifaunal GIS analysis.
26. Kappa-Omega-Aurora 765kV Bird Impact Assessment Report – Avifaunal GIS analysis.
27. Gamma – Kappa 2nd 765kV – Bird Impact Assessment Report – Avifaunal GIS analysis.
28. ESKOM Power line Kudu-Dorstfontein Amendment EIA – GIS specialist & map production.
29. Proposed Heilbron filling station EIA – GIS specialist & map production
30. ESKOM Lebatlhane EIA – GIS specialist & map production
31. ESKOM Pienaars River CNC EIA – GIS specialist & map production
32. ESKOM Lemara Phiring Ohrigstad EIA – GIS specialist & map production
33. ESKOM Pelly-Warmbad EIA – GIS specialist & map production
34. ESKOM Rosco-Bracken EIA –GIS specialist & map production
35. ESKOM Ermelo-Uitkoms EIA – GIS specialist & map production
36. ESKOM Wisani bridge EIA – GIS specialist & map production City of Tshwane – New bulk feeder pipeline projects x3Map production
37. ESKOM Lebohang Substation and 132kV Distribution Power Line Project Amendment GIS specialist & map production
38. ESKOM Geluk Rural Powerline GIS & Mapping
39. Eskom Kimberley Strengthening Phase 4 Project GIS & Mapping
40. ESKOM Kwaggafontein - Amandla Amendment Project GIS & Mapping
41. ESKOM Lephalale CNC – GIS Specialist & Mapping
42. ESKOM Marken CNC – GIS Specialist & Mapping
43. ESKOM Lethabong substation and powerlines – GIS Specialist & Mapping
44. ESKOM Magopela- Pitsong 132kV line and new substation – GIS Specialist & Mapping

45. Vlakfontein Filling Station – GIS Specialist & Mapping - EIA
46. Prieska – Hoekplaas Solar PV & BESS - GIS Specialist & Mapping – EIA
47. Mulilo Total Hydra Storage (MTHS) De Aar - GIS Specialist & Mapping – EIA
48. Merensky Uchoba Powerline, Steelpoort - GIS Specialist & Mapping – EIA
49. Douglas Solar Part 2 Amendment – grid connection - GIS Specialist & Mapping – EIA

Professional Affiliations

- South African Council for Natural Scientific Professions (SACNASP) registered Professional Natural Scientist (reg. nr 400177/09) – specialist field: Zoological Science. Registered since 2009.
- Southern African Wildlife Management Association - Member
- Zoological Society of South Africa - Member

Curriculum Vitae: Megan Loftie-Eaton

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	PhD Biological Sciences
Nationality	:	South African
Years of Experience	:	10 years

Key Qualifications

Megan Loftie-Eaton **(**Pr. Sci.Nat) holds a PhD in Biological sciences from the Avian Demography Unit, University of Cape Town, and has more than 10 years' experience conducting bird research, atlasing, mapping and environmental assessment consulting. Megan was an assistant researcher on the African Penguin EarthWatch Research Team, conducting population surveys on penguins and other seabirds, sustainable agriculture research, biodiversity surveys and ecological monitoring. She has acted as coordinator, Social media manager and communications officer for various programmes including The Biodiversity and Development Institute (OdonataMAP, Citizen Science Projects), LepiMAP, BirdMAP, ADU and Hoedspruit Hub. She is on the Expert Panel for a virtual museum covering several vertebrate taxa.ma Megan is also very active with the bird atlasing project, she presented and assessed several atlasing workshops in Africa and Europe. She facilitated an assessed Ecology courses and provided training materials for it. She has been involved in Environmental and specifically Avian assessments since 2020 by conducting fieldwork, completing assessments, and acting as an environmental assessment practitioner. She has several additional qualifications, including a FGASA Level 1 Nature guide qualification, a First aid level one qualification, snake and scorpion training courses and a course in humane trapping methods. She completed online global environmental management course, and a NQF level 5 outcomes-based assessment course. Megan is an author or co-author on several scientific papers and currently she operates as an Avifaunal specialist working with Chris van Rooyen Consulting.

Key Project Experience

Renewable Energy Facilities – avifaunal monitoring projects in association with Chris van Rooyen Consulting

1. Philipstown Kudu Solar Energy Facilities and associated infrastructure
2. Umsobomvu Solar Energy Facilities and associated infrastructure
3. Ezelsjacht Wind Energy Facility and associated infrastructure
4. Heuweltjies en Kraaltjies Wind Energy Facilities and associated infrastructure
5. Mercury Solar Energy Facilities and associated infrastructure
6. Perdekraal East Wind Energy Facility and associated infrastructure
7. Skilpad Solar Energy Facility and associated infrastructure

Other Avifaunal Projects

1. Blue Stone Quarry Wall Restoration, Robben Island, Western Cape, South Africa – Avifaunal Impact Assessment

Professional registrations and industrial affiliations

- **Professional Natural Scientist in Ecology (Member #135161)** registered with the South African Council for Natural Scientific Professions (SACNASP)
- **Environmental Assessment Practitioner (Number 2021/3690)** registered with the Environmental Assessment Practitioners Association of South Africa (EAPASA)
- **Member** of the Zoological Society of Southern Africa (ZSSA)

APPENDIX 3: PRE-CONSTRUCTION MONITORING PROTOCOL

The objective of the pre-construction monitoring conducted at the proposed Mulilo Wind Energy Facilities (WEFs) Cluster (Emvelo WEF, Rochdale WEF and Sheepmoor WEF) is to gather baseline data over a period of four seasons on the following aspects pertaining to avifauna:

- The abundance and diversity of birds on the proposed WEF site and on a suitable control site, to measure the potential displacement effect of the wind farm.
- Flight patterns of priority species to assess the potential collision risk with the turbines and associated power line infrastructure.

Currently, as it is not expected that species specific guidelines (i.e. those for Cape Vulture, Verreaux's Eagle, or Black Harrier) will be relevant, one set of guidelines are applicable to these wind facilities:

- Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015. *Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa.* Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa. Hereafter referred to as the wind guidelines.

The wind guidelines are applicable to all wind energy facilities which require environmental authorisation, and monitoring at the Amsterdam WEF site is being conducted in line with these guidelines. The wind guidelines require a minimum of four site visits a year. Wind priority species were identified using the latest (November 2014) BirdLife SA (BLSA) list of priority species for wind farms.

Monitoring at the WEF sites and a Control Site has been conducted by a team of monitors during the following time envelopes:

- 21 February–03 March 2022
- 21–27 April 2022
- 01–16 June 2022
- 06–21 October 2022
- 14–17 January 2023 (Transect counts only)
- 05–09 May 2023
- 28–30 June 2023
- 22–26 August 2023

Additional Vantage Point and Transect Count monitoring was conducted near the identified Martial Eagle nest to gain a better understanding of flight patterns and paths. Five surveys were conducted, in addition to the seven surveys completed as part of the pre-construction monitoring.

The five additional surveys were conducted during the following time envelopes:

- 17–22 October 2023
- 15–23 November 2023
- 30 November–05 December 2023
- 17–22 January 2024
- 14–20 February 2024

Monitoring is being conducted in the following manner:

- Two (2) drive transects were identified totalling 15.3km and 9.75km respectively at the WEF Sites, and one drive transect at the Control Site with a total length of 10.5km.

    - One monitor travelling slowly (± 10km/h) in a vehicle records all birds on both sides of the transect. The observer stops at regular intervals (every 500m) to scan the environment with binoculars. Drive transects are counted three times per sampling session (i.e. three times per seasonal site visit).
- Nine (9) walk transects of 1km each were identified at the WEF sites, and two at the Control Site,
    - Each walk transect is counted 4 times per sampling season. (i.e. four times per seasonal site visit).
    - All birds are recorded during walk transects.
- The following variables were recorded during drive transect and walk transect sampling:
    - Species;
    - Number of birds;
    - Date;
    - Start time and end time;
    - Estimated distance from transect;
    - Wind direction;
    - Wind strength (estimated Beaufort scale);
    - Weather (sunny, cloudy, partly cloudy, rain, mist);
    - Temperature (cold, mild, warm, hot);
    - Behaviour (flushed, flying-display, perched, perched-calling, perched-hunting, flying-foraging, flying-commute, foraging on the ground); and
    - Co-ordinates (priority species only).

The aim with drive transects is primarily to record large priority species (i.e. raptors and large terrestrial species), while walk transects are primarily aimed at recording small passerines. The primary objective of the transect monitoring is to gather baseline data on the use of the site by birds in order to measure potential displacement by the wind farm activities.

- Twelve (12) vantage points (VPs) were identified from which the majority of the proposed development area can be observed, to record the flight altitude and patterns of priority species. One VP was also identified on the control site. The following variables are recorded for each flight:
    - Species;
    - Number of birds;
    - Date;
    - Start time and end time;
    - Wind direction;
    - Wind strength (estimated Beaufort scale 1-7);
    - Weather (sunny, cloudy, partly cloudy, rain, mist);
    - Temperature (cold, mild, warm, hot);
    - Flight altitude (high i.e. >300m; medium i.e. 30m – 300m; low i.e. <30m)
    - Flight mode (soar; flap; glide; kite; hover) and
    - Flight time (in 15 second intervals).

Each VP is surveyed for a total of 12 hours per sampling season, with the intention of obtaining a total of 48 hours of sampling effort per VP once all four seasons have been completed. The objective of vantage point counts is to measure the potential collision risk with the turbines.

Three focal points (FP) of bird activity have been identified thus far:

- FP1: A large farm dam in a drainage line. This FP is surveyed once during each survey.
- FP2: Southern Bald Ibis colony (26°37'20.82" South, 30°18'36.43" East)
- FP3: Southern Bald Ibis colony (26°38'28.47" South, 30°17'37.67" East)

Nest searches. Dedicated searchers for priority species nests were carried out during each seasonal survey to search for raptor nests in all suitable habitat types.

There is also a large dam at the Control Site which is counted as part of the control drive transect.

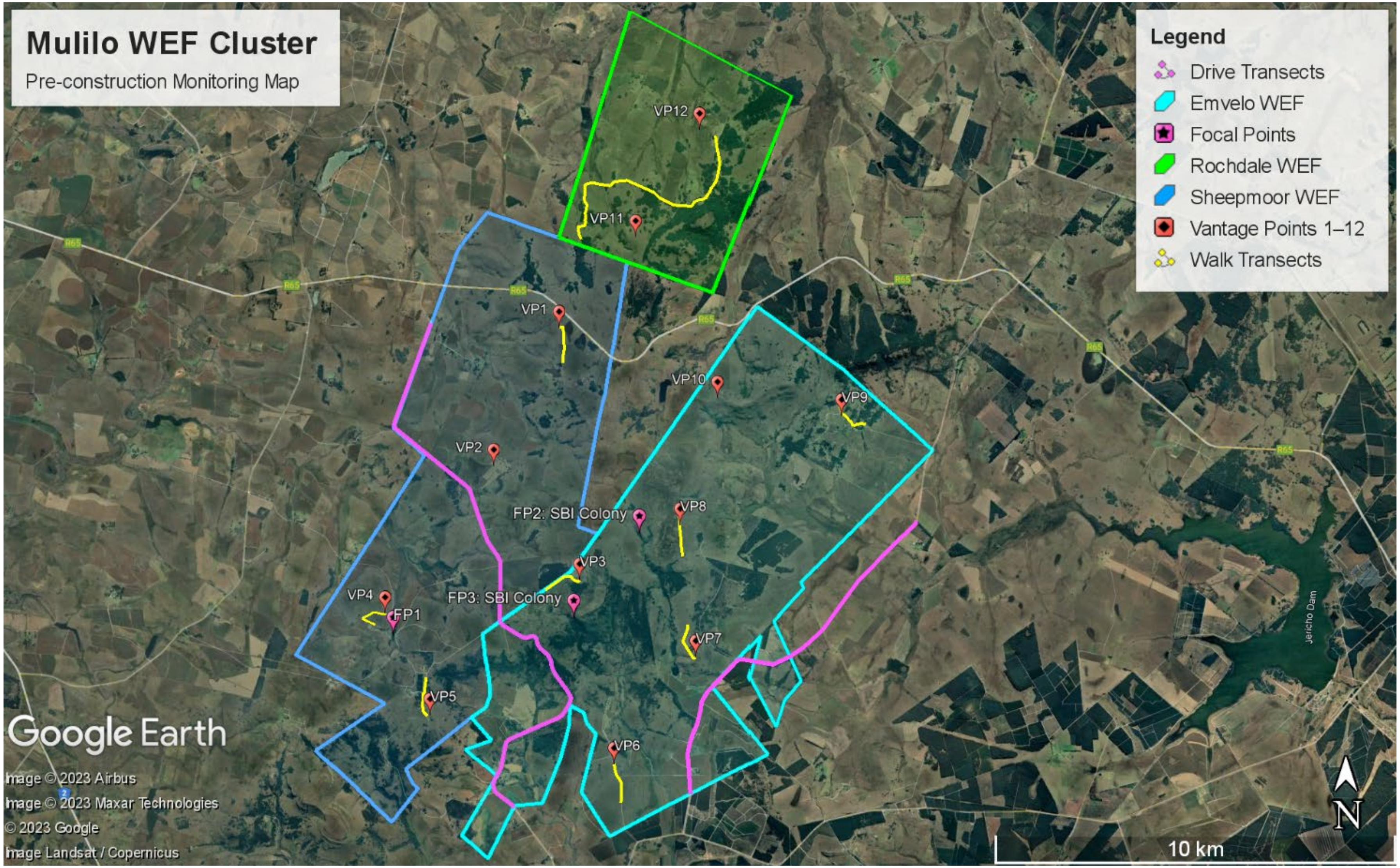

Figure 1: Locations of Focal Points, Vantage Points, Walk Transects and Drive Transects where Pre-Construction Monitoring is taking place.

APPENDIX 4: BIRD HABITAT

Figure 1: Grassland habitat in the Project Area.

Figure 2: A stand of alien trees in the Project Area.

Figure 3: Large dam in the Project Area.

Figure 4: Agriculture in the Project Area.

APPENDIX 5: SPECIES LIST FOR THE BROADER AREA

Species Name	Scientific Name	SABAP2 Reporting Rate %		Recorded During Monitoring
		Full Protocol	Ad Hoc Protocol	
African Black Duck	*Anas sparsa*	4,47	0,00	
African Black Swift	*Apus barbatus*	2,23	0,46	
African Darter	*Anhinga rufa*	14,53	3,21	x
African Dusky Flycatcher	*Muscicapa adusta*	1,12	0,00	
African Firefinch	*Lagonosticta rubricata*	16,20	2,75	x
African Fish Eagle	*Haliaeetus vocifer*	7,26	0,92	x
African Goshawk	*Accipiter tachiro*	0,56	0,00	x
African Harrier-Hawk	*Polyboroides typus*	15,64	2,29	x
African Hoopoe	*Upupa africana*	15,64	1,38	x
African Jacana	*Actophilornis africanus*	2,79	1,38	
African Marsh Harrier	*Circus ranivorus*	4,47	0,46	x
African Olive Pigeon	*Columba arquatrix*	1,12	0,00	x
African Palm Swift	*Cypsiurus parvus*	1,68	0,00	
African Paradise Flycatcher	*Terpsiphone viridis*	13,97	2,75	x
African Pipit	*Anthus cinnamomeus*	77,65	13,30	x
African Rail	*Rallus caerulescens*	6,15	0,46	x
African Reed Warbler	*Acrocephalus baeticatus*	2,23	0,46	
African Sacred Ibis	*Threskiornis aethiopicus*	37,43	5,50	x
African Snipe	*Gallinago nigripennis*	13,41	1,38	x
African Spoonbill	*Platalea alba*	22,91	1,83	x
African Stonechat	*Saxicola torquatus*	87,15	17,89	x
African Swamphen	*Porphyrio madagascariensis*	6,15	2,75	
African Wattled Lapwing	*Vanellus senegallus*	34,08	3,21	x
African Yellow Warbler	*Iduna natalensis*	11,73	1,83	x
Alpine Swift	*Tachymarptis melba*	0,56	0,00	
Amethyst Sunbird	*Chalcomitra amethystina*	19,55	1,83	x
Amur Falcon	*Falco amurensis*	26,26	9,63	x
Ant-eating Chat	*Myrmecocichla formicivora*	91,62	15,60	x
Banded Martin	*Riparia cincta*	56,98	5,50	x
Barn Swallow	*Hirundo rustica*	49,72	11,01	x
Barratt's Warbler	*Bradypterus barratti*	5,59	0,46	x
Bar-throated Apalis	*Apalis thoracica*	16,76	3,21	x
Black Crake	*Zapornia flavirostra*	9,50	0,92	
Black Cuckoo	*Cuculus clamosus*	2,79	0,00	x
Black Harrier	*Circus maurus*	0,00	0,46	

Species Name	Scientific Name	SABAP2 Reporting Rate %		Recorded During Monitoring
		Full Protocol	Ad Hoc Protocol	
Black Heron	*Egretta ardesiaca*	0,56	0,00	
Black Saw-wing	*Psalidoprocne pristoptera*	5,03	0,00	x
Black Sparrowhawk	*Accipiter melanoleucus*	15,08	1,38	x
Black-backed Puffback	*Dryoscopus cubla*	1,68	0,00	x
Black-bellied Bustard	*Lissotis melanogaster*	4,47	0,00	x
Black-chested Prinia	*Prinia flavicans*	13,41	1,38	x
Black-chested Snake Eagle	*Circaetus pectoralis*	4,47	0,46	x
Black-collared Barbet	*Lybius torquatus*	13,41	0,00	x
Black-crowned Tchagra	*Tchagra senegalus*	5,59	0,00	x
Black-headed Heron	*Ardea melanocephala*	50,28	2,75	x
Black-headed Oriole	*Oriolus larvatus*	32,96	3,21	x
Black-necked Grebe	*Podiceps nigricollis*	0,56	0,46	
Black-rumped Buttonquail	*Turnix nanus*	2,79	0,00	
Blacksmith Lapwing	*Vanellus armatus*	57,54	8,26	x
Black-throated Canary	*Crithagra atrogularis*	66,48	5,96	x
Black-winged Kite	*Elanus caeruleus*	65,92	14,22	x
Black-winged Lapwing	*Vanellus melanopterus*	21,23	1,38	x
Black-winged Stilt	*Himantopus himantopus*	4,47	0,46	
Blue Crane	*Grus paradisea*	12,85	0,46	x
Blue Korhaan	*Eupodotis caerulescens*	0,56	0,00	
Blue Waxbill	*Uraeginthus angolensis*	6,15	0,92	x
Blue-billed Teal	*Spatula hottentota*	0,56	0,00	
Bokmakierie	*Telophorus zeylonus*	74,30	9,17	x
Bronze Mannikin	*Spermestes cucullata*	0,56	0,92	x
Brown Snake Eagle	*Circaetus cinereus*	2,79	0,00	x
Brown-backed Honeybird	*Prodotiscus regulus*	1,12	0,00	x
Brown-throated Martin	*Riparia paludicola*	46,37	6,42	x
Buff-streaked Chat	*Campicoloides bifasciatus*	7,82	0,00	x
Buffy Pipit	*Anthus vaalensis*	0,00	0,00	x
Bush Blackcap	*Sylvia nigricapillus*	1,68	0,00	x
Cape Batis	*Batis capensis*	4,47	0,00	x
Cape Bunting	*Emberiza capensis*	14,53	0,46	x
Cape Canary	*Serinus canicollis*	82,68	11,93	x
Cape Crow	*Corvus capensis*	12,85	0,00	
Cape Eagle-Owl	*Bubo capensis*	-[12]	-	x

[12] No Reporting Rate as this species was recorded during monitoring only and not through SABAP2.

Species Name	Scientific Name	SABAP2 Reporting Rate %		Recorded During Monitoring
		Full Protocol	Ad Hoc Protocol	
Cape Grassbird	*Sphenoeacus afer*	32,40	5,96	x
Cape Longclaw	*Macronyx capensis*	89,94	14,22	x
Cape Robin-Chat	*Cossypha caffra*	70,39	9,63	x
Cape Shoveler	*Spatula smithii*	15,08	0,46	x
Cape Sparrow	*Passer melanurus*	68,72	6,42	x
Cape Starling	*Lamprotornis nitens*	2,79	0,00	
Cape Teal	*Anas capensis*	0,56	0,00	
Cape Turtle Dove	*Streptopelia capicola*	92,18	18,35	x
Cape Vulture	*Gyps coprotheres*	3,35	0,00	x
Cape Wagtail	*Motacilla capensis*	77,10	10,09	x
Cape Weaver	*Ploceus capensis*	42,46	4,13	x
Cape White-eye	*Zosterops virens*	44,13	5,05	x
Capped Wheatear	*Oenanthe pileata*	6,70	0,00	x
Cardinal Woodpecker	*Dendropicos fuscescens*	13,41	1,83	x
Cinnamon-breasted Bunting	*Emberiza tahapisi*	1,12	0,00	x
Cloud Cisticola	*Cisticola textrix*	10,06	0,92	x
Common Buttonquail	*Turnix sylvaticus*	3,35	0,00	
Common Buzzard	*Buteo buteo*	39,11	16,97	x
Common Greenshank	*Tringa nebularia*	5,03	0,00	
Common House Martin	*Delichon urbicum*	6,15	0,00	x
Common Moorhen	*Gallinula chloropus*	29,61	4,13	x
Common Myna	*Acridotheres tristis*	12,29	0,92	
Common Ostrich	*Struthio camelus*	20,67	2,29	x
Common Quail	*Coturnix coturnix*	34,64	4,13	x
Common Sandpiper	*Actitis hypoleucos*	0,56	0,00	
Common Swift	*Apus apus*	1,12	0,00	
Common Waxbill	*Estrilda astrild*	66,48	12,84	x
Crested Barbet	*Trachyphonus vaillantii*	1,68	0,00	x
Crowned Lapwing	*Vanellus coronatus*	53,07	5,50	x
Cuckoo Finch	*Anomalospiza imberbis*	0,56	0,00	
Dark-capped Bulbul	*Pycnonotus tricolor*	68,72	10,55	x
Denham's Bustard	*Neotis denhami*	5,03	0,00	x
Diederik Cuckoo	*Chrysococcyx caprius*	31,28	5,50	x
Drakensberg Prinia	*Prinia hypoxantha*	43,58	5,96	x
Dusky Indigobird	*Vidua funerea*	4,47	0,00	x
Eastern Clapper Lark	*Mirafra fasciolata*	14,53	0,46	x
Eastern Long-billed Lark	*Certhilauda semitorquata*	8,38	1,38	x

Species Name	Scientific Name	SABAP2 Reporting Rate %		Recorded During Monitoring
		Full Protocol	Ad Hoc Protocol	
Egyptian Goose	*Alopochen aegyptiaca*	69,27	9,63	x
Emerald-spotted Wood Dove	*Turtur chalcospilos*	0,56	0,00	
Eurasian Reed Warbler	*Acrocephalus scirpaceus*	0,56	0,00	
European Bee-eater	*Merops apiaster*	1,68	0,00	x
Fan-tailed Widowbird	*Euplectes axillaris*	46,37	4,13	x
Fiery-necked Nightjar	*Caprimulgus pectoralis*	1,12	0,00	
Fiscal Flycatcher	*Melaenornis silens*	26,26	2,29	x
Fork-tailed Drongo	*Dicrurus adsimilis*	30,73	1,38	x
Forest Buzzard	*Buteo trizonatus*	-	-	x
Fulvous Whistling Duck	*Dendrocygna bicolor*	0,00	0,46	
Giant Kingfisher	*Megaceryle maxima*	7,82	0,46	x
Glossy Ibis	*Plegadis falcinellus*	4,47	0,92	x
Golden-breasted Bunting	*Emberiza flaviventris*	19,55	0,92	x
Golden-tailed Woodpecker	*Campethera abingoni*	1,12	0,00	x
Goliath Heron	*Ardea goliath*	1,68	0,00	
Great Egret	*Ardea alba*	8,94	1,38	x
Greater Flamingo	*Phoenicopterus roseus*	1,68	0,00	x
Greater Honeyguide	*Indicator indicator*	4,47	0,92	x
Greater Striped Swallow	*Cecropis cucullata*	67,04	13,76	x
Grey Crowned Crane	*Balearica regulorum*	15,64	0,46	x
Grey Heron	*Ardea cinerea*	20,67	1,83	x
Grey-headed Bushshrike	*Malaconotus blanchoti*	1,12	0,00	
Grey-headed Gull	*Chroicocephalus cirrocephalus*	1,12	0,46	
Grey-winged Francolin	*Scleroptila afra*	15,08	0,00	x
Groundscraper Thrush	*Turdus litsitsirupa*	3,91	0,00	
Hadada Ibis	*Bostrychia hagedash*	83,24	12,84	x
Hamerkop	*Scopus umbretta*	16,76	0,46	x
Helmeted Guineafowl	*Numida meleagris*	54,19	3,67	x
Horus Swift	*Apus horus*	1,12	0,00	
House Sparrow	*Passer domesticus*	12,85	0,00	x
Intermediate Egret	*Ardea intermedia*	16,76	1,83	x
Jackal Buzzard	*Buteo rufofuscus*	32,40	8,72	x
Karoo Thrush	*Turdus smithi*	2,79	0,00	x
Kittlitz's Plover	*Charadrius pecuarius*	5,03	0,46	
Klaas's Cuckoo	*Chrysococcyx klaas*	1,12	0,46	x
Kurrichane Thrush	*Turdus libonyana*	17,32	0,92	x
Lanner Falcon	*Falco biarmicus*	12,85	0,46	x

Species Name	Scientific Name	SABAP2 Reporting Rate %		Recorded During Monitoring
		Full Protocol	Ad Hoc Protocol	
Laughing Dove	*Spilopelia senegalensis*	35,20	5,05	x
Lazy Cisticola	*Cisticola aberrans*	7,82	0,00	
Lesser Flamingo	*Phoeniconaias minor*	1,12	0,00	
Lesser Honeyguide	*Indicator minor*	1,68	0,00	x
Lesser Moorhen	*Paragallinula angulata*	0,56	0,46	
Lesser Striped Swallow	*Cecropis abyssinica*	2,79	1,38	x
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	8,38	0,46	
Levaillant's Cisticola	*Cisticola tinniens*	84,92	13,76	x
Little Egret	*Egretta garzetta*	1,68	0,92	
Little Grebe	*Tachybaptus ruficollis*	51,96	5,96	x
Little Rush Warbler	*Bradypterus baboecala*	10,06	0,92	x
Little Stint	*Calidris minuta*	1,12	0,00	
Little Swift	*Apus affinis*	10,06	2,75	x
Long-crested Eagle	*Lophaetus occipitalis*	13,97	14,22	x
Long-tailed Widowbird	*Euplectes progne*	82,68	16,06	x
Malachite Kingfisher	*Corythornis cristatus*	12,85	0,92	x
Malachite Sunbird	*Nectarinia famosa*	16,76	0,92	x
Marsh Owl	*Asio capensis*	1,68	0,46	x
Marsh Warbler	*Acrocephalus palustris*	2,23	0,00	x
Martial Eagle	*Polemaetus bellicosus*	5,59	0,00	x
Mocking Cliff Chat	*Thamnolaea cinnamomeiventris*	1,12	0,00	
Mountain Wheatear	*Myrmecocichla monticola*	2,79	0,00	
Namaqua Dove	*Oena capensis*	5,03	0,46	
Natal Spurfowl	*Pternistis natalensis*	6,15	0,92	x
Neddicky	*Cisticola fulvicapilla*	24,02	4,13	x
Nicholson's Pipit	*Anthus nicholsoni*	7,26	0,46	x
Northern Black Korhaan	*Afrotis afraoides*	0,56	0,00	
Olive Bushshrike	*Chlorophoneus olivaceus*	8,38	0,92	x
Olive Thrush	*Turdus olivaceus*	1,68	0,00	x
Orange-breasted Waxbill	*Amandava subflava*	15,64	1,83	x
Pale-crowned Cisticola	*Cisticola cinnamomeus*	30,17	3,21	x
Pied Avocet	*Recurvirostra avosetta*	1,68	0,00	
Pied Crow	*Corvus albus*	11,73	3,67	x
Pied Kingfisher	*Ceryle rudis*	11,73	1,38	x
Pied Starling	*Lamprotornis bicolor*	62,01	12,84	x
Pin-tailed Whydah	*Vidua macroura*	72,07	8,26	x
Plain-backed Pipit	*Anthus leucophrys*	1,12	0,00	

Species Name	Scientific Name	SABAP2 Reporting Rate %		Recorded During Monitoring
		Full Protocol	Ad Hoc Protocol	
Purple Heron	*Ardea purpurea*	10,06	0,00	x
Quailfinch	*Ortygospiza atricollis*	57,54	4,59	x
Red-backed Shrike	*Lanius collurio*	2,79	0,46	
Red-billed Quelea	*Quelea quelea*	44,13	5,50	x
Red-billed Teal	*Anas erythrorhyncha*	21,79	2,29	x
Red-capped Lark	*Calandrella cinerea*	59,22	6,42	x
Red-chested Cuckoo	*Cuculus solitarius*	11,73	0,92	x
Red-chested Flufftail	*Sarothrura rufa*	3,91	0,46	x
Red-collared Widowbird	*Euplectes ardens*	31,28	4,13	x
Red-eyed Dove	*Streptopelia semitorquata*	73,18	15,14	x
Red-faced Mousebird	*Urocolius indicus*	0,56	0,00	x
Red-headed Finch	*Amadina erythrocephala*	0,56	0,00	
Red-knobbed Coot	*Fulica cristata*	58,10	8,26	x
Red-throated Wryneck	*Jynx ruficollis*	36,31	3,21	x
Red-winged Francolin	*Scleroptila levaillantii*	32,96	3,67	x
Red-winged Starling	*Onychognathus morio*	5,59	1,83	x
Reed Cormorant	*Microcarbo africanus*	56,98	6,88	x
Rock Dove	*Columba livia*	1,68	0,00	
Rock Kestrel	*Falco rupicolus*	7,26	0,92	
Rock Martin	*Ptyonoprogne fuligula*	8,38	1,38	x
Ruff	*Calidris pugnax*	2,23	0,46	
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	1,68	0,00	x
Rufous-naped Lark	*Mirafra africana*	10,61	1,38	x
Sand Martin	*Riparia riparia*	1,68	0,46	
Secretarybird	*Sagittarius serpentarius*	24,02	2,29	x
Sedge Warbler	*Acrocephalus schoenobaenus*	0,56	0,00	
South African Cliff Swallow	*Petrochelidon spilodera*	37,99	4,13	x
South African Shelduck	*Tadorna cana*	30,73	4,59	x
Southern Bald Ibis	*Geronticus calvus*	26,82	4,13	x
Southern Black Flycatcher	*Melaenornis pammelaina*	2,23	0,00	x
Southern Boubou	*Laniarius ferrugineus*	53,63	5,96	x
Southern Fiscal	*Lanius collaris*	93,85	19,72	x
Southern Grey-headed Sparrow	*Passer diffusus*	74,30	9,17	x
Southern Masked Weaver	*Ploceus velatus*	88,83	12,39	x
Southern Pochard	*Netta erythrophthalma*	3,91	0,00	x
Southern Red Bishop	*Euplectes orix*	86,03	21,10	x
Speckled Mousebird	*Colius striatus*	26,26	0,92	x

Species Name	Scientific Name	SABAP2 Reporting Rate %		Recorded During Monitoring
		Full Protocol	Ad Hoc Protocol	
Speckled Pigeon	*Columba guinea*	54,75	3,21	x
Spike-heeled Lark	*Chersomanes albofasciata*	49,72	5,50	x
Spotted Eagle-Owl	*Bubo africanus*	11,73	1,38	x
Spotted Flycatcher	*Muscicapa striata*	2,79	0,46	
Spotted Thick-knee	*Burhinus capensis*	6,15	0,46	
Spur-winged Goose	*Plectropterus gambensis*	57,54	5,50	x
Squacco Heron	*Ardeola ralloides*	1,12	0,00	
Streaky-headed Seedeater	*Crithagra gularis*	16,76	1,83	x
Swainson's Spurfowl	*Pternistis swainsonii*	63,13	5,05	x
Tawny-flanked Prinia	*Prinia subflava*	6,15	0,46	x
Three-banded Plover	*Charadrius tricollaris*	34,08	2,29	x
Village Weaver	*Ploceus cucullatus*	9,50	0,92	x
Wailing Cisticola	*Cisticola lais*	10,61	0,46	x
Western Barn Owl	*Tyto alba*	5,03	0,92	
Western Cattle Egret	*Bubulcus ibis*	34,08	6,88	x
Western Osprey	*Pandion haliaetus*	0,56	0,00	
Whiskered Tern	*Chlidonias hybrida*	24,58	7,34	x
White Stork	*Ciconia ciconia*	10,61	2,29	x
White-backed Duck	*Thalassornis leuconotus*	5,59	0,46	x
White-bellied Bustard	*Eupodotis senegalensis*	12,29	0,00	x
White-breasted Cormorant	*Phalacrocorax lucidus*	8,94	1,38	x
White-faced Whistling Duck	*Dendrocygna viduata*	1,68	0,00	
White-rumped Swift	*Apus caffer*	36,87	4,13	x
White-throated Swallow	*Hirundo albigularis*	38,55	4,59	x
White-winged Tern	*Chlidonias leucopterus*	5,59	0,00	
Willow Warbler	*Phylloscopus trochilus*	13,97	1,38	x
Wing-snapping Cisticola	*Cisticola ayresii*	62,57	10,55	x
Wire-tailed Swallow	*Hirundo smithii*	0,56	0,00	
Wood Sandpiper	*Tringa glareola*	5,03	0,00	x
Yellow Canary	*Crithagra flaviventris*	11,73	0,92	x
Yellow-billed Duck	*Anas undulata*	60,89	6,88	x
Yellow-billed Kite	*Milvus aegyptius*	3,91	0,46	x
Yellow-breasted Pipit	*Anthus chloris*	1,12	0,00	x
Yellow-crowned Bishop	*Euplectes afer*	44,69	7,34	x
Yellow-fronted Canary	*Crithagra mozambica*	21,23	1,38	x
Yellow-throated Bush Sparrow	*Gymnoris superciliaris*	4,47	0,46	x
Zitting Cisticola	*Cisticola juncidis*	55,87	8,72	x

APPENDIX 6: ASSESSMENT CRITERIA

Where significant environmental aspects are present, significant environmental impacts ***may*** result. The significance of the impacts associated with the significant aspects can be determined by considering the risk:

Significance of Environmental Impact (Risk) = Probability x Consequence

The consequence of impacts can be described by considering the severity, spatial extent, and duration of the impact.

1 Severity of Impacts

Table 1-1 presents the ranking criteria that were used to determine the severity of impacts on priority species.

Table 1: Criteria for ranking the *Severity* of negative impacts on priority species

Environment	**Ranking Criteria**		
	Low (L-)	**Medium (M-)**	**High (H-)**
Ecology (Plant and animal life)	Disturbance of areas that are degraded, have little conservation value. Minor change in species variety or prevalence.	Disturbance of areas that have some conservation value. Complete change in species variety or prevalence.	Disturbance of areas that are pristine, have conservation value. Destruction of rare or endangered species.

2 Spatial Extent and Duration of Impacts

The duration and spatial scale of impacts were ranked using the criteria in Table 2 below:

Table 2: Ranking the *Duration* and *Spatial Scale* of impacts

	Ranking Criteria		
	L	**M**	**H**
Duration	Quickly reversible Less than the project life Short-term	Reversible over time/life of the project Medium-term	Permanent Beyond closure Long-term
Spatial Scale	Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/national

3 Consequence of Impacts

Having ranked the severity, duration and spatial extent, the overall consequence of impacts was determined using the guidelines in Table 3 below.

Table 3: Ranking the *Consequence* of an impact

			SEVERITY = L		
DURATION	Long-term	**H**			
	Medium-term	**M**			**MEDIUM**
	Short-term	**L**	**LOW**		
			SEVERITY = M		
DURATION	Long-term	**H**			**HIGH**
	Medium-term	**M**		**MEDIUM**	
	Short-term	**L**	**LOW**		
			SEVERITY = H		
DURATION	Long-term	**H**			
	Medium-term	**M**			**HIGH**
	Short-term	**L**	**MEDIUM**		
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/national
			SPATIAL		

4 Overall Significance of Impacts

Combining the consequence of the impact and the probability of occurrence, as shown by Table 4, provided the overall significance (risk) of impacts.

Table 4: Ranking the *Overall Significance* of impacts

PROBABILITY	Definite Continuous	**H**	**MEDIUM**		**HIGH**
	Possible Frequent	**M**		**MEDIUM**	
	Unlikely Seldom	**L**	**LOW**		**MEDIUM**
			L	**M**	**H**
			CONSEQUENCE (from Table 3)		

The overall significance ranking of the negative environmental impacts provides the guidelines in Table 5 for decision making.

Table 5: Guidelines for decision-making

Overall Significance Ranking	**Nature of Impact**	**Decision Guideline**
High	Unacceptable impacts.	Likely to be a fatal flaw.
Medium	Noticeable impact.	These are unavoidable consequence, which will need to be accepted if the project
Low	Minor impacts.	These impacts are not likely to affect the project decision.

APPENDIX 7: ENVIRONMENTAL MANAGEMENT PLAN FOR THE WEF

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
AVIFAUNA: MORTALITY DUE TO COLLISIONS WITH THE TURBINES					
Mortality of priority avifauna due to collisions with the wind turbines	Prevent mortality of priority avifauna	The results of the pre-construction monitoring must guide the layout of the turbines, especially as far as the identified no-turbine zones are concerned. No turbines must be constructed in the buffer zones which were identified based on the results of the pre-construction monitoring, with a specific view to limiting the risk of collisions to a variety of birds, including several Red Data species.	1. Design the facility with 210m buffers around drainage lines, and 110m buffers around wetland no-go zones. 2. Implement a 5km no-turbine zone around the Martial Eagle nest.	Once-off during the planning phase.	Project Developer
AVIFAUNA: MORTALITY DUE TO ELECTROCUTION ON 33KV NETWORK					
Electrocution of raptors on the internal 33kV poles	Prevent electrocutions	1. Overhead lines should be restricted to an absolute minimum and should only be allowed if underground cabling is unfeasible due technical (not financial) constraints. 2. Where the use of overhead lines is unavoidable due to technical reasons, the Avifaunal Specialist must be consulted to ensure that a raptor friendly pole design is used, and that appropriate mitigation is implemented pro-actively for complicated pole structures e.g. insulation of live components to prevent electrocutions on terminal structures and pole transformers.	1. Design the facility with underground cabling. 2. Consult with Avifaunal Specialist during the design phase of the overhead lines.	Once-off during the planning phase.	Project Developer

Management Plan for the Construction Phase (Including pre- and post-construction activities)

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
AVIFAUNA: DISPLACEMENT DUE TO DISTURBANCE					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of priority avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving. 2. Maximum use of existing roads. 3. Measures to control noise and dust according to latest best practice. 4. Restricted access to the rest of the property. 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation and rehabilitation of the footprint.	1. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance.	1. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			5. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		
AVIFAUNA: DISPLACEMENT DUE TO HABITAT TRANSFORMATION					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the wind turbines and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented by an appropriately qualified rehabilitation specialist, according to the recommendations of the botanical specialist study.	1. Develop a Habitat Restoration Plan (HRP) and ensure that it is approved. 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record and report any non-compliance. 3. Vehicle and pedestrian access to the site should be controlled and restricted to the facility footprint as much as possible to prevent unnecessary destruction of vegetation.	1. Appointment of rehabilitation specialist to develop Habitat Restoration Plan (HRP). 2. Site inspections to monitor progress of HRP.	1. Once-off 2. Once a year	1. Operations Manager 2. SHE Manager 3. SHE Manager 4. Operations Manager

AVIFAUNA: MORTALITY DUE TO COLLISIONS WITH 33 KV NETOWORK					
Mortality of avifauna due to collisions with the 33kV OHL.	Reduction of avian collision mortality	1. Overhead lines should be restricted to an absolute minimum and should only be allowed if underground cabling is unfeasible due technical (not financial) constraints. 2. Bird flight diverters should be installed on all 33kV overhead lines on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds, respectively. These devices must be installed as soon as the conductors are strung. Design specification should conform to types of devices that will be visible at night e.g. LED type bird flight diverters.	Fit Eskom approved Bird Flight Diverters on the earthwire at the demarcated sections of the OHL.	Once-off	Contractor

Management Plan for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
AVIFAUNA: MORTALITY DUE TO COLLISIONS WITH THE WIND TURBINES					
Bird collisions with the wind turbines	Prevention of collision mortality on the wind turbines.	1. Formal live-bird monitoring and carcass searches should be implemented at the start of the operational phase, as per the most recent edition of the Best Practice Guidelines at the time	1. Appoint Avifaunal Specialist to compile operational monitoring plan, including live bird monitoring and carcass searches.	1. Once-off 2. Years 1,2, 5 and every five years after that for the duration of the operational lifetime of the facility.	1. Operations Manager 2. Operations Manager 3. Operations Manager 4. Operations Manager

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		(Jenkins *et al*. 2015) to assess collision rates. The exact time when operational monitoring should commence, will depend on the construction schedule, and should commence when the first turbines start operating. The Best Practice Guidelines require that, as an absolute minimum, operational monitoring should be undertaken for the first two (preferably three) years of operation, and then repeated again in year 5, and again every five years thereafter for the operational lifetime of the facility. 2. If estimated annual collision rates indicate unacceptable mortality levels of priority species, i.e. if it exceeds mortality thresholds as determined by the avifaunal specialist in consultation with BLSA and other avifaunal specialists, additional measures will have to be implemented which could include shut down on demand or other proven measures.	2. Implement operational monitoring plan. 3. Design and implement mitigation measures if mortality thresholds are exceeded. 4. Compile quarterly and annual progress reports detailing the results of the operational monitoring and progress with any recommended mitigation measures.		

Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
AVIFAUNA: DISPLACEMENT DUE TO DISTURBANCE ASSOCIATED WITH THE DISMANTLING ACTIVITIES					
The noise and movement associated with the de-commissioning activities at the WEF footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the EMPr.	A site-specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMPr and should apply good environmental practice during construction. The EMPr must specifically include the following: 1. No off-road driving. 2. Maximum use of existing roads. 3. Measures to control noise and dust according to latest best practice. 4. Restricted access to the rest of the property. 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	1. Implementation of the EMPr. Oversee activities to ensure that the EMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the footprint area is	1. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			demarcated and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		

APPENDIX 8: ENVIRONMENTAL MANAGEMENT PLAN FOR THE GRID CONNECTION

Management Plan for the Planning and Design Phase Grid Connection

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
None					

Management Plan for the Construction Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
AVIFAUNA: DISPLACEMENT DUE TO DISTURBANCE					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads, where possible; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property;	1. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations.	1. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	Monitor via site inspections and report non-compliance.		
AVIFAUNA: MORTALITY DUE TO COLLISION WITH THE 132KV OHL					
Mortality of avifauna due to collisions with the 132kV OHL.	Reduction of avian collision mortality	The entire OHL to be marked with Eskom approved Bird Flight Diverters (BFDs). Design specification should conform to types of devices that will be visible at night e.g. LED type bird flight diverters.	1. Fit Eskom approved Bird Flight Diverters on the earthwire of the OHL.	1. Once-off	1. Contractor and ECO

Management Plan for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
AVIFAUNA: DISPLACEMENT DUE TO HABITAT TRANSFORMATION IN THE SUBSTATIONS					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance in the onsite substations.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented where possible by an appropriately qualified rehabilitation specialist, according to the recommendations of the botanical specialist study.	1. Develop a Habitat Restoration Plan (HRP) and ensure that it is approved. 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record and report any non-compliance.	1. Appointment of rehabilitation specialist to develop HRP. 2. Site inspections to monitor progress of HRP. 3. Adaptive management to ensure HRP goals are met.	1. Once-off 2. Once a year 3. As and when required	5. Facility Operator
AVIFAUNA: MORTALITY OF AVIFAUNA DUE TO COLLISION WITH THE 132KV OHL					
Mortality of avifauna due to collisions with the 132kV OHL.	Reduction of avian collision mortality	1. Monitor the collision mortality on the OHL.	1. Avifaunal specialist to conduct quarterly	1. Quarterly 2. As and when required	1. Facility operator

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		2. Apply additional BFDs if collision hotspots are discovered.	inspections of the OHL for a period of two years. 2. Apply additional BFDs if collision hotspots are discovered.		
AVIFAUNA: MORTALITY OF AVIFAUNA DUE TO ELECTROCUTION ON THE GRID INFRASTRUCTURE					
Mortality of avifauna due to electrocutions in the substations	Reduction of avian electrocution mortality	1. A Vulture-friendly pole design should be used. 2. Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is recommended. 3. Monitor the electrocution mortality in the substations. 4. Apply mitigation if electrocution happens regularly.	1. The construction of a single circuit powerline using the approved vulture friendly pole/tower design D-DT-7649 in accordance with the Distribution Technical Bulletin titled Refurbishment of 66/88kV line kite type frames with D-DT-7649 type top configuration - Reference Number 240-170000467 will eliminate the electrocution risk. The configuration of the insulators and the clearance distances between the live and earthed components on this structure can comfortably accommodate a perching vulture. However, if the OHL will be built on lattice structures, it is imperative that there is a minimum clearance of 1.8m between the jumper cables	1. Once-off 2. Weekly	1. Contractor 2. Facility operator

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			and/or insulators and the horizontal earthed component on the lattice structure. 2. Regular inspections of the substation yard		

Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
AVIFAUNA: DISPLACEMENT DUE TO DISTURBANCE					
The noise and movement associated with the decommissioning activities will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Decommissioning EMPr.	A site-specific Decommissioning EMPr (EMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMPr and should apply good environmental practice during decommissioning. The EMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads during the decommissioning phase and the construction of new roads should be kept to a minimum as far as practical; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the botanical	1. Implementation of the EMPr. Oversee activities to ensure that the EMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance 2. Ensure that decommissioning personne are made aware of the impacts relating to off-road driving. 3. Access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and	1. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		specialist report pertaining to the limitation of the footprint.	record and report non-compliance. 5. Ensure that the decommissioning area is demarcated clearly and that personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		

APPENDIX 9: OPERATIONAL MONITORING PLAN WEF

1 INTRODUCTION

The avifaunal post-construction monitoring at the proposed WEF must be conducted in accordance with the latest version (2015) of the *Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa* (Jenkins *et al*. 2011)[13].

2 AIM OF POST-CONSTRUCTION MONITORING

The avifaunal post construction monitoring aims to assess the impact of the WEF by comparing pre- and post-construction monitoring data and to measure the extent of bird fatalities caused by the WEF. Post-construction monitoring is therefore necessary to:

- Confirm as far as possible what the actual impacts of the WEF are on avifauna; and
- Determine what mitigation is required if need be (adaptive management).

The proposed post-construction monitoring can be divided into three categories:

- Habitat classification;
- Quantifying bird numbers and movements (replicating baseline pre-construction monitoring)
- Quantifying bird mortalities.

Post-construction monitoring will aim to answer the following questions:

- How has the habitat available to birds in and around the WEF changed?
- How has the number of birds and species composition changed?
- How have the movements of priority species changed?
- How has the WEF affected priority species' breeding success?
- How many birds collide with the turbines? And are there any patterns to this?
- What mitigation is necessary to reduce the impacts on avifauna?

3 TIMING

Post-construction monitoring should commence as soon as possible after the first turbines become operational to ensure that the immediate effects of the facility on resident and passing birds are recorded, before they have time to adjust or habituate to the development. However, it should be borne in mind that it is also important to obtain an understanding of the impacts of the facility as they would be over the lifespan of the facility. Over time the habitat within the WEF may change, birds may become habituated to, or learn to avoid the facility. It is therefore necessary to monitor over a longer period than just an initial one year.

4 DURATION

Monitoring should take place in Year 1 and 2 of the operational phase, and then repeated in Year 5 and every five years after that. After the first year of monitoring, the programme should be reviewed in order to incorporate

[13] Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa.

significant findings that have emerged. This may entail the revision of the number of turbines to be searched, and the size of the search plots, depending on the outcome of the first year of monitoring. If significant impacts are observed, i.e. exceeding predetermined thresholds, and mitigation is required, the matter should be taken up with the operator to discuss potential mitigation. In such instances the scope of monitoring could be reduced to focus only on the impacts of concern.

5 HABITAT CLASSIFICATION

Any observed changes in bird numbers and movements at a WEF may be linked to changes in the available habitat. The avian habitats available must be mapped at least once a year (at the same time every year), using the same methods which were used during pre-construction.

6 BIRD NUMBERS AND MOVEMENTS

In order to determine if there are any impacts relating to displacement and/or disturbance, all methods used to estimate bird numbers and movements during baseline monitoring must be applied as far as is practically possible in the same way to post-construction work in order to ensure maximum comparability of these two data sets. This includes sample counts of small terrestrial species, counts of large terrestrial species and raptors, focal site surveys and vantage point surveys according to the current best practice.

7 COLLISIONS

The collision monitoring must have three components:

- Experimental assessment of search efficiency and scavenging rates of bird carcasses on the site.
- Regular searches in the immediate vicinity of the wind farm turbines for collision casualties.
- Estimation of collision rates.

8 SEARCHER EFFICIENCY AND SCAVENGER REMOVAL

The value of surveying the area for collision victims is only valid if some measure of the accuracy of the survey method is developed. The probability of a carcass being detected and the rate of removal/decay of the carcass must be accounted for when estimating collision rates and when designing the monitoring protocol. This must be done in the form of searcher and scavenger trails at least twice a year.

9 COLLISION VICTIM SURVEYS

9.1 Aligning search protocols

The search protocol must be agreed upon between the bat and bird specialists to constitute an acceptable compromise between the current best practice guidelines for bird and bat monitoring.

Searches must begin as early in the mornings as possible to reduce carcass removal by scavengers. A carcass searcher must walk in straight line transects, 6 m apart, covering 3 m on each side. A team of searchers and one supervisor must be trained to implement the carcass searches. The searchers must have a vehicle available for transport per site. The supervisor must assist with the collation of the data at each site and to provide the data to the specialist in electronic format on a weekly basis. The specialists must ensure that the supervisor is completely familiar with all the procedures concerning the management of the data. The following must be sent to the specialist on a weekly basis:

- Carcass fatality data (hardcopy and scans as well as data entered into Excel spreadsheets);
- Pictures of any carcasses, properly labelled;
- GPS tracks of the search plots walked; and
- Turbine search interval spreadsheets.

When a carcass is found, it must be bagged, labelled, and kept refrigerated for species confirmation when the specialist visits the site.

9.2 Estimation of collision rates

Observed mortality rates need to be adjusted to account for searcher efficiency and scavenger removal. There have been many different formulas proposed to estimate mortality rates. The available methodologies must be investigated, and an appropriate method will be applied. The current method which is used widely is the GenEst method.

10 DELIVERABLES

10.1 Annual report

An operational monitoring report must be completed at the end of each year of operational monitoring. As a minimum, the report must attempt to answer the following questions:

- How has the habitat available to birds in and around the WEF changed?
- How has the number birds and species composition changed?
- How have the movements of priority species changed?
- How has the WEF affected priority species' breeding success?
- What are the likely drivers of any changes observed?
- How many, and which species of birds collided with the turbines and
- associated infrastructure? And are there any patterns to this?
- What is the significance of any impacts observed?
- What mitigation measures are required to reduce the impacts?

10.2 Quarterly reports

Concise quarterly reports must be provided with basic statistics and any issues that need to be addressed.

APPENDIX 10: SITE SENSITIVITY VERIFICATION WEF

RECONNAISSANCE REPORT (IN TERMS OF PART B OF THE ASSESSMENT PROTOCOLS PUBLISHED IN GN 320 ON 20 MARCH 2020

Introduction

In accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a reconnaissance visit has been 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).

Site Sensitivity Verification

The following methods and sources were used to compile this report:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP2) was obtained from the University of Cape Town (https://sabap2.birdmap.africa/), to ascertain which species occur within the **Broader Area** i.e. within a block consisting of 12 pentads. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 9 km. From 2007 to date, a total of 179 full protocol lists (i.e., surveys lasting a minimum of two hours each) have been completed for this area. In addition, 218 ad hoc protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2022.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation in the WEF application site was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2012 beta2) from the South African National Biodiversity Institute website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org).
- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2023) was used in order to view the Broader Area on a landscape level and to help identify sensitive bird habitat.
- Priority species for wind energy developments were identified from the most recent (November 2014) list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Retief *et al.* 2012).
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the WEF and Grid application site.
- The primary source of information on avifaunal diversity, abundance and flight patterns at the site were the results of a pre-construction programme conducted over four seasons (2022–2023) at the proposed Mulilo WEF Cluster (Emvelo WEF, Rochdale WEF and Sheepmoor WEF application sites). The primary methods of data capturing were walk transect counts, drive transect counts, focal point monitoring, vantage point counts and incidental sightings (see **Appendix 3** for a detailed explanation of the monitoring methods).

- Information gained from pre-construction monitoring at four potential wind farm sites in close proximity to the current site, namely Ujekamanzi WEFs 1–2 and Camden WEFs 1–2 also assisted in providing a comprehensive picture of avifaunal abundance and diversity in the greater area, including the current study area.

Outcome Of Site Reconnaissance

The WEF Project Site is situated in the Grassland Biome, in the Mesic Highveld Grassland Bioregion (Mucina & Rutherford 2006). The proposed site is comprised of undulating grassland plains, with small, scattered patches of dolerite outcrops in areas, low hills, pan depressions and drainage lines with associated wetland areas. Vegetation on site consists predominantly of Wakkerstroom Montane Grassland and Eastern Highveld Grassland. Wakkerstroom Montane Grassland comprises predominantly short montane grasslands on the plateaus and the relatively flat areas, with short forest and *Leucosidea* (ouhout) thickets occurring along steep, mainly east-facing slopes, and drainage areas (Mucina & Rutherford 2006). Eastern Highveld Grassland vegetation is comprised of a short, closed grassland cover, largely dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn (Mucina & Rutherford 2006). The black wattle *Acacia mearnsii* is an aggressive invader of riparian areas. Stands of alien *Eucalyptus* and *Pinus* species are scattered throughout the proposed development area.

Ermelo has a temperate climate. January is the warmest month with a maximum temperature of 24.4 C°. June and July are the coldest months, with a minimum temperature of 0.2 C°. The driest month is June with an average of 3 mm of precipitation. Most of the precipitation falls in December, averaging 151 mm. The average annual precipitation is around 756 mm (Climate – data.org 2021). The topography in the project area is characterised by gentle undulating plains. The predominant land use for this area is livestock grazing with some crop farming, mostly maize, soya beans and pastures. The livestock in the study area is a combination of mostly sheep and cattle, with a few horses.

Twelve (12) wind energy development priority SCC have been recorded during the on-site field surveys thus far. The recorded species are listed in the table below (NT = Near Threatened, VU = Vulnerable, EN = Endangered):

Species name	Scientific name	Global Conservation Status	Regional Conservation Status
African Marsh Harrier	*Circus ranivorus*	-	EN
Blue Crane	*Grus paradisea*	VU	NT
Cape Vulture	*Gyps coprotheres*	VU	EN
Denham's Bustard	*Neotis denhami*	NT	VU
Greater Flamingo	*Phoenicopterus roseus*	-	NT
Grey Crowned Crane	*Balearica regulorum*	EN	EN
Lanner Falcon	*Falco biarmicus*	-	VU
Martial Eagle	*Polemaetus bellicosus*	EN	EN
Secretarybird	*Sagittarius serpentarius*	EN	VU
Southern Bald Ibis	*Geronticus calvus*	VU	VU
White-bellied Bustard	*Eupodotis senegalensis*	-	VU
Yellow-breasted Pipit	*Anthus chloris*	VU	VU

National Environmental Screening Tool

The WEF Project Site and immediate environment is classified as **Medium** and **High Sensitivity** for bird species according to the Animal Species Theme (**Figure 1**). The Medium and/or High sensitivity classification is linked to the potential occurrence of Denham's Bustard *Neotis denhami* (Globally Near-Threatened and Regionally Vulnerable), Secretarybird *Sagittarius serpentarius* (Globally Endangered and Regionally Vulnerable), Southern Bald Ibis *Geronticus calvus* (Globally and Regionally Vulnerable), African Grass Owl *Tyto capensis* (Regionally Vulnerable), Grey-crowned Crane *Balearica regulorum* (Globally and Regionally Endangered), White-bellied Bustard *Eupodotis senegalensis* (Regionally Vulnerable), and Caspian Tern *Hydroprogne caspia* (Regionally Vulnerable).

The Project Site contains confirmed habitat for Species of Conservation Concern (SCC), primarily for Yellow-breasted Pipit and Southern Bald Ibis, as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020.

The WEF Project Site and immediate environment is classified as Medium Sensitivity for vultures according to the Vulture Species Theme (**Figure 2**). The Medium sensitivity is due the Project Site possibly affecting an area with between 5%–10% of the vulture population, according to the Screening Tool. During the pre-construction monitoring 48 minutes of Cape Vulture flights were recorded at medium height (i.e. within rotor-swept height). The passage rate for Cape Vultures after 756 hours of monitoring was 0.06 birds per day which amounts to about one Cape Vulture every two weeks. According to the Cervantes Population Utilization Distribution outputs the Emvelo WEF Project Site is rated low sensitivity (Cervantes et al 2023).

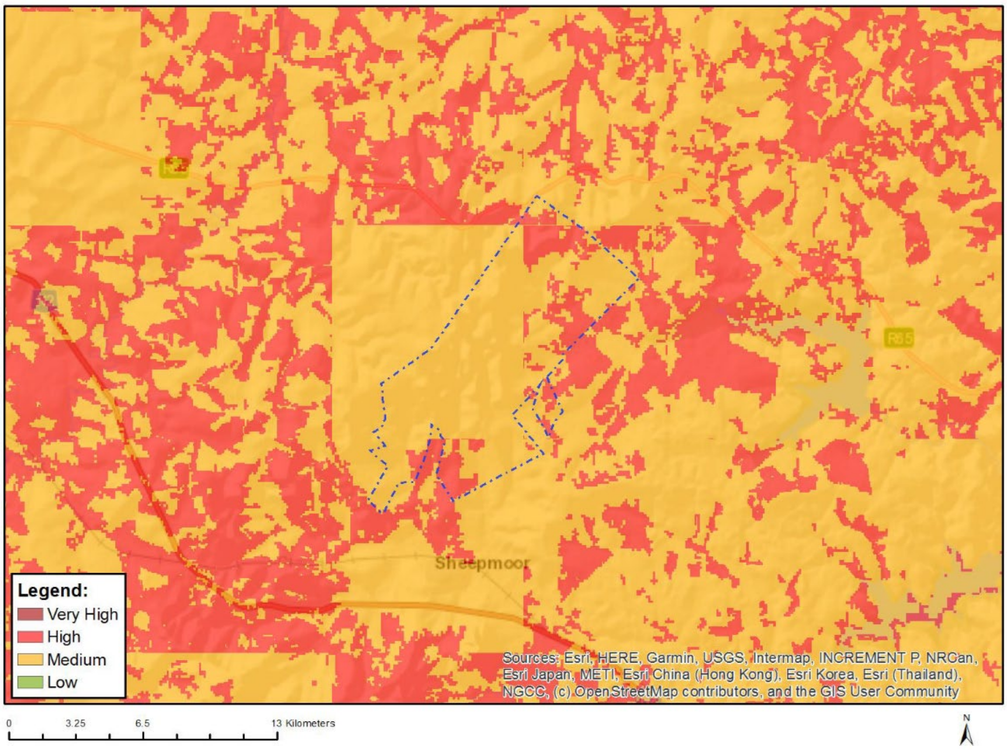

Figure 1: The classification of the Emvelo WEF Project Site according to the Animal Species Theme in the DFFE National Screening Tool.

MAP OF RELATIVE VULTURE SPECIES THEME SENSITIVITY

Figure 2: The classification of the Emvelo WEF Project Site according to the Vulture Species Theme in the DFFE National Screening Tool.

CONCLUSION

Based on the available SABAP2 data, the Site Sensitivity Verification survey, and the integrated pre-construction monitoring surveys conducted at the WEF Project Site, a classification of **High Sensitivity** for avifauna (for the **Animal Species Theme**) is confirmed for the Emvelo WEF and a classification of **Low Sensitivity** is suggested for the **Vulture Species Theme**.

APPENDIX 11: SITE SENSITIVITY VERIFICATION GRID CONNECTION

SITE SENSITIVITY VERIFICATION REPORT (IN TERMS OF THE PROCEDURES FOR THE ASSESSMENT AND MINIMUM CRITERIA FOR REPORTING ON IDENTIFIED ENVIRONMENTAL THEMES PUBLISHED IN GN 1150 ON 30 OCTOBER 2020)

INTRODUCTION

In accordance with the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site verification visit has been 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).

SITE SENSITIVITY VERIFICATION

The following methods and sources were used to compile this report:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP2) was obtained from the University of Cape Town (https://sabap2.birdmap.africa/), to ascertain which species occur within the **Broader Area** i.e. within a block consisting of 12 pentads (**Table 1**, **Figure 1**). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 9 km. From 2007 to date, a total of 179 full protocol lists (i.e., surveys lasting a minimum of two hours each) have been completed for this area. In addition, 218 ad hoc protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2022.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation in the WEF application site was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2012 beta2) from the South African National Biodiversity Institute website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org).
- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2023) was used in order to view the Broader Area on a landscape level and to help identify sensitive bird habitat.
- Priority species for wind energy developments were identified from the most recent (November 2014) list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Retief *et al.* 2012).
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the WEF and Grid application site.
- The primary source of information on avifaunal diversity, abundance and flight patterns at the site were the results of a pre-construction programme conducted over four seasons (2022–2023) at the proposed Mulilo

WEF Cluster (Emvelo WEF, Rochdale WEF and Sheepmoor WEF application sites). The primary methods of data capturing were walk transect counts, drive transect counts, focal point monitoring, vantage point counts and incidental sightings (see **Appendix 3** for a detailed explanation of the monitoring methods).

- Information gained from pre-construction monitoring at four potential wind farm sites in close proximity to the current site, namely Ujekamanzi WEFs 1–2 and Camden WEFs 1–2 also assisted in providing a comprehensive picture of avifaunal abundance and diversity in the greater area, including the current study area.

OUTCOME OF SITE SENSITIVITY VERIFICATION

The Grid Connection Project Site is situated in the Grassland Biome, in the Mesic Highveld Grassland Bioregion (Mucina & Rutherford 2006). The proposed site is comprised of undulating grassland plains, with small, scattered patches of dolerite outcrops in areas, low hills, pan depressions and drainage lines with associated wetland areas. Vegetation on site consists predominantly of Wakkerstroom Montane Grassland and Eastern Highveld Grassland. Wakkerstroom Montane Grassland comprises predominantly short montane grasslands on the plateaus and the relatively flat areas, with short forest and *Leucosidea* (ouhout) thickets occurring along steep, mainly east-facing slopes, and drainage areas (Mucina & Rutherford 2006). Eastern Highveld Grassland vegetation is comprised of a short, closed grassland cover, largely dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn (Mucina & Rutherford 2006). The black wattle *Acacia mearnsii* is an aggressive invader of riparian areas. Stands of alien *Eucalyptus* and *Pinus* species are scattered throughout the proposed development area.

Ermelo has a temperate climate. January is the warmest month with a maximum temperature of 24.4 C°. June and July are the coldest months, with a minimum temperature of 0.2 C°. The driest month is June with an average of 3 mm of precipitation. Most of the precipitation falls in December, averaging 151 mm. The average annual precipitation is around 756 mm (Climate – data.org 2021). The topography in the project area is characterised by gentle undulating plains. The predominant land use for this area is livestock grazing with some crop farming, mostly maize, soya beans and pastures. The livestock in the study area is a combination of mostly sheep and cattle, with a few horses.

NATIONAL ENVIRONMENTAL SCREENING TOOL

According to the DFFE national screening tool, the habitat within the Grid Connection PAOI is classified as **Medium** and **High** sensitivity for birds according to the Animal Species Theme (**Figure 1**). The Medium and/or High sensitivity classification is linked to the potential occurrence of Denham's Bustard *Neotis denhami* (Globally Near-Threatened and Regionally Vulnerable), Secretarybird *Sagittarius serpentarius* (Globally Endangered and Regionally Vulnerable), Southern Bald Ibis *Geronticus calvus* (Globally and Regionally Vulnerable), Grey-crowned Crane *Balearica regulorum* (Globally and Regionally Endangered), White-bellied Bustard *Eupodotis senegalensis* (Regionally Vulnerable), and Caspian Tern *Hydroprogne caspia* (Regionally Vulnerable). The PAOI contains confirmed habitat for Species of Conservation Concern (SCC), primarily for Southern Bald Ibis and Secretarybird (Globally Endangered and Regionally Vulnerable), as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020).

Eleven (11) power line sensitive SCC have been recorded during the on-site field surveys thus far. The recorded species are listed in the table below (NT = Near Threatened, VU = Vulnerable, EN = Endangered):

Species name	Scientific name	Global Conservation Status	Regional Conservation Status
African Marsh Harrier	*Circus ranivorus*	-	EN
Blue Crane	*Grus paradisea*	VU	NT
Cape Vulture	*Gyps coprotheres*	VU	EN
Denham's Bustard	*Neotis denhami*	NT	VU
Greater Flamingo	*Phoenicopterus roseus*	-	NT
Grey Crowned Crane	*Balearica regulorum*	EN	EN
Lanner Falcon	*Falco biarmicus*	-	VU
Martial Eagle	*Polemaetus bellicosus*	EN	EN
Secretarybird	*Sagittarius serpentarius*	EN	VU
Southern Bald Ibis	*Geronticus calvus*	VU	VU
White-bellied Bustard	*Eupodotis senegalensis*	-	VU

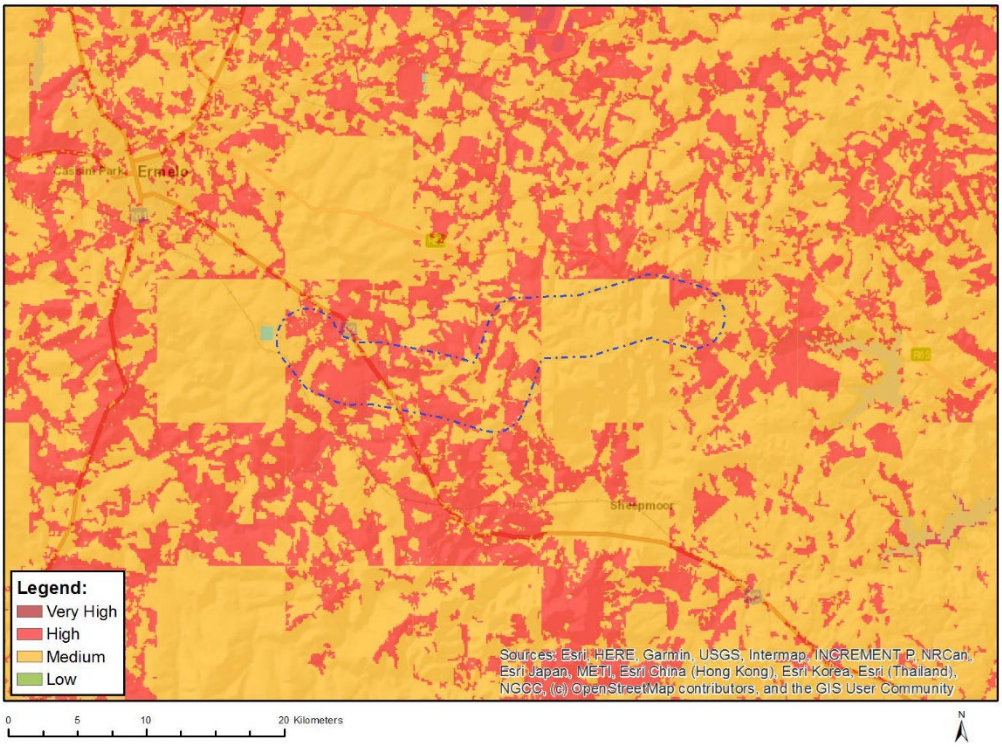

Figure 1: The National Web-Based Environmental Screening Tool map of the Grid PAOI, indicating sensitivities for the Animal Species Theme.

CONCLUSION

Based on the Site Sensitivity Verification survey and the integrated pre-construction monitoring conducted at the Project Site thus far, the classification of **High Sensitivity** for avifauna is supported for the Emvelo WEF Grid Connection PAOI.

APPENDIX 12: BLADE PAINTING AS MITIGATION STRATEGY

Coloured-blade mitigation at Africa's wind farms to reduce eagle deaths: implementation, challenges and solutions

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Introduction

The recent publication of the ground-breaking experimental study of black-blade mitigation at an operational wind farms in Norway (May et al. 2020) has opened up a new and exciting method that could reduce avian fatalities at wind farms in other, more biologically diverse area of the world where renewable energies are being rolled out. This contribution :

- Explains what black/coloured-blade mitigation is
- Outlines the theory behind the black-blade mitigation
- Outlines the field test of the idea
- Summarises the challenges for rolling it out in Africa
- Assesses what it could mean for reducing raptor fatalities in Africa

Figure 1: The single black-blade in the process of being painted in situ, at the Smøla Wind Farm. Painting white blades black after they are erected is more expensive than producing them at source.

Rationale

Research around the world has shown that avian populations are declining due to climate change effects arising from increasing temperature and decreased rainfall in arid areas (www.ipcc.ch/, Thomas et al. 2004, Simmons et al. 2004, Phipps et al. 2017). In the USA, non-renewable fossil fuel energy sources are estimated to kill ~14.5 million birds annually, whereas green wind energy kills about 234 000 birds per year (Sovacool 2013, Loss et al. 2013). That is a 62-fold difference and a powerful environmental argument in support of renewable energy for our future needs. But while wind farms have many positive effects, they also pose some environmental challenges, particularly where wind farms are poorly positioned (on migration corridors for example Smallwood references).

In Africa two data sets on avian fatalities indicate that an average of 2.0 bird (adjusted) fatalities occur per MW per year in South Africa (Perold et al. 2020), and at one farm 1 raptor per month is killed of which 17% are breeding red data raptors (Simmons and Martins 2018). With about 2294 MW already being produced by 27 operational farms here in 2019 (energy.org.za), the cumulative impacts of South African wind farms alone are in excess of 4500 birds annually. If about 36% (>1600 birds per annum) are predicted to be raptors (Ralston-Paton et al. 2017) and about 17% (Simmons and Martins 2018) are known to be red data species, then an estimated 280 red data raptors are likely to be killed per year in South Africa in 2020. Since taller and longer-bladed turbines kill significantly more birds (Loss et al. 2013) and bats (Barclay et al. 2007) then Africa's threatened birds face increasing risks.

The need for urgent mitigations to reduce these costs is at a premium. Enter the coloured-blade mitigation.

What is coloured-blade mitigation?

This is a new mitigation technique in which one of the three white blades on a wind turbine are painted black (figure 1). About two thirds of the blade to the tip is painted this way. This is designed to increase visibility and decrease avian impacts (May et al. 2020). Since Civil Aviation in South Africa does not allow black but does allow "Signal Red" we propose that this is used in experiments here in South Africa. The amount of paint required can also be reduced by using the two-strip patterning shown in the experiments of McIsaac (see below).

Why black-blade mitigation?

Several innovative mitigation measures have recently been proposed for wind farms (flashing UV lights, automated shut-down-on demand, habitat management: May et al. 2017) and in a few cases have reduced collisions. However, developers are reticent to implement these.

The idea for **Black-blade mitigation** arose from work by Hodos (2003) who argued that a bird's retina views moving objects differently at different distances and as the bird gets close to a fast-moving object, the retinal image is moving so fast that the birds' brain can no longer process it. This was dubbed "motion smear" and means that birds approaching a fast-moving object no longer see it, with disastrous consequences. He suggested that a single coloured-blade may break up the motion smear. This is supported by recent work from Sweden (Potier et al. 2018) who show that raptors, despite their very high visual acuity, have very poor contrast abilities (poorer than humans). So, a coloured blade may be even better than a black one. So, a light (white) blade against a bright background is unlikely to be seen. But a black or coloured one is.

What is the evidence that it works?

Black-blade mitigation was field-tested by May et al. (2020) at the Smøla wind farm in 2013 in Norway over 3.5 years. On Smøla, White-tailed Eagles *Haliaeetus albicilla* are being killed at a very high rate by collision with the turbine blades. Four turbines were painted with a single black-painted blade in summer 2013. The black-painted turbines killed (i) 71% fewer total birds and (ii) 100% fewer eagles relative to unpainted blades.

Even more exciting in 2020 still no eagles have been killed at the coloured-blade turbines since 2013. In other words, no more eagles were killed in the 11-year experiment (starting 7.5 years before painting (2006-2013) and in situ 3.5 years after painting (2013-2016) (May et al.

2020). This despite 45-50 territorial pairs present on the island of Smøla (Dahl et al. 2012). The white-bladed turbines, however, are still killing birds at an average of 6 eagles per year (B. Iuell in litt.).

We see little reason why coloured blade – in the form of **Signal-red**, approved by Civil Aviation, would not work as well. This is because raptors see well in the colour spectrum (i.e. with the cones in the retina as opposed to the rods which see in black and white).

What are the visual impacts?

Discussions with wind farm managers in South Africa and Kenya suggest that visual effects are among the possible negative perceptions. We, therefore, requested the Smøla managers to supply us with images and videos of the turning blades to determine the effects.

Figure 1: The black-blade set up on a cloudy day in Norway is shown left. The black-blade (far turbine) is little different to the shadow cast by the all-white blades in the foreground © Bjorn Iuell.

The effect can be seen in the video kindly provided by Arild Soleim at www.birds-and-bats.com/specialist-studies. This shows little to no visual flicker or intrusion on the landscape from a single coloured-blade, and this concern is largely negated for all but the most sensitive human observer. It also has the effect of making the blade appear slower as one follows the black blade itself.

We argue that the benefits (no eagles killed) far outweigh the costs (initial costs to produce the coloured-blades). And once the blades are installed there will be no further costs as there are with competing mitigations (DT bird, or observer-operated shut-downs).

Black blade and Civil Aviation – white blades are not the most conspicuous

South African Civil Aviation state that white is "to provide the maximum daytime conspicuousness" However this statement was tested by McIsaac (2003) and he found that white is NOT the most conspicuous colour for either a moving blade or a stationary one

Embedded in the experiments undertaken by McIsaac's (2003) on kestrels is this very revealing graphic showing how human observers perceive the same patterns (including pure white).

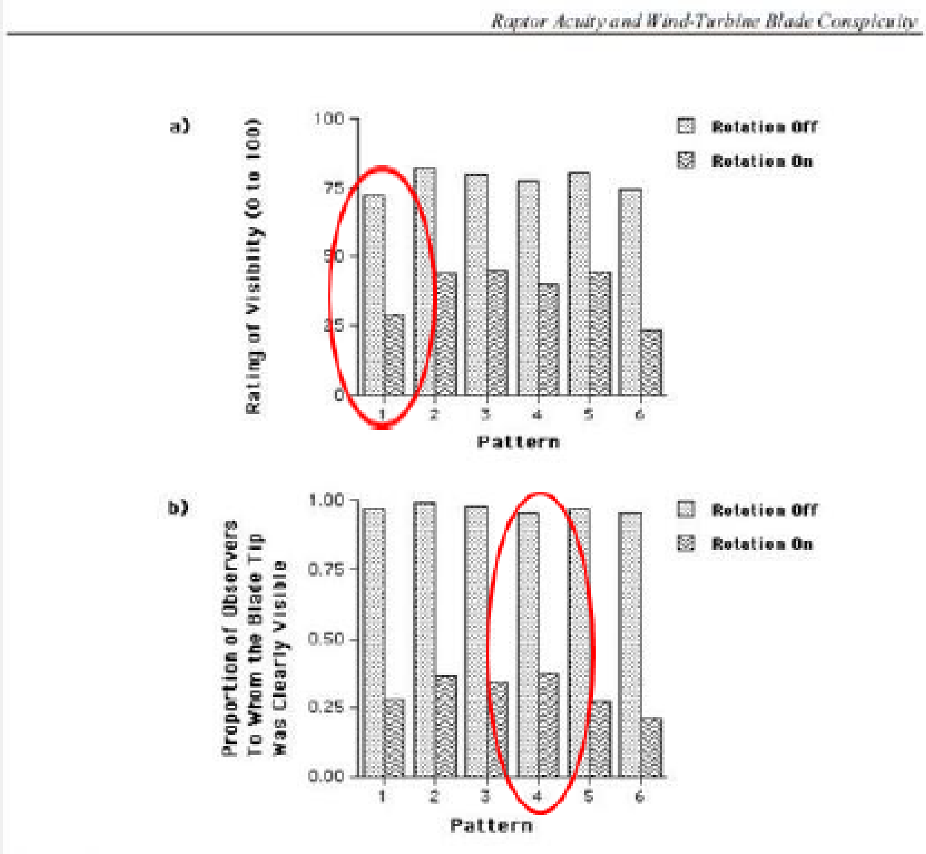

FIGURE 10. Human-perceived blade-pattern conspicuity: two-factor interactions of pattern and rotation. *These diagrams show the relationship between blade-pattern conspicuity and the effects of rotation. Illustrations of the blade patterns are presented in Fig. 9. Both blade pattern and rotation significantly affected conspicuity. Two ratings of pattern conspicuity are presented, a) full-blade visibility ratings, b) blade-tip visibility ratings.*

- **The pure white blade [pattern 1] was perceived as <u>less visible</u> by human observers than 5 of the other 6 patterns used whether the blades were spinning or not (top graph)**
- The <u>tip</u> of the pure white blade [pattern 1] was also perceived as less visible by human observers than 4 of the other 6 patterns used whether the blades were spinning or not (bottom graph)
- Like the Kestrels being tested, human observers saw patterned blades (patterns 2,3,4,5,6) better than pure white [pattern 1].

So, the CAA assumption that white is the most conspicuous colour for humans is not supported by experimentation with either raptorial birds or humans.

Patterned blades are better for both humans and raptors.

It is very important the South African Civil Aviation Authority is aware of these findings. Why? Because their guiding documents on painting of tall structures (**139.01.30 OBSTACLE LIMITATIONS AND MARKINGS OUTSIDE AERODROME OR HELIPORT (effective 1 August 2012)**) makes the following statement under section in **1.14. Wind turbine generators (Windfarms)**

- (4) Windfarm Markings (page 12 of 16)
  Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness. The colours grey, blue and darker shades of white should be avoided altogether. If such colours have been used, the wind turbines shall be supplemented with daytime lighting, as required.

While this assumption that "bright white" would be most obvious to pilots and others, the experiments of McIsaac (2001) indicate that this is a false assumption. The pure white blade performed very poorly in the experiments of McIsaac (2001) and the patterned blade (No. 4 below) performed best of all.

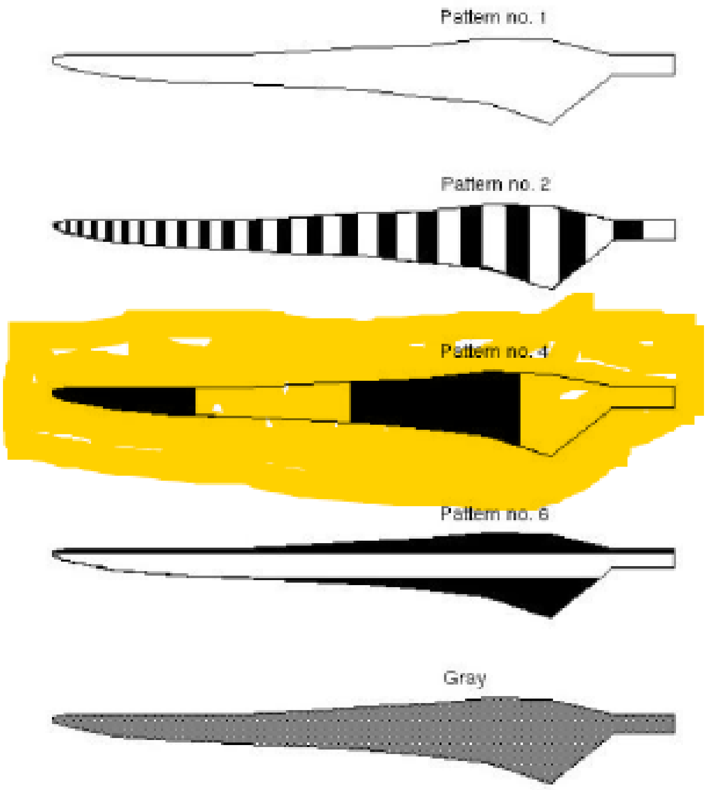

FIGURE 12. Kestrel-perceived blade-pattern conspicuity: stimulus blade patterns. *Depicted are the four black-and-white test patterns and the gray control pattern that were used to determine pattern conspicuity as perceived by a kestrel.*

Can it be applied in an African setting?

Given that eagles and raptors the world over probably see the landscape in similar ways there is a high probability that African eagles will see coloured-blades similarly well. Recent research on other raptors shows that despite their high visual acuity they see contrast more poorly than do humans (Potier, Milbus & Kelber 2019). This nicely explains why raptors take no avoiding action and are struck by white blades in the first place, and second why painting a blade black (increasing the contrast) increases the avoidance of those blades by eagles.

It also breaks up the "motion smear" researched by Hodos (2003) because he predicted a single black or coloured blade would increase the ability of birds to see movement in a set of fast-moving blade (the same effect can be seen by pilots of prop-driven planes, where one blade is painted differently). In an African setting the same can be seen on farmers' metal windmills where a blade is missing or painted on the rapidly spinning blades. Both increase the visual contrast and effect of movement.

The coloured-blade mitigation has yet to be rolled out in Africa – where it is urgently needed, given that we have over 100 species of raptors – more than any other continent (Clark and Davies 2018). Red blade tips have, however, already been used at the Ysterfontein Wind farm in the Western Cape, setting a precedent for their use elsewhere in South Africa.

Figure 2: Red-tipped turbine-blades on turbines at the Ysterfontein wind farm north west of Clanwilliam in the Western Cape (S 32° 9'23.42" E 18°49'7.10"). While these mitigations are not used in the correct single-blade configuration used by the Norwegians, they set a precedent for turbine blades to be red-painted in South Africa © RE Simmons

We have been informed that this mitigation is indeed being rolled out at the Kobe wind farm site in Japan. And there are plans for testing it in the Netherlands (Arjen Schultinga of Innogy, to Iuell Bjorn, Senior Environmental Advisor at Smøla Wind farm.)

This suggests that General Electric Renewables (GE), a manufacture of wind turbine blades, are already in the market for coloured blades. Attempts to engage with GE Renewables through the internet have proven unsuccessful despite contact with officials there.

We as avian specialist recommend the coloured-blade version of the black blade mitigation because (i) it is likely to be seen even more clearly by raptors than black, (ii) South African Civil Aviation (Lizell Stroh) in correspondence with Birdlife SA and Birds & Bats Unlimited have suggested that "signal red" would be preferable to black as it already used for marking structures such as towers, and is approved by them and (iii) the red paint may heat up less than a black blade in an African environment.

Four more aspects to consider from experience at the Smøla wind farm:

(i) It will cost a fraction to paint while the rotor blades are still on the ground instead of installed at the hub. At Smøla the painting was done with the blades up on the tower in situ and proved quite costly. The cost of painting one blade (with the crane lift and specialised personnel) was K55,000 ($5900). For all four blades and all fees and disbursements included over 2 weeks (due mainly to inclement weather) the total cost was c. K750 000 ($79 000). This would have been negligible had the blades been painted on the ground or come pre-painted (B. Iuell pers comm).

(ii) Although not an issue at Smøla, potentially a black blade may increase the blade temperature with potential consequences for blade quality and operation. We noticed that the temperature in the turbine tower at ground level with a painted tower base was high in summer (Stokke et al. 2020); there the surface area is large and more localized, and, of course, is not moving. No such effect was noticed for the black-painted turbine blades and there was no effect of any imbalance of the blades from differential heating of the black blade.

(iii) Smøla wind farm was not allowed to paint turbines which were constructed in the second construction stage due to insurance issues. Thus, guarantees with the blade manufacturers must be secured before the painting takes places – and preferably come pre-manufactured with a blade already painted red or black.

(iv) Each blade weighed 9 tonnes and the blade were painted with Carboline Windmastic TopCoat HSX. Two coats were applied and weighed approximately 60 kg. This is about 0.66% the weight of the blade and no mechanical effects were apparent. On inspection of the paint there was no wear or cracking apparent (B Iuell pers comm).

It is for influential players such as those in the South African Wind Energy Association and other wind farm developers, their governing bodies and avian conservation organisations to lobby the main players such as General Electric and Siemens to roll out this form of mitigation to reduce to a minimum the thousands of raptors deaths likely in future years. Without black or coloured blades on Africa's turbines we will continue to see the high fatality rates already apparent at some wind farms in South Africa (Simmons and Martins 2018, Perold et al. 2020).

With black-blade mitigation now shown to be highly effective in reducing eagle deaths in Norway, there is a great incentive for wind farm developers elsewhere to enact the coloured blade mitigation to reduce raptor deaths, particularly since it has no operational costs once installed.

Acknowledgments

Grateful thanks to Bjorn Iuell (Environmental Advisor to Smøla wind farm) for answering our numerous questions and providing extra information and photographs on Smøla's black blade project. Also to Arild Soleim at Smøla for the video clip of the moving blades, and to Lizell Stroh of SA Civil Aviation for valuable inputs.

Figure 3: A 4-year old Martial Eagle, struck by a white-bladed turbine, plummets to the earth at an Eastern Cape wind farm. Deaths like this could be reduced or avoided with black/coloured blade mitigation . © RE Simmons

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SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for 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)

REPORT TITLE

Proposed construction of the Emvelo Wind Energy Facility and associated grid infrastructure, near Ermelo, Mpumalanga Province, South Africa

Kindly note the following:

1. This form must always be used for assessment that are in support of 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 August 2023. 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.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the 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 act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Avifaunal Assessment
Specialist Company Name	AfriAvian Environmental
Specialist Name	Albert Froneman
Specialist Identity Number	730815 5080 081
Specialist Qualifications:	M.Sc. Conservation Biology
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2. DECLARATION BY THE SPECIALIST

I, Albert Froneman declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements 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 National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 NEMA Act.

Signature of the Specialist

AfriAvian Environmental

Name of Company:

03 Oct 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Albert Froneman_________, 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

AfriAvian Environmental

Name of Company

03 Oct 2024

Date

Signature of the Commissioner of Oaths

2024 -10- 03

Date

BRUCE MORRISON C. A. (S. A.)
COMMISSIONER OF OATHS
1995-12-05
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79 FIFTH STREET, SPRINGS

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Albert Froneman

Registration Number: 400177/09

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule 1 of the Act)

Zoological Science (Professional Natural Scientist)

Effective **8 September 2009** Expires **31 March 2025**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

VISUAL IMPACT SCOPING REPORT

EMVELO WIND ENERGY FACILITY AND OVERHEAD POWERLINES

PROPOSED MULILO CLUSTER WEF, NEAR ERMELO, MPUMALANGA PROVINCE

VISUAL IMPACT SCOPING REPORT

EMVELO WEF AND OVERHEAD POWERLINES

Submitted to:

Environmental Resource Management Southern Africa (Pty) Ltd

Prepared by:

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Report Revision No:	*Draft 02 – Includes Overhead Powerlines*
Date Issued:	08 November 2023
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Signed:	
Reference:	0106_2023: Mulilo Cluster VIA

EXPERTISE OF SPECIALIST

Name:	**GRAHAM A YOUNG**
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Professional Registration:	South African Council for the Landscape Architectural Profession (SACLAP) Reg. No. 87001 Fellow Institute of Landscape Architects of South Africa (FILASA)
Experience in Years:	45 years
Experience	Graham Young is a registered landscape architect with an interest and experience in landscape architecture, urban design, and environmental planning. He holds a degree in landscape architecture from the Universities of Toronto (BL) and Pretoria (ML). He has conducted visual impact assessments in Canada and Africa, where he has spent most of his working life. He has served as President of the Institute of Landscape Architects of South Africa (ILASA) and vice president of the Board of Control for Landscape Architects. He is a Fellow of the ILASA and a professionally registered landscape architect in South Africa (SACLAP). He is Secretary-General for the International Federation of Landscape Architects, Africa Region (IFLA Africa) and Vice President of IFLA (world). He runs his practice, Graham A Young Landscape Architect (GYLA). A speciality is Visual Impact Assessments, for which he has been cited with an Institute of Landscape Architects of South Africa (ILASA) Merit Award (1999). This work also includes landscape characterisation studies, end-use studies for quarries, and computer modelling and visualisation. He has completed over three hundred specialist reports for projects and conducted VIA reviews. He has served as a specialist witness in legal cases involving visual impact issues. Mr Young helped develop the *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes* (Oberholzer 2005) and produced a research document for Eskom, *The Visual Impacts of Power Lines* (2009). In 2011 he produced '*Guidelines for involving visual and aesthetic specialists'* for the Aapravasi Ghat Trust Fund Technical Committee, which manages a World Heritage Site in Mauritius, along with the *Visual Impact Assessment Training Module Guideline Document* for the same client.

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Menno Klapwijk has specialised for 39 years in environmental planning, construction rehabilitation and control, visual impact assessment, and landscape site design. Significant visual impact projects include: N3 De Beers Pass, Mzimvubu Government Water Scheme, Aggeneys Solar Park Moatize Power Plant (Mozambique), Transnet Multi-purpose Pipeline, Saldanha Steel, Mozal (Alusaf – Mozambique), Letsibogo Dam (Botswana), Blue Circle Cement Factory (East London), Phlogopite Factory (Phalaborwa), Iscor Heavy Minerals Smelter (Empangeni), many VIA's for Eskom 765 kV and 400kV transmission lines and substations, Mmamabula 400kV Transmission Line, Mine and Power Plant (Botswana), West Coast Combined Cycle Gas Turbine Power Plant (CCGT), De Hoop Dam and Pipeline (Sekhukuneland), Tugela Water Project (KwaZulu-Natal), Delportshoop Tower Mast (Delportshoop, Northern Cape), N3 Toll Road, Cedara (KwaZulu-Natal) to Heidelberg (Gauteng), Maputo Steel Project (Maputo, Mozambique), Ga-Pila Village (Potgietersrus, Limpopo Province) and Pom Pom Camp (Okavango, Botswana).

He has more than 100 publications and reports dealing mostly with environmental planning, environmental rehabilitations and control specification, environmental impact assessment and visual impact assessment.

1983:	B.Sc. (Land Arch), Texas A & M
1986:	Environmental Impact Assessment, Graduate School of Business, UCT
Registered:	South African Council for Landscape Architecture Practitioners (SACLAP)
Member:	Institute of Landscape Architects of South Africa (ILASA)
Member:	International Association of Impact Assessors (SA)
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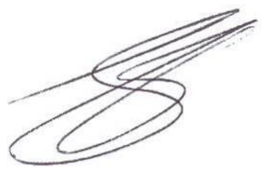
DECLARATION OF INDEPENDENCE

I, Graham Young, declare that –

- I am contracted as the Visual Impact Assessment Specialist for the EMVELO WIND ENERGY FACILITY and ASSOCIATED POWERLINES, Mpumalanga Province South Africa
- 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 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



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8 November 2023

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ACRONYMS, ABBREVIATIONS & GLOSSARY

Acronyms & Abbreviations	
BAR	Basic Assessment Report
BID	Background Information Document
DS	Distribution Substation
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GYLA	Graham Young Landscape Architect
kV	Kilovolt
MTS	Main Transmission Substation
MW	Megawatt
OHL	Overhead Power Transmission Line
SACLAP	South African Council for the Landscape Architectural Profession
WEF	Wind Energy Facility
WTG	Wind Turbine Generator
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment

Glossary	
Aesthetic Value	Aesthetic value is the emotional response derived from the experience of the environment with its natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings, and attitudes (Ramsay, 1993). Thus, aesthetic value encompasses more than the seen view, visual quality, or scenery, and includes atmosphere, landscape character and sense of place (Schapper, 1993).
Aesthetically significant place	A formally designated place visited by recreationists and others for the express purpose of enjoying its beauty. For example, tens of thousands of people visit Table Mountain on an annual basis. They come from around the country and even from around the world. By these measurements, one can make the case that Table Mountain (a designated National Park) is an aesthetic resource of national significance. Similarly, a resource that is visited by large numbers who come from across the region probably has

	regional significance. A place visited primarily by people whose place of origin is local is generally of local significance. Unvisited places either have no significance or are "no trespass" places. (After New York, Department of Environment 2000).
Aesthetic impact	Aesthetic impact occurs when there is a detrimental effect on the perceived beauty of a place or structure. Mere visibility, even startling visibility of a project proposal, should not be a threshold for decision making. Instead a project, by its visibility, must clearly interfere with or reduce (i.e. visual impact) the public's enjoyment and/or appreciation of the appearance of a valued resource e.g. cooling tower blocks a view from a National Park overlook (after New York, Department of Environment 2000).
Cumulative Effects	The summation of effects that result from changes caused by a development in conjunction with the other past, present, or reasonably foreseeable actions.
Glare	The sensation produced by luminance within the visual field that is sufficiently greater than the luminance to which. the eyes are adapted, which causes annoyance, discomfort, or loss in visual performance and visibility. *See* Glint. (USDI 2013:314)
Glint	A momentary flash of light resulting from a spatially localised reflection of sunlight. *See* Glare. (USDI 2013:314)
Landscape Character	The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, woods, trees, water bodies, buildings, and roads. They are generally quantifiable and can be easily described.
Landscape Impact	Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced (Institute of Environmental Assessment & The Landscape Institute 1996).
Study area	For the purposes of this report this Project the study area refers to the proposed project footprint / project site as well as the 'zone of potential influence' (the area defined as the radius about the centre point of the Project beyond which the visual impact of the most visible features will be insignificant) which is a 5,0km radius surrounding the proposed project footprint / site.
Project Footprint / Site	For the purposes of this report the Project *site* / *footprint* refers to the actual layout of the Project as described.
Sense of Place (genius loci)	Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. *A genius locus literally means* 'spirit of the place'.

Sensitive Receptors	Sensitivity of visual receptors (viewers) to a proposed development.
Viewshed analysis	The two-dimensional spatial pattern created by an analysis that defines areas, which contain all possible observation sites from which an object would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1,8m above ground level.
Visibility	The area from which project components would potentially be visible. Visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation, and distance.
Visual Exposure	Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion and visual acuity, which is also influenced by weather and light conditions.
Visual Impact	Visual effects relate to the changes that arise in the composition of available views because of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity.
Visual Intrusion	The nature of intrusion of an object on the visual quality of the environment resulting in its compatibility (absorbed into the landscape elements) or discord (contrasts with the landscape elements) with the landscape and surrounding land uses.
Visual absorption capacity	Visual absorption capacity is defined as the landscape's ability to absorb physical changes without transformation in its visual character and quality. The landscape's ability to absorb change ranges from low-capacity areas, in which the location of an activity is likely to cause visual change in the character of the area, to high-capacity areas, in which the visual impact of development will be minimal (Amir & Gidalizon 1990).
Worst-case Scenario	Principle applied where the environmental effects may vary, for example, seasonally to ensure the most severe potential effect is assessed.
Zone of Potential Visual Influence	By determining the zone of potential visual influence, it is possible to identify the extent of potential visibility and views which could be affected by the proposed development. Its maximum extent is the radius around an object beyond which the visual impact of its most visible features will be insignificant primarily due to distance.

EXECUTIVE SUMMARY

INTRODUCTION

Three separate Special Purpose Vehicles (SPVs) are proposing the development of a commercial wind farm cluster that is expected to comprise three separate (~200 MW to 360 MW) Wind Energy Facilities (WEFs). Each WEF will apply for its own grid connection route to connect to the existing Eskom Camden Substation, via approximately 20 – 31 km long 132 kV overhead transmission lines. The powerlines are proposed, and each have been assessed within a 300 m assessment corridor.

The proposed development sites are located near Ermelo and fall within the Msukaligwa Local Municipality and the Gert Sibande District Municipality, in the Mpumalanga Province.

This report deals specifically with the Emvelo WEF and associated grid connections.

PROJECT SITE AND STUDY AREA

The Project site is approximately 28km east of Ermelo and 37km west of Amsterdam in Mpumalanga. The study area was determined as the site provided by the Developer, and a 40 km buffer zone around it determined by the visual specialist as the maximum area of potential impact. The visibility of the turbines would be insignificant beyond this point. The 40 km buffer zone has also been established for the study, as it may be possible, that when viewed from an elevated position or when the turbines are silhouetted on a ridgeline, the structures could be visible depending on light and atmospheric conditions. The other consideration is the effect of flashing red lights on top of the turbines at night, which would be visible from great distances against what is currently a relatively dark rural sky.

AIM OF THE SPECIALIST STUDY

The study's main aim is to document the baseline and ensure that the visual/aesthetic risks of the proposed Project are understood. A full assessment of potential impacts will take place in the assessment phase of the S&EIA.

TERMS AND REFERENCE

A specialist study is required to establish the visual baseline and to identify and assess the visual impacts arising from the Project based on the general requirements for a comprehensive VIA. The following terms of reference was established:

- Undertake a site survey to determine the nature of the receiving environment and the extent of visual influence.
- Describe the landscape character and quality and assess the visual resource of the study area.
- Describe the visual characteristics of the components of the Project.
- Qualitatively assess the potential for shadow flicker.
- Rate the significance of the impact of the Project.
- Rate the potential cumulative effect of the Project.
- Propose mitigation measures to reduce the potential impact of the Project.

ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations have been made in the study:

- The description of project components is limited to what has been supplied to the author prior to the date of completion of this report.
- The accuracy of the viewshed analysis depends on the quality of the input digital surface model (DSM). Readily available digital contours for the area are limited to 20m contours. GYLA have interpolated these down to 1m intervals to get better accuracy. However, these types of viewshed investigations (using readily available GIS software and terrain contours only) are limited in their accuracy due to their inability to incorporate vegetation information. To be more accurate at predicting absolute visibility, the analysis would require "a 3D model of a tree/plant and a layer indicating the spatial distribution and density of vegetation on the landscape" (Llobera 2007:799) and buffering all existing buildings, structures and infrastructure. The possibility of indicating both the spatial and density distribution of tree/plants, and the three-dimensional model representing vegetation and all structures, is currently not available to the author. Therefore, on-site observations are critical.
- Site photos taken in early winter (when the site visit was conducted) do not necessarily reflect the complete landscape character of the area as experienced through all seasons i.e. the density of the bush in the summer would further restrict visual access to the site. The weather was sunny with some cloud and haze conditions.

FINDINGS - VISUAL IMPACT

Significance of Visual Impact

The significance of impact is based on the worst-case scenario and all project components taken together.

Construction phase

WEF

The impact on the visual environment during the construction phase is assessed to have a potential *medium severity* over a *local area* (but extend beyond the site boundary to at least at 8,0km) and would occur over the *short-term* (less than five years) resulting in a *medium consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as MEDIUM. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain MEDIUM**.**

OHPL

The impact on the visual environment during the construction phase is assessed to have a potential *medium severity* over a *local area* (but extend beyond the site boundary to at least at 5,0km) and would occur over the *short-term* (less than five years) resulting in a *medium consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as MEDIUM. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain MEDIUM.

Operational Phase

WEF

The worst-case impact on the visual environment during the operational phase is assessed to have a *high severity* over a *widespread area* and would occur over the *medium-term* (anticipated to be twenty to twenty-five years) resulting in a *high consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as HIGH. The significance of a high impact is that it would have an influence on the decision, and the impact would be unacceptable unless it is effectively mitigated. Mitigation measures are feasible (specifically with regards night lighting and the location of turbines to avoid flicker on affected residential locations) and can reduce the visual impact over time. The impact with mitigation is predicted to reduce slightly by would remain MEDIUM.

OHPL

The worst-case impact on the visual environment during the operational phase is assessed to have a *medium severity* over a regional *area* and would occur over the *medium-term* (anticipated to be thirty years) resulting in a *medium consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as MEDIUM. The significance of a moderate impact is that it could have an influence on the decision, and the impact will not be avoided unless it is mitigated. Mitigation measures are feasible and can reduce the visual impact over time. The impact with mitigation is predicted to reduce slightly by would remain MEDIUM.

Decommissioning Phase

WEF

The impact on the visual environment during this phase is assessed to have a *medium intensity* over a *local area* and would occur over the *short-term* (less than five years) resulting in a *low consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as MEDIUM. The implementation of mitigation measures would reduce the anticipated impact, but it would remain MEDIUM.

OHPL

The impact on the visual environment during this phase is assessed to have a *medium intensity* over a *local area* and would occur over the *short-term* (less than five years) resulting in a *low consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as MEDIUM. The implementation of mitigation measures would reduce the anticipated impact, but it would remain MEDIUM.

Cumulative Effects

WEF

The combined effect of proposed WEF and OHPL project and the existing power infrastructure and associated infrastructure would cause a major change the nature, sense of study and character of the sub-region's landscape's baseline.

The significance of the cumulative impact of these projects on the visual environment during their operational phases is assessed to have a *high severity* and over the *medium-term* resulting in a *high consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as HIGH. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain HIGH.

Plan of Study Assessment Phase

The significance of these high level impacts must be further investigated and rated in the Assessment Phase of the ESIA using computer modelling techniques that establish visibility (viewshed analyses), flicker shadow and visual intrusion using simulations representative of Project activities. The results of the I&AP process will also be known, which will establish receptor sensitivity to the Project.

The following issues will be addressed:

- Establish/confirm public concern for the Emvelo WEF Project, specifically as it concerns visual issues.
- Confirm the visibility and visual intrusion of project activities using computer modelling techniques (viewshed analyses and photomontage simulations and flicker analysis).
- Establish specific management measures (mitigation) to reduce the anticipated impact of the Project where appropriate.

*** GYLA ***

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1. INTRODUCTION

1.1 Project Overview and Background

Respective Special Purpose Vehicles (SPVs) are proposing the development of a commercial wind farm cluster that is expected to comprise three separate (up to 360 MW) Wind Energy Facilities (WEFs). Each WEF will apply for its own grid connection route to connect to the existing Eskom UItkoms Substation, via approximately 20 – 32 km long 132 kV overhead transmission lines. The powerlines are proposed and are each assessed within a 300 m assessment corridor.

The proposed development sites are located near Ermelo and fall within the Msukaligwa Local Municipality and the Gert Sibande District Municipality, in the Mpumalanga Province.

This report deals specifically with the Emvelo WEF and associated overhead powerlines.

1.2 Project site and Study Area

The Project site is approximately 28km east of Ermelo and 37km west of Amsterdam in Mpumalanga. The study area was determined as the site provided by the Developer, and a 40 km buffer zone around it determined by the visual specialist as the maximum area of potential impact. The visibility of the turbines would be insignificant beyond this point. Refer to Figure 1 Locality – Emvelo WEF Site, which identifies the study area. The 40 km buffer zone has also been established for the study, as it may be possible, that when viewed from an elevated position or when the turbines are silhouetted on a ridgeline, the structures could be visible depending on light and atmospheric conditions. The other consideration is the effect of flashing red lights on top of the turbines at night, which would be visible from great distances against what is currently a relatively dark rural sky.

It is anticipated that the potential visual impact should not extend beyond 5km and for this reason the visual specialist has limited the study area to 5km either side of the centre line of the proposed corridors.

1.3 Aim of the Specialist Study

The study's main aim is to document the baseline and ensure that the visual/aesthetic risks of the proposed Project are understood.

1.4 Terms and Reference

A specialist study is required to establish the visual baseline and to identify and assess the visual impacts arising from the Project based on the general requirements for a comprehensive VIA. The following terms of reference was established:

- Undertake a site survey to determine the nature of the receiving environment and the extent of visual influence.
- Describe the landscape character and quality and assess the visual resource of the study area.
- Describe the visual characteristics of the components of the Project.
- Qualitatively assess the potential for shadow flicker.
- Rate the significance of the impact of the Project.
- Rate the potential cumulative effect of the Project.

- Propose mitigation measures to reduce the potential impact of the Project.

1.5 Assumption, Uncertainties and Limitations

The following assumptions limitations have been made in the study:

- The description of project components is limited to what has been supplied to the author prior to the date of completion of this report.
- The accuracy of the viewshed analysis depends on the quality of the input digital surface model (DSM). Readily available digital contours for the area are limited to 20m contours. GYLA have interpolated these down to 1m intervals to get better accuracy. However, these types of viewshed investigations (using readily available GIS software and terrain contours only) are limited in their accuracy due to their inability to incorporate vegetation information. To be more accurate at predicting absolute visibility, the analysis would require “a 3D model of a tree/plant and a layer indicating the spatial distribution and density of vegetation on the landscape” (Llobera 2007:799) and buffering all existing buildings, structures and infrastructure. The possibility of indicating both the spatial and density distribution of tree/plants, and the three-dimensional model representing vegetation and all structures, is currently not available to the author. Therefore, on-site observations are critical.
- Site photos taken in early winter (when the site visit was conducted) do not necessarily reflect the complete landscape character of the area as experienced through all seasons i.e. the density of the bush in the summer would further restrict visual access to the site. The weather was sunny with some cloud and haze conditions.

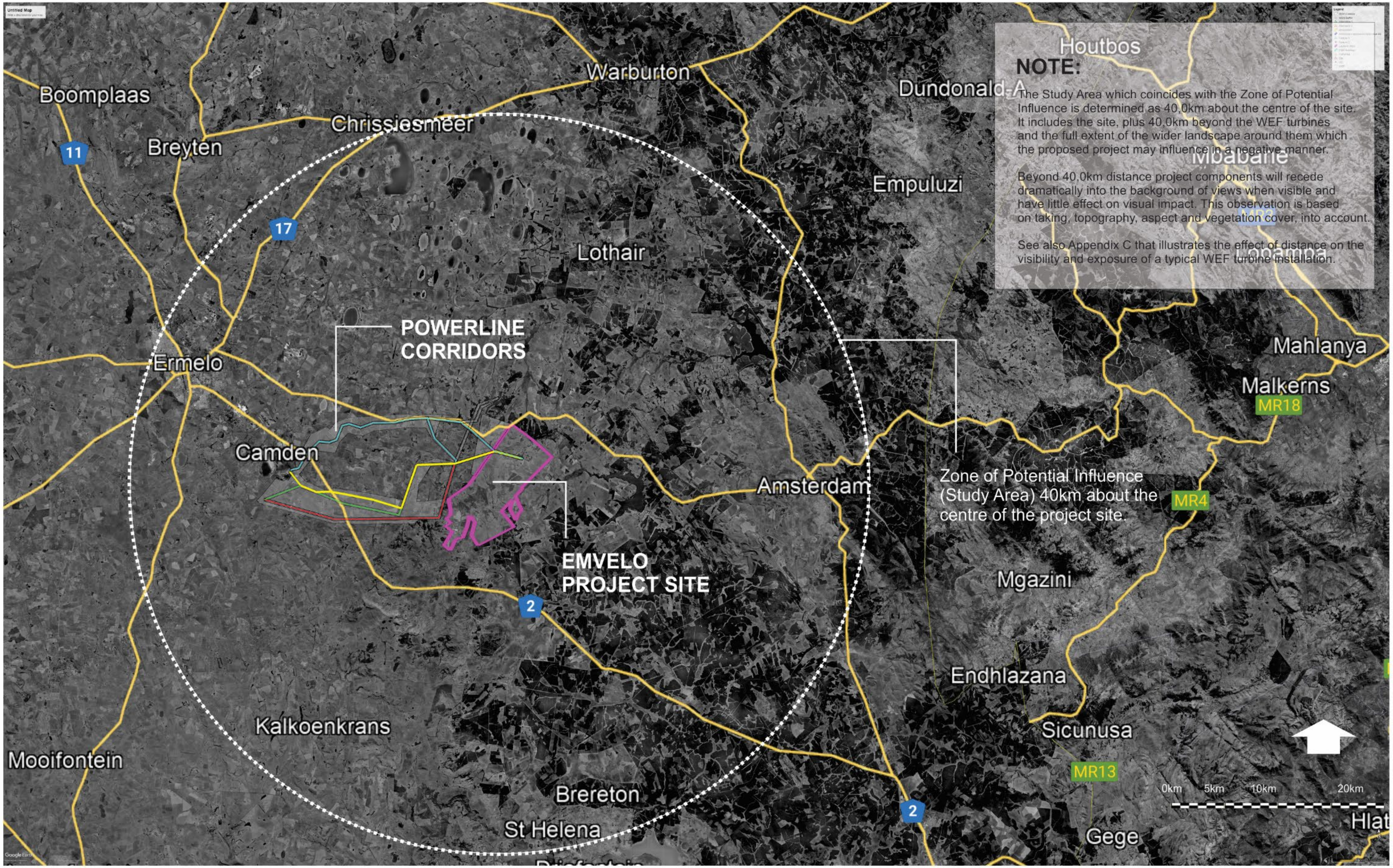

Figure 1: LOCALITY - Emvelo WEF Site

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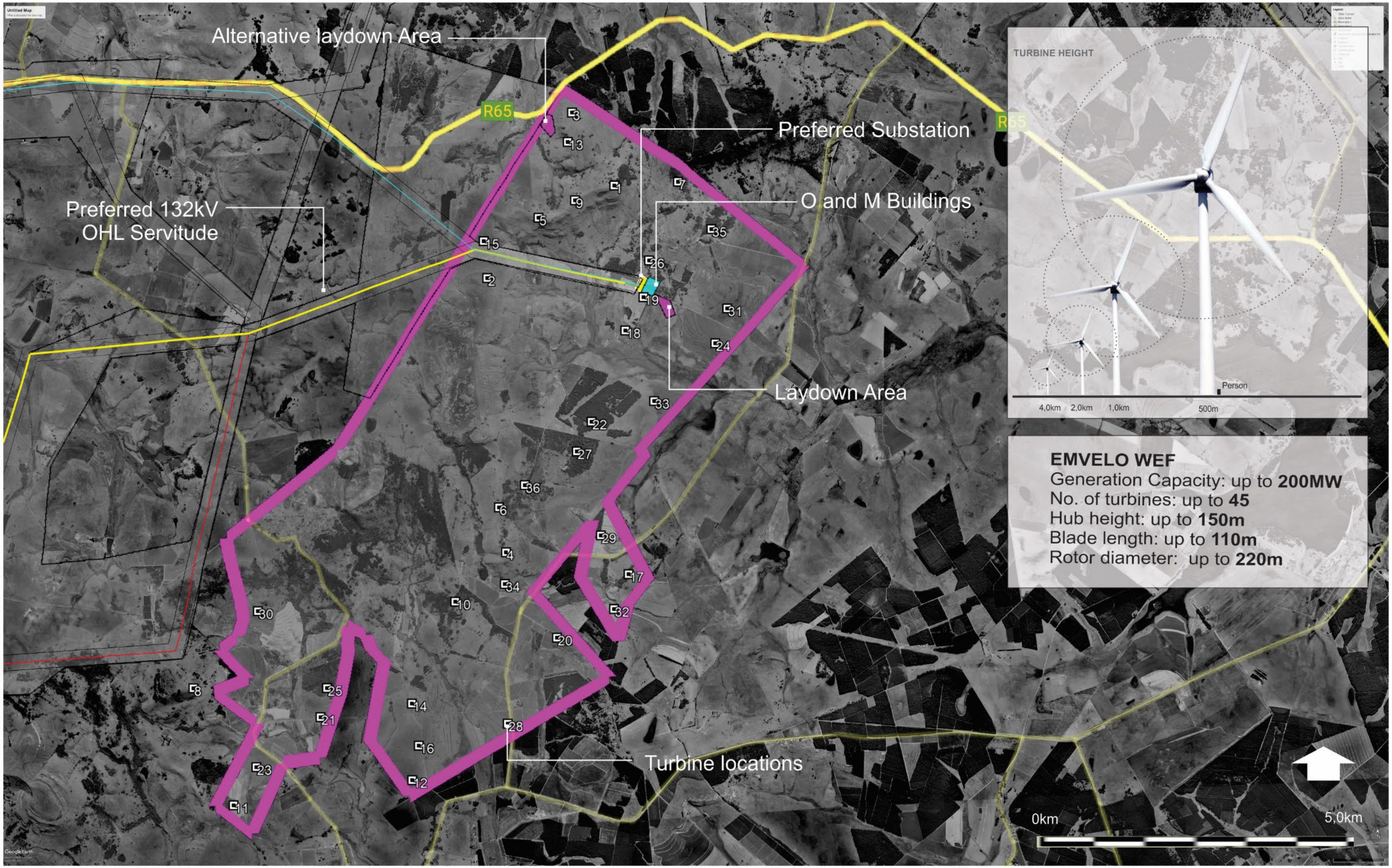

Figure 2: LAYOUT EMVELO - Wind Turbine Generator Areas

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2. NATIONAL ENVIROMENTAL GUIDELINES

There are no specific legal requirements nor is there any direct reference to the visual environment in the legislation. General legislation pertaining to the environment is contained in the National Environmental Management Act (NEMA) (Act No. 107 of 1998) as well as the National Heritage Resources Act No. 25, 1999 and the associated provincial regulations provide legislative protection for listed or proclaimed site, such as urban conservation areas, nature reserves and proclaimed scenic routes.

<u>National Environmental Management Act (Act 107 of 1998), EIA Regulations</u>

The specialist report is in accordance with the specification on conducting specialist studies as per Government Gazette (GN) R 982 (as amended) of the National Environmental Management Act (NEMA) Act 107 of 1998. The mitigation measures as stipulated in the specialist report can be used as part of the Environmental Management Programme Report (EMPR) and will be in support of the Environmental Impact Assessment (EIA) and Appendix 6 of the EIA Regulations 2014 (as amended).

<u>Western Cape Department of Environmental Affairs & Development Planning: Guideline for Involving Visual and Aesthetic Specialists in EIA Processes Edition 1 (CSIR, 2005)</u>

Although the guidelines were specifically compiled for the Province of the Western Cape, they provide guidance that is appropriate for any EIA process. The Guideline document also seeks to clarify instances when a visual specialist should get involved in the EIA process.[1]

The National Heritage Resources Act refers, under Part 1 General Principles, to the National Estate:

> 3.(2)(d) Landscapes and natural features of cultural significance

Visual pollution is controlled to a limited extent, by the Advertising on Roads and Ribbons Act (Act No. 21 of 1940) which deals mainly with signage on public roads.

The Protected Areas Act (NEMA) (Act 57 of 2003, Section 17) is also intended to protect natural landscapes.

[1] The Western Cape Guidelines are the only official guidelines for visual impact assessment reports in South Africa and can be regarded as best practice throughout the country.

3. APPROACH AND METHODOLOGY

3.1 Approach

The assessment of likely effects on a landscape resource and visual amenity is complex since it is determined through quantitative and qualitative evaluations. When assessing visual impact, the worst-case scenario is considered. Landscape and visual assessments are separate, although linked, procedures. The landscape, its analysis, and the assessment of impacts on the landscape all contribute to the visual impact assessment studies baseline. The potential impact on the landscape is assessed as an impact on an environmental resource, i.e. the physical landscape. On the other hand, visual impacts are assessed as one of the interrelated effects on people (i.e. the viewers and the result of an introduced object into a view or scene).

For a detailed description of the methodology to determine the value of a visual resource, refer to Appendix A. Appendices B and C list the criteria for determining the severity and significance of visual impact. Graphic 1 below graphically illustrates the visual impact process used in this Project.

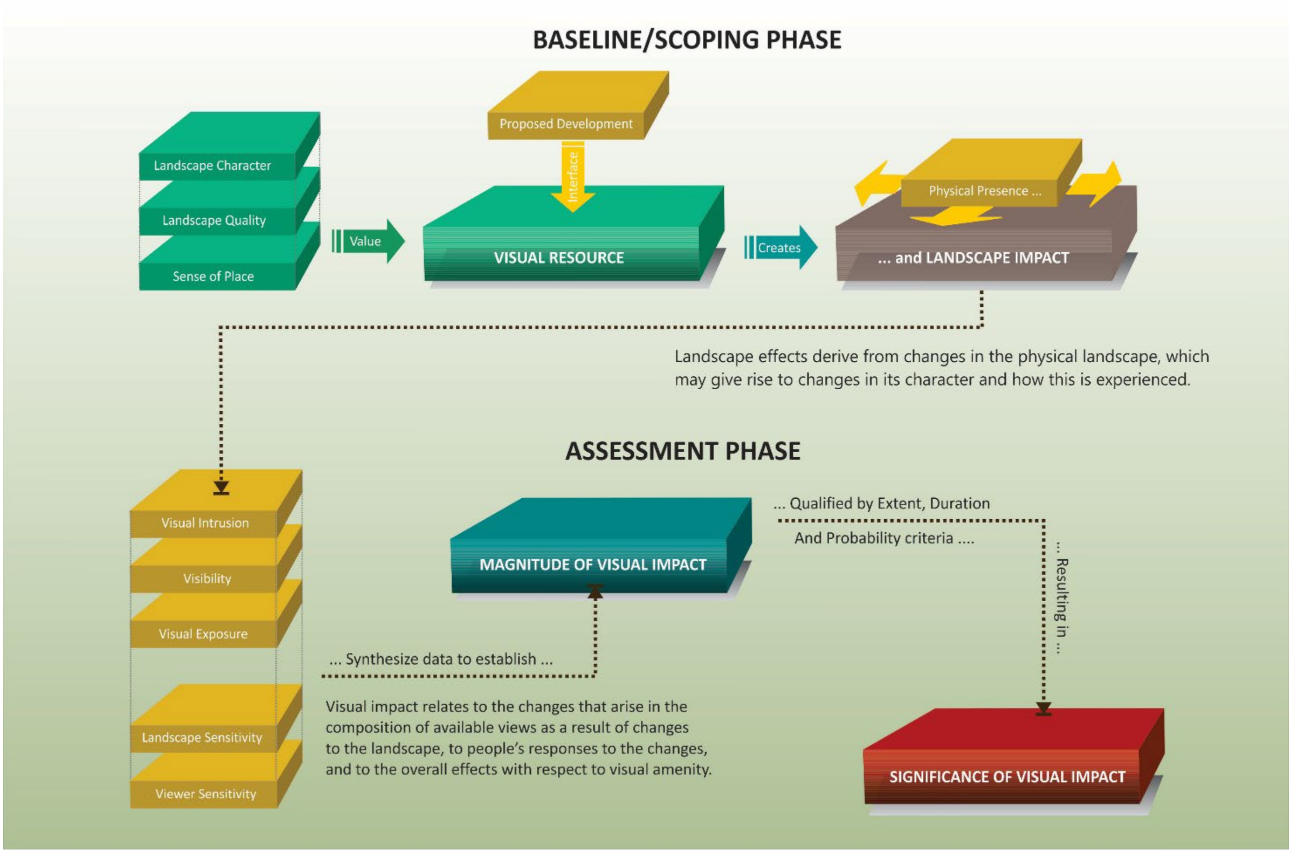

Plate 1: Visual Impact Process

3.2 Methodology

The following method was used:

- Site visit was undertaken on the 31 May and 13 June 2023.
- The method used for the study was both a desk top study using Google Earth and a site inspection. Google Earth, the Surveyor General, SANBI, the South African protected and Conservation Areas Database – DFFE, and Environment Geographic Information Systems were used to identify homesteads and structures that may be visually impacted. This information was referenced during the site inspection, which took place on 31 May and 13 June 2023. The field study entailed travelling

along public roads that surrounded and crossed the study area to determine the potential visibility from these areas. The route followed the R65 towards Amsterdam. The route turned off to the north following a route around the northern section of the Emvelo WEF section re-joining the R65 further east. The route then continued southwards past Sheepmoor where it linked up with the N2. From here the route followed the N2 back past the Camden power station to Ermelo.

- Project components: The physical characteristics of the project components were described and illustrated based on information supplied by the EAP.
- The landscape's character was described and rated in terms of its aesthetic appeal using recognised contemporary research in perceptual psychology as the basis, and its sensitivity as a landscape receptor.
- The sense of place of the study area was described as to its uniqueness and distinctiveness. The primary informant of these qualities was the spatial form and character of the natural landscape together with the cultural transformations associated with the historical/current use of the land.
- The visibility of the proposed Project was determined using on-site observations and a viewshed assessment.
- Illustrations, in basic simulations, of the proposed WEF and the proposed 132kV powerlines were overlaid onto panoramas of the landscape, as seen from nearby sensitive viewing points, to give the reviewer an idea of the scale and location of the proposed Project within its landscape context.
- Visual intrusion (contrast) of the proposed Project was determined by simulating its physical appearance from these sensitive viewing areas.
- The severity and significance of the visual impact of the proposed Project were rated based on the method described above and as detailed in Appendices B and C; and
- Measures to mitigate the negative impacts of the proposed Project were recommended.

4. DESCRIPTION OF THE PROJECT

4.1 Description

The scope of this report is the Emvelo Wind Energy Facility (WEF) and associated overhead powerlines application. The proposed technical details are presented in the table below:

Table 1: Project Technical Details[2]

Developer / Applicant	Emvelo Wind Energy Facility (Pty) LTD
DFFE Reference	To be confirmed
WEF Generation Capacity	Up to 200 MW
Site Access	Locality to be confirmed. Total width up to 15 m (12 m after rehabilitation) consisting of up to 3m width for underground 33 kV reticulation.
Number of Turbines	Up to 45
Hub Height from ground level	Up to 150 m
Blade Length	Up to 110 m
Rotor Diameter	Up to 220 m
Length of internal roads	Unknown at this point.
Width of internal roads	Up to 12 m to be rehabilitated to up to 9 m.
On-site substation capacity	Up to 132 kV
Proximity to grid connection	Approximately 30 km
Grid Connection Capacity	Up to 132 kV
Temporary turbine construction laydown and storage areas.	Crane platforms and hardstand laydown area up to 36 ha (Up to 0.8 ha per turbine)
Permanent footprint area dimensions, including roads, turbine hardstand areas, O&M buildings and battery pad.	O&M: Up to 0.5 ha Hardstand areas: Up to 0.75 ha Total area of final footprint (including roads): up to 180 ha
Operations and maintenance buildings (O&M building) with parking area	Up to 0.5 ha
BESS Area	Approximately 400 x 400 m
Height of fencing	2.8 m
Type of fencing	Where site offices are required, temporary screen fencing used to screen offices from the wider landscape.

[2] Supplied by the EAP.

It is intended that the Ermelo WEF be bid in the seventh bidding window of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) with the aim of evacuating the generated power from the WEF into the National Eskom Grid. This will aid in the diversification and stabilisation of the country's electricity supply in line with the objectives of the Integrated Resource Plan (IRP).

Emvelo WEF is proposed to comprise up to 45 turbines with a maximum output capacity of up to 200 MW. The WEF will be located on nineteen (19) land parcels and will have an anticipated lifespan of 20 – 25 years. The final design which will be requested for approval in the EA, will be determined based on the outcome of the specialist studies undertaken for the EIA phase of the development. The proposed turbine footprints and associated facility infrastructure will cover an area of up to 180 ha after rehabilitation, depending on final layout design.

It is proposed that an on-site substation with a capacity up to 132 kV and an up to 132 kV Overhead Powerline (OHPL) of approximately 30 km (300 m corridor), traversing eighteen (18) land parcels, be constructed to connect the proposed WEF to the Eskom Uitkoms Substation.

The expected operational life of a WEF is estimated up to 25 years. The construction and the commissioning of a WEF are expected to last approximately 18 to 24 months. Refer to Figure 2 for the layout and typical examples of wind turbines.

4.2 WEF Location Alternatives

No other location (development areas) alternatives are being considered. Renewable Energy (RE) development in South Africa (SA) is highly desirable from a social, environmental and development point of view and a wind energy installation is more suitable for the site due to the high wind resource.

Reason for the location chosen: This site is preferred due to the suitable climate, conditions, and topography. Based on the above site- specific attributes, the study area is considered highly preferred in terms of the development of a wind energy facility. As such, no property/ location alternatives have been considered.

4.3 WEF Technology Alternatives

No other technology alternatives are being considered.

4.4 Overhead Powerlines Alternatives

Four overhead powerline routes, within 300m servitudes, are under consideration. These are Alternatives 1, 2, and 3 and the Preferred alignment. Refer to Figure 3.

4.4.1 Alternative 3

Alternative 1 is aligned in areas where there are no other powerline corridors along the R65 and then southwest across open farming and grassland, making it potentially highly visible and would be seen in foreground views along the R65. It terminates in the Eskom Uitkoms Substation at Camden.

4.4.2 Alternative 1

The eastern section of the proposed corridor is routed over open rolling farmland and grassland along the same corridor as the Preferred option. It, however, goes further south before it turns west, where it too is in open land. It terminates south of the Camden Power Station at the same point as Alternative 2. No sections of this alternative occur within existing corridors.

4.4.3 Alternative 2

Alternative 2 is the most southerly route and is aligned across open farmland and rolling grassland making it potentially, highly visible. It terminates south of the Camden Power Station, where a new substation would be requited. No sections of this alternative occur within existing corridors.

4.4.4 Alternative 3

Alternative 3 is aligned in areas where there are no other powerline corridors along the R65 and then southwest across open farming and grassland, making it potentially highly visible and would be seen in foreground views along the R65. It terminates in the Eskom Uitkoms Substation at Camden. No sections of this alternative occur within existing corridors.

be requited. No sections of this alternative occur within existing corridors.

4.4.5 Preferred Alternative

The preferred alternative is also the visually preferred option. Its eastern section is aligned across open land where it is potentially highly visible, however, the western section of the line coincides with an existing 400kV corridor. This section of the OHPL would therefore not be as visually intrusive as it would be partially absorbed into the scene. This alternative will be assessed in the assessment phase of the visual impact assessment.

4.5 No-Go Alternative

The ‘no-go’ alternative is the option of not undertaking the proposed WEF project. Hence, if the ‘no-go’ option is implemented, there would be no development. This alternative would result in no environmental impacts from the proposed project on the site or surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report.

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5. POTENTIAL VISUAL ISSUES

WEF projects typically consist of large-scale infrastructure that can cause change to the fabric and character of an area and possible visual intrusion in sensitive landscapes due to their physical presence.

Typical issues associated with WEF projects are:

- Who will be able to see the new development?
- What will it look like, and will it contrast with the receiving environment?
- Will the development affect sensitive views in the area, and if so, how?
- What will be the impact of the development during the day and at night?
- What will the cumulative impact be, if any?
- What Shadow Flicker nuisance could be to nearby residents.

These potential impacts will be considered and rated in the risk assessment section of the report. At the time of writing, the public participation process has not been completed. Therefore, it is unknown if the public would raise visual issues and potentially indicate a sensitivity to visual and aesthetic concerns. It is assumed, based on the generic sensitivity criteria listed in Appendix B that receptor sensitivity would be Moderate.

5.1 Night Lighting

The negative effect of night lighting caused by the Project would be seen against a relatively dark night sky that has, however been impacted by lights from urban areas such as Ermelo and Sheepmoor. Security lighting could, however, be detrimental to people living in the immediately vicinity. It is a requirement by Civil Aviation that a red hazard flashing navigation light be installed on top of each turbine. These lights can be seen over extended distances of at least 40km and when viewed against a dark sky they become very visible.

5.2 Shadow Flicker

Farmsteads and other housing in close proximity to the wind turbines could experience the effect of flicker. A wind turbine's moving blades can cast a moving shadow on locations within a certain distance of a turbine. These moving shadows are called shadow flicker and can be a temporary phenomenon experienced by people at nearby residences or public gathering places. The impact area depends on the time of year and day (which determines the sun's azimuth and altitude angles) and the wind turbine's physical characteristics (height, rotor diameter, blade width, and orientation of the rotor blades). Shadow flicker generally occurs during low angle sunlight conditions, typically during sunrise and sunset times of the day. However, when the sun angle gets very low (less than 3 degrees), the light must pass through more atmosphere and becomes too diffused to form a coherent shadow. Shadow flicker will not occur when the sun is obscured by clouds or fog, at night, or when the source turbine(s) are not operating. (Green Rhino Energy). Not only can shadow flicker be a nuisance to nearby residents but, it has been suggested, could aggravate medical problems such as migraine and epilepsy.

Shadow flicker intensity is defined as the difference in brightness at a given location in the presence and absence of a shadow. Shadow flicker intensity diminishes with greater receptor-to-turbine separation distance. Shadow flicker intensity for receptor-to-turbine distances beyond 1,500 meters is very low and generally considered imperceptible. Shadow flicker intensity for receptor-to-turbine distances between 1,000 and 1,500 meters is also low and considered barely noticeable. At this distance shadow flicker intensity would only tend to be noticed under conditions that would enhance the intensity difference, such as observing from a dark room with a single window directly facing the turbine casting the shadow during sunny conditions. At distances less than 1,000 meters, shadow flicker may be more noticeable. In general, the largest number of shadow flicker hours, along with greatest shadow flicker intensity, occurs nearest the wind turbines (Green Rhino Energy, https://www.greenrhinoenergy.com/renewable/wind/wind_flicker.php).

A shadow flicker analysis calculates for each point of interest, in this case for each turbine:

- Number of hours per year that the flickering occurs,
- Maximum length (in minutes) that flickering occurs on the worst day in the year, and
- Number of days in the year that shadow flickering appears at all.

All the above are calculated for both the worst case.

Following German regulation, shadow flickering cannot be perceived by the human eye if the angle of the sun over the horizon is less than 3°. Plus, the blades of the turbines must cover at least 20% of the sun.

While guidelines differ, the ones in Germany are most widely adopted. Accordingly, the maximum impact allowed by shadow flickering is:

- 30 hours per annum of flickering in the worst case
- 30 minutes maximum on the worst day in the year

5.3 Overhead Powerlines

The 132Kv powerline pylons are approximately 28m tall and are readily visible within a grassland open and rolling landscape, which is typical of most of the study area. Various potential visual impact issues have been identified. The following general risks are associated with the visual intrusion in the landscape:

- Excessive clearing for preparing the area for the pylon structures as well as for the construction of temporary access roads.
- The relatively random and disorganised lay down of building materials and vehicles,
- Dust from construction activities.
- High seed bank of alien species in the topsoil can lead to the uncontrolled spread of exotic invader plant species. This could create a vegetated linear area that is visually contrary to the surrounding landscape.
- Areas and /or specific sites of aesthetic value may be disfigured by the introduction of a power line within the viewshed resulting in a permanent change to the existing visual quality of visually sensitive areas.
- The compromising of views from or the alteration of the ambience of natural areas.
- Need to keep certain areas such as road reserves and servitudes clear of vegetation which will result in visual scarring.

6. THE ENVIRONMENTAL SETTING

6.1 Landscape Character and nature of the Study Area

The study area consists of a landscape that varies from relatively flat with wide open grasslands and agricultural lands, to rolling with low ridges, valleys, ridges, escarpments, and flat-topped hills. Refer to Figure panoramas in Figures 4-1 to 4-4 and the distribution of landscape character types in Figure 5. Figure 3 gives the location of the panoramas. In the east the landscape drops down to the edge of the Mpumalanga escarpment with steeper valleys and ridges. The study area comprises gently undulating land originally covered with Eastern Highland Grassveld with Wakkerstroom Montane Grassland on the eastern edge (Mucina and Rutherford 2006:460) (refer to Figure 4-1 to 4-4). Most of the area is not often ploughed due to the clay soils. However, the very nature of the original vegetation in this area is low growing and visually uniform which does not provide much visual screening. Although the grassland vegetation is not overly sensitive to the development it does not assist in reducing the visual expose of the turbines. The vegetation is typical of the Highveld ambience, and it is this together with the topography which provides the Highveld sense of place.

The area in the northern sector of the study area exhibits a high aesthetic appeal imparted by the rolling topography, farmsteads, streams and rivers, dams and lakes, and farmlands.

The area further to the east forms the edge of the upper reaches of the escarpment and is fairly well forested with timber plantations which may assist in screening the visibility of the turbines (i.e., visual absorption capacity (VAC) is relatively high for the eastern sections of the study area.

The landscape in the west and south western parts of the study area are visually intruded by existing power lines, views of the Camden Power Station and settlements such as Sheepmoor, which do not have the aesthetic appeal of the north (refer to Figure 7). Although the hills to the far south of the N2 exert a reasonably powerful sense of place.

The study area is fairly well populated (refer to Figure 6 which illustrates potential receptor locations)[3], especially in the central/south which was borne out by the site visit.

The study area's visual quality (resource) can be categorised into five landscape character zones as illustrated in Figure 5. The area north of the R65 exhibits a high visual quality due to the rural agricultural ambience. The area to the east is more diverse with a mixture of grasslands, hills and valleys and timber production. The area to the south of the R65 to the N2 is a mix of farming, grazing settlements roads, power lines and game farms. In the far south and southwest are grassland covered rolling hills that reach elevations of over 1700m above sea level.

- The area north of the R65 exhibits a high visual quality due to the rural agricultural ambience and presence of water bodies (dams, vleis, pans and rivers) and the Chrissiesmeer Protected Environment.

[3] It is noted that the potential receptor locations have been identified by building locations on the Surveyor General data base. Not all these building would necessary be of a residential (sensitive viewing location) nature. During the assessment stage this would be verified.

Implication for the Project

The project will alter the visual ambience of the area and will have a potentially substantial negative effect on the visual quality of the landscape. The industrial nature of the turbines will contrast with the rural agricultural ambience. The turbine structures will visually stand out and contrast with the low and uniformly textured vegetation of the grassland landscape and agricultural lands. These landscape character types combine to present a Low VAC (Visual Absorption Capacity) which does not assist in screening the proposed development, nor does it assist in blending it with the landscape.

- The area to the east of the project site is more diverse with a mixture of grasslands, hills and valleys and timber production (refer to Figure 5).

Implication for the Project

This area is visually more diverse and presents a medium VAC which allows for some visual screening and blending with the visual environment. However, the magnitude and scale of the turbines will always be dominant in the visual environment.

- The area to the west and south of the N2 is a mix of farming, grazing settlements roads, power lines and game farms.

Implication for the Project

This area exhibits a mixed landscape which is a combination of both agricultural and industrial images. As with the previous zone, the diversity allows for some visual screening and blending with the visual environment. However, the magnitude and scale of the turbines will tend to be visually dominant.

- In the far south and south-west are grassland covered rolling hills that reach elevations of over 1700m above sea level.

Implication for the Project

The low and uniformly textured vegetation of the grassland landscape type and the agricultural lands visually contrast with the turbine structures making them visible in the landscape. These features combine to present a low Visual Absorption Capacity (VAC) which does not assist in screening the proposed development, nor does it assist in blending it with the landscape. The industrial nature of the turbines will contrast with the rural agricultural ambience.

The visual resource value of these landscape types is summarized in Table 2, Section 7, along with the relative landscape receptor sensitivities.

6.2 Sense of Place

According to Lynch (1992), a sense of place is the extent to which a person can recognise or recall a place as being distinct from other places - as having a vivid, unique, or at least particular, character of its own. The sense of place for the study area derives from the local landscape types described above and their impact on the senses.

The landscape character types in the study area (Figure 5) are common within this region. The sense of place for the area is overwhelmingly rural agricultural in nature as illustrated in Figures 4-1 to 4-5. The original vegetation type for this area was mainly undisturbed grasslands which have now been modified to that of grazing and in patches to that of ploughed lands for maize crop production. The rural nature of the study area continues further to the east where that grassland ambience is replaced with that of extensive timber plantations. (Figure 4-3. The area to the west and south of the study area has more of a mixed industrial/agricultural nature created by the presence of transmission powerlines, the Camden power station, the N2, settlements such as Sheepmoor (Figure 4-4) and the eastern edges of Ermelo).

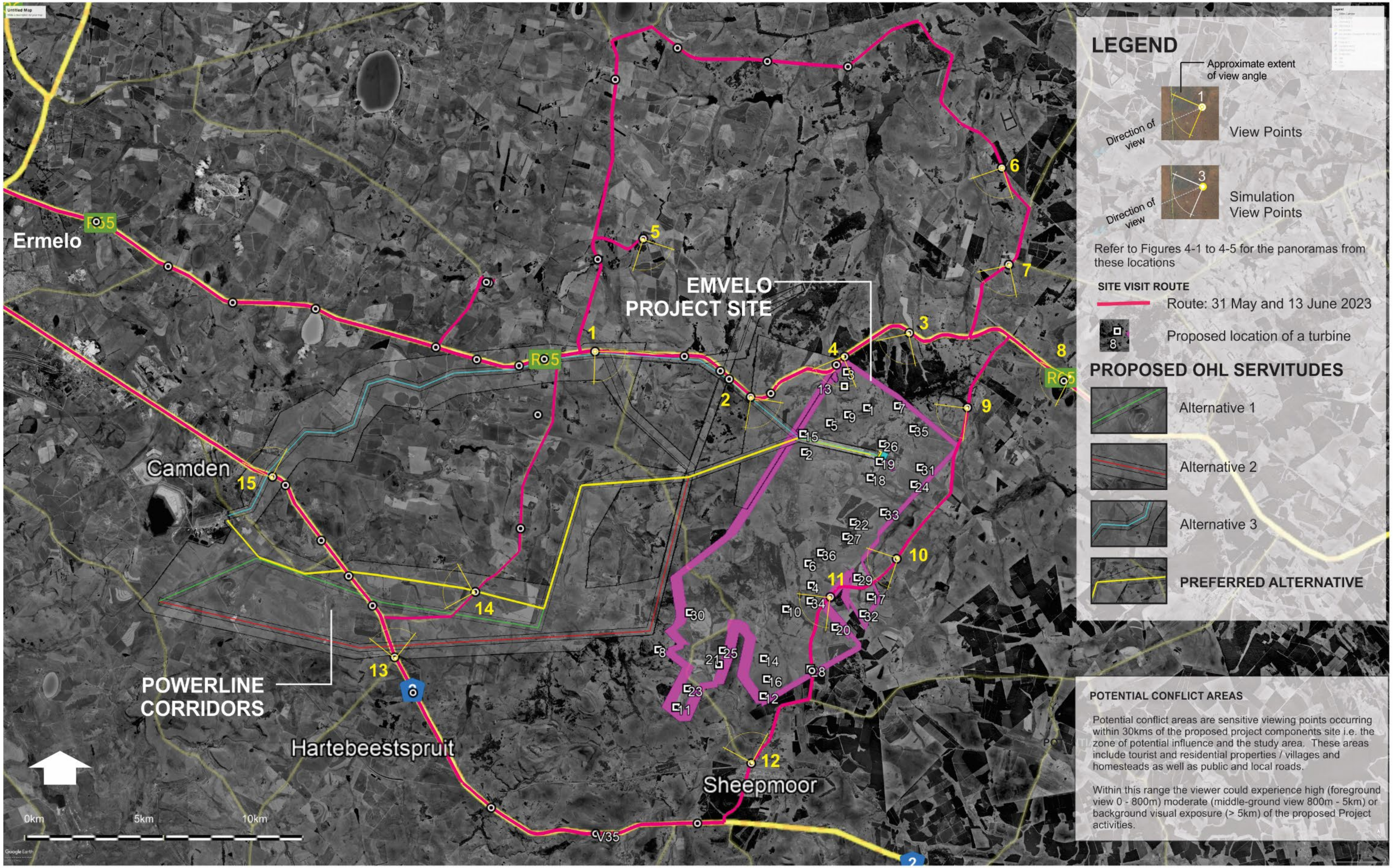

Figure 3: PANORAMA VIEW POINT LOCATIONS - Emvelo WEF Site

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View 1: looking east from the R65 towards the project site beyond the crest of the ridge line

View 2: looking east to the project site along the middle distant ridgelines

View 3: looking south west from the R65 regional road towards the site evident along the horizon line

Figure 04-1: LANDSCAPE CHARACTER - Views 1, 2 and 3

Refer to Figure 3 for location of viewing points

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View 1: looking east from the R65 towards the project site beyond the crest of the ridge line

View 2: looking east to the project site along the middle distant ridgelines

View 3: looking south west from the R65 regional road towards the site evident along the horizon line

Figure 04-1: LANDSCAPE CHARACTER - Views 1, 2 and 3

Refer to Figure 3 for location of viewing points

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Figure 04-2: LANDSCAPE CHARACTER - Views 4, 5 and 6

Refer to Figure 3 for location of viewing points

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View 7: looking south west from a local district road north of the R65 to the project site beyond the high horizon line.

View 8: looking west from the R65 towards the site located along the horizon line to the left of the immediate high ridge line

View 9: looking south west from a local district road towards the site along the distant horizon line and down onto the lower plains

Figure 04-3: LANDSCAPE CHARACTER - Views 7, 8 and 9

Refer to Figure 3 for location of viewing points

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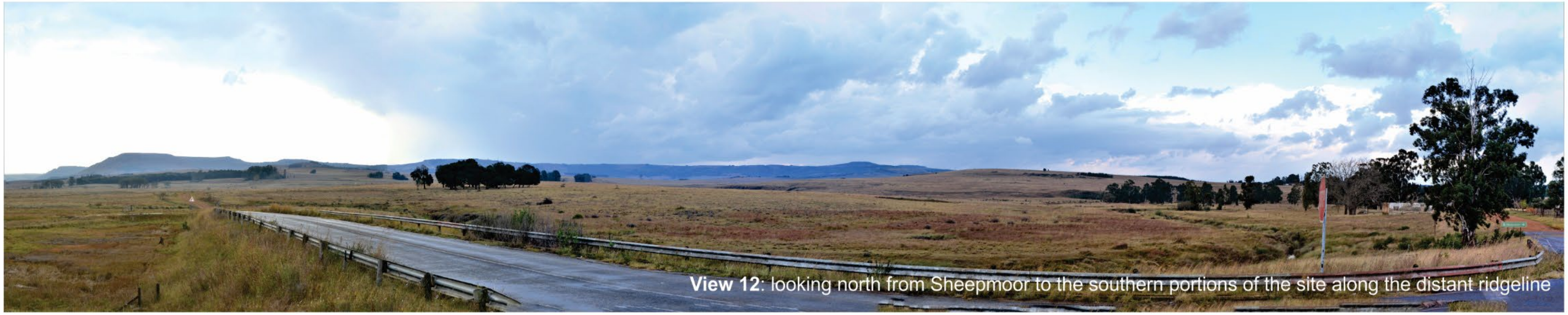
View 10: looking north from a local district road towards the eastern sections of the project site along the ridge line left to the left and down into the plains

View 11: looking south west from a local district road to the western sections of the project site



View 12: looking north from Sheepmoor to the southern portions of the site along the distant ridgeline

Figure 04-4: LANDSCAPE CHARACTER - Views 10, 11 and 12

Refer to Figure 3 for location of viewing points

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View 13: looking north along the N2 towards existing powerlines and the proposed Preferred and Alternatives 1 and 2 powerline crossing of the N2

View 14: looking west from a local district road along the proposed Preferred powerline servitude towards the Camden Power Station

View 15: looking north east from the N2 along an existing powerline servitude and the proposed Alternative 3 servitude

Figure 04-5: LANDSCAPE CHARACTER - Views 13, 14 and 15

Refer to Figure 3 for location of viewing points

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7. VISUAL RESOURCE

7.1 Visual Resource Value, Scenic Quality and Landscape Sensitivity

The value of the study area's visual resource and its associated scenic quality (using the scenic quality rating criteria described in Appendix A) are derived from the landscape types described above. The sensitivity of the study area's landscape (as a scenic resource) can be defined as *moderate* to *low* (as indicated in Table 1 below), within the context of the sub-region. These ratings are dependent on the landscape character:

- Does it contribute to the area's sense of place and distinctiveness?
- Quality? – in what condition is the existing landscape?
- Value – is the landscape valued by people, local community, visitors, and is the landscape recognised, locally, regionally or nationally? and
- Capacity – what scope is there for positive change in the existing landscape character?

When the criteria listed in Appendix A are considered and understood within the context of the sub-region. A visual resource value of moderate to high is assigned to the grasslands associated with grazing and maize production. The transformed natural grasslands associated with timber production in the east of the site have a moderate resource value. The landscape character type with the highest visual quality and consequently the most sensitive to development is the dams, vleis, pans and streams associated with the Chrissiesmeer Protected Area. The landscape character type with the lowest value is the power infrastructure and mines.

A summary of these values is provided in Table 2, which categorises the various local landscape character types and sensitivity to development, within the context of the sub-region.

Table 2: Value of the Visual Resource
(After: LiEMA 2013)

High Dams, vleis, pans and rivers (Chrissiesmeer Protected Area) and grassland on natural hills and ridgelines	**Moderate** Partially degraded and natural grassland associated with grazing, maize production and timber production	**Low** Power generation and distribution infrastructure
This landscape type is considered to have a *high* value because it is a: Distinct landscape that exhibits a positive character with valued features that combine to give the experience of unity, richness and harmony. It is a landscape that may be of particular importance to conserve, and which has an intense sense of place.	This landscape type is considered to have a *moderate* value because it is a: Common landscape that exhibits some positive character, but which has evidence of alteration / degradation/ erosion of features resulting in areas of more mixed character.	This landscape type is considered to have a *low* value because it is a: Minimal landscape generally negative in character with few, if any, valued features.

Sensitivity: It is sensitive to change in general and will be detrimentally affected if change is inappropriately dealt with. The Project site is partially located in this landscape type	Sensitivity: It is potentially sensitive to change in general and change may be detrimental if inappropriately dealt with. **The Project site is located primarily across these landscape types**	Sensitivity: It is not sensitive to change in general and change.

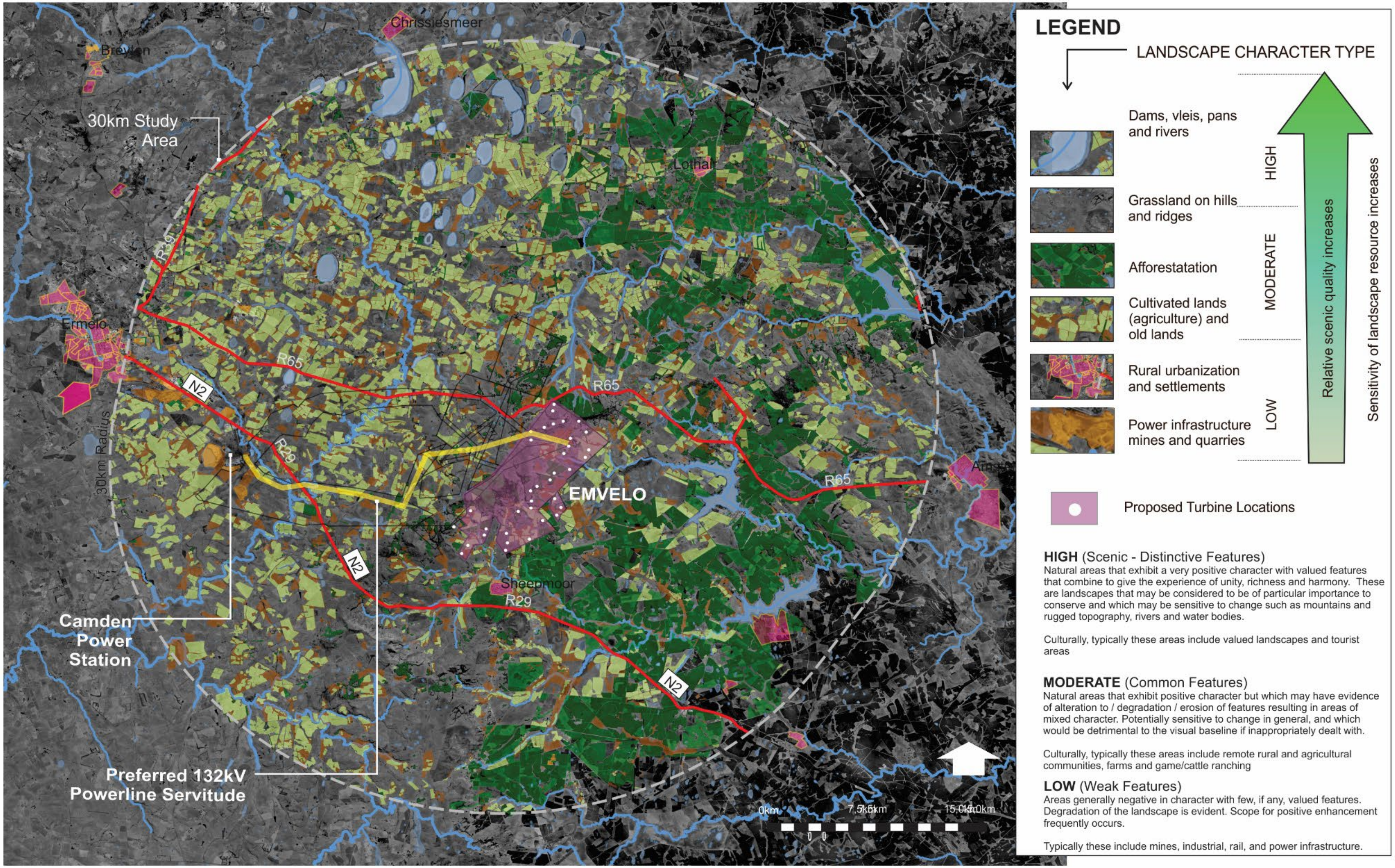

Figure 05: LANDSCAPE CHARACTER and SENSITIVITIES - Emvelo WEF

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8. POTENTIAL VISUAL IMPACT

Visual impacts relate to the changes that arise in the composition of available views as a result of changes to the landscape (as described in Section 8), to people's responses to the changes, and to the overall effects with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (caused by the physical presence of a new development) and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the area.

To assess the potential visual impact of the Project four main factors are considered. In this report a professional opinion is given relative to potential visual impact. In the Assessment Phase, which is to follow, viewshed and simulation modelling will be used to confirm or refute the original risk prediction.

Visual Intrusion:	The nature of intrusion or contrast (physical characteristics) of a Project component on the visual quality of the surrounding environment and its compatibility/discord with the landscape and surrounding land use.
Visibility:	The area/points from which Project components will be visible.
Visual exposure:	Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion.
Sensitivity:	Sensitivity of visual receptors to the proposed development

8.1 Visual Receptors

Visual receptors include people living in, visiting, or travelling through or adjacent to the study area and other local public roads (specifically the R65 road that connects Ermelo with Amsterdam to the east and the N2 which connects Ermelo with Piet Retief to the south-east).

The towns of Ermelo and Amsterdam and smaller settlements such as Sheepmoor and Lothar are within the study area. As the area is predominantly a farming community there are many farmsteads that fall within the study area. Activities and businesses that rely of the visual environment such as lodges, bed and breakfast establishments were not specifically observed in the study area although a game farm was noted on the eastern edge of the site.

8.2 Sensitive Viewers and locations

Although not all homesteads may be occupied fulltime, many of these will be in direct line of sight and within the 0-1km zone for the OHPL and a 0-5km zone for the turbines, where the magnitude of impact could be high. Other potential sensitive receptors include local towns and villages such as Ermelo, Sheepmoor, Lothair, Amsterdam and Camden, travellers on the main roads such as the N2, N11, R65 and secondary public roads, activities and institutions that rely on the aesthetic environment such as game farms, nature reserves, lodges, and B&B's

These receptors and viewing areas are listed in Table 3 below and their locations illustrated in Figure 6.

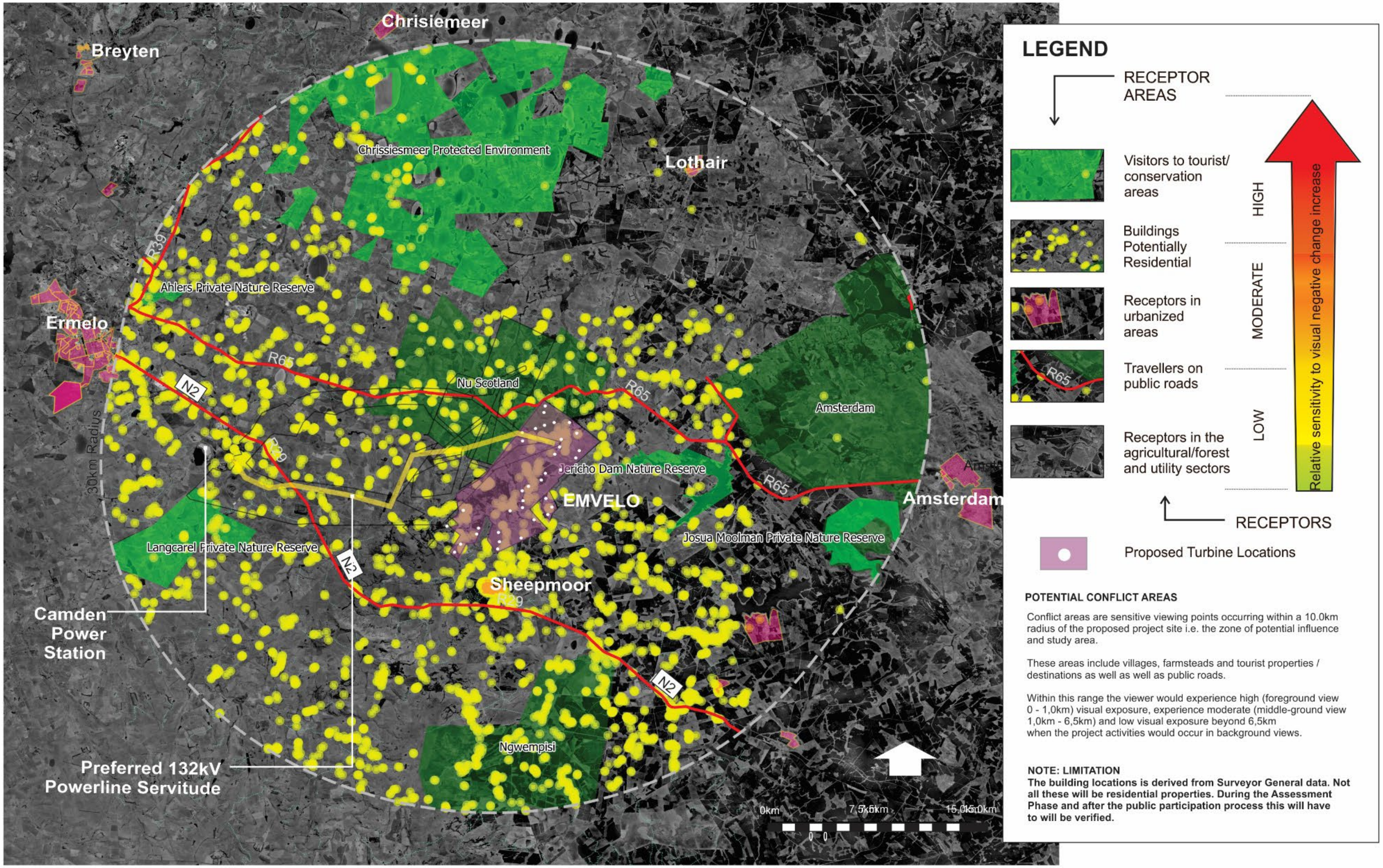

Figure 06: RECEPTOR SENSITIVITIES - Emvelo WEF

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Table 3: Visual Receptor Sensitivities

High	Moderate	Low
Receptors at residential units across the study area. Primarily east and south of the project site and in the site as well as nature reserves, lodges and B&B's	Locals travelling along the R65 and N2, and on the local connector roads that bisect the site	People working or travelling to work in the study area and related to the power production and transmission
Typical receptors -Visitors of tourist attractions and travelling along local routes, whose intention or interest may be focused on the landscape. -Communities where the development results in changes in the landscape setting or valued views enjoyed by the community. -Occupiers of residential properties with views affected by the development.	**Typical receptors** -People travelling through or past the affected landscape in cars or other transport routes.	**Typical receptors** Visitors and people working within the study area and travelling along local roads whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

8.3 Visibility

Visibility is described in terms of the areas that theoretically have direct line of sight in relation to distance the viewer is away from the object.

The visibility is dependent on the topography. The existing topography is very flat which does not assist in limiting the views. Visibility of the structures, due to the tall and imposing scale of the turbines, will potentially be continuous and uninterrupted up to 40km. It is considered that beyond 40 km views of the development, though still visible are considered insignificant in the landscape due to the exponential diminishing effect of distance.

In a study sponsored by the United States Department of the Interior Bureau of Land Management, 377 observations of five wind facilities in Wyoming and Colorado were made under various lighting and weather conditions. The facilities were found to be visible to the unaided eye at >58 km under optimal viewing conditions, with turbine blade movement often visible at 39 km. Under favourable viewing conditions, the wind facilities were judged to be major foci of visual attention at up to 19 km (12 mi) and likely to be noticed by casual observers at >37 km. A conservative interpretation suggests that for such facilities, an appropriate radius for visual impact analyses would be 48 km that the facilities would be unlikely to be missed by casual observers at up to 32 km, and that the facilities could be major sources of visual contrast at up to 16 km (Sullivan, *et. al*, 2011).

Activities associated with the Project will be visible to varying degrees and distances from the sensitive viewing areas described above and as indicated in Figure 5. During the construction phase, the Project's visibility will be influenced due to the preparatory activities, primarily earthworks and building works. During the operational phase, the visibility of the Project will be caused by the established wind turbines and associated infrastructure as well as the proposed new 132kV powerline (Preferred Alternative), which connect the Project site substation to the Uitkoms substation near the Camden power-station to the west of the site.

All Project components (WEF and OHPL) are planned within a landscape which has a relatively low visual absorption capacity (grassland and along the ridgelines).

Although, due to the nature of land (topography, grassland vegetation, timber and settlements) immediately adjacent and in the general vicinity of the site, the landscape, although reasonably flat to undulating, provides a low visual absorption capacity (VAC). This is due to the generally substantial height of the turbines (maximum 250m to tip of rotor blade), the nature of the vegetation cover. The landscape is therefore not readily able to 'absorb' the visual change. The site is most exposed along the R65 where it crosses through the northern Project site and the N2 that runs east -west south of the site. It is also highly exposed to farmsteads and settlements such as Sheepmoor.

8.4 Effects of Night Lighting (WEF)

I&APs consistently raise the impact of night lighting, specifically when they can be seen from tourist or residential sites and when the effect would continue for the Project's life. The negative effect of night lighting caused by the Project would be seen against a night sky already impacted by lights from surrounding urban areas such as Ermelo and Sheepmoor. Security lighting could however, potentially, be detrimental to people living in the immediate vicinity. The management measures, as proposed in Section 10, should be implemented to limit the spillage of light beyond the Project's site boundaries.

It is a requirement by Civil Aviation that a red hazard flashing navigation light be installed on top of each turbine. These lights can be seen over extended distances of at least 40km and when viewed against a dark sky they become very visible. To minimise this visual intrusion, the use of AVWS (Audio Visual Warning System) technology should be investigated. AVWS is a radar-based obstacle avoidance system that activates obstruction lighting and audio signals only when an aircraft is in close proximity to an obstruction on which an AVWS unit is mounted, such as a wind turbine. The obstruction lights and audio warnings are inactive when aircraft are not in proximity to the obstruction (BML 2013[4]).

8.5 Recommended Buffers for Wind Farms

Guidelines prepared for buffers around wind energy farms are indicated in Table 4 below (Lawson and Oberholzer 2022[5]). These are intended for regional scale mapping purposes and are considered in the scoping phase. They would have to be adapted for the local Project scale for each of the proposed wind farms. For example, buffers would vary depending on viewshed mapping, actual site conditions and the design height of wind turbines. To be considered in the Assessment Phase.

[4] United States Department of the Interior. 2013. Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands. Bureau of Land Management. Cheyenne, Wyoming. 342 pp, First Edition 2013.

[5] Lawson, Q. and Oberholzer, B. (2022) *Proposed Hoogland Wind Farms and Grid Connection Project, Northern Cluster: Hoogland 1 and Hoogland 2 Wind Farms: Visual Impact Assessment Version 5.* Unpublished report 09 June 2022. Stanford.

Table 4: Recommended Guidelines Visual Buffer Guidelines for Wind Turbines

Landscape Features	PGWC Guidelines[6]	SEA Visual Guidelines[7]	Comment
Project area boundary-	-	-	Usually 1.5 times height of the proposed turbines
Prominent topographic features	500m	500m	Includes prominent ridgelines, peaks and scarps
Steep slopes	>1:4	>1:4 and >1:10	Generally avoid slopes >1:10
Perennial rivers, large dams, wetland features	500m	250m to 500m	Subject to specialist fresh
Provincial / Arterial roads	500m	500m to 1km	Depends on local context, e.g. rural or urban areas
Scenic Routes and passes	2,5km	1 to 2,5km	Could be less if in a view shadow
National parks / protected areas	2km	3 to 5km	Could be less if in a view shadow
Private nature reserves / game farms / guest farms	500m	1,5 to 3km	Could be less if in a view shadow
Farmsteads	400m (noise)	500m	General literature recommends 500m to 2 km and 2km for flicker shadow
Settlements	800m	2 to 4km	Could be less if in a view shadow and 2km for flicker shadow
Cultural landscapes / heritage sites	500m	500m	Subject to heritage assessments.

[6] Provincial Government of the Western Cape, 2006. Recommended Criteria Thresholds for Regional and Site Level Assessment.
[7] CSIR, 2018. SEA for Wind and Solar Photovoltaic Energy in SA, Phase 2. Visual and Scenic Resources Chapter prepared by B. Oberholzer and Q. Lawson.

8.6 High-Level Identification of Potential Visual Impact

The potential impact ratings are based on the worst-case scenario and when the impacts of all aspects of the Project are taken together, i.e. the WEF and the OHPL. It is anticipated that visual impacts could result from the activities and infrastructure in all the Project phases i.e. construction, operational, and closure.

The method used for the assessment of potential impacts is set out in Appendix C. This assessment methodology enables the assessment of environmental impacts including cumulative impacts. Referring to the discussions in previous sections, a high-level identification of potential visual impacts is predicted. The estimated timeframe for the construction phase is eighteen months and the operational phase is approximately 20 – 25 years. The construction and decommissioning phases are estimated to be eighteen months. The full extent of these impacts will, however, be identified and rated in the Assessment Phase of the ESIA.

The significance of potential impacts could be reduced to some degree, should the proposed mitigation options listed in Section 10 be rigorously applied and managed throughout the life of the Project.

Tables 5, 6 and 7 below summarise the potential visual impact for all phases of the project.

We only assessing the preferred option

Table 5.1: WEF High Level Visual Impact Table for *CONSTRUCTION PHASE*

Impact Phase: Construction							
Potential impact description: Visual Impact Change of the landscape characteristics and key views i.e. visual intrusion and flicker effect.							
	Severity [8]	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Low	Negative	High	Medium	Medium
With Mitigation	Medium	Medium	Low	Neutral	High	Medium	Medium
Can the impact be reversed?			YES – by removing the infrastructure and rehabilitating the disturbed area				
Will impact cause irreplaceable loss or resources?			No – the resource will be returned to almost its original state after rehabilitation				
Can impact be avoided, managed, or mitigated?			No – the impact is highly visible, and it is not possible to significantly reduce the visibility of these structures				
• Limit area of disturbance for turbine footprint, access roads and construction camp or sites • Suppress dust during construction. • Site turbines at least 2 km from any occupied homestead hospitality/tourism facility, where possible. • Mitigation will already have been implemented by the placement of turbines according to distance from visual receptors. • Limit area of disturbance for access roads, substations and construction camp sites • Locate construction camps and all related facilities such as stockpiles, lay-down areas, batching plants in areas already impacted such as existing farmyards or in unobtrusive locations away from the main visual receptors. • Limit access tracks for construction and maintenance vehicles to existing roads where possible. Once established do not allow random access through the veld. • Suppress dust during construction. • Blend edges of road and platforms with surrounding landscape • Rehabilitate exposed disturbed areas. • Avoid vegetation stripping in straight lines but rather non-geometric shapes that blend with the landscape. • Limit need for security lighting. • Use non-reflective materials. • Paint all other project infrastructure elements such as operational buildings, support poles etc. a dark colour. • Avoid bright colour/patterns and logos.							
Residual impact	*Medium significance after mitigation*						

[8] High severity (Visual perspective)

- Has a substantial negative effect on the visual quality of the landscape.
- Contrasts dramatically with the patterns or elements that define the structure of the landscape
- Contrasts dramatically with land use, settlement, or enclosure patterns.

Is unable to be 'absorbed' into the landscape.

Table 5.2: OHPL High Level Visual Impact Table for *CONSTRUCTION PHASE*

Impact Phase: Construction							
Potential impact description: Visual Impact Change of the landscape characteristics and key views i.e. visual intrusion. Note that the worst case scenario is rated here, i.e. the eastern section of the powerline which is not routed in an existing corridor.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Low	Negative	High	Medium	Medium
With Mitigation	Medium	Medium	Low	Neutral	High	Medium	Medium
Can the impact be reversed?			YES – by removing the infrastructure and rehabilitating the disturbed area				
Will impact cause irreplaceable loss or resources?			No – the resource will be returned to almost its original state after rehabilitation				
Can impact be avoided, managed, or mitigated?			No – the impact is highly visible, and it is not possible to significantly reduce the visibility of these structures				
• Limit area of disturbance for access roads, and construction camp sites • Locate construction camps and all related facilities such as stockpiles, lay-down areas, batching plants in areas already impacted such as existing farmyards or in unobtrusive locations away from the main visual receptors. • Limit access tracks for construction and maintenance vehicles to existing roads where possible. Once established do not allow random access through the veld • Suppress dust during construction. • Blend edges of road and platforms with surrounding landscape • Rehabilitate exposed disturbed areas • Avoid vegetation stripping in straight lines but rather non-geometric shapes that blend with the landscape • Limit need for security lighting • Use non-reflective materials • Paint all other project infrastructure elements such as operational buildings, support poles etc. a dark colour • Avoid bright colour/patterns and logos							
Residual impact	*Medium significance after mitigation*						

Table 6.1: WEF High Level Visual Impact Table for *OPERATIONAL PHASE*

Impact Phase: Operation							
Potential impact description: Visual Impact Change of the landscape characteristics and key views i.e. visual intrusion and flicker effect.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	High	Medium	Negative	High	High	High
With Mitigation	High	High	Medium	Negative	High	High	High
Can the impact be reversed?			YES – by removing the infrastructure and rehabilitating the disturbed area				
Will impact cause irreplaceable loss or resources?			No – the resource will be returned to almost its original state after rehabilitation				
Can impact be avoided, managed, or mitigated?			No – the impact is highly visible, and it is not possible to significantly reduce the visibility of these structures				

• Mitigation will already have been implemented by the placement of turbines according to distance from visual receptors. • Manage need for top of turbine red hazard lighting to only when a plane enters the affected airspace rather than be permanently lit. • Limit need for security lighting. • Use non-reflective materials. • Paint all other project infrastructure elements such as operational buildings, support poles etc. a dark colour. • Avoid bright colour/patterns and logos. • Maintain rehabilitated disturbed areas.

Residual impact	*Medium significance after mitigation – explain lights*

Table 6.2: OHPL High Level Visual Impact Table for *OPERATIONAL PHASE*

Impact Phase: Operation							
Potential impact description: Visual Impact Change of the landscape characteristics and key views i.e. visual intrusion.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Medium	Negative	High	Medium	High
With Mitigation	Medium	Medium	Medium	Negative	High	Medium	High
Can the impact be reversed?			YES – by removing the infrastructure and rehabilitating the disturbed area				
Will impact cause irreplaceable loss or resources?			No – the resource will be returned to almost its original state after rehabilitation				
Can impact be avoided, managed, or mitigated?			No – the impact is highly visible and it is not possible to significantly reduce the visibility of these structures				
• Maintain rehabilitated disturbed areas							
Residual impact	*Medium significance after mitigation – explain lights*						

Table 7.1: WEF High Level Visual Impact Table for the Decommissioning Phase

Impact Phase: Decommissioning							
Potential impact description: Visual Impact Change of the landscape characteristics and key views i.e. visual intrusion and flicker effect.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Medium	Negative	High	Medium	Medium
With Mitigation	Medium	Medium	Medium	Neutral	High	Medium	Medium
Can the impact be reversed?			YES – by removing the infrastructure and rehabilitating the disturbed area				
Will impact cause irreplaceable loss or resources?			No – the resource will be returned to almost its original state after rehabilitation				
Can impact be avoided, managed, or mitigated?			Yes – the structures are no longer visible and all disturbed land will be rehabilitated.				
Mitigation measures to reduce residual risk or enhance opportunities:							

• Remove all project components from site • Rip all compacted hard surfaces such as platforms, words areas, access and service roads etc. and reshape to blend with the surrounding landscape • Rehabilitate/revegetate all disturbed areas to visually the original state by shaping and planting	
Residual impact	*Minor but generally none (The rehabilitated areas might not be visually compatible with the existing surrounding vegetation).*

Table 7.2: OHPL High Level Visual Impact Table for the Decommissioning Phase

Impact Phase: Decommissioning							
Potential impact description: Visual Impact Change of the landscape characteristics and key views i.e. visual intrusion.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Low	Low	Negative	High	Low	Medium
With Mitigation	Medium	Low	Low	Neutral	High	Low	Medium
Can the impact be reversed?			YES – by removing the infrastructure and rehabilitating the disturbed area				
Will impact cause irreplaceable loss or resources?			No – the resource will be returned to almost its original state after rehabilitation				
Can impact be avoided, managed, or mitigated?			Yes – the structures are no longer visible and all disturbed land will be rehabilitated				
Mitigation measures to reduce residual risk or enhance opportunities: • Remove all project components from site • Rip all compacted hard surfaces such as platforms, words areas, access and service roads etc. and reshape to blend with the surrounding landscape • Rehabilitate/revegetate all disturbed areas to visually the original state by shaping and planting							
Residual impact	*Minor but generally none (The rehabilitated areas might not be visually compatible with the existing surrounding vegetation).*						

8.6.1 Construction Phase

WEF

Construction activities include the removal of vegetation, earthworks required to create building terraces for internal substations and preparation of the internal roads as well as excavations for the turbine structures foundations associated infrastructure and the clearing of vegetation for access roads. Construction activities would potentially negatively affect the landscape's visual quality and sense of place relative to its baseline. They would contrast with the patterns that define the structure of the landscape.

The impact on the visual environment during the construction phase is assessed to have a potential *medium severity* over a *local area* (but extend beyond the site boundary to at least at 8,0km) and would occur over the *short-term* (less than five years) resulting in a *medium consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as MEDIUM. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain MEDIUM**.**

OHPL

Construction activities include the removal of vegetation, earthworks required to create building terraces for internal substations and the clearing of vegetation and preparation for access roads. Construction activities would potentially negatively affect the landscape's visual quality and sense of place relative to its baseline. They would contrast with the patterns that define the structure of the landscape.

The impact on the visual environment during the construction phase is assessed to have a potential *medium severity* over a *local area* (but extend beyond the site boundary to at least at 5,0km) and would occur over the *short-term* (less than five years) resulting in a *medium consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as MEDIUM. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain MEDIUM

8.6.2 Operational Phase

WEF

Operational activities include the regular maintenance of the wind turbines, vegetation management under and around the structures and maintenance of all other infrastructural components. Security lighting, aviation hazard flashing lights, and other lighting associated with the movement of security vehicles at night. These activities along with the physical presence of the Project components day and night, constitute the visual impact.

The worst-case impact on the visual environment during the operational phase is assessed to have a *high severity* over a *widespread area* and would occur over the *medium-term* (anticipated to be twenty five to twenty-five years) resulting in a *high consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as HIGH. The significance of a high impact is that it would have an influence on the decision, and the impact would be unacceptable unless it is effectively mitigated. Mitigation measures are feasible (specifically with regards night lighting and the location of turbines to avoid flicker on affected residential locations) and can reduce the visual impact over time. The impact with mitigation is predicted to reduce slightly by would remain MEDIUM.

OHPL

Operational activities include the maintenance of the access roads and pylons, and vegetation management and maintenance under and around the transmission lines and other infrastructural components such as substations. These activities along with the physical presence of the Project components, constitute the visual impact.

The worst-case impact on the visual environment during the operational phase is assessed to have a *medium severity* over a regional *area* and would occur over the *medium-term* (anticipated to be thirty years) resulting in a *medium consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as MEDIUM. The significance of a moderate impact is that it could have an influence on the decision, and the impact will not be avoided unless it is mitigated. Mitigation measures are feasible and can reduce the visual impact over time. The impact with mitigation is predicted to reduce slightly by would remain MEDIUM.

8.6.3 Decommissioning Phase

WEF

Decommissioning and closure activities include the dismantling and removal of infrastructure and the rehabilitation of the site back to its current, mostly natural, state.

The impact on the visual environment during this phase is assessed to have a *medium intensity* over a *local area* and would occur over the *short-term* (less than five years) resulting in a *low consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as MEDIUM. The implementation of mitigation measures would reduce the anticipated impact, but it would remain MEDIUM.

OHPL

Decommissioning and closure activities include the dismantling and removal of infrastructure and the rehabilitation of the site back to its current, mostly natural, state.

The impact on the visual environment during this phase is assessed to have a *medium intensity* over a *local area* and would occur over the *short-term* (less than five years) resulting in a *low consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as MEDIUM. The implementation of mitigation measures would reduce the anticipated impact, but it would remain MEDIUM.

9. MANAGEMENT MEASURES

In considering mitigating measures, three rules are considered - the measures should be feasible (economically), effective (how long will it take to implement and what provision is made for management/maintenance) and acceptable (within the framework of the existing landscape and land use policies for the area).

The following generic mitigation measures are suggested for the Project and should be included in the Environmental Management Plan Report (EMPr). The following general actions are recommended:

9.1 Planning and site development

- With the preparation of the land within the full extent of the Project site(s) onto which activities will take place, the minimum amount of existing vegetation and topsoil should be removed.
- Specifications with regards to the placement of construction camps (if required), as well as a site plan of the construction camp, indicating waste areas, storage areas and placement of ablution facilities, should be included in the EMPr. These areas should either be screened or positioned in areas where they would be less visible from the public road north of the Project site.
- When possible, construction activities should be limited to between 08:00 and 17:00 or in conjunction with the ECO and neighbours of the Project site.
- Adopt responsible construction practices that strictly contain the construction/establishment activities to demarcated areas.
- Building or waste material discarded should be undertaken at an authorised location, which should not be within any sensitive areas.

9.2 Earthworks and vegetation

- The mitigation measures during operation will need to focus on effective rehabilitation of the construction area. These specifications must be explicit and detailed and included in the contract documentation (Environmental Management Plan) so that the tasks can be costed and monitored for compliance and result.
- It is recommended that that a suitably qualified person, such as a landscape architect, is appointed to give attention to the concept and design of the aesthetic aspects of the project during the detailed design phase of the project prior to construction to integrate the design especially the shape of the cut and fill slopes with the surrounding landscape to ensure that the project blends in physically and aesthetically with the environment. The cut and fill slopes should not be steeper than 1:2.5 vertical to horizontal as this allows vegetation to establish more easily. This will also reduce erosion of the soil surface.
- Earthworks should be executed so that only the footprint and a small 'construction buffer zone' around the proposed activities are exposed. In all other areas, the naturally occurring vegetation should be retained.

- A detailed landscape and rehabilitation plan should be developed timeously by the landscape architect. The general landscaping shall reflect the existing surrounding landscape. Shape and blend edges of roads and platforms with surrounding landscape
- All cut and fill slopes (if any) and areas affected by construction work should be progressively top soiled and re-vegetated as soon as possible.
- Disturbed soil must be exposed for the minimum time possible once cleared of vegetation to avoid prolonged exposure to wind and water erosion and to minimise dust generation.

9.3 Structures and associated infrastructure

- Paint all structures with colours that reflect and compliment the colours of the surrounding landscape – avoid shiny materials.
- The colour of the components of the project components will make a difference to the visual fit of the project into the landscape and setting.
- Tones and tints of selected complementary colours that fit the setting should be considered.
- Subdued and complimentary natural shades and tints blend easily into a landscape setting.
- Vivid primary or bright or reflective colours or surfaces will accentuate the visual presence of the development and should be avoided.

9.4 Good housekeeping

- "Housekeeping" procedures should be developed for the Project to ensure that the project site and lands adjacent to it are kept clean of debris, garbage, graffiti, fugitive trash, or waste generated on-site; procedures should extend to control of "track out" of dirt on vehicles leaving the active construction site and controlling sediment in stormwater runoff.
- During construction, temporary fences surrounding the material storage yards and laydown areas should be covered with 'shack' cloth (khaki coloured) or shade cloth.
- Operating facilities should be actively maintained during operation.

9.5 Lighting

- As night lighting during both construction and operation is one of the more objectionable forms of visual impact, it is important that selective and sensitive location and design of the lighting requirements for the construction camp and the sub-station are developed. For instance, reduce the height from which floodlights are fixed and identify zones of high and low lighting requirements with the focus of the lights being inward, rather than outward.
- Light pollution is largely the result of bad lighting design, which allows artificial light to shine outward and upward into the sky, where it is not wanted, instead of focusing the light downward, where it is needed. Ill designed lighting washes out the darkness of the night sky and radically alters the light levels in rural areas where light sources shine as 'beacons' against the dark sky and are generally not wanted.

- Of all the pollutions faced, light pollution is perhaps the most easily remedied. Simple changes in lighting design and installation yield immediate changes in the amount of light spilled into the atmosphere. The following are measures that must be considered in the lighting design of the Project, particularly at the management and service platforms:

- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the site i.e. lights are to be aimed away from adjacent roads and residential areas.

- Minimize the number of light fixtures to the bare minimum, including security lighting.

- Avoid high pole top security lighting along the periphery of the site and at the substation and BESS areas, and use only lights activated on illegal entry to the site.

- It is a requirement by Civil Aviation that a red hazard flashing navigation light be installed on top of each turbine. To minimise this visual intrusion, the use of AVWS (Audio Visual Warning System) technology should be investigated.

9.6 Shadow Flicker

- Avoid locating any of the turbines within 2km of a residence to limit the effect of shadow flicker.

10 CUMULATIVE EFFECT

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect how the landscape is experienced, and cumulative effects may be positive or negative. Where they comprise a range of benefits, they may form part of the mitigation measures.

10.1 The cumulative effect of the Project

Cumulative effects can also arise from the intervisibility of a range of developments and the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual developments may not be significant, but they may adversely impact visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, vegetative cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions (LI-IEMA (2013)). Table 8 summarises the cumulative effect of the Project along with the two proposed WEF and associated OHLs which makes up the cluster development. It also considers existing power infrastructure.

Table : 8.1 WEF High Level Visual Impact Table for the Cumulative Effect

Impact Phase: Cumulative							
Potential impact description: Visual Impact Change of the landscape characteristics and key views i.e. visual intrusion and flicker effect.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation / Enhancement	High	High	Medium	Negative	High	High	Medium
With Mitigation / Enhancement	High	High	Medium	Negative	High	High	Medium
Can the impact be reversed?			NO because all existing physical elements will remain				
Will impact cause irreplaceable loss or resources?			NO but will be a loss				
Can impact be avoided, managed, or mitigated?			NO but can be managed at night by managing the red hazard lights in top of the turbines to be not continuous.				
•							
Residual impact	*Yes, but would reduce once the turbine sand associated infrastructure is removed and revert to the back to the current cumulative infrastructure consisting of transmission lines, power station, etc.*						

The cumulative impact of the Project is <u>HIGH.</u> The Emvelo WEF will be seen together with the other two proposed WEF's (Rochdale and Sheepmoor) that are planned. These, together with the proposed new transmission power lines running south and through the study area, as well as the existing Camdon power station and powerlines, contribute to the cumulative effect of power infrastructure in the sub-region (see Figure 7 Cumulative Effect).

The combined effect of proposed WEF project and the existing power infrastructure and associated infrastructure would cause a major change the nature, sense of study and character of the sub-region's landscape's baseline.

The significance of the cumulative impact of these projects on the visual environment during their operational phases is assessed to have a *high severity* and over the *medium-term* resulting in a *high consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as HIGH. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain HIGH.

Table : 8.2 OHPL High Level Visual Impact Table for the Cumulative Effect

Impact Phase: Cumulative							
Potential impact description: Visual Impact Change of the landscape characteristics and key views i.e. visual intrusion.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation / Enhancement	High	High	Medium	Negative	High	High	Medium
With Mitigation / Enhancement	High	High	Medium	Negative	High	High	Medium
Can the impact be reversed?		NO because all existing physical elements will remain					
Will impact cause irreplaceable loss or resources?		NO but will be a loss					
Can impact be avoided, managed, or mitigated?		NO The impact will remain.					
•							
Residual impact	*Yes, but would reduce once the powerlines and associated infrastructure is removed and revert to the back to the current cumulative infrastructure consisting of transmission lines, power station, etc.*						

The cumulative impact of the Project is HIGH. The Emvelo WEF and OHPL will be seen together with the other two proposed WEF's (Rochdale and Sheepmoor) that are planned as well against existing powerlines that occur within the viewshed. These, together with the proposed new transmission power line running south and west through the study area, as well as the existing Camdon Power Station and powerlines, contribute to the cumulative effect of power infrastructure in the sub-region (see Figure 7 Cumulative Effect).

The combined effect of proposed WEF and OHPL project and the existing power infrastructure and associated infrastructure would cause a major change the nature, sense of study and character of the sub-region's landscape's baseline.

The significance of the cumulative impact of these projects on the visual environment during their operational phases is assessed to have a *high severity* and over the *medium-term* resulting in a *high consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as HIGH. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain HIGH.

10.2 Plan of Study Assessment Phase

The significance of these high level impacts must be further investigated and rated in the Assessment Phase of the ESIA using computer modelling techniques that establish visibility (viewshed analyses), flicker shadow and visual intrusion using simulations representative of Project activities. The results of the I&AP process will also be known, which will establish receptor sensitivity to the Project.

The following issues will be addressed:

- Establish/confirm public concern for the Emvelo WEF Project, specifically as it concerns visual issues
- Confirm the visibility and visual intrusion of project activities using computer modelling techniques (viewshed analyses and photomontage simulations and flicker analysis)
- Establish specific management measures (mitigation) to reduce the anticipated impact of the Project where appropriate.

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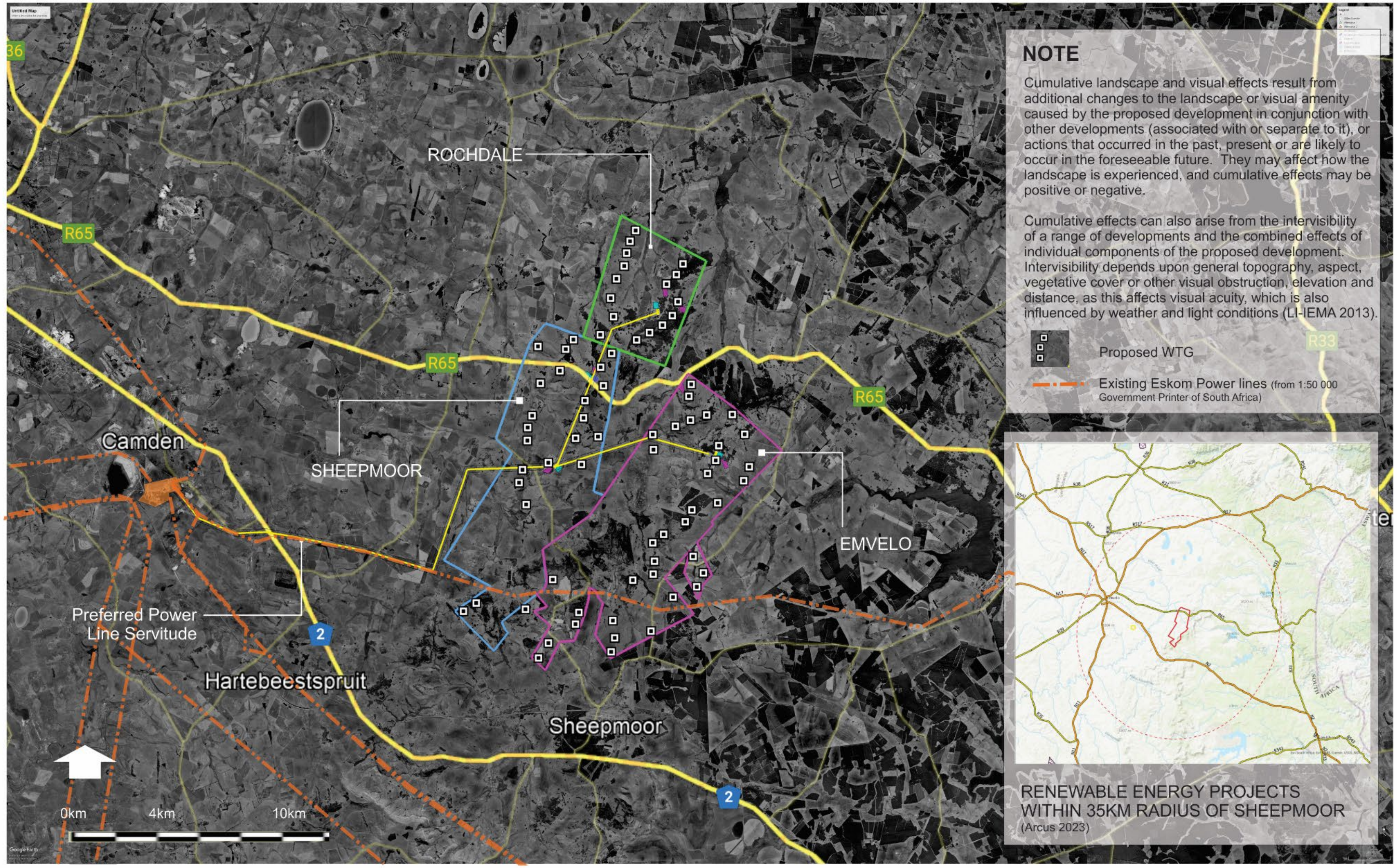

Figure 07: CUMULATIVE EFFECT - Mulilo WEF Projects

11 CONCLUSION

The existing visual condition of the landscape that may be affected by the proposed Emvelo WEF and associated OHPL has been described. The study area's scenic quality has been rated *high* to *low* within the context of the sub-region. The Project site is in a *moderate* rated landscape type. Sensitive viewing areas and landscape types have been identified and mapped, indicating potential sensitivity to the Project, mainly for users of the farmsteads, settlements and towns and the R65 and the N2 roads.

Impacts on views are the highest when viewers are sensitive to change in the landscape, and the view is focused on and dominated by the change. The Project's visual impact will cause moderate changes in the landscape that are noticeable to people viewing the Project.

Construction activities include the removal of vegetation, earthworks required to create building terraces for turbines and the preparation of the internal roads. Construction activities would negatively affect the landscape's visual quality and sense of place relative to its baseline. They would contrast with the patterns that define the structure of the immediate landscape and cause a significant change over a local to regional area, resulting in a moderate change to key views. However, the greatest impact would be on the site itself. Mitigation measures are minimal with the greatest effect only at night.

Operational activities include the regular cleaning and maintenance, vegetation management under and around the turbines and powerline servitudes as well as maintenance of all other infrastructural components. Security lighting and other lighting associated with the movement of security vehicles at night. These activities along with the physical presence of the Project components day and night, constitute the visual impact.

Decommissioning and closure activities include the dismantling and removal of all infrastructure and the rehabilitation of the site back to its current, mostly natural, state.

11.1 Significance of Visual Impact

The significance of impact is based on the worst-case scenario and all project components taken together.

11.1.1 Construction phase

The impact on the visual environment during the construction phase is assessed to have a potential *medium severity* over a *local area* (but extend beyond the site boundary to at least at 8,0km) and would occur over the *short-term* (less than five years) resulting in a *medium consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as MEDIUM. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain MEDIUM.

11.1.2 Operational Phase

The worst-case impact on the visual environment during the operational phase is assessed to have a *high severity* over a *widespread area* and would occur over the *medium-term* resulting in a *high consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as HIGH. The significance of a high impact is that it would have an influence on the decision, and the project could cause unacceptable impacts that will not be avoided unless mitigated is effectively applied and managed in the long term. Mitigation measures are feasible and can reduce the visual impact over time. The impact with mitigation is predicted to reduce to MEDIUM.

11.1.3 Decommissioning Phase

The impact on the visual environment during this phase is assessed to have a *medium intensity* over a *local area* and would occur over the *short-term* (less than five years) resulting in a *low consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as MEDIUM. The implementation of mitigation measures would reduce the anticipated impact, but it would remain MEDIUM**.**

11.2 Cumulative Effects

The significance of the cumulative impact of these projects on the visual environment during their operational phases is assessed to have a *high severity* and over the *medium-term* resulting in a *high consequence*. The probability of the unmitigated impact is *high* resulting in a predicted significance of impact as HIGH. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain HIGH.

The significance of these impacts will be further investigated and rated in the Assessment Phase of the ESIA using computer modelling techniques that establish visibility (viewshed analyses) and visual intrusion using simulations representative of Project activities.

****GYLA****

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APPENDIX A: DETERMINING THE VISUAL RESOURCE VALUE OF A LANDSCAPE

To reach an understanding of the effect of development on a landscape resource, it is necessary to consider the distinct aspects of the landscape as follows:

Landscape Elements and Character

The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, savannah, trees, water bodies, buildings and roads are generally quantifiable and can be easily described.

Landscape character is therefore the description of pattern, resulting from combinations of natural (physical and biological) and cultural (land use) factors and how people perceive these. The visual dimension of the landscape reflects the way in which these factors create repetitive groupings and interact to create areas that have a specific visual identity. The process of landscape character assessment can increase appreciation of what makes the landscape distinctive and what is important about an area. The description of landscape character thus focuses on the *nature of the land*, rather than the response of a viewer.

Landscape Value – all encompassing (Aesthetic Value)

Aesthetic value is the emotional response derived from the experience of the environment with its natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes (Ramsay 1993). Thus, aesthetic value encompasses more than the seen view, visual quality or scenery, and includes atmosphere, landscape character and sense of place (Schapper 1993).

Aesthetic appeal (value) is considered high when the following are present (Ramsay 1993):

- *Abstract qualities*: such as the presence of vivid, distinguished, uncommon or rare features or abstract attributes.
- *Evocative responses*: the ability of the landscape to evoke particularly strong responses in community members or visitors.
- *Meanings*: the existence of a long-standing special meaning to a particular group of people or the ability of the landscape to convey special meanings to viewers in general.
- *Landmark quality*: a particular feature that stands out and is recognised by the broader community.

Sense of Place

Central to the concept of a sense of place is that the place requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations and traditions associated with historic use and habitation. According to Lynch (1992) sense of place "is the extent to which a person can recognise or recall a place as being distinct from other places - as having a vivid, or unique, or at least particular, character of its own". Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. In some cases, these values allocated to the place are similar for a wide spectrum of users or viewers, giving the place a universally recognised and therefore, strong sense of place.

Scenic Quality

Assigning values to visual resources is a subjective process. The phrase, "beauty is in the eye of the beholder," is often quoted to emphasise the subjectivity in determining scenic values. Yet, researchers have found consistent levels of agreement among individuals asked to evaluate visual quality.

Studies for perceptual psychology have shown human preference for landscapes with a higher visual complexity particularly in scenes with water, over homogeneous areas. Based on contemporary research landscape quality increases when:

- Topographic ruggedness and relative relief increase.
- Where water forms are present.
- Where diverse patterns of grasslands and trees occur.
- Where natural landscape increases and man-made landscape decreases.
- And where land use compatibility increases, and land use edge diversity decreases (Crawford 1994).

Scenic Quality - Explanation of Rating Criteria:

(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

Landform: Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured. Outstanding landforms may be monumental, as the Fish River or Blyde River Canyon, the Drakensberg or other mountain ranges, or they may be exceedingly artistic and subtle as certain pinnacles, arches, and other extraordinary formations.

Vegetation: (Plant communities) Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular (wildflower displays in the Karoo regions). Consider also smaller scale vegetational features, which add striking and intriguing detail elements to the landscape (e.g., gnarled or wind beaten trees, and baobab trees).

Water: That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.

Colour: Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast, and harmony.

Adjacent Scenery: Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range from 0-8 kilometres, depending upon the characteristics of the topography, the vegetative cover, and other such factors. This factor is generally applied to units which would normally rate extremely low in score, but the influence of the adjacent unit would enhance the visual quality and raise the score.

Scarcity: This factor provides an opportunity to give added importance to one or all the scenic features that appear to be relatively unique or rare within one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is several not so spectacular elements in the proper combination that produces the most pleasing and memorable scenery - the scarcity factor can be used to recognise this type of area and give it the added emphasis it needs.

Cultural Modifications: Cultural modifications in the landform / water, vegetation, and addition of structures should be considered and may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit.

Scenic Quality Inventory and Evaluation Chart

(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

Key factors	Rating Criteria and Score		
Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations including major Badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers. **5**	Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or detail features which are interesting though not dominant or exceptional. **3**	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features. **1**
Vegetation and landcover	A variety of vegetative types as expressed in interesting forms, textures, and patterns. **5**	Some variety of vegetation, but only one or two major types. **3**	Little or no variety or contrast in vegetation. **1**
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. **5**	Flowing, or still, but not dominant in the landscape. **3**	Absent, or present, but not noticeable. **0**
Colour	Rich colour combinations, variety, or vivid colour; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. **5**	Some severity or variety in colours and contrast of the soil, rock, and vegetation, but not a dominant scenic element. **3**	Subtle colour variations, contrast, or interest; generally mute tones. **1**
Influence of adjacent scenery	Adjacent scenery greatly enhances visual quality. **5**	Adjacent scenery moderately enhances overall visual quality. **3**	Adjacent scenery has little or no influence on overall visual quality. **0**
Scarcity	One of a kind; or unusually memorable, or exceedingly rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. National and provincial parks and conservation areas *** 5+**	Distinctive, though somewhat like others within the region. **3**	Interesting within its setting, but common within the region. **1**

Cultural modifications	Modifications add favourably to visual variety while promoting visual harmony. **2**	Modifications add little or no visual variety to the area and introduce no discordant elements. **0**	Modifications add variety but are very discordant and promote strong disharmony. **4**

Scenic Quality (i.e. value of the visual resource)

In determining the quality of the visual resource both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is very high.

When considering both objective and subjective factors associated with the landscape there is a balance between landscape character and individual landscape features and elements, which would result in the values as follows:

Value of Visual Resource – expressed as Scenic Quality
(After The Landscape Institute with the Institute of Environmental Management and Assessment (2002))

High	**Moderate**	**Low**
Areas that exhibit an incredibly positive character with valued features that combine to give the experience of unity, richness, and harmony. These are landscapes that may be of particular importance to conserve, and which may be sensitive change in general and which may be detrimental if change is inappropriately dealt with.	Areas that exhibit positive character, but which may have evidence of alteration to /degradation/erosion of features resulting in areas of more mixed character. Potentially sensitive to change in general; again, change may be detrimental if inappropriately dealt with, but it may not require special or particular attention to detail.	Areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.

APPENDIX B: METHOD FOR DETERMINING THE *MAGNITUDE / INTESITY* OF LANDSCAPE AND VISUAL IMPACT

A visual impact study analysis addresses the importance of the inherent aesthetics of the landscape, the public value of viewing the natural landscape, and the contrast or change in the landscape from the Project.

For some topics, such as water or air quality, it is possible to use measurable, technical international or national guidelines or legislative standards, against which potential effects can be assessed. The assessment of likely effects on a landscape resource and on visual amenity is more complex, since it is determined through a combination of quantitative and qualitative evaluations. (The Landscape Institute with the Institute of Environmental Management and Assessment (2002).

Landscape impact assessment includes a combination of objective and subjective judgements, and it is therefore important that a structured and consistent approach is used. It is necessary to differentiate between judgements that involve a degree of subjective opinion (as in the assessment of landscape value) from those that are normally more objective and quantifiable (as in the determination of magnitude of change). Judgement should always be based on training and experience and be supported by clear evidence and reasoned argument. Accordingly, suitably qualified and experienced landscape professionals carry out landscape and visual impact assessments (The Landscape Institute with the Institute of Environmental Management and Assessment (2002),

Landscape and visual assessments are separate, although linked, procedures. The landscape baseline, its analysis and the assessment of landscape effects all contribute to the baseline for visual assessment studies. The assessment of the potential effect on the landscape is carried our as an effect on an environmental resource, i.e. the landscape. Visual effects are assessed as one of the interrelated effects on population.

Landscape Impact

Landscape impacts derive from changes in the physical landscape, which may give rise to changes in its character and from effects to the scenic values of the landscape. This may in turn affect the perceived value ascribed to the landscape. The description and analysis of effects on a landscape resource relies on the adoption of certain basic principles about the positive (or beneficial) and negative (or adverse) effects of change in the landscape. Due to the inherently dynamic nature of the landscape, change arising from a development may not necessarily be significant (Institute of Environmental Assessment & The Landscape Institute (2002)).

Visual Impact

Visual impacts relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (caused by the physical presence of a new development) and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the area.

To assess the magnitude of visual impact four main factors are considered.

Visual Intrusion:	The nature of intrusion or contrast (physical characteristics) of a project component on the visual quality of the surrounding environment and its compatibility/discord with the landscape and surrounding land use.
Visibility:	The area/points from which project components will be visible.
Visual exposure:	Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion.
Sensitivity:	Sensitivity of visual receptors to the proposed development

Visual Intrusion / contrast

Visual intrusion deals with the notion of contextualism i.e. how well does a project component fit into the ecological and cultural aesthetic of the landscape as a whole? Or conversely what is its contrast with the receiving environment. Combining landform / vegetation contrast with structure contrast derives overall visual intrusion/contrast levels of high, moderate, and low.

Landform / vegetation contrast is the change in vegetation cover and patterns that would result from construction activities. Landform contrast is the change in landforms, exposure of soils, potential for erosion scars, slumping, and other physical disturbances that would be noticed as uncharacteristic in the natural landscape. Structure contrast examines the compatibility of the proposed development with other structures in the landscape and the existing natural landscape. Structure contrast is typically strongest where there are no other structures (e.g., buildings, existing utilities) in the landscape setting.

Photographic panoramas from key viewpoints before and after development are presented to illustrate the nature and change (contrast) to the landscape created by the proposed development. A computer simulation technique is employed to superimpose a graphic of the development onto the panorama. The extent to which the component fits or contrasts with the landscape setting can then be assessed using the following criteria.

- Does the physical development concept have a negative, positive, or neutral effect on the quality of the landscape?
- Does the development enhance or contrast with the patterns or elements that define the structure of the landscape?
- Does the design of the Project enhance and promote cultural continuity, or does it disrupt it?

The risk of the intrusion / contrast can then be measured in terms of the sensitivity of the affected landscape and visual resource given the criteria listed below. For instance, within an industrial area, a new sewage treatment works may have an insignificant landscape and visual impact; whereas in a *valued* landscape it might be considered to be an intrusive element. (Institute of Environmental Assessment & The landscape Institute (1996)).

Visual Intrusion

High	Moderate	Low	Positive
If the Project: - Has a substantial negative effect on the visual quality of the landscape. - Contrasts dramatically with the patterns or elements that define the structure of the landscape. - Contrasts dramatically with land use, settlement, or enclosure patterns. - Is unable to be 'absorbed' into the landscape.	If the Project: - Has a moderate negative effect on the visual quality of the landscape. - Contrasts moderately with the patterns or elements that define the structure of the landscape. - Is partially compatible with land use, settlement, or enclosure patterns. - Is partially 'absorbed' into the landscape.	If the Project: - Has a minimal effect on the visual quality of the landscape. - Contrasts minimally with the patterns or elements that define the structure of the landscape. - Is mostly compatible with land use, settlement, or enclosure patterns. - Is 'absorbed' into the landscape.	If the Project: - Has a beneficial effect on the visual quality of the landscape. - Enhances the patterns or elements that define the structure of the landscape. - Is compatible with land use, settlement, or enclosure patterns.

Result Notable change in landscape characteristics over an extensive area and/or intensive change over a localised area resulting in major changes in key views.	*Result* Moderate change in landscape characteristics over localised area resulting in a moderate change to key views.	*Result* Imperceptible change resulting in a minor change to key views.	*Result* Positive change in key views.

Visual intrusion also diminishes with scenes of higher complexity, as distance increases, the object becomes less of a focal point (more visual distraction), and the observer's attention is diverted by the complexity of the scene (Hull and Bishop (1988)).

Visibility

A viewshed analysis was carried out to define areas, which contain all possible observation sites from which the development would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1.8m above ground level. Topographic data was captured for the site and its environs at 10 m contour intervals to create the Digital Terrain Model (DTM). The DTM includes features such as vegetation, rivers, roads and nearby urban areas. These features were 'draped' over the topographic data to complete the model used to generate the viewshed analysis. It should be noted that viewshed analyses are not absolute indicators of the level of significance (magnitude) of the impact in the view, but merely a statement of the fact of potential visibility. The visibility of a development and its contribution to visual impact is predicted using the criteria listed below:

Visibility

High	Moderate	Low
Visual Receptors If the development is visible from over half the zone of potential influence, and/or views are mostly unobstructed and/or most viewers are affected.	*Visual Receptors* If the development is visible from less than half the zone of potential influence, and/or views are partially obstructed and or many viewers are affected	*Visual Receptors* If the development is visible from less than a quarter of the zone of potential influence, and/or views are mostly obstructed and/or few viewers are affected.

Visual Exposure

Visual exposure relates directly to the distance of the view. It is a criterion used to account for the limiting effect of increased distance on visual impact. The impact of an object in the foreground (0 – 800m) is greater than the impact of that same object in the middle ground (800m – 5.0 km) which, in turn is greater than the impact of the object in the background (greater than 5.0 km) of a particular scene.

Distance from a viewer to a viewed object or area of the landscape influences how visual changes are perceived in the landscape. Generally, changes in form, line, colour, and texture in the landscape become less perceptible with increasing distance.

Areas seen from 0 to 800m are considered foreground; foliage and fine textural details of vegetation are normally perceptible within this zone.

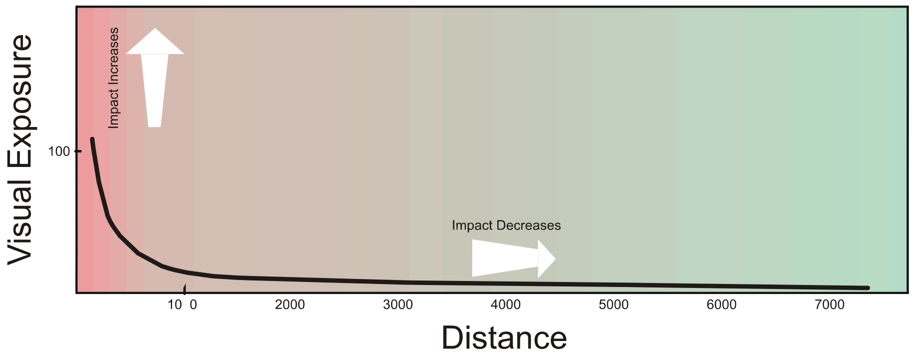
Areas seen from 800m to 5.0km are considered middle ground; vegetation appears as outlines or patterns. Depending on topography and vegetation, middle ground is sometimes considered to be up to 8.0km.

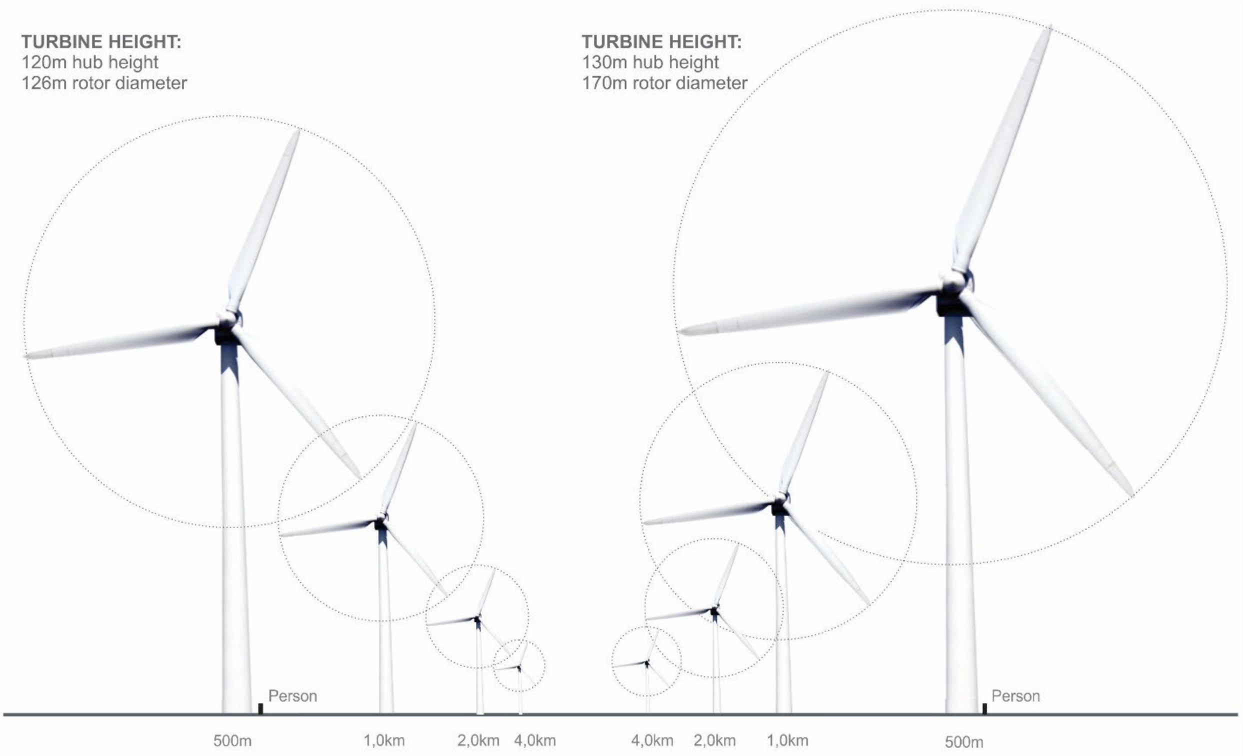
Areas seen from 5.0km to 8.0km and sometimes up to 16km and beyond are considered background. Landforms become the most dominant element at these distances.

Seldom seen areas are those portions of the landscape that, due to topographic relief or vegetation, are screened from the viewpoint or are beyond 16km from the viewpoint. Landforms become the most dominant element at these distances.

The impact of an object diminishes at an exponential rate as the distance between the observer and the object increases. Thus, the visual impact at 1000 m would be 25% of the impact as viewed from 500 m. At 2000 m it would be 10% of the impact at 500 m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (e.g.: Hull and Bishop (1988)) and is used as an important criteria for the study. This principle is illustrated in the Figures below.

Effect of Distance on Visual Exposure





COMPARISON OF TURBINE SIZES_Visual Exposure

Sensitivity of Visual Receptors

When visual intrusion, visibility and visual exposure are incorporated, and qualified by sensitivity criteria (visual receptors) the magnitude of the impact of the development can be determined.

The sensitivity of visual receptors and views will be depended on:

- The location and context of the viewpoint.
- The expectations and occupation or activity of the receptor.
- The importance of the view (which may be determined with respect to is popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in the facilities provided for its enjoyment and references to it in literature or art).

The most sensitive receptors may include:

- Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape.
- Communities where the development results in changes in the landscape setting or valued views enjoyed by the community.
- Occupiers of residential properties with views affected by the development.
- These would all be high.

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value).
- People travelling through or past the affected landscape in cars, on trains or other transport routes.
- People at their place of work.

The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

In this process more weight is usually given to changes in the view or visual amenity which are greater in scale, and visible over a wide area. In assessing the effect on views, consideration should be given to the effectiveness of mitigation measures, particularly where planting is proposed for screening purposes (Institute of Environmental Assessment & The Landscape Institute (1996).

Sensitivity of Visual Receptors

High	Moderate	Low
Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape. Communities where the development results in changes in the landscape setting or valued views enjoyed by the community.	People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value). People travelling through or past the affected landscape in cars, on trains or other transport routes.	The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view (i.e. office and industrial areas).

Occupiers of residential properties with views affected by the development.		Roads going through urban and industrial areas

Magnitude of the Visual Impact

Potential visual impacts are determined by analysing how the physical change in the landscape, resulting from the introduction of a project, are viewed and perceived from sensitive viewpoints. Impacts to views are the highest when viewers are identified as being sensitive to change in the landscape, and their views are focused on and dominated by the change. Visual impacts occur when changes in the landscape are noticeable to viewers looking at the landscape from their homes or from parks, and conservation areas, highways and travel routes, and important cultural features and historic sites, especially in foreground views.

The magnitude of impact is assessed through a synthesis of visual intrusion, visibility, visual exposure and viewer sensitivity criteria. Once the magnitude of impact has been established this value is further qualified with spatial, duration and probability criteria to determine the *significance* of the visual impact.

For instance, the fact that visual intrusion and exposure diminishes significantly with distance does not necessarily imply that the relatively small impact that exists at greater distances is unimportant. The level of impact that people consider acceptable may be dependent upon the purpose they have in viewing the landscape. A particular development may be unacceptable to a hiker seeking a natural experience, or a household whose view is impaired, but may be barely noticed by a golfer concentrating on his game or a commuter trying to get to work on time (Ittleson *et al.,* 1974).

In synthesising these criteria a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful, and should not be used as a substitute for reasoned professional judgement. (Institute of Environmental Assessment and The landscape Institute (1996)).

Severity (Magnitude) of Visual Impact

High	Moderate	Low	Negligible
Total loss of or major alteration to key elements/features/characteristics of the baseline.	Partial loss of or alteration to key elements/features/characteristics of the baseline.	Minor loss of or alteration to key elements/features/characteristics of the baseline.	Very minor loss or alteration to key elements/features/characteristics of the baseline.
I.e. Pre-development landscape or view and/or introduction of elements considered to be totally uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and/or introduction of elements that may be prominent but may not necessarily be substantially uncharacteristic when set within the attributes	I.e. Pre-development landscape or view and/or introduction of elements that may not be uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and/or introduction of elements that are not uncharacteristic with the surrounding landscape – approximating the 'no change' situation.

High scenic quality impacts would result.	of the receiving landscape. Moderate scenic quality impacts would result	Low scenic quality impacts would result.	Negligible scenic quality impacts would result.

Cumulative effects

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect the way in which the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the intervisibility (visibility) of a range of developments and /or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effect on visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions. (Institute of Environmental Assessment and The landscape Institute (1996)).

APPENDIX C: CRITERIA FOR RISK ASSESSMENT METHODOLOGY

The significance of environmental aspects can be determined and ranked by considering the criteria presented in Table 1. In some cases it may be necessary to undertake the impact assessment to determine whether a particular aspect is significant. Therefore, a fair degree of iteration is unavoidable during the assessment process.

Table 1: Criteria used to determine the significance of environmental aspects

Significance Ranking	Negative Aspects	Positive Aspects
H (High)	Will always/often exceed legislation or standards. Has characteristics that could cause significant negative impacts.	Compliance with all legislation and standards. Has characteristics that could cause significant positive impacts.
M (Moderate)	Has characteristics that could cause negative impacts.	Has characteristics that could cause positive impacts.
L (Low)	Will never exceed legislation or standards. Unlikely to cause significant negative impacts.	Will always comply with all legislation and standards. Unlikely to cause significant positive impacts.

SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Where significant environmental aspects are present ("high" or "moderate"), significant environmental impacts ***may*** result. The significance of the impacts associated with the significant aspects can be determined by considering the risk:

Significance of Environmental Impact (Risk) = Probability x Consequence

The consequence of impacts can be described by considering the severity, spatial extent and duration of the impact.

Severity of Impacts

Table 2 presents the ranking criteria that can used to determine the severity of impacts on the bio-physical and socio-economic environment. Table 3 provides additional ranking criteria for determining the severity of negative impacts on the bio-physical environment.

Table 2: Criteria for ranking the *Severity* of environmental impacts

Type of Criteria	Negative			Positive		
	H-	**M-**	**L-**	**L+**	**M+**	**H+**
Qualitative	Substantial deterioration. Death, illness or injury.	Moderate deterioration. Discomfort.	Minor deterioration. Nuisance or minor irritation.	Minor improvement.	Moderate improvement.	Substantial improvement.
Quantitative	Measurable deterioration.		Change not measurable i.e., will remain within current range.		Measurable improvement.	
	Recommended level will often be violated.	Recommended level will occasionally be violated.	Recommended level will never be violated.		Will be within or better than recommended level.	

Community Response	Vigorous community action.	Widespread complaints.	Sporadic complaints.	No observed reaction.	Favorable publicity

Table 3: Criteria for ranking the *Severity* of negative impacts on the bio-physical environment

Environment	Ranking Criteria		
	Low (L-)	**Medium (M-)**	**High (H-)**
Soils and land capability	Minor deterioration in land capability. Soil alteration resulting in a low negative impact on one of the other environments (e.g., ecology).	Partial loss of land capability. Soil alteration resulting in a moderate negative impact on one of the other environments (e.g., ecology).	Complete loss of land capability. Soil alteration resulting in a high negative impact on one of the other environments (e.g., ecology).
Ecology (Plant and animal life)	Disturbance of areas that are degraded, have little conservation value or are unimportant to humans as a resource. Minor change in species variety or prevalence.	Disturbance of areas that have some conservation value or are of some potential use to humans. Complete change in species variety or prevalence.	Disturbance of areas that are pristine, have conservation value or are an important resource to humans. Destruction of rare or endangered species.
Surface and Groundwate r	Quality deterioration resulting in a low negative impact on one of the other environments (ecology, community health etc.)	Quality deterioration resulting in a moderate negative impact on one of the other environments (ecology, community health etc.).	Quality deterioration resulting in a high negative impact on one of the other environments (ecology, community health etc.).

Table 4: Ranking the *Duration* and *Spatial Scale* of impacts

	Ranking Criteria		
	L	**M**	**H**
Duration	Quickly reversible Less than the project life Short-term	Reversible over time Life of the project Medium-	Permanent Beyond closure
Spatial Scale	Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary

Where the severity of an impact varies with distance, the severity should be determined at the point of compliance or the point at which sensitive receptors will be encountered. This position corresponds to the spatial extent of the impact.

Consequence of Impacts

Having ranked the severity, duration and spatial extent, the overall consequence of impacts can be determined using the following qualitative guidelines:

Table 5: Ranking the *Consequence* of an impact

			SEVERIT Y = L		
DURATION	Long-term	**H**			
	Medium-term	**M**			**MEDIUM**
	Short-term	**L**	**LOW**		
			SEVERITY = M		
DURATION	Long-term	**H**			**HIGH**
	Medium-term	**M**		**MEDIUM**	
	Short-term	**L**	**LOW**		
			SEVERITY = H		
DURATION	Long-term	**H**			
	Medium-term	**M**			**HIGH**
	Short-term	**L**	**MEDIUM**		
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary
			SPATIAL SCALE		

To use Table 5, firstly go to one of the three "layers" based on the severity ranking obtained from Table 2 and/ or Table 3. Thereafter determine the consequence ranking by locating the intersection of the appropriate duration and spatial scale rankings.

Overall Significance of Impacts

Combining the consequence of the impact and the probability of occurrence, as shown by Table 6, provides the overall significance (risk) of impacts.

Table 6: Ranking the *Overall Significance* of impacts

PROBABILITY	Definite Continuous	**H**	**MEDIUM**		**HIGH**
	Possible Frequent	**M**		**MEDIUM**	
	Unlikely Seldom	**L**	**LOW**		**MEDIUM**
			L	**M**	**H**
			CONSEQUENCE (from Table 5)		

The overall significance ranking of the negative environmental impacts provides the following guidelines for decision making:

Table 7: Guidelines for decision-making

Overall Significance Ranking	Nature of Impact	Decision Guideline
High	Unacceptable impacts.	Likely to be a fatal flaw.
Moderate	Noticeable impact.	These are unavoidable consequence, which will need to be accepted if the project is allowed to proceed.
Low	Minor impacts.	These impacts are not likely to affect the project decision.

APPENDIX D: CRITERIA FOR PHOTO / COMPUTER SIMULATION

To characterise the nature and magnitude of visual intrusion of the proposed Project, a photographic simulation technique was used. This method was used according to Sheppard (in Lange 1994), where a visual simulation is good quality when the following five criteria are met.

Representativeness:	A simulation should represent important and typical views of a project.
Accuracy:	The similarity between a simulation and the reality after the Project has been realised.
Visual clarity:	Detail, parts and overall contents have to be clearly recognisable.
Interest:	A simulation should hold the attention of the viewer.
Legitimacy:	A simulation is defensible if it can be shown how it was produced and to what degree it is accurate.

To comply with this standard it was decided to produce a stationary or static simulation (Van Dortmont in Lange, 1994), which shows the proposed development from a typical static observation points (Critical View Points).

Photographs are taken on site during a site visit with a manual focus, 50mm focal depth digital camera. All camera settings are recorded and the position of each panoramic view is recorded by means of a GPS. These positions, coordinates are then placed on the virtual landscape (see below).

A scale model of the proposal is built in virtual space, scale 1:1, based on CAD (vector) information as supplied by the architect / designers. This model is then placed on a virtual landscape, scale 1:1, as produced by means of GIS software. The accuracy of this depends on the contour intervals.

The camera views are placed on the points as recorded on the virtual landscape. The respective photographs are overlaid onto the camera views, and the orientation of the cameras adjusted accordingly. The light source is adjusted to suit the view. Each view is then rendered as per the process above.

SOUTH AFRICAN COUNCIL FOR THE LANDSCAPE ARCHITECTURAL PROFESSION

REGISTRATION CERTIFICATE

THIS IS TO CERTIFY THAT

Graham Albert Young

IS REGISTERED AS A

Professional Landscape Architect

In terms of the regulations of Section 19(2)(a) of the Landscape Architectural Profession Act, 2000 (Act No.45 of 2000)

REGISTER PARTICULARS

REGISTRATION NUMBER:	87001
ID NUMBER:	5302235681082
REGISTRATION RENEWAL DATE:	2025-08-01
CERTIFICATE SERIAL NUMBER:	PRCL 2008077
CERTIFICATE DATE OF ISSUE:	2020-08-24

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Mr T. M. Munyai
PRESIDENT

Mrs C. E. Chinga
REGISTRAR

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CONFIRMATION OF GOOD STANDING

Registration Category: **Professional Landscape Architect**
Registration Number: **87001**
Certificate Expiry Date: **2025-07-30**

The South African Council for the Landscape Architectural Profession certifies that:

FULL NAME: **Graham Albert Young**
IDENTITY NUMBER: ****022*568*082**

- Is in good standing with the South African Council for the Landscape Architectural Profession;
- Registration with the South African Council for the Landscape Architectural Profession has not been suspended or cancelled and there are no proceedings pending by SACLAP to cancel or suspend his/her registration with SACLAP;
- In terms of Section 27(3) of the Act, a Registered Person must comply with the Code of Conduct and failure to do so constitutes improper conduct;
- Please note that only a Registered Person in Good Standing will appear in the database of Registered Persons, which may be accessed on www.saclap.org.za;
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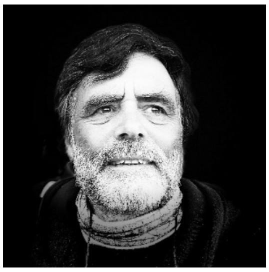

Graham Young PrLArch FILASA

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Graham is a registered landscape architect with interest and experience in landscape architecture, urban design, and environmental planning. He holds a degree in landscape architecture from the University of Toronto and has practiced in Canada and Africa, where he has spent the greater part of his working life. He has served as President of the Institute of Landscape Architects of South Africa (ILASA) and as Vice President of the Board of Control for Landscape Architects.

During his 30 years plus career he has received ILASA and other industry awards. He has published widely on landscape architectural issues and has had projects published both locally and internationally in, scientific and design journals and books. He was a being a founding member of Newtown Landscape Architects and is also a senior lecturer, teaching landscape architecture and urban design at post and undergraduate levels, at the University of Pretoria. He has been a visiting studio critic at the University of Witwatersrand and University of Cape Town and in 2011 was invited to the University of Rhode Island, USA as their Distinguished International Scholar for that year. Recently, Graham resigned from NLA and now practices as a Sole Proprietor.

A niche specialty of his is Visual Impact Assessment for which he was cited with an ILASA Merit Award in 1999. He has completed over 250 specialist reports for projects in South Africa, Canada and other African countries. He was on the panel that developed the *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes* (2005) and produced a research document for Eskom, *The Visual Impacts of Power Line* (2009). In 2011, he produced '*Guidelines for involving visual and aesthetic specialists'* for the Aapravasi Ghat Trust Fund Technical Committee (they manage a World Heritage Site) along with the *Visual Impact Assessment Training Module Guideline Document.*

*** GYLA ***

APPENDIX F: SPECIALIST DECLARATION

HERITAGE SURVEY MULILO EMVELO WEF & OHL

FOR ARCUS & MULILO

DATE: 19 NOVEMBER 2023

By Gavin Anderson & Louise Anderson

Umlando: Archaeological Surveys and Heritage Management

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Phone: 035-7531785 Cell: 0836585362

INDEMNITY AND CONDITIONS RELATING TO THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. Umlando reserves the right to modify aspects of the report including the recommendations if and when new information becomes available from ongoing research or further work in this field or pertaining to this investigation.

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Abbreviations

HP	Historical Period
IIA	Indeterminate Iron Age
LIA	Late Iron Age
EIA	Early Iron Age
ISA	Indeterminate Stone Age
ESA	Early Stone Age
MSA	Middle Stone Age
LSA	Late Stone Age
HIA	Heritage Impact Assessment
PIA	Palaeontological Impact Assessment

INTRODUCTION

Emvelo WEF is proposed to comprise up to 45 turbines with a maximum output capacity of up to 360 MW. The WEF will be located on nineteen (19) land parcels and will have an anticipated lifespan of 20 – 25 years. The final design will be determined and amended based on the outcome of the specialist studies undertaken during the S&EIA process. The proposed turbine footprints and associated facility infrastructure will cover an area of up to 150 ha after rehabilitation, depending on final layout design.

It is proposed that an on-site substation with a capacity up 132 kV and an up to 132 kV Overhead Powerline (OHPL) of approximately 29 km (300 m corridor) in distance, traversing fifteen (15) land parcels, be constructed to connect the proposed WEF to the Eskom Camden Substation.

ASSUMPTIONS AND LIMITATIONS

The main assumptions in the study were:

1. the various features noted in the desktop study would still be visible.
2. The various tracks noted on Google Earth would be accessible via 4x4
3. The black wattle plantations would not hinder access to sites
4. Vegetation would be low and thus site visibility would be good.
5. Wind turbines would not be located on low lying land, and thus not all of these areas required assessment unless affected by transmission lines

The limitations to the study were:

1. Black wattle plantations had exceeded in size as per Google Earth imagery and restricted access to areas. The plantations were at some times impenetrable.
2. Some of the access tracks no longer existed
3. Heavy rains had resulted in dense/tall vegetation. While the desktop and other sites were visible, the details of features were often obscured. This is especially the case for human graves at older settlements.

TERMS OF REFERENCE

The terms of reference for the project are:

- Undertake a desktop study for previous HIA studies in the footprint
- Undertake a desktop study using historical maps and databases for known sites
- Undertake desktop palaeontological survey to note sensitive areas
- Undertake field survey to record heritage sites
- Assess the significance of each heritage site in relation to the type of development
- Suggest mitigation and provide a management plan
- Provide a kml, or shape, file of the recorded sites.
- Provide a significance of impact for each type of site

SENSITIVITY SCREENING

The screening report states that the affected area is of low significance. I disagree with this as there have been no previous surveys in the general area with which the screening tool can compare. Just because an area does not have known sites, does not mean it is of low significance. It means that there have probably been no previous survey heritage.

The survey results indicate the area is of low, medium and high significance.

FIG. 1 GENERAL LOCATION OF THE EMVELO WEF & OHL

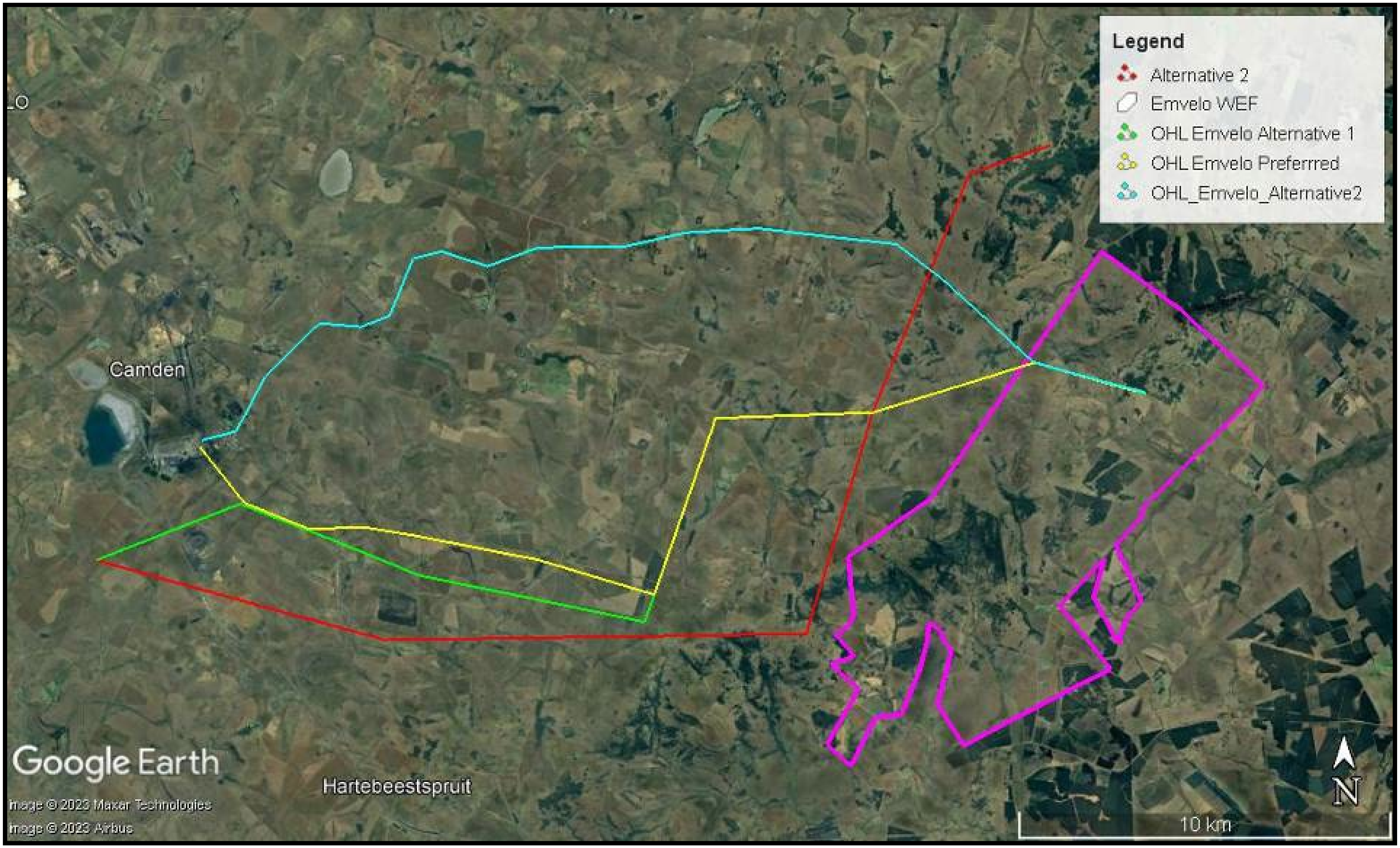


FIG. 2: AERIAL OVERVIEW OF THE EMVELO WEF TURBINE LOCATIONS

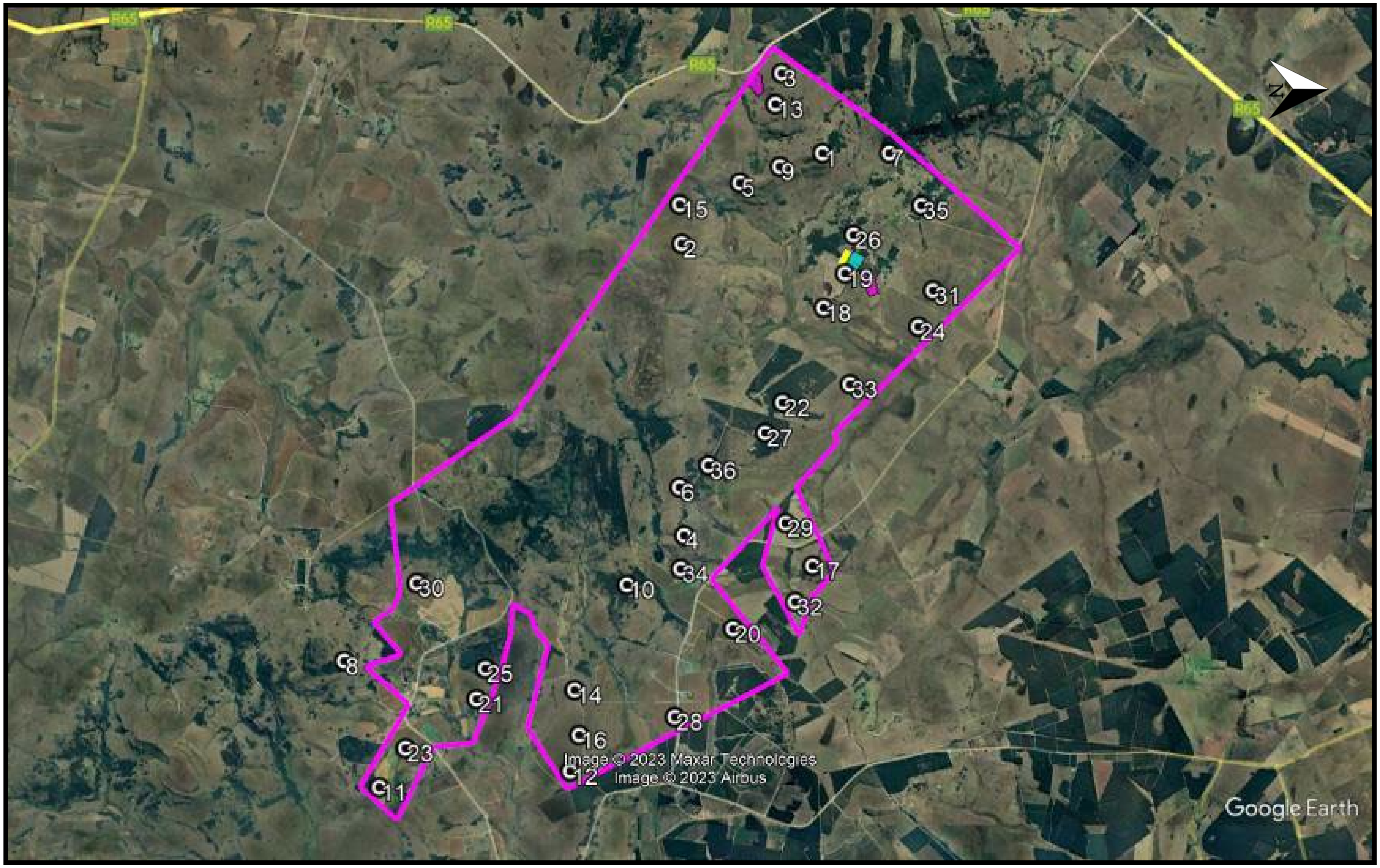


FIG. 3: TOPOGRAPHICAL MAP OF THE EMVELO WEF

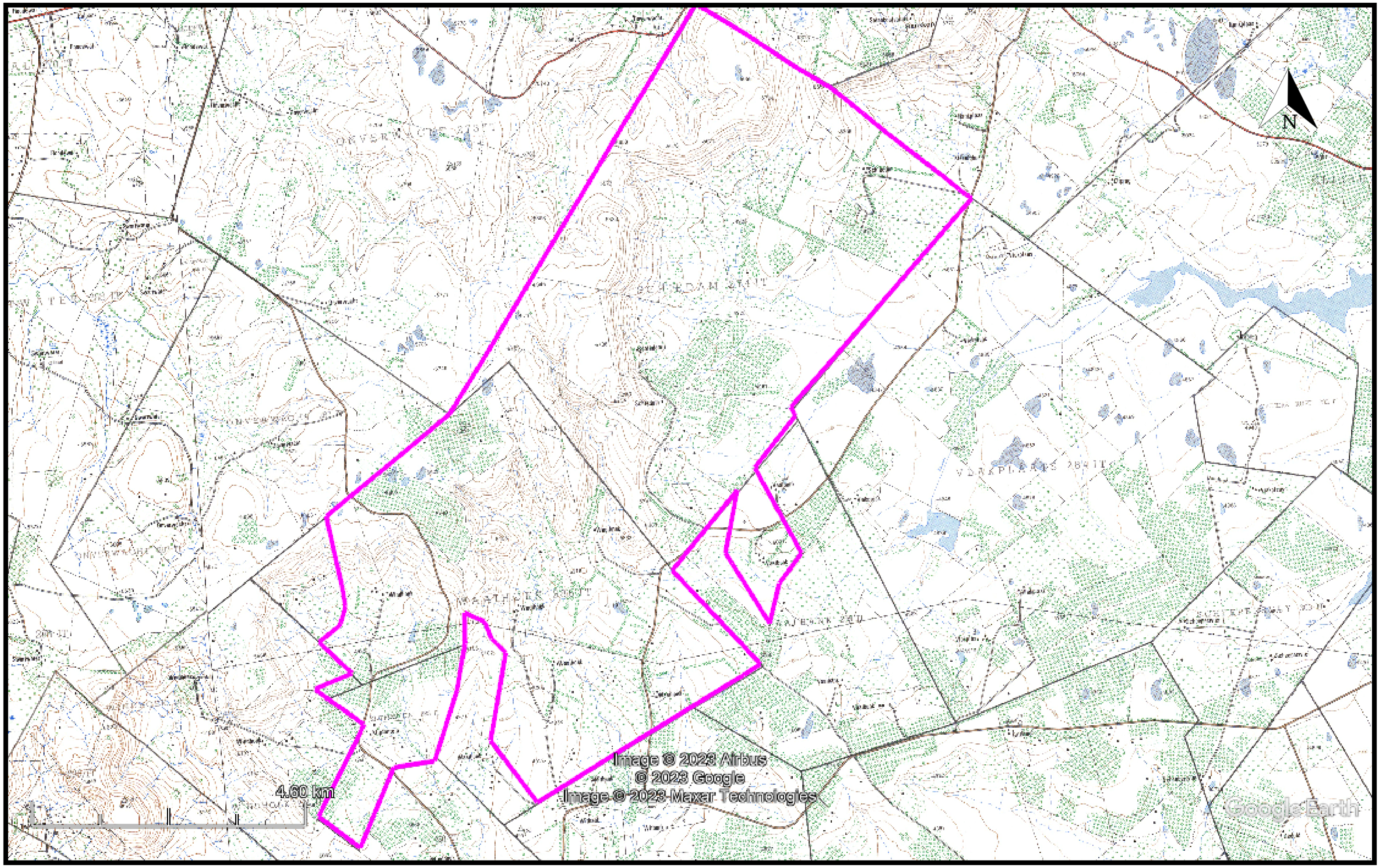


FIG. 4: SCENIC VIEWS OF THE STUDY AREA

NATIONAL HERITAGE RESOURCES ACT OF 1999

The National Heritage Resources Act of 1999 (pp 12-14) protects a variety of heritage resources. This are resources are defined as follows:

1. **"**For the purposes of this Act, those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities.
2. Without limiting the generality of subsection (1), the national estate may include—
    - 2.1. Places, buildings, structures and equipment of cultural significance;
    - 2.2. Places to which oral traditions are attached or which are associated with living heritage;
    - 2.3. Historical settlements and townscapes;
    - 2.4. Landscapes and natural features of cultural significance;
    - 2.5. Geological sites of scientific or cultural importance;
    - 2.6. Archaeological and palaeontological sites;
    - 2.7. Graves and burial grounds, including—
        - 2.7.1. Ancestral graves;
        - 2.7.2. Royal graves and graves of traditional leaders;
        - 2.7.3. Graves of victims of conflict;
        - 2.7.4. Graves of individuals designated by the Minister by notice in the Gazette;
        - 2.7.5. Historical graves and cemeteries; and
        - 2.7.6. Other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
3. Sites of significance relating to the history of slavery in South Africa;
    - 3.1. Movable objects, including—

4. Objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;

4.1. Objects to which oral traditions are attached or which are associated with living heritage;

4.2. Ethnographic art and objects;

4.3. Military objects;

4.4. objects of decorative or fine art;

4.5. Objects of scientific or technological interest; and

4.6. books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

5. Without limiting the generality of subsections (1) and (2), a place or object is to be considered part of the national estate if it has cultural significance or other special value because of—

5.1. Its importance in the community, or pattern of South Africa's history;

5.2. Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;

5.3. Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;

5.4. Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;

5.5. Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;

5.6. Its importance in demonstrating a high degree of creative or technical achievement at a particular period;

5.7. Its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;

5.8. Its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and

5.9. sites of significance relating to the history of slavery in South Africa"

METHOD

The method for Heritage assessment consists of several steps.

The first step forms part of the desktop assessment. Here we would consult the database that has been collated by Umlando. These database contain archaeological site locations and basic information from several provinces (information from Umlando surveys and some colleagues), most of the national and provincial monuments and battlefields in Southern Africa (http://www.vuvuzela.com/googleearth/monuments.html) and cemeteries in southern Africa (information supplied by the Genealogical Society of Southern Africa). We use 1st and 2nd edition 1:50 000 topographical and 1937 aerial photographs where available, to assist in general location and dating of buildings and/or graves. The database is in Google Earth format and thus used as a quick reference when undertaking desktop studies. Where required we would consult with a local data recording centre, however these tend to be fragmented between different institutions and areas and thus difficult to access at times. We also consult with an historical architect, palaeontologist, and an historian where necessary.

The survey results will define the significance of each recorded site, as well as a management plan.

All sites are grouped according to low, medium, and high significance for the purpose of this report. Sites of low significance have no diagnostic artefacts or features. Sites of medium significance have diagnostic artefacts or features and these sites tend to be sampled. Sampling includes the collection of artefacts for future analysis. All diagnostic pottery, such as rims, lips, and decorated sherds are sampled, while bone, stone, and shell are mostly noted. Sampling usually occurs on most sites. Sites of high significance are excavated and/or extensively sampled. Those sites that are extensively sampled have high research potential, yet poor preservation of features.

Defining significance

Heritage sites vary according to significance and several different criteria relate to each type of site. However, there are several criteria that allow for a general significance rating of archaeological sites.

These criteria are:

1. State of preservation of:

1.1. Organic remains:

1.1.1. Faunal

1.1.2. Botanical

1.2. Rock art

1.3. Walling

1.4. Presence of a cultural deposit

1.5. Features:

1.5.1. Ash Features

1.5.2. Graves

1.5.3. Middens

1.5.4. Cattle byres

1.5.5. Bedding and ash complexes

2. Spatial arrangements:

2.1. Internal housing arrangements

2.2. Intra-site settlement patterns

2.3. Inter-site settlement patterns

3. Features of the site:

3.1. Are there any unusual, unique or rare artefacts or images at the site?

3.2. Is it a type site?

3.3. Does the site have a very good example of a specific time period, feature, or artefact?

4. Research:

4.1. Providing information on current research projects

4.2. Salvaging information for potential future research projects

5. Inter- and intra-site variability

5.1. Can this particular site yield information regarding intra-site variability, i.e. spatial relationships between various features and artefacts?

5.2. Can this particular site yield information about a community's social relationships within itself, or between other communities?

6. Archaeological Experience:

6.1. The personal experience and expertise of the CRM practitioner should not be ignored. Experience can indicate sites that have potentially significant aspects, but need to be tested prior to any conclusions.

7. Educational:

7.1. Does the site have the potential to be used as an educational instrument?

7.2. Does the site have the potential to become a tourist attraction?

7.3. The educational value of a site can only be fully determined after initial test-pit excavations and/or full excavations.

8. Other Heritage Significance:

8.1. Palaeontological sites

8.2. Historical buildings

8.3. Battlefields and general Anglo-Zulu and Anglo-Boer sites

8.4. Graves and/or community cemeteries

8.5. Living Heritage Sites

8.6. Cultural Landscapes, that includes old trees, hills, mountains, rivers, etc related to cultural or historical experiences.

The more a site can fulfill the above criteria, the more significant it becomes. Test-pit excavations are used to test the full potential of an archaeological deposit. This occurs in Phase 2. These test-pit excavations may require further excavations if the site is of significance (Phase 3). Sites may also be mapped and/or have artefacts sampled as a form of mitigation. Sampling normally occurs when the artefacts may be good examples of their type, but are not in a primary archaeological context. Mapping records the spatial relationship between features and artefacts.

The above significance ratings allow one to grade the site according to SAHRA's grading scale. This is summarised in Table 1.

TABLE 1: SAHRA GRADINGS FOR HERITAGE SITES

SITE SIGNIFICANCE	FIELD RATING	GRADE	RECOMMENDED MITIGATION
High Significance	National Significance	Grade 1	Site conservation / Site development
High Significance	Provincial Significance	Grade 2	Site conservation / Site development
High Significance	Local Significance	Grade 3A / 3B	
High / Medium Significance	Generally Protected A		Site conservation or mitigation prior to development / destruction
Medium Significance	Generally Protected B		Site conservation or mitigation / test excavation / systematic sampling / monitoring prior to or during development / destruction
Low Significance	Generally Protected C		On-site sampling monitoring or no archaeological mitigation required prior to or during development / destruction

DESKTOP STUDY

Two HIA studies have occurred near Camden power station. Celliers (2013) recorded isolated graves, stone walling and cemeteries. Fourie (2020) did not record any sites. Figure 5 shows the location of recorded heritage sites in the general area. Only the cemetery has been previously recorded.

Only two of the original Surveyor general maps are available online. These two maps indicate that the farms were surveyed in 1876 and probably leased shortly thereafter (fig. 6 - 7). This does not mean that the farms were not occupied by farmers before hand, as Quit Rent system was in place,

The 1969 topographical map indicated that there were several settlements, or homesteads, kraals, farm buildings and a cemetery within the WEF (fig, 8). The location of these features is given in Table 2.

Most of the footprint is in low lying areas that will not have turbines.

TABLE 2: LOCATION OF DESKTOP SITES

Name	Latitude	Longitude	Description
b3	-26.640665712	30.327446730	x3 buildings
grave 2	-26.681198422	30.274383144	Farm complex
Klipfontein	-26.678342368	30.275034825	Ruins
Ruin 2	-26.599368725	30.330021317	Settlement
s100	-26.636570931	30.334739544	Settlement
s101	-26.635711061	30.332109871	Settlement
s102	-26.637451756	30.331193625	Settlement
s103	-26.639661600	30.333515978	Settlement
s104	-26.647710561	30.332237747	Settlement
s105	-26.643247938	30.341596121	Settlement
s110	-26.650501094	30.297549771	Settlement
s111	-26.660156644	30.287908760	Settlement
s112	-26.653408968	30.303691633	Settlement
s113	-26.652708409	30.306501460	Settlement
s114	-26.654157681	30.309541751	Settlement
s115	-26.649673976	30.304992340	Settlement

s116	-26.649505012	30.307741190	Settlement
s117	-26.647307506	30.308791820	Settlement
s118	-26.654845029	30.315730873	Settlement
s119	-26.665123584	30.323506922	Settlement
s120	-26.667121108	30.322537975	Settlement
s121	-26.659690265	30.327324019	Settlement
s122	-26.670791341	30.339073928	Settlement
s123	-26.670809663	30.314997199	Settlement
s124	-26.671738201	30.315441812	Settlement
s125	-26.671584396	30.316806433	Settlement
s126	-26.672525547	30.316040585	Settlement
s127	-26.673151715	30.317056854	Settlement
s128	-26.675320398	30.316640348	Settlement
s129	-26.674418608	30.309944117	Settlement
s130	-26.678738377	30.310450537	Settlement
s131	-26.683728375	30.309304911	Settlement
s132	-26.684661093	30.308869568	Settlement
s133	-26.687754382	30.306788377	Settlement
s134	-26.677011576	30.283832328	Settlement
s135	-26.677094294	30.276020313	Settlement
s136	-26.679390115	30.279017203	Settlement
s137	-26.680928494	30.280291623	Settlement
s138	-26.682865716	30.281596283	Settlement
s85	-26.590055083	30.356997554	Settlement
s86	-26.594189893	30.347581605	Settlement
s87	-26.595401123	30.356571780	Settlement
s88	-26.601591650	30.351617715	Settlement
s89	-26.599316656	30.354747029	Settlement
s9	-26.665729385	30.253675394	Settlement
s90	-26.604452269	30.359642660	Settlement
s91	-26.600755077	30.340588990	Settlement
s92	-26.599524169	30.337789290	Settlement
s93	-26.599001249	30.336415729	Settlement
s94	-26.608182121	30.311326411	Settlement
s95	-26.618507233	30.325722515	Settlement
s96	-26.619520016	30.336307016	Settlement
s97	-26.612646444	30.344751312	Settlement
s98	-26.611433518	30.356244103	Settlement
s99	-26.631169495	30.344360123	Settlement
Schiedam	-26.598693910	30.366039405	Farm complex
Schiedam	-26.623959900	30.326098113	Farm complex
Schiedam 2	-26.631370375	30.328491814	Farm complex
Vaalbank	-26.656182983	30.343781954	Farm complex
Waaihoek 2	-26.650089921	30.315988681	Farm complex
Waaihoek 3	-26.660901196	30.301811980	Farm complex
Waaihoek 3	-26.675712020	30.324095510	Farm complex
Waaihoek 4	-26.670065460	30.307322003	Farm complex

FIG. 5: LOCATION OF RECORDED SITES IN THE GENERAL AREA

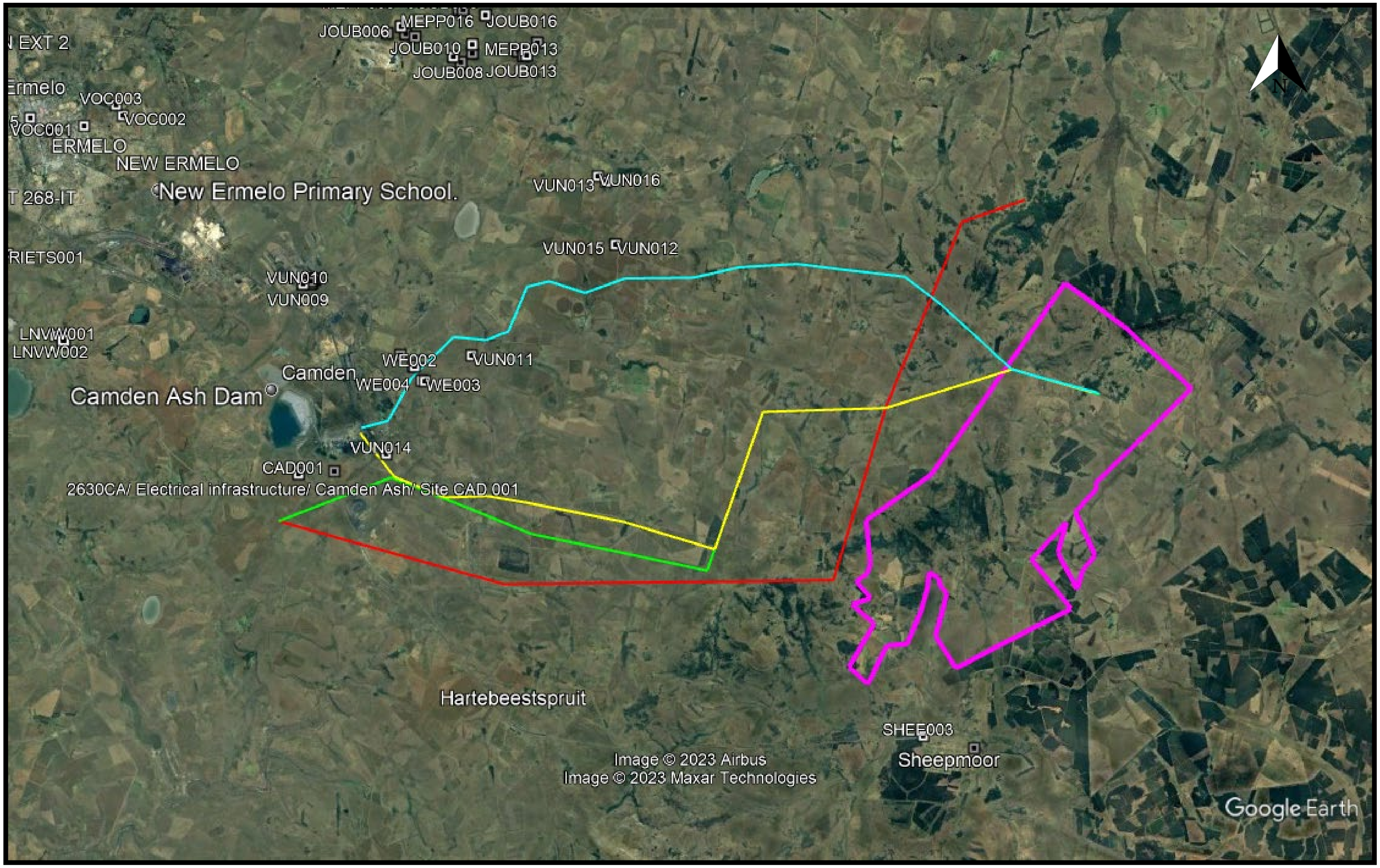


FIG. 6: SURVEYOR GENERAL MAP OF ZWARTWATER 1876

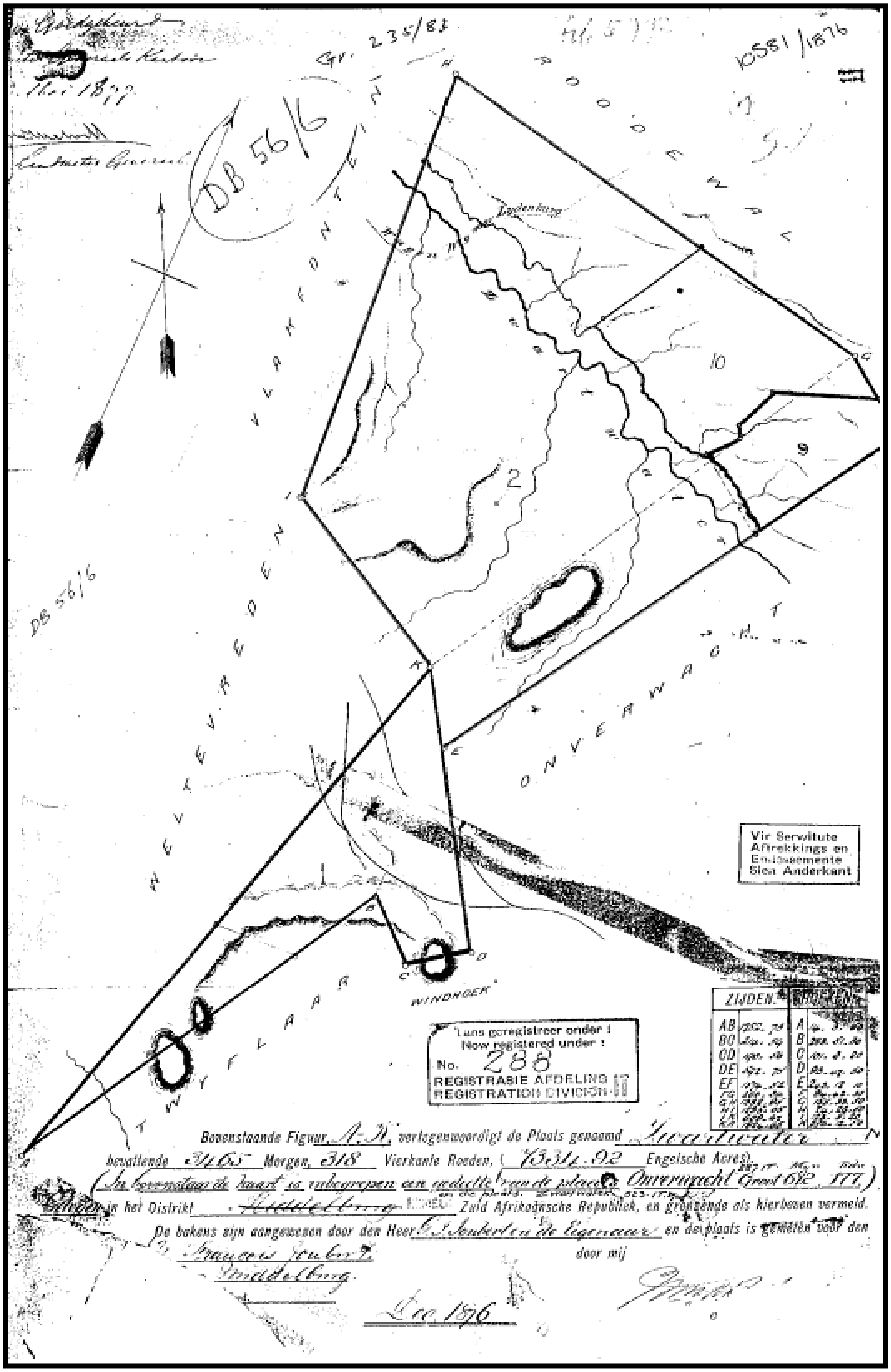


FIG. 7: SURVEYOR GENERAL MAP OF ONVERWACHT 287 (1914)

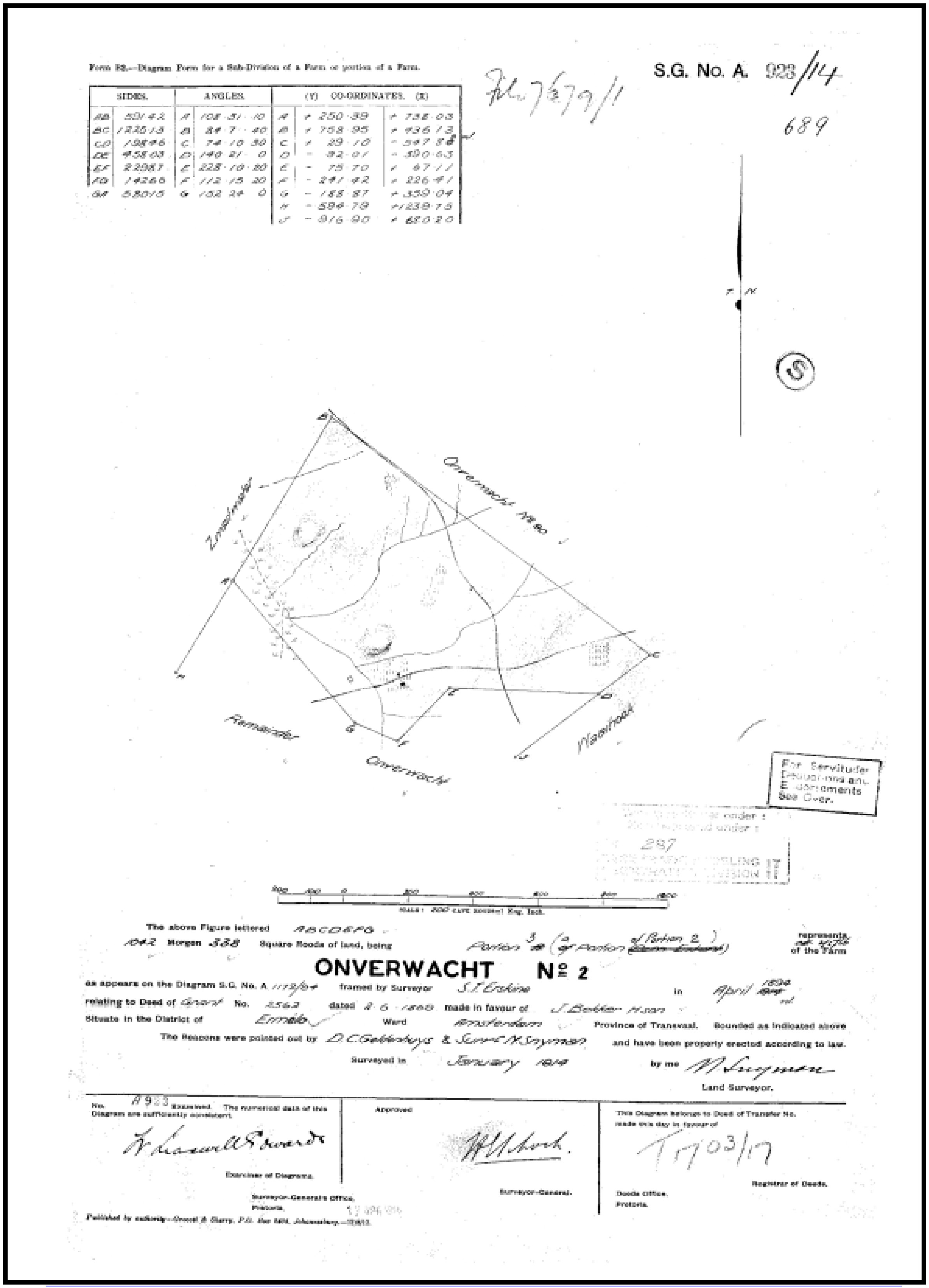
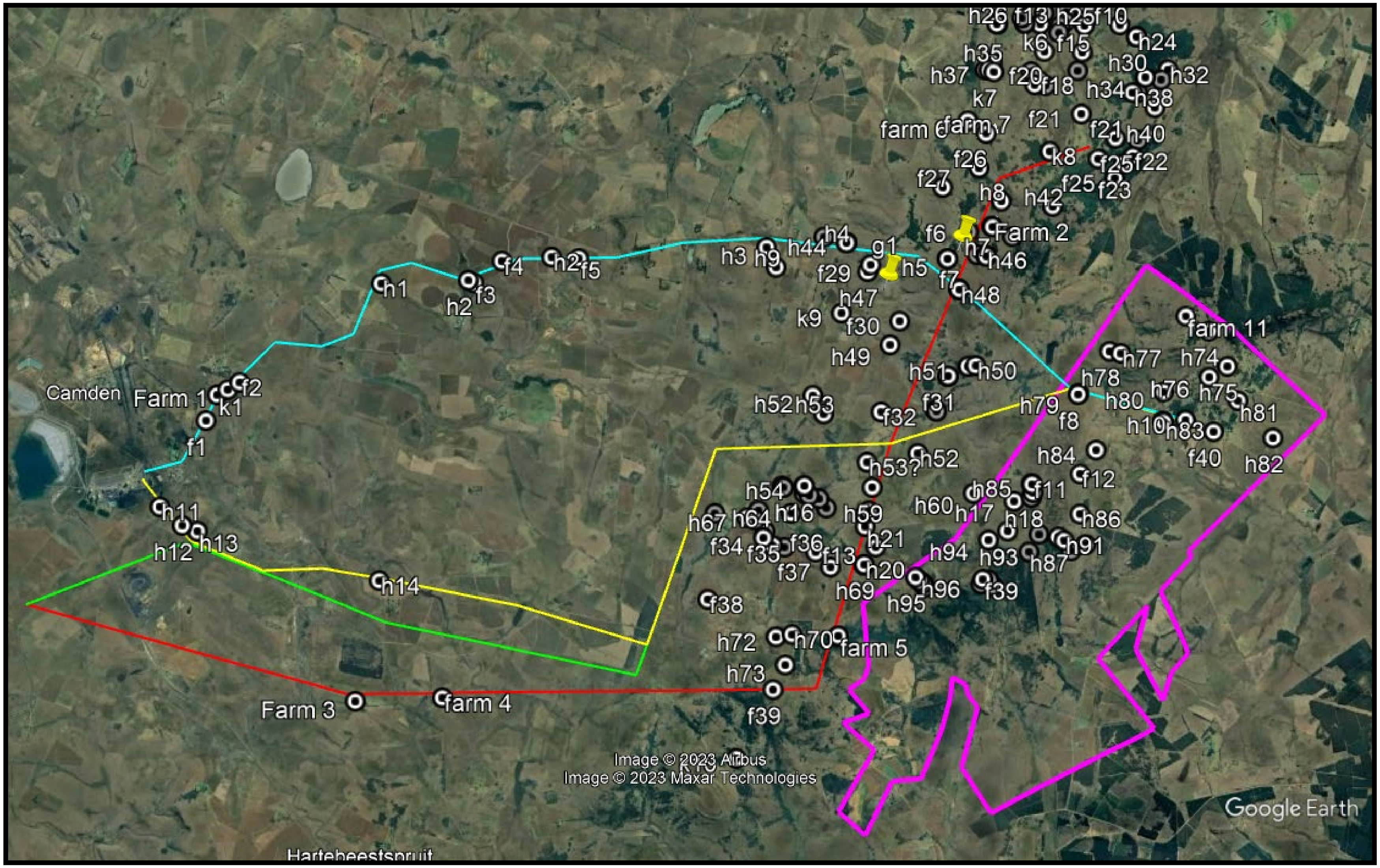


FIG. 8: LOCATION OF DESKTOP SITES FOR THE WEF AND OHL



FIELD SURVEY

The field survey was undertaken in mid-May 2023. Ground visibility varied from good to poor. Sites in the grassland were visible as general features and sometimes specific features were noted. This was dependent on the type and length of grass.

The black wattle woodlots have greatly expanded and covered many of the settlements form the desktop study. There was no evidence of these settlements where access through the woodlots was possible. The Black Wattle has literally destroyed the sites and any potential graves. The situation is exacerbated by the current program of removing the black wattle being removed by bulldozers in some areas.

Many of the desktop sites are also in fields that have been converted to agricultural activity. While several areas have kept known graves intact, within these fields, others have not. In this way, large wattle woodlots and agricultural fields were omitted from the survey. Grasslands were not omitted.

A general statement regarding settlements and graves can be made from the survey. Those settlements that were surveyed tend to have human graves associated with them. The desktop settlements that could not be surveyed for various reasons, many still have graves associated with them. They would be subsurface and in various states of preservation. These latter settlements should be treated as sensitive for potential graves, but do not need to be treated as a red flag.

The report deals with the WEF and then each OHL in their own capacity.

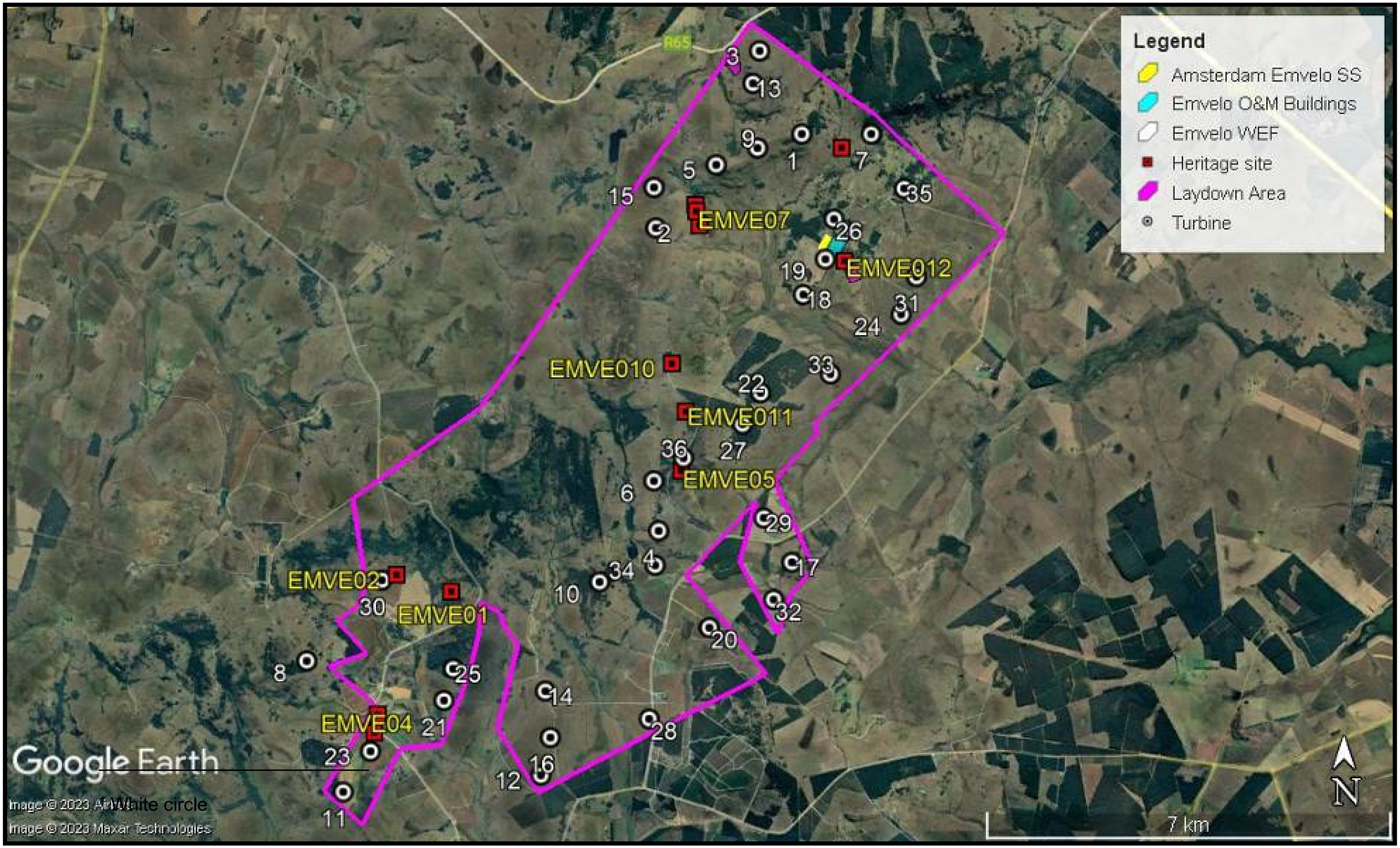
EMVELO WEF

The Emvelo WEF consisted of large maize fields at the base and in the valley, and steep hills. The hills have been overgrown with black wattle and many of the access roads/tracks are now covered. This made site access a problem in a few areas. These sites can be re-assessed if they are to be affected during the final site walkthrough. Table 3 lists the recorded sites. Fig. 9 show the location of these sites

TABLE 3: LOCATION OF RECORDED SITES

Name	Latitude	Longitude	Description
EMVE01	-26.659232578	30.287890668	grave
EMVE02	-26.656614731	30.278515784	Windhoek 2 graves
EMVE03	-26.678342368	30.275034825	Klipfontein farm
EMVE04	-26.681143700	30.274493393	Cemetery
EMVE05	-26.640561011	30.327702841	farmhouse
EMVE06	-26.602617800	30.330840200	modern cemetery
EMVE07	-26.600501450	30.330320888	Graves, walling
EMVE08	-26.599500959	30.330142801	House ruins
EMVE09	-26.590699717	30.355348755	kraal
EMVE010	-26.623959900	30.326098113	Schiedam
EMVE011	-26.631370375	30.328491814	Schiedam 2
EMVE012	-26.608061255	30.355924805	cemetery

FIG. 9: LOCATION OF RECORDED SITES FOR THE EMVELO WEF IN RELATION TO THE TURBINES[1]



EMVE01

The site is located near the base of the hill and corresponds with S111 from the desktop study. According to the landowner there is a grave near this site. The grave has apparently been opened at some stage in the past (fig. 10). The site was surrounded by black wattle and not accessible.

Significance: The site is of high significance.

Mitigation: It is unlikely that the grave will be affected. A 50m buffer needs to be placed around the site. The site needs to be clearly demarcated before construction begins. The site will need to be visibly demarcated before construction phase commences if any activity occurs within 50m of it. The demarcation should be 20m from the grave.

SAHRIS: 3

FIG. 10: APPROXIMATE LOCATION OF THE GRAVE AT EMVE02

EMVE02

The site is located halfway up the hill just above the maize fields. The site is one of the Windhoek farms dating to the 1930s and 1940s. The site consists of a stone walled house with a rondavel behind it (fig. 11). There is a grave for the five year old son in front of the house, and it dates to 30 January 1939. There is no name on the grave.

Significance: The site is of high significance due to the grave. The buildings may have significance due to its vernacular architecture. They will need to be assessed by a Built Environment specialist if they are to be affected.

Mitigation: It is unlikely that the grave will be affected. A 50m buffer needs to be placed around the site. The site needs to be clearly demarcated before construction begins. The site will need to be visibly demarcated before construction phase commences if any activity occurs within 50m of it. The demarcation should be 20m from the grave.

SAHRIS: 3A

FIG. 11: FEATURES AT EMVE02

EMVE03

The site is located near the river at the base of the hill. The site is the original Klipfontein farm complex (fig. 12). The farm dates to the 1890s and some of the original housing Historical middens would occur in the general area.

The farm complex will not be affected by the WEF

Significance: The buildings would need to be assessed by a Built Environment specialist if they were to be affected.

Mitigation: Currently no mitigation is required.

SAHRIS: pending

FIG. 12: FARM COMPLEX AT EMVE03

EMVE04

The site is located next to the maize fields and beside the road. The site is a cemetery to the Senekal and Joubert families that lived at Klipfontein (fig. 13). The graves date from 1892 to 1968 and are all of adults, except for one child.

Significance: The site is of high significance.

Mitigation: It is unlikely that the cemetery will be affected. A 50m buffer needs to be placed around the site. The site will need to be visibly demarcated before construction phase commences if any activity occurs within 50m of it. The demarcation should be 20m from the grave.

SAHRIS: 3A

FIG. 13: EMVE04

EMVE05

The site is located near the base of the hill amongst the black wattle trees. The site consists of a single building that appears to be a farmhouse (fig. 14). The building relates to B3 from the desktop. The window frames are made from wood and thus the building probably pre-dates the 1960s.

Significance: pending

Mitigation: The building will need to be assessed by a Built Environment specialist. It is unlikely that the building will be affected by the WEF.

SAHRIS: 3C

FIG. 14: BUILDING AT EMVE05

EMVE06

The site is located on the slopes of the hill. The site consists of recent cemetery with 30+ graves (fig. 15). The graves are stone cairns in an east-west orientation.

Significance: The site is of high significance.

Mitigation: It is unlikely that the cemetery will be affected. A 50m buffer needs to be placed around the site. The site will need to be visibly demarcated before construction phase commences if any activity occurs within 50m of it. The demarcation should be 20m from the grave.

SAHRIS: 3A

FIG. 15: CEMETERY AT EMVE06

EZEM07

The site is located near the base of the main hill. The site consist of several depressions that could be house floors, parts of stone walling and terracing and four stone cairns that are probably graves (fig. 16). There are two small stone walled kraals further up the hill.

The transmission line will occur ~20m south of the main site, but pass over the small kraal uphill.

Significance: The site is of significance.
Mitigation: The site will not be affected by the WEF.
SAHRIS: 3A

EZEM08

The site is located at the base of the hill 30m north of EZEM07. The site consists of the ruins of what appears to be the original Schiedam farm, or Ruin 2 from the desktop (fig. 17). The site consists of two rectangular farm buildings with a circular structure between them. The buildings are 12m x 10m in size. There is some terracing to the south.

The vegetation was too dense to note any middens that would occur. The site is to the north of the transmission line and in the footprint.

Significance: The site is of medium significance due to potential 19th century middens.
Mitigation: The site will not be affected by the WEF.
SAHRIS: 3B

FIG. 16: FEATURES AT ESEM07

FIG. 17: BUILDINGS AT EZEM08

EMVE09

The site is located on the top of the hill and was not accessible during the survey. The site consists of two stone walled kraals that are visible on the Google Earth map (fig. 18). The kraals may be related to S85 that occurs 150m to the east.

Significance: The site is of low significance.

Mitigation: If the kraals are to be affected, then they will need to be mapped and photographed prior to construction.

SAHRIS: 3C

FIG. 18: STONE WALLED KRAAL AT EMVE09

EMVE010

The site is located in a black wattle thicket with limited visibility and accessibility. The site is one of the Schiedam farm houses consist of a stone walled kraal and buildings (fig. 19). This may be the original Schiedam farm and thus predate the 1900s.

Significance: The site is of significance.

Mitigation: Mitigation

SAHRIS: 3

FIG. 19: AERIAL VIEW OF EMVE010

EMVE011

The site is located on the top of a small hill. The site consists of a main farmhouse that is referred to as Schiedam 2 on the desktop. The farmhouse appears to post-date the 1960s due to the types of air vents near the roof and the lack of wooden frames (fig. 20)

Significance: The site is of low/no significance.

Mitigation: No further mitigation is required.

SAHRIS: N/A

FIG. 20: EVEM011

EMVE012

The site is located near the base of a hill and next to the road. The site consists of fifteen graves in an informal cemetery (fig. 21). The area is~20m x 30m in size and the graves are in an east-west orientation. The cemetery appears to be more recent in age. The site is in the current laydown area. Part of the laydown area will need to be moved.

Significance: The site is of high significance.

Mitigation: It is unlikely that the cemetery will be affected. A 50m buffer needs to be placed around the site. The site will need to be visibly demarcated before construction phase commences if any activity occurs within 50m of it. The demarcation should be 20m from the grave.

SAHRIS: 3A

FIG. 21: CEMETERY AT EMVE012

DESKTOP PALAEONTOLOGICAL ASSESSMENT

The area is of very high palaeontological sensitivity (fig. 22). Dr Alan Smith undertook a desktop PIA for the proposed Emvelo WEF (Appendix A). He states:

“The SAHRIS Palaeosensitivity Map ... considers the Vryheid Formation as a Very High Palaeosensitivity Zone... In practise, no vertebrate fossils have been recorded from the Vryheid Formation in this area, however invertebrate trace fossils are common (Tavener Smith et al, 1989; Mason and Christie, 1985; Hastie et al., 2019), but these are of no particular value, in this area.

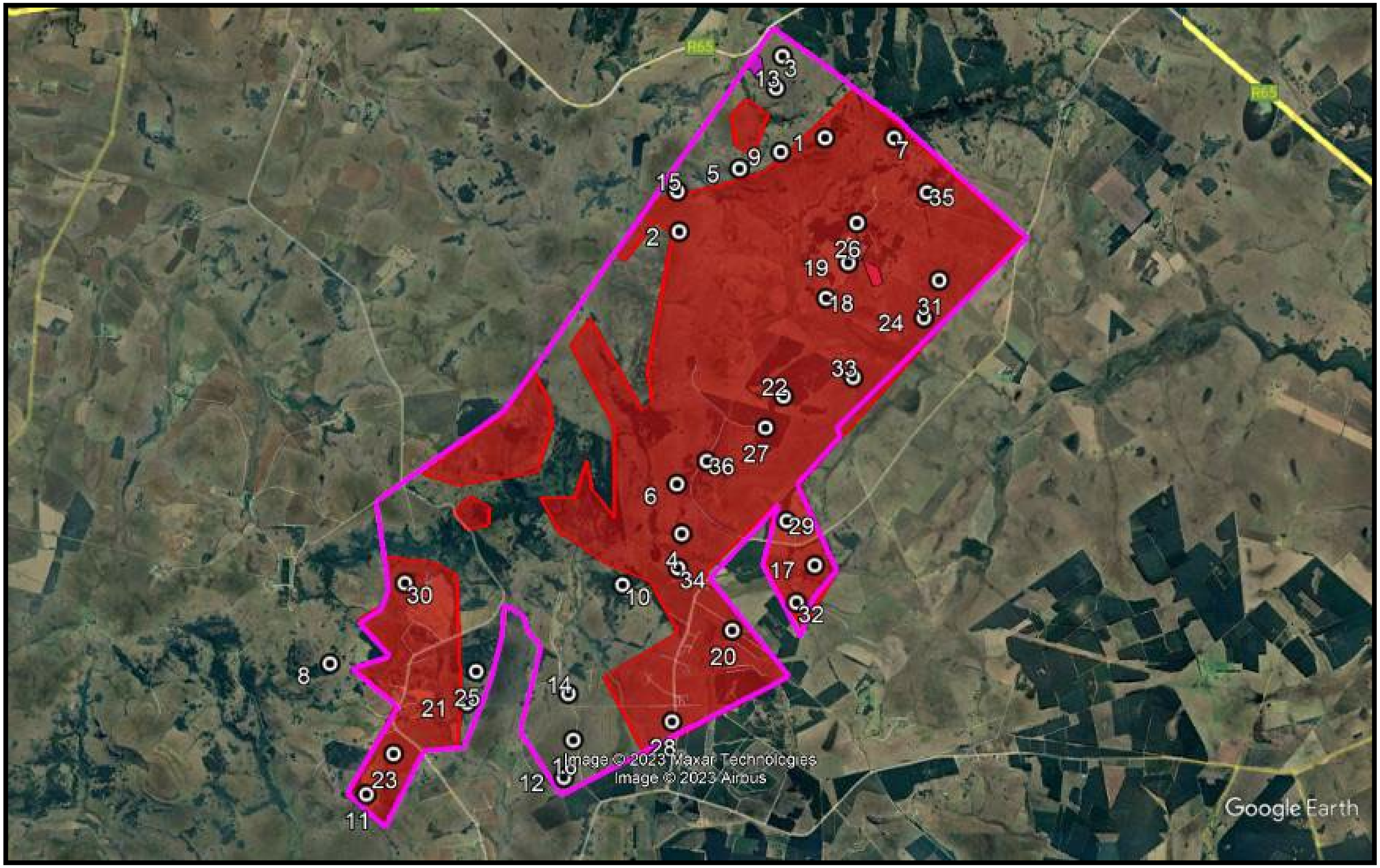
Groenewald (2018) pointed out that the aquatic marine reptile, *Mesosaurus* (earliest known reptile from the Karoo Basin), as well as the fish, *Palaeoniscus capensis*, have been recorded in the Whitehill Formation in the southern part of the basin (MacRae, 1999), which is correlated with the Vryheid Formation... The Vryheid Formation in this area has its provenance in the north (Tavener Smith, 1982). The Whitehill Formation source is in the south. There is also a southerly source to the lower Vryheid Formation (Hastie et al., 2019), but this regime does not extend north of Vryheid. The Vryheid Formation is generally believed to be marine (Hastie et al., 2019) but no significant fossils have been discovered. The lack of vertebrate fossils is problematic. In the marine case it may be due to the water being heavily silted but this is speculation.”

This area is mostly non-fossiliferous Karoo Dolerite and no further mitigation is required.

The chance of significant fossils being found on this site are **Low,** but not **Zero. Consequently a “Chance Find Protocol”** has been included to cover this eventuality.

No further palaeontological work is required, unless triggered by the "**Chance Find Protocol**", which must form part of the Environmental Management Programme (EMPr) for the site'

FIG. 22: LOCATION OF HIGH SENSITIVE PALAEONTOLOGICLA AREAS



OVERHEAD LINES

There are four Overhead lines (OHL): 1 preferred and 3 alternatives. Some overlap in places, but each will be treated separately.

PREFERRED OHL

Pending info

The location of the preferred OHL is shown in fig. 23 – 25.

FIG. 23: AERIAL OVERVIEW OF THE PREFERRED OHL

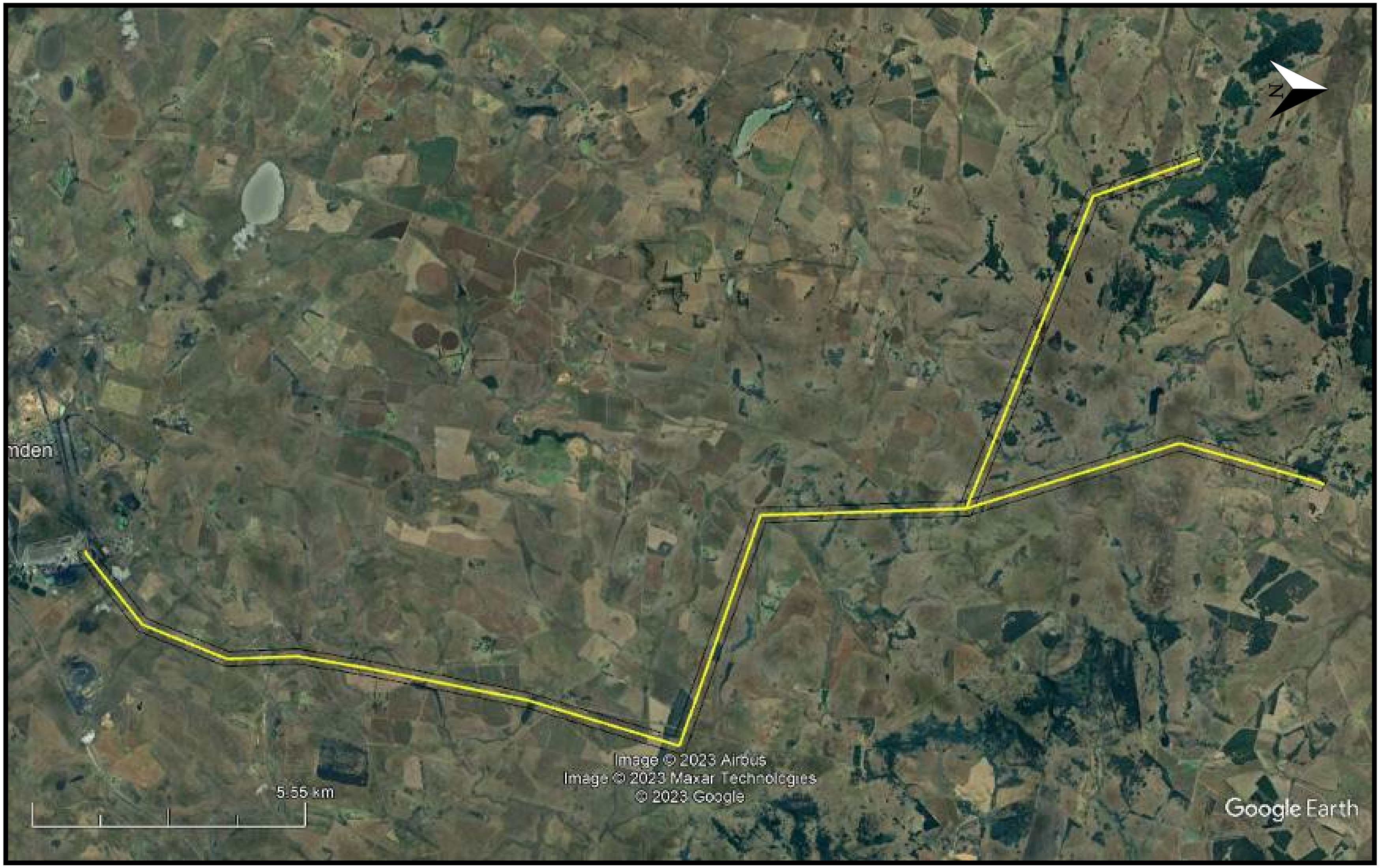


FIG. 24: TOPOGRAPHICAL MAP OF THE PREFERRED OHL

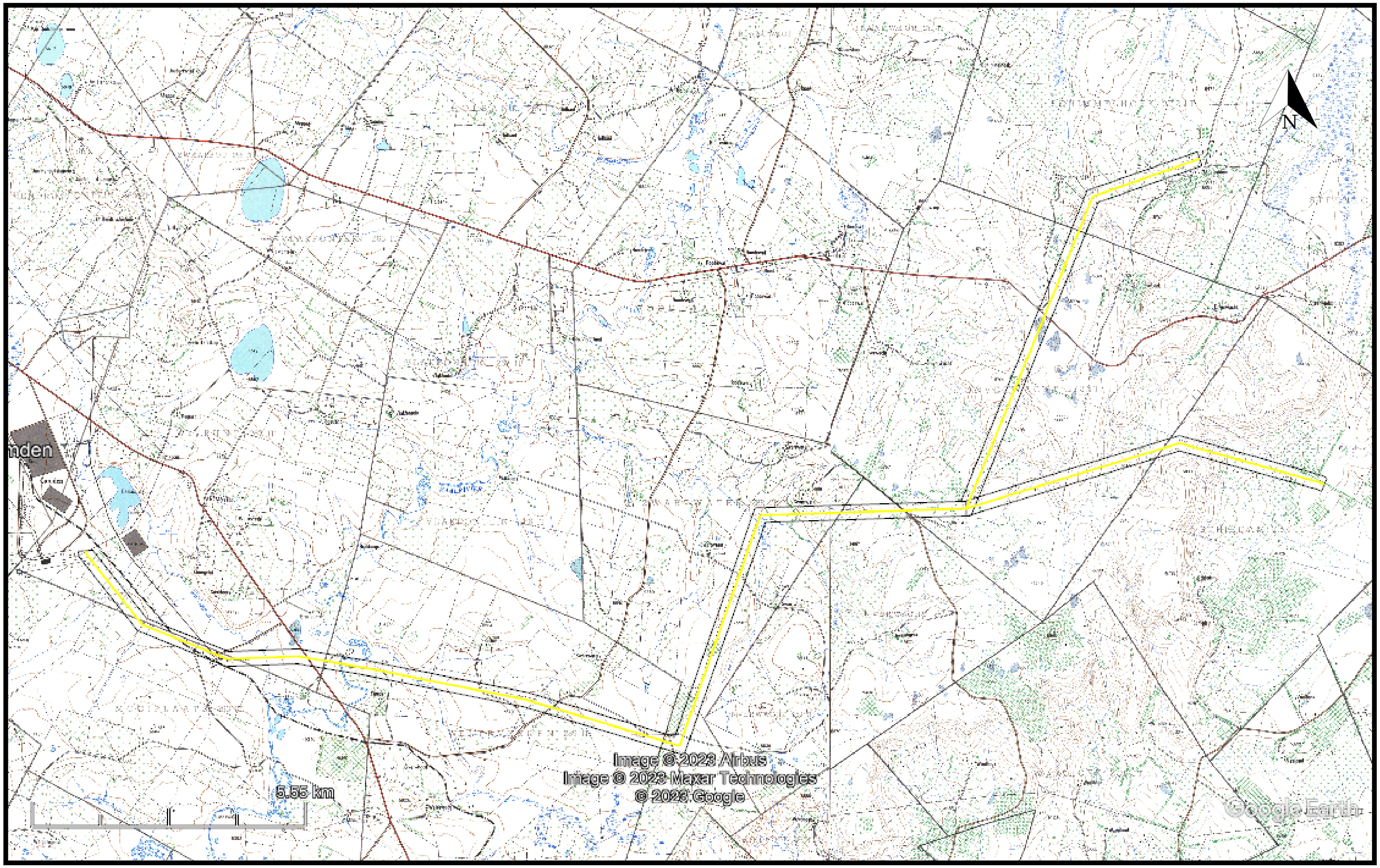


FIG. 25: SCENIC VIEWS OF THE PREFERRED OHL

DESKTOP STUDY

The 1969 topographical map indicated that there were several settlements, or homesteads, kraals and farm buildings along the route. The location of these features are given in Table 4 and fig. 8. Some of these sites will be directly affected by the transmission line, while most are in the footprint our just outside of the footprint.

TABLE 4: LOCATION OF DESKTOP SITES

Name	Latitude	Longitude	Description
k4	-26.639329513	30.158493982	Kraal
Ruin 2	-26.599368725	30.330021317	Ruin
s13	-26.546130499	30.323444652	Settlement
s29	-26.637677613	30.120726334	Settlement
s3	-26.662677585	30.130601041	Settlement
s30	-26.636981297	30.121591442	Settlement
s31	-26.641623441	30.135345100	Settlement
s34	-26.611814709	30.259626834	Settlement
s35	-26.587853931	30.288226500	Settlement
s46	-26.550681623	30.311582320	Settlement
s67	-26.606786970	30.291934198	Settlement

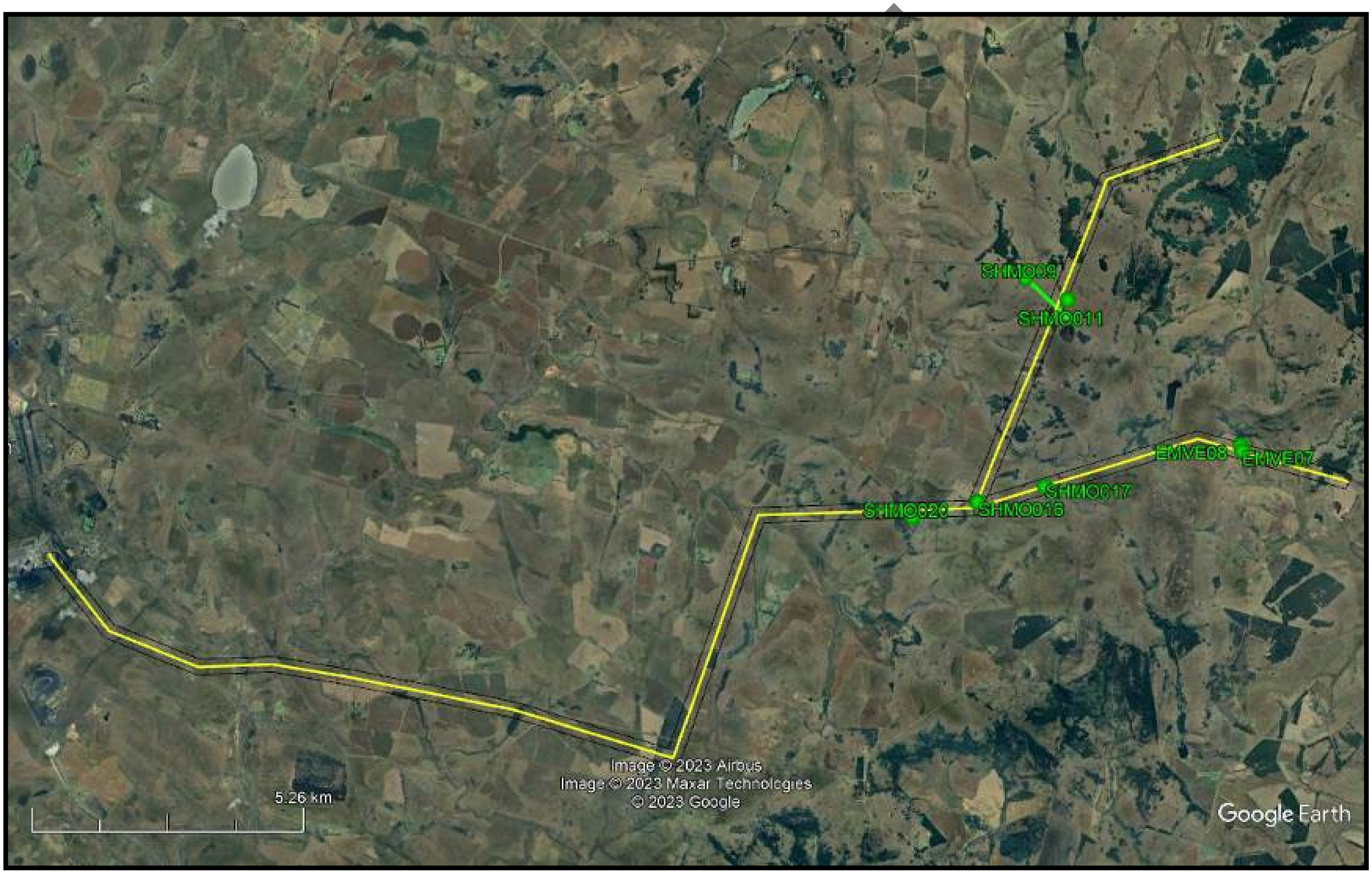
FIELD SURVEY

Table 5 lists the recorded sites, while fig. 26 shows the location of these sites

TABLE 5 LOCATION OF RECORDED SITES

Name	Latitude	Longitude	Description
EMVE07	-26.600501450	30.330320888	LIA or HP settlement
EMVE08	-26.599500959	30.330142801	House ruins
SHMO09	-26.570522600	30.287594200	Row of Stellae
SHMO011	-26.574274200	30.295731100	settlement 59, x5 houses
SHMO016	-26.609387400	30.278318600	graves,
SHMO017	-26.606701315	30.291456770	HP settlement
SHMO020	-26.611976600	30.265673200	walling and settlement S68

FIG. 26: LOCATION OF RECORDED SITES FOR THE PREFERRED OHL



EZEM07

The site is located near the base of the main hill. The site consist of several depressions that could be house floors, parts of stone walling and terracing and four stone cairns that are probably graves (fig. 27). There are two small stone walled kraals further up the hill.

The transmission line will occur ~20m south of the main site, but pass over the small kraal uphill.

Significance: The site is of significance.
Mitigation: The site will not be affected by the WEF.
SAHRIS: 3A

EZEM08

The site is located at the base of the hill 30m north of EZEM07. . The site consists of the ruins of what appears to be the original Schiedam farm, or Ruin 2 from the desktop (fig. 28). The site consists of two rectangular farm buildings with a circular structure between them. The buildings are 12m x 10m in size. There is some terracing to the south.

The vegetation was too dense to note any middens that would occur. The site is to the north of the transmission line and in the footprint.

Significance: The site is of medium significance due to potential 19th century middens.
Mitigation: The site will not be affected by the WEF.
SAHRIS: 3B

FIG. 27: FEATURES AT ESEM07

FIG. 28: BUILDINGS AT EZEM08

SHMO09

The site is a row of stone stellae that were used to form part of the original farm boundary or subdivision. The row continues for ~1km (fig. 29). The row forms part of the cultural landscape.

The transmission line passes over the row of stellae

Significance: The site is of low significance.

Mitigation: The construction should avoid ,moving the stellae.

SAHRIS: 3C

FIG. 29: STELLAE AT SHMO09

SHMO011

The site is located 550m southeast of SHMO010 and also on the top of the hill. The site consists of at least five house foundations (fig. 30). No other features were noted; however the vegetation was too dense to make an accurate assessment. No graves were noted, but they could occur.

Significance: The site is of significance.

Mitigation: The area will need to be re-assessed once the vegetation has receded as the site may be part of a larger LIA and HP site. If the site is archaeological then the graves could be removed; however a PPP will still need to be undertaken. The site features would need to be mapped and/or excavated.

SAHRIS: 3C currently)

FIG. 30: HOUSE FOUNDATIONS AT SHMO011

SHMO016

The site is located halfway down the hill, northwest of Onverwacht #3. The site consists of a single grave post-dating 2000 (fig. 31). The grave is a stone cairn roughly in a north-south orientation. The deceased is known to the landowner.

Significance: The site is of high significance.

Mitigation: The transmission line will need to be moved at least 50m from the grave with no structures in that radius. The grave will need to be visibly demarcated before construction phase commences.

SAHRIS: 3A

FIG. 31: GRAVE AT SHMO16

SHMO017

The site is located on a rocky hill overlooking a stream. The site consists of a cemetery to the west, a domestic area to the east, and a kraal in the north (fig. 32). The cemetery consists of ~14 graves mostly in an east-west orientation. The graves are very low on the ground and hardly visible above the grass.

There are six stone walled features that appear to be related to houses. Two of these are rectangular while four are circular. They are 3m – 4m in width. In the centre of these features is a large stone cairn that is a grave. All the entrances of the houses face towards the grave.

The stone walled kraal is 15m x 15m in size. The entrance faces uphill towards the house.

The site dates to the Historical Period due to the rectangular structures; however the rest of the building and central grave follows a Nguni-speaking settlement pattern. According to the landowner, Mr Robberts, none of the workers claim the ancestral graves, nor are the known to the community.

Significance: The site is of high significance.

Mitigation: The site cannot be affected. A 50m buffer needs to be placed around the site. The site needs to be clearly demarcated before construction begins. The site will need to be visibly demarcated before construction phase commences if any activity occurs within 50m of it.

SAHRIS: 3A

FIG. 32: FEATURES AT SHMO017

SHMO020

The site is located 150m – 200m northeast of SHMO019 and also within the black wattle thickets. The site consists of the foundations of several houses that are part of S68 from the desktop (fig. 33). Some of the people from S68 may be buried at SHMO019.

Significance: The site is of low significance.

Mitigation: No further mitigation is required; however the site is still sensitive for potential human graves.

SAHRIS: 3C

FIG. 33: HOUSE FOUNDATIONS AT SHMO020

DESKTOP PALAEONTOLOGICAL ASSESSMENT

The area is of very high palaeontological sensitivity (fig. 34). Dr Alan Smith undertook a desktop PIA for the proposed Emvelo WEF (Appendix A). He states:

"The SAHRIS Palaeosensitivity Map ... considers the Vryheid Formation as a Very High Palaeosensitivity Zone... In practise, no vertebrate fossils have been recorded from the Vryheid Formation in this area, however invertebrate trace fossils are common (Tavener Smith et al, 1989; Mason and Christie, 1985; Hastie et al., 2019), but these are of no particular value, in this area.

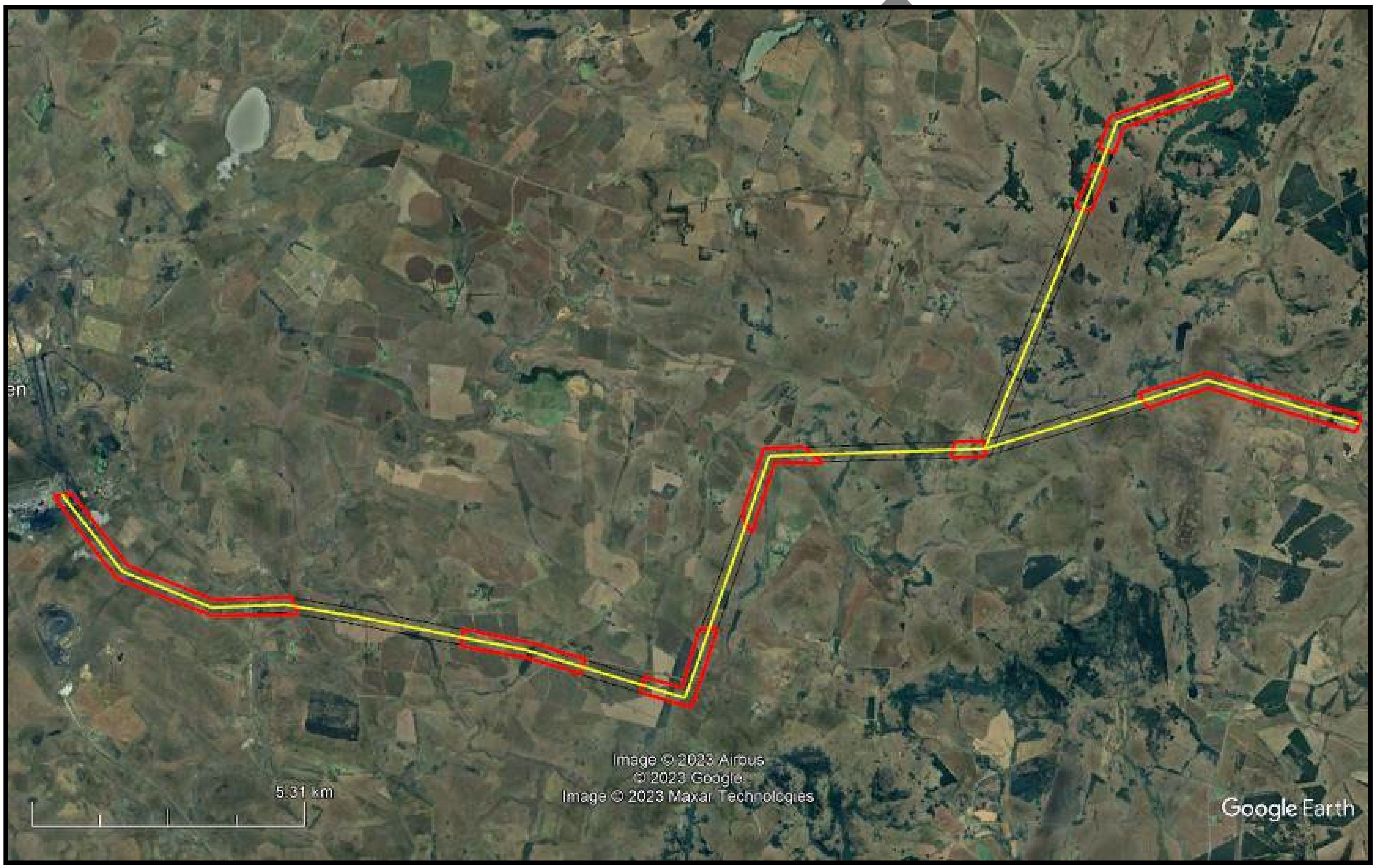
Groenewald (2018) pointed out that the aquatic marine reptile, *Mesosaurus* (earliest known reptile from the Karoo Basin), as well as the fish, *Palaeoniscus capensis*, have been recorded in the Whitehill Formation in the southern part of the basin (MacRae, 1999), which is correlated with the Vryheid Formation... The Vryheid Formation in this area has its provenance in the north (Tavener Smith, 1982). The Whitehill Formation source is in the south. There is also a southerly source to the lower Vryheid Formation (Hastie et al., 2019), but this regime does not extend north of Vryheid. The Vryheid Formation is generally believed to be marine (Hastie et al., 2019) but no significant fossils have been discovered. The lack of vertebrate fossils is problematic. In the marine case it may be due to the water being heavily silted but this is speculation."

The Preferred OHL will have shallow foundations and will have little palaeosensitivity impact...

The chance of significant fossils being found on this site are **Low,** but not **Zero. Consequently a "Chance Find Protocol"** has been included to cover this eventuality.

No further palaeontological work is required, unless triggered by the "**Chance Find Protocol**", which must form part of the Environmental Management Programme (EMPr) for the site.

FIG. 34: LOCATION OF HIGH SENSITIVE PALAEONTOLOGICLA AREAS



ALTERNATIVE 1 OHL

The location of the preferred OHL is shown in fig.'s 35 - 37.

PENDING INFO

FIG. 35: AERIAL OVERVIEW OF THE ALTERNATIVE 1 OHL

FIG. 36: TOPOGRAPHICAL MAP OF THE ALTERNATIVE 1OHL

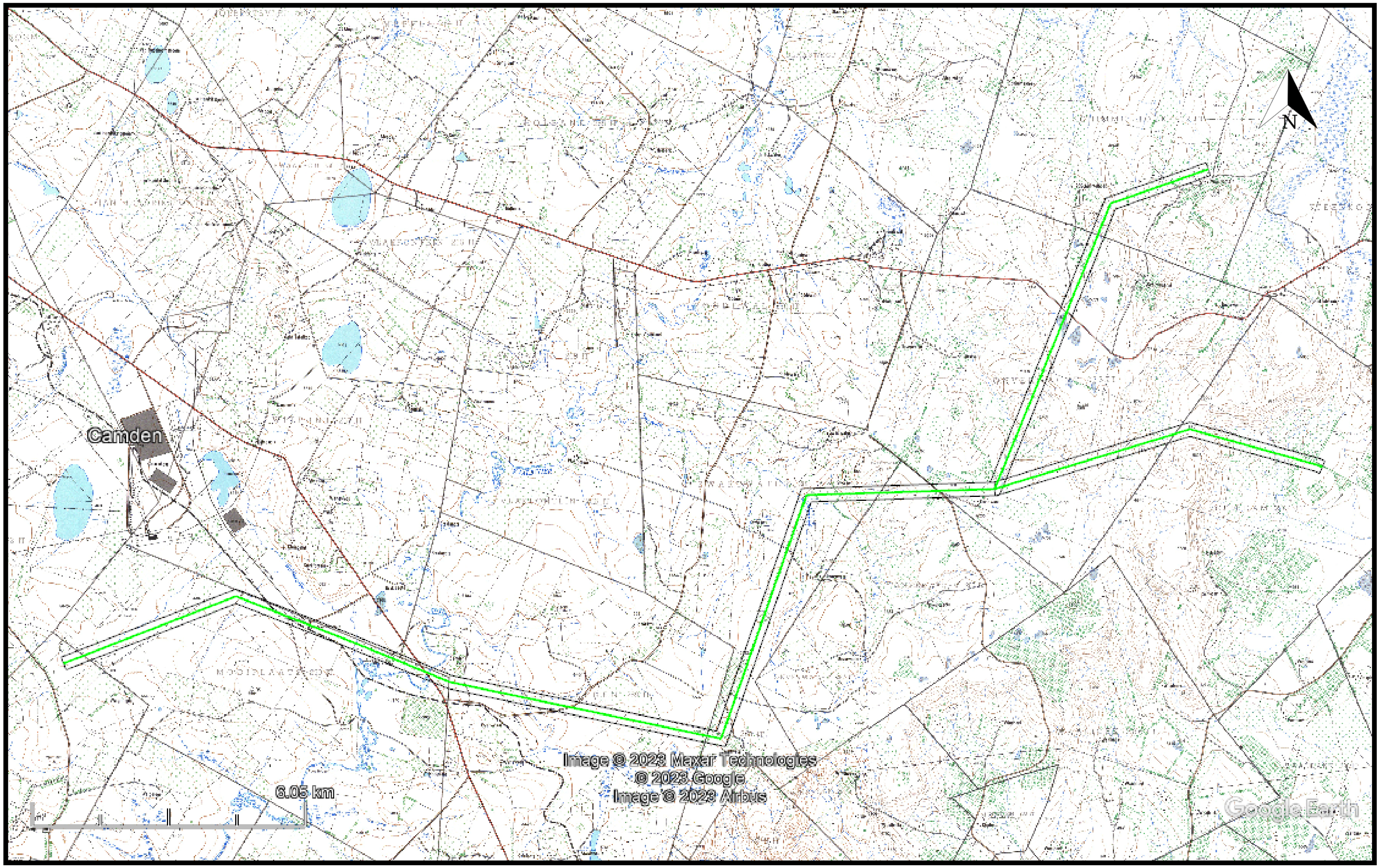


FIG. 37: SCENIC VIEWS OF THE STUDY AREA

DESKTOP STUDY

The 1969 topographical map indicated that there were several settlements, or homesteads, kraals and farm buildings along the route. The location of these features are given in Table 6 and fig. 8. Some of these sites will be directly affected by the transmission line, while most are in the footprint our just outside of the footprint.

TABLE 6: LOCATION OF DESKTOP SITES

Name	Latitude	Longitude	Description
k4	-26.639329513	30.158493982	Kraal
Ruin 2	-26.599368725	30.330021317	Ruin
s13	-26.546130499	30.323444652	Settlement
s29	-26.637677613	30.120726334	Settlement
s3	-26.662677585	30.130601041	Settlement
s30	-26.636981297	30.121591442	Settlement
s31	-26.641623441	30.135345100	Settlement
s34	-26.611814709	30.259626834	Settlement
s35	-26.587853931	30.288226500	Settlement
s46	-26.550681623	30.311582320	Settlement
s67	-26.606786970	30.291934198	Settlement

FIELD SURVEY

Table 7 lists the recorded sites while fig. 38 shows the location of these sites

TABLE 7: LOCATION OF RECORDED SITES

Name	Latitude	Longitude	Description
EMVE07	-26.600501450	30.330320888	Settlement
EMVE08	-26.599500959	30.330142801	House ruins
SHMO09	-26.570522600	30.287594200	Row of Stellae
SHMO011	-26.574274200	30.295731100	settlement 59, x5 houses
SHMO016	-26.609387400	30.278318600	grave, 2000 onwards
SHMO017	-26.606701315	30.291456770	Settlement
SHMO020	-26.611976600	30.265673200	wallling and S68

FIG. 38: LOCATION OF RECORDED SITES ALONG ALTERNATIVE 1 OHL

EZEM07

The site is located near the base of the main hill. The site consist of several depressions that could be house floors, parts of stone walling and terracing and four stone cairns that are probably graves (fig. 39). There are two small stone walled kraals further up the hill.

The transmission line will occur ~20m south of the main site, but pass over the small kraal uphill.

Significance: The site is of significance.
Mitigation: The site will not be affected by the WEF.
SAHRIS: 3A

EZEM08

The site is located at the base of the hill 30m north of EZEM07. The site consists of the ruins of what appears to be the original Schiedam farm, or Ruin 2 from the desktop (fig. 40). The site consists of two rectangular farm buildings with a circular structure between them. The buildings are 12m x 10m in size. There is some terracing to the south.

The vegetation was too dense to note any middens that would occur. The site is to the north of the transmission line and in the footprint.

Significance: The site is of medium significance due to potential 19th century middens.
Mitigation: The site will not be affected by the WEF.
SAHRIS: 3B

FIG. 39: FEATURES AT ESEM07

FIG. 40: BUILDINGS AT EZEM08

SHMO09

The site is a row of stone stellae that were used to form part of the original farm boundary or subdivision. The row continues for ~1km (fig. 41). The row forms part of the cultural landscape.

The transmission line passes over the row of stellae

Significance: The site is of low significance.

Mitigation: The construction should avoid ,moving the stellae.

SAHRIS: 3C

FIG. 41: STELLAE AT SHMO09

SHMO011

The site is located 550m southeast of SHMO010 and also on the top of the hill. The site consists of at least five house foundations (fig. 42). No other features were noted; however the vegetation was too dense to make an accurate assessment. No graves were noted, but they could occur.

Significance: The site is of significance.

Mitigation: The area will need to be re-assessed once the vegetation has receded as the site may be part of a larger LIA and HP site. If the site is archaeological then the graves could be removed; however a PPP will still need to be undertaken. The site features would need to be mapped and/or excavated.

SAHRIS: 3C currently)

FIG. 42: HOUSE FOUNDATIONS AT SHMO011

SHMO016

The site is located halfway down the hill, northwest of Onverwacht #3. The site consists of a single grave post-dating 2000 (fig. 43). The grave is a stone cairn roughly in a north-south orientation. The deceased is known to the landowner.

Significance: The site is of high significance.

Mitigation: The transmission line will need to be moved at least 50m from the grave with no structures in that radius. The grave will need to be visibly demarcated before construction phase commences.

SAHRIS: 3A

FIG. 43: GRAVE AT SHMO16

SHMO017

The site is located on a rocky hill overlooking a stream. The site consists of a cemetery to the west, a domestic area to the east, and a kraal in the north (fig. 44). The cemetery consists of ~14 graves mostly in an east-west orientation. The graves are very low on the ground and hardly visible above the grass.

There are six stone walled features that appear to be related to houses. Two of these are rectangular while four are circular. They are 3m – 4m in width. In the centre of these features is a large stone cairn that is a grave. All the entrances of the houses face towards the grave.

The stone walled kraal is 15m x 15m in size. The entrance faces uphill towards the house.

The site dates to the Historical Period due to the rectangular structures; however the rest of the building and central grave follows a Nguni-speaking settlement pattern. According to the landowner, Mr Robberts, none of the workers claim the ancestral graves, nor are the known to the community.

Significance: The site is of high significance.

Mitigation: The site cannot be affected. A 50m buffer needs to be placed around the site. The site needs to be clearly demarcated before construction begins. The site will need to be visibly demarcated before construction phase commences if any activity occurs within 50m of it.

SAHRIS: 3A

FIG. 44: FEATURES AT SHMO017

SHMO020

The site is located 150m – 200m northeast of SHMO019 and also within the black wattle thickets. The site consists of the foundations of several houses that are part of S68 from the desktop (fig. 45). Some of the people from S68 may be buried at SHMO019.

Significance: The site is of low significance.

Mitigation: No further mitigation is required; however the site is still sensitive for potential human graves.

SAHRIS: 3C

FIG. 45: HOUSE FOUNDATIONS AT SHMO020

The area is of very high palaeontological sensitivity (fig. 46). Dr Alan Smith undertook a desktop PIA for the proposed Emvelo WEF (Appendix A). He states:

"The SAHRIS Palaeosensitivity Map ... considers the Vryheid Formation as a Very High Palaeosensitivity Zone... In practise, no vertebrate fossils have been recorded from the Vryheid Formation in this area, however invertebrate trace fossils are common (Tavener Smith et al, 1989; Mason and Christie, 1985; Hastie et al., 2019), but these are of no particular value, in this area.

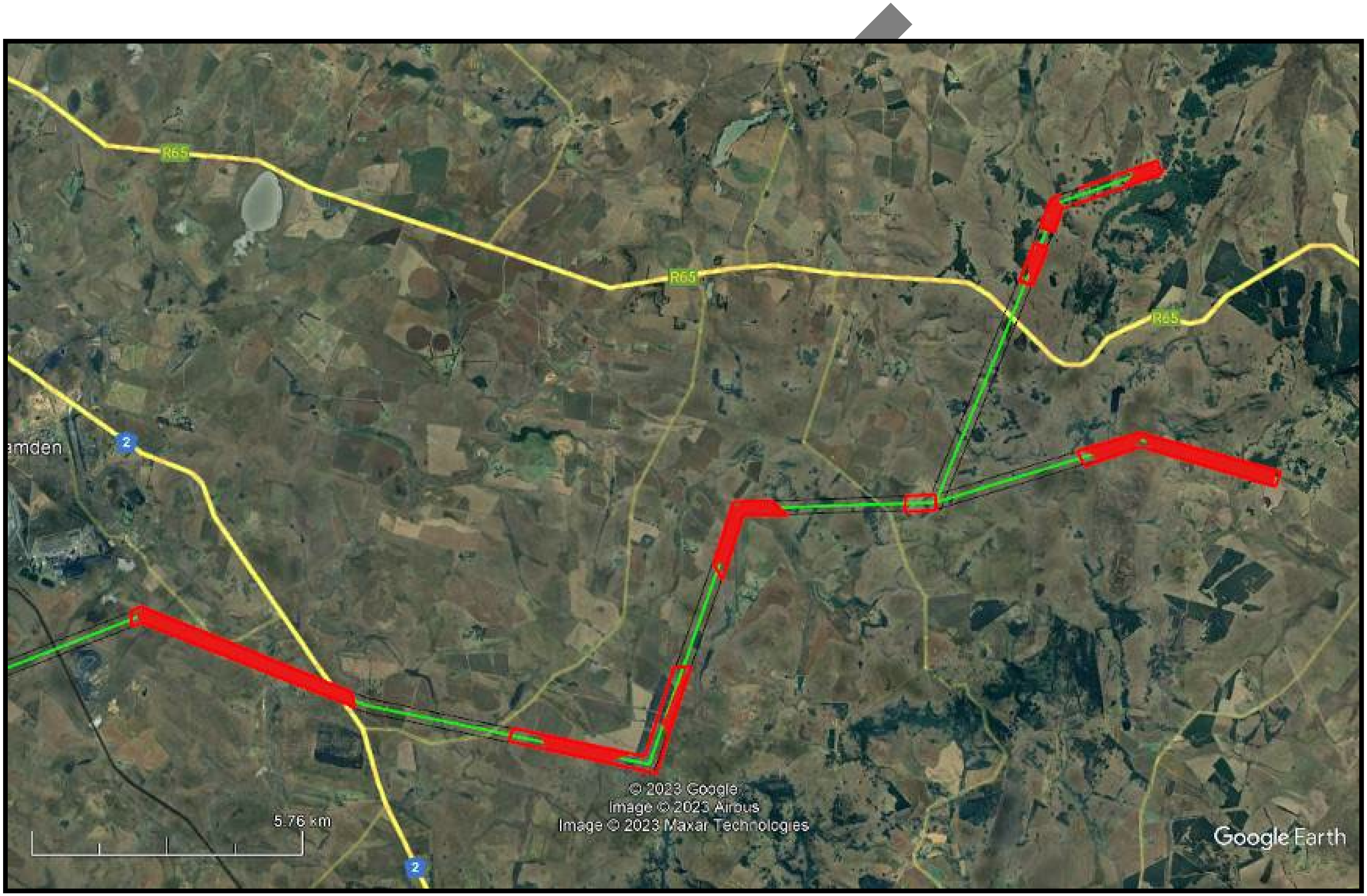
Groenewald (2018) pointed out that the aquatic marine reptile, *Mesosaurus* (earliest known reptile from the Karoo Basin), as well as the fish, *Palaeoniscus capensis*, have been recorded in the Whitehill Formation in the southern part of the basin (MacRae, 1999), which is correlated with the Vryheid Formation... The Vryheid Formation in this area has its provenance in the north (Tavener Smith, 1982). The Whitehill Formation source is in the south. There is also a southerly source to the lower Vryheid Formation (Hastie et al., 2019), but this regime does not extend north of Vryheid. The Vryheid Formation is generally believed to be marine (Hastie et al., 2019) but no significant fossils have been discovered. The lack of vertebrate fossils is problematic. In the marine case it may be due to the water being heavily silted but this is speculation."

The Alternative 1 OHL will have shallow foundations and will have little palaeosensitivity impact...

The chance of significant fossils being found on this site are **Low,** but not **Zero. Consequently a "Chance Find Protocol"** has been included to cover this eventuality.

No further palaeontological work is required, unless triggered by the "**Chance Find Protocol**", which must form part of the Environmental Management Programme (EMPr) for the site.

FIG. 46: LOCATION OF HIGH SENSITIVE PALAEONTOLOGICLA AREAS



ALTERNATIVE 2 OHL

Pending info

FIG. 47: AERIAL OVERVIEW OF THE ALTERNATIVE 2 OHL

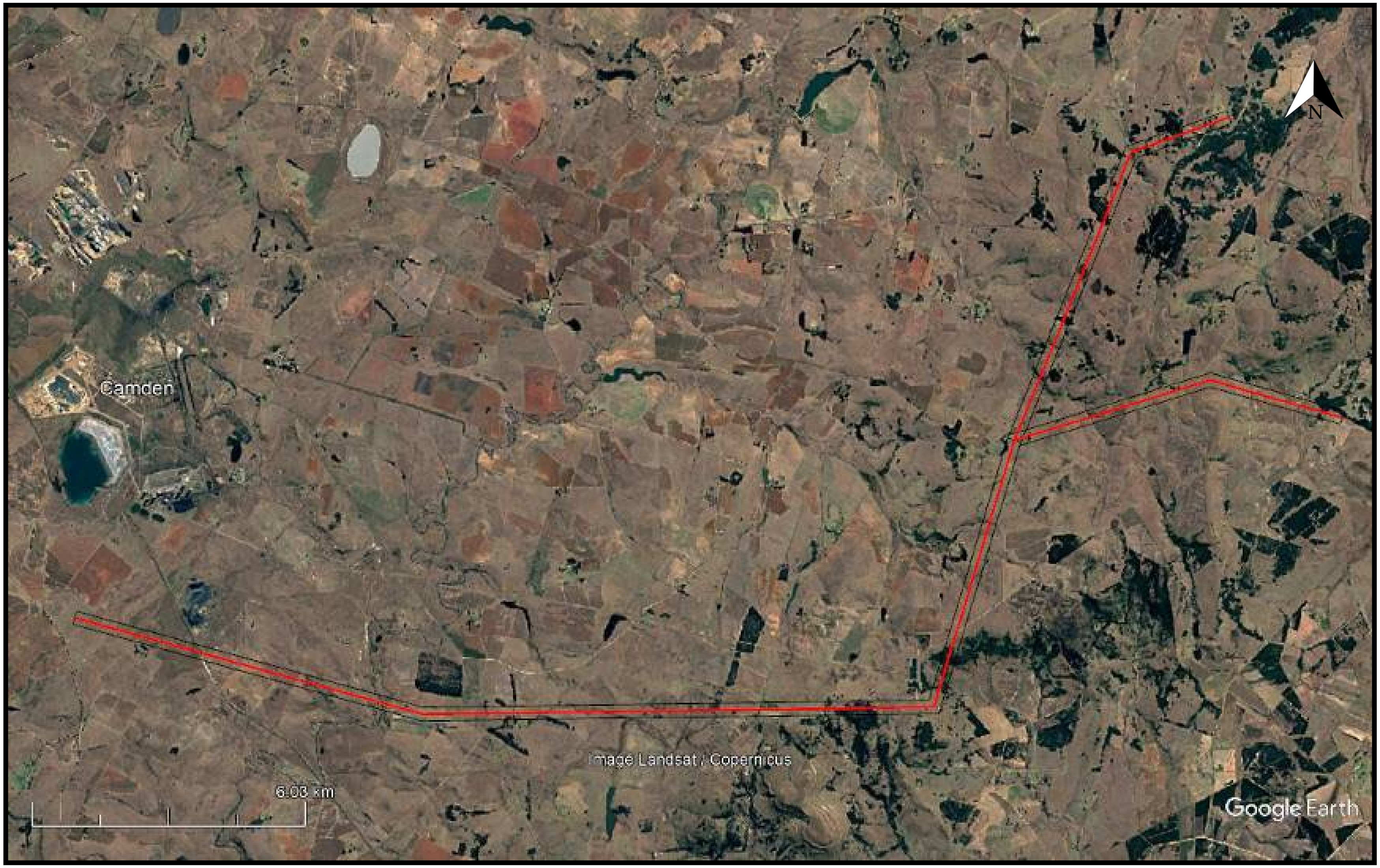


FIG. 48: TOPOGRAPHICAL MAP OF ALTERNATIVE 2 OHL

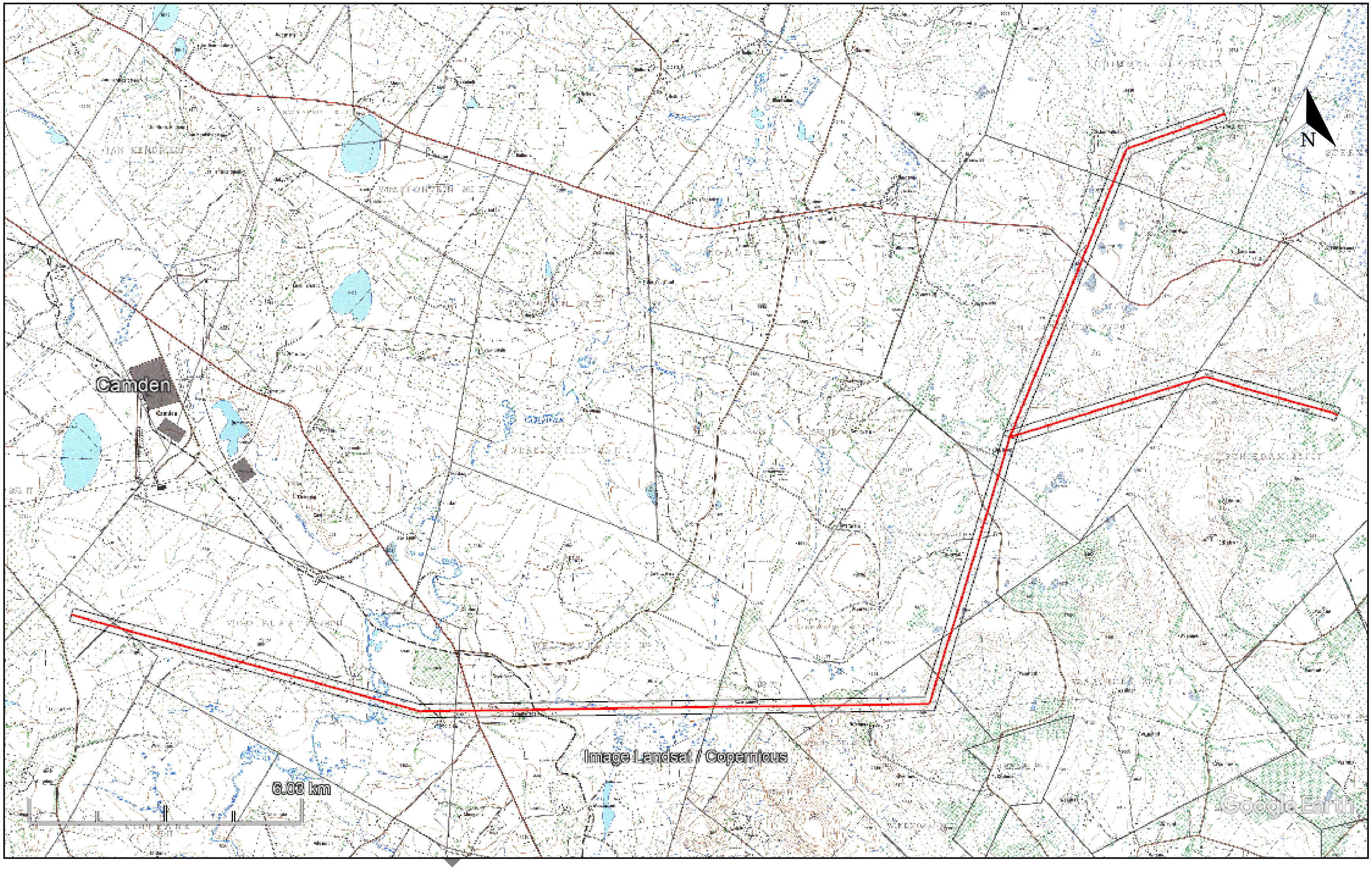


FIG. 49: SCENIC VIEWS OF ALTERNATIVE 2 OHL

DESKTOP STUDY

The 1969 topographical map indicated that there were several settlements, or homesteads, kraals and farm buildings along the route. The location of these features are given in Table 8. Some of these sites will be directly affected by the transmission line, while most are in the footprint our just outside of the footprint.

TABLE 8: LOCATION OF DESKTOP SITES

Name	Latitude	Longitude	Description	Affected By Footprint Or Direct
k1	-26.666571857	30.155268469	Kraal	Footprint
k2	-26.663937947	30.167743444	Building	Direct
Mooifontein	-26.548868529	30.323932706	Farm building	Footprint
Mooiplaas	-26.666898014	30.151174540	Farm building	Outside Footprint
Ruin 2	-26.599368725	30.330021317	Farm building	Footprint
s1	-26.658850049	30.115817509	Settlement	Outside Footprint
s10	-26.657873510	30.262235918	Settlement	Outside Footprint
s11	-26.656376840	30.262837354	Settlement	Outside Footprint
s13	-26.546130499	30.323444652	Settlement	Footprint
s2	-26.659005794	30.118980149	Settlement	Footprint
s3	-26.662677585	30.130601041	Settlement	Outside Footprint
s35	-26.587853931	30.288226500	Settlement	Footprint
s4	-26.663753091	30.132944906	Settlement	Outside Footprint
s46	-26.550681623	30.311582320	Settlement	Direct
s5	-26.665395614	30.176070000	Settlement	Footprint
s59	-26.574699629	30.295994183	Settlement	Footprint
s6	-26.665129096	30.177006308	Settlement	Footprint
s67	-26.606786970	30.291934198	Settlement	Direct
s7	-26.667338022	30.167466763	Settlement	Footprint
s72	-26.621978383	30.271823071	Settlement	Footprint
s79	-26.662393697	30.250519651	Settlement	Footprint
Welgelegen	-26.652407077	30.084308190	Farm building	Outside Footprint
Weltevrede	-26.665606534	30.167715469	Farm building	Direct

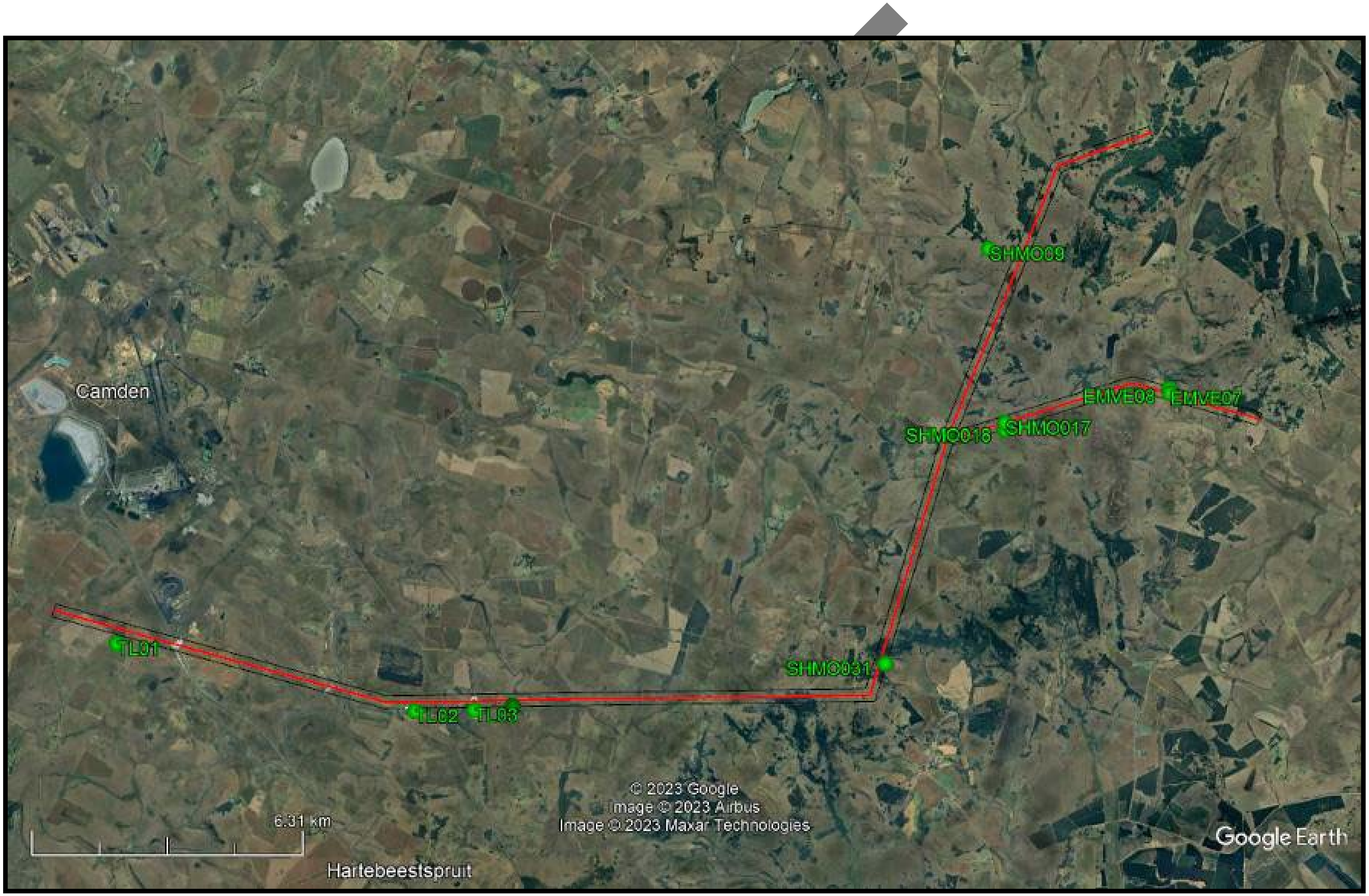
FIELD SURVEY

The location of the recorded sites is shown in Table 9 and fig. 50.

TABLE 9: LOCATION OF RECORDED SITES

Name	Latitude	Longitude	Description
EMVE07	-26.600501450	30.330320888	Graves, walling
EMVE08	-26.599500959	30.330142801	House ruins
SHMO017	-26.606701315	30.291456770	Historical settlement
SHMO018	-26.608241900	30.291393900	grave
SHMO031	-26.656889774	30.263701535	graves
SHMO09	-26.570522600	30.287594200	Row of Stellae
TL01	-26.652407	30.084308	Farm building
TL02	-26.666673	30.153815	Farm building
TL03	-26.666418	30.167715	Weltevrede Farm ruins
TL04	-26.665551	30.176653	Settlement

FIG. 50: LOCATION OF RECORDED SITES



TL01

The site is located just outside of the transmission line footprint and was not part of the survey. The site consists of the ruins of the farm Weltevreden (fig. 51).

Significance: The site is of medium significance in terms of middens.
Mitigation: Mitigation will only be required if affected.
SAHRIS: 3B

FIG. 51: WELGELEGEN FARM

TL02

The site is located along transmission line and forms part of the Farm Mooiplaas. The part of the farm that falls within the footprint consists of a barn and a stone walled kraal (fig. 52). The kraal is very low and just visible. It is not used as a kraal at the moment.

Significance: The site is of low significance.

Mitigation: No mitigation is currently required

SAHRIS: 3

FIG. 52: BUILDING AND KRAAL AT TL02

TL03

The site is located at the base of a small hill and appears to be the original Weltevrede farm. The site consist of the ruins of a double story farmhouse, barns and associated buildings (fig. 53) There is a large stone walled kraal to the north. South of the dam is another kraal and foundations of possible houses. The main kraal is square, 25m in size. There is a secondary kraal attached to it that is 12m in size.

The main house is 20m x 10m in size and is a double story building. There is another building of the same dimensions 10m to the south. Both buildings are in ruin and disrepair.

Approximately 200m south of the main farm buildings is another stone walled buildings and the foundations of other buildings. These could be barns and related structures.

The farm buildings probably date to the 1870s and are thus automatically protected. Any rubbish middens associated with the farm complex are also protected.

The transmission line currently passes between the house and main kraal.

Significance: The site is of medium significance due to its age and is an example of vernacular architecture.

Mitigation: The OHL Emvelo Alternative 2 runs between the main kraal and farm house. This will bisect the farm complex and its landscape. The transmission line will need to be moved 100m northwards. In this way, it would not affect any potential middens and features.

SAHRIS: 3B

FIG. 53: BUILDINGS AT TL03 (WELTEVREDE)

TL04

The site is located north of the black wattle. TL04 corresponds with S4 and S5 from the desktop study. The site consists of low walling and circular depressions within the dense grass (fig. 54). A full assessment of the site was not possible due to the thick vegetation. However, graves could occur near the observed features.

The transmission line occurs 80m north from the nearest feature.

Significance: The site needs to be re-assessed if the transmission line is moved southwards.

Mitigation: No mitigation is currently required; however 50m buffer should be placed between the most northern feature and the transmission line.

SAHRIS: 3A if there are graves, otherwise 3C

FIG. 54: WALLING AT TL04

SHMO016

The site is located halfway down the hill, northwest of Onverwacht #3. The site consists of a single grave post-dating 2000 (fig. 55). The grave is a stone cairn roughly in a north-south orientation.

The grave occurs 10m east of the transmission line.

Significance: The site is of high significance.

Mitigation: The transmission line will need to be moved at least 50m from the grave with no structures in that radius. The grave will need to be visibly demarcated before construction phase commences.

SAHRIS: 3A

FIG. 55: GRAVE AT SHMO16

SHMO017

The site is located on a rocky hill overlooking a stream. The site consists of a cemetery to the west, a domestic area to the east, and a kraal in the north (fig. 56). The cemetery consists of ~14 graves mostly in an east-west orientation. The graves are very low on the ground and hardly visible above the grass.

There are six stone walled features that appear to be related to houses. Two of these are rectangular while four are circular. They are 3m – 4m in width. In the centre of these features is a large stone cairn that is a grave. All the entrances of the houses face towards the grave.

The stone walled kraal is 15m x 15m in size. The entrance faces uphill towards the house.

The site dates to the Historical Period due to the rectangular structures; however the rest of the building and central grave follows an Nguni-speaking settlement pattern. According to the landowner, Mr Robberts, none of the workers claim the ancestral graves, nor are the known to the community.

The transmission line passes through the middle of the site.

Significance: The site is of high significance.

Mitigation: The transmission line needs to move at least 50m away from the edge of the site. I would suggest it moves northwards due to SHMO-18 occuring to the south. The site needs to be clearly demarcated before construction begins.

SAHRIS: 3A

FIG. 56: FEATURES AT SHMO017

SHMO018

The site is located ~150m uphill, south-southwest from SHMO017. The site consists of a single grave with an unmarked headstone (fig. 57). The grave is in an east-west orientation.

The grave falls just outside of the footprint.

Significance: The site is of HIGH significance.
Mitigation: No mitigation is currently required.
SAHRIS: 3A

FIG. 57: GRAVE AT SHMO018

SHMO031

The site is located within the eastern side of a black wattle thicket. The site is either S10, S11, S80 or S81, or a combination of them (fig. 58). The black wattle has destroyed any of the houses and was an impenetrable thicket from the west. The landowner informed me of the graves between the agricultural fields and black wattle. These graves occur on the outer footprint of the transmission line.

Significance: The site is of high significance.

Mitigation: No mitigation is currently required as the transmission line occurs on the western side of the black wattle that acts as a natural buffer

SAHRIS: 3A

FIG. 58: LOCATION OF SETTLEMENTS AND GRAVES AT SHMO031

EZEM07

The site is located near the base of the main hill. The site consist of several depressions that could be house floors, parts of stone walling and terracing and four stone cairns that are probably graves (fig. 69). There are two small stone walled kraals further up the hill.

The transmission line will occur ~20m south of the main site, but pass over the small kraal uphill.

Significance: The site is of significance.

Mitigation: The transmission line should be moved slightly southwards so that it does not affect the main site with graves. The site needs to be clearly demarcated before construction begins.

SAHRIS: 3A

EZEM08

The site is located at the base of the hill 30m north of EZEM07. . The site consists of the ruins of what appears to be the original Schiedam farm or Ruin 2 from the desktop (fig. 60). The site consists of two rectangular farm buildings with a circular structure between them. The buildings are 12m x 10m in size. There is some terracing to the south.

The vegetation was too dense to note any middens that would occur. The site is to the north of the transmission line and in the footprint.

Significance: The site is of medium significance due to potential 19th century middens.

Mitigation: The site will not be affected by the transmission line that is 90m to the south.

SAHRIS: 3B

FIG. 59: FEATURES AT ESEM07

FIG. 60: BUILDINGS AT EZEM08

SHMO09

The site is a row of stone stellae that were used to form part of the original farm boundary or subdivision. The row continues for ~1km (fig. 61). The row forms part of the cultural landscape.

The transmission line passes over the row of stellae

Significance: The site is of low significance.
Mitigation: The construction should avoid, moving the stellae.
SAHRIS: 3C

FIG. 61: ROW OF STONE STELLA

SHM011

The site is located on a small hill just north of the tarred road. The site relates to S59 from the desktop study and consists of five house floor remains (fig. 62). The vegetation was too dense to make an accurate assessment, and I would assume that human graves would occur within the site.

The transmission line occurs 90m to the west of the site.

Significance: The site is currently of low significance, unless human graves occur.

Mitigation: The site needs to be clearly demarcated before construction phase begins.

SAHRIS: 3C

FIG. 62: HOUSE FLOORS AT SHMO011

DESKTOP PALAEONTOLOGICAL ASSESSMENT

The area is of very high palaeontological sensitivity (fig. 63). Dr Alan Smith undertook a desktop PIA for the proposed Emvelo WEF (Appendix A). He states:

"The SAHRIS Palaeosensitivity Map ... considers the Vryheid Formation as a Very High Palaeosensitivity Zone... In practise, no vertebrate fossils have been recorded from the Vryheid Formation in this area, however invertebrate trace fossils are common (Tavener Smith et al, 1989; Mason and Christie, 1985; Hastie et al., 2019), but these are of no particular value, in this area.

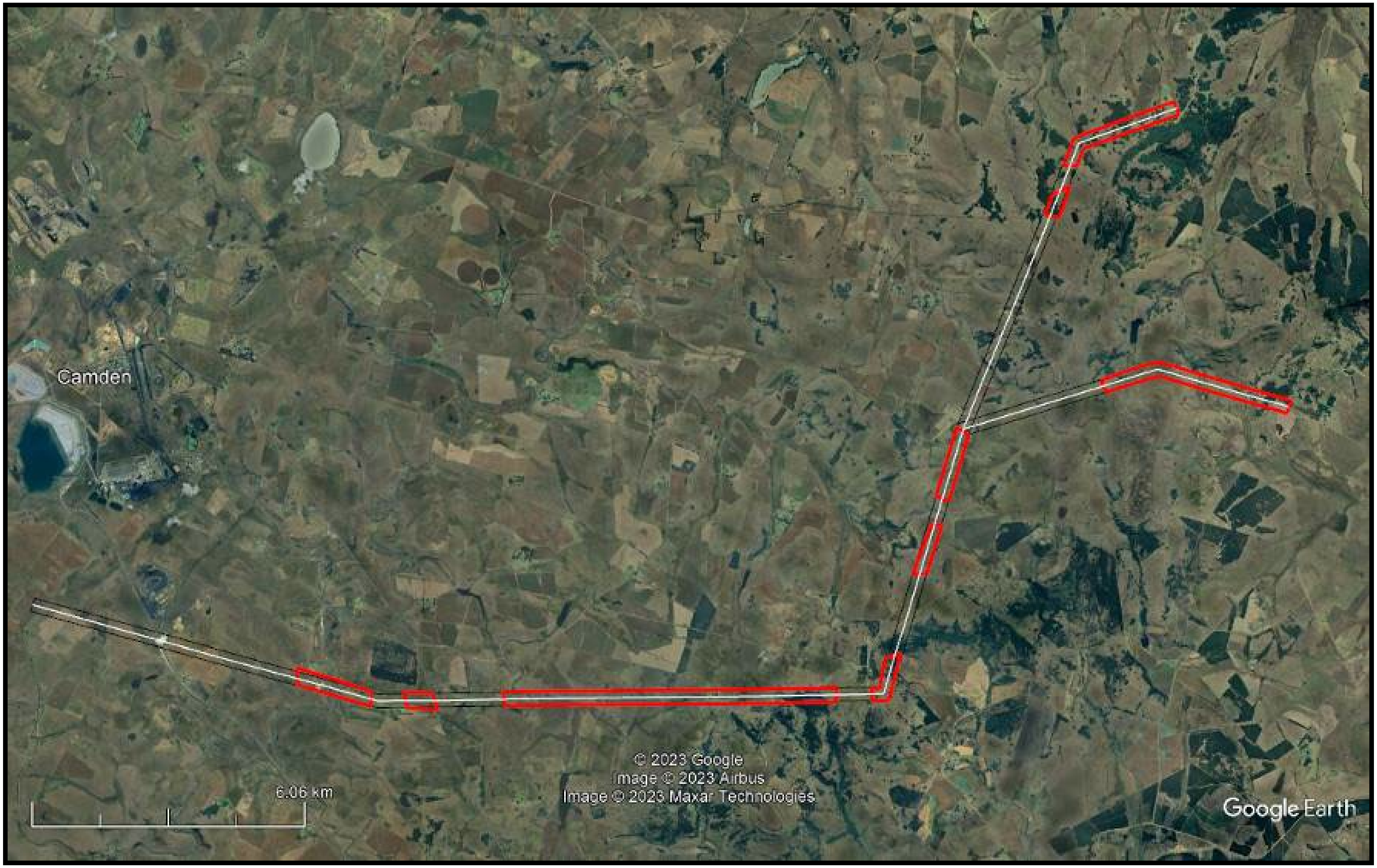
Groenewald (2018) pointed out that the aquatic marine reptile, *Mesosaurus* (earliest known reptile from the Karoo Basin), as well as the fish, *Palaeoniscus capensis*, have been recorded in the Whitehill Formation in the southern part of the basin (MacRae, 1999), which is correlated with the Vryheid Formation... The Vryheid Formation in this area has its provenance in the north (Tavener Smith, 1982). The Whitehill Formation source is in the south. There is also a southerly source to the lower Vryheid Formation (Hastie et al., 2019), but this regime does not extend north of Vryheid. The Vryheid Formation is generally believed to be marine (Hastie et al., 2019) but no significant fossils have been discovered. The lack of vertebrate fossils is problematic. In the marine case it may be due to the water being heavily silted but this is speculation."

The Alternative 2 OHL will have shallow foundations and will have little palaeosensitivity impact.

The chance of significant fossils being found on this site are **Low,** but not **Zero. Consequently a "Chance Find Protocol"** has been included to cover this eventuality.

No further palaeontological work is required, unless triggered by the "**Chance Find Protocol**", which must form part of the Environmental Management Programme (EMPr) for the site.

FIG. 63: LOCATION OF HIGH SENSITIVE PALAEONTOLOGICLA AREAS



ALTERNATIVE 3 OHL

The location of Alternative 3 OHL fig.'s 64 - 66.

FIG. 64: AERIAL OVERVIEW OF ALTERNATIVE 3

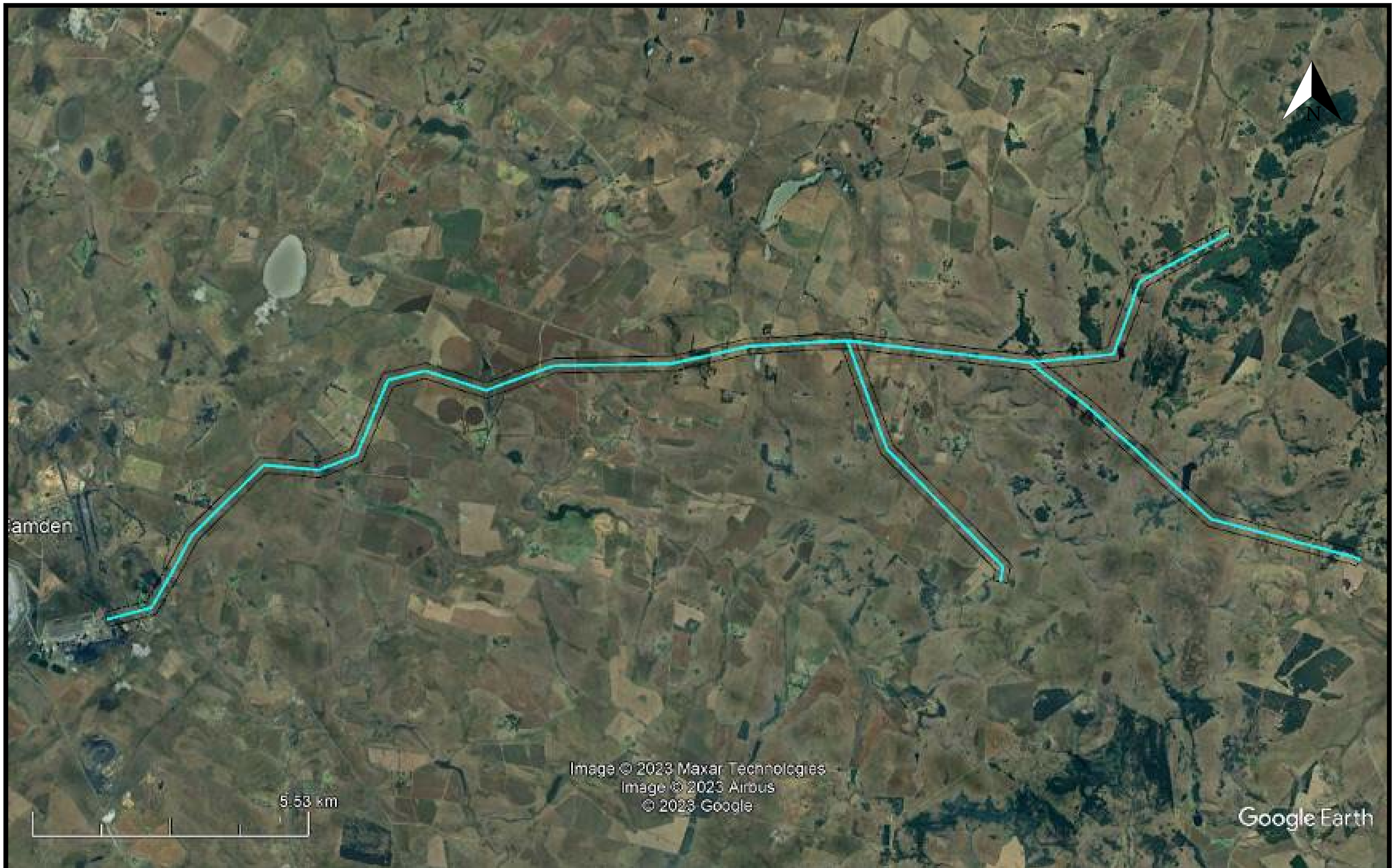


FIG. 65: TOPOGRAPHICAL MAP OF ALTERNATIVE 3

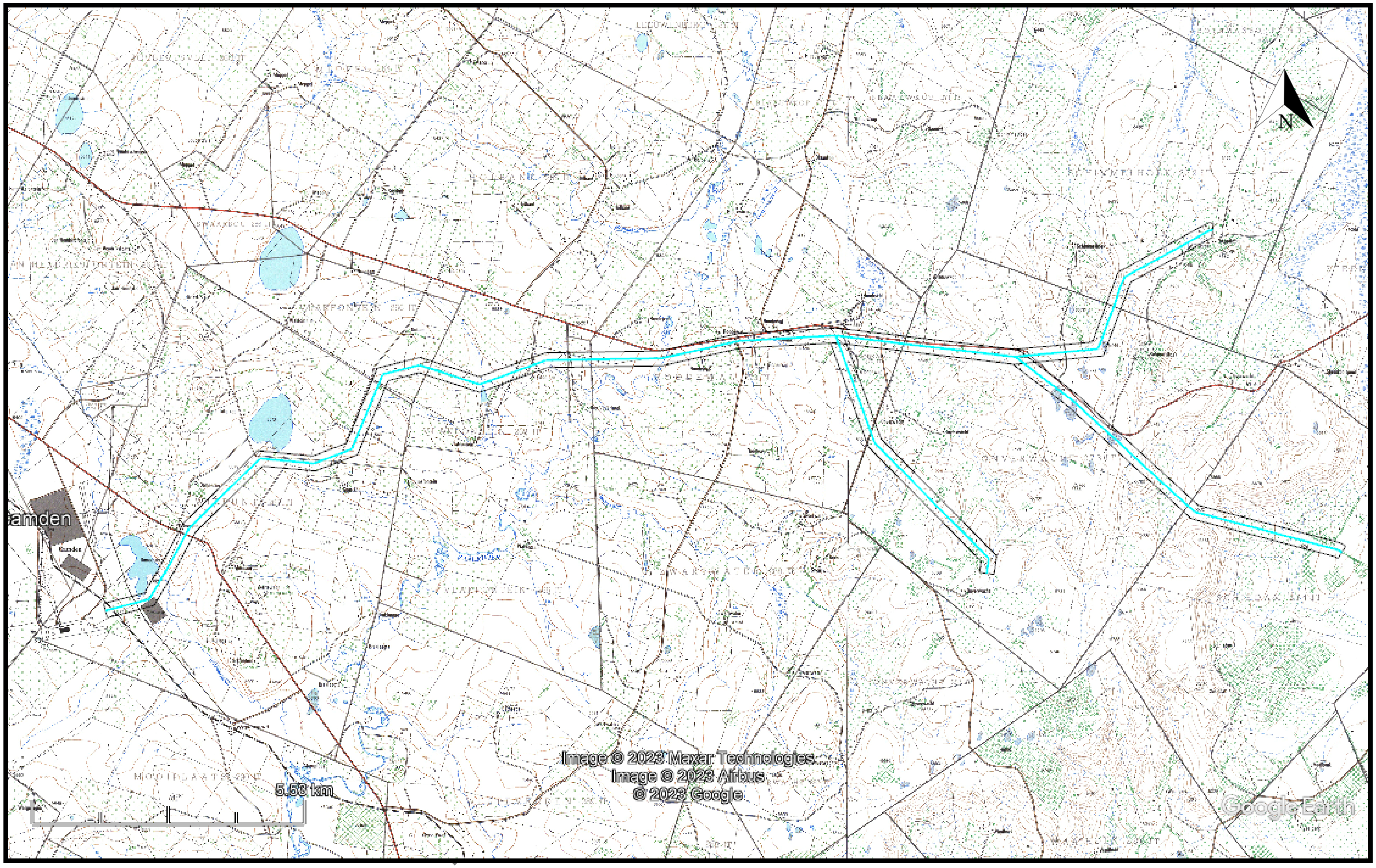


FIG. 66: SCENIC VIEWS OF THE STUDY AREA

DESKTOP STUDY

The 1969 topographical map indicated that there were several settlements, or homesteads, kraals and farm buildings along the route. The location of these features are given in Table 10. Some of these sites will be directly affected by the transmission line, while most are in the footprint.

TABLE 10: LOCATION OF DESKTOP SITES

Name	Latitude	Longitude	Description
Grave	-26.563894307	30.232655451	Cemetery
Holbank	-26.566200478	30.236891819	Farm house
k3	-26.569613421	30.281804495	Kraal
k6	-26.573283727	30.249277038	Kraal
Roodewal	-26.573256735	30.251704300	Farm house
Ruin 2	-26.599368725	30.330021317	Farm house
s12	-26.550806010	30.318406504	Settlement
s13	-26.546130499	30.323444652	Settlement
s14	-26.570156513	30.281529850	Settlement
s15	-26.566582933	30.259989783	Settlement
s16	-26.567670536	30.257720700	Settlement
s17	-26.566985621	30.256291856	Settlement
s18	-26.565863284	30.254474002	Settlement
s19	-26.569665278	30.214082757	Settlement
s2	-26.659005794	30.118980149	Settlement
s20	-26.571458481	30.212979431	Settlement
s21	-26.570569607	30.199860781	Settlement
s22	-26.570307746	30.197816482	Settlement
s23	-26.574918539	30.179165394	Settlement
s24	-26.574747357	30.176868218	Settlement
s25	-26.572510510	30.153685437	Settlement
s26	-26.572400800	30.157504436	Settlement
s27	-26.586562228	30.148547814	Settlement
s28	-26.589282820	30.134043646	Settlement
s33	-26.603861893	30.276136708	Settlement
Vlakfontein	-26.572767769	30.186527738	Farm house

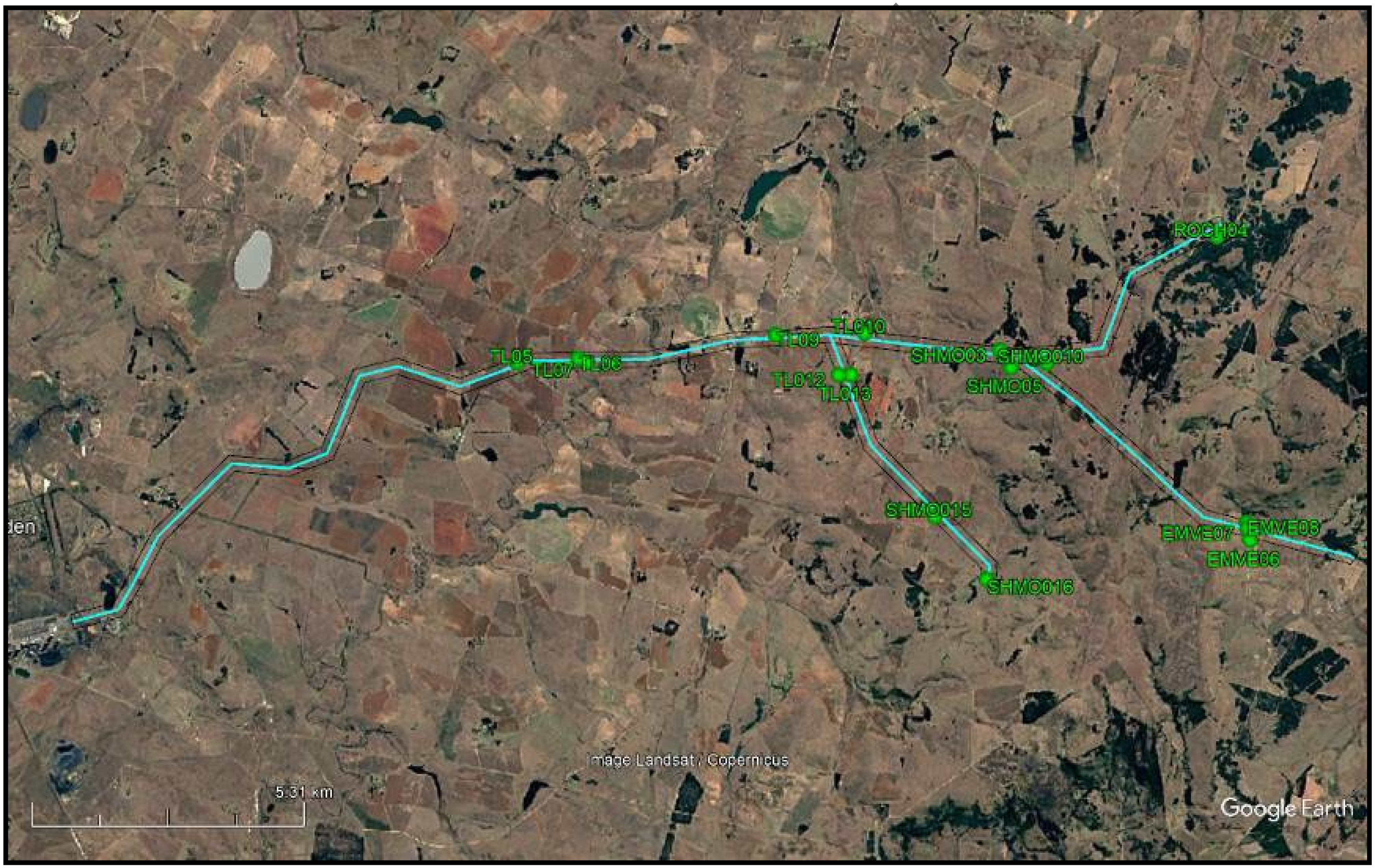
FIELD SURVEY

Table 11 lists the desktop settlements, while Table 3 lists the recorded sites. Fig. 67 show the location of these sites

TABLE 11: LOCATION OF RECORDED SITES

Name	Latitude	Longitude	Description
EZEM06	-26.602617800	30.330840200	modern cemetery
EZEM07	-26.600501450	30.330320888	LIA or HP settlement
EZEM08	-26.599500959	30.330142801	Schiedam
ROCH04	-26.548868529	30.323932706	Mooifontein
SHMO03	-26.569013053	30.280872595	Settlement
SHMO04	-26.569869600	30.281628800	Settlement
SHMO09	-26.570522600	30.287594200	Row of Stellae
SHMO010	-26.571229644	30.290122635	Settlement
SHMO015	-26.598286500	30.268117800	Settlement?
SHMO016	-26.609387400	30.278318600	grave, 2000 onwards
TL05	-26.571071826	30.186007785	Vlakfontein Labourers' houses
TL05	-26.572767769	30.186527738	Vlakfontein
TL07	-26.570991000	30.199839600	houses x3
TL07	-26.570331500	30.198004200	settlement 22
TL09	-26.566200478	30.236891819	Holbank
TL010	-26.565863284	30.254474002	Settlement 18
TL011	-26.569829467	30.252662345	cemetery modern
TL012	-26.573283727	30.249277038	Kraal

FIG. 67: LOCATION OF RECORDED SITES



EMVE06

The site is located on the slopes of the hill. The site consists of recent cemetery with 30+ graves (fig. 68). The graves are stone cairns in an east-west orientation.

Significance: The site is of high significance.

Mitigation: It is unlikely that the cemetery will be affected. A 50m buffer needs to be placed around the site. The site will need to be visibly demarcated before construction phase commences if any activity occurs within 50m of it. The demarcation should be 20m from the grave.

SAHRIS: 3A

FIG. 68: CEMETERY AT EMVE06

EMVE07

The site is located near the base of the main hill. The site consist of several depressions that could be house floors, parts of stone walling and terracing and four stone cairns that are probably graves. (fig. 69). There are two small stone walled kraals further up the hill.

The transmission line will occur ~20m south of the main site, but pass over the small kraal uphill.

Significance: The site is of significance.

Mitigation: The site will may be affected by the transmission line. If a pylon is placed within 50m of the site then the site will need to be demarcated with a 20m buffer.

SAHRIS: 3A

EZEM08

The site is located at the base of the hill 30m north of EZEM07. . The site consists of the ruins of what appears to be the original Schiedam farm or Ruin 2 from the desktop (fig. 70). The site consists of two rectangular farm buildings with a circular structure between them. The buildings are 12m x 10m in size. There is some terracing to the south.

The vegetation was too dense to note any middens that would occur. The site is to the north of the transmission line and in the footprint.

Significance: The site is of medium significance due to potential 19th century middens.

Mitigation: The site will not be directly be affected by the transmission line. If a pylon is placed within 50m of the site then the site will need to be demarcated with a 20m buffer.

SAHRIS: 3B

FIG. 69: FEATURES AT EMVE07

FIG. 70: BUILDINGS AT EMVE08

ROCH04

The site is at the base of the hill overlooking the valley. The site is Mooifontein from the desktop study. The site consists of a farmhouse, a large kraal and several sandstone and/or dolerite buildings that have been added through time (fig. 71).

The site probably dates to the late 19^{th} century or early 2oth century and thus the buildings are protected.

Significance: The site is of possible medium to high significance for the buildings and vernacular architecture...

Mitigation: If the buildings are to be affected, then the site requires a Built Environment assessment. A general 100m radius around the site should be placed for potential historical middens.

SAHRIS: 3B for middens while the buildings need an assessment.

FIG. 71: BUILT STRUCTURES AT ROCH04

SHMO03

The site is located on the top of a wide hill near the road. The site consists of house foundation and a quarry (fig. 72). The house foundation is on a raised platform 5m in diameter floor. There is a small low wall 2m from foundation. Tot he north of the house is a broken lower grinding stone. The grinding stone suggests a pre-19th century date for the site. The quarry area appears to be the source for the wall and house foundation.

Significance: The site is of low-medium significance since few domestic sites of this age occur in the general area.

Mitigation: The site should not be damaged. A 20m buffer must be placed around the site. If any construction occurs within 50m of the site, then it needs to be clearly demarcated before construction begins.

SAHRIS: 3C

FIG. 72: QUARRY AND HOUSE FLOOR AT SHMO03

SHMO04

The site is located ~120m southeast of the house at SHMO02. The site consist of three circular depressions that are probably house remains (fig. 73). The site S14 and K4 are related to this site; however, there is no longer a kraal.

Significance: The site is of low significance.

Mitigation: No further mitigation is required.

SAHRIS: 3C

FIG. 73: CIRCULAR HOUSE FOUNDATIONS

SHMO09

The site is a row of stone stellae that were used to form part of the original farm boundary or subdivision. The row continues for ~1km (fig. 74). The row forms part of the cultural landscape.

The transmission line passes over the row of stellae

Significance: The site is of low significance.

Mitigation: The construction should avoid ,moving the stellae.

SAHRIS: 3C

FIG. 74: STELLAE AT SHMO09

SHMO010

The site is located north of the road on the crest of the hill. Much of the site is obscured by the dense vegetation; however some basic features could be identified over a 200m x 120m area (fig. 75). These features are:

- Four circular walls varying from 6m to 15m in diameter
- Rectangular stone walling 9m x 5m in size
- Raised floor similar to SHMO03
- Two stone cairns that could be a grave

The site may extend beyond these features. The site appears to be a mix of Late Iron Age and Historical Period features.

Significance: The site is of high significance due to potential graves and spatial settlement pattern. No LIA sites have been recorded in this area.

Mitigation: The area will need to be re-assessed once the vegetation has receded as the site may be part of a larger LIA and HP site. If the site is archaeological then the graves could be removed; however a PPP will still need to be undertaken. The site features would need to be mapped and/or excavated.

SAHRIS: 3A for the graves

FIG. 75: HOUSE FEATURES AT SHMO010

SHMO015

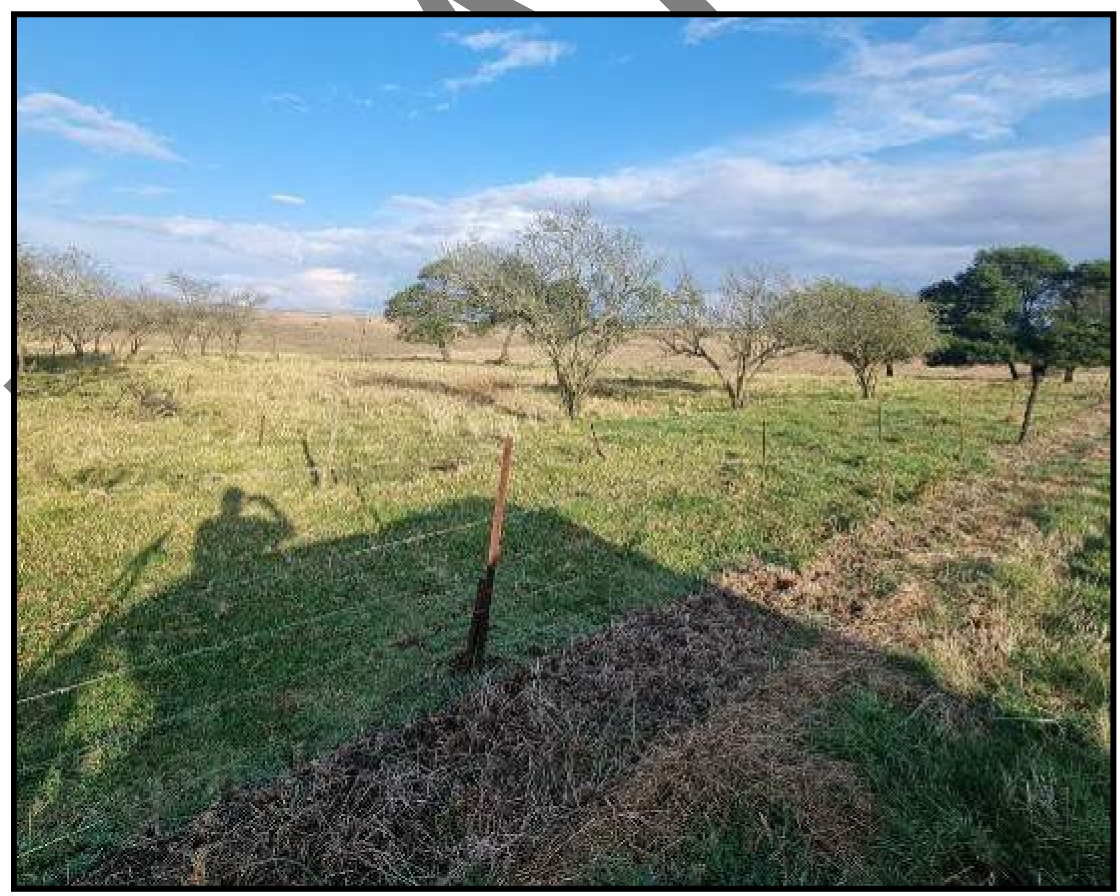
The site is located on the top of the hill next to maize fields. The site consists of several fruit trees in a cleared area (fig. 76). The site appears to be an old settlement; however no obvious features were noted.

Significance: The site is of low significance.

Mitigation: No further mitigation is required.

SAHRIS: 3C

FIG. 76: POSSIBLE SETTLEMENT



SHMO016

The site is located halfway down the hill, northwest of Onverwacht #3. The site consists of a single grave post-dating 2000 (fig. 77). The grave is a stone cairn roughly in a north-south orientation. The deceased is known to the landowner.

Significance: The site is of high significance.

Mitigation: The transmission line will need to be moved at least 50m from the grave with no structures in that radius. The grave will need to be visibly demarcated before construction phase commences.

SAHRIS: 3A

FIG. 77: GRAVE AT SHMO16

TL05

The site is located below the top of the hil1. The site consists of the farm and farm labourer's houses of Vaalbank noted in the desktop. (fig. 78). The transmission line passes between the main farm building and the (abandoned) labourers' houses. The buildings appear to be younger than 60 years in age and do not appear on the 1969 topographical map.

Significance: The site is of low significance.

Mitigation: The transmission line will pass between the farm and labourers' houses. The houses appear to be post 1970s and thus are not protected. No further mitigation is required.

SAHRIS: N/A

FIG. 78: HOUSES AT TL05

TL06

The site is located on a low gradient below the top of the hill. The site consists of low sunken stone walled circle (fig. 79). There stone circle 2m in diameter near the main circle. This is also near S22 from the desktop study.

The transmission line will pass over the site.

Significance: The site is currently of low significance.

Mitigation: The area will need to be re-assessed if this option is chosen for potential graves. This will need to occur when the vegetation has been burnt or at the end of winter. If graves do occur then they can be buffered and demarcated while the line is slightly re-aligned.

SAHRIS: 3C

FIG. 79: STONE CIRCLE AT TL06

TL07

The site is located 200m east of TL06. The site consists of the foundation of three houses (fig. 80). No other features were noted in the dense vegetation.

The transmission line will pass over the site.

Significance: The site is currently of low significance.

Mitigation: The area will need to be re-assessed if this option is chosen for potential graves. This will need to occur when the vegetation has been burnt or at the end of winter. If graves do occur then they can be buffered and demarcated while the line is slightly re-aligned.

SAHRIS: 3C

FIG. 80: HOUSE FOUNDATION AT TL07

TL09

The site is located beside the R65. The site consists of the Holbank farm buildings that have now been converted into a General Dealer (fig. 81).

The transmission line will not affect the buildings.

Significance: A Built Environment specialist will need to assess the building if it is to be affected.

Mitigation: No mitigation is currently required.

SAHRIS: pending

FIG. 81: HOLBANK FARMHOUSE

TL012

The site is located near the base of the hill next to a small stream. The site consists of large rectangular stone walled kraal 50m x 18m in size (fig. 82). The kraal has a central dividing wall and an exit on the south and north ends. The kraal is probably related to TL013 (Roodewal).

The kraal will not be directly affected by the line.

Significance: The site is of low significance.

Mitigation: The site will not be directly be affected by the transmission line. If a pylon is placed within 50m of the site then the site will need to be demarcated with a 20m buffer.

SAHRIS: 3C

FIG. 82: KRAAL AT TL012

TL013

The site is located on the top of the small hill. The site is the original Roodewal farmhouse and consists of a farmhouse and possible water reservoir (fig. 83). The original house was made from dolerite slabs, and brick additions were added later.

The transmission line will not affect the buildings.

Significance: A Built Environment specialist will need to assess the building if it is to be affected.

Mitigation: No mitigation is currently required.

SAHRIS: pending

FIG. 83: ROODEWAL FARMHOUSE

DESKTOP PALAEONTOLOGICAL ASSESSMENT

The area is of very high palaeontological sensitivity (fig. 84). Dr Alan Smith undertook a desktop PIA for the proposed Emvelo WEF (Appendix A). He states:

"The SAHRIS Palaeosensitivity Map ... considers the Vryheid Formation as a Very High Palaeosensitivity Zone... In practise, no vertebrate fossils have been recorded from the Vryheid Formation in this area, however invertebrate trace fossils are common (Tavener Smith et al, 1989; Mason and Christie, 1985; Hastie et al., 2019), but these are of no particular value, in this area.

Groenewald (2018) pointed out that the aquatic marine reptile, *Mesosaurus* (earliest known reptile from the Karoo Basin), as well as the fish, *Palaeoniscus capensis*, have been recorded in the Whitehill Formation in the southern part of the basin (MacRae, 1999), which is correlated with the Vryheid Formation... The Vryheid Formation in this area has its provenance in the north (Tavener Smith, 1982). The Whitehill Formation source is in the south. There is also a southerly source to the lower Vryheid Formation (Hastie et al., 2019), but this regime does not extend north of Vryheid. The Vryheid Formation is generally believed to be marine (Hastie et al., 2019) but no significant fossils have been discovered. The lack of vertebrate fossils is problematic. In the marine case it may be due to the water being heavily silted but this is speculation."

The Alternative 1 OHL will have shallow foundations and will have little palaeosensitivity impact...

The chance of significant fossils being found on this site are **Low,** but not **Zero. Consequently a "Chance Find Protocol"** has been included to cover this eventuality.

No further palaeontological work is required, unless triggered by the "**Chance Find Protocol**", which must form part of the Environmental Management Programme (EMPr) for the site.

FIG. 84: LOCATION OF HIGH SENSITIVE PALAEONTOLOGICLA AREAS

MANAGEMENT PLAN

Any activity within 50m of a heritage site that cannot be affected will require that site to be clearly demarcated before any construction activity occurs. Demarcation: Demarcation is a physical high visibility demarcation that occurs 20m from the edge of the site. Normally demarcations is 5m from the edge; however since there will be heavy equipment involved, this needs to be increased to lessen possible impacts. Demarcation needs to occur before construction activity begins and they type of demarcti0n should be part of the site Safety, Health, Environment and Quality (SHEQ) course. This needs to be the standard approach to all sites with variation allowed in a few cases.

Many of the settlements from the desktop no longer exist as they have been abandoned, overgrown by black wattle thickets and/or are now part of the agricultural fields. Where graves are known to the landowners, they tend to be buffered and omitted from farming activity. All of the old settlements that were recorded had graves associated with them. One could assume that those settlements that no longer exist, or were not accessible, could have graves. These graves will not be marked, as the cairns would be disturbed. All settlements from the desktop study should thus be treated has being sensitive for potential graves. Those that will be affected could re-assessed after the area has been cleared of wattle and/or the vegetation has been thinned out at the end of winter or burnt.

All possible graves should be treated as graves until proven otherwise. Any activity within 50m of a grave will require that grave to be clearly demarcated before any construction activity occurs.

Isolated stone kraals may be removed/demolished after they have been mapped and photographed. Any stone walled feature that is to be damaged will require a permit from the

Ruins and old farmhouses should preferably not be damaged and will require an assessment by a Built Environment specialist. They would also require a permit of they are to be (partially) damaged. Old farmhouses will have historical middens associated with them. These middens would need to be excavated/sampled if exposed.

While the palaeontology is of very high sensitivity as it forms [part of the Vryheid formation, very few significant vertebrate fossils have been found in it. A Chance Find Protocol was initiated for the construction phase.

Only EMV012 will be currently affected by the preferred laydown area infrastructure. This area needs to be moved away from the cemetery. The access road needs to be moved westwards so as not to affect the cemetery.

SIGNIFICANCE OF IMPACT

Impact Phase: Construction/ Operation/Decommissioning							
Potential impact description: Graves/Cemeteries • Any construction activity near human graves has the possibility of disturbing the remains. • There may be more subsurface graves with no demarcation.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	H	H	Negative	High	High	High
With Mitigation	Low	Low	Low	Positive	Low	Low	Low
Can the impact be reversed?			No. they are a finite resource				
Will impact cause irreplaceable loss or resources?			Yes. they are a finite resource				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: • *List and describe* • Cannot be affected.50m buffer from the edge. 20m visible demarcation if within 100m							
Residual impact	high negative impact if no mitigation occur						

Impact Phase: Construction/ Operation/Decommissioning							
Potential impact description: 20th century settlements without graves Abandoned settlements with no visible structures are destroyed							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Low	Low	Low	Neutral	Low	Low	High
With Mitigation	Low	Low	Low	Neutral	Low	Low	High
Can the impact be reversed?			No.				
Will impact cause irreplaceable loss or resources?			YES. No. They are a finite resource				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: • *List and describe* • Once no graves are confirmed, then may be destroyed if the PPP has been approved …							
Residual impact	Yes, but acceptable as of low negative significance						

Impact Phase: Construction/ Operation/Decommissioning							
Potential impact description: 20th century settlements with graves • Abandoned settlements with graves and no visible structures are destroyed							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Low	High	Negative	High	Medium	High
With Mitigation	Low	Low	low	Positive	low	low	High
Can the impact be reversed?			No. They are finite resource				
Will impact cause irreplaceable loss or resources?			YES. They are finite resource				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: • Graves cannot be affected • .50m buffer from the edge • 20m visible demarcation if within 100m…							
Residual impact	Yes, but acceptable as of low negative significance,						

Impact Phase: Construction/ Operation/Decommissioning							
Potential impact description: Late Iron Age settlements Detailed description of impact Archaeological site may be destroyed							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Low	High	Negative	High	High	High
With Mitigation	Low	Low	High	positive	High	Medium	High
Can the impact be reversed?			NO. Finite resource				
Will impact cause irreplaceable loss or resources?			YES. Finite resource				
Can impact be avoided, managed or mitigated?			YES. Salvage excavations				
Mitigation measures to reduce residual risk or enhance opportunities: • Sites may be excavated • PPP to ensure there are no claimants							
Residual impact	Yes, but acceptable as of low positive significance						

Impact Phase: Construction/ Operation/Decommissioning							
Potential impact description: Ruins • Ruins are protected by the NHA if they are older than 60 years in age. • Loss of vernacular architecture • Loss of historical middens							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Low	High	Negative	High	High	High
With Mitigation	Low	Low	High	positive	High	Medium	High
Can the impact be reversed?			NO. It is a finite resource				
Will impact cause irreplaceable loss or resources?			YES. It is a finite resource				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: • Should not be affected. • Middens may need to be sampled or excavated • Buildings need to be assessed by Built Environment specialist to determine architectural value • Will require mapping, photography if affected							
Residual impact	Yes, but acceptable as of medium negative significance						

Impact Phase: Construction/ Operation/Decommissioning							
Potential impact description: isolated stone walled kraals Built structure to be damaged							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Low	High	Negative	High	High	High
With Mitigation	Low	Low	High	positive	High	Medium	High
Can the impact be reversed?			YES, Rebuild the structure elsewhere				
Will impact cause irreplaceable loss or resources?			YES. If is a finite resource				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: • mapped and photographed • requires a permit							
Residual impact	Yes, but acceptable as of low negative significance						

<table>
<tr><th colspan="8">Impact Phase: Construction/ Operation/Decommissioning</th></tr>
<tr><td colspan="8">Potential impact description: farm buildings
• Cultural landscape
• Vernacular architecture
• Historical buildings
• Historical middens
• Requires assessment by built environment specialist if to be damaged.</td></tr>
<tr><th></th><th>Severity</th><th>Extent</th><th>Duration</th><th>Status</th><th>Probability</th><th>Significance</th><th>Confidence</th></tr>
<tr><td>Without Mitigation</td><td>High</td><td>Low</td><td>High</td><td>Negative</td><td>High</td><td>High</td><td>High</td></tr>
<tr><td>With Mitigation</td><td>Low</td><td>Low</td><td>High</td><td>positive</td><td>High</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="3">Can the impact be reversed?</td><td colspan="5">YES. Buildings could be rebuilt</td></tr>
<tr><td colspan="3">Will impact cause irreplaceable loss or resources?</td><td colspan="5">YES. It is a finite resource</td></tr>
<tr><td colspan="3">Can impact be avoided, managed or mitigated?</td><td colspan="5">YES. Avoid the buildings and mitigate</td></tr>
<tr><td colspan="8">Mitigation measures to reduce residual risk or enhance opportunities:
• Should not be affected.
• Middens may need to be sampled or excavated
• Mapped and photographed
• Requires assessment from Built Environment specialist
• Will require a permit if to be damaged.</td></tr>
<tr><td colspan="2">Residual impact</td><td colspan="6">Yes, unacceptable high negative impact if not mitigated</td></tr>
</table>

Impact Phase: Construction/ Operation/Decommissioning							
Potential impact description: Paeolontology • Fossils could be disturbed							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Low	Low	High	Negative	Low	Low	High
With Mitigation	Low	Low	High	positive	Low	Low	High
Can the impact be reversed?			YES. Fossils could be reconstructed				
Will impact cause irreplaceable loss or resources?			YES. Fossils could be reconstructed				
Can impact be avoided, managed or mitigated?			YES. Chance Find Protocol				
Mitigation measures to reduce residual risk or enhance opportunities: • Chance Find protocol.							
Residual impact	Yes, but acceptable as of low negative significance						

Impact Phase: Construction/ Operation/Decommissioning							
Potential impact description: Paeolontology • Fossils could be disturbed							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Low	Low	High	Negative	Low	Low	High
With Mitigation	Low	Low	High	positive	Low	Low	High
Can the impact be reversed?			YES. Fossils could be reconstructed				
Will impact cause irreplaceable loss or resources?			YES. Fossils could be reconstructed				
Can impact be avoided, managed or mitigated?			YES. Chance Find Protocol				
Mitigation measures to reduce residual risk or enhance opportunities: • Chance Find protocol.							
Residual impact	Yes, but acceptable as of low negative significance						

CUMULATIVE IMPACTS

Impact Phase: Cumulative							
Potential impact description: Graves/Cemeteries • Any construction activity near human graves has the possibility of disturbing the remains. • There may be more subsurface graves with no demarcation.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	H	H	Negative	High	High	High
With Mitigation	Low	Low	Low	Positive	Low	Low	Low
Can the impact be reversed?			No. they are a finite resource. reburial is not an option				
Will impact cause irreplaceable loss or resources?			Yes. they are a finite resource				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: • Cannot be affected. • 50m buffer from the edge. • 20m visible demarcation if within 100m •							
Residual impact	high negative impact						

Impact Phase: Cumulative							
Potential impact description: 20th century settlements without graves Detailed description of impact Abandoned settlements with no visible structures are destroyed							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Low	Low	Low	Neutral	Low	Low	High
With Mitigation	Low	Low	Low	Neutral	Low	Low	High
Can the impact be reversed?			No.				
Will impact cause irreplaceable loss or resources?			YES. No. They are a finite resource				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: • *List and describe* • Once no graves are confirmed, then may be destroyed if the PPP has been approved …							
Residual impact	Yes, but acceptable as of low negative significance						

Impact Phase: Cumulative							
Potential impact description: 20th century settlements with graves Detailed description of impact • Abandoned settlements with graves and no visible structures are destroyed							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Low	High	Negative	High	Medium	High
With Mitigation	Low	Low	low	Positive	low	low	High
Can the impact be reversed?			No. They are finite resource				
Will impact cause irreplaceable loss or resources?			YES. They are finite resource				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: • Graves cannot be affected • .50m buffer from the edge • 20m visible demarcation if within 100m..							
Residual impact	*(for example: Yes, but acceptable as of low negative significance, or Yes, unacceptable high negative impact)*						

Impact Phase: Cumulative							
Potential impact description: Palaeontology • Fossils could be disturbed							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Low	Low	High	Negative	Low	Low	High
With Mitigation	Low	Low	High	positive	Low	Low	High
Can the impact be reversed?			YES. Fossils could be reconstructed				
Will impact cause irreplaceable loss or resources?			YES. Fossils could be reconstructed				
Can impact be avoided, managed or mitigated?			YES. Chance Find Protocol				
Mitigation measures to reduce residual risk or enhance opportunities: • Chance Find protocol.							
Residual impact	Yes, but acceptable as of low negative significance						

Impact Phase: Cumulative							
Potential impact description: Late Iron Age settlements Detailed description of impact Archaeological site may be destroyed							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Low	High	Negative	High	High	High
With Mitigation	Low	Low	High	positive	High	Medium	High
Can the impact be reversed?			NO. Finite resource				
Will impact cause irreplaceable loss or resources?			YES. Finite resource				
Can impact be avoided, managed or mitigated?			YES. Salvage excavations				
Mitigation measures to reduce residual risk or enhance opportunities: • Sites may be excavated • PPP to ensure there are no claimants							
Residual impact	(Yes, but acceptable as of low positive significance						

Impact Phase: Cumulative							
Potential impact description: Ruins • Ruins are protected by the NHA if they are older than 60 years in age. • Loss of vernacular architecture • Loss of historical middens							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Low	High	Negative	High	High	High
With Mitigation	Low	Low	High	positive	High	Medium	High
Can the impact be reversed?			NO. It is a finite resource				
Will impact cause irreplaceable loss or resources?			YES. It is a finite resource				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: • Should not be affected. • Middens may need to be sampled or excavated • Buildings need to be assessed by Built Environment specialist to determine architectural value • Will require mapping, photography if affected							
Residual impact	Yes, but acceptable as of medium negative significance						

Impact Phase: Cumulative							
Potential impact description: isolated stone walled kraals Built structure to be damaged							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Low	High	Negative	High	High	High
With Mitigation	Low	Low	High	positive	High	Medium	High
Can the impact be reversed?			YES, Rebuild the structure elsewhere				
Will impact cause irreplaceable loss or resources?			YES. If is a finite resource				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: • mapped and photographed • requires a permit							
Residual impact	Yes, but acceptable as of low negative significance						

Impact Phase: Cumulative							
Potential impact description: farm buildings • Cultural landscape • Vernacular architecture • Historical buildings • Historical middens • Requires assessment by built environment specialist if to be damaged.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Low	High	Negative	High	High	High
With Mitigation	Low	Low	High	positive	High	Medium	High
Can the impact be reversed?			YES. Buildings could be rebuilt				
Will impact cause irreplaceable loss or resources?			YES. It is a finite resource				
Can impact be avoided, managed or mitigated?			YES. Avoid the buildings and mitigate				
Mitigation measures to reduce residual risk or enhance opportunities: • Should not be affected. • Middens may need to be sampled or excavated • Mapped and photographed • Requires assessment from Built Environment specialist • Will require a permit if to be damaged.							
Residual impact	Yes, acceptable low negative impact						

Impact Phase: Cumulative							
Potential impact description: Palaeontology • Fossils could be disturbed							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Low	Low	High	Negative	Low	Low	High
With Mitigation	Low	Low	High	positive	Low	Low	High
Can the impact be reversed?			YES. Fossils could be reconstructed				
Will impact cause irreplaceable loss or resources?			YES. Fossils could be reconstructed				
Can impact be avoided, managed or mitigated?			YES. Chance Find Protocol				
Mitigation measures to reduce residual risk or enhance opportunities: • Chance Find protocol.							
Residual impact	Yes, but acceptable as of low negative significance						

CONCLUSION

A heritage survey was undertaken for the proposed Emvelo WEF.The desktop study noted sixty-three possible heritage sties. Most of these were farm labourers' settlements that could have graves Many of these sites occur in areas that will not be affected by the WEF and related infrastructure. The field survey recorded twelve heritage sites were recorded within the study area. Most of these sites will not be affected by the WEF. Those that are currently affected, can be mitigated by relocating the turbine.

The field survey also confirmed that most of the desktop settlements have human graves associated with them. A 50m sensitivity buffer should be placed around each of these for possible graves. Unfortunately, the black wattle has damaged most of these sites, while agricultural activity would have destroyed these sites.

One cemetery will be currently affected by the laydown area. This area will need to be moved and the cemetery clearly demarcated before construction begins.

While the palaeontology is of very high sensitivity as it forms [part of the Vryheid formation, very few significant vertebrate fossils have been found in it. A Chance Find Protocol was initiated for the construction phase.

REFERENCES

Maps

2630CA Camden 1968, 2000

2630 CA Sheepmore 1968, 2000

235/83

A 9231/14

Database

SARHIS

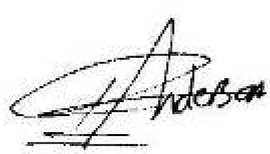
Umlando

EXPERIENCE OF THE HERITAGE CONSULTANT

Gavin Anderson has a M. Phil (in archaeology and social psychology) degree from the University of Cape Town. Gavin has been working as a professional archaeologist and heritage impact assessor since 1995. He joined the Association of Professional Archaeologists of Southern Africa in 1998 when it was formed. Gavin is rated as a Principle Investigator with expertise status in Rock Art, Stone Age and Iron Age studies. In addition to this, he was worked on both West and East Coast shell middens, Anglo-Boer War sites, and Historical Period sites.

DECLARATION OF INDEPENDENCE

I, Gavin Anderson, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.



Gavin Anderson
Archaeologist/Heritage Impact Assessor

APPENDIX A

PIA DESKTOP

DESKTOP PALEONTOLOGICAL ASSESSMENT FOR A PROPOSED WEF POWER STATION NEAR CAMDEN, MPUMALANGA

FOR

UMLANDO: Archaeological Surveys & Heritage Management
PO Box 102532, Meerensee, KwaZulu-Natal 3901
phone (035)7531785 fax: 0865445631
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Email:umlando@gmail.com

by

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Telephone: 031 208 6896
asconsulting@telkomsa.net

19 June, April 2023

Declaration of Independence

This report has been compiled by Dr Alan Smith (Pr. Sc. Nat.) of Alan Smith Consulting, Durban. The views expressed in this report are entirely those of the author, if not then the source has been duly acknowledged. No other interest was displayed during the decision making process for the Project.

Specialist: Dr Alan Smith

Signature: 

EXECUTIVE SUMMARY

Alan Smith Consulting was appointed by Umlando to conduct a desk-top assessment of the potential impacts to **Palaeontology Resources** that might occur through the proposed development of a WEF Power Station, near Camden, Mpumalanga. This project is to be constructed on Vryheid Formation rocks. Although zoned red by SAHRIS these rocks are unlikely to contain any significant palaeontological material.

Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), requires a Palaeontological Impact Assessment (PIA) to assess any potential impacts to palaeontological heritage.

The chances of encountering fossils are **Low,** but **Not Zero**; consequently a ***"Chance Find Protocol"*** has been included.

ACRONYMS

BA:	Basic Assessment
EDTEA:	(Department of) Economic Development, Tourism and Environmental Affairs
HIA:	Heritage Impact Assessment
PIA;	Palaeontological Impact Assessment
SAHRA:	South African Heritage Resource Agency
SAHRIS:	South African Heritage Resources Information System

1. BACKGROUND

It is proposed that a WEF Power Station be erected near Camden, Mpumalanga (Figure 1 & 2)

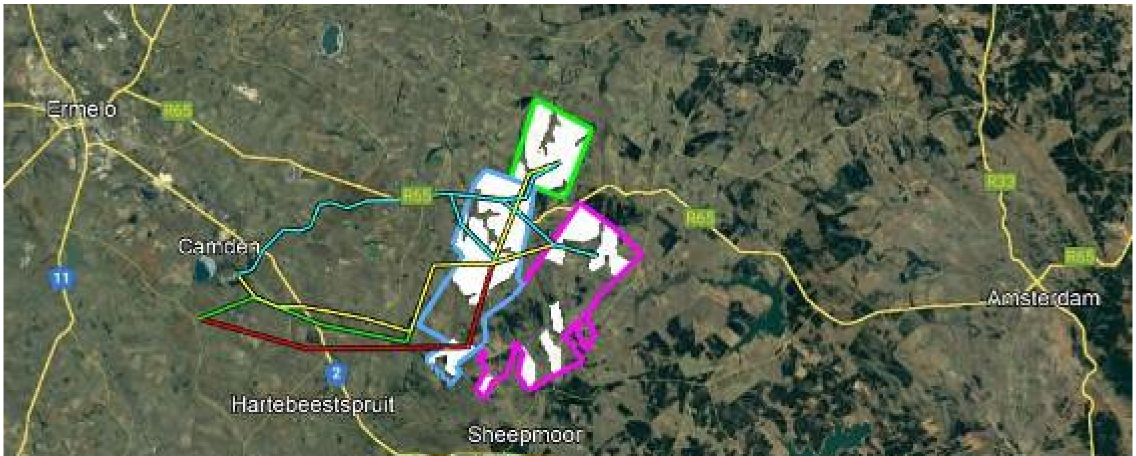

Figure 1: Location map of the proposed Camden WEF Power Station Project.

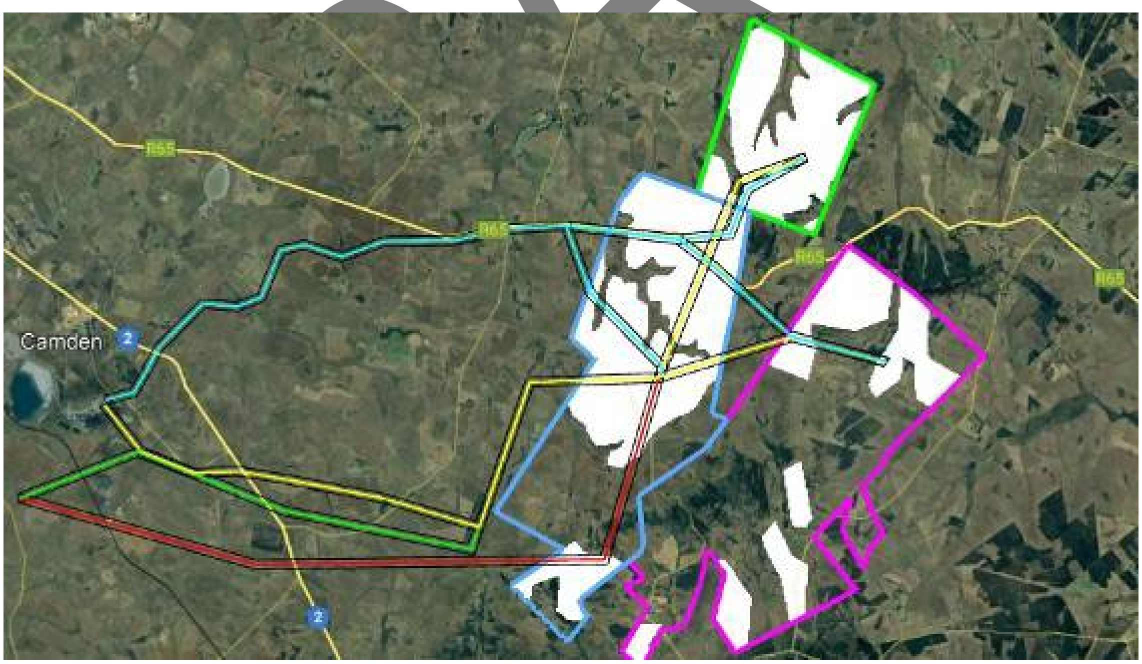

Figure 2: Proposed Camden WEF Power Station sites and power gridlines zoomed. The white colour indicates areas classified as high palaeosensitive by SAHRIS.

2. TERMS OF REFERENCE

Alan Smith Consulting was requested by UMLANDO: Archaeological Surveys & Heritage Management to provide a Desk-Top Palaeo Impact Assessment for the proposed WEF Power Station near Camden (Figure 1 &2). The work was to be based on the knowledge gained from desktop review. This report is to meet the requirements of the National Environmental Management Act (Act 107 of 1998) [as amended] Environmental Impact Assessment (EIA) regulations, Appendix 6.

3. SCOPE AND PURPOSE OF REPORT

A Palaeontological Impact Assessment (PIA) is a means of identifying any significant palaeontological material before development begins, so that these can be managed in such a way as to allow the development to proceed (if appropriate) without undue impacts to the fragile heritage of South Africa. The Desk-Top PIA report will outline any management and/or mitigation requirements that will need to be complied with from a heritage point of view and that should be included in the conditions of authorisation, should this be granted.

4. METHODOLOGY

Geological maps, a literature review and personal experience (see section 10) were used in this research.

5. GEOLOGY

Some of this site is underlain by Vryheid Formation and the rest by Karoo Dolerite (Figure 3).

Vryheid Formation

The Permian aged Vryheid Formation (Kungurian Stage ¬ 260Ma: Green and Smith, 2012) comprises predominantly coarse-grained sandstone and siltstones, interbedded by dark shales and coal beds. The Formation is interpreted as mainly fluvial, in this area. Here rivers built deltas which prograded into the ancient Karoo Sea, which was a cratonic sea located in the Gondwana Supercontinent. This body of water was either an inland sea, or partially connected to the ancient ocean which surrounded the Gondwana Supercontinent (Johnson et al, 2009). Economic coal seams are known from the Vryheid Formation in this region and are actively mined.

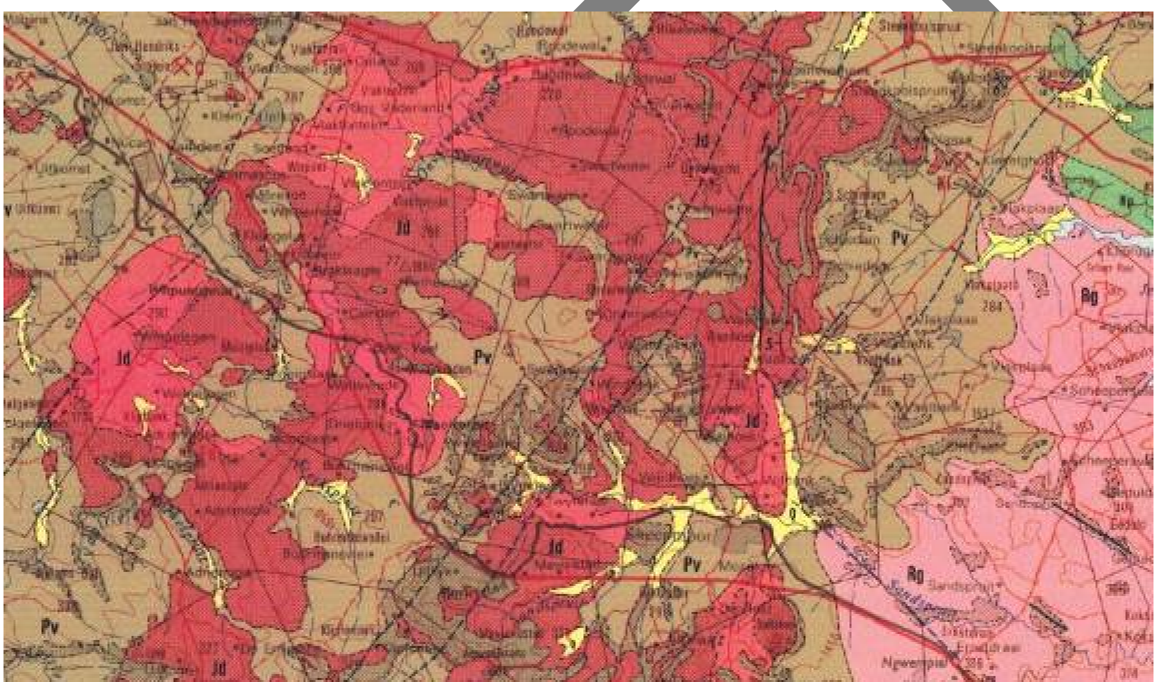

Figure 3: Extract from the Mbabane (2630) 1:250 000 Geological map. According to this map, the proposed Camden WEF Development site is underlain by Vryheid Formation (*Pv*: grey) and Karoo Dolerite (Jd: red).

6. PALAEONTOLOGY

Vryheid Formation

The SAHRIS Palaeosensitivity Map (Figure 4) considers the Vryheid Formation as a Very High Palaeosensitivity Zone (Table 1). In practise, no vertebrate fossils have been recorded from the Vryheid Formation in this area, however invertebrate trace fossils are common (Tavener Smith et al, 1989; Mason and Christie, 1985; Hastie et al., 2019), but these are of no particular value, in this area.

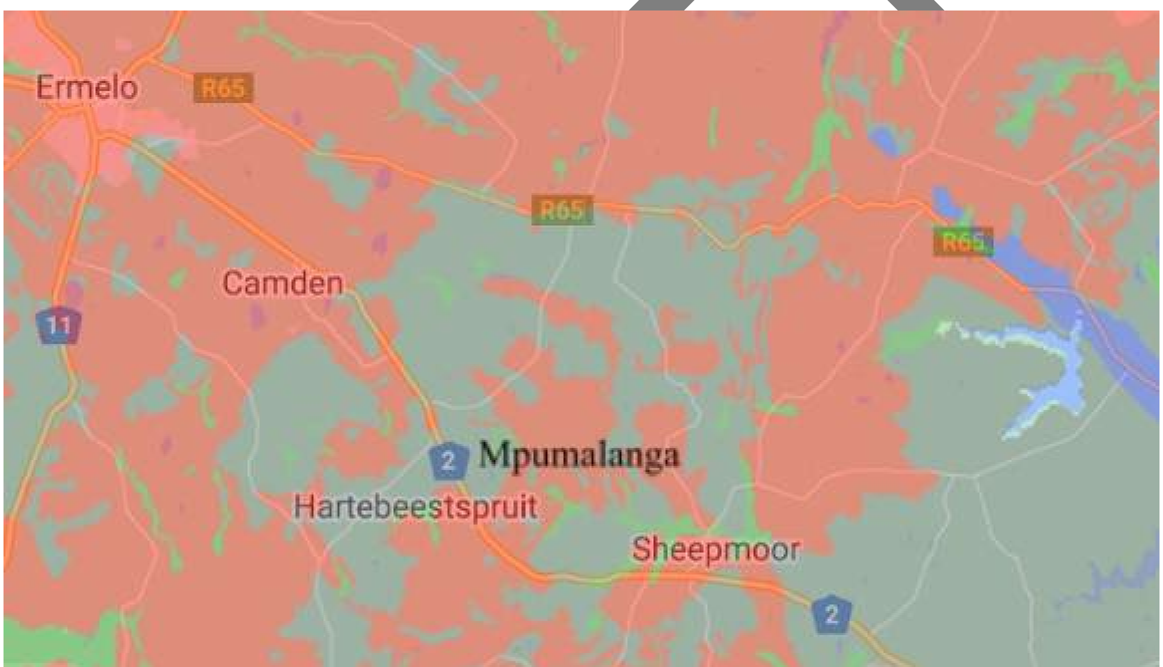

Figure 4: Palaeosensitivity of the Camden proposed WEF Power Station site. Vryheid Formation is indicated in red and Karoo Dolerite in grey.

Groenewald (2018) pointed out that the aquatic marine reptile, *Mesosaurus* (earliest known reptile from the Karoo Basin), as well as the fish, *Palaeoniscus capensis*, have been recorded in the Whitehill Formation in the southern part of the basin (MacRae, 1999), which is correlated with the Vryheid Formation. The Whitehill Formation is interpreted as marine. The Whitehill Formation (1000 km to the southwest), within the

Main Karoo Basin, *may* be a correlative of the Vryheid Formation, however these two rock units are not physically connected and this has never been proved. The Vryheid Formation in this area has its provenance in the north (Tavener Smith, 1982). The Whitehill Formation source is in the south. There is also a southerly source to the lower Vryheid Formation (Hastie et al., 2019), but this regime does not extend north of Vryheid. The Vryheid Formation is generally believed to be marine (Hastie et al., 2019) but no significant fossils have been discovered. The lack of vertebrate fossils is problematic. In the marine case it may be due to the water being heavily silted but this is speculation.

Table 1: Summary of SAHRIS categories

Colour	Sensitivity	Required Action
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required

Economic coal seams are known from the Vryheid Formation in Mpumalanga (Tavener Smith et al., 1989). Coal is carbon produced by compressed plant material and thus itself constitutes a fossil deposit. Plants such as *glossopteris*, *gangamopteris* and *sigillaria* can be recognized. Although these are significant on a continental scale for correlation between the present continents and general dating, they are very common. Coal is routinely burned in power stations. Animals must have grazed on these plants, but they are not found.

Proposed Locations

Three proposed locations and their associated gridlines are illustrated (Figure 5).

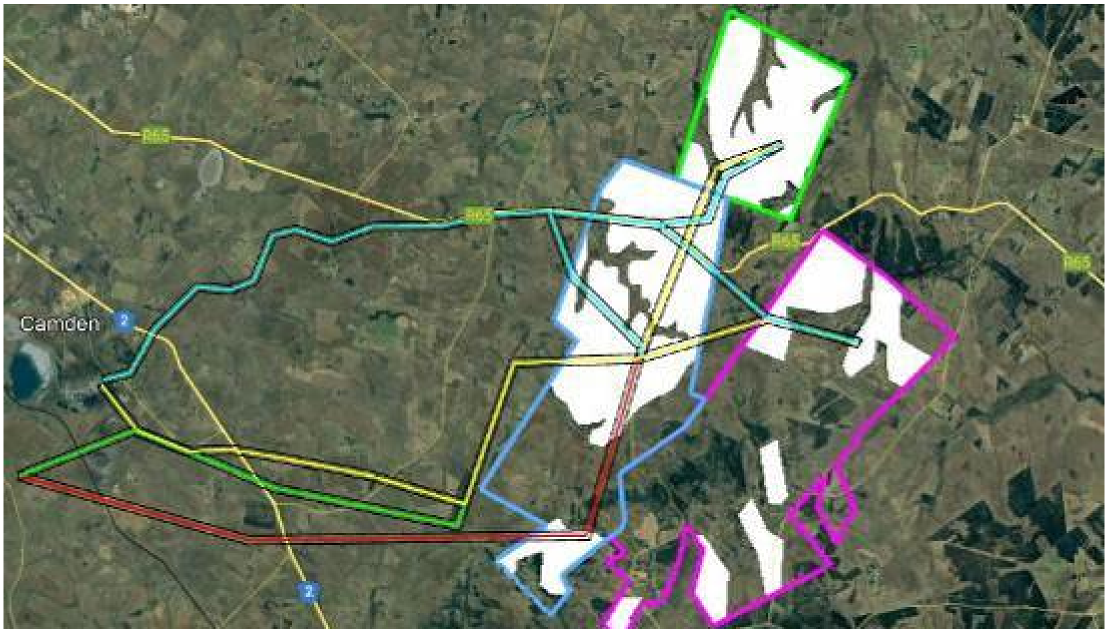

Figure 5: This image shows the different possible WEF locations. Note the white colouration indicates SAHRIS the red highly sensitive zone (see Figure 4 and Table 1).

Rochdale WEF (Figure 5). This area is mostly red (Vryheid Formation)'

Sheepmoor WEF (Figure 5). This area is about 60% red (Vryheid Formation) in the north with the rest being non-fosilliferous Karoo Dolerite.

Emvelo WEF (Figure 5). This area is mostly non-fossiliferous Karoo Dolerite.

The transmission lines (Figure 5). The gridlines will have shallow foundations so will have little palaeosensitivity impact.

The purple outlined are contains the least "high palaeosensitivity". However no significant body fossils have been found in the Vryheid Formation. Theoretically body fossils should be encountered but they are not.

7. CONCLUSIONS

The chance of significant fossils being found on this site are **Low,** but not **Zero. Consequently a "Chance Find Protocol"** has been included to cover this eventuality.

No further palaeontological work is required, unless triggered by the "**Chance Find Protocol**", which must form part of the Environmental Management Programme (EMPr) for the site'

8. CHANCE FIND PROTOCOL

This Chance Find Protocol must be included in the site EMPr.

If any fossils are found, a Palaeontologist must be notified immediately by the ECO and/or EAP and a site visit must be arranged at the earliest possible time with the Palaeontologist.

In the case of the ECO or the Site Manager becoming aware of suspicious looking palaeo-material:

- The construction must be halted in that specific area and the Palaeontologist must be given enough time to reach the site and remove the material before excavation continues.
- Mitigation will involve the attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labeled, and boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

Functional responsibilities of the Developer

1. At full cost to the project, and guided by the appointed Palaeontological Specialist, ensure that a representative archive of palaeontological samples and other records is assembled to characterize the palaeontological occurrences affected by the excavation operation.

2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting

areas, removal of overburden if necessary, and the return of discarded material to the disposal areas.

3. Facilitate systematic recording of the stratigraphic and palaeo-environmental features in exposures in the fossil-bearing excavations, by described and measured geological sections, and by providing aid in the surveying of positions where significant fossils are found.

4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds.

5. Provide covered, dry storage for samples and facilities for a work area for sorting, labeling and boxing/bagging samples.

6. Costs of basic curation and storage until collected. Documentary record of palaeontological occurrences must be done.

7. The contractor will, in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which appropriate information regarding plans for excavations and work schedules must be indicated on the plan of the excavation sites. This must be done in conjunction with the appointed specialist.

8. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period.

9. Locations of samples and measured sections are to be pegged, and routinely and accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any “significant fossils” are recorded during the time of excavation.

9. REFERENCES

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10. DETAILS OF SPECIALIST

Dr Alan Smith
Private Consultant: ***Alan Smith Consulting, 29 Brown's Grove, Sherwood, Durban, 4091***

&

Honorary Research Fellow: ***Discipline of Geology, School of Agriculture, Earth and Environmental Sciences, University of KwaZulu-Natal, Durban***.

Role: Specialist Palaeontological Report production

Expertise of the specialist:

- PhD in Geology (University of KwaZulu-Natal), Pr. Sc. Nat., I.A.H.S.
- Expert in Vryheid Formation (Ecca Group) in northern KZN, this having been the subject of PhD.
- MSc in Stromatolites (paleontological subject).
- Scientific Research experience includes:
  1. Stromatolites (9 peer reviewed journal articles and one in review)
  2. Fluvial geomorphology
  3. Palaeoflood hydrology
- Cretaceous deposits.
- Experience includes understanding Earth Surface Processes in both fluvial and coastal environments (modern & ancient).
- Alan has published in both national and international, peer-reviewed journals. He has published + 50 journal articles with +620 citations (detailed CV available on request).
- Attended and presented scientific papers and posters at numerous international and local conferences (UK, Canada, South Africa) and is actively involved in research.

Selected recent palaeo-related work includes:

- Desktop PIA: Proposed middle income housing units on Portion 23 of Farm Lot H Weston 13026, Bruntville, Mpofana Local Municipality. Client: UMLANDO.
- Desktop PIA: Proposed ByPass Pipeline for Ulundi bulk water pipeline upgrade. Client: UMLANDO.
- Fieldwork PIA: Bhekuzulu Epangweni KZN water reticulation project, Cathkin Park. Client: Mike Webster, HSG Attorneys.

- Fieldwork PIA: Mpungoze water supply scheme, Empangeni. Client: Enviropro.
- Fieldwork PIA: Helpmekaar Dam. Client: Afzelia environmental consultants.
- Desktop PIA: Zuka valley, Ballito. Client: Mike Webster, HSG Attorneys.
- Mevamhlope proposed quarry palaeontology report. Client: Enviropro.
- Desktop PIA: Proposed Lovu Desalination site. Client: eThembeni Cultural Heritage.
- Desktop PIA: Tinley Manor phase 2 North & South banks: eThembeni Cultural Heritage
- Desktop PIA: Tongaat. Client: eThembeni Cultural Heritage.
- Palaeontological Assessment Reports (3) to Scatec Solar SA (Pty) Ltd on an Appraisal of Inferred Palaeontological Sensitivity for a Potential Photo Voltaic Park at (1) Farm Rooilyf near Groblershoop, N Cape; (2) Farm Riet Fountain No. Portions 1 and 6, 18km SE of De Aar, N Cape; and (3) Dreunberg, near Burgersdorp, Eastern Cape. Client: Sustainable Development Projects.

APPENDIX B

CV AND QUALIFICATIONS

Name: Gavin Craig Anderson

Current Employment: Member of Winter Night Investments cc, T/A Umlando: Archaeological Surveys & Heritage Management

Registered with South African Heritage Resources Agency and KZN Heritage as a Principle Investigator with expertise status in Iron Age, Stone Age and Rock Art

B.A.(Soc.Sci), U.C.T. Majors: Archaeology, Psychology, Sociology. 1990.

B.A.(Hons) in Archaeology, 1991, U.C.T.

Masters of Philosophy in Archaeology/Social Psychology: 1996, UCT.

Various Health & Occupational Safety courses related to specific companies.

PROFESSIONAL EXPERIENCE:

a) CEO for Institute for Cultural Resource Management, Natal Museum (1995 – 2004)

b) Co-owner of Umlando: Archaeological surveys and heritage Management (2004-2013)

c) Surveys and/or excavations of:

(1) Proposed aquaculture farms, Eastern Cape
(2) Dube Trade Port: Agrizone 2 and Support Zone 2
(3) Dams:
(4) Richards Bay Minerals
(5) Tronox mines
(6) Eskom transmission lines
(7) Water reticulations lines
(8) Sewer lines
(9) Game Reserves: Phinda, Huluhluwe-Mfolozi, iSimangaliso Wetland Park
(10) Tongaat-Hulett (Moreland) Pty. Ltd properties
(11) Low Cost Housing projects
(12) Upmarket housing estates
(13) Afforestation permit applications
(14) uShaka Marine World
(15) Cellular Phone masts
(16) Harbour expansions: Durban, Richards Bay & East London
(17) Quarries & Borrow pits
(18) Living Heritage Study: Drakensberg buffer zone

(19)Wind Energy Farm developments

(20)Photovoltaic farm developments

(21)Cemeteries

(22)Roads: National, Provincial, and District

From 2004 onwards Gavin has undertaking Heritage Impact Assessments as opposed to only archaeological impact assessments. Heritage Impact Assessments includes archaeology, palaeontology, historical buildings, living heritage sites, cultural landscapes, and human graves. In these HIA's Gavin has subcontracted various people related to the field of study, and produced overall HIA reports.

Gavin received his M. Phil (Archaeology & Social Psychology) in 1994. He was head of the Institute for Cultural Resource Management at the Natal Museum from 1994 – 2004. Gavin and Louise Anderson formed Umlando: Archaeological Surveys and Heritage Management cc in 2004. Gavin is rated by the Association of Southern African professional Archaeologists as a Principle Investigator with expertise in the Stone Age, Rock Art and Iron Age.

Gavin has recorded over 3000 heritage sites in his professional career. These sites span the entire heritage spectrum.

EXPERIENCE OF THE HERITAGE CONSULTANT

Gavin Anderson has a M. Phil (in archaeology and social psychology) degree from the University of Cape Town. Gavin has been working as a professional archaeologist and heritage impact assessor since 1995. He joined the Association of Professional Archaeologists of Southern Africa in 1998 when it was formed. Gavin is rated as a Principle Investigator with expertise status in Rock Art, Stone Age and Iron Age studies. In addition to this, he was worked on both West and East Coast shell middens, Anglo-Boer War sites, and Historical Period sites.

DECLARATION OF INDEPENDENCE

I, Gavin Anderson, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

Gavin Anderson
Archaeologist/Heritage Impact Assessor

<< archaeologists

THE ASSOCIATION OF SOUTHERN AFRICAN PROFESSIONAL ARCHAEOLOGISTS

CERTIFICATE OF MEMBERSHIP

HEREBY CONFIRMS THAT

GAVIN CRAIG ANDERSON

Is a Professional Member (No 0005) of
the Association of Southern African Professional
Archaeologists and is in good standing
with the organisation

Valid April 2024 - March 2025

2024

ALBINO JOPELA
CHAIRPERSON

SHAHZAADEE KHAN
TREASURER

SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for 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)

REPORT TITLE

Mulilo Amsterdam WEF Cluster

Kindly note the following:

1. This form must always be used for assessment that are in support of 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 August 2023. 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.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the 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 act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Heritage
Specialist Company Name	umlando
Specialist Name	Gavin anderson
Specialist Identity Number	6902225189084
Specialist Qualifications:	M. Phil (archaeology and social psychology)
Professional affiliation/registration:	ASAPA
Physical address:	1Perch Pool, meerensee
Postal address:	PO Box 10153
Postal address	Meerensee, Richards Bay
Telephone	0367531785
Cell phone	0836585362
E-mail	Umlando@gmail.com

2. DECLARATION BY THE SPECIALIST

I, Gavin Anderson declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements 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 National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 NEMA Act.

Signature of the Specialist

umlando

Name of Company:

06 Oct 2024

Date

SPECIALIST DECLARATION FORM – AUGUST 2023

UNDERTAKING UNDER OATH/ AFFIRMATION

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

Anderson

Signature of the registered Environmental Assessment Practitioner

Umlando

Name of Company

06 October 2024

Date

Gibb

Signature of the Commissioner of Oaths

06 October 2024

Date

COMMISSIONER OF OATHS (RSA)
LEANNE GIBBONS CA (SA)
Membership No: 08194702
7 Short Road
Walmer
Port Elizabeth
6070

Mulilo Renewable Energy Developments (Pty) Ltd

NOISE REPORT FOR SITE SENSITIVITY VERIFICATION AND SCOPING PURPOSES

for the

proposed Emvelo Wind Energy Facility and associated Infrastructure east of Ermelo, Mpumalanga Province

Study done for:

ARCUS

Prepared by:

EARES
Enviro Acoustic Research

P.O. Box 2047, Garsfontein East, 0060
Tel: 012 – 004 0362, Fax: 086 – 621 0292, E-mail: info@eares.co.za

This Report should be sited as:

De Jager, M. 2023: "*Noise Report for Site Sensitivity Verification and Scoping Purposes for the proposed Emvelo Wind Energy Facility and associated Infrastructure east of Ermelo, Mpumalanga Province*". Enviro-Acoustic Research, Pretoria

Client:

Arcus Consultancy Services South Africa (Pty) Ltd
for
Mulilo Renewable Energy Developments (Pty) Ltd

240 Main Road
1st Floor Great Westerford
Rondebosch
7700
Tel: +27 21 412 1529

Report no:

ACSA-MEWEF/SNR/202306-Rev 0

Author:

M. de Jager *(B. Ing (Chem))*

Review:

Johan Maré *(MSc. Microbiology, Pri Sci Nat (400092/91))*

Date:

June 2023

EXECUTIVE SUMMARY

INTRODUCTION AND PURPOSE

Enviro-Acoustic Research cc was commissioned by Arcus Consultancy Services South Africa (Pty) Ltd (the EAP) to undertake a specialist study to determine the potential noise impact on the surrounding environment due to the proposed establishment of the proposed Emvelo Wind Energy Facility ("WEF") east of Ermelo, Mpumalanga.

This report is the result of the initial phase study (desktop) of the Environmental Impact Assessment ("EIA") process investigating the potential noise impact that such a facility may have on the surrounding environment, highlighting methodologies, potential issues to be investigated as well as preliminary findings and recommendations. The Environmental Impact Assessment process will be facilitated by Arcus Consultancy Services South Africa (Pty) Ltd, the appointed Environmental Assessment Practitioner ("EAP") for this project.

This report considers local and international guidelines, using the terms of reference ("ToR") as proposed by SANS 10328:2008 and as stipulated by the requirements specified in the Assessment Protocol for Noise that were published on 20 March 2020, in Government Gazette 43110, GN 320.

PROJECT DESCRIPTION

The project applicant is proposing the development of a cluster of commercial WEFs (and associated infrastructure east of Ermelo, with the projects known as Emvelo WEF, Rochdale WEF and Sheepmoor WEF, with this report specifically focusing on the Emvelo WEF. These projects are concurrently being considered on the surrounding properties and are assessed by way of separate impact assessment processes contained in the 2014 Environmental Impact Assessment Regulations (GN No. R982, as amended) for listed activities contained in Listing Notices 1, 2 and 3 (GN R983, R984 and R985, as amended).

The Emvelo WEF (and associated infrastructure) could include the following components:

- A number of wind turbine generators ("WTGs");
- Temporary laydown, hardstands and storage areas;
- Temporary construction camps and batching plants;
- Medium voltage cabling connecting the WTGs;
- A Battery Energy Storage System ("BESS");
- Internal roads (existing roads will be upgraded wherever possible);
- A 33/132kV on-site Independent Power Producer ("IPP") substation;
- Medium voltage collector system to connect the turbines to the on-site IPP;

- Operation and maintenance ("O&M") buildings; and
- Other supporting infrastructure.

DESCRIPTION OF STUDY AREA

The proposed WEF will be located in the Msukaligwa Local Municipality (Gert Sibande District – Mpumalanga Province). The topography can be described as moderately (the north) to strongly (in the south) undulating plains, though topography will not influence the propagation of noise from the project. Land use within the Project Focus Area ("PFA") is a combination of residential, wilderness, some dryland crops (including forestry activities) and animal husbandry. The R65 roads transects the PFA in the north.

DESCRIPTION OF AMBIENT SOUND LEVELS

Ambient sound levels were measured over a 2-night period from 7 to 9 June 2023 at six locations, resulting in more than 900 daytime and 500 night-time measurements. Each measurement was collected over a 10-minute period and included a number of sound level descriptors, including; equivalent values, minimum and maximum levels, statistical sound levels as well as spectral information. Confidence levels in the resulting data are high and it is expected that the ambient sound level data would be applicable of other locations in the area.

Bird communication noises were significant and generally dominant, with some sounds from domestic animals (dogs, cows, sheep and chickens) audible at times.

Considering the average fast-weighted sound level data collected in the area:

- daytime fast-weighted sound levels ranged from 24 to more than 70 dBA, with average daytime sound levels being 43.3 dBA. This is typical of a rural noise district and considering the developmental character, a rating level of 45 dBA (typical of a rural noise district) will be assumed for the daytime period; and
- night-time fast-weighted sound levels ranged from 21 to more than 58 dBA, with average night-time sound levels being 37.3 dBA. This is typical of a rural to suburban noise district, with a typical rating level of 35 dBA.

FINDINGS AND RECOMMENDATIONS

This assessment is based on a desktop assessment as well as a basic predictive model to identify potential issues of concern. Construction and operational noises could be at a sufficient level to propagate over large distances and this assessment indicates a potential noise impact on the closest receptors.

Considering the preliminary wind turbine layout (which will be updated in response to specialist findings, resource and technical optimisation for the EIA Phase), there is a potential of a **low** to **medium** significance of a noise impact during the construction phase, and of a **low** to **high** significance during the operational phase on the different identified NSR. It should be noted that mitigation measures would be identified and recommended during the environmental noise impact assessment which would reduce the significance to low.

Further study is required and it is recommended that a full Environmental Noise Impact Assessment study be conducted for the Emvelo WEF.

Signature
Morné de Jager
2023 – 06 – 22

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ABBREVIATIONS

ADT	Articulated Dump Trucks
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
BA	Basic Assessment
BESS	Battery Energy Storage System
dB/dBA	Decibel
DFFE	Department of Forestry, Fisheries and the Environment
EARES	Enviro Acoustic Research cc

ECA	Environment Conservation Act
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EHS	Environmental Health and Safety
ENIA	Environmental Noise Impact Assessment
ENPAT	Environmental Potential Atlas for South Africa
ETSU	Energy Technology Support Unit
EPs	Equator Principles
EPC	Engineering, Procurement and Construction
EPFIs	Equator Principles Financial Institutions
GN	Government Notice
GNR	Government Notice Regulation
I&APs	Interested and Affected Parties
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
ISO	International Organization for Standardization
METI	Ministry of Economy, Trade, and Industry
NASA	National Aeronautical and Space Administration
NEMA	National Environmental Management Act
NCR	Noise Control Regulations
NSD	Noise-sensitive Development
NSR	Noise-sensitive Receptors
PPP	Public Participation Process
PWL	Sound Power Level
SABS	South African Bureau of Standards
SANS	South African National Standards
SPL	Sound Power Level
SR	Significance Rating
UTM	Universal Transverse Mercator
WHO	World Health Organization
WEF	Wind Energy Facility

GLOSSARY OF UNITS

dB	Decibel (expression of the relative loudness of the un-weighted sound level in air)
dBA	Decibel (expression of the relative loudness of the A-weighted sound level in air)
Hz	Hertz (measurement of frequency)
kg/m^2	Surface density (measurement of surface density)
km	kilometre (measurement of distance)
m	Meter (measurement of distance)
m^2	Square meter (measurement of area)
m^3	Cubic meter (measurement of volume)
mamsl	Meters above mean sea level
m/s	Meter per second (measurement for velocity)
^{o}C	Degrees Celsius (measurement of temperature)
μPa	Micro pascal (measurement of pressure – in air in this document)

1 INTRODUCTION

1.1 INTRODUCTION AND PURPOSE

Enviro-Acoustic Research cc was commissioned by Arcus Consultancy Services South Africa (Pty) Ltd (the EAP) to undertake a specialist study to determine the potential noise impact on the surrounding environment due to the proposed establishment of the proposed Emvelo Wind Energy Facility ("WEF") east of Ermelo, Mpumalanga.

This report is the result of the initial phase study (desktop) of the Environmental Impact Assessment ("EIA") process investigating the potential noise impact that such a facility may have on the surrounding environment, highlighting methodologies, potential issues to be investigated as well as preliminary findings and recommendations. The Environmental Impact Assessment process will be facilitated by Arcus Consultancy Services South Africa (Pty) Ltd, the appointed Environmental Assessment Practitioner ("EAP") for this project.

It is important to note this document is only the Scoping Document. This report presents conceptual scenarios to illustrate important concepts. A detailed assessment will be undertaken in the future Environmental Noise Impact Assessment.

1.2 BRIEF PROJECT DESCRIPTION

The project applicant is proposing the development of a cluster of commercial WEFs (and associated infrastructure east of Ermelo, with the projects known as Emvelo WEF, Rochdale WEF and Sheepmoor WEF. These projects are concurrently being considered on the surrounding properties and are assessed by way of separate impact assessment processes contained in the 2014 Environmental Impact Assessment Regulations (GN No. R982, as amended) for listed activities contained in Listing Notices 1, 2 and 3 (GN R983, R984 and R985, as amended).

This report specifically focusses on the proposed Emvelo WEF, with the regional location of this WEF illustrated in **Figure 1-1**. This WEF (and associated infrastructure) could include the following components:

- A number of wind turbine generators ("WTGs");
- Temporary laydown, hardstands and storage areas;
- Temporary construction camps and batching plants;
- Medium voltage cabling connecting the WTGs;
- A Battery Energy Storage System ("BESS");
- Internal roads (existing roads will be upgraded wherever possible);

- A 33/132kV on-site Independent Power Producer ("IPP") substation;
- Medium voltage collector system to connect the turbines to the on-site IPP;
- Operation and maintenance ("O&M") buildings; and
- Other supporting infrastructure.

1.3 POTENTIAL NOISE SOURCES

Noises will be associated with the construction and operational phases, though the main noise source from this project would be the WTGs (**sections 5.2.1** and **5.2.2**) during the operational phase. Low noise levels are associated with the BESS (climate control system – see **section 5.2.5**) and the substation (see **section 5.2.6**). WTG noises however would be the dominant source of noise associated with the project.

The sound power emission levels ("SPL") of the WTG are normally provided by the manufacturer, either as the apparent SPL, maximum warranted SPL, a calculated SPL (for new WTG where the noise levels were not previously measured) or measured sound power levels as reported in terms of IEC 61400-11 or IEC 61400-14. It is unique for each make and model and the sound power levels already include the effect of the hub height, rotor diameter and abatement technologies.

Minor factors in the calculated noise (rating) levels are:

- The spectral characteristics of the WTG;
- Temperature and Humidity;
- Noise abatement technologies implemented by the manufacturer;
- Topography and wind shear effects;
- The hub height of the WTG nacelle (the declared SPL level already include this factor, modelling using different hub height than the level specified by the manufacturer does have a slight influence on the calculated noise levels at a receptor location);
- Ground surface characteristics.

Factors that do influence SPL are:

- The rotor diameter of the WTG (the declared SPL level already include this factor);
- The manufacture of the WTG, the model name or number (the declared SPL level already include this factor).

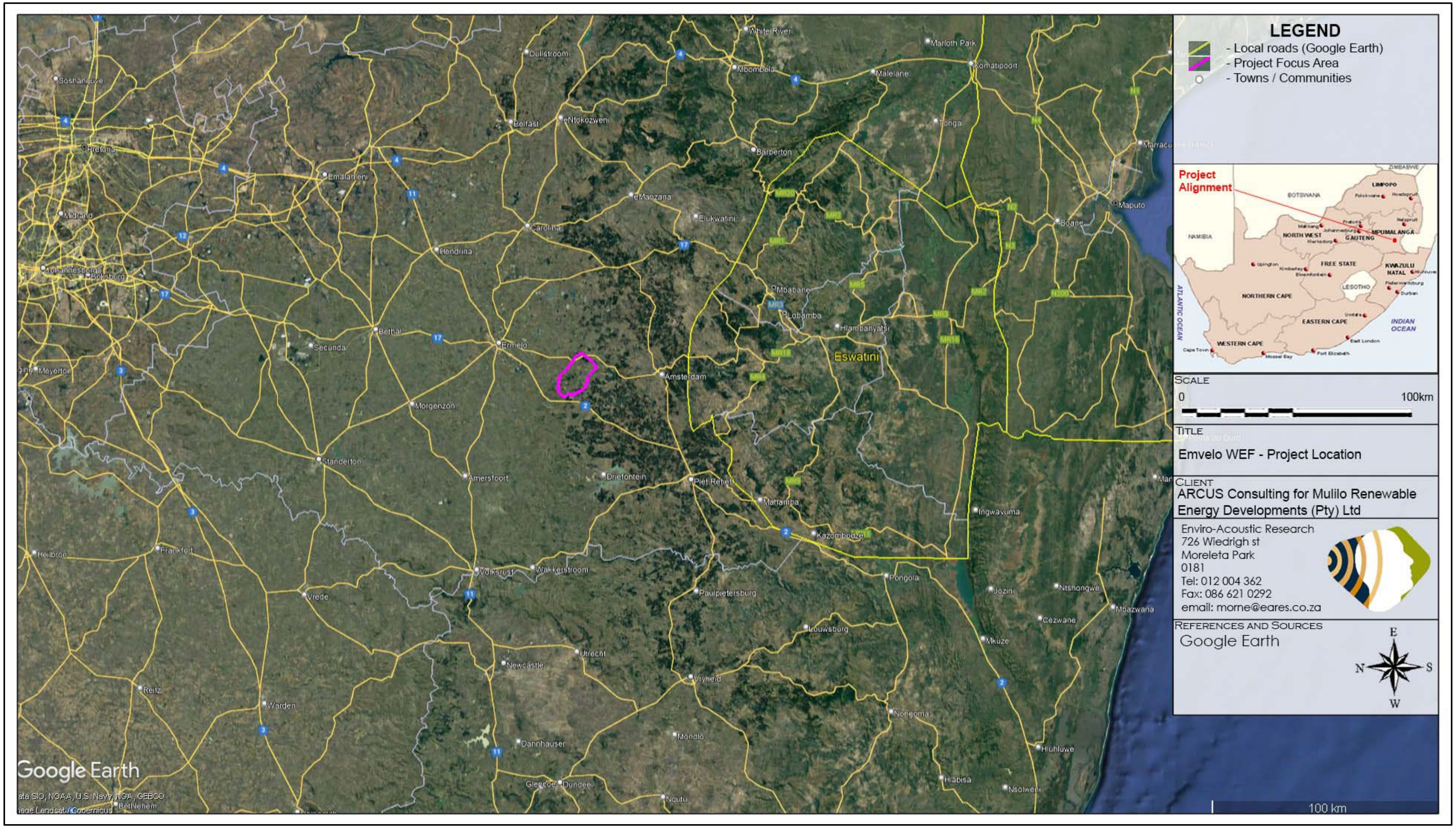

Figure 1-1: Regional Location of the proposed Emvelo WEF

2 STUDY AREA

The proposed WEF will be located in the Msukaligwa Local Municipality (Gert Sibande District – Mpumalanga Province). The project focus area ("PFA") is an area selected to enclose all potential project infrastructure up to 2,000 m from activities or equipment that may generate significant noise. The regional location of the PFA is illustrated in **Figure 1-1**. The PFA is further described in terms of environmental components that may contribute to or change the sound character in the area.

2.1.1 Topography

The topography can be described as moderately (the north) to strongly (in the south) undulating plains. Due to the height of the wind turbines, as well as the position where they may be developed, it is unlikely that topographical features will limit the propagation of sound from the wind turbines.

2.1.2 Roads and rail roads

The R65 transects that PFA in the north, though this road does not carry significant traffic. While traffic noises may be audible up to 2,000m during quiet periods at night and noise from vehicular traffic will not be considered in this Scoping, or the future Environmental Noise Impact Assessment ("ENIA") reports. There are also a number of small roads exiting from these roads, used by the local communities and farmers.

2.1.3 Land use and unrelated noise sources

Based on available aerial images, land use within the Project Focus Area ("PFA") is residential, wilderness (including ecotourism), some dryland crops (including forestry activities) and animal husbandry. Residential structures are scattered in a heterogeneous manner within the PFA. Minor noise sources are associated with agricultural and typical household activities. Noise from these sources will not be investigated in this scoping, or the future environmental noise impact assessment ("ENIA") as these are minor noise sources associated with daytime activities.

2.1.4 Residential areas

There are no formal residential areas within the PFA, though the town of Sheepmoor is located just south of the PFA.

2.1.5 Ground conditions and vegetation

Most of the area falls within the Grassland biome with the natural vegetation being a mix of north-easterly sandy highveld, Piet Retief sourveld and bankenveld to sour sandveld transition. Agriculture and other anthropogenic activities did impact on the ground surface, though most of the area is well covered by trees, (seasonal) crops, grasses, sedges and shrubs. Medium (construction phase) to 75% hard (operational phase) ground surface conditions will be used for modelling purposes in the future Environmental Noise Impact Assessment ("ENIA"). It should be noted that this factor is only relevant for air-borne waves being reflected from the ground surface, with certain frequencies slightly absorbed by the vegetation.

2.1.6 Existing Ambient Sound Levels

Ambient sound levels were measured over a 2-night period from 7 to 9 June 2023 at six locations in the vicinity of the WEF, resulting in more than 900 daytime and 500 night-time measurements. Each measurement was collected over a 10-minute period and included a number of sound level descriptors, including; equivalent values, minimum and maximum levels, statistical sound levels as well as spectral information. Confidence levels in the resulting data are high and it is expected that the ambient sound level data would be applicable of other locations in the area.

Bird communication noises were significant and generally dominant, with some sounds from domestic animals (dogs, cows, sheep and chickens) audible at times.

Considering the average fast-weighted sound level data collected in the area:

- daytime fast-weighted sound levels ranged from 24 to more than 70 dBA, with average daytime sound levels being 43.3 dBA. This is typical of a rural noise district and considering the developmental character, a rating level of 45 dBA (typical of a rural noise district) will be assumed for the daytime period; and
- night-time fast-weighted sound levels ranged from 21 to more than 58 dBA, with average night-time sound levels being 37.3 dBA. This is typical of a rural to suburban noise district, with a typical rating level of 35 dBA.

2.1.7 Desired Rating Levels

Construction activities will impact on the ambient sound levels, and the desired rating levels (recommended noise limits) would be:

- 50 dBA for the daytime period (typical of a sub-urban noise district); and
- 42 dBA for the night-time period (typical of a sub-urban noise district).

The development of the WEF will result in changes in the ambient sound levels during the operational phase. Considering the result of the ambient sound level measurements, the fact that the WTG will only operate (and generate noise) during periods with increased winds as well as the noise limits recommended by the World Health Organization ("WHO"

– see **section 4.4.1**) and the International Finance Corporation ("IFC" – see **section 4.4.5**), desired rating levels will be 45 dBA for the night-time period.

2.2 COMMENTS RECEIVED TO DATE

The author is not aware of any comments raised by the authorities or interested and affected parties at the date this noise scoping report was compiled. It should however be noted that the scoping phase is the start of the Public Participation Process ("PPP") as part of the EIA. Comments regarding noise may only be available during the EIA and PPP process.

2.3 POTENTIAL PROJECT ALTERNATIVES

The decision to develop the WEF at this location is the result of a number of feasibility studies, considering a number of factors, including (amongst others):

- the availability of a viable wind resource;
- the availability of land to develop the WEF;
- grid capacity and the viability to connect the WEF to the national grid or to supply the electrical power to an end-user (potential off-take agreement(s));
- topography and site access;
- land use and suitability;
- landowner support;
- Limited environmental constraints;
- viable alternative options (Photo-voltaic versus concentrated solar versus other power generation technologies).

As a WEF was selected as the most feasible option, secondary alternatives include (amongst others):

- the total electrical power generation capacity;
- the WTG layout of the WEF (to be advised by the various findings of the specialists during the scoping phase); and
- the type and size of the WTG (that will only be decided at a much later stage in the project).

2.4 ENVIRONMENTAL SENSITIVITY – NOISE THEME

The project site was assessed in terms of the Noise Sensitivity Theme using the National Web-based Environmental Screening Tool[1]. The output of the Screening Tool is presented

[1] https://screening.environment.gov.za/screeningtool/#/pages/welcome

on **Figure 3-1**, highlighting a number of areas identified to have a "very high" noise sensitivity. A site verification report will be completed after the site visit and included in the future Environmental Noise Impact Assessment (ENIA).

2.5 Legislative Requirements and Terms of Reference

A noise impact assessment must be conducted if the proposed development triggers the following:

- A change in land use as highlighted in SANS 10328:2008 (section 3.3 of the SANS guideline);
- If a wind farm (wind turbines - SANS 10328:2008 [5.4 (i)]) or a source of low-frequency noise (such as cooling or ventilation fans - SANS 10328:2008 [5.4 (l)]) is to be established within 2,000 m from a potential NSR *or visa versa*;
- It is generally required by the local or district authority as part of the environmental authorization or planning approval in terms of Regulation 2(d) or GN R154 of 1992;
- It is a controlled activity in terms of the NEMA EIA Regulations, 2014, as amended and an ENIA is required, because:
  - It may cause a disturbing noise that is prohibited in terms of section 18(1) of the Government Notice 579 of 2010;
  - It is an environmental theme to be further assessed as identified by the National Web-based Environmental Screening Tool as required by Government Gazette No. 42451 of 10 May 2019 (proposed procedures for noise assessments);

2.5.1 Requirements as per GG 43110 (GNR 320 of March 2020)

The Department of Forestry, Fisheries and Environment ("DFFE") also promulgated Government Notice Regulation (GNR) 320, dated 20 March 2020 as published in Government Gazette No. 43110. The 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 National Environmental Management Act, 1998, when applying for Environmental Authorisation would be applicable to this project.

This regulation defines the requirements for undertaking a site sensitivity verification, specialist assessment and the minimum report content requirements for environmental impact where a specialist assessment is required but no protocol has been prescribed. It requires that the current land use be considered using the national web based environmental screening tool to confirm the site sensitivity available at: https://screening.environment.gov.za.

If an applicant intending to undertake an activity identified in the scope of this protocol for which a specialist assessment has been identified on the screening tool on a site identified as being of:

- "very high" sensitivity for noise, must submit a Noise Specialist Assessment; or
- "low" sensitivity for noise, must submit a Noise Compliance Statement.

On a site where the information gathered from the site sensitivity verification differs from the designation of "very high" sensitivity on the screening tool and it is found to be of a "low" sensitivity, a Noise Compliance Statement must be submitted. On a site where the information gathered from the initial site sensitivity verification differs from the designation of "low" sensitivity on the screening tool and it is found to be of a "very high" sensitivity, a Noise Specialist Assessment must be submitted.

If any part of the proposed development footprint falls within an area of "very high" sensitivity, the assessment and reporting requirements prescribed for the "very high" sensitivity apply to the entire footprint excluding linear activities for which noise impacts are associated with construction activities only and the noise levels return to the current levels after the completion of construction activities, in which case a compliance statement applies. In the context of this protocol, development footprint means the area on which the proposed development will take place and includes any area that will be disturbed.

In terms of GNR320 (of 20 March 2020), the Site Sensitivity Verification should be undertaken prior to the commencement of the Specialist assessment. The protocol states:

1. The site sensitivity verification must be undertaken by an environmental assessment practitioner or a noise specialist, where the noise specialist means someone with relevant academic qualifications and with experience in the domain of acoustic assessments and noise management.
2. The site sensitivity verification must be undertaken through the use of:
    a) a desktop analysis, using satellite imagery;
    b) a preliminary onsite inspection; and
    c) any other available and relevant information.
3. The outcome of the site sensitivity verification must be recorded in the form of a report that:
    a) confirms or disputes the current use of the land and environmental sensitivity as identified by the screening tool, such as new developments or infrastructure etc.;
    b) contains a motivation and evidence (e.g., photographs) of either the verified or different use of the land and environmental sensitivity; and

c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

The National Web based Environmental Screening Tool[2] was used to screen the proposed site for the noise environmental sensitivity as per the requirements of Government Notice Regulation ("GNR") 320 (of 20 March 2020), considering the site location illustrated in **Figure 3-1**.

A screening report generated by the Online Screening Tool highlighted that a Noise Impact Assessment must be completed and appended to the Environmental Impact Assessment ("EIA") documentation for the project. This screening report was developed for *Utilities Infrastructure => Electricity => Generation => Renewable => Wind* category, with the noise sensitive areas illustrated on **Figure 3-1**. The areas defined to have a potential "**very high**" sensitivity to noise were downloaded as a layer from the online screening tool.

2.5.2 Requirements as per South African National Standards

In South Africa the document that addresses the issues specifically concerning environmental noise is SANS 10103:2008. It has been revised extensively in 2008 and brought in line with the guidelines of the World Health Organization (WHO). It provides the maximum average ambient noise levels during the day and night to which different types of developments may be exposed indoors.

The SANS 10328:2008 specifies the methodology to assess the potential noise impacts on the environment due to a proposed activity that might impact on the environment. This standard also stipulates the minimum requirements to be investigated for Scoping purposes. It stipulates the need for a Plan of Study for Scoping (clause 7.2 of SANS 10328:2008), highlighted in **Table 2-1** on the following page.

In addition, the Scoping report should contain sufficient information to allow the EAP to compile the Plan of Study for future EIA, including the Noise component.

In this regard the following will be included to assist the EAP in the compilation of the Plan of Study (PoS) for the EIA, discussed in general in **section 10** and defined in **section 10.2**.

[2] https://screening.environment.gov.za/screeningtool/#/pages/welcome

Table 2-1: Checklist - Plan of Study for Scoping (SANS 10328:2008)

Checklist as per SANS 10328:2008 (clause 7.2)	Section
identification and description of the noise sources associated with the development that has to be investigated	1.3
identification and description of noise-sensitive developments associated with the development that has to be investigated	3.4
identification and description of the noise sources and noise-sensitive developments in the target area that could affect the development (or that could be affected by the development) that has to be investigated	2.1.2 2.1.3
identification, with the assistance of all interested or affected parties, and description of all the noise sources and noise-sensitive developments associated with the development, or located within the target area, that are to be excluded from the investigation. The reason(s) for the exclusion shall be stated	2.1.2 2.1.3

3 SITE SENSITIVITY VERIFICATION

A site sensitivity verification (also referred to as a sensitivity interpretation in this report) has been undertaken in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) ("NEMA") Environmental Impact Assessment ("EIA") Regulations of 2014, in order to confirm the current land use and environmental sensitivity within the potential PFA. The details of the specialist doing the site sensitivity verification are noted below:

Date of Site Visit	The larger area was visited 7 to 9 June 2023
Specialist Name	Francois de Vries (Acoustics)
Professional Registration Number (if applicable)	Not applicable, there is no registration body in South Africa that could allow professional registration for acoustic consultants.
Specialist Affiliation / Company	Enviro-Acoustic Research CC

3.1 Output from National Environmental Screening Tool

The site was initially assessed using the National Environmental Screening tool, available at, https://screening.environment.gov.za. The output from the National Online Screening tool indicates a number of areas within and up to 2,000 m from the project boundary to be considered to be of a "very high" sensitivity to noise. These potentially "very high" sensitive areas (in terms of noise) are indicated on **Figure 3-1**.

It was reported that the structures identified are used on a permanent or temporary basis and these locations are considered noise sensitive.

3.2 Description on how the Site Sensitivity Verification was undertaken

The site sensitivity verification was done considering:

1. Available aerial images (Google Earth ®), with images dated between 2022 and 2023; and
2. Knowledge gained during a site visit in June 2023.

3.3 Outcome of the Site Sensitivity Verification

Areas with a "Very High" Sensitivity to noise are indicated on **Figure 3-1**. The online screening tool identified a number of areas with a "very high" sensitivity to noise in the vicinity of the proposed development.

There are permanent or temporary residential activities at the locations marked 1 to 16, and these locations are located within 2,000m from the area where wind turbines may be developed. These residential activities are considered to be noise-sensitive and the areas are considered to have a "Very High" sensitivity to noise. This report agrees with that finding.

Because a number of these structures are used for residential purposes and considered to be noise-sensitive, the potential impact from noise from the project should be assessed in a Noise Specialist Study.

3.4 POTENTIAL NOISE SENSITIVE RECEPTORS

Figure 3-2 illustrates generalized 500 m, 1,000 m and 2,000 m buffer zones around the properties where wind turbines may be erected. Generally, noises from wind turbines[3]:

- could be significant within 500 m from a wind turbine, with receptors staying within 500 m from operational wind turbines subject to noises at a potentially sufficient level to be considered disturbing. The significance from noise from a wind turbine located within this zone may be high and the development of wind turbines in this area is not recommended. This is recommended to be a No-Go area in terms of noise;
- are normally clearly audible when between 500 and 1000m from an NSR. Depending on the layout and the sound power emission levels ("SPL"), the significance of the noise impact could be low to high. The wind farm layout should be carefully planned when locating wind turbines in this area, as the turbines cumulatively contribute to noise levels at the NSR. This however can only be assessed once a layout is available, together with the SPL of the selected wind turbine model. For an initial layout, it is not recommended that more than two (2) wind turbines be located closer than 1,000m from any NSR;
- may be just audible or significant, again depending on the number of wind turbines located within 2,000m from an NSR (as well as the SPL of the selected wind turbine). The significance of the noise impact could be low to medium. The wind farm layout should be carefully planned when locating wind turbines in this area, as the turbines cumulatively contribute to noise levels at the NSR. This however can only be assessed once a layout is available, together with the SPL of the selected wind turbine model. For an initial layout, it is not recommended that more than eight (8) wind turbines be located closer than 2,000m from any NSR (inclusive of those located closer than 1,000m)); and,

[3] This is subject to the design of the wind farm, as well as the sound power emission levels (re 1 pW) of the particular wind turbine used at the project

- Are generally of a low significance at distanced greater than 2,000m, although this again would depend on the layout, the SPL of the wind turbine as well as local meteorological conditions. There are a number of new wind turbines with sound power emission levels exceeding 110 dBA (re 1 pW) that does impact on the extent of noise impact (see also **Figure 7-1**).

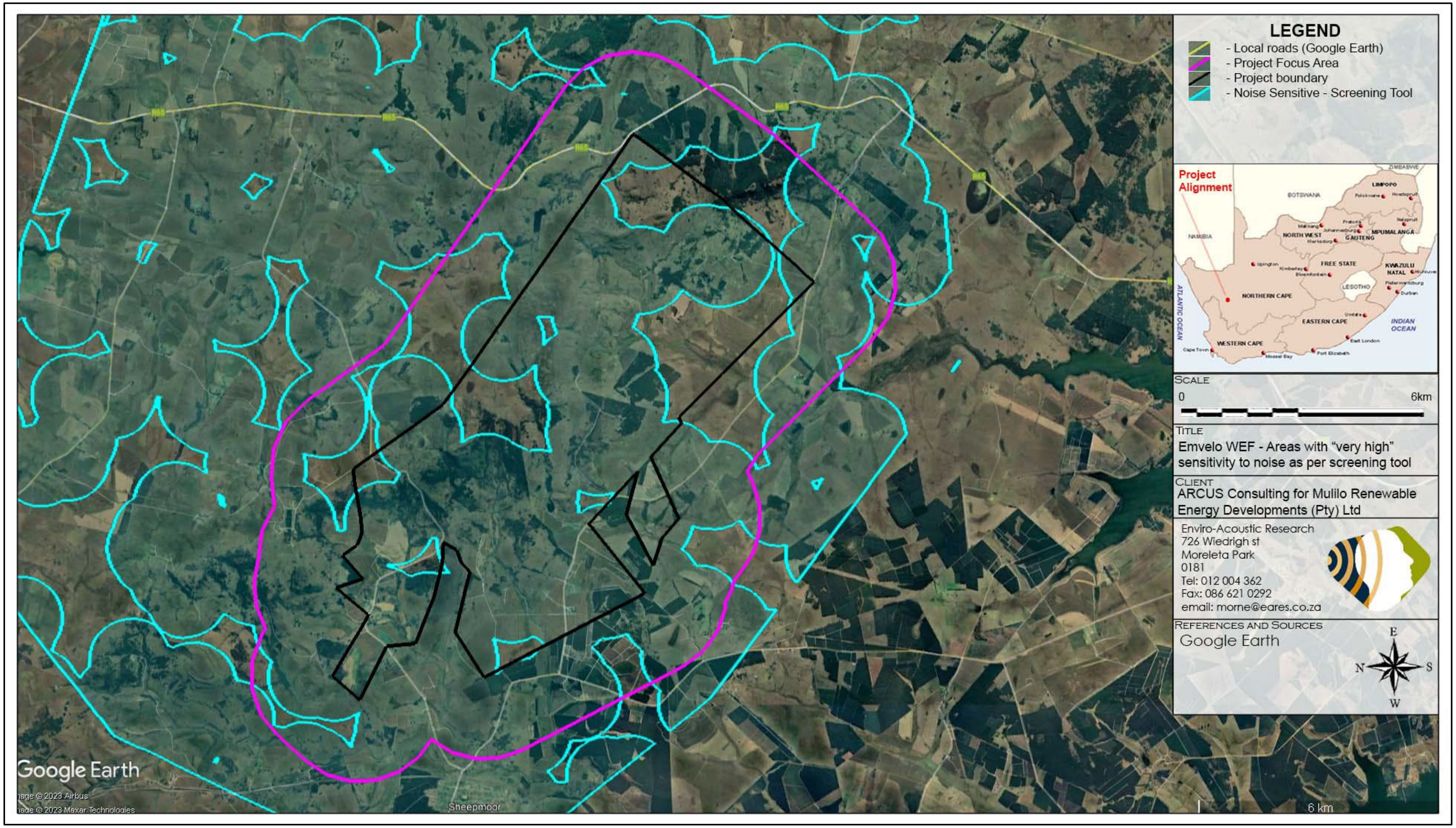

Figure 3-1: Areas identified by the online screening tool to have a "Very High" sensitivity to noise

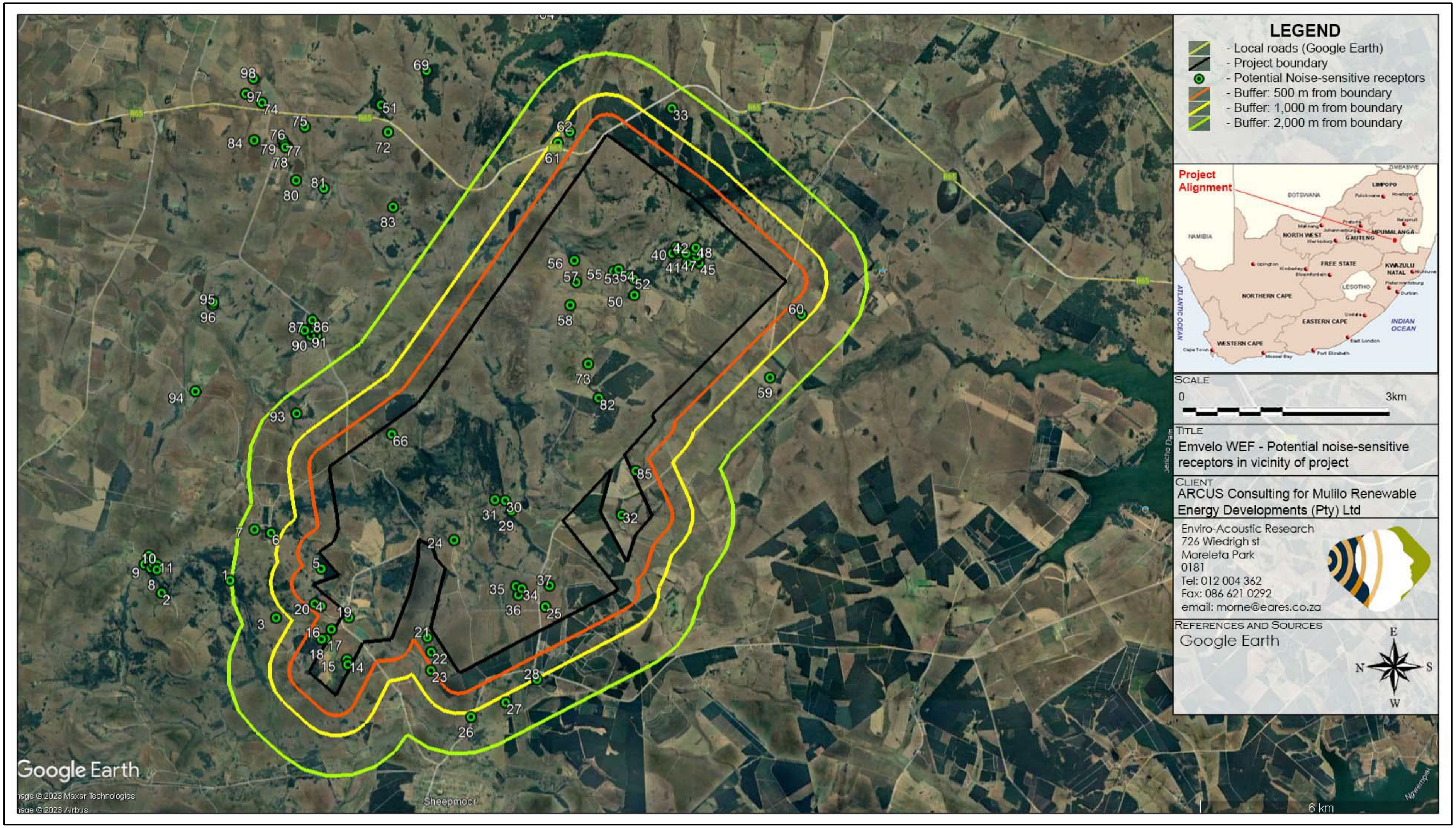

Figure 3-2: Aerial Image indicating closest Noise-sensitive developments to the Emvelo WEF project

4 POLICIES AND THE LEGAL CONTEXT

4.1 THE REPUBLIC OF SOUTH AFRICA CONSTITUTION ACT ("THE CONSTITUTION")

The environmental right contained in section 24 of the Constitution provides that everyone is entitled to an environment that is not harmful to his or her well-being. In the context of noise, this requires a determination of what level of noise is harmful to the well-being of humans. The general approach of the common law is to define an acceptable level of noise as that which the reasonable person can be expected to tolerate in the particular circumstances. The subjectivity of this approach can be problematic; however, this has led to the development of noise standards (see **Section 4.3.1**).

"Noise pollution" is specifically included in Part B of Schedule 5 of the Constitution, which means that noise pollution control is a local authority competence, provided that the local authority concerned has the capacity to carry out this function.

4.2 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998)

The National Environmental Management Act, 1998 (Act 107 of 1998), as amended ("NEMA") defines "pollution" to include any change in the environment, including noise. A duty therefore arises under section 28 of NEMA to take reasonable measures while establishing and operating any facility to prevent noise pollution occurring. NEMA sets out measures, which may be regarded as reasonable. They include the following measures to:

1. investigate, assess and evaluate the impact on the environment;
2. inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed to avoid causing significant pollution or degradation of the environment;
3. cease, modify or control any act, activity or process causing the pollution or degradation;
4. contain or prevent the movement of the pollution or degradation;
5. eliminate any source of the pollution or degradation; and
6. remedy the effects of the pollution or degradation.

Regulations have been promulgated in GN R982, R983, R984 and R985 in GG 38282, dated 4 December 2014, which came into effect on 8 December 2014. These were amended in April 2017, specifically promulgated in GN R326, R327, R325 and R324 in GG 40772, dated 7 April 2017.

Furthermore, Protocols were published in Government Gazette 43110 / GNR 320 on 20 March 2020 for specific environmental themes, including noise. "Requirements 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 National Environmental Management Act, 1998, when applying for Environmental Authorisation". These Protocols prescribe the general requirements for undertaking site sensitivity verification and the level of specialist assessment required as well as the assessment reporting requirements per environmental theme. The requirements of the Noise Protocol for the undertaking of a Noise Specialist Assessment have been adhered to. The national web-based Environmental Screening Tool identified the site to be of high noise sensitivity and therefore full Noise Specialist Assessment has been undertaken.

When the requirements of a protocol apply, the requirements of Appendix 6 of the Environmental Impact Assessment Regulations, as amended, (EIA Regulations), promulgated under sections 24(5) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), are replaced by the requirements of GNR 320.

4.3 THE ENVIRONMENT CONSERVATION ACT, 1989 (ACT 73 OF 1989)

The Environment Conservation Act, 1989 (Act 73 of 1989) ("ECA") allowed the Minister of Environmental Affairs and Tourism to make regulations regarding noise, among other concerns. The Minister has implemented Noise Control Regulations under the ECA as discussed below.

4.3.1 Noise Control Regulations (GN R154 of 1992)

In terms of section 25 of the ECA, the national Noise Control Regulations (GN R154 in *Government Gazette* No. 13717 dated 10 January 1992) (NCRs) were promulgated. The NCRs were revised under Government Notice No. R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. Provincial Noise Control Regulations exists in the Free State, Gauteng and Western Cape provinces, with the National Regulations being in effect in the Northern Cape Province.

The National Noise Control Regulations (GN R154 1992) defines:
"**Controlled area**" as:
A piece of land designated by a local authority where, in the case of--

c) Industrial noise in the vicinity of an industry-

i. the reading on an integrating impulse sound level meter, taken outdoors at the end of a period of 24 hours while such meter is in operation, exceeds 61 dBA; or
ii. the calculated outdoor equivalent continuous "A"-weighted sound pressure level at a height of at least 1,2 meters, but not more than 1,4 meters, above the ground for a period of 24 hours, exceeds 61 dBA;

"**disturbing noise**" as:

Noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more.

"**zone sound level**" as:
A derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area. *This is the same as the Rating Level as defined in SANS 10103:2008.*

In addition:
In terms of Regulation 2 -
"A local authority may –
(c): if a noise emanating from a building, premises, vehicle, recreational vehicle or street is a disturbing noise or noise nuisance, or may in the opinion of the local authority concerned be a disturbing noise or noise nuisance, instruct in writing the person causing such noise or who is responsible therefor, or the owner or occupant of such building or premises from which or from where such noise emanates or may emanate, or all such persons, to discontinue or cause to be discontinued such noise, or to take steps to lower the lever of the noise to a level conforming to the requirements of these Regulations within the period stipulated in the instruction: Provided that the provisions of this paragraph shall not apply in respect of a disturbing noise or noise nuisance caused by rail vehicles or aircraft which are not used as recreational vehicles;
(d): before changes are made to existing facilities or existing uses of land or buildings, or before new buildings are erected, in writing require that noise impact assessments or tests are conducted to the satisfaction of that local authority by the owner, developer, tenant or occupant of the facilities, land or buildings or that, for the purposes of regulation 3(b) or (c), reports or certificates in relation to the noise impact to the satisfaction of that local authority are submitted by the owner, developer, tenant or occupant to the local authority on written demand";

In terms of Regulation 4 of the Noise Control Regulations:
"No person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof".

4.4 INTERNATIONAL GUIDELINES

While there exists a number of international guidelines and standards that could encompass a document in itself, the three mentioned below were selected as they are used by different countries in the subject of environmental noise management, with the last two documents specifically focussing on the noises associated by WEFs.

4.4.1 Guidelines for Community Noise (World Health Organization, 1999)

The World Health Organization's (WHO) document on the *Guidelines for Community Noise* is the outcome of the WHO- expert task force meeting held in London, United Kingdom, in April 1999. It is based on the document entitled "Community Noise" that was prepared for the WHO and published in 1995 by the Stockholm University and Karolinska Institute.

The scope of the WHO's effort to derive guidelines for community noise is to consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments.

Guidance on the health effects of noise exposure of the population has already been given in an early publication of the series of Environmental Health Criteria. The health risk to humans from exposure to environmental noise was evaluated and guidelines values derived. The issue of noise control and health protection was briefly addressed.

The document uses the L_{Aeq} and L_{Amax} descriptors to define noise levels. This document was important in the development of the SANS 10103 standard.

4.4.2 The Assessment and Rating of Noise from Wind Farms (Energy Technology Support Unit, 1997)

This report describes the findings of a Working Group on Wind Turbine Noise, facilitated by the United Kingdom Department of Trade and Industry. It was developed as an Energy Technology Support Unit[4] (ETSU) project. The aim of the project was to provide information and advice to developers and planners on noise from wind turbines. The report represents the consensus view of a number of experts (experienced in assessing and controlling the environmental impact of noise from wind farms). Their findings can be summarised as follow:

1. Absolute noise limits applied at all wind speeds are not suited to wind farms; limits set relative to the background noise (including wind as seen in **Figure 6-3**) are more appropriate;
2. $L_{A90,10mins}$ is a much more accurate descriptor when monitoring ambient and turbine noise levels;
3. The effects of other wind turbines in a given area should be added to the effect of any proposed WF, to calculate the cumulative effect;

[4] ETSU was set up in 1974 as an agency by the United Kingdom Atomic Energy Authority to manage research programmes on renewable energy and energy conservation. The majority of projects managed by ETSU were carried out by external organizations in academia and industry. In 1996, ETSU became part of AEA Technology plc which was separated from the UKAEA by privatization.

4. Noise from a WEF should be restricted to no more than 5 dBA above the current ambient noise level at an NSR. Ambient noise levels are measured onsite in terms of the $L_{A90,10min}$ descriptor for a period sufficiently long enough for a set period;
5. Wind farms should be limited within the range of 35 dBA to 40 dBA (day-time) in a low noise environment. A fixed limit of 43 dBA should be implemented during all night time noise environments. This should increase to 45 dBA (day and night) if the NSR has financial investments in the WF; and
6. A penalty system should be implemented for wind turbine/s that operates with a tonal characteristic.

This is likely the guideline used in the most international countries to estimate the potential noise impact stemming from the operation of a WEF. It also recommends an improved methodology (compared to a fixed upper noise level) on determining ambient sound levels in periods of higher wind speeds, critical for the development of a wind energy facility. Because of its international importance, the methodologies used in the ETSU R97 document will be recommended in this report for implementation should projected noise levels (from the proposed WEF at NSR) exceed the zone sound levels as recommended by SANS 10103:2008.

4.4.3 Noise Guidelines for Wind Farms (MoE, 2008)

This document establishes the sound level limits for land-based wind power generating facilities and describes the information required for noise assessments and submissions under the ECA and the Environmental Protection Act, Canada.

The document defines:

- Sound Level Limits for different areas (similar to rural and urban areas), defining limits for different wind speeds at 10 m height, refer also **Table 4-1**[5]
- The Noise Assessment Report, including:
  - Information that must be part of the report;
  - Full description of noise sources;
  - Adjustments, due to the wind speed profile (wind shear);
  - The identification and defining of potential sensitive receptors;
  - Prediction methods to be used (ISO 9613-2);
  - Cumulative impact assessment requirements;
  - It also defines specific model input parameters;
  - Methods on how the results must be presented; and
  - Assessment of Compliance (defining magnitude of noise levels).

[5]The measurement of wind induced background sound level is not required to establish the applicable limit. The wind induced background sound level reference curve was determined by correlating the A-weighted ninetieth percentile sound level (L90) with the average wind speed measured at a particularly quiet site. The applicable Leq sound level limits at higher wind speeds are given by adding 7 dB to the wind induced background L90 sound level reference values

Table 4-1: Summary of Sound Level Limits for Wind Farms (MoE)

Wind speed (m/s) at 10 m height	4	5	6	7	8	9	10
Wind Turbine Sound Level Limits, Class 3 Area, dBA	40	40	40	43	45	49	51
Wind Turbine Sound Level Limits, Class 1 & 2 Areas, dBA	45	45	45	45	45	49	51

The document used the $L_{Aeq,1h}$ noise descriptor to define noise levels.

It should be noted that these Sound Level Limits are included for the reader to illustrate the criteria used internationally. Due to the lack of local regulations specifically relevant to WEFs this criterion will also be considered during the determination of the significance of the noise impact.

4.4.4 Equator Principles

The **Equator Principles** (EPs) are a voluntary set of standards for determining, assessing and managing social and environmental risk in project financing. Equator Principles Financial Institutions (EPFIs) commit to not providing loans to projects where the borrower will not or is unable to comply with their respective social and environmental policies and procedures that implement the EPs.

The EPs were developed by private sector banks and were launched in June 2003. The banks chose to model the EPs on the environmental standards of the World Bank and the social policies of the International Finance Corporation (IFC). As of March 2021, 116 financial institutions (located in 37 different countries) have adopted the EPs, which have become the de facto standard for banks and investors on how to assess major development projects around the world. The environmental standards of the World Bank have been integrated into the social policies of the IFC since April 2007 as the IFC Environmental, Health and Safety (EHS) Guidelines.

4.4.5 IFC: General EHS Guidelines – Environmental Noise Management (IFC, 2007)

These guidelines are applicable to noise created beyond the property boundaries of a development that conforms to the EPs.

It states that noise prevention and mitigation measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guideline at the most sensitive point of reception. The preferred method for controlling noise from stationary sources is to implement noise control measures at the source.

It goes as far as to propose methods for the prevention and control of noise emissions, including:

- Selecting equipment with lower sound power levels;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment casing radiating noise;
- Improving the acoustic performance of constructed buildings, apply sound insulation;
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m^2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective;
- Installing vibration isolation for mechanical equipment;
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas;
- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding;
- Placement of permanent facilities away from community areas if possible;
- Taking advantage of the natural topography as a noise buffer during facility design;
- Reducing project traffic routing through community areas wherever possible;
- Planning flight routes, timing and altitude for aircraft (airplane and helicopter) flying over community areas; and
- Developing a mechanism to record and respond to complaints.

It sets noise level guidelines (see **Table 4-2**) as well as highlighting the certain monitoring requirements pre- and post-development.

Table 4-2: IFC Table 7.1-Noise Level Guidelines

Receptor type	One hour L_{Aeq} (dBA)	
	Daytime 07:00 - 22:00	Night-time 22:00 – 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The document uses the $L_{Aeq,1\ hr}$ noise descriptors to define noise levels. It does not determine the detection period, but refers to the International Electrotechnical Commission (IEC) Standards, which require the fast detector setting on the Sound Level Meter during measurements for Europe.

4.4.6 Environmental, Health, and Safety Guidelines for Wind Energy (WBG, 2015) [36]

The EHS Guidelines for wind energy include information relevant to environmental, health, and safety aspects of onshore and offshore wind energy facilities was published by the World Bank

Group ("WBG"). It should be applied to wind energy facilities from the earliest feasibility assessments from the time of the environmental impact assessment, and continue to be applied throughout the construction and operational phases.

When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever are more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment.

It provides a brief overview of construction and operational noises, potential operational mitigation measures and a number of principles on the assessment of noise impacts, including:

- Receptors should be chosen according to their environmental sensitivity (human, livestock, or wildlife);
- Preliminary modeling should be carried out to determine whether more detailed investigation is warranted. The preliminary modeling can be as simple as assuming hemispherical propagation (i.e., the radiation of sound, in all directions, from a source point). Preliminary modeling should focus on sensitive receptors within 2,000 meters (m) of any of the turbines in a wind energy facility;
- If the preliminary model suggests that turbine noise at all sensitive receptors is likely to be below an L_{A90} of 35 dBA at a wind speed of 10 meters/second (m/s) at 10 m height during day and night times, then this preliminary modeling is likely to be sufficient to assess noise impact; otherwise it is recommended that more detailed modeling be carried out, which may include background ambient noise measurements;
- All modeling should take account of the cumulative noise from all wind energy facilities in the vicinity having the potential to increase noise levels;
- If noise criteria based on ambient noise are to be used, it is necessary to measure the background noise in the absence of any wind turbines. This should be done at one or more noise-sensitive receptors. Often the critical receptors will be those closest to the wind energy facility, but if the nearest receptor is also close to other significant noise sources, an alternative receptor may need to be chosen; and
- The background noise should be measured over a series of 10-minute intervals, using appropriate wind screens. At least five of these 10-minute measurements should be taken for each integer wind speed from cut-in speed to 12 m/s.

This project would mainly use the terms of reference defined by the Guidelines and Protocols stipulated in South Africa, but, as these guidelines and protocols are not specifically for wind projects, would also consider the World Bank EHS recommendations. As there are NSR located within 2,000m from WTG, a comprehensive environmental noise impact assessment, inclusive of detailed noise modelling (for the operational phase), will be undertaken.

4.4.7 Environmental Noise Guidelines for the European Region (WHO, 2018) [39]

This document identifies levels at which noise has "adverse health effects" and recommends actions to reduce exposure. Compared to previous WHO guidelines on noise, this version contains five significant developments:

- Stronger evidence of the cardiovascular and metabolic effects of environmental noise;
- Inclusion of new noise sources, namely wind turbine noise and leisure noise, in addition to noise from transportation (aircraft, rail, and road traffic);
- Use of a standardized approach to assess the evidence;
- A systematic review of evidence, defining the relationship between noise exposure and risk of adverse health outcomes;
- Use of long-term average noise exposure indicators to better predict adverse health outcomes.

The WHO (2018) considers adverse health effects in **section 2.4.3.2** of their report, dividing these effects into the following health outcomes:

- Cardiovascular disease – Ischaemic heart disease and hypertension;
- Cognitive impairment – Reading and oral comprehension;
- Permanent hearing impairment; and
- Self-reported sleep disturbance and annoyance.

While the WHO (2018) highlights that there is insufficient evidence of adverse health effects at noise levels below 40 dBA L_{night}, adverse health effects were reported at levels starting from 40 dB L_{night}. At 40 dB, about 3–4% of the population still reported being highly sleep-disturbed due to noise, which was considered relevant to health. It recommends that the guideline level should minimise adverse health effects to less than:

- 3% of the population experiencing sleep disturbances; and
- 10% of the population being highly annoyed.

This report recommends, that, for average noise exposure, the WHO Guideline Development Group conditionally recommends reducing noise levels produced by wind turbines below 45 dB L_{den}[6], as wind turbine noise above this level is associated with adverse health effects.

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[6] *Day–evening–night noise level is a European standard to express noise level over an entire day. It imposes a penalty on sound levels during evening and night and it is primarily used for noise assessments of airports, busy main roads, main railway lines and in cities over 100,000 residents. This equates to a night-time equivalent noise level of approximately 38.7 dBA.*

5 POTENTIAL NOISE SOURCES

Increased noise levels are directly linked with the various activities associated with the construction of the proposed Emvelo WEF and related infrastructure, as well as the operation phase of the activity. The potential noise impacts from the activities associated with these phases are discussed in the following sections.

5.1 POTENTIAL NOISE SOURCES: CONSTRUCTION PHASE

5.1.1 Construction equipment

It is estimated that construction will take approximately 24 – 36 months subject to the final design of the WEF, weather and ground conditions, including time for testing and commissioning. The construction process will consist of the following principal activities:

- Site survey and preparation;
- Establishment of site entrance, internal access roads, contractors' compound and passing places;
- Civil works to sections of the public roads to facilitate with turbine delivery;
- Site preparation activities will include clearance of vegetation at the footprint of each turbine as well as crane hard-standing areas. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site;
- Construct foundations – due to the volume of concrete that will be required, an on-site batching plant will be required to ensure a continuous concreting operation. The source of aggregate is yet to be determined but is expected to be derived from an offsite source or brought in as ready-mix. If the stones removed during the digging of foundations are suitable as an aggregate this may be used as the aggregate in the concrete mix.
- Transport of components & equipment to site – all components will be brought to site in sections by means of flatbed trucks. Additionally, components of various specialized construction and lifting equipment are required on site to erect the wind turbines and will need to be transported to site. The typical civil engineering construction equipment will need to be brought to the site for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.). The transportation of ready-mix concrete to site or the materials for onsite concrete batching will result in a temporary increase in heavy traffic (one turbine foundation may require up to 100 concrete trucks, and is undertaken as a continuous pour);
- Establishment of laydown & hard standing areas - laydown areas will need to be established at each turbine position for the placement of wind turbine components. Laydown and storage areas will also be required to be established for the civil

engineering construction equipment which will be required on site. Hard standing areas will need to be established for operation of the cranes. Cranes of the size required to erect turbines are sensitive to differential movement during lifting operations and require a hard-standing area;

- Erect turbines - a crane will be used to lift the tower sections into place and then the nacelle will be placed onto the top of the assembled tower. The next step will be to assemble or partially assemble the rotor on the ground; it will then be lifted to the nacelle and bolted in place. A small crane will likely be needed for the assembly of the rotor while the large crane will be needed to put it in place;
- Construct substation - the underground cables carrying the generated power from the individual turbines will connect at the substation. The construction of the substation would require a site survey; site clearing and levelling (including the removal / cutting of rock outcrops) and construction of access road/s (where required); construction of a substation terrace and foundation; assembly, erection and installation of equipment (including transformers); connection of conductors to equipment; and rehabilitation of any disturbed areas and protection of erosion sensitive areas;
- Establishment of ancillary infrastructure - A workshop as well as a contractor's equipment camp may be required. The establishment of these facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. A laydown area for building materials and equipment associated with these buildings will also be required; and
- Site rehabilitation - once construction is completed and all construction equipment are removed; the site will be rehabilitated where practical and reasonable.

There are a number of factors that determine the audibility as well as the potential of a noise impact on receptors. Maximum noises generated can be audible over a large distance, however, these maximum noises are generally of very short duration. If maximum noise levels however exceed 65 dBA at a receptor, or if it is clearly audible with a significant number of instances where the noise level exceeds the prevailing ambient sound level with more than 15 dB, the noise can increase annoyance levels and may ultimately result in noise complaints. Potential maximum noise levels generated by various construction equipment as well as the potential extent of these sounds are presented in **Table 5-1**.

Average or equivalent sound levels are another factor that impacts on the ambient sound levels and is the constant sound level that the receptor can experience. Typical sound power levels associated with various activities that may be found at a construction site are presented in **Table 5-2**.

Table 5-1: Potential maximum noise levels generated by construction equipment

Equipment Description[7]	Impact Device?	Maximum Sound Power Levels (dBA)	Operational Noise Level at given distance considering potential maximum noise levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modeling only considering distance) (dBA)											
			5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Auger Drill Rig	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Backhoe	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Compactor (ground)	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Concrete Batch Plant	No	117.7	92.7	86.7	80.6	72.7	66.7	63.1	60.6	57.1	52.7	49.2	46.7	40.6
Concrete Mixer Truck	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Crane	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Dozer	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Drill Rig Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Excavator	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Flat Bed Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Front End Loader	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Grader	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Impact Pile Driver	Yes	129.7	104.7	98.7	92.6	84.7	78.7	75.1	72.6	69.1	64.7	61.2	58.7	52.6
Rivit Buster/Chipping Gun	Yes	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Slurry Plant	No	112.7	87.7	81.7	75.6	67.7	61.7	58.1	55.6	52.1	47.7	44.2	41.7	35.6
Slurry Trenching Machine	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Soil Mix Drill Rig	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Tractor	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Vibratory Concrete Mixer	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Vibratory Pile Driver	No	129.7	104.7	98.7	92.6	84.7	78.7	75.1	72.6	69.1	64.7	61.2	58.7	52.6
Warning Horn	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Welder/Torch	No	107.7	82.7	76.7	70.6	62.7	56.7	53.1	50.6	47.1	42.7	39.2	36.7	30.6

[7] Equipment list and Sound Power Level source: http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm

Table 5-2: Potential equivalent noise levels generated by various equipment

Equipment Description	Equivalent (average) Sound Levels (dBA)	Operational Noise Level at given distance considering equivalent (average) sound power emission levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modelling only considering distance) (dBA)											
		5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Air compressor	92.6	67.6	61.6	55.5	47.6	41.6	38.0	35.5	32.0	27.6	24.1	21.6	15.5
Bulldozer CAT D10	111.9	86.9	80.9	74.9	66.9	60.9	57.4	54.9	51.3	46.9	43.4	40.9	34.9
Cement truck (with cement)	111.7	86.7	80.7	74.7	66.7	60.7	57.2	54.7	51.2	46.7	43.2	40.7	34.7
Crane	107.5	82.5	76.5	70.5	62.5	56.5	53.0	50.5	46.9	42.5	39.0	36.5	30.5
Diesel Generator (Large - mobile)	106.1	81.2	75.1	69.1	61.2	55.1	51.6	49.1	45.6	41.2	37.6	35.1	29.1
Dumper/Haul truck - Terex 30 ton	112.2	87.2	81.2	75.2	67.2	61.2	57.7	55.2	51.7	47.2	43.7	41.2	35.2
Excavator - Hitachi EX1200	113.1	88.1	82.1	76.1	68.1	62.1	58.6	56.1	52.6	48.1	44.6	42.1	36.1
FEL (988) (FM)	115.6	90.7	84.6	78.6	70.7	64.6	61.1	58.6	55.1	50.7	47.1	44.6	38.6
General noise	108.8	83.8	77.8	71.8	63.8	57.8	54.2	51.8	48.2	43.8	40.3	37.8	31.8
Grader - Operational Hitachi	108.9	83.9	77.9	71.9	63.9	57.9	54.4	51.9	48.4	43.9	40.4	37.9	31.9
Road Truck average	109.6	84.7	78.7	72.6	64.7	58.7	55.1	52.6	49.1	44.7	41.1	38.7	32.6
Rock Breaker, CAT	120.7	95.7	89.7	83.7	75.7	69.7	66.2	63.7	60.2	55.7	52.2	49.7	43.7
Vibrating roller	106.3	81.3	75.3	69.3	61.3	55.3	51.8	49.3	45.8	41.3	37.8	35.3	29.3
Water Dozer, CAT	113.8	88.8	82.8	76.8	68.8	62.8	59.3	56.8	53.3	48.8	45.3	42.8	36.8
Wind Turbine: Acciona AW125/3000	108.5	83.5	77.5	71.5	63.5	57.5	54.0	51.5	48.0	43.5	40.0	37.5	31.5
Wind Turbine: Goldwind GW165-6.0	112.6	87.6	81.6	75.6	67.6	61.6	58.1	55.6	52.1	47.6	44.1	41.6	35.6
Wind Turbine: Nordex N163 / 5.X	109.2	84.2	78.2	72.2	64.2	58.2	54.7	52.2	48.7	44.2	40.7	38.2	32.2
Wind Turbine: Vesta V66, ave	102.6	77.7	71.6	65.6	57.7	51.6	48.1	45.6	42.1	37.7	34.1	31.6	25.6
Wind Turbine: Vesta V66, max	108.0	83.0	77.0	71.0	63.0	57.0	53.5	51.0	47.5	43.0	39.5	37.0	31.0
Wind Turbine: Vesta V66, min	96.3	71.3	65.3	59.3	51.3	45.3	41.8	39.3	35.8	31.3	27.8	25.3	19.3
Wind Turbine: Vesta V90 2 MW VCS	104.0	79.0	73.0	67.0	59.0	53.0	49.5	47.0	43.5	39.0	35.5	33.0	27.0
Wind Turbine: Vestas V117 3.3MW	107.0	82.0	76.0	70.0	62.0	56.0	52.5	50.0	46.4	42.0	38.5	36.0	30.0
Wind Turbine: Vestas V150-4.2 MW	104.9	79.9	73.9	67.9	60.0	54.0	50.4	48.0	44.5	40.0	36.5	34.0	28.0

The equipment likely to be required to complete the above tasks will typically include:

- excavator/graders, bulldozer(s), dump trucks(s), vibratory roller, bucket loader, rock breaker(s), drill rig, flatbed truck(s), pile drivers, TLB, concrete truck(s), crane(s), fork lift(s) and various 4WD and service vehicles.

5.1.2 Blasting

Blasting may be required as part of the civil works to clear obstacles or to prepare foundations. Should a borrow pit be used to supply rocks for construction purposes, blasting could also be expected. However, no information regarding the use, or even the feasibility of such a borrow pit is known.

However, blasting will not be considered for the following reasons:

- Blasting is highly regulated, and control of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use minimum explosives and will occur in a controlled manner. With regards to blasting in borrow pits, explosives are used with a low detonation speed, reducing vibration, sound pressure levels and air blasts. The breaking of obstacles with explosives is also a specialized field, and when correct techniques are used, it causes less noise than using a rock-breaker.
- People are generally more concerned over ground vibration and air blast levels that might cause building damage than the impact of the noise from the blast.
- Blasts are an infrequent occurrence, with a loud but a relative instantaneous character. Potentially affected parties normally receive sufficient notice (siren), and the knowledge that the duration of the siren noise as well as the blast will be over relatively fast, resulting in a higher acceptance of the noise.

5.1.3 Traffic

A potential significant source of noise during the construction phase is additional traffic to and from the site, as well as traffic on the site. The use of a borrow pit(s), on site crushing and screening and concrete batching plants will significantly reduce heavy vehicle movement to and from the site.

Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period. Noise levels due to traffic can be estimated using various different noise algorithms.

5.2 Potential Noise Sources: Operation Phase

The proposed development would be designed to have an operational life of up to 25 years with the possibility to further expand the lifetime of the WEF. The only development related activities on-site will be routine servicing (access roads and light traffic) and unscheduled maintenance. The noise impact from maintenance activities is insignificant, with the main noise source being the wind turbine blades and the nacelle (components inside) as highlighted in the following sections.

Noise emitted by wind turbines can be associated with two types of noise sources. These are aerodynamic sources due to the passage of air over the wind turbine blades and mechanical sources which are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment for yaw, blade pitch, etc. These sources normally have different characteristics and can be considered separately. In addition, there are other noise sources of lower levels, such as the substations and traffic (maintenance).

5.2.1 Wind Turbine Noise: Aerodynamic sources[8]

Aerodynamic noise is emitted by a wind turbine blade through a number of sources such as:

1. Self-noise due to the interaction of the turbulent boundary layer with the blade trailing edge.
2. Noise due to inflow turbulence (turbulence in the wind interacting with the blades).
3. Discrete frequency noise due to trailing edge thickness.
4. Discrete frequency noise due to laminar boundary layer instabilities (unstable flow close to the surface of the blade).
5. Noise generated by the rotor tips.

Therefore, as the wind speed increases, noises created by the wind turbine also increase. At a low wind speed the noise created by the wind turbine is generally (relatively) low, and increases to a maximum at a certain wind speed when it either remains constant, increase very slightly or even drops as illustrated in **Figure 5-1**.

[8] *Renewable Energy Research Laboratory, 2006; ETSU R97: 1996*

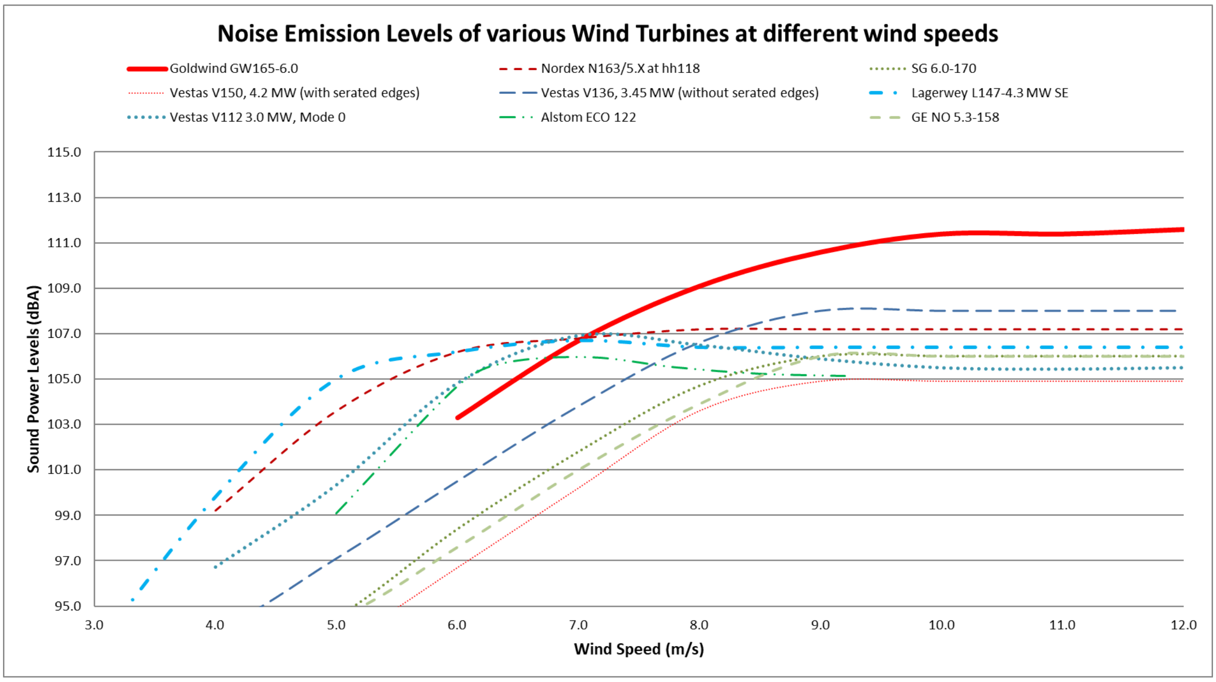

Figure 5-1: Noise Emissions Curve of a number of different wind turbines (figure for illustration purposes only)

5.2.1.1 Control Strategies to manage Noise Emissions during operation

Wind turbine manufacturers also provide their equipment with control mechanisms to allow for a certain noise reduction during operation that can include:

- A reduction of rotational speed;
- The increase of the pitch angle and/or reduction of nominal generator torque to reduce the angle of attack;
- Implementation of blade technologies such as serrated edges, changing the shape of the blade tips or the edge (proprietary technologies); and
- The insulation of the nacelle.

These mechanisms are used in various ways to allow the reduction of noise levels from the wind turbines, although this may also result in a reduction of power generation.

5.2.2 Wind Turbine: Mechanical sources[9]

Mechanical noise is normally perceived within the emitted noise from wind turbines as an audible tone(s) which is subjectively more intrusive than a broad band noise of the same sound pressure level. Sources for this noise are normally associated with:

- the gearbox and the tooth mesh frequencies of the step-up stages;

[9] *Renewable Energy Research Laboratory, 2006; ETSU R97: 1996; Audiology Today, 2010; HGC Engineering, 2007*

- generator noise caused by coil flexure of the generator windings which is associated with power regulation and control;
- generator noise caused by cooling fans; and
- control equipment noise caused by hydraulic compressors for pitch regulation and yaw control.

Tones are noises with a narrow sound frequency composition (e.g., the whine of an electrical motor). Annoying tones can be created in numerous ways: machinery with rotating parts such as motors, gearboxes, fans and pumps often create tones. An imbalance or repeated impacts may cause vibration that, when transmitted through surfaces into the air, can be heard as tones. Pulsating flows of liquids or gases can also create tones, which may be caused by combustion processes or flow restrictions. The best and most well-known example of a tonal noise is the buzz created by a flying mosquito.

Where complaints have been received due to the operation of wind farms, tonal noise from the installed wind turbines appears to have increased the annoyance perceived by the complainants and has indeed been the primary cause for complaint.

However, tones were normally associated with the older models of turbines. All turbine manufacturers have started to ensure that sufficient forethought is given to the design of quieter gearboxes and the means by which these vibration transmission paths may be broken. Through the use of careful gearbox design and/or the use of anti-vibration techniques, it is possible to minimize the transmission of vibration energy into the turbine supporting structure. The benefits of these design improvements have started to filter through into wind farm developments which are using these modified wind turbines. ***New generation wind turbine generators do not emit any clearly distinguishable tones***.

5.2.3 Low Frequency Noise[10]

Low frequency sound is the term used to describe sound energy in the region below ~200 Hz. The rumble of thunder and the throb of a diesel engine are both examples of sounds with most of their energy in this low frequency range. Infrasound is often used to describe sound energy in the region below 20 Hz.

Almost all noise in the environment has components in this region although they are of such a low level that they are not significant (wind, ocean, thunder). Sound that has most

[10] *Renewable Energy Research Laboratory, 2006; DELTA, 2008; DEFRA, 2003; HGC Engineering, 2006; Whitford, Jacques, 2008; Noise-con, 2008; Minnesota DoH, 2009; Kamperman, 2008, Van den Berg, 2004*

of its energy in the 'infrasound' range is only significant if it is at a very high level, far above normal environmental levels.

Because of the low rotational rates of the blades of a wind turbines, the peak acoustic energy radiated by large wind turbines is in the infrasonic range with a peak in the 8-12 Hz range. For smaller machines, this peak can extend into the low-frequency "audible" (20-20KHz) range because of higher rotational speeds and multiple blades.

It should be noted that a number of studies highlighted that these sounds are below the threshold of perception (BWEA, 2005), although this should be clarified. Most acousticians would agree that the low frequency sounds are inaudible to most people, yet, there are a number of studies that highlight that it can be more perceptible to people inside their houses as well as people that are more sensitive to low frequency sounds.

Low frequency noise is always present around us as it is produced by both man and nature. While problems have been associated with older downwind wind turbines in the 1980s, this has been considered by the wind industry and modern upwind turbines do not suffer from the same problems. Low Frequency Noise however has been very controversial in the last few years with the anti-wind fraternity claiming measurable impacts, with governments and wind-energy supporter studies indicating no link between low-frequency sound and any health impacts.

5.2.4 Amplitude modulation[11]

Although considered rare, there is one other characteristic of wind turbine sound that increases the sleep disturbance potential above that of other long-term noise sources. The amplitude modulation (AM) of the sound emissions from the wind turbines creates a repetitive rise and fall in sound levels synchronized to the blade rotation speed, sometimes referred to as a "swish" or "thump".

Pedersen (2003) highlighted a weak correlation between sound pressure level and noise annoyance caused by wind turbines. Residents complaining about wind turbines noise perceived more sound characteristics than noise levels. People were able to distinguish between background ambient sounds and the sounds the blades made. The noise produced by the blades lead to most complaints. Most of the annoyance was experienced between 16:00 and midnight. This could be an issue as noise propagation modelling would be

[11] *Renewable Energy Research Laboratory, 2006; Audiology Today, 2010; HGC Engineering, 2007; Whitford, 2008; Noise-con, 2008; DEFRA, 2007; Bowdler, 2008*

reporting an equivalent, or "average" sound pressure level, a parameter that ignores the "character" of the sound.

That AM can be a risk and significantly increase the annoyance with WEFs cannot be disputed. It has been reported with a number of recent studies confirming this significant noise characteristic. However, even though there are thousands of wind turbine generators in the world, amplitude modulation is still one subject receiving the least complaints and due to these very few complaints, little research went into this subject. It is important to note that it is not possible to predict whether AM may occur, nor to calculate the potential related impact.

5.2.5 Battery Energy Storage Systems

The developer proposes to include a BESS at their WEF to store energy for use at a later time or date using electro-chemical solutions. The typical components of a BESS are:

- The battery system which could consist of:
  - Multiple cells,
  - The battery management system; and,
  - The battery thermal management system.
- Components required for the reliable operation of the overall system, including:
  - Energy management system; and,
  - System thermal management.
- Power electronics that can be grouped into the conversion unit (such as an invertor), which manage the power flow between the grid and battery, including the required control and monitoring components, voltage sensing units and thermal management of power electronic components (fans or climate control system).

There could be numerous such BESS modules running in parallel to increase the total storage capacity of the system up to the desired or needed capacity. The typical components are illustrated in **Figure 5-2**.

While certain components may generate a slight hum under load, the dominant source of noise is from the fans or climate control system used to manage heat in the system and/or to maintain the BESS within its optimal operating temperature range. These BESSs however generate low noise levels, with any potential noise impact generally limited to areas within 200m of the BESS. This is an insignificant noise level and the significance of this noise will be low.

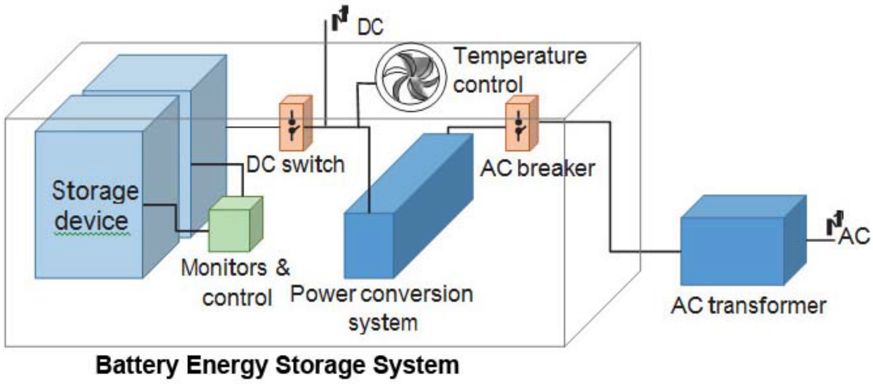

Figure 5-2: Conceptual BESS components[12]

5.2.6 Transformer noises (Substations)

Also known as magnetostriction[13], is when the sheet steel used in the core of the transformer tries to change shape when being magnetised. When the magnetism is taken away, the shape returns, only to try and deform in a different manner when the polarity is changed.

This deformation is not uniform; consequently, it varies all over a sheet. With a transformer core being composed of many sheets of steel, these deformations are taking place erratically all over each sheet, and each sheet is behaving erratically with respect to its neighbour. The resultant is the "hum" frequently associated with transformers. While this may be a soothing sound in small home appliances, various complaints are logged in areas where people stay close to these transformers. At a voltage frequency of 50 Hz, these "vibrations" take place 100 times a second, resulting in a tonal noise at 100Hz.

However, this is a relatively easy noise to mitigate with the use of acoustic shielding and/or placement of the transformer and will not be considered further in this ENIA study. Substations in addition generate low noise levels, with the hum from the transformers inaudible further than 200 m from the transformers.

5.2.7 Transmission Line Noise (Corona noise)

Corona noise[14] is caused by the partial breakdown of the insulation properties of air surrounding the conducting wires. It can generate an audible and radio-frequency noise, but generally only occurs in humid conditions, as provided by fog or rain. A minimum line

[12] Source: http://www.amdcenergy.com/battery-energy-storage-system.html
[13] https://en.wikipedia.org/wiki/Magnetostriction
[14] https://en.wikipedia.org/wiki/Corona_discharge

potential of 70kV or higher is generally required to generate corona noise depending on the electrical design. Corona noise does not occur on domestic distribution lines.

Corona noise has two major components: a low frequency tone associated with the frequency of the AC supply (100 Hz for 50 Hz source) and broadband noise. The tonal component of the noise is related to the point along the electric waveform at which the air begins to conduct. This varies with each cycle and consequently the frequency of the emitted tone is subject to great fluctuations. Corona noise can be characterised as broadband 'crackling' or 'buzzing', but ***fortunately it is generally only a feature that occurs during fog or rain***.

It will not be further investigated, as corona discharges results in:

- Power losses,
- Audible noises,
- Electromagnetic interference,
- A purple glow,
- Ozone production; and
- Insulation damage.

As such Electrical Service Providers, such as ESKOM, go to great lengths to design power transmission equipment to minimise the formation of corona discharges. In addition, it is an infrequent occurrence with a relatively short duration compared to other operational noises.

6 METHODOLOGY: NOISE SPECIALIST ASSESSMENT

6.1 NOISE IMPACT ON ANIMALS[15]

A great deal of research was conducted in the 1960's and 1970's on the effects of aircraft noise on animals. While aircraft noise has a specific characteristic, the findings should be relevant to most noise sources.

Overall, the research suggests that species differ in their response to:

- Various types of noise;
- Durations of noise; and
- Sources of noise.

A general animal behavioural reaction to aircraft noise is the startle response. However, the strength and length of the startle response appears to be dependent on:

- which species is exposed;
- whether there is one animal or a group; and
- whether there have been some previous exposures.

Unfortunately, there are numerous other factors in the environment of animals that also influence the effects of noise. These include predators, weather, changing prey/food base and ground-based disturbance, especially anthropogenic. This hinders the ability to define the real impact of noise on animals.

From these and other studies the following can be concluded:

- Animals respond to impulsive (sudden) noises (higher than 90 dBA) by running away. If the noises continue, animals would try to relocate. This is not relevant to wind energy facilities because the turbines do not generate any impulsive noises close to these sound levels.
- Animals of most species exhibit adaptation with noise, including aircraft noise and sonic booms (far worse than noises associated with Wind Turbines).
- More sensitive species would relocate to a quieter area, especially species that depend on hearing to hunt or evade prey, or species that makes use of sound/hearing to locate a suitable mate.
- Noises associated with helicopters, motor- and quad bikes significantly impact on animals.

[15] Report to Congressional Requesters, 2005; USEPA, 1971; Autumn, 2007; Noise quest, 2010

6.2 WHY NOISE CONCERNS COMMUNITIES[16]

Noise can be defined as "unwanted sound", an audible acoustic energy that adversely affects the physiological and/or psychological well-being of people, or which disturbs or impairs the convenience or peace of any person. One can generalise by saying that sound becomes unwanted when it:

- Hinders speech communication;
- Impedes the thinking process;
- Interferes with concentration;
- Obstructs activities (work, leisure and sleeping); and
- Presents a health risk due to hearing damage.

However, it is important to remember that whether a given sound is "noise" depends on the listener or hearer. The driver playing loud rock music on their car radio hears no noise, but the person in the traffic behind them hears nothing but noise.

Response to noise is unfortunately not an empirical absolute, as it is seen as a multi-faceted psychological concept, including behavioural and evaluative aspects. For instance, in some cases annoyance is seen as an outcome of disturbances, in other cases it is seen as an indication of the degree of helplessness with respect to the noise source.

Noise does not need to be loud to be considered "disturbing". One can refer to a dripping tap in the quiet of the night, or the irritating "thump-thump" of the music from a neighbouring house at night when one would like to sleep.

Severity of the annoyance depends on factors such as:

- Background sound levels, and the background sound levels the receptor is used to;
- The manner in which the receptor can control the noise (helplessness);
- The time, unpredictability, frequency, distribution, duration, and intensity of the noise;
- The physiological state of the receptor; and
- The attitude of the receptor about the emitter (noise source).

6.2.1 Annoyance associated with Wind Energy Facilities[17]

Annoyance is the most widely acknowledged effect of environmental noise exposure, and is considered to be the most widespread. It is estimated that less than a third of the individual noise annoyance is accounted for by acoustic parameters, and that non-acoustic

[16] World Health Organization, 1999; Noise quest, 2010; Journal of Acoustical Society of America, 2009
[17] Van den Berg, 2011; Milieu, 2010.

factors plays a major role. Non-acoustic factors that have been identified include age, economic dependence on the noise source, attitude towards the noise source and self-reported noise sensitivity.

On the basis of a number of studies into noise annoyance, exposure-response relationships were derived for high annoyance from different noise sources. These relationships, illustrated in **Figure 6-1**, are recommended in a European Union position paper published in 2002, stipulating policy regarding the quantification of annoyance. This can be used in an Environmental Health Impact Assessment and cost-benefit analysis to translate noise maps into overviews of the numbers of persons that may be annoyed, thereby giving insight into the situation expected in the long term. It is not applicable to local complaint-type situations or to an assessment of the short-term effects of a change in noise climate.

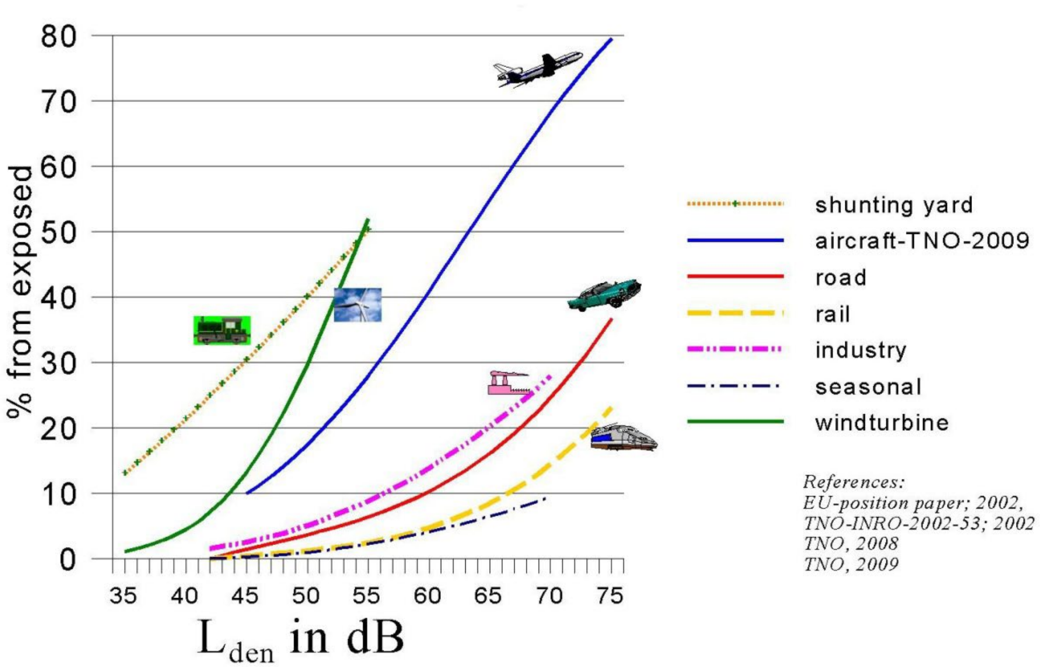

Figure 6-1: Percentage of annoyed persons as a function of the day-evening-night noise exposure at the façade of a dwelling

While the total ambient sound levels are of importance, the spectral characteristics also determines the likelihood that someone will hear external noises that may or may not be similar in spectral characteristics to that of vegetation created noise. Bolin (2006) did investigate spectral characteristics and determined the annoyance might occur at levels where noise generated by wind turbine noise exceeds natural ambient sounds with 3 dB or more.

6.3 Impact Assessment Criteria

6.3.1 Overview: The common characteristics

The word "noise" is generally used to convey a negative response or attitude to the sound received by a listener. There are four common characteristics of sound, any or all of which determine listener response and the subsequent definition of the sound as "noise". These characteristics are:

- Intensity;
- Loudness;
- Annoyance; and
- Offensiveness.

Of the four common characteristics of sound, intensity is the only one which is not subjective and can be quantified. Loudness is a subjective measure of the effect the sound has on the human ear. As a quantity it is therefore complicated but has been defined by experimentation on subjects known to have normal hearing.

The annoyance and offensive characteristics of noise are also subjective. Whether or not a noise causes annoyance mostly depends upon its reception by an individual, the environment in which it is heard, the type of activity and mood of the person and how acclimatised or familiar that person is to the sound.

6.3.2 Noise criteria of concern

The criteria used in this report were drawn from the criteria for the description and assessment of environmental impacts from the Integrated Environmental Management Information Series (DEAT, 2002).

There are a number of criteria that are of concern for the assessment of noise impacts. These can be summarised in the following manner:

- *Increase in noise levels:* People or communities often react to an increase in the ambient noise level they are used to, which is caused by a new source of noise. With regards to the NCRs, an increase of more than 7 dBA is considered a disturbing noise. See also **Figure 6-2**.
- *Zone Sound Levels:* Previously referred as the acceptable rating levels, sets acceptable noise levels for various areas. See also **Table 6-1**.
- *Absolute or total noise levels:* Depending on their activities, people generally are tolerant to noise up to a certain absolute level, e.g., 65 dBA. However, anything above this level is considered unacceptable.

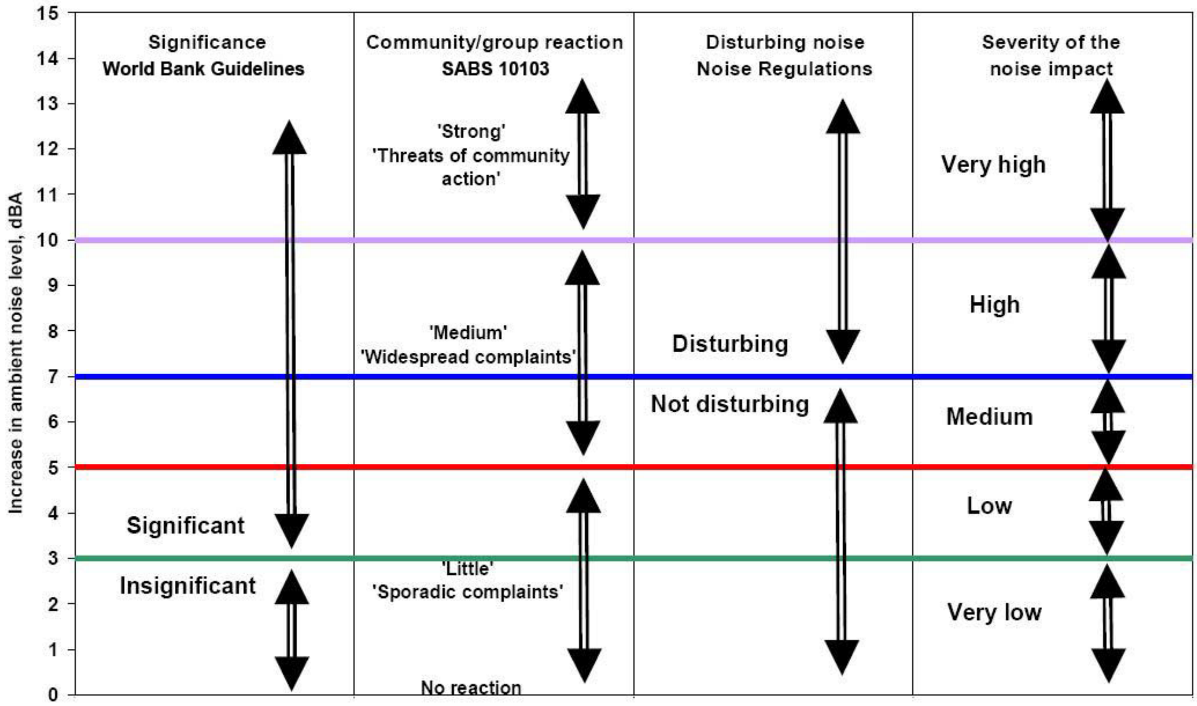

Figure 6-2: Criteria to assess the significance of impacts stemming from noise

In South Africa the document that addresses the issues concerning environmental noise is SANS 10103. See also **Table 6-1**. It provides the maximum average ambient noise levels, $L_{Req,d}$ and $L_{Req,n}$, during the day and night respectively to which different types of developments may be exposed. For rural areas the Zone Sound Levels (Rating Levels) are:

- Day (06:00 to 22:00) - $L_{Req,d}$ = 45 dBA, and
- Night (22:00 to 06:00) - $L_{Req,n}$ = 35 dBA.

SANS 10103 also provides a guideline for estimating community response to an increase in the general ambient noise level caused by an intruding noise. If Δ is the increase in noise level, the following criteria are of relevance:

- **Δ ≤ 3 dBA:** An increase of 3 dBA or less will not cause any response from a community. It should be noted that for a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level would not be noticeable.
- **3 < Δ ≤ 5 dBA:** An increase of between 3 dBA and 5 dBA will elicit 'little' community response with 'sporadic complaints'. People will just be able to notice a change in the sound character in the area.
- **5 < Δ ≤ 15 dBA:** An increase of between 5 dBA and 15 dBA will elicit a 'medium' community response with 'widespread complaints'. In addition, an increase of 10 dBA is subjectively perceived as a doubling in the loudness of a noise. For an

increase of more than 15 dBA the community reaction will be 'strong' with 'threats of community action'.

In addition, it should be noted that the NCRs defines disturbing noise to be any change in the ambient noise levels higher than 7 dBA than the background.

Table 6-1: Acceptable Zone Sound Levels for noise in districts (SANS 10103)

1	2	3	4	5	6	7
Type of district	Equivalent continuous rating level ($L_{Req.T}$) for noise dBA					
	Outdoors			Indoors, with open windows		
	Day/night $L_{R,dn}$ [a]	Daytime $L_{Req,d}$ [b]	Night-time $L_{Req,n}$ [b]	Day/night $L_{R,dn}$ [a]	Daytime $L_{Req,d}$ [b]	Night-time $L_{Req,n}$ [b]
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with one or more of the following: workshops; business premises; and main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

6.3.3 Determining appropriate Zone Sound Levels

SANS 10103 unfortunately does not cater for instances when background noise levels change due to the impact of external forces. Locations close to the sea for instance always have a background noise level exceeding 35 dBA, and, in cases where the sea is rather turbulent, it can easily exceed 45 dBA. Similarly, noise induced by high winds is not included.

Setting noise limits relative to the background noise level is relatively straightforward when the prevailing background noise level and source level are constant. However, wind turbines emit noise that is related to wind speed, and the environment within which they are heard will probably also be dependent upon the strength of the wind and the noise associated with its effects. It is therefore necessary to derive a background noise level that is indicative of the noise environment at the receiving property for different wind speeds so that the turbine noise level at any particular wind speed can be compared with the background noise level in the same wind conditions.

6.3.3.1 Using International Guidelines to set Noise Limits

When assessing the overall noise levels emitted by a WEF, it is necessary to consider the full range of operating wind speeds of the wind turbines. This covers the wind speed range from around 3-5 m/s (the turbine cut-in wind speed) up to a wind speed range of 25-35 m/s measured at the hub height of a wind turbine. However, ETSU-R97 (1996) proposes that noise limits only be placed up to a wind speed of 12 m/s for the following reasons:

1. Wind speeds are not often measured at wind speeds greater than 12 m/s at 10 m height;
2. Reliable measurements of background ambient sound levels and turbine noise will be difficult to make in high winds due to the effects of wind noise on the microphone and the fact that one could have to wait several months before such winds were experienced;
3. Turbine manufacturers are unlikely to be able to provide information on sound power levels at such high wind speeds for similar reasons; and
4. If a wind farm meets noise limits at wind speeds lower than 12m/s, it is most unlikely to cause any greater loss of amenity at higher wind speeds. Turbine noise levels increase only slightly as wind speeds increase; however, background ambient sound levels increase significantly with increasing wind speeds due to the force of the wind.

Available data indicates that wind-induced noises start to increase at wind speeds 3 – 4 m/s, becoming a significant (and frequently the dominant noise source in rural areas) at wind speeds higher than 10 – 12 m/s/. Most wind turbines reach their maximum noise emission level at a wind speed of 8 – 10 m/s. At these wind speeds increased wind-induced noises (wind howling around building, rustling of leaves in trees, rattling noises, etc.) could start to drown other noises, including that being generated by wind turbines[18].

Sound level vs. wind speed data is presented in the following figures (see from **Figure 6-3**)[19]. It is based on approximately 30,000 measurements collected at various quiet locations in South Africa (locations further than 10 km from the ocean). Also indicated are around 480 actual night-time measurements collected within 10 km from the proposed WEF. There were no apparent or observable sounds that would have impacted on the measurements at these locations. There was a lack of higher wind speeds during previous site visits, but as with other sites, ambient sound levels are expected to increase as the

[18] It should be noted that this does not mean that the wind turbines are inaudible.
[19] The sound level measuring instruments were located at a quiet location in the garden of the various houses. Data was measured in 10-minute bins and then co-ordinated with the 10 m wind speed derived from the wind mast of the developer. This wind mast was not close to the dwellings, being approximately 3,500m from the measurement locations.

surrounding wind speed increase. This has been found at all locations where measurements have been done for a sufficiently long enough period of time (more than 30 locations comprising of more than 38,000 measurements) with the data agreeing with a number of international studies on the subject.

Considering this data as well as the international guidelines (MOE, see **Table 4-1**; IFC, see **Table 4-2**), noise limits starting at 40 dB that increases to more than 45 dB (as wind speeds increase) could be acceptable. Project participants could be exposed to noise levels up to 45 dBA (ETSU-R97).

6.3.3.2 Using local regulations to set noise limits

Noise limits as set by the NCRs (GN 5479 of 20 August 1999 – **section 4.3.1**) defines a "**disturbing noise**" as the noise level that causes the ambient noise level to rise above the designated zone level, or if no zone level has been designated, the typical rating levels for ambient noise in districts, indicated in table 2 of SABS 0103. Accepting that the sound levels in the area may be typical of a sub-urban to urban noise district, the desired rating levels (see **section ☐**) would be 55 dBA for the daytime, and 45 dBA for the night-time period.

As can be observed from **Figure 6-3**[20], if ambient sound levels were measured at increased wind speeds, ambient sound levels will be higher as wind-induced noises increase. Data collected during the site visit will be used to determine and motivate the acceptable zone sound level for the project, and the sound level data will also be used to estimate the probability for a noise impact to occur.

How wind-induced noises increase depends significantly on the measuring location and surrounding environment, but it is expected to be higher than 35 dBA closer to dwellings.

[20] The sound level measuring instruments were located at a quiet location in the garden of the various houses. Data was measured in 10-minute bins and then co-ordinated with the 10 m wind speed derived from the wind mast of the developer. This wind mast normally was not close to the dwelling, at times being further than 5,000 meters from the measurement location. It is possible that the wind may be blowing at the location of the wind mast with no wind at the measurement location, resulting in low sound levels recorded.

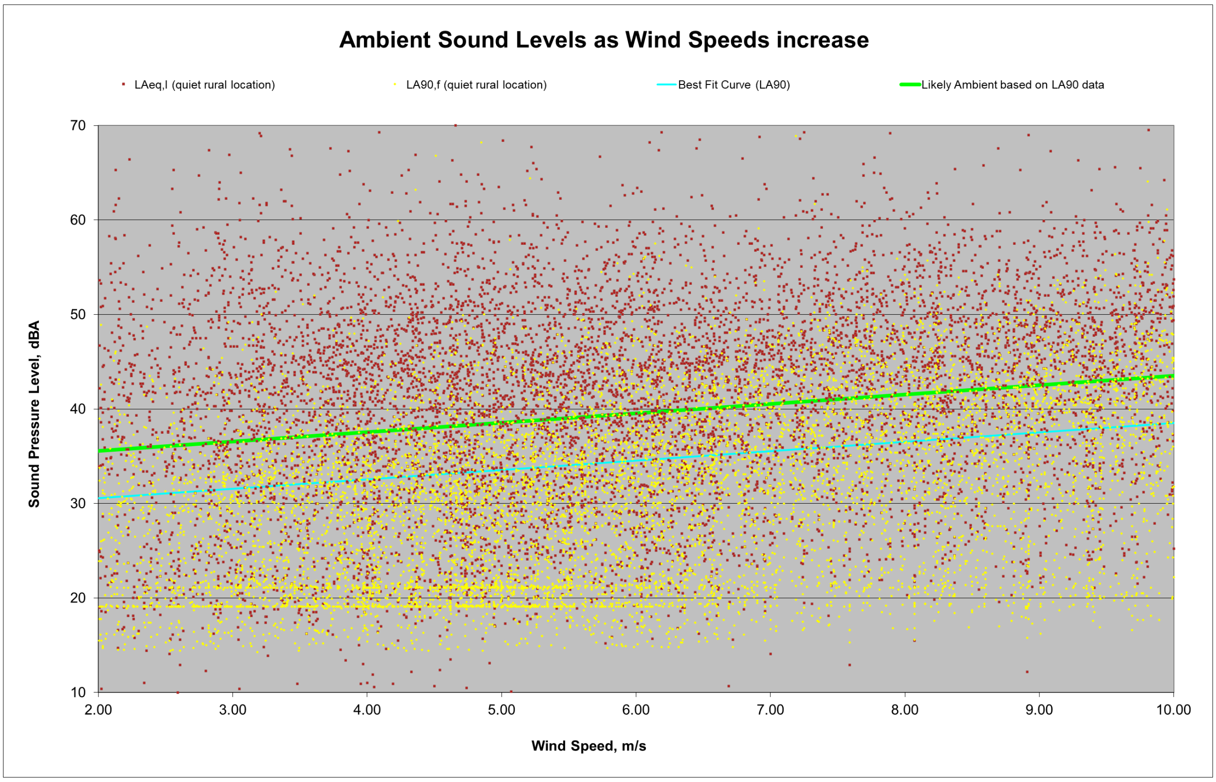

Figure 6-3: Ambient sound levels – quiet inland location (A-Weighted)

6.4 DETERMINING THE EIA SIGNIFICANCE OF THE NOISE IMPACT

The potential significance of the noise impact will be assessed during the future EIA phase, using the EIA criteria developed by the Author, considering the criteria of the EAP as well as the DEAT (CSIR, 2002) guideline. In order to establish a coherent framework within which all impacts could be objectively assessed, it will be necessary to establish a rating system, which will be applied consistently to all the criteria during the future ENIA specialist study.

The significance of the noise impact is determined by considering aspects such as:

- The Consequence (magnitude, severity or intensity) of the noise level;
- The Spatial Extent of the potential noise impact;
- The Reversibility of the potential impact;
- The Duration of the various project phases; and
- The Probability of the impact occurring.

7 RESULTS AND PRELIMINARY IMPACT ASSESSMENT

7.1 CONSTRUCTION PHASE

Projected construction noise impacts will only be modelled during the future EIA phase, considering the infrastructure and WTG layout.

As can be seen from **Table 5-1** and **Table 5-2**, noise levels could exceed 45 dBA[21], higher than both the day- and night-time rating levels (during low wind conditions) for a rural noise district.

A potential alignments of access routes were not available during the scoping phase and the potential impact associated with the construction of access roads (a temporary impact), as well as the influence of construction traffic passing NSR (potentially impact ambient sound levels in the short term), will only be considered during the future ENIA.

7.2 OPERATIONAL PHASE: ESTIMATED IMPACT AND IMPORTANT CONCEPTS

Projected operational noise impacts will only be modelled during the future EIA phase. However, considering the presence of NSR as well as noise levels associated with operating WTG, noises could change existing ambient sound levels, will be audible and could annoy NSR.

As can be seen from **Table 5-2**, the equivalent noise level could be higher than 45 dBA at distances closer than 500m from NSR (using the sound power emission level of 112.6 dBA re 1 pW), though the basic model does not consider the potential cumulative effects, the impact of atmospheric absorption, ground surface or topography. This noise level is higher than the proposed desired night-time rating level. The potential extent of noise from different WTG are also illustrated in **Figure 7-1**.

This however will be considered in more detail during the EIA phase, using the WTG layout as well as the SPL of a viable WTG, using an internationally recognized noise propagation model. Such a noise propagation model can also consider cumulative noise impacts, as well as factors such as air absorption, character of the noise, surface factors and topography.

[21] Depending on factors such as the number of simultaneous noise-generating activities as well as the sound power emission levels of the equipment

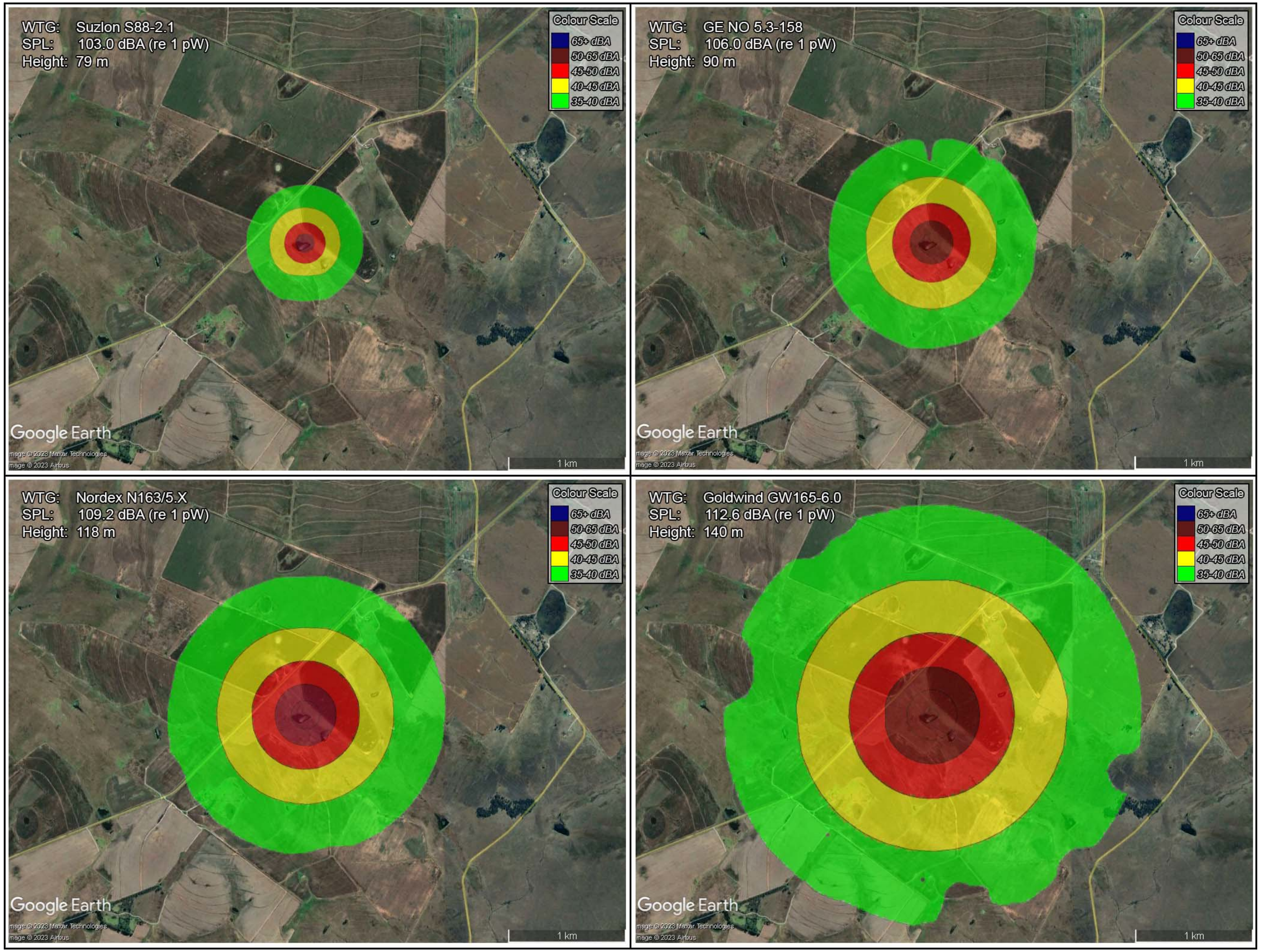

Figure 7-1: Extent of noises from different wind turbines (unmitigated, worst-case parameters)

8 PRELIMINARY SIGNIFICANCE OF THE NOISE IMPACT

8.1 CONSTRUCTION PHASE NOISE IMPACT

The impact assessment for the various activities defined in **Section 5.1** and assessed in **Section 7.1** that can create noise and may impact on the surrounding environment is summarized in the following **Table 8-1**.

Table 8-1: Scoping Level Noise Impact Assessment: Construction Activities

Impacts: Increases in noise levels at closest receptors. Noise levels exceeding the SANS 10103 rating level.			
Desktop Sensitivity Analysis: Based on the daytime ambient sound level measurements, this is a rural noise district (rating level of 45 dBA). Based on the night-time ambient sound level measurements, this is a rural noise district (night-time rating level of 35 dBA).			
Issue	**Nature of Impact**	**Extent of Impact**	**No-go areas**
Increase in noise level at receptors. Disturbing noises. Noises exceeding rating level.	Increased noises or disturbing noises may increase annoyance levels with project. Noise levels could exceed 45 dBA during construction. (temporary construction of access roads, construction of WTG as well as construction traffic passing close to NSR)	Multiple construction activities taking place simultaneously may impact an area up to 2,000m from the activities at night	As a preliminary guideline, construction activities within 160m from an identified and verified NSR is not recommended considering daytime noise limits (considering only construction noises). This buffer would be more considering night-time noise rating levels.
Description of expected significance of impact: Without noise propagation modeling where cumulative effects are included, it is difficult to assess the potential significance of the noise impact. Using the precautious approach, it is Possible to Highly Probable that a noise impact will occur (depending on location of NSR), with the consequence likely Negligible to Moderately Severe (depending on location of NSR in relation to noise generating activities). The significance may be **very low** to **medium** at the different NSR. Construction noise impacts however: (a) are highly reversible; (b) will not result in the irreplaceable loss of resources; and (c) potential noise impacts can be managed, mitigated or even avoided. It should be noted that mitigation measures would be identified and recommended during the environmental noise impact assessment which would reduce the significance to low.			
Gaps in Knowledge & recommendation for further study: Insufficient information is available to consider the potential noise impact.			
Recommendations: Scoping level assessment is insufficient and a full ENIA is required.			

8.2 OPERATIONAL PHASE NOISE IMPACT

The impact assessment for the various activities defined in **Section 5.2** and calculated in **section 7.2** will increase the ambient noise levels in the area. The noise impact is assessed and summarized in the following **Table 8-2**.

Table 8-2: Impact Assessment: Operational Activities

Impacts: Increases in noise levels at closest receptors, though WTG will only operate during periods with increased wind speeds. Considering international guidelines, a noise limit of 45 dBA is recommended.			
Desktop Sensitivity Analysis: Rural area with night-time $L_{R,n}$ rating level of 35 dBA, although data indicate that ambient sound levels will increase as the wind speeds increase.			
Issue	**Nature of Impact**	**Extent of Impact**	**No-go areas**
Increase in noise level at receptors. Noises exceeding rating level.	Increased noises may increase annoyance levels with project.	Multiple WTG operating at night could impact on an area up to 2,500m from the WTG.	As the noise level depends on the layout (that would determine the cumulative effect from all WTG located within 2,500 m from an NSR) as well as the final WTG, no-go areas cannot be confirmed during the scoping phase.
Description of expected significance of impact: Depending on the layout and the SPL of WTG available on the market, noise levels may be higher than 45 dBA for a worst-case scenario (using the SPL of 112.6 dBA). Without noise propagation modeling where cumulative effects are included, it is difficult to assess the potential significance of the noise impact. Using the precautious approach, it is <u>Probable</u> to <u>Highly Probable</u> that a noise impact will occur, with a **low to high** significance at the different NSR. The potential significance of the noise impact will be assessed in more detail in EIA phase using a more detailed noise model. It should be noted that mitigation measures would be identified and recommended during the environmental noise impact assessment which would reduce the significance to low.			
Gaps in Knowledge & recommendation for further study: Insufficient information is available to consider the potential noise impact. A final wind turbine layout is required as well as the status of the identified NSR. The applicant should confirm the SPL of the potential noise source may be used at the WEF (or that should be evaluated).			
Recommendations: Scoping level assessment is insufficient and a full ENIA is recommended.			

9 CONCLUSIONS AND RECOMMENDATIONS

This report is a site sensitivity verification and scoping level assessment of the predicted noise environment due to the development of the Emvelo WEF east of Ermelo, Mpumalanga.

This assessment is based on a desktop assessment as well as a basic predictive model to identify potential issues of concern. Wind turbines do emit noises at sufficient levels to propagate over large distances and this assessment indicates a potential noise impact on the closest receptors.

Considering the preliminary wind turbine layout (which will be updated in response to specialist findings, resource and technical optimisation for the EIA Phase), there is a potential of a **low** to **medium** significance of a noise impact during the construction phase, and of a **low** to **high** significance during the operational phase on the different identified NSR. It should be noted that mitigation measures would be identified and recommended during the environmental noise impact assessment which would reduce the significance to low.

Further study is required and it is recommended that a full Environmental Noise Impact Assessment study be conducted for the Emvelo WEF.

10 TERMS OF REFERENCE FOR THE ENVIRONMENTAL NOISE IMPACT PHASE

Work that will take place during the ENIA phase is defined in section 8 of SANS 10328:2008.

10.1 PURPOSE OF THE ENVIRONMENTAL NOISE IMPACT ASSESSMENT

The purpose of an environmental noise impact investigation and assessment is to determine and quantify the acoustical impact of, or on a proposed development.

10.2 PLAN OF STUDY FOR ENVIRONMENTAL NOISE IMPACT INVESTIGATION AND ASSESSMENT

In this regard the following will be included to assist the EAP in the compilation of the Plan of Study (PoS) for the EIA:

- Data (layout and SPL of selected WTG) as received from the developer will be used to model the potential noise impact. The following information will be considered:
    - The SPL details of a WTG that may be used at this WEF;
    - The latest WEF layout to be assessed;
    - The surface contours of the project focus area;
    - Surface and meteorological constants;
- The potential impact will be evaluated (where possible) in terms of the nature (description of what causes the effect, what/who might be affected and how it/they might be affected) as well as the extent of the impact;
- The potential significance of the identified issues will be calculated based on the evaluation of the issues/impacts;
- The development of an Environmental Management Plan and a proposal of potential mitigation measures (if required); and
- Recommendations.

10.3 ENVIRONMENTAL NOISE IMPACT INVESTIGATION

10.3.1 Sound emission from the identified noise sources

Sound emission data as warranted by the wind turbine manufacturer would be used to calculate the potential noise emissions from the wind turbines. In the instance that this data is unavailable, sound emission data as measured and calculated in accordance with IEC 61400-11 (*Wind turbine generator systems – Part 11: Acoustic noise measurements* *techniques*) or IEC 61400-14 (*Wind turbines – Part 14: Declaration of apparent sound power levels and tonality values*) could be used.

The operating cycle and nature of the sound emission (impulsiveness, tonal character or potential low frequencies) would, where relevant, be considered when the expected rating level in the target area is calculated.

10.3.2 Determination of Rating levels

The sound propagation model defined by ISO 9613-2:1996 for both the construction and operational phases to calculate projected equivalent noise levels. Other input parameters used would include:

- Air temperature of 10 °C;
- Relative humidity of 70%;
- Appropriate ambient sound levels associated with a selected wind speed;
- Layout of the proposed facility as provided by the developer;
- Topography details;
- Height of turbine above sea level as well as height of wind turbine above surface level;
- Projected outside equivalent noise levels at Potentially Sensitive Receptors at height above sea-level (plus 4 meters for the operational phase, plus 2 m for the construction phase);
- 75% hard ground surface for the operational phase (medium ground surface for the construction phase).

10.3.3 Assessment of the noise impact: No mitigation

The significance will be determined considering the defined magnitude of the noise level, the extent as well as the duration of the projected noise impact, as well as the probability that this impact may take place.

The magnitude of the noise impact will be assessed by considering:

- The total projected cumulative noise level compared to the appropriate acceptable rating levels as defined in Table 2 of SANS 10103:2008;
- The potential community response from Table 5 of SANS 10103:2008. In addition, other relevant and suitable literature may be consulted as defined in the scoping report. In particular the likely ambient sound levels due to wind induced noises will be estimated at the wind speed under investigation and considered; and
- The likely and projected ambient sound levels.

Likely ambient sound levels associated with wind speeds as well as the projected change in ambient sound levels would also be considered when estimating the probability that a NSR may be impacted by increased noise levels.

10.3.4 Assessment of the noise impact: With Implementation of Mitigation

Should the significance of the impact be medium or high, the potential significance will be estimated considering that the developer would be implementing reasonable mitigation measures. Potential viable mitigation measures will be included.

10.4 ENVIRONMENTAL NOISE IMPACT REPORT

The Environmental Noise Impact Report will cover the following points:

- the purpose of the investigation;
- a brief description of the planned development or the changes that are being considered;
- a brief description of the existing environment including, where relevant, the topography, surface conditions and meteorological conditions during measurements;
- the identified noise sources together with their respective sound pressure levels or sound power levels (or both) and, where applicable, the operating cycles, the nature of sound emission, the spectral composition and the directional characteristics;
- the identified noise sources that were not taken into account and the reasons as to why they were not investigated;
- the identified Potentially Sensitive Receptors and the noise impact on them;
- where applicable, any assumptions, with references, made with regard to any calculations or determination of source and propagation characteristics;
- an explanation, either by a brief description or by reference, of all measuring and calculation procedures that were followed, as well as any possible adjustments to existing measuring methods that had to be made, together with the results of calculations;
- an explanation, either by description or by reference, of all measuring or calculation methods (or both) that were used to determine existing and predicted rating levels, as well as other relevant information, including a statement of how the data were obtained and applied to determine the rating level for the area in question;
- the location of measuring or calculating points in a sketch or on a map;
- quantification of the noise impact with, where relevant, reference to the literature consulted and the assumptions made;
- alternatives that were considered and the results of those that were investigated;

- a list of all the interested or affected parties that offered any comments with respect to the environmental noise impact investigation (if comments are received);
- a detailed summary of all the comments received from interested or affected parties as well as the procedures and discussions followed to deal with them (if comments are received);
- conclusions that were reached;
- proposed recommendations including potential mitigation measures;
- any follow-up investigation which should be conducted at completion of the project as well as at regular intervals after the commissioning of the project so as to ensure that the recommendations of this report will be maintained in the future.

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APPENDIX A

Curriculum Vitae

The Author started his career in the mining industry as a bursar Learner Official (JCI, Randfontein), working in the mining industry, doing various mining related courses (Rock Mechanics, Surveying, Sampling, Safety and Health [Ventilation, noise, illumination etc.] and Metallurgy. He did work in both underground (Coal, Gold and Platinum) as well as opencast (Coal) for 4 years. He changed course from Mining Engineering to Chemical Engineering after his second year of his studies at the University of Pretoria.

After graduation he worked as a Water Pollution Control Officer at the Department of Water Affairs and Forestry for two years (first year seconded from Wates, Meiring and Barnard), where duties included the perusal (evaluation, commenting and recommendation) of various regulatory required documents (such as EMPR's, Water Use License Applications and EIA's), auditing of license conditions as well as the compilation of Technical Documents.

Since leaving the Department of Water Affairs, Morné has been in private consulting for the last 20 years, managing various projects for the mining and industrial sector, private developers, business, other environmental consulting firms as well as the Department of Water Affairs. During that period he has been involved in various projects, either as specialist, consultant, trainer or project manager, successfully completing these projects within budget and timeframe. During that period he gradually moved towards environmental acoustics, focusing on this field exclusively since 2007.

He has been interested in acoustics as from school days, doing projects mainly related to loudspeaker design. Interest in the matter brought him into the field of Environmental Noise Measurement, Prediction and Control as well as blasting impacts. Since 2007 he has completed more than 300 Environmental Noise Impact Assessments, numerous Noise Monitoring Reports as well as various acoustic consulting services, including amongst others:

Wind Energy Facilities	*Full Environmental Noise Impact Assessments for - Bannf (Vidigenix), iNCa Gouda (Aurecon SA), Isivunguvungu (Aurecon), De Aar (Aurecon), Kokerboom 1 (Aurecon), Kokerboom 2 (Aurecon), Kokerboom 3 (Aurecon), Kangnas (Aurecon), Plateau East and West (Aurecon), Wolf (Aurecon), Outeniqwa (Aurecon), Umsinde Emoyeni (ARCUS) , Komsberg (ARCUS), Karee (ARCUS), Kolkies (ARCUS), San Kraal (ARCUS), Phezukomoya (ARCUS), Canyon Springs (Canyon Springs), Perdekraal (ERM), Scarlet Ibis (CESNET), Albany (CESNET), Sutherland (CSIR), Kap Vley (CSIR), Kuruman (CSIR), Rietrug (CSIR), Sutherland 2 (CSIR), Perdekraal (ERM), Teekloof (Mainstream), Eskom Aberdene (SE), Dorper (SE), Spreeukloof (SE), Loperberg (SE), Penhoek Pass (SE), Amakhala Emoyeni (SE), Zen (Savannah Environmental – SE), Goereesoe (SE), Springfontein (SE), Garob (SE), Project Blue (SE), ESKOM Kleinzee (SE), Namas (SE), Zonnequa (SE), Walker Bay (SE), Oyster Bay (SE), Hidden Valley (SE), Deep River (SE), Tsitsikamma (SE), AB (SE), West Coast One (SE), Hopefield II (SE), Namakwa Sands (SE), VentuSA Gouda (SE), Dorper (SE), Klipheuwel (SE), INCA Swellendam (SE), Cookhouse (SE), Iziduli (SE), Msenge (SE), Cookhouse II (SE), Rheboksfontein (SE), Suurplaat (SE), Karoo Renewables (SE), Koningaas (SE), Spitskop (SE), Castle (SE), Khai Ma (SE), Poortjies (SE), Korana (SE), IE Moorreesburg (SE), Gunstfontein (SE), Boulders (SE), Vredenburg (Terramanzi), Loeriesfontein*

	(SiVEST), Rhenosterberg (SiVEST), Noupoort (SiVEST), Prieska (SiVEST), Dwarsrug (SiVEST), Graskoppies (SiVEST), Philco (SiVEST), Hartebeest Leegte (SiVEST), Ithemba (SiVEST), !Xha Boom (SiVEST), Spitskop West (Terramanzi), Haga Haga (Terramanzi), Vredenburg (Terramanzi), Msenge Emoyeni (Windlab), Wobben (IWP), Trakas (SiVest), Beaufort West (SiVest)
Mining and Industry	*Full Environmental Noise Impact Assessments for – Delft Sand (AGES), BECSA – Middelburg (Golder Associates), Kromkrans Colliery (Geovicon Environmental), SASOL Borrow Pits Project (JMA Consulting), Lesego Platinum (AGES), Tweefontein Colliery (Cleanstream Environmental), Evraz Vametco Mine and Plant (JMA), Goedehoop Colliery (Geovicon), Hacra Project (Prescali Environmental), Der Brochen Platinum Project (J9 Environment), Brandbach Sand (AGES), Verkeerdepan Extension (CleanStream Environmental), Dwaalboom Limestone (AGES), Jagdlust Chrome (MENCO), WPB Coal (MENCO), Landau Expansion (CleanStream Environmental), Otjikoto Gold (AurexGold), Klipfontein Colliery (MENCO), Imbabala Coal (MENCO), ATCOM East Expansion (Jones and Wagner), IPP Waterberg Power Station (SE), Kangra Coal (ERM), Schoongesicht (CleanStream Environmental), EastPlats (CleanStream Environmental), Chapudi Coal (Jacana Environmental), Generaal Coal (JE), Mopane Coal (JE), Glencore Boshoek Chrome (JMA), Langpan Chrome (PE), Vlakpoort Chrome (PE), Sekoko Coal (SE), Frankford Power (REMIG), Strahrae Coal (Ferret Mining), Transalloys Power Station (Savannah), Pan Palladum Smelter, Iron and PGM Complex (Prescali Environmental), Fumani Gold (AGES), Leiden Coal (EIMS), Colenso Coal and Power Station (SiVEST/EcoPartners), Klippoortjie Coal (Gudani), Rietspruit Crushers (MENCO), Assen Iron (Tshikovha), Transalloys (SE), ESKOM Ankerlig (SE), Nooitgedacht Titano Project (EcoPartners), Algoa Oil Well (EIMS), Spitskop Chrome (EMAssistance), Vlakfontein South (Gudani), Leandra Coal (Jacana), Grazvalley and Zoetveld (Prescali), Tjate Chrome (Prescali), Langpan Chromite (Prescali), Vereeniging Recycling (Pro Roof), Meyerton Recycling (Pro Roof), Hammanskraal Billeting Plant 1 and 2 (Unica), Development of Altona Furnace, Limpopo Province (Prescali Environmental), Haakdoorndrift Opencast at Amandelbult Platinum (Aurecon), Landau Dragline relocation (Aurecon), Stuart Coal Opencast (CleanStream Environmental), Tetra4 Gas Field Development (EIMS), Kao Diamonds – Tiping Village Relocation (EIMS), Kao Diamonds – West Valley Tailings Deposit (EIMS), Upington Special Economic Zone (EOH), Arcellor Mittal CCGT Project near Saldanha (ERM), Malawi Sugar Mill Project (ERM), Proposed Mooifontein Colliery (Geovicon Environmental), Goedehoop North Residue Deposit Expansion (Geovicon Environmental), Mutsho 600MW Coal-Fired Power Plant (Jacana Environmentals), Tshivhaso Coal-Fired Power Plant (Savannah Environmental), Doornhoek Fluorspar Project (Exigo), Royal Sheba Project (Cabanga Environmental), Rietkol Silica (Jacana), Gruisfontein Colliery (Jacana), Lehlabile Colliery (Jaco-K Consulting), Bloemendal Colliery (Enviro-Insight), Rondevly Colliery (REC), Welgedacht Colliery (REC), Kalabasfontein Extension (EIMS), Waltloo Power Generation Project (EScience), Buffalo Colliery (Marang), Balgarthen Colliery (Rayten), Kusipongo Block C (Rayten), Zandheuvel (Exigo), NamPower Walvis Bay (GPT), Eloff Phase 3 (EIMS), Dunbar (Enviro-Insight), Smokey Hills (Prescali), Bierspruit (Aurecon)*
Road and Railway	*K220 Road Extension (Urbansmart), Boskop Road (MTO), Sekoko Mining (AGES), Davel-Swaziland-Richards Bay Rail Link (Aurecon), Moloto Transport Corridor Status Quo Report and Pre-Feasibility (SiVEST), Postmasburg Housing Development (SE), Tshwane Rapid Transport Project, Phase 1 and 2 (NRM Consulting/City of Tshwane), Transnet Apies-river Bridge Upgrade (Transnet), Gautrain Due-diligence (SiVest), N2 Piet Retief (SANRAL), Atterbury Extension, CoT (Bokomoso Environmental), Riverfarm Development (Terramanzi), Conakry to Kindia Toll Road (Rayten)*
Airport	*Oudtshoorn Noise Monitoring (AGES), Sandton Heliport (Alpine Aviation), Tete Airport Scoping (Aurecon)*
Noise monitoring and Audit Reports	*Peerboom Colliery (EcoPartners), Thabametsi (Digby Wells), Doxa Deo (Doxa Deo), Harties Dredging (Rand Water), Xstrata Coal – Witbank Regional (Xstrata), Sephaku Delmas (AGES), Amakhala Emoyeni WEF (Windlab Developments), Oyster Bay WEF (Renewable Energy Systems), Tsitsikamma WEF Ambient Sound Level study (Cennergi and SE), Hopefield WEF (Umoya), Wesley WEF (Innowind), Ncora WEF (Innowind), Boschmanspoort (Jones and Wagner), Nqamakwe WEF (Innowind), Hopefield WEF Noise Analysis (Umoya), Dassiesfontein WEF Noise Analysis (BioTherm), Transnet Noise Analysis (Aurecon), Jeffries Bay Wind Farm (Globeleq), Sephaku Aganang (Exigo), Sephaku Delmas (Exigo), Beira Audit (BP/GPT), Nacala Audit (BP/GPT), NATREF (Nemai), Rappa Resources (Rayten), Measurement Report for Sephaku Delmas (Ages), Measurement Report for Sephaku Aganang (Ages), Bank of Botswana measurements (Linnspace), Skukuza Noise Measurements (Concor), Development noise measurement protocol for Mamba Cement (Exigo), Measurement Report for Mamba Cement (Exigo), Measurement Report for Nokeng Fluorspar (Exigo), Tsitsikamma Community Wind Farm Pre-operation sound measurements (Cennergi), Waainek WEF Operational Noise Measurements*

	(Innowind), Sedibeng Brewery Noise Measurements (MENCO), Tsitsikamma Community Wind Farm Operational noise measurements (Cennergi), Noupoort Wind Farm Operational noise measurements (Mainstream), Twisdraai Colliery (Lefatshe Minerals), SASOL Prospecting (Lefatshe Minerals), South32 Klipspruit (Rayten), Sibanye Stillwater Kroondal (Rayten), Rooiberg Asphalt (Rooiberg Asphalt), SASOL Shondoni (Lefatshe), SASOL Twisdraai (Lefatshe), Anglo Mototolo (Exigo), Heineken Inyaniga (AECOM), Glencore Izimbiwa (Cleanstream) Glencore Impunzi (Cleanstream), Black Chrome Mine (Prescali) Sibanye Stillwater Ezulwini (Aurecon), Sibanye Stillwater Beatrix (Aurecon), Bank of Botshwana (Linspace), Lakeside (Linspace), Skukuza (SiVest), Rietvlei Colliery (Jaco-K Consulting)
Small Noise Impact Assessments	*TCTA AMD Project Baseline (AECOM), NATREF (Nemai Consulting), Christian Life Church (UrbanSmart), Kosmosdale (UrbanSmart), Louwlardia K220 (UrbanSmart), Richards Bay Port Expansion (AECOM), Babalegi Steel Recycling (AGES), Safika Slag Milling Plant (AGES), Arcelor Mittal WEF (Aurecon), RVM Hydroplant (Aurecon), Grootvlei PS Oil Storage (SiVEST), Rhenosterberg WEF, (SiVEST), Concerto Estate (BPTrust), Ekuseni Youth Centre (MENCO), Kranskop Industrial Park (Cape South Developments), Pretoria Central Mosque (Noman Shaikh), Soshanguve Development (Maluleke Investments), Seshego-D Waste Disposal (Enviroxcellence), Zambesi Safari Equipment (Owner), Noise Annoyance Assessment due to the Operation of the Gautrain (Thornhill and Lakeside Residential Estate), Upington Solar (SE), Ilangalethu Solar (SE), Pofadder Solar (SE), Flagging Trees WEF (SE), Uyekraal WEF (SE), Ruuki Power Station (SE), Richards Bay Port Expansion 2 (AECOM), Babalegi Steel Recycling (AGES), Safika Ladium (AGES), Safika Cement Isando (AGES), RareCo (SE), Struisbaai WEF (SE), Perdekraal WEF (ERM), Kotula Tsatsi Energy (SE), Olievenhoutbosch Township (Nali), , HDMS Project (AECOM), Quarry extensions near Ermelo (Rietspruit Crushers), Proposed uMzimkhulu Landfill in KZN (nZingwe Consultancy), Linksfield Residential Development (Bokomoso Environmental), Rooihuiskraal Ext. Residential Development, CoT (Plandev Town Planners), Floating Power Plant and LNG Import Facility, Richards Bay (ERM), Floating Power Plant project, Saldanha (ERM), Vopak Growth 4 project (ERM), Elandspoort Ext 3 Residential Development (Gibb Engineering), Tiegerpoort Wedding Venue (Henwood Environmental), Monavoni Development (Marindzini), Rezoning of Portion 1 (Primo Properties), Tswaing Mega City (Makole), Mabopane Church (EP Architects), ERGO Soweto Cluster (Kongiwe), Fabio Chains (Marang), GIDZ JMP (Marang), Temple Complex (KWP Create), Germiston Metals (Dorean), Sebenza Metals (Dorean)*
Project reviews and amendment reports	*Loperberg (Savannah), Dorper (Savannah), Penhoek Pass (Savannah), Oyster Bay (RES), Tsitsikamma Community Wind Farm Noise Simulation project (Cennergi), Amakhala Emoyeni (Windlab), Spreeukloof (Savannah), Spinning Head (SE), Kangra Coal (ERM), West Coast One (Moyeng Energy), Rheboksfontein (Moyeng Energy), De Aar WEF (Holland), Quarterly Measurement Reports – Dangote Delmas (Exigo), Quarterly Measurement Reports – Dangote Lichtenburg (Exigo), Quarterly Measurement Reports – Mamba Cement (Exigo), Quarterly Measurement Reports – Dangote Delmas (Exigo) Quarterly Measurement Reports – Nokeng Fluorspar (Exigo), Proton Energy Limited Nigeria (ERM), Hartebeest WEF Update (Moorreesburg) (Savannah Environmental), Modderfontein WEF Opinion (Terramanzi), IPD Vredenburg WEF (IPD Power Vredenburg), Paul Puts WEF (ARCUS), Juno WEF (ARCUS), etc.*

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APPENDIX B

Glossary of Terms

GLOSSARY OF ACOUSTIC TERMS, DEFINITIONS AND GENERAL INFORMATION

1/3-Octave Band	A filter with a bandwidth of one-third of an octave representing four semitones, or notes on the musical scale. This relationship is applied to both the width of the band, and the centre frequency of the band. See also definition of octave band.
A – Weighting	An internationally standardised frequency weighting that approximates the frequency response of the human ear and gives an objective reading that therefore agrees with the subjective human response to that sound.
Air Absorption	The phenomena of attenuation of sound waves with distance propagated in air, due to dissipative interaction within the gas molecules.
Alternatives	A possible course of action, in place of another, that would meet the same purpose and need (of proposal). Alternatives can refer to any of the following, but are not limited hereto: alternative sites for development, alternative site layouts, alternative designs, alternative processes and materials. In Integrated Environmental Management the so-called "no go" alternative refers to the option of not allowing the development and may also require investigation in certain circumstances.
Ambient	The conditions surrounding an organism or area.
Ambient Noise	The all-encompassing sound at a point being composed of sounds from many sources both near and far. It includes the noise from the noise source under investigation.
Ambient Sound	The all-encompassing sound at a point being composite of sounds from near and far.
Ambient Sound Level	Means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such a meter was put into operation. In this report the term Background Ambient Sound Level will be used.
Amplitude Modulated Sound	A sound that noticeably fluctuates in loudness over time.
Applicant	Any person who applies for an authorisation to undertake a listed activity or to cause such activity in terms of the relevant environmental legislation.
Assessment	The process of collecting, organising, analysing, interpreting and communicating data that is relevant to some decision.
Attenuation	Term used to indicate reduction of noise or vibration, by whatever method necessary, usually expressed in decibels.
Audible frequency Range	Generally assumed to be the range from about 20 Hz to 20,000 Hz, the range of frequencies that our ears perceive as sound.
Ambient Sound Level	The level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (e.g., sound from a particular noise source or sound generated for test purposes). Ambient sound level as per Noise Control Regulations.
Broadband Noise	Spectrum consisting of a large number of frequency components, none of which is individually dominant.
C-Weighting	This is an international standard filter, which can be applied to a pressure signal or to a *SPL* or *PWL* spectrum, and which is essentially a pass-band filter in the frequency range of approximately 63 to 4000 Hz. This filter provides a more constant, flatter, frequency response, providing significantly less adjustment than the A-scale filter for frequencies less than 1000 Hz.
Controlled area (as per National Noise Control Regulations)	a piece of land designated by a local authority where, in the case of- (a) road transport noise in the vicinity of a road- (i) the reading on an integrating impulse sound level meter, taken outdoors at the end of a period extending from 06:00 to 24:00 while such meter is in operation, exceeds 65 dBA; or (ii) the equivalent continuous "A"-weighted sound pressure level at a height of at least 1,2 metres, but not more than 1,4 metres, above the

	ground for a period extending from 06:00 to 24:00 as calculated in accordance with SABS 0210-1986, titled: "Code of Practice for calculating and predicting road traffic noise", published under Government Notice No. 358 of 20 February 1987, and projected for a period of 15 years following the date on which the local authority has made such designation, exceeds 65 dBA; (b) aircraft noise in the vicinity of an airfield, the calculated noisiness index, projected for a period of 15 years following the date on which the local authority has made such designation, exceeds 65 dBA; or (c) industrial noise in the vicinity of an industry- (i) the reading on an integrating impulse sound level meter, taken outdoors at the end of a period of 24 hours while such meter is in operation, exceeds 61 dBA; or (ii) the calculated outdoor equivalent continuous "A"-weighted sound pressure level at a height of at least 1,2 metres, but not more than 1,4 metres, above the ground for a period of 24 hours, exceeds 61 dBA;
dB(A)	Sound Pressure Level in decibel that has been A-weighted, or filtered, to match the response of the human ear.
Decibel (dB)	A logarithmic scale for sound corresponding to a multiple of 10 of the threshold of hearing. Decibels for sound levels in air are referenced to an atmospheric pressure of 20 µ Pa.
Diffraction	The process whereby an acoustic wave is disturbed and its energy redistributed in space as a result of an obstacle in its path, Reflection and refraction are special cases of diffraction.
Direction of Propagation	The direction of flow of energy associated with a wave.
Disturbing noise	Means a noise level that exceeds the zone sound level or, if no zone sound level has been designated, a noise level that exceeds the ambient sound level at the same measuring point by 7 dBA or more.
Environment	The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group; these circumstances include biophysical, social, economic, historical, cultural and political aspects.
Environmental Control Officer	Independent Officer employed by the applicant to ensure the implementation of the Environmental Management Plan (EMP) and manages any further environmental issues that may arise.
Environmental impact	A change resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts may be the direct consequence of an organisation's activities or may be indirectly caused by them.
Environmental Impact Assessment	An Environmental Impact Assessment (EIA) refers to the process of identifying, predicting and assessing the potential positive and negative social, economic and biophysical impacts of any proposed project, plan, programme or policy that requires authorisation of permission by law and that may significantly affect the environment. The EIA includes an evaluation of alternatives, as well as recommendations for appropriate mitigation measures for minimising or avoiding negative impacts, measures for enhancing the positive aspects of the proposal, and environmental management and monitoring measures.
Environmental issue	A concern felt by one or more parties about some existing, potential or perceived environmental impact.
Equivalent continuous A-weighted sound exposure level ($L_{Aeq,T}$)	The value of the average A-weighted sound pressure level measured continuously within a reference time interval *T*, which have the same mean-square sound pressure as a sound under consideration for which the level varies with time.
Equivalent continuous A-weighted rating level ($L_{Req,T}$)	The Equivalent continuous A-weighted sound exposure level *($L_{Aeq,T}$)* to which various adjustments has been added. More commonly used as ($L_{Req,d}$) over a time interval 06:00 – 22:00 (T=16 hours) and ($L_{Req,n}$) over a time interval of 22:00 – 06:00 (T=8 hours). It is a calculated value.
F (fast) time weighting	(1) Averaging detection time used in sound level meters.

	(2) Fast setting has a time constant of 125 milliseconds and provides a fast reacting display response allowing the user to follow and measure not too rapidly fluctuating sound.
Footprint area	Area to be used for the construction of the proposed development, which does not include the total study area.
Free Field Condition	An environment where there is no reflective surfaces.
Frequency	The rate of oscillation of a sound, measured in units of Hertz (Hz) or kiloHertz (kHz). One hundred Hz is a rate of one hundred times per second. The frequency of a sound is the property perceived as pitch: a low-frequency sound (such as a bass note) oscillates at a relatively slow rate, and a high-frequency sound (such as a treble note) oscillates at a relatively high rate.
Green field	A parcel of land not previously developed beyond that of agriculture or forestry use; virgin land. The opposite of Greenfield is Brownfield, which is a site previously developed and used by an enterprise, especially for a manufacturing or processing operation. The term Brownfield suggests that an investigation should be made to determine if environmental damage exists.
G-Weighting	An International Standard filter used to represent the infrasonic components of a sound spectrum.
Harmonics	Any of a series of musical tones for which the frequencies are integral multiples of the frequency of a fundamental tone.
I (impulse) time weighting	(1) Averaging detection time used in sound level meters as per South African standards and Regulations. (2) Impulse setting has a time constant of 35 milliseconds when the signal is increasing (sound pressure level rising) and a time constant of 1,500 milliseconds while the signal is decreasing.
Impulsive sound	A sound characterized by brief excursions of sound pressure (transient signal) that significantly exceed the ambient sound level.
Infrasound	Sound with a frequency content below the threshold of hearing, generally held to be about 20 Hz. Infrasonic sound with sufficiently large amplitude can be perceived, and is both heard and felt as vibration. Natural sources of infrasound are waves, thunder and wind.
Integrated Development Plan	A participatory planning process aimed at developing a strategic development plan to guide and inform all planning, budgeting, management and decision-making in a Local Authority, in terms of the requirements of Chapter 5 of the Municipal Systems Act, 2000 (Act 32 of 2000).
Integrated Environmental Management	IEM provides an integrated approach for environmental assessment, management, and decision-making and to promote sustainable development and the equitable use of resources. Principles underlying IEM provide for a democratic, participatory, holistic, sustainable, equitable and accountable approach.
Interested and affected parties	Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.
Key issue	An issue raised during the Scoping process that has not received an adequate response and that requires further investigation before it can be resolved.
L_{A90}	the sound level exceeded for the 90% of the time under consideration
Listed activities	Development actions that is likely to result in significant environmental impacts as identified by the delegated authority (formerly the Minister of Environmental Affairs and Tourism) in terms of Section 21 of the Environment Conservation Act.
L_{AMin} *and* L_{AMax}	Is the RMS (root mean squared) minimum or maximum level of a noise source.
Loudness	The attribute of an auditory sensation that describes the listener's ranking of sound in terms of its audibility.
Magnitude of impact	Magnitude of impact means the combination of the intensity, duration and extent of an impact occurring.
Masking	The raising of a listener's threshold of hearing for a given sound due to the presence of another sound.
Mitigation	To cause to become less harsh or hostile.

Negative impact	A change that reduces the quality of the environment (for example, by reducing species diversity and the reproductive capacity of the ecosystem, by damaging health, or by causing nuisance).
Noise	a. Sound that a listener does not wish to hear (unwanted sounds). b. Sound from sources other than the one emitting the sound it is desired to receive, measure or record. c. A class of sound of an erratic, intermittent or statistically random nature.
Noise Level	The term used in lieu of sound level when the sound concerned is being measured or ranked for its undesirability in the contextual circumstances.
Noise-sensitive development	developments that could be influenced by noise such as: a) districts (see table 2 of SANS 10103:2008) 1. rural districts, 2. suburban districts with little road traffic, 3. urban districts, 4. urban districts with some workshops, with business premises, and with main roads, 5. central business districts, and 6. industrial districts; b) educational, residential, office and health care buildings and their surroundings; c) churches and their surroundings; d) auditoriums and concert halls and their surroundings; e) recreational areas; and f) nature reserves. In this report Noise-sensitive developments is also referred to as a Potential Sensitive Receptor
Octave Band	A filter with a bandwidth of one octave, or twelve semi-tones on the musical scale representing a doubling of frequency.
Positive impact	A change that improves the quality of life of affected people or the quality of the environment.
Property	Any piece of land indicated on a diagram or general plan approved by the Surveyor-General intended for registration as a separate unit in terms of the Deeds Registries Act and includes an erf, a site and a farm portion as well as the buildings erected thereon
Public Participation Process	A process of involving the public in order to identify needs, address concerns, choose options, plan and monitor in terms of a proposed project, programme or development
Reflection	Redirection of sound waves.
Refraction	Change in direction of sound waves caused by changes in the sound wave velocity, typically when sound wave propagates in a medium of different density.
Reverberant Sound	The sound in an enclosure which results from repeated reflections from the boundaries.
Reverberation	The persistence, after emission of a sound has stopped, of a sound field within an enclosure.
Significant Impact	An impact can be deemed significant if consultation with the relevant authorities and other interested and affected parties, on the context and intensity of its effects, provides reasonable grounds for mitigating measures to be included in the environmental management report. The onus will be on the applicant to include the relevant authorities and other interested and affected parties in the consultation process. Present and potential future, cumulative and synergistic effects should all be taken into account.
S (slow) time weighting	(1) Averaging times used in sound level meters. (2) Time constant of one [1] second that gives a slower response which helps average out the display fluctuations.
Sound Level	The level of the frequency and time weighted sound pressure as determined by a sound level meter, i.e., A-weighted sound level.
Sound Power	Of a source, the total sound energy radiated per unit time.
Sound Pressure Level (SPL)	Of a sound, 20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level. International values for the reference sound pressure level are 20 micro pascals in air and 100

	millipascals in water. SPL is reported as L_p in dB (not weighted) or in various other weightings.
Soundscape	Sound or a combination of sounds that forms or arises from an immersive environment. The study of soundscape is the subject of acoustic ecology. The idea of soundscape refers to both the natural acoustic environment, consisting of natural sounds, including animal vocalizations and, for instance, the sounds of weather and other natural elements; and environmental sounds created by humans, through musical composition, sound design, and other ordinary human activities including conversation, work, and sounds of mechanical origin resulting from use of industrial technology. The disruption of these acoustic environments results in noise pollution.
Study area	Refers to the entire study area encompassing all the alternative routes as indicated on the study area map.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs (Brundtland Commission, 1987).
Tread braked	The traditional form of wheel brake consisting of a block of friction material (which could be cast iron, wood or nowadays a composition material) hung from a lever and being pressed against the wheel tread by air pressure (in the air brake) or atmospheric pressure in the case of the vacuum brake.
Zone of Potential Influence	The area defined as the radius about an object, or objects beyond which the noise impact will be insignificant.
Zone Sound Level	Means a derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area. This is similar to the Rating Level as defined in SANS 10103:2008.

forestry, fisheries & the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

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SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for 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)

REPORT TITLE

Mulilo Amsterdam WEFs - Rochdale, Sheepmoor and Emvelo projects

Kindly note the following:

1. This form must always be used for assessment that are in support of 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 August 2023. 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.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the 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 act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Environmental Noise Impact Assessment
Specialist Company Name	Enviro-Acoustic Research CC
Specialist Name	Morné de Jager
Specialist Identity Number	711221 5062 080
Specialist Qualifications:	B. Tech (Environmental) / B. Ing (Chemical)
Professional affiliation/registration:	De Jager: SAIOSH, 72765282; SACNASP, 117253
Physical address:	726 Wiedrigh Street, Moreleta Park, Pretoria, 0181
Postal address:	PO Box 2047, Garsfontein East, Pretoria, 0060
Postal address	
Telephone	012 004 0362
Cell phone	082 565 4059
E-mail	morne@eares.co.za

2. DECLARATION BY THE SPECIALIST

I, **Morné de Jager** declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements 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 National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 NEMA Act.

M. de Jager

Signature of the Specialist

Enviro-Acoustic Research CC

Name of Company:

16 Aug 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ **Morné de Jager** _________, 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

Enviro-Acoustic Research CC

Name of Company

16 August 2024

Date

Commissioner of Oaths
MJ MILLARD
Ex Officio
Professional Accountant (SA)
Membership no: 8916
P.O. Box 90803,Garsfontein, Pretoria, 0040

Signature of the Commissioner of Oaths

16 Aug 2024

Date

SOCIAL ASSESSMENT

BASELINE SCOPING REPORT

EMVELO WIND ENERGY FACILITY

MPUMALANGA PROVINCE

OCTOBER 2023

Prepared

by

Tony Barbour

Tony Barbour
ENVIRONMENTAL CONSULTING

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EXECUTIVE SUMMARY

INTRODUCTION AND LOCATION

Arcus Consulting was appointed to manage the Environmental Impact Assessment (EIA) process for the proposed up to 200 MW Emvelo Wind Energy Facility (WEF) located approximately 30 km east of the town of Ermelo in the Msukaligwa Municipality in the Mpumalanga Province. The Emvelo WEF forms one of three WEFs proposed in the area.

Tony Barbour Environmental Consulting was appointed to undertake a specialist Social Impact Assessment (SIA) as part of an EIA process. This report contains the findings of the Scoping Level SIA for the proposed project.

SUMMARY OF KEY FINDINGS

The key findings of the study are summarised under the following sections:

- Fit with policy and planning.
- Construction phase impacts.
- Operational phase impacts.
- Cumulative impacts.
- Decommissioning phase impacts.
- No-development option.

The findings of the Social Baseline Scoping Report are based on a review of relevant documents and the author's experience with undertaking SIAs for other renewable energy projects in the study area. The issues will be confirmed and assessed during the Assessment Phase of the EIA process.

POLICY AND PLANNING ISSUES

The development of renewable energy is strongly supported at a national, provincial, and local level. The development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all refer to and support renewable energy. The development of renewable energy is also supported by key provincial policies.

CONSTRUCTION PHASE

The key social issues associated with the construction phase include:

Potential positive impacts

- Creation of employment and business opportunities, and the opportunity for skills development and on-site training.

Potential negative impacts

- Impacts associated with the presence of construction workers on local communities.
- Impacts related to the potential influx of jobseekers.
- Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site.
- Increased risk of grass fires associated with construction related activities.

- Nuisance impacts, such as noise, dust, and safety, associated with construction related activities and vehicles.
- Impact on productive farmland.

The findings of the Social Scoping study indicate that the significance of the potential negative impacts with mitigation will be **Low Negative**. The potential negative impacts associated with the proposed construction phase can therefore be effectively mitigated if the recommended mitigation measures are implemented. Table 1 summarises the significance of the impacts associated with the construction phase. The significance ratings will be confirmed during the assessment phase.

Table 1: Summary of social impacts during construction phase

Impact	Significance No Mitigation/Enhancement	Significance With Mitigation/Enhancement
Creation of employment and business opportunities	Medium (Positive)	Medium (Positive)
Presence of construction workers and potential impacts on family structures and social networks	Low (Negative)	Low (Negative)
Influx of job seekers	Low (Negative)	Low (Negative)
Safety risk, stock theft and damage to farm infrastructure associated with presence of construction workers	Medium (Negative)	Low (Negative)
Increased risk of grass fires	Medium (Negative)	Low (Negative)
Impact of heavy vehicles and construction activities	Medium (Negative)	Low (Negative)
Loss of farmland	Medium (Negative)	Low (Negative)

OPERATIONAL PHASE

The following key social issues are of relevance to the operational phase:

Potential positive impacts
- Generate renewable energy.
- Creation of employment opportunities.
- Benefits associated with establishment of community trust.
- Benefits for local landowners.

The proposed project will supplement South Africa's energy and assist to improve energy security. In addition, it will also reduce the country's reliance on coal as an energy source. This represents a positive social benefit.

Potential negative impacts
- Visual impacts and associated impacts on sense of place.
- Potential impact on property values.
- Potential impact on tourism.

The findings of the findings of the Social Scoping study indicate that the significance of all the potential negative impacts with mitigation will be **Low Negative**. The potential negative impacts can therefore be effectively mitigated. The significance of the impacts associated with the operational phase are summarised in Table 2. The significance ratings will be confirmed during the assessment phase.

Table 2: Summary of social impacts during operational phase

Impact	Significance No Mitigation/Enhancement	Significance With Mitigation/Enhancement
Generate renewable energy	Moderate (Positive)	High (Positive)
Creation of employment and business opportunities	Low (Positive)	Medium (Positive)
Benefit associated with community trust	Moderate (Positive)	High (Positive)
Benefits for landowners	Low (Positive)	Medium (Positive)
Visual impact and impact on sense of place	Low (Negative)	Low (Negative)
Impact on property values	Low (Negative)	Low (Negative)
Impact on tourism	Low (Negative)	Low (Negative)

CUMULATIVE IMPACTS

Cumulative impact on sense of place
The establishment of the proposed WEF and other renewable energy facilities in the area will create the potential for combined and sequential visibility impacts. The significance will be informed by the findings of the VIA.

Cumulative impact on local services and accommodation
The potential cumulative impact on local services and accommodation will depend on the timing construction phases for the different renewable energy projects in the area. With effective planning the significance of the potential impact was rated as **Low Negative**.

Cumulative impact on local economy
The significance of this impact with enhancement was rated as **Moderate Positive**.

The significance ratings will be confirmed during the assessment phase.

DECOMMISSIONING PHASE

Given the relatively small number of people employed during the operational phase (~ 20), the potential negative social impact on the local economy associated with decommissioning will be limited. In addition, the potential impacts associated with the decommissioning phase can also be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low (negative). Decommissioning will also create temporary employment opportunities. The significance likely to be Low (negative).

NO-DEVELOPMENT OPTION

The No-Development option would represent a lost opportunity for South Africa to improve energy security and supplement its current energy needs with clean, renewable energy. Given South Africa's current energy security challenges and its position as one of the highest per capita producers of carbon emissions in the world, this would represent a significant negative social cost.

CONCLUSION

The findings of the Social Scoping study indicate that the proposed Emvelo WEF project will create a number of social and socio-economic benefits, including creation of employment and business opportunities during both the construction and operational phase. In addition, the WEF will generate renewable energy for use by mines and industrial operations in the area.

TABLE OF CONTENTS

CONTENTS OF THE SPECIALIST REPORT – CHECKLIST

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	Section 1.5, Annexure A
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Section 1.6, Annexure D
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1, Section 1.2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.2, Section 3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 4
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Interviews will be undertaken during Assessment Phase
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.2, Annexure B
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 4
(g) an identification of any areas to be avoided, including buffers;	Section 4
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 3
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.4,
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	Section 4
(k) any mitigation measures for inclusion in the EMPr;	Mitigation measures will be identified during the Assessment Phase
(l) any conditions for inclusion in the environmental authorisation;	N/A Scoping Report
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	N/A Scoping Report
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	N/A Scoping Report
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report	Interviews will be undertaken during Assessment Phase
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Interviews will be undertaken during Assessment Phase

(q) any other information requested by the competent authority	N/A
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Comply with the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, GN 320. This specifically includes Part A, which provides the Site Sensitivity Verification Requirements where a Specialist Assessment is required but no Specific Assessment Protocol has been prescribed. As at September 2020, there are no sensitivity layers on the Screening Tool for Socio-economic-features. Part A has therefore not been compiled for this assessment.

ACRONYMS

BESS	Battery Energy Storage System
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DM	District Municipality
GSDM	Gert Sibanye District Municipality
HD	Historically Disadvantaged
EIA	Environmental Impact Assessment
IDP	Integrated Development Plan
IPP	Independent Power Producer
kV	Kilovolts
LED	Local Economic Development
LM	Local Municipality
MM	Msukaligwa Municipality
MW	Megawatt
SDF	Spatial Development Framework
SIA	Social Impact Assessment
WEF	Wind Energy Facility

SECTION 1: INTRODUCTION

1.1 INTRODUCTION

Arcus Consulting was appointed to manage the Environmental Impact Assessment (EIA) process for the proposed up to 200 MW Emvelo Wind Energy Facility (WEF) located approximately 30 km east of the town of Ermelo in the Msukaligwa Municipality in the Mpumalanga Province (Figure 1.1). The Emvelo WEF forms one of three WEFs proposed in the area. Tony Barbour Environmental Consulting was appointed to undertake a specialist Social Impact Assessment (SIA) as part of an EIA process.

This report contains the findings of the Scoping Level SIA for the proposed project.

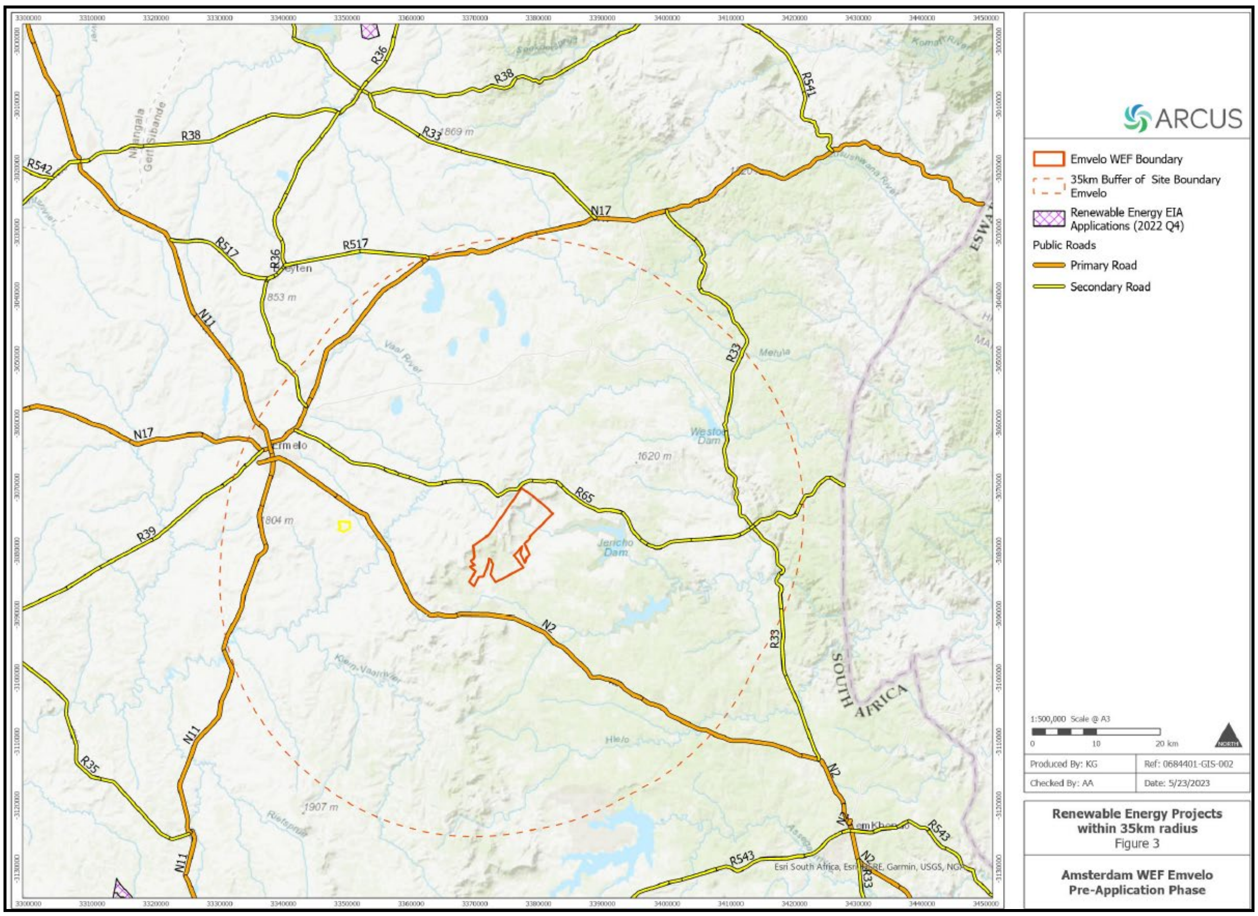


Figure 1.1: Location of Emvelo WEF study area

1.2 TERMS OF REFERENCE AND APPROACH

The terms of reference for the Scoping Level SIA require:

- A description of the environment that may be affected by the activity and the way the social environment may be affected by the proposed development.
- A description of the baseline social and socio-economic conditions in the study area that have a bearing on the proposed development.
- An overview of the key policy and planning documents that have a bearing on the proposed development and the social assessment study.
- The identification of the potential social issues associated with the proposed development.
- Identification of potential enhancement and mitigation measures.
- Outline of the terms of reference for the Social Impact Assessment (SIA) to be undertaken during the Assessment Phase of the Environmental Impact Assessment (EIA).

The approach to the Scoping Level SIA study is based on the Western Cape Department of Environmental Affairs and Development Planning Guidelines for Social Impact Assessment (February 2007). These guidelines are based on international best practice.

In this regard the study involved:

- Review of socio-economic data for the study area.
- Review of relevant planning and policy frameworks for the area.
- Review of information from similar studies, including the SIAs undertaken for other renewable energy projects in the study area.
- Site visit.
- Identification and assessment of the social issues associated with the proposed project.

Interviews with key stakeholders and interested and affected parties will be undertaken during the assessment phase. Annexure A contains a list of the secondary information reviewed. Annexure B summarises the assessment methodology that will be used to assign significance ratings during the assessment process.

1.3 PROJECT DESCRIPTION

Emvelo WEF is proposed to comprise up to 45 turbines with a maximum output capacity of up to 200 MW. The WEF will be located on nineteen (19) land parcels and will have an anticipated lifespan of 20 – 25 years. The final design will be determined and amended based on the outcome of the specialist studies undertaken during the S&EIA process. The proposed turbine footprints and associated facility infrastructure will cover an area of up to 180 ha after rehabilitation, depending on final layout design.

It is proposed that an on-site substation with a capacity up 132 kV and an up to 132 kV Overhead Powerline (OHPL) of approximately 30 km (300 m corridor) in distance, traversing eighteen (18) land parcels, be constructed to connect the proposed WEF to the Eskom Uitkoms Substation. Table 1.1 outlines technical details for the WEF. Table 1.2 lists the affected properties.

Table 1.1: Technical details of Emvelo WEF

Developer / Applicant	Emvelo Wind Energy Facility (Pty) LTD
DFFE Reference	To be confirmed
WEF Generation Capacity	Up to 200 MW
Site Access	Locality to be confirmed. Total width up to 15 m (12 m after rehabilitation) consisting of up to 3m width for underground 33 kV reticulation.
Number of Turbines	Up to 45
Hub Height from ground level	Up to 150 m
Blade Length	Up to 110 m
Rotor Diameter	Up to 220 m
Length of internal roads	Unknown at this point.
Width of internal roads	Up to 12 m to be rehabilitated to up to 9 m.
On-site substation capacity	Up to 132 kV
Proximity to grid connection	Approximately 30 km
Grid Connection Capacity	Up to 132 kV
Temporary turbine construction laydown and storage areas.	Crane platforms and hardstand laydown area up to 36 ha (Up to 0.8 ha per turbine)
Permanent footprint area dimensions, including roads, turbine hardstand areas, O&M buildings and battery pad.	O&M: Up to 0.5 ha Hardstand areas: Up to 0.75 ha Total area of final footprint (including roads): up to 180 ha
Operations and maintenance buildings (O&M building) with parking area	Up to 0.5 ha
BESS Area	Approximately 400 x 400 m (Photograph 1.2)
Height of fencing	2.8 m
Type of fencing	Where site offices are required, temporary screen fencing used to screen offices from the wider landscape.

Table 1.2: Affected properties and landowners

Landowner	Farm Name	Farm No.	Portion No.
DC Geldenhuys Family Trust	Remainder of the Farm Schiedam No. 274	274	RE
Randell's Ranch Trust (Philip Randall)	Portion 2 of the Farm Schiedam No. 274	274	2
Antonette Swart	Remainder Portion 1 of the Farm Schiedam No. 274	274	1
Henry Goodwin Geldenhuys	Portion 6 of the Farm Schiedam No. 274	274	6
Loufried Testamentere Trust	Portion 5 of the Farm Schiedam No. 274	274	5
Josef & Merinda Loraine Benjamin van Tonder	Remaining Extent Ptn 1 of the Farm Vaalbank No. 285	285	1
Josef & Merinda Loraine Benjamin van Tonder	Portion 5 of the Farm Vaalbank No. 285	285	5
Johan Saaiman Trust	Portion 9 of the Farm Waaihoek No. 286	286	9
Johannes Stephanus Roberts	Remainder Portion 2 of the Farm Waaihoek No. 286	286	2
Johannes Stephanus Roberts	Remainder Portion 6 of the Farm Waaihoek No. 286	286	6
Johannes Stephanus Roberts	Remainder Portion 13 of the Farm Waaihoek No. 286	286	13
JMJ Trust	Portion 7 of the Farm Waaihoek No. 286	286	7
JMJ Trust	Portion 10 of the Farm Waaihoek No. 286	286	10
JMJ Trust	Portion 5 of the Farm Waaihoek No. 286	286	5
Josua Meyer Trust	Waaihoek	286	14
Josua Meyer Trust	Waaihoek	286	3
Josua Meyer Trust	Waaihoek	286	12
NWJ Vorster Trust	Remaining Extent of the Farm Klipfontein No. 283	283	RE
Josua Meyer Trust	Bosjesspruit	291	7
Emvelo WEF Grid Connection			
Randell's Ranch Trust (Philip Randall)	Schiedam	274	2
National Government - of the Republic of South Africa	Onverwacht	273	1
Shammah Trust	Portion 7 of the Farm Onverwacht No. 273	273	7
Harrob Beleggings Pty Ltd (Jan Roberts)	Portion 8 of the Farm Onverwacht	273	8

Landowner	Farm Name	Farm No.	Portion No.
	No. 273		
Harrob Beleggings Pty Ltd (Jan Roberts)	Portion 3 of the Farm Onverwacht No. 287	287	3
Van Der Merwe Broers Trust	Portion 9 of the Farm Zwartwater No. 288	288	9
Merwe Johannes Jacobus Van Der	Portion 10 of the Farm Zwartwater No. 288	288	10
Kansvat Beleggings Pty Ltd	Zwartwater	288	2
National Government of SA	Zwartwater	288	1
Dream World Inv 450 Pty Ltd	Weltevreden	289	10
Dream World Inv 450 Pty Ltd	Weltevreden	289	11
Dream World Inv 450 Pty Ltd	Weltevreden	289	6
Van Der Merwe Broers Trust	Weltevreden	289	RE/3
National Government of SA	Witpunt	267	RE/7
National Government of SA	Mooiplaats	290	7
National Government of SA	Mooiplaats	290	8
Kayipheli Trust	Witpunt	267	29
Eskom Holdings Ltd	Camden Power Station	329	RE

Photograph 1.1: Typical example of wind turbine

Photograph 1.2: Example of BESS located in storage containers

1.4 ASSUMPTIONS AND LIMITATIONS

1.4.1 Assumptions

Identification of social issues
The identification of social issues is based on the authors experience associated with undertaking in the region of 140 SIAs for renewable energy facilities and associated infrastructure (substations, transmission lines, roads etc.), including SIAs for projects in the study area. Based on this the author is confident that the majority of social issues have been identified. As indicated above, interviews with affected landowners will be undertaken during the Assessment Phase of the SIA.

Technical suitability
It is assumed that the development site represents a technically suitable site for the establishment of the proposed development.

Strategic importance of the project
The strategic importance of promoting renewable and other forms of energy is supported by the national and provincial energy policies.

Fit with planning and policy requirements
Legislation and policies reflect societal norms and values. The legislative and policy context therefore plays an important role in identifying and assessing the potential social impacts associated with a proposed development. In this regard, a key component of the SIA process is to assess the proposed development in terms of its fit with key planning and policy documents. As such, if the findings of the study indicate that the proposed development in its current format does not conform to the spatial principles and guidelines contained in the relevant legislation and planning documents, and there are no significant or unique opportunities created by the development, the development cannot be supported.

1.4.2 Limitations

Demographic data
The 2021 Census data was not available at the time of preparing the report. The data from the 2011 and 2016 Household Community Survey is therefore referred to.

Interviews
Interviews with affected landowners and key stakeholders will be undertaken during the Assessment Phase of the SIA. However, as indicted above, the author is confident that the key social issues have been identified.

1.5 SPECIALIST DETAILS

Tony Barbour is an independent specialist with 30 years' experience in the field of environmental management. In terms of SIA experience Tony Barbour has undertaken in the region of 300 SIA's and is the author of the Guidelines for Social Impact Assessments for EIA's adopted by the Department of Environmental Affairs and Development Planning (DEA&DP) in the Western Cape in 2007. Annexure C contains a copy of CV for Tony Barbour.

1.6 DECLARATION OF INDEPENDENCE

This confirms that Tony Barbour, the specialist consultant responsible for undertaking the study and preparing the Scoping Level SIA Report, is independent and does not have a vested or financial interest in the proposed development being either approved or rejected. Annexure D contains a copy of signed declaration of independence.

1.7 REPORT STUCTURE

The report is divided into five sections, namely:

- Section 1: Introduction.
- Section 2: Policy and planning context.
- Section 3: Overview of study area.
- Section 4: Identification and assessment of key issues.
- Section 5: Summary of key findings.

SECTION 2: POLICY AND PLANNING ENVIRONMENT

2.1 INTRODUCTION

Legislation and policy embody and reflect key societal norms, values, and developmental goals. The legislative and policy context therefore plays an important role in identifying, assessing, and evaluating the significance of potential social impacts associated with any given proposed development. An assessment of the "policy and planning fit[1]" of the proposed development therefore constitutes a key aspect of the Social Impact Assessment (SIA). In this regard, assessment of "planning fit" conforms to international best practice for conducting SIAs.

Section 2 provides an overview of the policy and planning environment affecting the proposed project. For the purposes of meeting the objectives of the SIA the following policy and planning documents were reviewed:

- The National Energy Act (2008).
- The White Paper on the Energy Policy of the Republic of South Africa (December 1998).
- The White Paper on Renewable Energy (November 2003).
- Integrated Resource Plan (IRP) for South Africa (2010-2030).
- The National Development Plan (2011).
- Mpumalanga Spatial Development Framework (2019).
- Msukaligwa Municipality Integrated Development Plan (2019-2020).
- Msukaligwa Spatial Development Framework (2019).

The section also provides a review of the renewable energy sector in South Africa.

2.2 NATIONAL POLICY ENVIRONMENT

2.2.1 National Energy Act (Act No 34 of 2008)

The National Energy Act was promulgated in 2008 (Act No 34 of 2008). One of the objectives of the Act was to promote diversity of supply of energy and its sources. In this regard, the preamble makes direct reference to renewable resources, including solar and wind:

"To ensure that diverse energy resources are available, in sustainable quantities, and at affordable prices, to the South African economy, in support of economic growth and poverty alleviation, taking into account environmental management requirements (…); to provide for (…) increased generation and consumption of renewable energies."(Preamble).

[1] Planning fit" can simply be described as the extent to which any relevant development satisfies the core criteria of appropriateness, need, and desirability, as defined or circumscribed by the relevant applicable legislation and policy documents at a given time.

2.2.2 White Paper on the Energy Policy of the Republic of South Africa

Investment in renewable energy initiatives, such as the proposed SEF, is supported by the White Paper on Energy Policy for South Africa (December 1998). In this regard, the document notes:

"Government policy is based on an understanding that renewables are energy sources in their own right, are not limited to small-scale and remote applications, and have significant medium and long-term commercial potential".

"Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future".

The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly ***solar*** and wind and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

Government policy on renewable energy is thus concerned with meeting the following challenges:

- Ensuring that economically feasible technologies and applications are implemented.
- Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential, and compared to investments in other energy supply options.
- Addressing constraints on the development of the renewable industry.

The White Paper also acknowledges that South Africa has neglected the development and implementation of renewable energy applications, despite the fact that the country's renewable energy resource base is extensive, and many appropriate applications exist.

The White Paper also notes that renewable energy applications have specific characteristics that need to be considered. Advantages include:

- Minimal environmental impacts in operation in comparison with traditional supply technologies.
- Generally lower running costs, and high labour intensities.

Disadvantages include:

- Higher capital costs in some cases.
- Lower energy densities.
- Lower levels of availability, depending on specific conditions, especially with sun and wind-based systems.

2.2.3 White Paper on Renewable Energy

The White Paper on Renewable Energy (November 2003) (further referred to as the White Paper) supplements the *White Paper on Energy Policy*, which recognizes that the medium and long-term potential of renewable energy is significant. This Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.

The White Paper notes that while South Africa is well endowed with renewable energy resources that have the potential to become sustainable alternatives to fossil fuels, these have thus far remained largely untapped. As signatory to the Kyoto Protocol[2], Government is determined to make good the country's commitment to reducing greenhouse gas emissions. To this purpose, Government has committed itself to the development of a framework in which a national renewable energy framework can be established and operate.

South Africa is also a signatory of the Copenhagen Accord, a document that delegates at the 15th session of the Conference of Parties (COP 15) to the United Nations Framework Convention on Climate Change agreed to "take note of" at the final plenary on 18 December 2009. The accord endorses the continuation of the Kyoto Protocol and confirms that climate change is one of the greatest challenges facing the world. In terms of the accord South Africa committed itself to a reduction target of 34% compared to business as usual. In this regard, the IRP 2010 aims to allocate 43% of new energy generation facilities in South Africa to renewables.

Apart from the reduction of greenhouse gas emissions, the promotion of renewable energy sources is aimed at ensuring energy security through the diversification of supply (in this regard, also refer to the objectives of the National Energy Act).

Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels.

2.2.4 Integrated Energy Plan (2016)

The development of a National Integrated Energy Plan (IEP) was envisaged in the White Paper on the Energy Policy of the Republic of South Africa of 1998 and, in terms of the National Energy Act, 2008 (Act No. 34 of 2008), the Minister of Energy is mandated to develop and, on an annual basis, review and publish the IEP in the Government Gazette. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development.

The IEP notes that South Africa needs to grow its energy supply to support economic expansion and in so doing, alleviate supply bottlenecks and supply-demand deficits. In addition, it is essential that all citizens are provided with clean and modern forms of energy at an affordable price. As part of the Integrated Energy Planning process, eight key objectives were identified, namely:

- Objective 1: Ensure security of supply.
- Objective 2: Minimise the cost of energy.
- Objective 3: Promote the creation of jobs and localisation.
- Objective 4: Minimise negative environmental impacts from the energy sector.
- Objective 5: Promote the conservation of water.

[2] The Kyoto Protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC), aimed at fighting global warming. The UNFCCC is an international environmental treaty with the goal of achieving "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The Protocol was initially adopted on 11 December 1997 in Kyoto, Japan and entered into force on 16 February 2005. As of November 2009, 187 states have signed and ratified the protocol (Wikipedia).

- Objective 6: Diversify supply sources and primary sources of energy.
- Objective 7: Promote energy efficiency in the economy.
- Objective 8: Increase access to modern energy.

The IEP provides an assessment of current energy consumption trends within different sectors of the economy (i.e., agriculture, commerce, industry, residential and transport) and uses this information to identify future energy requirements, based on different scenarios. The scenarios are informed by different assumptions on economic development and the structure of the economy and also consider the impact of key policies such as environmental policies, energy efficiency policies, transport policies and industrial policies, amongst others.

Based on this information the IEP then determines the optimal mix of energy sources and technologies to meet those energy needs in the most cost-effective manner for each of the scenarios. The associated environmental impacts, socio-economic benefits and macroeconomic impacts are also analysed. The IEP is therefore focused on determining the long-term energy pathway for South Africa, taking into account a multitude of factors which are embedded in the eight objectives.

As part of the analysis four key scenarios were developed, namely the Base Case, Environmental Awareness, Resource Constrained and Green Shoots scenarios:

- The Base Case Scenario assumes that existing policies are implemented and will continue to shape the energy sector landscape going forward. It assumes moderate economic growth in the medium to long term.
- The Environmental Awareness Scenario is characterised by more stringent emission limits and a more environmentally aware society, where a higher cost is placed on externalities caused by the supply of energy.
- The Resource Constrained Scenario in which global energy commodity prices (i.e., coal, crude oil, and natural gas) are high due to limited supply.
- The Green Shoots Scenario describes an economy in which the targets for high economic growth and structural changes to the economy, as set out in the National Development Plan (NDP), are met.

The IEP notes that South Africa should continue to pursue a diversified energy mix which reduces reliance on a single or a few primary energy sources. In terms of renewable energy, the document refers to wind and solar energy. The document does however appear to support solar over wind noting that solar PV and CSP with storage present excellent opportunities to diversify the electricity mix, to produce distributed generation and to provide off-grid electricity. Solar technologies also present the greatest potential for job creation and localisation. Incentive programmes and special focused programmes to promote further development in the technology, as well as solar roll-out programmes, should be pursued.

In terms of existing electricity generation capacity, the IEP indicates that existing capacity starts to decline notably from 2025, with significant plant retirement occurring in 2031, 2041 and 2048. By 2050 only 20% of the current electricity generation capacity remains. As a result, large investments are required in the electricity sector in order to maintain an adequate supply in support of economic growth.

By 2020, various import options become available, and some new coal capacity is added along with new wind, solar and gas capacity. The mix of generation capacity technologies by 2050 is considerably more diverse than the current energy mix, across all scenarios. The main differentiating factors between the scenarios are the level of demand, constraints on emission limits and the carbon dioxide externality costs.

In all scenarios the energy mix for electricity generation becomes more diverse over the period to 2050, with coal reducing its share from about 85% in 2015 to 15–20% in 2050 (depending on the scenario). Solar, wind, nuclear, gas and electricity imports increase their share. The Environmental Awareness and Green Shoots scenarios take on higher levels of renewable energy.

An assessment of each scenario against the eight objectives with reference to renewable energy notes while all scenarios seek to ensure that costs are minimised within the constraints and parameters of each scenario, the Base Case Scenario presents the least cost followed by the Environmental Awareness, Resource Constrained and Green Shoots scenarios respectively when total energy system costs are considered.

In terms of promoting job creation and localisation potential, the Base Case Scenario presents the greatest job creation potential, followed by the Resource Constrained, Environmental Awareness and Green Shoots scenarios respectively. In all scenarios, approximately 85% of total jobs are localisable. For electricity generation, most jobs result from solar technologies followed by nuclear and wind, with natural gas and coal making a smaller contribution.

The Environmental Awareness Scenario, due to its stringent emission constraints, shows the lowest level of total emissions over the planning horizon. This is followed by the Green Shoots, Resource Constrained and Base Case scenarios. These trends are similar when emissions are considered cumulatively and individually by type.

The IEP notes that a diversified energy mix with a reduced reliance on a single or a few primary energy sources should be pursued. In terms of renewable energy, wind and solar are identified as the key options.

Wind
Wind energy should continue to play a role in the generation of electricity. Allocations to ensure the development of wind energy projects aligned with the IRP2010 should continue to be pursued.

Solar
- Solar should play a much more significant role in the electricity generation mix than it has done historically and constitutes the greatest share of primary energy (in terms of total installed capacity) by 2050. The contribution of solar in the energy mix comprises both CSP and solar PV.
- Investments should be made to upgrade the grid in order to accommodate increasing solar and other renewable energy contributions.

With reference to the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), the IEP notes:

- The REIPPPP should be extended, and new capacity should be allocated through additional bidding windows in order ensure the ongoing deployment of renewable energy technologies.
- Experience and insights gained from the current procurement process should be used to streamline and simplify the process.

- The implementation of REIPPPP projects in subsequent cycles of the programme should be aligned with the spatial priorities of provincial and local government structures in the regions that are selected for implementation, in line with the Spatial Development Frameworks. This will ensure that there is long-term, sustainable infrastructure investment in the areas where REIPP projects are located. Such infrastructure includes bulk infrastructure and associated social infrastructure (e.g., education and health systems). This alignment will further assist in supporting the sustainable development objectives of provincial and local government by benefiting local communities.

The IEP indicates that Renewable Energy Development Zones (REDZs) have been identified and describe geographical areas:

- In which clusters (several projects) of wind and solar PV development will have the lowest negative impact on the environment while yielding the highest possible social and economic benefit to the country.
- That are widely agreed to have strategic importance for wind and solar PV development.
- Where the environmental and other authorisation processes have been aligned and streamlined based on scoping level pre-assessments and clear development requirements.
- Where proactive and socialised investment can be made to provide time-efficient infrastructure access.

2.2.5 Integrated Resource Plan

The integrated resource plan (IRP) is an electricity capacity plan which aims to provide an indication of the country's electricity demand, how this demand will be supplied and what it will cost. On 6 May 2011, the Department of Energy (DoE) released the Integrated Resource Plan 2010-2030 (IRP 2010) in respect of South Africa's forecast energy demand for the 20-year period from 2010 to 2030. The IRP 2010 was intended to be a 'living plan' that would be periodically revised by the DoE. However, this was never done and resulted in an energy mix that failed to adequately meet the constantly changing supply and demand scenarios in South Africa, nor did it reflect global technological advancements in the efficient and responsible generation of energy.

On 27 August 2018, the then Minister of Energy published a draft IRP which was issued for public comment (Draft IRP). Following a lengthy public participation and consultation process the Integrated Resource Plan 2019 (IRP 2019) was gazetted by the Minister of Mineral Resources and Energy, Gwede Mantashe, on 18 October 2019, updating the energy forecast for South Africa from the current period to the year 2030. The IRP is an electricity capacity plan which aims to provide an indication of the country's electricity demand, how this demand will be supplied and what it will cost.

Since the promulgated IRP 2010, the following capacity developments have taken place. A total 6 422MW under the government led Renewable Energy Independent Power Producers Programme (RE IPP Procurement Programme) has been procured, with 3 876MW currently operational and made available to the grid. In addition, IPPs have commissioned 1 005MW from two Open Cycle Gas Turbine (OCGT) peaking plants. Under the Eskom build programme, the following capacity has been commissioned: 1 332MW of Ingula pumped storage, 1 588MW of Medupi, 800MW of Kusile and 100MW of Sere Wind Farm. In total, 18 000MW of new generation capacity has been committed to.

Provision has been made for the following new additional capacity by 2030:

- 1 500MW of coal.
- 2 500MW of hydro.
- 6 000MW of solar PV.
- 14 400MW of wind.
- 1 860MW of nuclear.
- 2 088MW for storage.
- 3 000MW of gas/diesel.
- 4 000MW from other distributed generation, co-generation, biomass and landfill technologies.

Figure 2.1 provides a summary of the allocations and commitments between the various energy sectors.

	Coal	Coal (Decommis-sioning)	Nuclear	Hydro	Storage	PV	Wind	CSP	Gas & Diesel	Other (Distributed Generation, CoGen, Biomass, Landfill)
Current Base	37,149		1 860	2,100	2 912	1 474	1 980	300	3 830	499
2019	2,155	-2,373					244	300		Allocation to the extent of the short term capacity and energy gap.
2020	1,433	-557				114	300			
2021	1,433	-1403				300	818			
2022	711	-844			513	400 1,000	1,600			
2023	750	-555				1000	1,600			500
2024			1,860				1,600		1000	500
2025						1000	1,600			500
2026		-1,219					1,600			500
2027	750	-847					1,600		2000	500
2028		-475				1000	1,600			500
2029		-1,694			1575	1000	1,600			500
2030		-1,050		2,500		1000	1,600			500
TOTAL INSTALLED CAPACITY by 2030 (MW)	33,364		1,860	4,600	5,000	8,288	17,742	600	6,380	
% Total Installed Capacity (% of MW)	43		2.36	5.84	6.35	10.52	22.53	0.76	8.1	
% Annual Energy Contribution (% of MWh)	58.8		4.5	8.4	1.2*	6.3	17.8	0.6	1.3	

Installed Capacity
Committed/Already Contracted Capacity
Capacity Decommissioned
New Additional Capacity
Extension of Koeberg Plant Design Life
Includes Distributed Generation Capacity for own use

- 2030 Coal Installed Capacity is less capacity decommissioned between years 2020 and 2030.
- Koeberg power station rated/installed capacity will revert to 1,926MW (original design capacity) following design life extension work.
- Other/ Distributed generation includes all generation facilities in circumstances in which the facility is operated solely to supply electricity to an end-use customer within the same property with the facility.
- Short term capacity gap is estimated at 2,000MW.

Figure 2.1: Summary of energy allocations and commitments

As indicated above, the changes from the Draft IRP capacity allocations see an increase in solar PV and wind, and a significant decrease in gas and diesel; and new inclusions include nuclear and storage.

In terms of renewable energy four bidding rounds have been completed for renewable energy projects under the RE IPP Procurement Programme. The most dominant technology in the IRP2019 is renewable energy from wind and solar PV technologies, with wind being identified as the stronger of the two technologies. There is a consistent annual allocation of 1 600MW for wind technology commencing in the year 2022 up to 2030. The solar PV allocation of 1 000MWs per year is incremental over the period up to 2030, with no allocation in the years 2024 (being the year the Koeberg nuclear extension is expected to be commissioned) and the years 2026 and 2027 (presumably since 2 000MW of gas is expected in the year 2027). The IRP 2019 states that although there are annual build limits, in the long run such limits will be reviewed to take into account demand and supply requirements.

2.2.6 National Development Plan

The National Development Plan (NDP) contains a plan aimed at eliminating poverty and reducing inequality by 2030. The NDP identifies 9 key challenges and associated remedial plans. Managing the transition towards a low carbon national economy is identified as one of the 9 key national challenges. Expansion and acceleration of commercial renewable energy is identified as a key intervention strategy.

2.2.7 The New Growth Path Framework

The aim of the New Economic Growth Path Framework is to enhance growth, employment creation and equity. Central to the New Growth Path is a massive investment in infrastructure as a critical driver of jobs across the economy. In this regard, the framework identifies investments in five key areas namely: energy, transport, communication, water, and housing.

The New Growth Path also identifies five other priority areas as part of the programme, through a series of partnerships between the State and the private sector. The Green Economy as one of the five priority areas to create jobs, including expansions in construction and the production of technologies for solar, wind and biofuels. In this regard, clean manufacturing and environmental services are projected to create 300 000 jobs over the next decade.

2.2.8 National Infrastructure Plan

The South African Government adopted a National Infrastructure Plan in 2012. The aim of the plan is to transform the economic landscape while simultaneously creating significant numbers of new jobs and strengthening the delivery of basic services. The plan also supports the integration of African economies. In terms of the plan, Government will invest R827 billion over the next three years to build new and upgrade existing infrastructure. The aim of the investments is to improve access by South Africans to healthcare facilities, schools, water, sanitation, housing, and electrification. The plan also notes that investment in the construction of ports, roads, railway systems, ***electricity plants***, hospitals, schools, and dams will contribute to improved economic growth.

As part of the National Infrastructure Plan, Cabinet established the Presidential Infrastructure Coordinating Committee (PICC). The Committee identified and developed 18 strategic integrated projects (SIPS). The SIPs cover social and economic infrastructure across all nine provinces (with an emphasis on lagging regions) and consist of:

- Five geographically-focussed SIPs.
- Three spatial SIPs.
- Three energy SIPs.
- Three social infrastructure SIPs.
- Two knowledge SIPs.
- One regional integration SIP.
- One water and sanitation SIP.

The three energy SIPS are SIP 8, 9 and 10.

SIP 8: Green energy in support of the South African economy

- Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010).
- Support bio-fuel production facilities.

SIP 9: Electricity generation to support socio-economic development

- Accelerate the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy and address historical imbalances.
- Monitor implementation of major projects such as new power stations: Medupi, Kusile and Ingula.

SIP 10: Electricity transmission and distribution for all

- Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development.
- Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity.

2.3 PROVINCIAL AND LOCAL LEVEL POLICY AND PLANNING

2.3.1 Mpumalanga Spatial Development Framework (2019)

The spatial vision for Mpumalanga Province is "A sustainable, vibrant and inclusive economy, Mpumalanga". The SDF identifies a number of opportunities and challenges facing the province. The opportunities are linked to the province's natural resources, well developed economy, and established economies.

Natural Environment: The natural environment is diversified and is associated with the Highveld and the Lowveld areas in the province. Five major rivers systems in the flow through Mpumalanga and it is an important catchment area.

Connectivity and Infrastructure: The province is well connected in terms of infrastructure and is connected to Maputo and Richards Bay ports by both rail and road.

Economy: The province's rich biodiversity and scenic beauty support the tourism industry, while at the same time mining, specifically coal mining, plays a key role in the province's economy. The availability of high potential soil and diverse climatic condition also support a range of crops.

Urban settlements: The key urban centres are well established economic centres and offer the opportunity for further economic development by leveraging on the towns' economic bases.

In terms of challenges, climate change is identified as a key challenge. In this regard the activities in the province, specifically the generation of coal powered energy, account for 90% of South Africa's scheduled emissions. The province is also home to 50% of the most polluted towns in the country. The predicted impacts associated with climate change include decreased rainfall in the province and increase temperatures. This will increase the risk of natural disasters, including droughts, flooding and fires.

The SDF identifies five spatial objectives, namely:

Connectivity and corridor functionality: The aim is to ensure connectivity between nodes, secondary towns, marginalised areas, the surrounding area, and to green open space systems.

Sustainable concentration and agglomeration: The aim is to promote the creation of an agglomeration economy that will encourage people and economic activities to locate near one another in urban centres and industrial clusters.

Conservation and resource utilisation: The aim is to promote the maximisation, protection and maintenance of ecosystems, scarce natural resources, high-potential agricultural land, and integrated open space systems.

Liveability and sense of place: The aim is to create settlements that contribute to people's sense of personal and collective wellbeing and to their sense of satisfaction in being residents of a settlements.

Rural diversity and transformation: The aim is to create Urban-Rural anchors and choices for residents within the rural economy linked to access to markets, food security and security of land tenure.

Connectivity and corridor functionality, Sustainable concentration and agglomeration, and Conservation and resource utilisation are of specific relevance the proposed development.

Connectivity and corridor functionality

The strategic objectives (SOs) that are relevant the study area and the proposed development include:

- Strategic Objective 2: Development of the existing corridors and building new linkages to increase capacity and economic opportunities and ensure connectivity to the surrounding areas
- Strategic Objective 5: Decongestion of the coal haul roads and Improvement of Freight Network

In terms of SO 2, the spatial linkages identified for development and upgrading include the upgrade of N17, N17/N2 Corridor and the N12 and N11 corridor. The site is flanked by the N2 to the south and N11 to the south west.

Sustainable concentration and agglomeration

Of specific relevance, Strategic Objective 4, Diversify Economy, focusses on the need to diversify the economy. The SDF notes that mining sector contributes 25% to Mpumalanga's GVA. In addition, there are a number of other sectors directly or indirectly dependent on mining such as manufacturing (specifically metal processing) and utilities (specifically power generation). The combined GVA of these three sectors makes up more than 40% of the provincial GVA.

However, the SDF recognises that mining is not a sustainable industry and resources are finite. There is therefore a need for a gradual shift from mining-oriented sectors to the sustainable economic sectors to maintain sustained growth of the provincial economy. Mpumalanga's Coal Mining and Coal Fired Power Plant region (located mainly in the Highveld area) will be come under increasing pressure due to environmental considerations. As a result, the region is likely to experience a decline in demand for coal and with it a decline in the associated employment it creates. There is therefore a need to diversify the regional economy and facilitate the gradual transition of economic activities in the region. The proposed development supports the objective of diversifying the provinces economy.

Conservation and resource utilisation
The strategic objectives (SOs) that are relevant the study area and the proposed development include:

- Strategic Objective 2: Ensure conservation of all water resources and catchment Areas.
- Strategic Objective 4: Promote a low carbon and climate resilient economy.
- Strategic Objective 6: To optimally utilise the mining potential without compromising the long-term sustainability of the natural environment.

Strategic Objective 2: Ensure Conservation of all Water Resources and Catchment Areas

Achieving Strategic Objective 2, Ensure Conservation of all Water Resources and Catchment Areas is closely linked to diversifying the economy. The SDF notes that the provinces water resources are under pressure from high demand activities, including Eskom's power stations, mining, and industrial uses. The proposed development represents a low consumer of water.

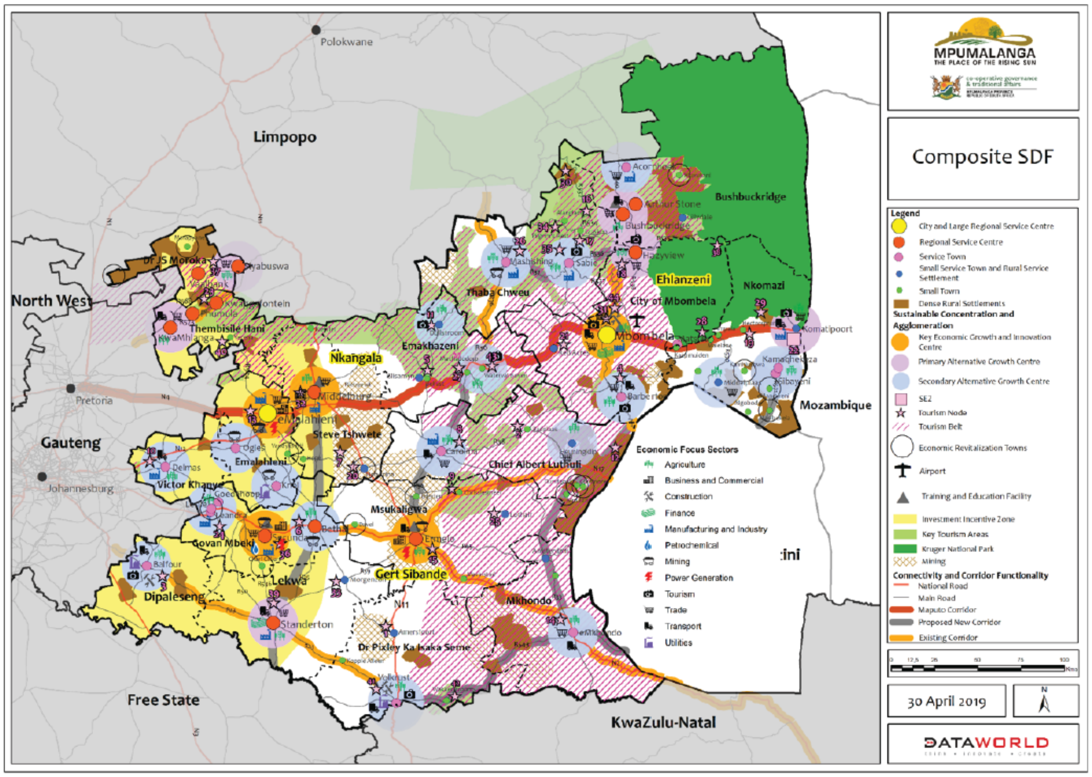
Strategic Objective 4: Promote a Low Carbon and Climate Resilient Economy

Mpumalanga is home to 12 of Eskom's 15 coal-fired power stations; petrochemical plants including Sasol's refinery in Secunda; metal smelters; coal and other mines; brick and stone works; fertiliser and chemical producers; explosives producers; and other smaller industrial operations, making the Highveld one of South Africa's industrial heartlands (CER, 2017). As a result, the air quality within the Mpumalanga Province, especially within the Highveld area, is the poorest in South Africa. The Highveld region accounts for approximately 90 % of South Africa's scheduled emissions of industrial dust, sulphur dioxide and nitrogen oxides (Wells et al. 1996, as cited in Josipovic et al. 2009). Achieving Strategic 4, Promote a low carbon and climate resilient economy, is closely linked to diversifying the economy. The proposed development supports the development of a low carbon, climate resistant economy.

Strategic Objective 6: To optimally utilise the mining potential without compromising the long-term sustainability of the natural environment

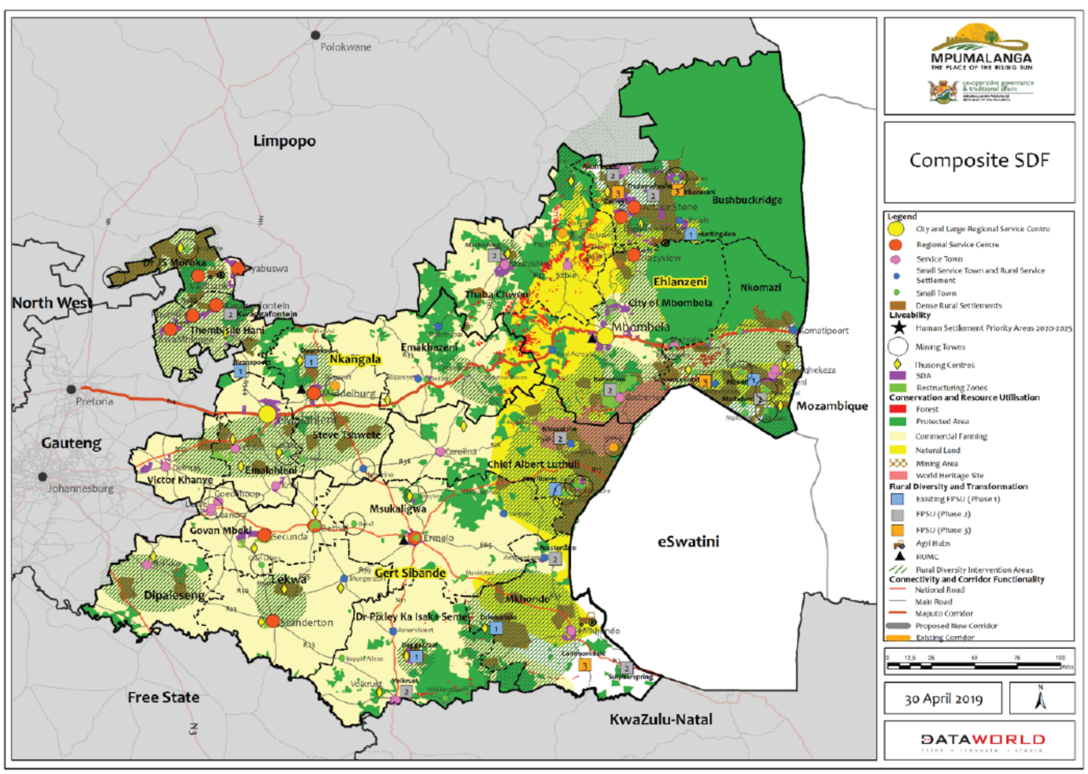
Mining contributes R 49.6 billion (approximately 25%) to the provincial economy. The key mining sector is coal, which represents 83% of South Africa's coal production. The mining sector, specifically coal mining, creates employment opportunities and supports the manufacturing and power generation sector. However, mining is also associated with many issues including water and soil contamination, air pollution and environmental degradation.

Achieving Strategic 6, To optimally utilise the mining potential without compromising the long-term sustainability of the natural environment is closely linked to diversifying and developing a low carbon climate resistant economy. The proposed development supports the objective of diversifying and developing a low carbon, climate resistant economy. In terms of the high-level composite spatial development framework, Ermelo is identified as a Regional Service Centre (red dot) and the development area located to the east of the town falls within area defined as a Tourism Belt (pink hatched) (Figure 2.2). The economic sectors in the area include mining and power generation. The dominant land use in the study area is commercial agriculture (yellow, Figure 2.3).



Source: Mpumalanga SDF

Figure 2.2: Mpumalanga Composite SDF-Economic Activities



Source: Mpumalanga SDF

Figure 2.3: Mpumalanga Composite SDF-Land Uses

2.3.2 Msukaligwa Integrated Development Plan

The Vision of Msukaligwa Municipality (MM) is to be "A Beacon of Service Excellence". The associated mission to meet the vision is:

- Enhancing community participation to steer development initiatives towards community needs.
- Advocating and stimulating local economy to promote economic growth and development.
- Improving good governance and measurable service delivery techniques.
- Enhancing effectiveness and efficiency in the utilization of available resources.
- Empowering our communities and the vulnerable groups in particular.
- Working in partnership with all its stakeholders.
- Continuously mobilizing resources to achieve high standards in service.

A SWOT analysis undertaken as part of the IDP process identified and number of opportunities and threats that are relevant to the development, namely.

Opportunities
- Power utility, government services, mining, tourism, agriculture, and forestry.
- National corridor developments (N2, N11 and N17).
- Strategic location of the municipality.

Threats
- Ageing infrastructure.
- High unemployment rate.
- Mines that are not rehabilitated.

Based on the outcome of the SWOT analysis a number of key focus areas were identified for attention over the 5-year IDP planning period of which the following are relevant.

- Unemployment and poor economic development.
- Insufficient access to basic services.
- Poor maintenance and upgrading of services infrastructure.
- Poor roads and storm water drainage system.

Besides Ermelo to the west of the study area, the only other settlement located within relatively close proximity to the site is the rural settlement of Sheepmoor, located to the north of the N2 and in the southern portion of the study area.

The community engagement process undertaken as part of the IDP process indicated that a number of key issues in the rural areas that are relevant to the development. These include:

Basic services
A number of the rural areas in the MM that do not have access to basic services, including potable water, electricity, and toilets. Some of these challenges can be addressed through the SED initiatives associated with the development.

Skills development and job opportunities
There is a need to support skills development and create employment opportunities. The initiatives listed in the IDP include building of skills development centres or multipurpose centres, employing local contractors on projects implemented within municipality, creating

opportunities for skills transfers by contractors and the provision of bursaries and learnerships. The proposed development will create opportunities for skills development and employment.

Sports and recreation
There is a shortage of sports and recreation facilities and opportunities in many of the rural areas within the MM. The initiatives identified in the IDP to address this include the refurbishment of existing sports facilities, including the provision of ablution facilities, the construction of new sport facilities in remote areas and upgrading of security to prevent vandalism. Some of these challenges can be addressed through the SED initiatives associated with the development.

Section E of the IDP lists the developmental goals, objectives, strategies, and performance indicators. The strategic goals that are relevant to the development include:

- Sustainable and reliable delivery of basic services.
- Reduced unemployment and poverty.
- Social cohesion and spatial transformation.

The key priorities in terms of basic services with specific reference to rural areas includes the establishment of new and or up-grading of existing clinics, and the provision of mobile clinic services for more remote rural areas. The need for clinics outside Ermelo to operate 24 hours and seven days a week due to the absence of hospitals nearby was also raised as a key issue. reach the areas.

In terms of community facilities, the needs identified included, community halls and more Thusong Centres. Centres also need to be established for disabled members of the community.

The key priority in terms of unemployment and poverty is to support economic development and create employment opportunities.

The strategic objectives that are relevant to the development include:

- To provide sustainable and reliable services to communities.
- To coordinate efforts to address unemployment and poverty.

2.2.3 Msukaligwa Municipality Spatial Development Framework

The spatial vision for the MM is "*a diversified, vibrant rural economy that make optimal use of natural resources, supported by a well-connected network of sustainable rural service and economic nodes, where people have access to services and economic opportunity*".

The SDF is informed by a number of spatial objectives, namely:

- Provide a spatial structure that facilitates access to services for all communities.
- Protect strategic water sources and sensitive eco-systems.
- Provide space for the diversification of the local economy.
- Eliminate past spatial settlement patterns.

The provision of space of the diversification of the local economy is of specific relevance to the proposed development.

A SWOT analysis was undertaken as part of the preparation of the SDF. The key outcomes of the analysis are summarised below.

Strengths

- Rich natural resource base – minerals, high potential agricultural land, water resources, natural environment (lakes region).

Weakness

- Typical rural population distribution making it difficult to reach people with services.
- Remaining service backlogs (water, sanitation, refuse removal).
- Increasing poverty levels.
- Relatively low skills levels
- Declining functional literacy.

Opportunities

- National projects to enhance regional links may strengthen the locational advantage of Ermelo / Wesselton.
- Potential for tourism linked to natural assets.
- Potential for larger scale beneficiation supported by current nodal structure and transport links.
- Legislative investment by mines (social and labour plans) and the associated opportunity for service provision and socio-economic development[3].

Threats

- Declining coal reserves threatens mining economy and employment. Impact on mining sector also impacts on other related industries, such as manufacturing and transport.
- Global and national move away from carbon-based economy will lead to decline in mining, coal power generation economy and employment. This will also impact on mining related industries.
- Competing land uses – mining, agriculture, urban expansion, conservation
- Climate change – decreased rainfall and increased temperatures will have impact on agriculture, forestry, and settlements.
- Population growth exceeding expected and current economic growth.

The results of the SWOT analysis informed the identification of a set of priority issues centred around natural resource management and human development. The issues that are relevant to the proposed development include:

Strategic water source areas

Msukaligwa is part of a catchment area which is classified as strategic water source area at a national scale. The preservation and sustainable use of these water sources is becoming increasingly important in view of climate change. Decisions about the future development of the area should take cognisance of this issue, and not sacrifice long term water security in favour of meeting short term economic or development targets.

Conflicting land uses

Msukaligwa is richly endowed with natural resources including water, high potential land, minerals, and sensitive ecosystems that occur in attractive natural landscapes. However, these natural resources and the demand to exploit them spatially overlap and often conflict. The SDF highlights the need to address and manage potential land use conflicts.

[3] Opportunities associated with SLPs would also apply to Community Trusts associated with renewable energy projects.

Reliance on Carbon Economy
The area's economy is currently strongly dependent on coal mining. In addition to coal mining, the area also hosts the Camden Power Station. The SDF notes that the eventual decline of the mining sector and coal-based power generation, based on declining coal deposits and a move away from a carbon-based economy, is a long-term certainty for the area. Emphasis in spatial planning should be on the creation of opportunities to diversify the economy to lessen the impact of the decline.

The SDF highlights the risks posed by climate change, specifically given that large section of the economy is reliant on agriculture and forestry. The area is also the source area of some of the main strategic waterways of the country.

The SDF identifies a number of structuring elements that inform the spatial concept for the MM. These include urban development nodes, transportation corridors, mining areas and commercial agriculture and conservation areas.

The main town of Ermelo is designated as a Primary Node. The function of a Primary Node is to:

- Provide higher order services to the growing urban population, as well as the rural catchment area surrounding the node.
- Provide space for economic diversification and higher intensity economic development, with a focus on agriculture and related activities, mining, utilities, and ***power generation***, as well as transport and logistics. Support should also be provided too industrial and commercial uses, as well as business incubation centres and innovation centres, training facilities and educational institutes.

Sheepmoor, located in the southern part of the study area, is designated as Rural Node and has been identified as a site for the establishment of a Farmer Production Support Unit in terms of the Department of Rural Development and Land Reform's Agri-Park Programme. The economic focus on Sheepmoor is on forestry and agriculture (livestock, grains (maize and beans) and vegetables). Economic initiatives such as the establishment of grain silo, training in tree farming and provision of connecting infrastructure should be prioritised. The development of small agri-villages in consultation with Mondi/ Sappi is also identified as an initiative. The Socio-Economic Development (SED) spend linked to the proposed development could support for these initiatives.

The N2 and N17 are identified as Primary Transportation Corridors, while the N11 is identified as a Secondary Corridor. The SDF notes that development of nodes along these corridors are proposed, in order to intensify development at specific points and achieve economies of scale.

The SDF highlights the key role and spatial extent of mining in the MM, including reference to the Camden coal-fired power station south of Ermelo. Over the longer term the rehabilitation of mining areas and a range of alternative peri-urban uses should be considered for the impacted areas in view of the decrease reliance on coal. Commercial Agriculture also represents a key economic activity in the MM. However, the SDF notes that climate change will pose a risk to the agricultural sector.

The structuring elements have been used to identify spatial focus areas. The areas of relevance to the development include:

- Agriculture and Forestry Focus Areas.
- Conservation and Tourism Focus Area.
- Mining and Peri-Urban Focus Areas.

Agriculture and Forestry Focus Areas
In terms of agricultural development, the SDF notes that the recommendations of the District Rural Development Plan for Gert Sibande District Municipality be implemented. The Plan identifies a number of rural intervention areas (RIAs). As indicated in Figure 2.4, the study area is not located in an RIA. The main land uses in the study area consist of Forestry (Strategic Water Resource Area, Green) and Commercial Farming (Brown)

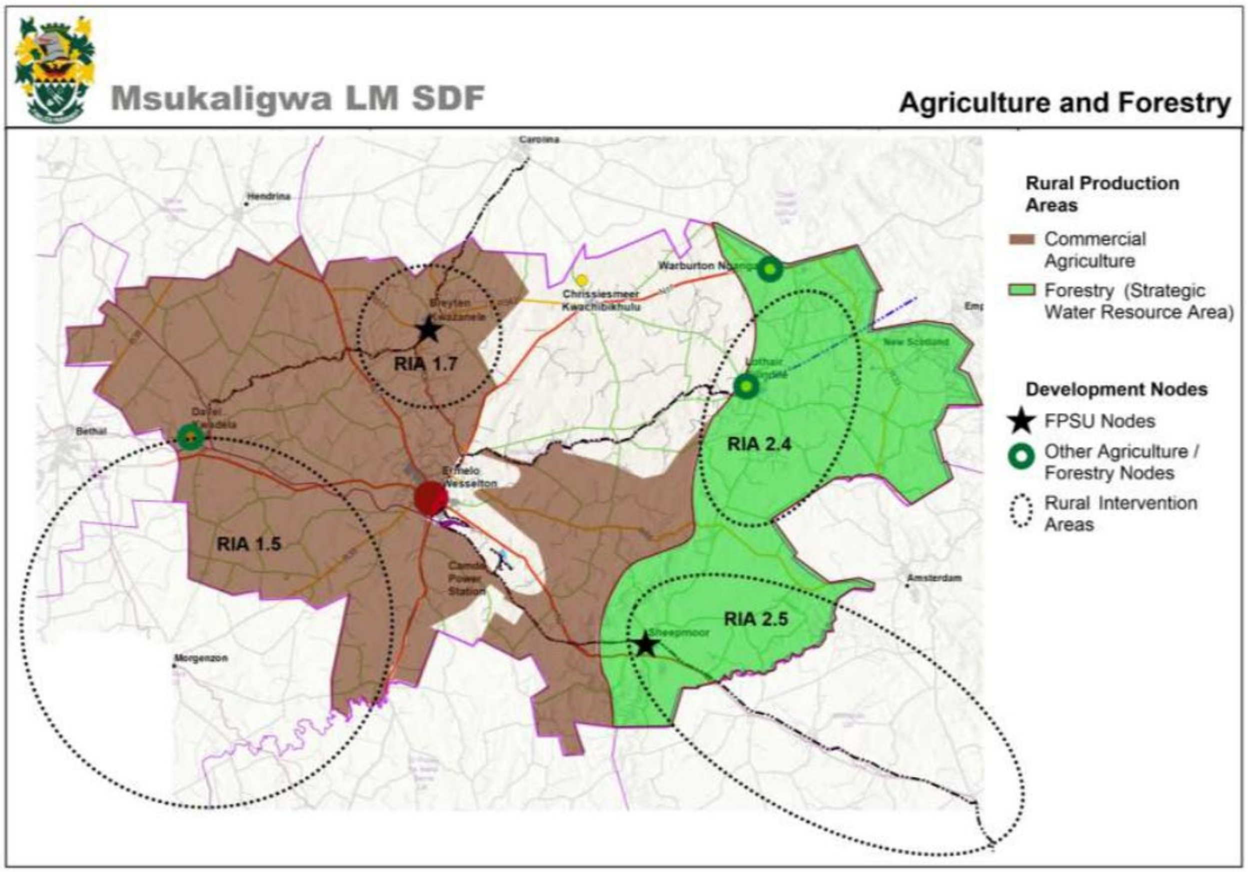


Figure 2.4: Msukaligwa SDF-Agriculture and Forestry

Conservation and Tourism Focus Areas
The SDF notes that the entire Msukaligwa area is environmentally sensitive, and all human activity should be conducted in such a way as to minimise impact. The key areas of significance identified include:

- The lakes region – this natural asset is not only an economic asset for tourism, but also an important ecosystem and an important mechanism to mitigate the impacts of climate change.
- Strategic water source areas and river headwaters – the area makes an important contribution to national water security, and requires clean water for human development and economic activities such as agriculture.

- Protected areas – a number of small, protected areas exist outside the lake's region. There areas are not only important ecologically, but also from a tourism perspective.

The natural and cultural assets of Msukaligwa, notable the lakes region, has the potential to serve as a major attraction. In addition, the area's proximity to the large markets of Gauteng and good regional connectivity should be harnessed in attracting more local tourists.

As indicated in Figure 2.5, the majority of the proposed development area is located in a Protect Area. This will need to be assessed as part of the relevant specialist studies.

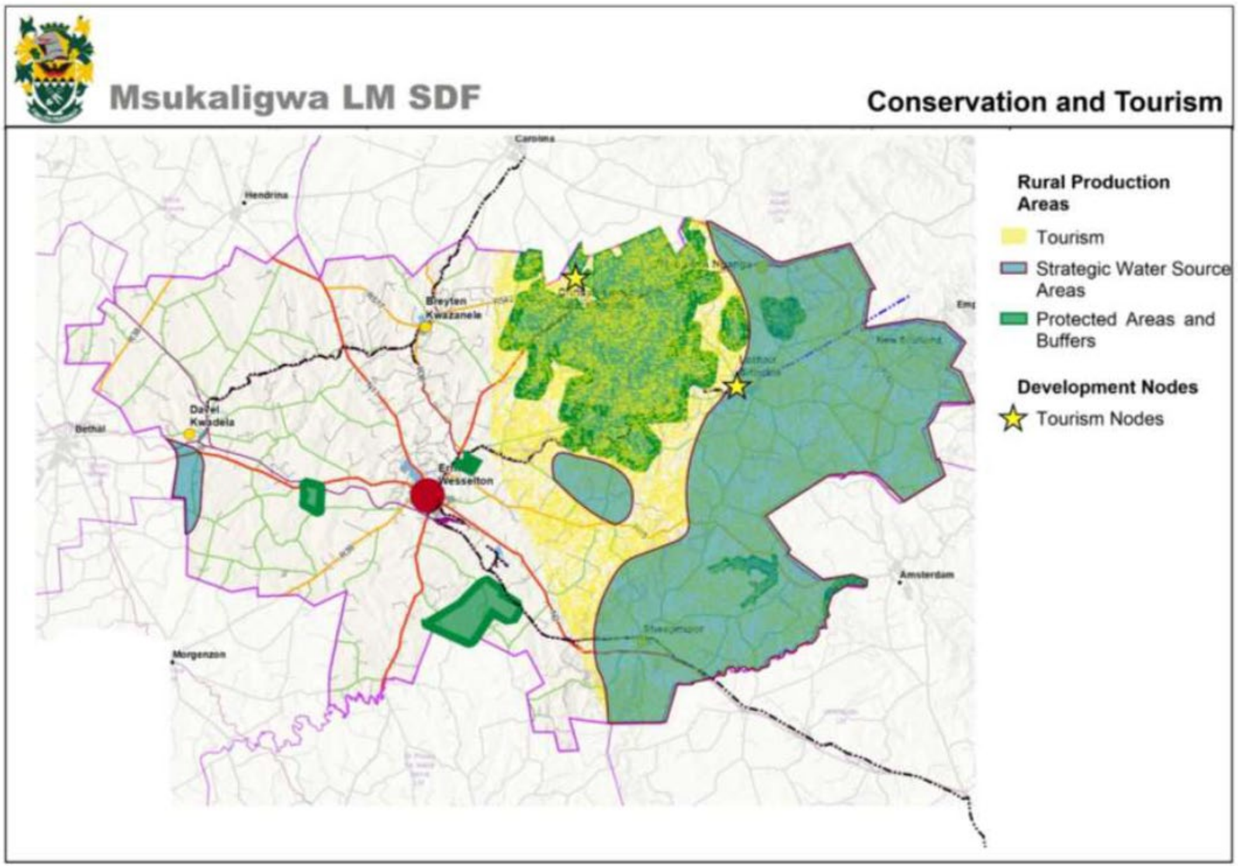


Figure 2.5: Msukaligwa SDF-Conservation and Tourism

Mining Areas

The SDF acknowledges the importance of the mining sector and notes that it will need to be accommodated over the short to medium term. However, of relevance to the proposed development the SDF refers to green industries and indicates that the existing site of the Camden Power Station and surrounds should be made available for new industrial development in the long term, to manage the long-term impact of the Power Station being decommissioned. The existing road and rail infrastructure render the area in the vicinity of the Power Station and the site itself highly accessible creating an opportunity for redevelopment with alternative uses requiring extensive space and good connectivity. The SDF also notes that the mining belt area holds other potential that should be harnessed with a long-term view of diversifying the local economy to soften the long-term impact of eventual decline in mining. As indicated in Figure 2.6, the development area is located in an area of moderate to no mining potential with a limited number of mining activities (brown areas). The composite spatial development framework for the MM is informed by the various structuring elements. The spatial layout is reflected in Figure 2.7. As indicated in Figure 2.7, most the development area falls within area that consists of tourism, protected area and buffers.

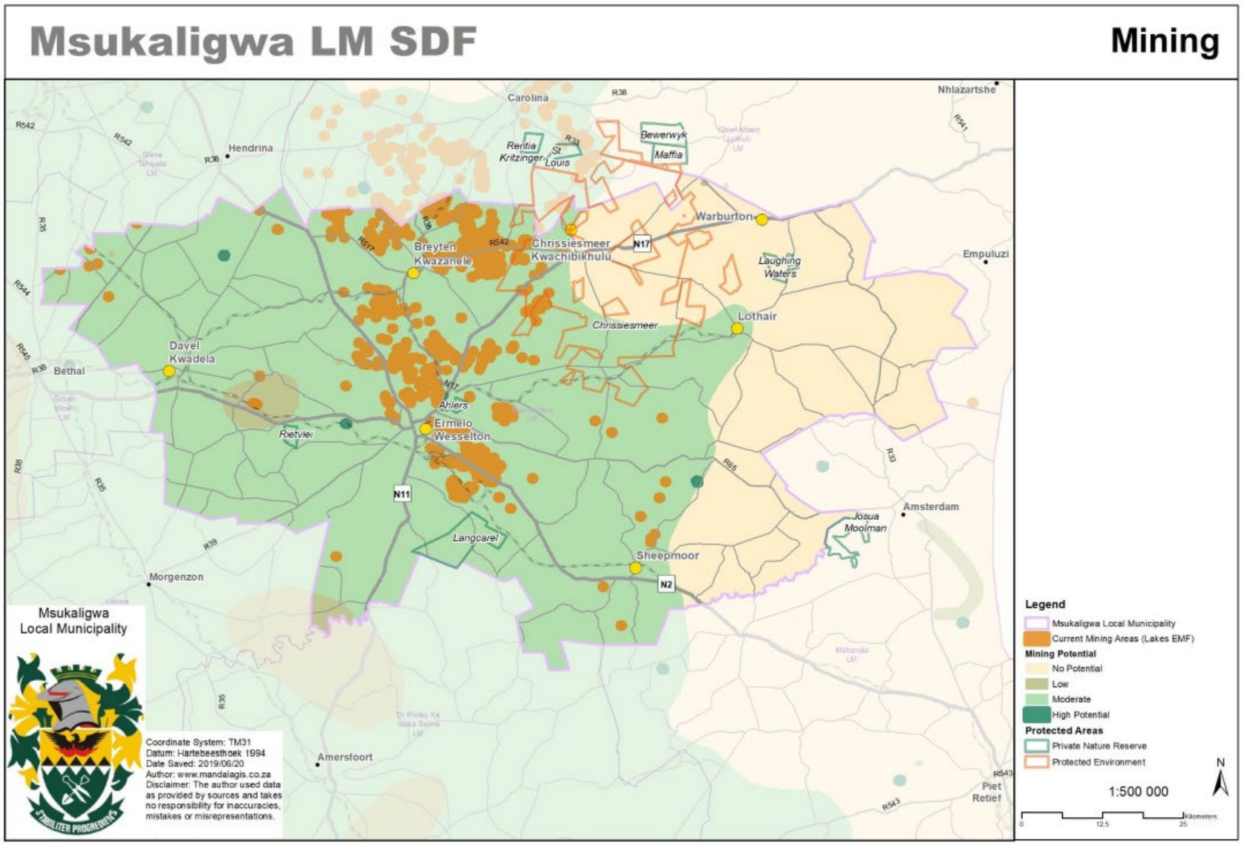


Figure 2.6: Msukaligwa SDF-Mining

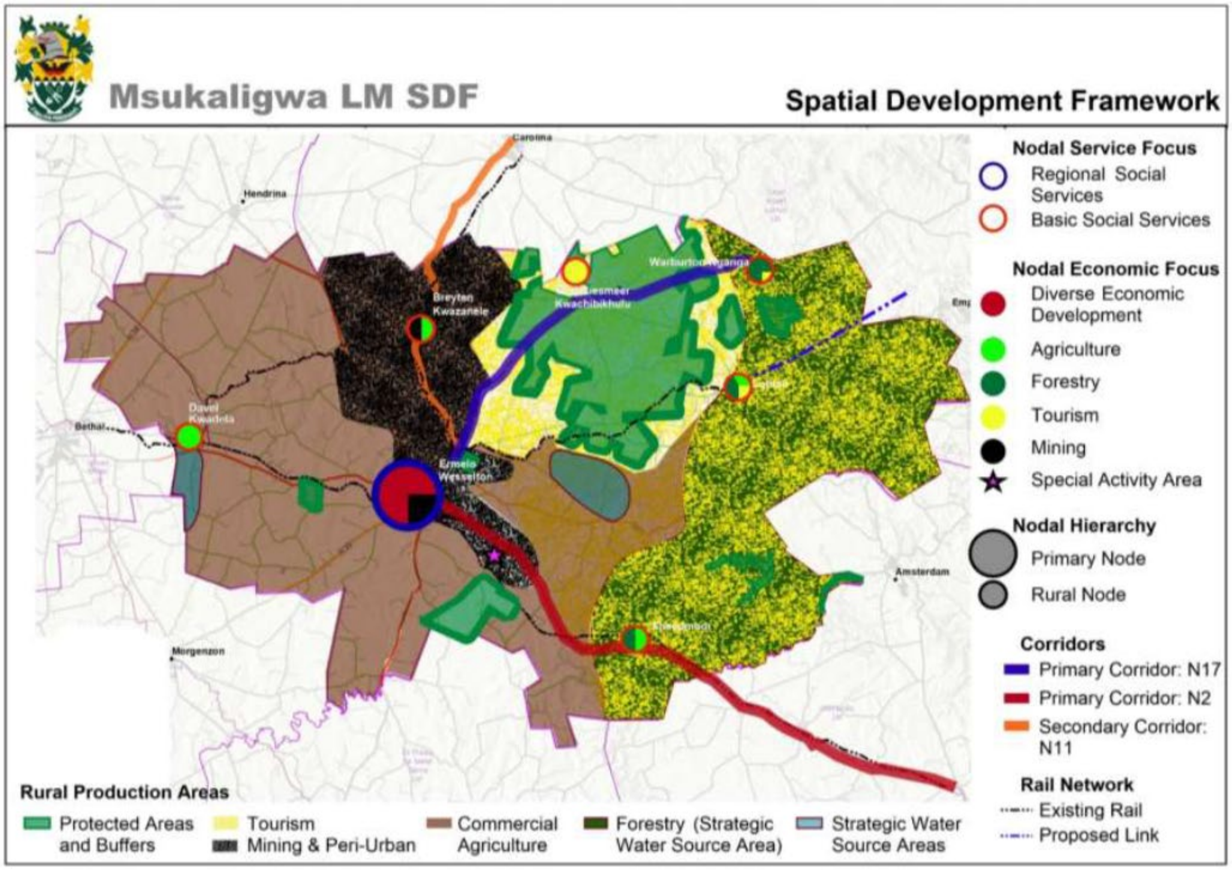


Figure 2.7: Msukaligwa SDF-Composite Spatial Development Framework

2.3 OVERVIEW RENEWABLE ENERGY SECTOR IN SOUTH AFRICA

The section below provides an overview of the potential benefits associated with the renewable energy sector in South Africa. Given that South Africa supports the development of renewable energy at national level, the intention is not to provide a critical review of renewable energy. The focus is therefore on the contribution of renewable energy, specifically in terms of supporting economic development.

The following documents were reviewed:

- Independent Power Producers Procurement Programme (IPPPP): An Overview (June 2020), Department of Energy, National Treasury and DBSA.
- Green Jobs Study (2011), IDC, DBSA Ltd and TIPS.
- Powering the Future: Renewable Energy Roll-out in South Africa (2013), Greenpeace South Africa.
- WWF SA, Renewable Energy Vision 2030, South Africa, 2014.
- Jacqueline M. Borel-Saladin, Ivan N. Turok, (2013). The impact of the green economy on jobs in South Africa), South African Journal of Science, *Volume 109 /Number 9/10, September/October 2013.*
- The potential for local community benefits from wind farms in South Africa, Louise Tait (2012), Master’s Thesis, Energy Research Centre University of Cape Town.

2.4.1 Independent Power Producers Procurement Programme (IPPPP): An Overview

The section below provides an overview of the potential benefits associated with the renewable energy sector in South Africa based on the information contained in the Independent Power Producers Procurement Programme (IPPPP): An Overview (December 2021), Department of Energy, National Treasury and DBSA. The document presents an overview of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) undertaken by the Department of Energy, National Treasury, and the Development Bank of South Africa in December 2021. The programme's primary mandate is to secure electrical energy from the private sector for renewable and non-renewable energy sources. With regard to renewables, the programme is designed to reduce the country's reliance on fossil fuels, stimulate an indigenous renewable energy industry and contribute to socio-economic development and environmentally sustainable growth. The IPPPP has been designed not only to procure energy but has also been structured to contribute to the broader national development objectives of job creation, social upliftment and broadening of economic ownership.

The Integrated Resource Plan for electricity (IRP) provides South Africa's long-term plan for electricity generation. It primarily aims to ensure security of electricity supply, minimise the cost of that supply, limit water usage and reduce greenhouse gas (GHG) emissions, while allowing for policy adjustment in support of broader socio-economic developmental imperatives. The IRP 2019 was promulgated in October 2019 and replaced the IRP 2010 as the country's official electricity infrastructure plan.

It calls for 37 696MW of new and committed capacity to be added between 2019 and 2030 from a diverse mix of energy sources and technologies as ageing coal plants are decommissioned and the country transitions to a larger share of renewable energy. By2030, the electricity generation mix is set to comprise of 33 364MW (42.6%) coal, 17 742MW (22.7%) wind, 8 288MW (10.6%) solar photovoltaic (PV), 6 830MW(8.7%) gas or diesel, 5 000MW (6.4%) energy storage, 4 600MW (5.9%) hydro, 1 860MW (2.4%) nuclear and 600MW (0.8%) concentrating solar power (CSP). Additionally, a short-term gap at least 2000MW is to be filled between 2019 and 2022, thereby further raising new capacity requirements, while distributed or embedded generation for own-use is positioned to add 4 000MW between 2023 and 2030. The IRP is intended to be frequently updated, which could impact future capacity allocations from various energy sources and technologies.

Energy supply

By the end of December 2021, the REIPPPP had made the following significant impacts.

- 6 323 MW of electricity had been procured from 92 RE Independent Power Producers (IPPs) in BW1-4.
- 5 661 MW of electricity generation capacity from 85 IPP projects has been connected to the national grid.
- 71 073GWh of energy has been generated by renewable energy sources procured under the REIPPPP since the first project became operational in November 2013.

Renewable energy IPPs have proved to be very reliable. Of the 85 projects that have reached COD, 77 projects have been operational for longer than a year. The energy generated over the past 12-month period for these 77 projects is 14 117GWh, which is 95% of their annual energy contribution projections (P50) of 14 924GWh over a 12-month delivery period. Thirty-one (31) of the 77 projects (40%) have individually exceeded their P50 projections.

Comparatively, the following statistics were presented at the REIPPPP Bid Window 6 Bidders Conference on 7 July 2022 by the IPP Office based on data as of March 2022 following seven bid rounds (IPP Office, 2022[4]):

- 92 IPPs have been selected as preferred bidders.
- 6 323 MW of electricity capacity procured.
- 5 826 MW already operational from 87 IPPs.
- 74 805 GWh energy generated by Renewable Energy sources.

Energy costs
In line with international experience, the price of renewable energy is increasingly cost competitive when compared with conventional power sources. The REIPPPP has effectively captured this global downward trend with prices decreasing in every bid window. Energy procured by the REIPPPP is progressively more cost effective and has approached a point where the wholesale pricing for new coal-and renewable-generated energy intersect.

Through the competitive bidding process, the IPPPP effectively leveraged rapid, global technology developments and price trends, buying clean energy at lower and lower rates with every bid cycle, resulting in SA getting the benefit of renewable energy at some of the lowest tariffs in the world. The price for wind power has dropped by 50% to R0.94/kWh, while solar PV has dropped with 75% to R1.14/kWh between BW1 and BW4.

Prices contracted under the REIPPPP for all technologies are well below the published REFIT prices. The REIPPPP has effectively translated policy and planning into delivery of clean energy at very competitive prices. As such it is contributing to the national aspirations of secure, affordable energy, lower carbon intensity and a transformed 'green' economy. with the BW4 price directly comparable with the per kWh price of new coal generation. Solar PV has dropped most significantly with a price decrease of 75% to R1.10/kWh between BW1 and BW4. This compares with the industry estimates in April 2020 of R1.45/kWh for Medupi. Considering the on-going delays incompletion, indications are that these costs may even be significantly higher.

Investment
The document notes that the REIPPPP has attracted significant investment in the development of the REIPPs into the country. The total investment (total project costs[5]), including interest during construction, of projects under construction and projects in the process of closure is R209.6 billion (this includes total debt and equity of R209 billion, as well as early revenue and VAT facility of R0.5 billion).

The REIPPPP has attracted R42 billion in foreign investment and financing in the seven bid windows (BW1 – BW4). This is almost double the inward FDI attracted into South Africa during 2015 (R22.6 billion). The document notes that the share of foreign investment and equity showed an increase in the most recent bid window (2S2), suggesting that the

[4] IPP Office (2022). RENEWABLE ENERGY INDEPENDENT POWER PRODUCER PROCUREMENT PROGRAMME (REIPPPP) BID WINDOW 6 BIDDERS' CONFERENCE, 7 JULY 2022 [online]. Accessed July 2022. https://www.ipp-renewables.co.za/PressCentre/GetPressRelease?fileid=16a21004-f9fd-ec11-9578-2c59e59ac9cd&fileName=BW6%20Bidders%20Conference%20Consolidated.pdf.

[5] Total project costs means the total capital expenditure to be incurred up to the commercial operations date in the design, construction, development, installation, and or commissioning of the project)

REIPPPP continued to generate investor confidence despite the poor economic conditions in South Africa in recent years.

Comparatively, based on the information presented at the REIPPPP Bid Window 6 Bidders Conference on 7 July 2022 by the IPP Office (IPP Office, 2022), approximately R209.6 billion investment has been attracted for energy infrastructure in all bid windows; and as at March 2022 an actual R1.9 billion contribution was realised for socio-economic development.

South African citizen shareholding

The importance of retaining local shareholding in IPPs is key condition of the procurement requirements. The RFP notes that bidders are required to have South African Equity Participation of 40% in order to be evaluated. South African (local) equity shareholding across BW1-4 equates to 52% (R31.4 billion) of the total equity shareholding (R61.0 billion) was held by South African's across BW1 to BW4, 1S2 and 2S2. This equates to substantially more than the 40% requirement. Foreign equity amounts to R29.6 billion and contributes 49% of total equity.

The REIPPPP also contributes to Broad Based Black Economic Empowerment (BBBEE) and the creation of black industrialists. In this regard, Black South Africans own, on average, 34% of projects that have reached financial close (BW1-BW4), which is 4% higher than the 30% target. This includes black people in local communities that have ownership in the IPP projects that operate in or near their communities and represents the majority share of total South African Entity Participation.

On average, black local communities own 9% of projects that have reached financial close. This is well above the 5% target. In addition, an average of 21% shareholding by black people in engineering, procurement, and construction (EPC) contractors has been attained for projects that have reached financial closure. This is higher than 20% target. The shareholding by black people in operating companies of IPPs has averaged 30% (against the targeted 20%) for the 85 projects in operation (i.e. in BW1–4).

The target for shareholding by black people in top management has been set at 40%, with an average 68% achieved to date. The target has therefore been significantly exceeded.

Community shareholding and community trusts

The regulations require a minimum ownership of 2.5% by local communities in IPP projects as a procurement condition. This is to ensure that a substantial portion of the investments has been structured and secured as local community equity. An individual community's dividends earned will depend on the terms of each transaction corresponding with the relevant equity share. To date all shareholding for local communities have been structured through the establishment of community trusts. For projects in BW1 to BW4, qualifying communities will receive R25.5 billion net income over the life of the projects (20 years). The report notes that the bulk of the money will however only start flowing into the communities from 2028 due to repayment obligations in the preceding years (repayment obligations are mostly to development funding institutions). However, despite the delay this represents a significant injection of capital into mainly rural areas of South Africa. If the net projected income for the first seven bid windows (BW1-BW4) was structured as equal payments overtime, it would represent an annual net income of R1.27 billion per year.

Income to all shareholders only commences with operation of the facility. Revenue generated to date by the 85 operational IPPs amounts to R149.9 billion.

Procurement spend

In addition to the financial investments into the economy and favourable equity structures aimed at supporting BEE, the REIPPPP also targets broader economic and socio-economic investment. This is through procurement spend and local content.

The total projected procurement spend for BW1 to BW4 during the construction phase was R71.1 billion, while the projected operations procurement spend over the 20 years operational life is estimated at 75.2 billion. The combined (construction and operations) procurement value is projected as R146.3 billion of which R92.1 billion has been spent to date. For construction, of the R71.1 billion already spent to date, R71 billion is from the 85 projects which have already been completed. These 85 projects had planned to spend R64.2 billion. The actual procurement construction costs have therefore exceeded the planned costs by 11% for completed projects.

Preferential procurement
The share of procurement that is sourced from Broad Based Black Economic Empowered (BBBEE) suppliers, Qualifying Small Enterprises (QSE), Exempted Micro Enterprises (EME) and women owned vendors are tracked against commitments and targeted percentages. The IA target requirement for BBBEE is 60% of total procurement spend. However, the actual share of procurement spend by IPPs from BBBEE suppliers for construction and operations combined is currently reported as 83%, which is significantly higher than the target of 60%, but also the 71% that had been committed by IPPs. BBBEE, as a share of procurement spend for projects in construction, is also reported as 84% with operations slightly lower at 74%.

The majority of the procurement spend to date has been for construction purposes. Of the R76 billion spent on procurement during construction, R64.3 billion has reportedly been procured from BBBEE suppliers, achieving 84.6% of total procured. Actual BBBEE spend during construction for BW1 and BW2 alone was R25.5 billion, 81% more than the 14.1 billion planned by the IPPs. The R64.3 billion spent on BBBEE during construction is 30% more than the R49.7 billion that had originally been anticipated by all IPPs procured in BW1-4.
Total procurement spend by IPPs from QSE and EMEs has amounted to R28.1 billion (construction and operations) to date, which exceeds commitments by 250% and is 30% of total procurement spend to date (while the required target is 10%). QSE and EME's procurement spend for construction was 31% of construction procurement to date and 26% of operational procurement, exceeding the 10% targets set. QSE and EME share of construction procurement spend totals R23.8 billion, which is 5.4 times the planned spend for construction of R4.4 billion during this procurement phase.

In terms of procurement from women-owned vendors to date, 5% of total construction procurement spend has been from woman-owned vendors (against a targeted 5%), and 6% of operational procurement spend has been realised from woman-owned vendors to date, thereby exceeding the targeted 5%. In terms of construction spend, R 4.1 billion was undertaken by women-owned vendors, which is almost double the R 1.8 billion expected to be spent for the construction of projects that have reached financial close.

The REIPPPP has therefore created significant employment opportunities for black South African citizens and local communities beyond planned targets. This highlights the importance of the programme in terms of employment equity and the creation of more equal societies.

Local Content[6]

The report notes that the REIPPP programme represents the country's most comprehensive strategy to date in achieving the transition to a greener economy. Local content minimum thresholds and targets were set higher for each subsequent bid window. The report notes that for a programme of this magnitude, with construction procurement spend alone estimated at R71.1 billion, the result is a substantial stimulus for establishing local manufacturing capacity. The local content strategy has created the required incentives for a number of international technology and component manufactures to establish local manufacturing facilities.

The documents notes that for the portfolio as a whole, the expectation would reasonably be for local content spend to fall between 25% and 65% of the total project value (considering the range of targets and minimum requirements). Local content commitments by IPPs amount to R66.3 billion or 45% of total project value (R148.2 billion for all bid windows).

Actual local content spend reported for IPPs that have started construction amounts to R63.3 billion against a corresponding project value (as realised to date) of R127.2 billion. This means that 50% of the project value has been locally procured, exceeding the 45% commitment from IPPs and the thresholds for BW1 – BW4 (25-45%).

To date, the R63.3 billion local content spend reported by active IPPs is already 96% of the R66 billion local content expected. This is with 6 projects still in construction, and 85 of the 91 active projects having reached COD (i.e. 93% of the active portfolio complete). For the 85 projects that have reached COD, local content spend has been R 58.72 billion of a committed R58.67 billion, which is 0.1 more than the planned local spend.

Leveraging employment opportunities

To date, a total of 63 291 job years[7] have been created for South African citizens, of which 48 110 job years were in construction and 15 182 in operations. These job years should rise further past the planned target as more projects enter the construction phase. Employment opportunities across BW1-4 are 143% of the planned number during the construction phase (i.e. 33 707 job years), with 6 projects still in construction and employing people. The number of employment opportunities is therefore likely to continue to grow beyond the original expectations.

By the end of December 2021, 85 projects had successfully completed construction and moved into operation. These projects created 44 172 job years of employment, compared to the anticipated 30 488. This was 45% more than planned.

The report notes that employment thresholds and targets were consistently exceeded across the entire portfolio. The average share of South African citizens of total South Africa based employees for BW1 – BW4 was 91% during construction (against a target of 80%), while it was 96% during operations for BW1 – BW4 (against a target of 80%). The report notes that the construction phase offers a high number of opportunities over shorter durations, while the operations phase requires fewer people, but over an extended operating period.

[6] Local content is expressed as a % of the total project value and not procurement or total project costs.

[7] The equivalent of a full-time employment opportunity for one person for one year

To date, 48 110 job years for SA citizens were achieved during construction, which is 43% above the planned 33 707 job years for active projects. These job years are expected to rise further since 6 projects are still in construction.

In terms of benefits for local communities, significantly more people from local communities were employed during construction than was initially planned. For active projects, the expectation for local community participation was 13 284 job years. To date 25 272 job years have been realised (i.e. 90% more than initially planned), with 6 projects still in, or entering, construction. The number of black SA citizens employed during construction also exceeded the planned numbers by 74%.

Black South African citizens, youths and rural or local communities have been the major beneficiaries during the construction phases, as they respectively represent 81%, 44% and 48% of total job opportunities created by IPPs to date. However, woman and disabled people could still be significantly empowered as they represent a mere 10% and 0.4% of total jobs created to date, respectively. Nonetheless, the fact that the REIPPPP has raised employment opportunities for black South African citizens and local communities beyond planned targets, indicates the importance of the programme to employment equity and the drive towards more equal societies.

The share of black citizens employed during construction (81%) and the early stages of operations (85%) has significantly exceeded the 50% target and the 30% minimum threshold. Likewise, the share of skilled black citizens (as a percentage of skilled employees) for both construction (71%) and operations (82%) has also exceeded the 30% target and minimum threshold of 18%. The share of local community members as a share of SA-based employees was 48% and 70% for construction and operations respectively – significantly exceeding the minimum threshold of 12% and the target of 20%.

Socio-economic development (SED) contributions

An important focus of the REIPPPP is to ensure that the build programme secures sustainable value for the country and enables local communities to benefit directly from the investments attracted into the area. In this regard, IPPs are required to contribute a percentage of projected revenues accrued over the 20-year project operational life toward SED initiatives. These contributions accrue over the 20-year project operation life and are used to invest in housing and infrastructure as well as healthcare, education, and skills development.

The minimum compliance threshold for SED contributions is 1% of the revenue with 1.5% the targeted level over the 20-year project operational life. For the current portfolio of projects, the average commitment level is 2%, which is 101% higher than the minimum threshold level. To date (across BW1-4) a total contribution of R22.8 billion has been committed to SED initiatives. Assuming an even, annual revenue spread, the average contribution per year would be R1.1 billion. Of the total commitment, R18.5 billion is specifically allocated for local communities where the IPPs operate. With every new IPP on the grid, revenues and the respective SED contributions will increase.

As a percentage of revenue, SED obligations become effective only when operations commence, and revenue is generated. Of the 91 IPPs that have reached financial close (BW1–BW4), 85 are operational. The SED contributions associated with these 85 projects has amounted to R 1.8 billion to date.

In terms of ED and SED spend, education, social welfare, and health care initiatives have a SED focus. SED spend on education has been almost double the expenditure on enterprise development. This is despite enterprise development being a stand-alone commitment category in terms of the IA. This is, in part, due to the fact that some early childhood development programmes have also been incorporated in educational programmes. IPPs have supported 1 388 education institutions with a total of R437 million in contributions, from 2015 to the end of June 2021. A total of 1 276 bursaries, amounting to R210.8 million, have been awarded by 67 IPPs from 2015 until the end of June 2021. The largest portion of the bursaries were awarded to African and Coloured students (97.4%), with women and girls receiving 56.3% of total bursaries. The Northern Cape province benefitted most from the bursaries awarded, with 57.2%, followed by the Eastern Cape (20.2%) and Western Cape (14.1%). Enterprise development and social welfare are the focus areas that have received the second highest share of the contributions to date.

Enterprise development contributions
The target for IPPs to spend on enterprise development is 0.6% of revenues over the 20-year project operational life. However, for the current portfolio, IPPs have committed an average of 0.63% or 0.03% more than the target. Enterprise development contributions committed for BW1-4, amount to R7.2 billion. Assuming an equal distribution of revenue over the 20-year project operational life, enterprise development contributions would be R358 million per annum. Of the total commitment, R5.6 billion is specifically committed directly within the local communities where the IPPs operate, contributing significantly to local enterprise development.

Of the total commitment, R5.6 billion is specifically committed directly within the local communities where the IPPs operate, contributing significantly to local enterprise development. A total contribution of R504.1 million has already been made to the local communities (i.e. 94%of the total R537.9 million enterprise development contributions made to date).

Contribution to cleaner energy and water savings
As part of the global commitment, South Africa is targeting an emissions trajectory that peaks at 34% below a "business as usual" case in 2020, 42% below in 2025 and from 2035 declines in absolute terms. The REIPPPP contributes constructively to economic stability, energy security and environmental sustainability.

The emission reductions for the programme during the preceding 12 months (June 2019-June 2020) is calculated as 15.1 million tonnes CO_2 (MtonCO_2) based on the 14 835 GWh energy that has been generated and supplied to the grid over this period. This represents 75% of the total projected annual emission reductions (20.5MtonCO_2) achieved with only partial operations. A total of 72.1 Mton CO_2 equivalent reduction has been realised from programme inception to date.

The March 2019 Report also notes that since operation, the IPPs have saved 42.8 million kilolitres of water related to fossil fuel power generation. This saving will have increased with the increase in energy generated by renewable energy since 2019. The REIPPPP therefore contributes significantly towards meeting South Africa's GHG emission targets and, at the same time, supporting energy security, economic stability, and environmental sustainability.

2.4.2 Green Jobs Study

The study notes that South Africa has one of the most carbon-intensive economies in the world, therefore making the greening of the electricity mix a national imperative. Within this context the study notes that the green economy could be an extremely important trigger and lever for enhancing a country's growth potential and redirecting its development trajectory in the 21st century. The attractiveness of wind and solar technologies is not only supported by local conditions, but also by the relatively mature stage of their technological development.

The aim of the Green Jobs study was to provide information on the net direct job creation anticipated to emerge in the formal economy across a wide range of technologies/activities that may be classified as green or contributing to the greening of the economy. The study looked at the employment potential for a number of green sectors, including power generation, over three consecutive timeframes, namely, the short term (2011 – 12), medium term (2013 – 17) and long term (2018 – 25). The analysis attempts to estimate the employment potential associated with: building, construction and installation activities; operations and maintenance services; as well as the possible localisation spin-offs for the manufacturing sector as the domestic production of equipment, parts and components benefits from preferential local procurement.

It is also worth noting that the study only considered direct jobs in the formal economy. Multiplier effects were not taken into account. As a result, the analysis only captures a portion of the potential employment impact of a greening economy. International studies have indicated that there are considerable backward and forward linkages through various value chains of production, as well as of indirect and induced employment effects. The employment figures can therefore be regarded as conservative.

The analysis reveals the potential of an unfolding green economy to lead to the creation of approximately 98 000 new direct jobs, on average, in the short term, almost 255 000 in the medium term and around 462 000 employment opportunities in the formal economy in the long term. The number of jobs linked to the power generation was estimated to be ~ 12 500 in the short term, 57 500 in the medium term and 130 000 in the long term. Power generation jobs therefore account for 28% of the employment opportunities created in the long term. However, the report notes that the contribution made by a progressively expanding green energy generation segment increases from 14% of the total in the short term, or just over 13 500 jobs, to more than 28% in the long term (166 400) (Table 2.3). The study also found that energy generation is expected to become an increasingly important contributor to green job creation over time, as projects are constructed or commissioned.

Table 2.3: Net direct employment potential estimated for the four broad types of activity and their respective segments in the long term, and an indication of the roll-out over the three timeframes

Broad green economy category		Segment	Technology/product	Total net direct employment potential in the long-term	Net direct manufacturing employment potential in the long-term	Total net direct employment potential (ST, MT, LT)	Net direct manufacturing employment potential (ST, MT, LT)
ENERGY GENERATION	Renewable (non-fuel) electricity	Wind power	Onshore wind power	5 156	2 105	VL, L, M	L, M, H
			Offshore wind power				
		Solar power	Concentrated solar power	3 014	608	N, VL, M	N, VL, M
			Photovoltaic power	13 541	8 463	M, H, H	H, VH, VH
		Marine power	Marine power	197	0	N, N, VL	N, N, N
		Hydro power	Large hydro power	272	111	VL, VL, VL	VL, M, VL
			Micro-/small-hydro power	100	0	VL, VL, VL	N, N, N
	Fuel-based renewable electricity	Waste-to-energy	Landfills	1 178	180	VL, VL, L	VL, VL, L
			Biomass combustion	37 270	154	VL, H, VH	VL, VL, L
			Anaerobic digestion	1 429	591	VL, VL, L	VL, L, M
			Pyrolysis/Gasification	4 348	2 663	VL, L, M	VL, H, H
			Co-generation	10 789	1 050	L, M, H	M, H, H
	Liquid fuel	Bio-fuels	Bio-ethanol	52 729	6 641	M, H, VH	L, H, VH
			Bio-diesel				
ENERGY GENERATION SUB-TOTAL				130 023	22 566		
ENERGY & RESOURCE EFFICIENCY		Green buildings	Insulation, lighting, windows	7 340	838	L, M, M	L, M, M
			Solar water heaters	17 621	1 225	L, H, H	L, M, H
			Rain water harvesting	1 275	181	VL, VL, L	VL, VL, L
		Transportation	Bus Rapid Transport	41 641	350	VH, VH, VH	H, M, L
		Industrial	Energy efficient motors	-566	4	VL, VL, VL	VL, VL, VL
			Mechanical insulation	666	89	VL, VL, VL	VL, VL, VL
ENERGY & RESOURCE EFFICIENCY SUB-TOTAL				67 977	2 686		
EMMISIONS AND POLLUTION MITIGATION		Pollution control	Air pollution control	900	166	N, VL, VL	N, L, L
			Electrical vehicles	11 428	10 642	VL, L, H	N, H, VH
			Clean stoves	2 783	973	VL, VL, L	VL, L, M
			Acid mine water treatment	361	0	VL, VL, VL	N, N, N
		Carbon Capture and Storage		251	0	N, VL, VL	N, N, N
		Recycling		15 918	9 016	M, H, H	H, VH, VH
EMMISIONS AND POLLUTION MITIGATION SUB-TOTAL				31 641	20 797		
NATURAL RESOURCE MANAGEMENT		Biodiversity conservation & eco-system restoration		121 553	0	H, VH, VH	N, N, N
		Soil & land management		111 373	0	VH, VH, VH	N, N, N
NATURAL RESOURCE MANAGEMENT SUB-TOTAL				232 926	0		
TOTAL				462 567	46 049		

(Source: Green Jobs Study, 2011)

Notes:

- VH = very high (total employment potential > 20 000 direct jobs; manufacturing employment potential > 3 000 direct jobs);
- H = high (total employment potential > 8 000 but < 20 000; manufacturing employment potential > 1 000 but < 3 000);
- M = medium (total employment potential > 3 000 but < 8 000; manufacturing employment potential > 500 but < 1 000);
- L = low (total employment potential > 1 000 but < 3 000; manufacturing employment potential > 150 but < 500);

- VL = very low (total employment potential > 0 but < 1 000; manufacturing employment potential > 0 but < 150);
- N = negligible/none (total employment potential = 0; manufacturing employment potential = 0).

Of relevance the study also notes that the largest gains are likely to be associated with operations and maintenance (O&M) activities, particularly those involved in the various natural resource management initiatives. In this regard, operations and maintenance employment linked to renewable energy generation plants will also be substantial in the longer term. The employment growth momentum related to building, construction and installation activities peaks in the medium term, largely propelled by mass transportation infrastructure, stabilising thereafter as green building methods become progressively entrenched.

In addition, as projects related to a greening economy are progressively commissioned, the potential for local manufacturing also become increasingly viable. Employment gains in manufacturing are also expected to be relatively more stable than construction activities, since the sector should continue exhibiting growth potential as new and replacement components are produced, as additional markets are penetrated, and as new green technologies are introduced. Manufacturing segments with high employment potential in the long term would include suppliers of components for wind and solar farms. The study does note that a shortage of skills in certain professional fields pertinent to renewable energy generation presents a challenge that must be overcome.

The study also identifies a number of advantages associated with renewable energy with a large 'technical' generation potential. In this regard, renewable energy, such as solar and wind, does not emit carbon dioxide (CO_2) in generating electricity and is associated with exceptionally low lifecycle emissions. The construction period for renewable energy projects are much shorter than those of conventional power stations, while an income stream may, in certain instances, be provided to local communities through employment and land rental. The study also notes that the greenhouse gases (GHG) associated with the construction phase are offset within a short period of time compared with the project's lifespan. Renewable power therefore provides an ideal means for reaching emission reduction targets in a relatively easy manner. In addition, and of specific relevance to South Africa, renewable energy source is not dependent on water (as compared to the massive water requirements of conventional power stations), has a limited footprint and therefore does not impact on large tracts of land, poses limited pollution and health risks, specifically when compared to coal and nuclear energy plants.

Of relevance, the study also notes that renewable energy projects in rural areas create an opportunity to benefit the local and regional economy through the creation of jobs and tax revenues.

2.4.3 Powering the Future: Renewable Energy Roll-out in South Africa

The study notes that South Africa has higher CO_2 emissions per GDPppp (2002 figures) from energy and cement production than China or the USA (Letete, T et al). Energy accounts for 83% of the total GHG emissions (excluding land use, land use change and forestry) with fuel combustion in the energy industry accounting for 65% of the energy emissions of South Africa (DEA, 2011).

Within a broader context of climate change, coal energy does not only have environmental impacts, it also has socio-economic impacts. Acid mine drainage from abandoned mines in

South Africa impacts on water quality and poses the biggest threat to the country's limited water resources. Huge volumes of water are also required to wash coal and cool operating power stations. Eskom uses an estimated 10 000 litres of water per second due to its dependency on coal (Greenpeace, 2012).

The report notes that the concerns relating to whether South Africa can afford renewable energy arise out of the perception that renewable energy (RE) is expensive while fossil and nuclear technologies are cheap. The premise also ignores life cycle costing of the technologies which is favourable to renewable technologies where the sources of fuel are free or cheap.

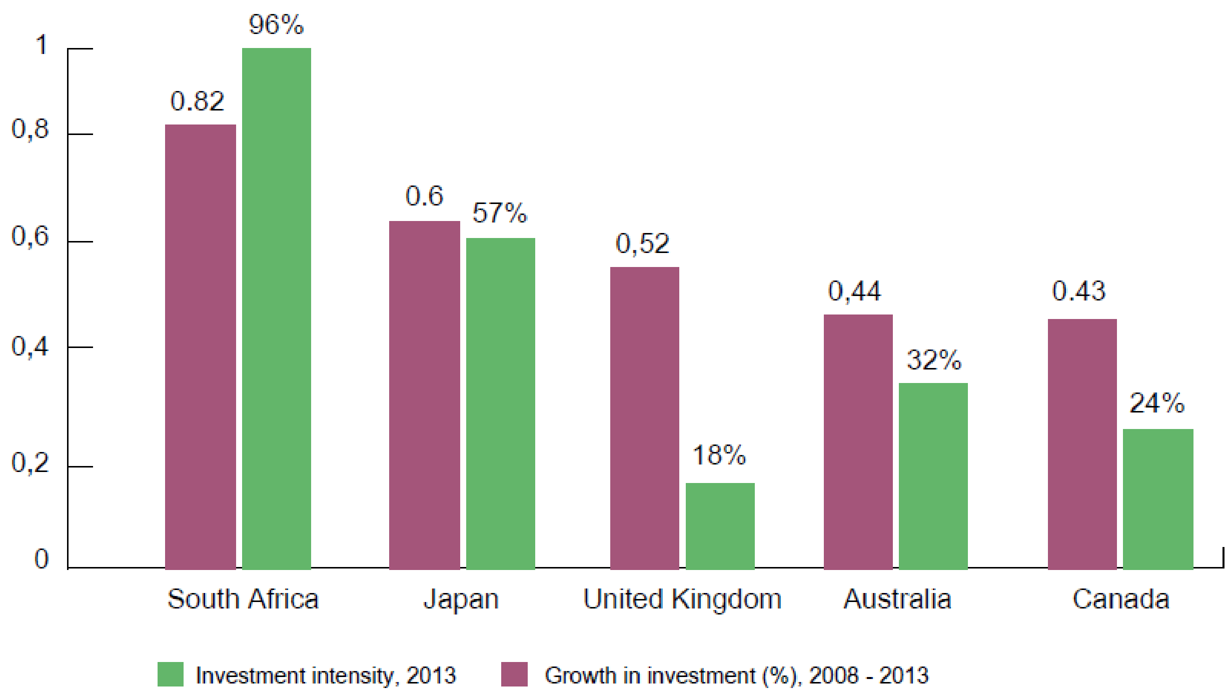
2.4.4 WWF SA Renewable Energy Vision 2030

In its vision the WWF motivated for a more ambitious plan, suggesting that the IRP should provide for an 11-19% share of electricity capacity by 2030, depending on the country's growth rate over the next fifteen years. The vision is to increase renewable energy at the expense of new coal-fired and nuclear capacity. The report notes that in addition to the obvious environmental benefits of this scenario, it will enable South Africa to add flexibility to energy supply capacity on an on-demand basis.

The report notes that Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) introduced in 2011, has by all accounts been highly successful in quickly and efficiently delivering clean energy to the grid. Increasingly competitive bidding rounds have led to substantial price reductions. In this regard, the study indicates that in three years, wind and solar PV have reached pricing parity with supply from new coal-fired power stations from a levelised cost of electricity (LCOE) perspective.

In bidding window 3 of August 2013, the average tariffs bid for wind and solar PV were R0,66/kWh and R0.88/kWh respectively, well below the recent estimates of R1.05/kWh for supply from the coal-fired Medupi and Kusile power stations (Papapetrou 2014).

The report also notes that the REIPPPP has several contracting rounds for new renewables supply. A robust procurement process, extension of a 20-year sovereign guarantee on the power purchase agreement (PPA) and, especially, ideal solar power conditions, have driven the investment case for RE in South Africa. In this regard, South Africa has been identified as one of the worlds' leading clean energy investment destinations (Figure 2.1).



Source: *Pew (2014)*

Notes: *Investment intensity is defined as clean energy investment per dollar of GDP.*

Figure 2.1: South Africa leads as a clean energy investment destination

With regard to local economic development, the REIPPPP sets out various local economic development requirements with stipulated minimum threshold and aspirational targeted levels, which each bidder must comply with. Based on the Broad-Based Black Economic Empowerment Codes, this requirement comprises the following components which make up a scorecard:

- Ownership by black people and local communities.
- Job creation.
- Local content.
- Management control.
- Preferential procurement.
- Enterprise development.
- Socio-economic development.

The final award is based on a combined evaluation in which price determines 70% of the ranking and performance on the local economic development scorecard the remaining 30%. This gives non-price criteria a much heavier weighting than they would normally enjoy under Government's preferential procurement policy.

Job creation, local content and preferential procurement accounted for the bulk of possible points on the scorecard in REIPPPP Round 3. Consequently, a requirement to source goods and services locally is considered to be the central driver of project costs associated with local economic development. In terms of local content, the definition of local content is quite broad, being the value of sales less the costs associated with imports. However, through successive bidding rounds, the definition has become subject to more detailed definition, with an expanding list of exclusions and increased targeting in terms of key components identified by the Department of Trade and Industry for local manufacturing. This has benefitted local manufacturers and suppliers.

The WWF study considers a low and high growth renewable energy scenario. The capital requirements for the low growth scenario are estimated at R474 billion over the period 2014-2030 (2014 Rand value), rising to R1.084 trillion in the high-growth scenario, in which 35 GW of capacity is built. Each annual round of purchasing 2 200 MW of RE capacity would cost approximately R77 billion in 2014 Rand value terms. In relative economic terms, this equates to 2% of the GDP per annum or approximately one quarter of Government's planned annual investment in infrastructure over the medium term. In the low economic growth scenario, which is arguably the more realistic one, the average annual new liability over the period is approximately R40 billion.

The study also points out that infrastructure spend is more beneficial than other government expenditure due to the infrastructure multiplier effect. This refers to the beneficial impact of infrastructure on economic growth in both the short term, resulting from expansion in aggregate demand, as well as in the longer term (six to eight years) due to enhanced productive capacity in the economy. A recent USA study on highway expenditure revealed the infrastructure multiplier to be a factor of two on average, and greater during economic downturns (Leduc & Wilson 2013). This means that one dollar spent on infrastructure raises GDP by two dollars. If the same were to hold true, as similar analysis suggests it would (Kumo 2012, Ngandu et al 2010), this indicates that the construction of renewable energy plants could be a valuable economic growth driver at a time when fears of recession abound.

The report concludes that the WWF is optimistic that South Africa can achieve a much more promising clean energy future than current plans allow for. With an excellent solar resource and several good wind-producing pockets, the country is an ideal candidate for a renewable energy revolution.

The report indicates that the levelised cost of producing renewable energy already competes favourably with the three main alternatives, namely coal, gas and nuclear. In addition, renewable energy would contribute to a more climate-resilient future and insulate South Africa from dependence on expensive and unreliable fuel sources priced in dollars. Critical from a planning perspective, the report notes that renewable energy can also provide added flexibly on an 'as needed' basis, as electricity demand grows. This is vital in a highly uncertain environment.

2.4.5 The impact of the green economy on jobs in South Africa

The paper notes that greening the economy is particularly important in South Africa for two basic reasons: (1) the exceptional level of unemployment that the country is experiencing and (2) the high carbon impact of the economy.

In terms of employment, the paper refers to the IDC *Green Jobs R*eport (2011). In summary, the short-term (next 2 years) estimate of total net employment potential is 98 000 jobs, and the long-term (next 8 years) employment potential is 462 567 jobs. Natural resource management is predicted to lead to the greatest number of these at 232 926 long-term jobs. Green energy generation is estimated to produce 130 023 long-term jobs, with energy and resource efficiency measures adding another 67 977 long-term jobs.

The paper notes that the Green Jobs Report was prepared by seventeen primary researchers from three prominent organisations, namely the IDC, the Development Bank of South Africa, and Trade and Industrial Policy Strategies. Many role players from other organisations were also consulted, including the World Wide Fund for Nature, the Green Building Council, the Economic Development Department and private companies involved in green industries.

Despite questions surrounding the employment estimates contained in the Green Jobs Report, green economic activity does appear to generate more local jobs than fossil-fuel-based industries. Some of the estimates also indicate the potential for significant employment. The paper concludes that the figures represent a promising starting point that warrants further research and policy involvement in greening the economy in South Africa.

2.4.6 The potential for local community benefits

In her thesis, Tait[8] notes that the distributed nature of renewable energy generation can induce a more geographically dispersed pattern of development. As a result, RE sites can be highly suited to rural locations with otherwise poor potential to attract local inward investment therefore enabling to target particularly vulnerable areas.

In her conclusion, Tait notes that the thesis has found positive evidence for the establishment of community benefit schemes in the wind sector in South Africa. These benefits would also apply to solar projects. The BBBEE requirements for developers as set out in the DoE's IPPPP for renewables is the primary driver for such schemes. The procurement programme, in keeping with the objective of maximising the economic development potential from this new sector, includes a specific focus on local communities in which wind farms are located.

The procurement programme, typical of all Government tendering processes, includes a BBBEE scorecard on which renewable energy projects are evaluated. However, the renewables scorecard appears to play an important part in a renewed focus on the broad-based Aspects of the legislation, as enforced by a recent national review of the BBBEE Act. In this regard, the renewables scorecard includes specifications for local communities in respect of broad-based ownership schemes, socio--economic development and enterprise development contributions. This approach to legislating social responsibilities of business in all sectors definitely has a South African flavour, borne out of the political history of the country and the imperatives for social transformation laid out in the constitution.

While Tait notes that it is still early days for the development of this sector and one cannot determine the impact that such benefit schemes may have, it is clear though that targeted development expenditure will be directed to multiple rural communities and there seems to be a strong potential to deliver socio-economic benefits.

[8] The potential for local community benefits from wind farms in South Africa, Louise Tait (2012), Master's Thesis, Energy Research Centre University of Cape Town

SECTION 3: OVERVIEW OF STUDY AREA

3.1 INTRODUCTION

Section 3 provides a baseline description of the study area with regard to:

- The administrative context.
- Provincial context.
- Overview of district and local municipalities.
- Site and the surrounding land uses.

3.2 ADMINISTRATIVE CONTEXT

The study area is located within the Msukaligwa Municipality (MM) within the Mpumalanga Province. The MM is one of the seven Local Municipalities that make up the Gert Sibande District Municipality (Figure 3.1). The town of Ermelo is the administrative seat of the MM.

Figure 3.1: Location of Msukaligwa Municipality within the Gert Sibande District Municipality and Mpumalanga Province.

3.3 DEMOGRAPHIC OVERVIEW

Population

The population of the MM in 2016 was 164 608 (Community Household Survey 2016). Of this total, 35.4% were under the age of 18, 60.4% were between 18 and 64, and the remaining 4.1% were 65 and older. The MM therefore had a high percentage of the population that fall within the economically active group of 18-65. The figures are higher than the figures for the GSDM and Mpumalanga (57.7% and 56.6% respectively). This is likely to be due to the employment opportunities associated with the mining and manufacturing activities in the MM.

The dependency ratio is the ratio of non-economically active dependents (usually people younger than 15 or older than 64) to the working age population group (15-64). The higher the dependency ratio the larger the percentage of the population dependent on the economically active age group. This in turn translates to reduced revenue for local authorities to meet the growing demand for services. The traditional approach is based people younger than 15 or older than 64. The information provided provides information for the age group under 18. The total number of people falling within this age group will therefore be higher than the 0-15 age group. However, most people between the age of 15 and 17 are not economically active (i.e., they are likely to be at school).

Using information on people under the age of 18 is therefore likely to represent a more accurate reflection of the dependency ratio. Based on these figures, the dependency ratios for the MM, the GSDM and Mpumalanga in 2016 were 65.4%, 73.5% and 77% respectively. The high dependency ratios reflect the limited employment and economic opportunities in the area and the province as a whole. As indicated above, a high dependency ratio also places pressure on local authorities in terms of service delivery.

In terms of race groups, Black Africans made up 91.6% of the population on the MM, followed by Whites, 6.9% and Asian or Indians, 0.9%, and Coloureds, 0.6%. This figures for the GSDM are similar. The main first language spoken in the MM was isizulu, 79.1%, followed by Siswati, 7.3% and Afrikaans, 6.2%.

Households and house types

The total number of households in the MM in 2016 was 51 090, which constituted approximately 20% of the total number of households in the GSDM. Of these 66.2% were formal houses, 9.1% flats in backyards, 6.6% traditional dwellings, and 9.4% shacks or informal dwellings. The figures for the GSDM were 67.2%, 4.6%, 6.7% and 13.4% respectively. The majority of dwellings in the MM are therefore formal structures. A relatively large percentage of the properties in the MM (43.3%), while 5.9% were owned and in the process of being paid off. 22.1% of the households rented their properties, while 10.6% occupied their properties rent free. The rent-free figure is likely to be associated with farm workers. The relatively high number of properties that are owned and or in the process of being paid off reflects a relatively stable and established community.

In terms of household heads, approximately 38.9% of the households in the MM and 39.1% of the households in the GSDM were headed by women. These figures similar to the provincial figure of 39.71%. The high percentage of households headed by women reflects the likelihood that the men have left the area in search of employment opportunities in Gauteng. Women headed households tend to be more vulnerable.

Household income
Based on the data from the 2011 Census, 12.6% of the population of the MM had no formal income, 4.1% earned less than R 4 800, 7.1% earned between R 5 000 and R 10 000 per annum, 17.7% between R 10 000 and R 20 000 per annum and 20.9% between R 20 000 and 40 000 per annum (2016). The poverty gap indicator produced by the World Bank Development Research Group measures poverty using information from household per capita income/consumption. This indicator illustrates the average shortfall of the total population from the poverty line. This measurement is used to reflect the intensity of poverty, which is based on living on less than R3 200 per month for an average sized household (~ 40 000 per annum). Based on this measure, in the region of 62.4% of the households in the MM and 65.2% in the GSDM live close to or below the poverty line. The low-income levels reflect the rural nature of the local economy and the limited formal employment opportunities outside in the urban areas. This is also reflected in the high unemployment rates. The low-income levels are a major concern given that an increasing number of individuals and households are likely to be dependent on social grants. The low-income levels also result in reduced spending in the local economy and less tax and rates revenue for the MM. This in turn impacts on the ability of the MM to maintain and provide services.

Household income levels are likely to have been impacted by the COVID-19 pandemic. The number of households in the MM and GSDM that live close to or below the poverty line is likely to have increased over the last 18 months. This, coupled with the high dependency ratio, is a major cause of concern for the area.

Employment
The official unemployment rate in the MM in 2016 was 15.6%, while 42.6% were employed, and 36.4% were regarded as not economically active. However, the COVID-19 pandemic is likely to have resulted in an increase in unemployment rates in both the ULM and Ward 3. Recent figures released by Stats South Africa also indicate that South Africa's unemployment rate is in the region of 36%, the highest formal unemployment rate in the world.

Education
In terms of education levels, the percentage of the population over 20 years of age in the MM and GSDM with no schooling was 10.6% (2016), compared to 10.8% and 11.3% for the GSDM and Mpumalanga Cape Province. The percentage of the population over the age of 20 with matric was 34.12%, compared to 34.3% and 36.1% for the GSDM and Mpumalanga. The education levels for the MM are therefore similar to the DM and Provincial figures.

3.4 MUNICIPAL SERVICES

Electricity
Based on 2016 survey, 87% of households in the MM had access to electricity, compared to 90% for the GSDM and 93% for Mpumalanga.

Access to water
Based on the 2016 survey information, 81.7% of households in the MM were supplied by a service provider, while 5.8% relied on their own service or natural sources (4%). The reliance on own services or natural sources reflects the rural nature of large parts the MM.

Sanitation
72.3% of the households in the MM had access to flush toilets (2016), while 18.8% relied on pit toilets and 3.2% had no access to formal sanitation. The high percentage of

households that rely on pit toilets is linked to the relatively high percentage (9.4%) of households that live in shacks.

Refuse collection

Only 59.4% of the households in the MM had access to regular refuse removal service, while 16.5% disposed of their waste at their own dump and 7.1% had not access to facilities. The low percentage of households that have access to regular refuse removal services is linked to the relatively high percentage (9.4%) of households that live in shacks. The relatively higher percentage that dispose of their waste at their own dump reflects the rural nature of the area and the difficulty of providing municipal services to areas located at a distance from the main towns in the area.

3.5 HEALTH, EDUCATION AND COMMUNITY FACILITIES

Health Services

The MM IDP indicates that there is 1 government and 1 private hospital in the MM, 10 primary health care clinics, and 4 mobile clinics (Table 3.1).

Table 3.1: Health services in Msukaligwa Municipality

Facilities	Number
Private Hospitals	1
Primary Health Care Clinics	10
Mobile Clinics	4
Government hospitals	1
Infectious Hospital (TB)	1
Dentists	4
Gynaecologist	1
Social Workers	12
Private Doctors	20

Educational Facilities

The MM IDP indicates that there are 71 primary schools, 6 high schools, 12 combined schools and 11 secondary schools in the MM. There is 1 FET College, but no tertiary facility (Table 3.2). The IDP notes that given the growth in the area there is a need for at least a tertiary institution within the GSDM. Development within Ermelo has also created a need for more primary and high schools.

Table 3.2: Educational Facilities in Msukaligwa Municipality

Facility	Number
No. of Primary Schools	71
No. of High School	6
No. of Combined Schools	12
No. of Secondary Schools	11
No. of Tertiary Education Facilities	0
No. of FET Colleges	1
No. of Training Centres/Adult Education	9
No. of Private Schools	3
Day Care Centres	40

Community Facilities

Table 3.3 lists the community facilities in the MM. As indicated in the table, Ermelo as the administrative centre is relatively well catered for in terms of community facilities, including police stations, sports facilities, libraries, community halls and pension pay out points. However, Sheepmoor, which is the closest rural settlement to the development area does not have a library and the sports facility is an informal soccer field.

Table 3.3: Community facilities

Area/Town	Police Station	Public Sport Facilities	Public Libraries	Community Halls	MPCC/TSC	Post Offices	Pension pay points	Comments
Breyten/KwaZanele	1	4	2	2	1	1	1	There is one informal soccer field at Breyten
Ermelo, Wesselton, Cassim Park and Thusiville	2	9	4	5	-	1	2	There are five informal soccer field at Wesselton. The Thusiville library is completed but not yet operating.
Chrissiesmeer/Kwachibikhulu	1	1	1	1	-	1	1	There is one informal soccer field at Chrissiesmeer
Davel/Kwadela	1	2	1	1	-	1	1	There is one informal soccer field at KwaDela. There is a complaint that the existing library at Davel is far from the majority users who reside at KwaDela.
Lothair/Silindile	1	1	1	1	1	1	1	The TSC is almost completed and postal services run by agency at Lothair
Sheepmoor	1	1	-	1	-	1	1	There is one informal soccer field at Sheepmoor. No library at Sheepmoor
Warburton/Nganga	-	1	-	-	-	1		Postal services run by agency at Warburton. The sport facility is an informal soccer field. No library service at Warburton.
TOTAL	**7**	**19**	**8**	**11**	**2**	**6**		

3.6 ECONOMIC OVERVIEW

The economic growth rate for Msukaligwa was at 3.0% per annum on average over the period 1996 to 2017 and forecasted average annual GDP growth for 2017-2022 relatively low at 1.3%. The contribution of Msukaligwa to the Mpumalanga economy was around 4.3%, making it the fifth largest local economy in the province. It is the second largest economy in the District, contributing around 15.5%. The key economic sectors in the MM in 2017 in terms of contribution to GDP were mining (20.3%), community services (18.5%), trade (including industries such as tourism) (18.2%) and finance (14.2%) (Table 3.4). Despite the importance of agriculture, it only contributed 6% to GDP in 2017. The IDP notes that the MM has a comparative advantage in economic sectors such as agriculture, transport, and mining.

Table 3.4: Contribution of sectors to Msukaligwa Municipality GDP

Economic Sector	**2014**	**2017**	**Change**
Agriculture	5,3%	6,0%	0,7%
Community Services	18,4%	18,5%	0,1%
Construction	2,7%	2,7%	0,0%
Finance	13,3%	14,2%	0,9%
Manufacturing	5,1%	5,1%	0,0%
Mining	20,8%	20,3%	-0,5%
Trade	18,5%	18,2%	-0,3%
Transport	11,3%	11,3%	0,0%
Utilities	4,5%	3,8%	-0,7%

Finance and Agriculture achieved the highest, although slight, growth in contribution from 2014 to 2017. The contribution of utilities, mining and trade declined slightly.

In terms of employment, the trade sector (20.6%) was the most important sector in terms of employment, followed by community services (15.3%), mining (12.8%), finance (11.6%) and manufacturing (10.1%) (Table 3.5).

Table 3.5: Contribution to employment of sectors in Msukaligwa Municipality

Employment Sector	**2014**	**2017**	**Change**
Agriculture	6%	6,3%	0,3%
Community Services	14,5%	15,3%	0,8%
Construction	7,9%	8,5%	0,6%
Finance	11,2%	11,6%	0,4%
Manufacturing	9,9%	10,1%	0,2%
Mining	14,7%	12,8%	-1,9%
Trade	21,1%	20,6%	-0,5%
Transport	4,5%	4,7%	0,2%
Utilities	2,5%	2,4%	-0,1%

In terms of unemployment, the MM unemployment rate was the 6th lowest among all the municipal areas of Mpumalanga. The unemployment rate deteriorated slightly from 23.1% in 2014 to 24.1% in 2017. Unemployment rates are higher for females at 29.8% and for males at 24.1%. However, youth unemployment at 34.5% is a key concern.

The IDP notes that in terms of future economic development, coal mining can be expected to remain an important sector for the short to medium term. However, the role of this sector is expected to decline in the medium to long term due to limited coal resources, and a move away from a coal-based economy locally and globally due the impact on climate. The current transport and logistics sector is also likely to be impacted on by a decline in coal mining.

3.7 OVERVIEW OF STUDY AREA

3.7.1 Introduction

The study area is located ~ 30 km to the east of the town of Ermelo, which is the administrative centre of the MM (Figure 3.2). Ermelo is the administrative seat of both the Msukaligwa Local Municipality (MLM) and the Gert Sibande District Municipality (GSDM) and is also known as the garden city of Mpumalanga and the gateway to the province. The small settlement of Sheepmoor is located to the south of the study area (Photograph 3.1).

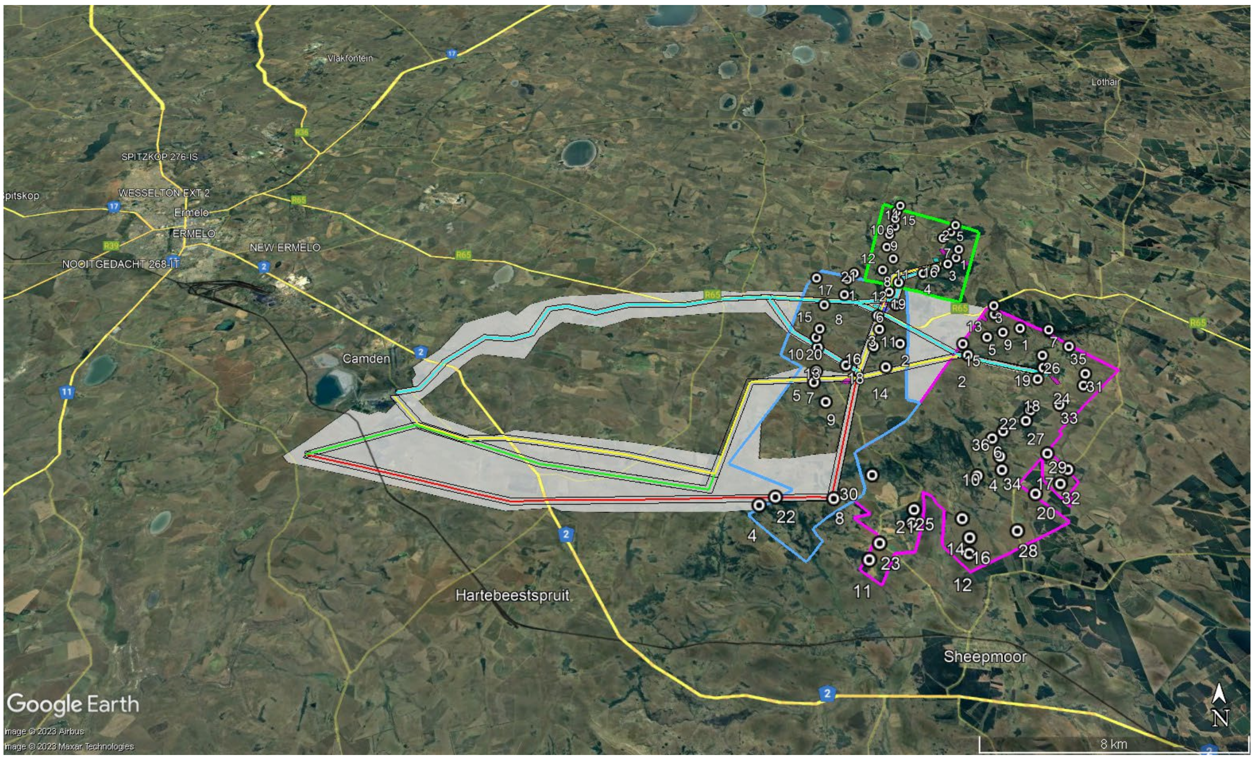


Figure 3.2: Location of study area. Emvelo WEF study area (pink outline)

Photograph 3.1: Sheepmoor settlement

Three national highways, namely the N2, N11 and the N17 intersect at Ermelo. The N2 freeway connects Ermelo with Richards Bay on the KwaZulu Natal coastline. The N11 South connects the town to Newcastle to the south and then onto the Ladysmith before linking up with the N3 to Durban. The N11 north connects to Middelburg and the N4 freeway west to Pretoria. The N17 West connects the town to the southern suburbs of Johannesburg and N17 East to eSwatini.

Ermelo is also a major railway junction between Mpumalanga and KwaZulu-Natal. The rail junction connects to Machadodorp which is on the Pretoria and Maputo railway line. The town also lies on the Richards Bay railway line that connects the Mpumalanga coalfields with the export Port of Richards Bay on the Indian Ocean. The N2 and Richards Bay railway line run to the south of the study area. The proposed Emvelo WEF project is located to the north of the N2 and south of the R65 (Figure 3.2). The grid connections run in an east west direction linking up with the Camden substation located adjacent to Eskom's Camden Power Station, located ~ 31 km to the west of the study area (Photograph 3.2).

Construction of the 1600 MW power station commenced in November/December 1962 and the first turbo-generator was commissioned in April 1967. The last of the eight units was commissioned in 1969. The Camden Power station became the starting point of the national power grid, consisting of a series of 400 kV lines which today interconnect the entire country. The power station has six 111.86 m high cooling towers and four 154 chimney (smoke stacks) that served 8 boilers. Between 1990 and 2006 the station was mothballed, but South Africa's energy crisis in the early 21st century prompted Eskom to recommission the station, starting with unit 6 in July 2005 and completing with unit 1 in July 2008. The development of the Camden Power station also involved the construction of the village of Camden, located ~ 1.3km to the north of the power station.

Photograph 3.2: Camden Power Station

The general topography of the study area consists of rolling hills to the north of Sheepmoor (Photograph 3.3 and 3.4) that rises to a higher lying escarpment (Photograph 3.5 and 3.6). The land uses consist of dryland agriculture (maize) and livestock.

The study area is not located within a designated Renewable Energy Development Zone (REDZ). No operational REFs are currently located within significant proximity of the site. The DFF&E's Renewable Energy applications interactive viewer (last updated February 2022) indicates no historic applications within a 35 km radius of the site. In addition to the three WEFs proposed by Mulilo, two WEFs and a Solar Energy Facility area proposed in the vicinity of the Camden Power Station (Enertrag).

Photograph 3.2: Area to the north of Sheepmoor

Photograph 3.3: Area to the north of Sheepmoor

Photograph 3.4: Area on escarpment to the north of Sheepmoor

Photograph 3.5: View looking east along R65 with study area to the right

SECTION 4: ASSESSMENT OF KEY SOCIAL ISSUES

4.1 INTRODUCTION

Section 4 provides an overview of key social issues identified that will be assessment during the Assessment Phase. The identification of key issues was based on:

- Review of project related information.
- Experience/ familiarity of the author with the area and local conditions.
- Experience with similar projects.

The section is divided into the following sections:

- Compatibility with relevant policy and planning context ("planning fit").
- Social issues associated with the construction phase.
- Social issues associated with the operational phase.
- Social issues associated with the decommissioning phase.
- Social implications of "no development" alternative.
- Social implications associated with cumulative impacts.

The key issues and significance ratings will be confirmed during the assessment phase.

4.2 ASSESSMENT OF POLICY AND PLANNING FIT

The development of renewable energy is strongly supported at a national, provincial, and local level. The development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all refer to and support renewable energy. The development of renewable energy is also supported by the MMSDF. In this regard the SDF acknowledges the importance of the mining sector and notes that it will need to be accommodated over the short to medium term. However, of relevance to the proposed development the SDF refers to green industries and indicates that the existing site of the Camden Power Station and surrounds should be made available for new industrial development in the long term, to manage the long-term impact of the Power Station being decommissioned.

4.3 CONSTRUCTION PHASE SOCIAL IMPACTS

Potential positive impacts

- Creation of employment and business opportunities, and opportunity for skills development and on-site training.

Potential negative impacts

- Impacts associated with the presence of construction workers on local communities.
- Impacts related to the potential influx of jobseekers.
- Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site.
- Increased risk of grass fires associated with construction related activities.

- Nuisance impacts, such as noise, dust, and safety, associated with construction related activities and vehicles.
- Impact on productive farmland.

4.3.1 Creation of local employment, training, and business opportunities

The construction phase will extend over a period of approximately 18-24 months and create in the region of 200-250 employment opportunities that will benefit members from the local communities in the area, specifically Ermelo. These opportunities will include opportunities for low, semi and highly workers. Most of the employment opportunities will accrue to Historically Disadvantaged (HD) members of the community. A percentage of the wage bill will be spent in the local economy which will also create opportunities for local businesses in the local towns in the area, specifically Ermelo. Given relatively high local unemployment levels and limited job opportunities in the area, this will represent a significant, if localised, social benefit. Based on information from similar projects the total wage bill will be in the region of R 25 million (2023 Rand values). A percentage of the wage bill will be spent in the local economy which will also create opportunities for local businesses in the local towns in the area.

The capital expenditure will be approximately R 6 billion (2023 Rand value) and will create opportunities for local businesses. Due to the presence of the mining and energy sector, there are likely to suitably qualified companies in Ermelo that can provide the required services and products. The local service sector will also benefit from the construction phase. The potential opportunities would be linked to accommodation, catering, cleaning, transport, and security, etc. associated with the construction workers on the site. The hospitality industry in the area will also benefit from the provision of accommodation and meals for professionals (engineers, quantity surveyors, project managers, product representatives etc.) and other (non-construction) personnel involved on the project. Experience from other construction projects indicates that the potential opportunities are not limited to on-site construction workers but also to consultants and product representatives associated with the project.

The potential benefits for local communities are confirmed by the findings of the Overview of the IPPPP undertaken by the Department of Energy, National Treasury and DBSA (June 2020). The study found that to date, a total of 52 603 job years[9] have been created for South African citizens, of which 42 355 job years were in construction and 10 248 in operations. To date, 42 355 job years for SA citizens were achieved during construction, which is 26% above the planned 33 707 job years for active projects. These job years are expected to rise further since 23BW4 projects are still in or entering, construction.

In terms of benefits for local communities, significantly more people from local communities were employed during construction than was initially planned. For active projects, the expectation for local community participation was 13 284 job years. To date 22 935 job years have been realised (i.e. 73% more than initially planned), with 23 projects still in, or entering, construction. The number of black SA citizens employed during construction also exceeded the planned numbers by 53%.

Black South African citizens, youths and rural or local communities have been the major beneficiaries during the construction phases, as they respectively represent 81%, 43% and

[9] The equivalent of a full-time employment opportunity for one person for one year.

49% of total job opportunities created by IPPs to date. However, woman and disabled people could still be significantly empowered as they represent a mere 10% and 0.4% of total jobs created to date, respectively. Nonetheless, the fact that the REIPPPP has raised employment opportunities for black South African citizens and local communities beyond planned targets, indicates the importance of the programme to employment equity and the drive towards more equal societies.

The share of black citizens employed during construction (81%) and the early stages of operations (84%) has significantly exceeded the 50% target and the 30% minimum threshold. Likewise, the share of skilled black citizens (as a percentage of skilled employees) for both construction (69%) and operations (80%) has also exceeded the 30% target and minimum threshold of 18%. The share of local community members as a share of SA-based employees was 49% and 68% for construction and operations respectively – exceeding the minimum threshold of 12% and the target of 20%.

Table 4.1: Impact assessment of employment, skills development, and business creation opportunities during the construction phase

Impact Phase: Construction							
Potential impact description: Creation of employment and business opportunities during the construction phase							
	Extent	**Duration**	**Severity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Positive	Medium	M	High
With Mitigation/ Enhancement	H	L	H	Positive	Medium	H	High
Can the impact be reversed?			Yes: By not implementing the project				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, see below				

Assessment of No-Go option
There is no impact as the current status quo would be maintained.

Recommended enhancement measures
In order to enhance local employment and business opportunities associated with the construction phase the following measures should be implemented:

Employment
- Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase.
- Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
- Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria.
- Before the construction phase commences the proponent should meet with representatives from the MM to establish the existence of a skills database for the area.

If such as database exists, it should be made available to the contractors appointed for the construction phase.

- The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project.
- Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
- The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Business

- The proponent should liaise with the MM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g., construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction service providers. These companies should be notified of the tender process and invited to bid for project-related work.

Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.

4.3.2 Impact of construction workers on local communities

The presence of construction workers poses a potential risk to family structures and social networks. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on local communities. The most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to potentially risky behaviour, mainly of male construction workers, including:

- An increase in alcohol and drug use.
- An increase in crime levels.
- The loss of girlfriends and/or wives to construction workers.
- An increase in teenage and unwanted pregnancies.
- An increase in prostitution.
- An increase in sexually transmitted diseases (STDs), including HIV.

The objective will be to source as many of the low and semi-skilled workers locally. These workers will be from the local community and form part of the local family and social networks. This will reduce the risk and mitigate the potential impacts on the local community. While it is possible to reduce the risks associated with construction workers it is not possible to totally avoid the potential impacts.

Table 4.2: Assessment of impact of the presence of construction workers in the area on local communities

Impact Phase: Construction							
Potential impact description: Potential impacts on family structures and social networks associated with the presence of construction workers							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Negative	Medium	M	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	L	High
Can the impact be reversed?		Yes, for some impacts but not all. The risk cannot be eliminated.					
Will impact cause irreplaceable loss or resources?		N/A					
Can impact be avoided, managed, enhanced and or mitigated?		Yes, see below					

Assessment of No-Go option
There is no impact as the current status quo would be maintained.

Recommended mitigation measures
- Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase.
- Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase.
- The SEP and CHSSP should include a Grievance Mechanism that enables stakeholders to report resolve incidents.
- Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories.
- The proponent and contractor should develop a Code of Conduct (CoC) for construction workers. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be subject to appropriate disciplinary action and/or dismissed. All dismissals must comply with the South African labour legislation. The CoC should be signed by the proponent and the contractors before the contractors move onto site. The CoC should form part of the CHSSP.
- The proponent and the contractor should implement an HIV/AIDS, COVID-19 and Tuberculosis (TB) awareness programme for all construction workers at the outset of the construction phase. The programmes should form part of the CHSSP.
- No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

4.3.3 Influx of job seekers

Large construction projects tend to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These job seekers can in turn become "economically stranded" in the area or decide to stay on irrespective of finding a job or not. While the proposed project on its own does not constitute a large construction project, the establishment of a number of renewable energy projects in the area may attract job seekers to the area. As in the case of construction workers employed on the project, the actual presence of job seekers in the area does not in itself constitute a social impact. However, the way in which they conduct themselves can impact on the local community. The main areas of concern associated with the influx of job seekers include:

- Impacts on existing social networks and community structures.
- Competition for housing, specifically low-cost housing.
- Competition for scarce jobs.
- Increase in incidences of crime.

These issues are similar to the concerns associated with the presence of construction workers and are discussed in Section 4.3.2. The findings of the SIA indicate that the potential for economically motivated in-migration and subsequent labour stranding is likely to be negligible. The risks associated with the influx of job seekers are therefore likely to be low.

Table 4.3: Assessment of impact of job seekers on local communities

Impact Phase: Construction							
Potential impact description: Potential impacts on family structures, social networks and community services associated with the influx of job seekers							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	L	Negative	Low	L	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	L	High
Can the impact be reversed?			Yes, for some impacts but not all. The risk cannot be eliminated.				
Will impact cause irreplaceable loss or resources?			N/A				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, see below				

Assessment of No-Go option
There is no impact as the current status quo would be maintained.

Recommended mitigation measures
It is impossible to stop people from coming to the area in search of employment. However, as indicated above, the proponent should ensure that the employment criteria favour residents from the area. In addition:

- Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase.
- Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase.
- The proponent should implement a “locals first” policy, specifically with regard to unskilled and low skilled opportunities.
- The proponent should implement a policy that no employment will be available at the gate.

4.3.4 Risk to safety, livestock, and farm infrastructure

The presence on and movement of construction workers on and off the site poses a potential safety threat to local famers and farm workers in the vicinity of the site. In addition, farm infrastructure, such as fences and gates, may be damaged and stock losses may also result from gates being left open and/or fences being damaged, or stock theft linked either directly or indirectly to the presence of farm workers on the site. The potential risks (safety, livestock, and farm infrastructure) can be effectively mitigated by careful planning and managing the movement of construction on and off the site workers during the construction phase.

Table 4.4: Assessment of risk to safety, livestock, and damage to farm infrastructure

Impact Phase: Construction							
Potential impact description: Potential risk to safety of farmers and farm workers, livestock and damage to farm infrastructure associated with the movement of construction workers on and to the site							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Negative	Medium	M	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	L	High
Can the impact be reversed?			Yes: By repairing damage and compensating for stock losses etc.				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, see below				

Assessment of No-Go option
There is no impact as the current status quo would be maintained.

Recommended mitigation measures
- Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase.
- Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase.
- The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for.
- All farm gates must be closed after passing through.
- Contractors appointed by the proponent should provide daily transport for low and semi-skilled workers to and from the site.
- The proponent should establish a CoC for workers (see above).
- The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors, and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below).

- The proponent should implement a Grievance Mechanism that provides local farmers with an effective and efficient mechanism to address issues related to report issues related to damage to farm infrastructure, stock theft and poaching etc.
- The Environmental Management Plan (EMP) must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.
- Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained in the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.
- Contractors appointed by the proponent must ensure that construction workers who are found guilty of stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the CoC. All dismissals must be in accordance with South African labour legislation.
- It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

4.3.5 Nuisance impacts associated with construction related activities

The construction activities on site and movement of heavy construction vehicles during the construction phase has the potential to create noise and dust impacts, damage local roads and create safety impacts for other road users. Based on the findings of the SIA the potential dust and noise impacts associated with the construction phase are likely to be limited. The traffic related impacts associated with the transport of materials to the site can also be effectively managed if the required mitigation measures are implemented.

Table 4.5: **Assessment of the impacts associated with construction related activities**

Impact Phase: Construction							
Potential impact description: Potential dust and safety impacts and damage to road surfaces associated with movement of construction related traffic to and from the site							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Negative	Medium	M	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	L	High
Can the impact be reversed?			Yes, by rehabilitating disturbed areas				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, see below				

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
The potential impacts associated with heavy vehicles can be effectively mitigated. The mitigation measures include:

- Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase.

- Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase.
- Timing of construction activities should be planned to avoid / minimise impact on access to silos in the area, specifically from May to August.
- Ongoing communication with landowners and road users during construction period. This should be outlined in the SEP.
- The proponent should implement a Grievance Mechanism that provides local farmers and other road users with an effective and efficient mechanism to address issues related to construction related impacts, including damage to local gravel farm roads.
- Implementation of a road maintenance programme throughout the construction phase to ensure that the affected roads maintained in a good condition and repaired once the construction phase is completed.
- Repair of all affected road portions at the end of construction period where required.
- Dust suppression measures must be implemented on un-surfaced roads, such as wetting on a regular basis and ensuring that vehicles used to transport building materials are fitted with tarpaulins or covers.
- All vehicles must be roadworthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.

4.3.6 Increased risk of grass fires

The presence of construction workers and construction-related activities on the site poses an increased risk of grass fires that could, in turn pose, a threat to livestock, crops, wildlife and farm infrastructure. The local landowners indicated that the area is very susceptible to grass fires during the winter months (May-October) and that the veld can take up to 3 years to recover to full productivity.

Table 4.6: Risk posed by veld fires to livestock, farm infrastructure and grazing

Impact Phase: Construction							
Potential impact description: Potential loss of grazing for livestock and damage to farm infrastructure.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Negative	Medium	M	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	L	High
Can the impact be reversed?			Yes: By repairing damage and compensating for damages and losses				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, see below				

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
The mitigation measures include:

- Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase.
- Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase.
- The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc., during the construction phase will be compensated for. The agreement should be signed before the construction phase commences.
- Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas.
- Smoking on site should be confined to designated areas.
- Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high-risk dry, windy summer months.
- Contractor should provide adequate fire-fighting equipment on-site, including a fire fighting vehicle.
- Contractor should provide fire-fighting training to selected construction staff.
- No construction staff, except for security staff, to be accommodated on site overnight.
- As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire-fighting costs borne by farmers and local authorities.

4.3.7 Impacts associated with loss of farmland

The activities associated with the construction phase and establishment of the proposed project and associated infrastructure will result in the disturbance and loss of land available for crops and grazing. However, experience from other WEFs is that impact on farming operations can be effectively minimised and mitigated by careful planning in the final layout of the proposed WEF and associated components. The impact on farmland associated with the construction phase can also be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase. Recommended mitigation measures are outlined below.

The timing / phasing on construction activities should where possible also be planned to avoid and or minimise disruption to planning and harvesting operations. Affected landowners should be involved in planning of timing of construction activities. Consideration should also be given to planning the construction activities so as to ensure arable areas remain productive for as long as possible, i.e., are not withdrawn from production months in advance. Ideally, construction should start after harvesting and be planned to reduce disruptions to the following planting season.

Table 4.7: **Assessment of impact on productive farmland**

Impact Phase: Construction							
Potential impact description: The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the WEFs and power lines will impact on grazing.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Negative	Medium	M	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	L	High
Can the impact be reversed?			Yes, by rehabilitating disturbed areas				
Will impact cause irreplaceable loss or resources?			No, however, disturbed areas will need to be rehabilitated				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, see below				

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
The potential impacts associated with damage to, and loss of farmland can be effectively mitigated. The aspects that should be covered include:

- The loss of high-quality agricultural land should be avoided and or minimised by careful planning in the final layout of the proposed WEF facilities, where possible.
- Affected landowners should be notified about the timing of construction related activities in advance.
- The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised.
- An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase.
- All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase.
- The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up by the Environmental Consultants appointed to manage the EIA.
- The implementation of the Rehabilitation Programme should be monitored by the ECO.

4.4 OPERATIONAL PHASE SOCIAL IMPACTS

The following key social issues are of relevance to the operational phase:

Potential positive impacts
- The establishment of infrastructure to improve energy security and support renewable sector.
- Creation of employment opportunities.
- Benefits to the affected landowners.

- Benefits associated with the socio-economic contributions to community development.

Potential negative impacts
- Visual impacts and associated impacts on sense of place.
- Impact on property values.
- Impact on tourism.

4.4.1 Improve energy security and support the renewable energy sector

The primary goal of the proposed project is to improve energy security in South Africa by generating additional energy. The proposed WEF also reduces the carbon footprint associated with energy generation. The project should therefore be viewed within the context of the South Africa's current reliance on coal powered energy to meet the majority of its energy needs, and secondly, within the context of the success of the REIPPPP.

Table 4.8: Improve energy security and support renewable sector

Impact Phase: Operational							
Potential impact description: Development of infrastructure to generate clean, renewable energy and improve energy security.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	M	Positive	Medium	M	High
With Mitigation/ Enhancement	M	H	M	Positive	High	H	High
Can the impact be reversed?			Yes, by removing infrastructure				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, see below				

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
Should the proposed WEF be approved the proponent should:

- Maximise the number of employment opportunities for local community members.
- Implement training and skills development programs for members from the local community.
- Maximise opportunities for local content and procurement.

4.4.2 Creation of employment and business opportunities

The proposed development will create~ 20 full time employment opportunities during the operational phase. Based on similar projects the annual operating budget will be in the region of R 24 million (2022 Rand values), including wages.

Table 4.9: Impact assessment of employment, sills development and business creation opportunities

Impact Phase: Operational							
Potential impact description: Creation of employment and business opportunities associated with the operational phase							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	L	M	L	Positive	Low	H	High
With Mitigation/ Enhancement	L	M	L	Positive	Low	H	High
Can the impact be reversed?			Yes, by removing project				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, measures will be provided in the Assessment Report				

Recommended enhancement measures
The enhancement measures listed in Section 4.3.1, i.e., to enhance local employment and business opportunities during the construction phase, also apply to the operational phase. In addition, the proponent should investigate providing training and skills development to enable locally based service providers to provide the required services for the operational phase.

4.4.3 Generate income for affected landowners

The proponent will be required to either purchase the land or enter into a rental agreement with the affected landowners for the use of the land for the establishment of the proposed WEF. Farming operations are impacted by droughts and market fluctuations. Any additional source of income therefore represents a significant benefit for the affected landowner(s). The additional income would assist to reduce the risks to their livelihoods posed by droughts and fluctuating market prices for outputs and farming inputs, such as fuel, feed etc. The additional income would improve economic security of farming operations, which in turn would improve job security of farm workers and benefit the local economy.

Table 4.10: Assessment of benefits associated with income generated for affected farmer(s)

Impact Phase: Operational							
Potential impact description: The generation of additional income represents a significant benefit for the local affected farmer(s) and reduces the risks to their livelihoods posed by droughts and fluctuating market prices for farming inputs, such as fertilizers, fuel, feed etc.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	L	Positive	Low	L	High
With Mitigation/ Enhancement	M	M	M	Positive	Medium	H	High
Can the impact be reversed?			Yes, by not implementing agreements				

Will impact cause irreplaceable loss or resources?	No
Can impact be avoided, managed, enhanced and or mitigated?	Yes, see below

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended enhancement measures
- Implement agreements with affected landowners.
- The loss of high-quality agricultural land should be avoided and or minimised by careful planning in the final layout of the proposed WEF facilities, where possible.

4.4.4 Benefits associated with the socio-economic development contributions

The REIPPPP has been designed not only to procure energy but has also been structured to contribute to the broader national development objectives of job creation, social upliftment and broadening of economic ownership. Socio-economic development (SED) contributions are an important focus of the REIPPPP and are aimed at ensuring that local communities benefit directly from the investments attracted into the area. These contributions are linked to Community Trusts and accrue over the project operation life and, in so doing, create an opportunity to generate a steady revenue stream over an extended period. This revenue can be used to fund development initiatives in the area and support the local community. The long-term duration of the revenue stream also allows local municipalities and communities to undertake long term planning for the area. The revenue from the proposed WEF can be used to support a number of social and economic initiatives in the area, including:

- Creation of jobs.
- Education.
- Support for and provision of basic services.
- School feeding schemes.
- Training and skills development.
- Support for SMME's.

The minimum compliance threshold for SED contributions is 1% of the revenue with 1.5% the targeted level over the 20-year project operational life. For the current portfolio of projects, the average commitment level is 2.2%, which is 125% higher than the minimum threshold level. To date (across seven bid windows) a total contribution of R23.1 billion has been committed to SED initiatives. Assuming an even, annual revenue spread, the average contribution per year would be R1.2 billion. Of the total commitment, R18.8 billion is specifically allocated for local communities where the IPPs operate. With every new IPP on the grid, revenues and the respective SED contributions will increase.

SED contributions do therefore create opportunities for local rural communities. However, SED contributions can also be mismanaged. This is an issue that will need to be addressed when managing SED investments.

Table 4.11: Assessment of benefits associated with socio-economic development contributions

Impact Phase: Operational							
Potential impact description: SED contributions funded by revenue generated from the sale of energy. The revenue can be used to fund local community development							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	H	M	Positive	Medium	L	High
With Mitigation/ Enhancement[10]	M	H	M	Positive	Medium	H	High
Can the impact be reversed?			Yes, by not implementing project				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, see below				

Assessment of No-Go option

There is no impact as it maintains the current status quo. However, the potential opportunity costs in terms of the supporting the social and economic development in the area would be lost. This would also represent a negative impact.

Recommended enhancement measures

To maximise the benefits and minimise the potential for corruption and misappropriation of funds the following measures should be implemented:

- The proponents should liaise with the LM and KHLM to identify projects that can be supported by SED contributions.
- Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community.
- Strict financial management controls, including annual audits, should be instituted to manage the SED contributions.

4.4.5 Visual impact and impact on sense of place

The proposed WEF will impact on the areas existing rural sense of place. The potential visual impact on the areas sense place will be informed by the findings of the VIA.

[10] Assumes effective management of Community Trust

Table 4.12: Visual impact and impact on sense of place

Impact Phase: Operational							
Potential impact description: Visual impact associated with the proposed WEF and the potential impact on the areas rural sense of place.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	L	Negative	Low	M	High
With Mitigation/ Enhancement	M	M	L	Negative	Low	M	High
Can the impact be reversed?			Yes, by removing turbines				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, see below				

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
- The recommendations contained in the VIA should also be implemented.
- Install radar activated civil aviation light system.

4.4.6 Potential impact on property values

A literature review was undertaken as part of the SIA. It should be noted that the review does not constitute a property evaluation study and merely seeks to comment on the potential impact of wind farms on property values based on the findings of studies undertaken overseas. The assessment rating is based on the findings of the review. In total five articles were identified and reviewed namely:

- Stephen Gibbons (April 2014): Gone with the wind: Valuing the Visual Impacts of Wind turbines through house prices. London School of Economics and Political Sciences & Spatial Economics Research Centre, SERC Discussion Paper 159.
- Review of the Impact of Wind Farms on Property Values, Urbis Pty Ltd (2016): Commissioned by the Office of Environment and Heritage, NSW, Australia.
- Yasin Sunak and Reinhard Madlener (May 2012): The Impact of Wind Farms on Property Values: A Geographically Weighted Hedonic Pricing. School of Business and Economics / E.ON Energy Research Center, RWTH Aachen University. Model Working Paper No. 3/2012.
- Martin D. Heintzelman and Carrie M. Tuttle (March 3, 2011): Values in the Wind: A Hedonic Analysis of Wind Power Facilities. Economics and Financial Studies School of Business, Clarkson University.
- Ben Hoen, Jason P. Brown, Thomas Jackson, Ryan Wiser, Mark Thayer and Peter Cappers (August 2013): A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States. Ernest Orlando Lawrence Berkeley National Laboratory.

Based on the findings of the literature review the potential impact of WEFs on rural property values is likely to be low, specifically for farms that are farmed as productive farms. As indicated above, the potential loss of productive land and the associated potential impact on property values can also be minimised by careful planning and siting of wind turbines.

Table 4.13: Assessment of potential impact on property values and operations

Impact Phase: Operational							
Potential impact description: Potential impact on property values and current operations linked to the visual impact associated with the proposed WEF and the potential impact on the areas rural sense of place.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	L	Negative	Low	M	High
With Mitigation/ Enhancement	M	M	L	Negative	Low	M	High
Can the impact be reversed?			Yes, by removing turbines				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, see below				

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
The recommendations contained in the VIA should be implemented.

4.4.7 Potential impact on tourism

A review of international literature in the impact of wind farms was undertaken as part of the SIA. Three articles were reviewed, namely:

- Atchison, (April 2012). Tourism Impact of Wind Farms: Submitted to Renewables Inquiry Scottish Government. University of Edinburgh.
- Glasgow Caledonian University (2008). The economic impacts of wind farms on Scottish tourism. A report prepared for the Scottish Government.
- Regeneris Consulting (2014). Study into the Potential Economic Impact of Wind Farms and Associated Grid Infrastructure on the Welsh Tourism Sector.

Based on the findings of the review there is limited evidence to suggest that the proposed WEF would impact on the tourism in the area. As indicated above, the area has also been impacted by the Camden Power Station and associated transmission lines and large-scale coal mining.

Table 4.14: Impact on tourism in the region

Impact Phase: Operational							
Potential impact description: Potential impact of the WEF on local tourism							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	L	Negative	Low	L	High
With Mitigation/ Enhancement	M	M	L	Negative	Low	L	High
Can the impact be reversed?			Yes, by removing turbines				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, see below				

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
The recommendations contained in the VIA should be implemented.

4.5 CUMULATIVE IMPACT ON SENSE OF PLACE

The potential cumulative impacts on the areas sense of place will be largely linked to potential visual impacts. In this regard the Scottish Natural Heritage (2005) describes a range of potential cumulative landscape impacts associated with wind farms on landscapes. The relevant issues identified by Scottish Natural Heritage study include:

- Combined visibility (whether two or more wind farms will be visible from one location).
- Sequential visibility (e.g., the effect of seeing two or more wind farms along a single journey, e.g., road or walking trail).
- The visual compatibility of different wind farms in the same vicinity.
- Perceived or actual change in land use across a character type or region.
- Loss of a characteristic element (e.g., viewing type or feature) across a character type caused by developments across that character type.

The guidelines also note that cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one renewable energy facility and the associated infrastructure at a time, but if each successive stretch of the road is dominated by views of renewable energy facilities, then that can be argued to be a cumulative visual impact (National Wind Farm Development Guidelines, DRAFT - July 2010).

The establishment of the WEF and other WEFs in the area will create the potential for combined and sequential visibility impacts. The impact on sense of place will be informed by the findings of the VIA.

Table 4.15: Cumulative impacts on sense of place and the landscape

Impact Phase: Operational							
Potential impact description: Cumulative visual impact associated with the establishment of a WEF on the areas rural sense of place and character of the landscape							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	M	Negative	Medium	M	Medium
With Mitigation/ Enhancement	M	M	M	Negative	Medium	M	Medium
Can the impact be reversed?			Yes, by removing turbines				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed, enhanced and or mitigated?			Yes, see below				

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
- The recommendations contained in the VIA should be implemented.

4.6 CUMULATIVE IMPACT ON LOCAL SERVICES AND ACCOMMODATION

The objective will be to source as many low and semi-skilled workers for the construction phase from the MM, specifically Ermelo. This will reduce the pressure on local services and accommodation in Ermelo. For a single WEF project ~ 200-250 workers may require accommodation. In the event of the construction phase for 3 projects overlapping, the total number of workers requiring accommodation would be between 500 and 600. The potential pressure on local services will depend on the number of locally based contractors and workers that are employed during the construction phase.

The potential impact should also be viewed within the context of the potential positive cumulative impacts for the local economy associated with the establishment of the proposed facility and associated renewable energy projects in the MM. These benefits will create opportunities for investment in the MM, including the opportunity to up-grade and expand existing services and the construction of new houses. Socio-economic development (SED) contributions also represent an important focus of the REIPPPP and is aimed at ensuring that the build programme secures sustainable value for the country and enables local communities to benefit directly from the investments attracted into the area. The proposed WEF is also required to contribute a percentage of projected revenues accrued over the 20-year period to SED. This will provide revenue that can be used by the MM to invest in up-grading local services where required. In should also be noted that it is the function of national, provincial, and local government to address the needs created by development and provide the required services. The additional demand for services and accommodation created by the establishment of development renewable energy projects should therefore be addressed in the Integrated Development Planning process undertaken by the MM.

Table 4.16: Cumulative impacts on local services

Impact Phase: Operational							
Potential impact description: The establishment of a number of renewable energy facilities has the potential to place pressure on local services, specifically medical, education and accommodation							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	L	Negative	Low	L	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	L	High
Can the impact be reversed?		Yes, by implementing effective mitigation					
Will impact cause irreplaceable loss or resources?		No					
Can impact be avoided, managed, enhanced and or mitigated?		Yes, measures will be provided in the Assessment Report					

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended mitigation measures
The proponent should assess the availability of accommodation in Ermelo should the project be approved.

4.7 CUMULATIVE IMPACT ON LOCAL ECONOMY

In addition to the potential negative impacts, the establishment of renewable energy facilities and associated infrastructure, including the proposed WEF, will also create several socio-economic opportunities for the MLM. The positive cumulative opportunities include creation of employment, skills development and training opportunities, and downstream business opportunities. The potential cumulative benefits are associated with both the construction and operational phase of renewable energy projects and associated infrastructure and extend over a period of 20-25 years. However, steps must be taken to maximise employment opportunities for members from the local communities in the area and support skills development and training programmes.

Table 4.17: Cumulative impacts on local economy

Impact Phase: Operational							
Potential impact description: The establishment of a number of renewable energy facilities in the region will create employment, skills development and training opportunities, creation of downstream business opportunities.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	H	M	Positive	Medium	L	High
With Mitigation/ Enhancement	M	H	M	Positive	High	M	High
Can the impact be reversed?		Yes, by not implementing project					
Will impact cause irreplaceable loss or resources?		No					

Can impact be avoided, managed, enhanced and or mitigated?	Yes, see below

Assessment of No-Go option
There is no impact as it maintains the current status quo.

Recommended enhancement measures
The proponent should create opportunities for local SMMEs during the operational phase.

4.8 ASSESSMENT OF DECOMMISSIONING PHASE

Typically, the major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. However, in the case of the proposed facility the decommissioning phase is likely to involve the disassembly and replacement of the existing components with more modern technology. This is likely to take place in the 20 - 25 years post commissioning[11]. The decommissioning phase is therefore likely to create additional, construction type jobs, as opposed to the jobs losses typically associated with decommissioning. The number of people employed during the operational phase will be in the region of 20. Given the low number of people employed during the operational phase the decommissioning of the facility will not have a significant negative social impact on the local community. The potential impacts associated with the decommissioning phase can also be effectively managed with the implementation of a retrenchment and downscaling programme.

The decommissioning phase will also create employment opportunities. This will represent a positive impact. These jobs will, however, be temporary.

Table 4.18: Impacts associated with decommissioning

Impact Phase: Decommissioning							
Potential impact description: Social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	L	Negative	Low	M	High
With Mitigation/ Enhancement	M	L	L	Negative	Low	L	High
Can the impact be reversed?	Yes, by removing turbines						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed, enhanced and or mitigated?	Yes, see below						

Assessment of No-Go option

[11] There is also a possibility that the existing wind turbines may be replaced with new, more efficient turbines at the end of the first 20-year contract period. This would create additional employment opportunities and ensure that the existing operational phase jobs are maintained.

There is no impact as it maintains the current status quo.

Recommended mitigation measures
The following mitigation measures are recommended:

- The proponent should ensure that retrenchment packages are provided for all staff retrenched when the WEF is decommissioned.
- All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning.

4.9 ASSESSMENT OF NO-DEVELOPMENT OPTION

The primary goal of the project is to generate additional energy and improve energy security. The project also aims to reduce the carbon footprint associated with energy generation. As indicated above, energy supply constraints and the associated load shedding have had a significant impact on the economic development of the South African economy. South Africa also relies on coal-powered energy to meet more than 90% of its energy needs. South Africa is therefore one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions.

The No-Development option would represent a lost opportunity for South Africa to improve energy security and supplement is current energy needs with clean, renewable energy. Given South Africa's current energy security challenges and its position as one of the highest per capita producers of carbon emissions in the world, this would represent a significant negative social cost.

Table 4.19: Assessment of no-development option

Impact Phase: No Development Option							
Potential impact description: The no-development option would result in the lost opportunity for the NLKM and a lost opportunity to supplement SAs current energy needs with clean							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement [12]	M	H	H	Negative	High	H	High
With Mitigation/ Enhancement	M	H	H	Positive	High	H	High
Can the impact be reversed?		N/A					
Will impact cause irreplaceable loss or resources?		No					
Can impact be avoided, managed, enhanced and or mitigated?		Yes, see below					

Recommended enhancement measures
The proposed WEF should be developed, and the mitigation and enhancement measures identified in the SIA and other specialist studies should be implemented.

[12] Assumes that the proposed WEF is not developed

SECTION 5: KEY FINDINGS AND RECOMMENDATIONS

5.1 INTRODUCTION

Section 5 lists the key findings of the Social Scoping study. These findings are based on:

- A review of key planning and policy documents pertaining to the area.
- A review of social and economic issues associated with similar developments.
- The experience of the authors with other renewable energy projects.
- Site visit to the study area.

5.2 SUMMARY OF KEY FINDINGS

The key findings of the study are summarised under the following sections:

- Fit with policy and planning.
- Construction phase impacts.
- Operational phase impacts.
- Cumulative impacts.
- Decommissioning phase impacts.
- No-development option.

The key issues and associated significance ratings will be confirmed during the assessment phase.

5.2.1 Policy and planning issues

The development of renewable energy is strongly supported at a national, provincial, and local level. The development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all refer to and support renewable energy. The development of renewable energy is also supported by the MMSDF. In this regard the SDF acknowledges the importance of the mining sector and notes that it will need to be accommodated over the short to medium term. However, of relevance to the proposed development the SDF refers to green industries and indicates that the existing site of the Camden Power Station and surrounds should be made available for new industrial development in the long term, to manage the long-term impact of the Power Station being decommissioned.

5.2.2 Construction phase impacts

The key social issues associated with the construction phase include:

Potential positive impacts
- Creation of employment and business opportunities, and the opportunity for skills development and on-site training.

The construction phase will extend over a period of approximately 18-24 months and create in the region of 200-250 employment opportunities. Members from the local communities in Ermelo and the MM would qualify for the majority of low skilled and semi-skilled employment opportunities and a number of skilled opportunities. The Most of these employment opportunities will accrue to Historically Disadvantaged (HD) members from the local community. Given relatively high local unemployment levels and limited job opportunities in the area, this will represent a significant, if localised, social benefit. The total wage bill will be in the region of R 25 million (2023 Rand values). A percentage of the wage bill will be spent in the local economy which will also create opportunities for local businesses in Ermelo and the MM. The capital expenditure associated with the construction phase will be approximately R 6 billion (2023 Rand value). This will create opportunities for local companies and the regional and local economy. Due to the presence of the mining and energy sector, there are likely to suitably qualified companies in Ermelo that can provide the required services and products. The local service sector will also benefit from the construction phase. The potential opportunities would be linked to accommodation, catering, cleaning, transport, and security, etc. associated with the construction workers.

Potential negative impacts

- Impacts associated with the presence of construction workers on local communities.
- Impacts related to the potential influx of jobseekers.
- Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site.
- Increased risk of grass fires associated with construction related activities.
- Nuisance impacts, such as noise, dust, and safety, associated with construction related activities and vehicles.
- Impact on productive farmland.

The findings of the SIA indicate that the significance of the potential negative impacts with mitigation will be **Low Negative**. The potential negative impacts associated with the proposed construction phase can therefore be effectively mitigated if the recommended mitigation measures are implemented. Table 5.1 summarises the significance of the impacts associated with the construction phase.

Table 5.1: Summary of social impacts during construction phase

Impact	Significance No Mitigation/Enhancement	Significance With Mitigation/Enhancement
Creation of employment and business opportunities	Medium (Positive)	Medium (Positive)
Presence of construction workers and potential impacts on family structures and social networks	Medium (Negative)	Low (Negative)
Influx of job seekers	Low (Negative)	Low (Negative)
Safety risk, stock theft and damage to farm infrastructure associated with presence of construction workers	Medium (Negative)	Low (Negative)
Increased risk of grass fires	Medium (Negative)	Low (Negative)
Impact of heavy vehicles and construction activities	Medium (Negative)	Low (Negative)
Loss of farmland	Medium (Negative)	Low (Negative)

5.2.3 Operational phase impacts

The following key social issues are of relevance to the operational phase:

Potential positive impacts
- Establishment of infrastructure to improve energy security and support renewable sector.
- Creation of employment opportunities.
- Benefits for local landowners.
- Benefits associated with socio-economic contributions to community development.

The proposed project will supplement South Africa's energy and assist to improve energy security. In addition, it will also reduce the country's reliance on coal as an energy source. This represents a positive social benefit.

Potential negative impacts
- Visual impacts and associated impacts on sense of place.
- Potential impact on property values.
- Potential impact on tourism.

The findings of the SIA indicate that the significance of all the potential negative impacts with mitigation will be **Low Negative**. The potential negative impacts can therefore be effectively mitigated. The significance of the impacts associated with the operational phase are summarised in Table 5.2.

Table 5.2: Summary of social impacts during operational phase

Impact	Significance No Mitigation/Enhancement	Significance With Mitigation/Enhancement
Establishment of infrastructure to improve energy security and support renewable sector	High (Positive)	High (Positive)
Creation of employment and business opportunities during maintenance	Low (Positive)	Medium (Positive)
Benefits associated with socio-economic contributions to community development	Medium (Positive)	Medium (Positive)
Benefits for landowners	Low (Positive)	Medium (Positive)
Visual impact and impact on sense of place	Low (Negative)	Low (Negative)
Impact on property values	Low (Negative)	Low (Negative)
Impact on tourism	Low (Negative)	Low (Negative)

5.2.4 Assessment of cumulative impacts

Cumulative impact on sense of place

The establishment of the WEF and other wind energy facilities in the area will create the potential for combined and sequential visibility impacts. The significance will be informed by the VIA.

Cumulative impact on local services and accommodation
The potential cumulative impact on local services and accommodation will depend on the timing construction phases for the different renewable energy projects in the area. With effective planning the significance of the potential impact was rated as **Low Negative**.

Cumulative impact on local economy
The significance of this impact with enhancement was rated as **Moderate Positive**.

5.2.5 Decommissioning phase

Given the relatively small number of people employed during the operational phase (~ 20), the potential negative social impact on the local economy associated with decommissioning will be limited. In addition, the potential impacts associated with the decommissioning phase can also be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low (negative). Decommissioning will also create temporary employment opportunities. The significance was assessed to be Low (positive).

5.2.6 Assessment of no-development option

The No-Development option would represent a lost opportunity for South Africa to improve energy security and supplement its current energy needs with clean, renewable energy. Given South Africa's current energy security challenges and its position as one of the highest per capita producers of carbon emissions in the world, this would represent a significant negative social cost. The No-Development option is not supported by the findings of the SIA.

5.3 CONCLUSION

The findings of the Social Scoping study indicate that the proposed Emvelo WEF project will create a number of social and socio-economic benefits, including creation of employment and business opportunities during both the construction and operational phase. In addition, the WEF will generate renewable energy for use by mines and industrial operations in the area.

The findings of the SIA also indicate that the potential negative impacts associated with both the construction and operational phase are likely to be **Low Negative** with mitigation. The potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented. The Emvelo WEF is therefore supported by the initial findings of the Social Scoping study.

5.4 PLAN OF STUDY FOR SIA

The proposed approach to the SIA is based on the Guidelines for SIA endorsed by Western Cape Provincial Environmental Authorities (DEA&DP) in 2007. The Guidelines are based on accepted international best practice guidelines, including the Guidelines and Principles for Social Impact Assessment (Inter-organizational Committee on Guidelines and Principles for Social Impact Assessment, 1994) and IAIA Guidance for Assessing and Managing Social Impacts (2015). The approach to the study will involve:

- Collection and review of reports and baseline socio-economic data on the area. This includes socio-economic characteristics of the affected areas, current and future land uses, and land uses planning documents relating to the study area and surrounds.

- Identification of the components associated with the construction and operational phase of the proposed project, including estimate of total capital expenditure, number of employment opportunities created and breakdown of the employment opportunities in terms of skill levels (low, medium and high skilled), breakdown of wages per skill level, assessment procurement policies etc.;
- Site visit and interviews with key affected parties, including local communities, local landowners, key government officials (local and regional), the client, local farmers associations, tourism and conservation officials, chamber of commerce etc.
- Review of key findings of the key specialist studies that have a bearing on the SIA, such as the Visual Impact Assessment (VIA). This information will also be used to inform the engagement with the affected landowners.
- Identification and assessment of key social issues and assessment of potential impacts (negative and positive) associated with the construction, operational and decommissioning phase of the project.
- Identification and assessment of cumulative impacts (positive and negative).
- Identification of appropriate measures to avoid, mitigate, enhance, and compensate for potential social impacts.
- Preparation of Social Impact Assessment (SIA) Report.

Interviews will be undertaken with key stakeholders and interested and affected parties during the assessment phase.

ANNEXURE A

REFERENCES

- The National Energy Act (2008).
- The White Paper on the Energy Policy of the Republic of South Africa (December 1998).
- The White Paper on Renewable Energy (November 2003).
- Integrated Resource Plan (IRP) for South Africa (2010-2030).
- The National Development Plan (2011).
- Mpumalanga Spatial Development Framework (2019).
- Msukaligwa Municipality Integrated Development Plan (2019-2020).
- Msukaligwa Spatial Development Framework (2019).

ANNEXURE B

METHODOLOGY FOR THE ASSESSMENT OF POTENTIAL IMPACTS

Assessment of Impacts and Mitigation
The significance of environmental aspects can be determined and ranked by considering the criteria presented in Table 1. In some cases it may be necessary to undertake the impact assessment to determine whether a particular aspect is significant. Therefore, a fair degree of iteration is unavoidable during the assessment process.

Table 1 – Criteria used to determine the significance of environmental aspects

Significance Ranking	Negative Aspects	Positive Aspects
H (High)	Will always/often exceed legislation or standards. Has characteristics that could cause significant negative impacts.	Compliance with all legislation and standards. Has characteristics that could cause significant positive impacts.
M (Moderate)	Has characteristics that could cause negative impacts.	Has characteristics that could cause positive impacts.
L (Low)	Will never exceed legislation or standards. Unlikely to cause significant negative impacts.	Will always comply with all legislation and standards. Unlikely to cause significant positive impacts.

The aspect identification and ranking process is largely a screening exercise whereby the aspects that do not have the potential to cause significant impacts are eliminated. Aspects ranked "high" and "moderate" are significant and the possible impacts associated with their presence will need to be determined. Aspects ranked "low" do not warrant further attention. The significance of the aspects should be ranked on the assumption that the management recommended in the EIA will be in place i.e. *with management*. This represents the scenario that the proponent wishes to have considered for approval. The environmental aspects associated with the proposed project activities during the construction, operational, closure phases (where appropriate) need to be identified. The influence of various project alternatives on the significance of the aspects must also be considered.

It may be desirable to also undertake a *without management* aspect ranking, since this highlights the sensitivity of the key risk areas to management and, hence, the management priorities. However, the dilemma in such an exercise is deciding on how much management to include. In the case of a mining project, for example, does one assume that the tailings dam will be completely absent or merely operated poorly? A useful rule of thumb is to assume that all the management required for operational reasons will be in place, but that any management specifically for environmental control will be absent. The danger in presenting *without management* ranking scenario in an EIA report is that it does not represent the scenario that the proponent wishes to have approved.

SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Where significant environmental aspects are present ("high" or "moderate"), significant environmental impacts ***may*** result. The significance of the impacts associated with the significant aspects can be determined by considering the risk:

Significance of Environmental Impact (Risk) = Probability x Consequence

The consequence of impacts can be described by considering the severity, spatial extent and duration of the impact.

SEVERITY OF IMPACTS

Table 2 presents the ranking criteria that can used to determine the severity of impacts on the bio- physical and socio-economic environment. Table 3 provides additional ranking criteria for determining the severity of negative impacts on the bio-physical environment.

Table 2 – Criteria for ranking the *Severity* of environmental impacts

Type of Criteria	Negative			Positive		
	H-	M-	L-	L+	M+	H+
Qualitative	Substantial deterioration. Death, illness or injury.	Moderate deterioration. Discomfort.	Minor deterioration. Nuisance or minor irritation.	Minor improvement.	Moderate improvement.	Substantial improvement .
Quantitative	Measurable deterioration.		Change not measurable i.e. will remain within current range.		Measurable improvement.	
	Recommended level will often be violated.	Recommended level will occasionally be violated.	Recommended level will never be violated.		Will be within or better than recommended level.	
Community Response	Vigorous community action.	Widespread complaints.	Sporadic complaints.		No observed reaction.	Favourable publicity

Table 3 – Criteria for ranking the *Severity* of negative impacts on the bio-physical environment

Environment	Ranking Criteria		
	Low (L-)	**Medium (M-)**	**High (H-)**
Soils and land capability	Minor deterioration in land capability. Soil alteration resulting in a low negative impact on one of the other environments (e.g. ecology).	Partial loss of land capability. Soil alteration resulting in a moderate negative impact on one of the other environments (e.g. ecology).	Complete loss of land capability. Soil alteration resulting in a high negative impact on one of the other environments (e.g. ecology).
Ecology (Plant and animal life)	Disturbance of areas that are degraded, have little conservation value or are unimportant to humans as a resource. Minor change in species variety or prevalence.	Disturbance of areas that have some conservation value or are of some potential use to humans. Complete change in species variety or prevalence.	Disturbance of areas that are pristine, have conservation value or are an important resource to humans. Destruction of rare or endangered species.
Surface and Groundwater	Quality deterioration resulting in a low negative impact on one of the other environments (ecology, community health etc.)	Quality deterioration resulting in a moderate negative impact on one of the other environments (ecology, community health etc.).	Quality deterioration resulting in a high negative impact on one of the other environments (ecology, community health etc.).

Spatial Extent and Duration of Impacts
The duration and spatial scale of impacts can be ranked using the following criteria:

Table 4 – Ranking the *Duration* and *Spatial Scale* of impacts

	Ranking Criteria		
	L	**M**	**H**
Duration	Quickly reversible Less than the project life Short-term	Reversible over time Life of the project Medium-term	Permanent Beyond closure Long-term
Spatial Scale	Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/national

Where the severity of an impact varies with distance, the severity should be determined at the point of compliance or the point at which sensitive receptors will be encountered. This position corresponds to the spatial extent of the impact.

Consequence of Impacts

Having ranked the severity, duration and spatial extent, the overall consequence of impacts can be determined using the following qualitative guidelines:

Table 5 – Ranking the *Consequence* of an impact

SEVERITY = H					
DURATION	Long-term	H			
	Medium-term	M			MEDIUM
	Short-term	L	LOW		
SEVERITY = M					
DURATION	Long-term	H			HIGH
	Medium-term	M		MEDIUM	
	Short-term	L	LOW		
SEVERITY = H					
DURATION	Long-term	H			
	Medium-term	M			HIGH
	Short-term	L	MEDIUM		
			L	M	H
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/national
			SPATIAL SCALE		

To use Table 5, firstly go to one of the three "layers" based on the severity ranking obtained from Table 2 and/ or Table 3. Thereafter determine the consequence ranking by locating the intersection of the appropriate duration and spatial scale rankings.

Overall Significance of Impacts

Combining the consequence of the impact and the probability of occurrence, as shown by Table 6, provides the overall significance (risk) of impacts.

Table 6 – Ranking the *Overall Significance* of impacts

PROBABILITY	Definite Continuous	H	MEDIUM		HIGH
	Possible Frequent	M		MEDIUM	
	Unlikely Seldom	L	LOW		MEDIUM
			L	M	H
			CONSEQUENCE (from Table 5)		

The overall significance ranking of the negative environmental impacts provides the following guidelines for decision making:

Table 7 – Guidelines for decision-making

Overall Significance Ranking	Nature of Impact	Decision Guideline
High	Unacceptable impacts.	Likely to be a fatal flaw.
Moderate	Noticeable impact.	These are unavoidable consequence, which will need to be accepted if the project is allowed to proceed.
Low	Minor impacts.	These impacts are not likely to affect the project decision.

ANNEXURE C

Tony Barbour
ENVIRONMENTAL CONSULTING

10 Firs Avenue, Claremont, 7708, South Africa
(Cell) 082 600 8266
(E-Mail) tony@tonybarbour.co.za

Tony Barbour's has 30 years' experience in the field of environmental consulting and management. His experience includes working for ten years as a consultant in the private sector followed by four years at the University of Cape Town's Environmental Evaluation Unit. He has worked as an independent consultant since 2004, with a key focus on Social Impact Assessment. His other areas of interest include Strategic Environmental Assessment and review work.

EDUCATION

- BSc (Geology and Economics) Rhodes (1984);
- B Economics (Honours) Rhodes (1985);
- MSc (Environmental Science), University of Cape Town (1992)

EMPLOYMENT RECORD

- Independent Consultant: November 2004 – current;
- University of Cape Town: August 1996-October 2004**:** Environmental Evaluation Unit (EEU), University of Cape Town. Senior Environmental Consultant and Researcher;
- Private sector: 1991-August 2000: 1991-1996**:** Ninham Shand Consulting (Now Aurecon, Cape Town). Senior Environmental Scientist; 1996-August 2000: Steffen, Robertson and Kirsten (SRK Consulting) – Associate Director, Manager Environmental Section, SRK Cape Town.

LECTURING

- University of Cape Town: Resource Economics; SEA and EIA (1991-2004);
- University of Cape Town: Social Impact Assessment (2004-current);
- Cape Technikon: Resource Economics and Waste Management (1994-1998);
- Peninsula Technikon: Resource Economics and Waste Management (1996-1998).

RELEVANT EXPERIENCE AND EXPERTISE

Tony Barbour has undertaken in the region of 260 SIA's, including SIA's for infrastructure projects, dams, pipelines, and roads. All of the SIAs include interacting with and liaising with affected communities. In addition, he is the author of the Guidelines for undertaking SIA's as part of the EIA process commissioned by the Western Cape Provincial Environmental Authorities in 2007. These guidelines have been used throughout South Africa.

Tony was also the project manager for a study commissioned in 2005 by the then South African Department of Water Affairs and Forestry for the development of a Social Assessment and Development Framework. The aim of the framework was to enable the Department of Water Affairs and Forestry to identify, assess and manage social impacts associated with large infrastructure projects, such as dams. The study also included the development of guidelines for Social Impact Assessment, Conflict Management, Relocation and Resettlement and Monitoring and Evaluation.

Countries with work experience include South Africa, Namibia, Angola, Botswana, Zambia, Lesotho, Swaziland, Ghana, Senegal, Nigeria, Mozambique, Mauritius, Kenya, Ethiopia, Oman, South Sudan, Sudan and Armenia.

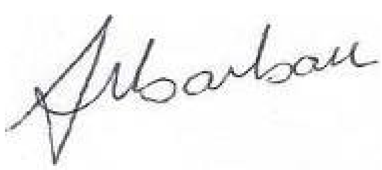
ANNEXURE D

The specialist declaration of independence in terms of the Regulations_

I, Tony Barbour , declare that -- General

declaration:

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:

Tony Barbour Environmental Consulting and Research

Name of company (if applicable):

5 September 2023

Date:

forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002 Tel: +27 12 399 9000, Fax: +27 86 625 1042

SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for 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)

REPORT TITLE

Mulilo Amsterdam WEFs - Rochdale, Sheepmoor and Emvelo WEFs

Kindly note the following:

1. This form must always be used for assessment that are in support of 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 August 2023. 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.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the 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 act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Social Impact Assessment (SIA)
Specialist Company Name	Tony Barbour Environmental Consulting
Specialist Name	Tony Barbour
Specialist Identity Number	6106085018082
Specialist Qualifications:	BSc, BEconomics (Hons), MSc (Environmental Science)
Professional affiliation/registration:	IAIA
Physical address:	10 Firs Avenue, Claremont, 7708
Postal address:	10 Firs Avenue, Claremont, 7708
Telephone	021-7613118
Cell phone	0826008266
E-mail	tony@tonybarbour.co.za

2. DECLARATION BY THE SPECIALIST

I, Tony Barbour, declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements 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 National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 NEMA Act.

AJBarbour

Signature of the Specialist

Tony Barbour Consulting

Name of Company:

14 May 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Tony Barbour, 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

Tony Barbour Environmental Consulting

Name of Company

14 May 2024

Date

Constable
7236242-1 S. TSEWU

Signature of the Commissioner of Oaths

14 May 2024

Date

SUID-AFRIKAANSE POLISIEDIENS
STASIEBEVELVOERDER
14 MAY 2024
STATION COMMANDER
CLAREMONT K.P / C.P.
SOUTH AFRICAN POLICE SERVICE

SMEC INTERNAL REF. P1J1

Scoping Assessment: Traffic and Transportation

Proposed Mulilo Cluster Emvelo WEF near Ermelo, MP Province

Prepared for ERM Southern Africa (Pty) Ltd

22 November 2023

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Signature			

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The report supersedes all previous draft or interim reports, whether written or presented orally, before the date of this report. This report has not and will not be updated for events or transactions occurring after the date of the report or any other matters which might have a material effect on its contents, or which come to light after the date of the report. SMEC is not obliged to inform you of any such event, transaction or matter nor to update the report for anything that occurs, or of which SMEC becomes aware, after the date of this report.

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1 Introduction

1.1 Background

SMEC South Africa (Pty) Ltd was appointed by ERM Southern Africa (Pty) on behalf of Mulilo Renewable Energy Development (Pty) Ltd to conduct a Transport Scoping Assessment for the proposed development of a commercial wind farm cluster, Emvelo WEF, located near Ermelo, Mpumalanga Province, within the Msukaligwa Local and the Gert Sibande District Municipalities. The Emvelo WEF is one of three proposed Mulilo Cluster Wind Energy Facilities (WEFs). The purpose of the Transport Scoping Assessment, which constitutes a phase of the overall Environmental Impact Assessment (EIA) process prior to the final Impact Assessment (Specialist Studies: Traffic and Transportation), includes the following objectives:

- Assess the receiving environment in terms of the current state and potential positive or negative impacts;
- Assess site alternatives to make recommendations on the most suitable site from a traffic and transportation perspective;
- Identify significant issues to be investigated further during the execution of the EIA phase;
- Determine the scope of the ensuing EIA phase, in terms of specialist studies for traffic and transportation;
- Allow for informed decision-making with regards to the EIA process.

1.2 Study Area

The location of one of the proposed Mulilo Cluster Wind Energy Facilities (WEF) – Emvelo WEF development site in relation to the surrounding road network is shown in Figure 1-1.

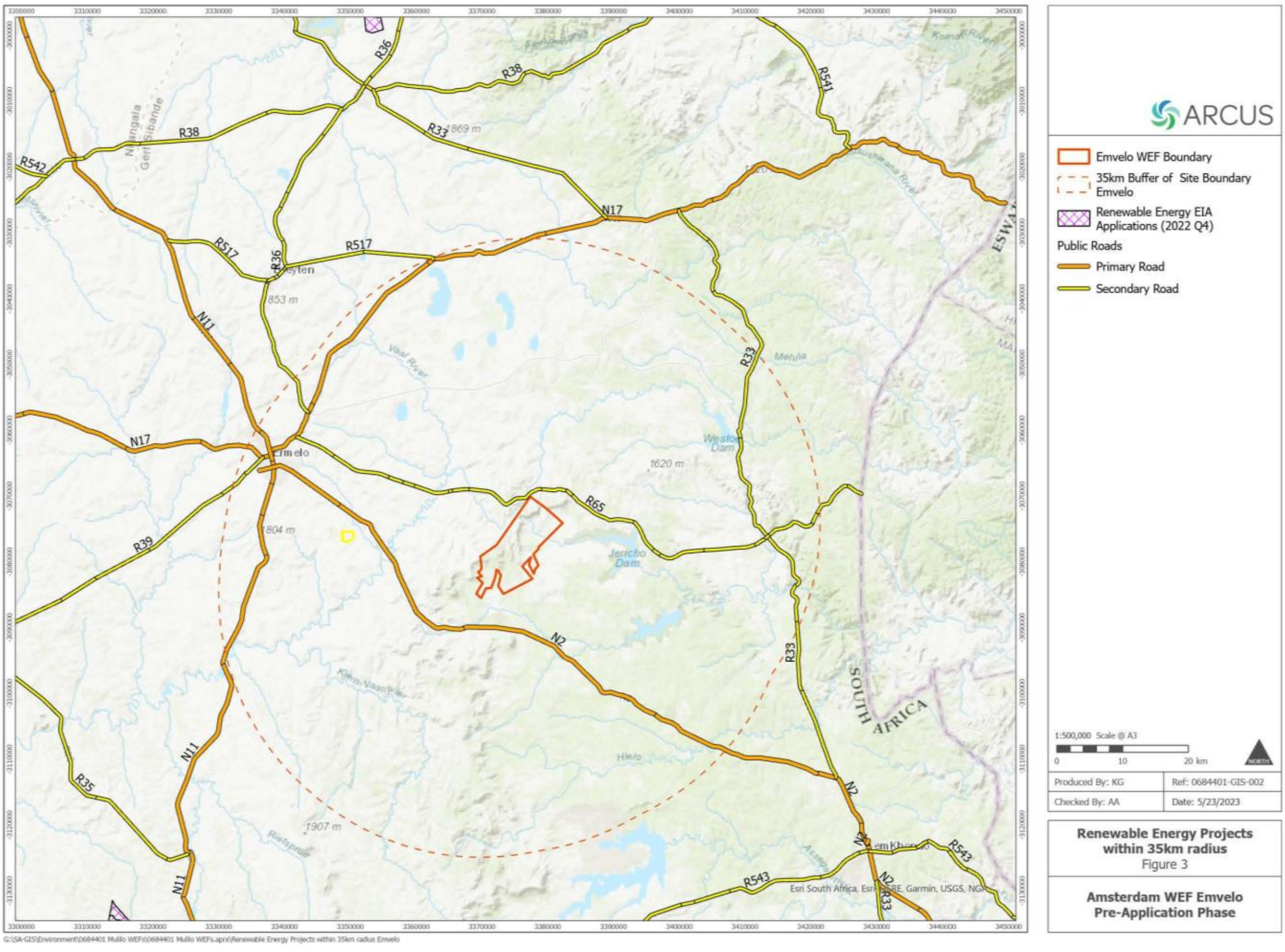

Figure 1-1: Locality Map (*Source: ERM*)

1.3 Development Details

The proposed development of Emvelo WEF is proposed to comprise up to 45 turbines with a maximum output capacity of up to 200 MW. The WEF will be located on nineteen (19) land parcels and will have an anticipated lifespan of 20 – 25 years. The Emvelo WEF development site boundary comprises of various land parcels and farm portions listed in Table 1-1.

As per technical details of the project, it is proposed that an on-site substation with a capacity up to 132 kV and an up to 132 kV Overhead Powerline (OHPL) of approximately 30 km (300 m corridor) in distance, traversing eighteen (18) land parcels, be constructed to connect the proposed WEF to the Eskom Uitkoms Substation.

The proposed turbine footprints and associated facility infrastructure is expected to cover an area of up to 150ha after rehabilitation, depending on final layout design. The proposed layout of turbines and locations of supporting infrastructure are shown in Figure 1-2.

Table 1-1: Affected Farm Portions

Farm Name	Farm No.	Portion (s)
Various Portions of the Farm Schiedam No. 274	274	RE, RE/1, 2, 5 and 6
Various Portions of the Farm Vaalbank No. 285	285	RE/1 and 5
Various Portions of the Farm Waaihoek No. 286	286	RE/2, 3, 5, RE/6, 7, 9, 10, 12, RE/13 and 14
Remaining Extent of the Farm Klipfontein No. 283	283	RE
Portion 7 of the Farm Bosjesspruit	291	7

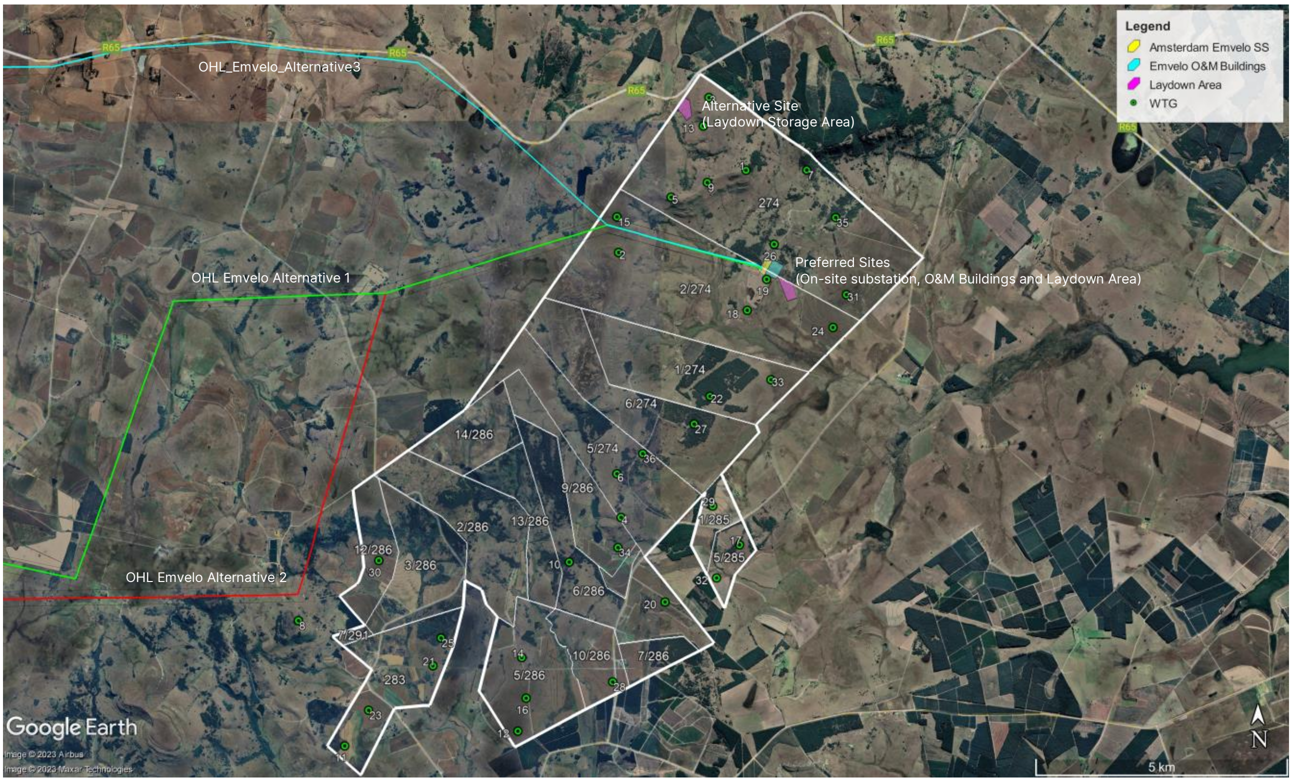

Figure 1-2: Proposed Development Site - Emvelo WEF

1.4 Specialist Details

Below is a summary of key specialists involved in the project. A detailed CV of key Specialist, Professional Registration and Declaration will be included in the final reporting EIA stages.

Key Specialist: Victor de Abreu

Victor de Abreu is a registered Professional Civil Engineer with over 34+ years' experience in the Traffic and Transport planning field. He holds a BSc, MSc and GDE from WITS University. Although his main field of expertise is Transport Planning and Traffic Engineering, he has operated in environments with an infrastructure focus particularly related to Roads and Stormwater management and design. Victor has held senior management positions in medium and large consultancy environments and serves in a voluntary capacity in SAICE as well as at board level in the education sector. Victor currently sits on the Board of SMEC South Africa.

Assistant Specialist: Reabetswe Mokomele

Reabetswe Mokomele is a registered Candidate Engineer with over 6+ years' experience in the Traffic and Transport Planning field. He holds a BEng (Civil) degree from the University of Johannesburg. Reabetswe's main field of expertise is Transport Planning and Traffic Engineering focusing particularly on undertaking technical and feasibility studies, site investigations, road master planning, traffic impact assessments (TIA) of varied scope to support various land-use planning for private/government clients.

Supporting Assistant Specialist: Meluleki Mthethwa

Meluleki Mthethwa is a technician with over 1+ years' experience in the Traffic and Transport planning field. He holds a National Diploma (Civil Engineering) qualification from the Mangosuthu University of Technology. Meluleki has been involved in the usage of various traffic engineering software and programmes such as SIDRA Intersection, QGIS, PTV Vissim, and SATURN, Civil 3D, AutoCAD Civil 3D and AutoTurn.

1.5 Methodology and Approach

A desktop study and site visit were conducted to understand the existing receiving environment of the potential sites. The sites were then evaluated based on their advantages and disadvantages in terms of traffic and transportation, particularly relative to available access and infrastructure of the existing road network. The potential traffic and transport related impacts were then identified for future assessment and the data collection and consultation requirements for the full Impact Assessment were determined. This information can be used as input into the wider scoping assessment and evaluation of the sites from the perspective of other disciplines, for the selection of the final site. The methodology and approach are summarised in Figure 1-3.

Figure 1-3: Summary of Methodology and Approach

1.6 Site Visit Details

A site visit was conducted on Wednesday, 31 May 2023 for purposes of identifying any fatal flaws with respect to various aspects including traffic and transportation. The site visit included a high-level evaluation of the current local transportation infrastructure network in the vicinity of proposed Mulilo Cluster Energy Facilities (WEF) development sites. The findings were recorded in the form of a Site Sensitivity/Site Visit Report attached in Appendix A.

2 Receiving Environment

2.1 Land use

The proposed Emvelo WEF development site is situated in a rural area where the predominant land use activities include livestock farming, crop farming and logging. These activities are expected to continue during the construction, operation, and eventual decommissioning of the site.

2.2 Road Network

The general location of the sites is made up of farmlands with rural unpaved Class 4 Provincial roads such as D532 and D1299 supporting movement between the various farms as well as access to some of these land parcel. The complete major road network is shown in Figure 2-1 in relation to the proposed WEF project area and described further in Table 2-1.

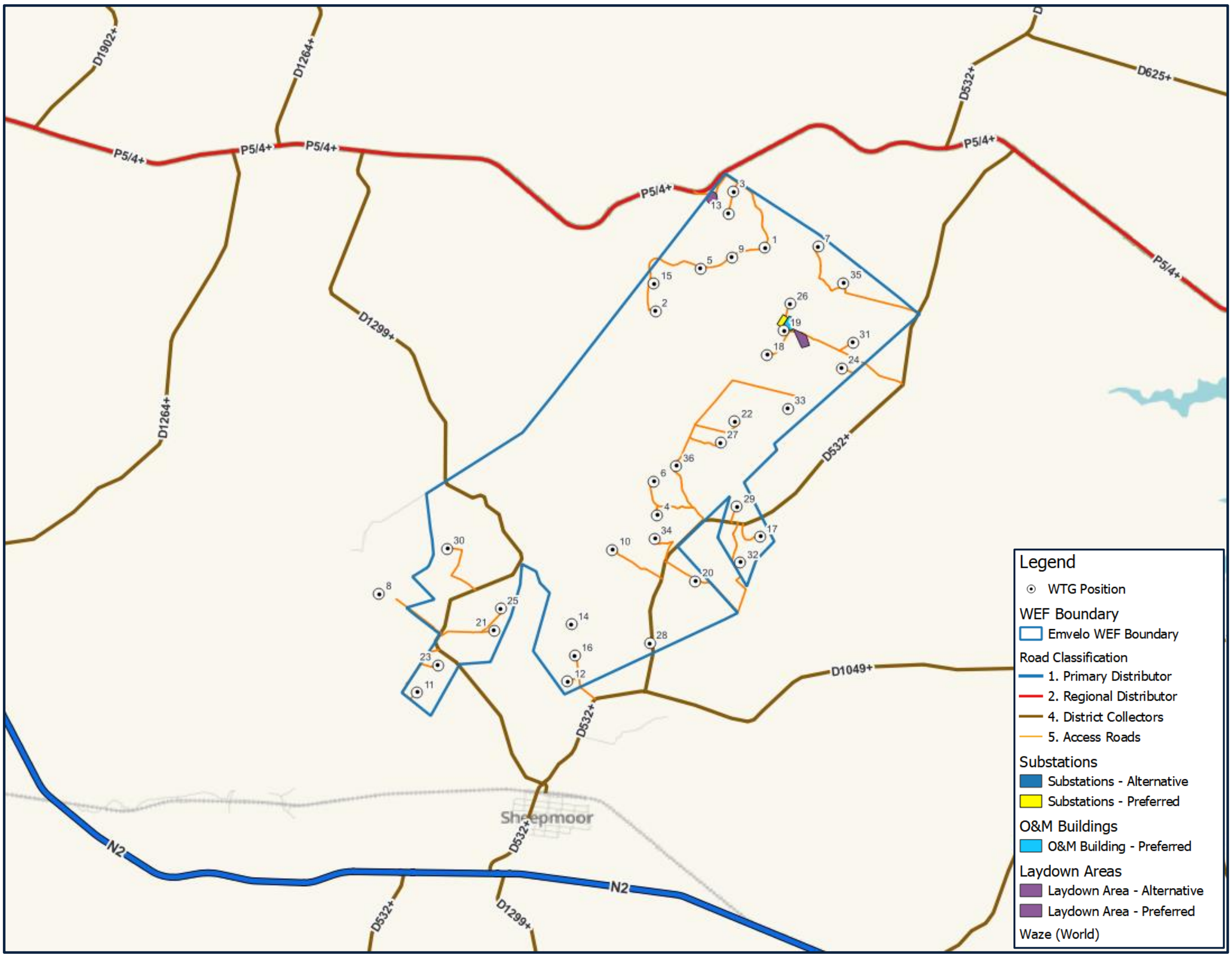

Figure 2-1: Surrounding Major Road Network

Table 2-1: Major Road Network

Road Name	Class	Description	Road Ownership
N2 National Road	1	• A paved/tarred single carriageway (undivided road) with a single lane per direction. • N2 National Road is a major primary east-west link between the towns of Ermelo and Piet Retief which are situated to the west and east of the proposed development, respectively. • N2 National Road consists of approximately 110km road length between Ermelo and Piet Retief. • N2 National Road has a typical cross-section width of at least 7.6m • N2 National Road connects to other National Roads namely, the N17 and the N11 in Ermelo to the northwest and continues in the southeast direction to Durban. • N2 National Road caries high traffic volumes with a significant proportion of heavy vehicles/trucks.	SANRAL
Road D532/Station St	4	• Road D532 is a primary north-south local gravel road providing access to the N2 National Road and to the R65 which are situated to the south and north of the proposed development site area, respectively. • Road D532 has approximately less than 3km road length of paved section from the N2 National Road named Station St passing through the local community of Sheepmoor. • Station St has a cross-section width – 6.6m and gravel road width of up to 10m. • Road D532 is approximately 23km in length between the N2 National Road and the R65. • Road D532 carries very low traffic volumes.	Mpumalanga Government
R65	2	• A paved/tarred single carriageway (undivided road) with a single lane per direction. • The R65 is a primary east-west regional road connecting the towns of Amsterdam and Ermelo which are situated to the east and west of the proposed development, respectively. • The R65 has varying roadway widths of between 7.6-11.6m • The R65 consists of approximately 77km road length between Ermelo and Amsterdam. • The R65 carries moderate traffic volumes.	Mpumalanga Government
Road D1299	4	• Road D1299 is a primary north-south local gravel road providing access to the N2 National Road (through Road D532) and to the R65 which are situated to the south and north of the proposed development site area, respectively. • Road D1299 runs across the south-western portion of the Emvelo WEF site area. • Road D1299 has a typical roadway width of up to 8m • Road D1299 consists of approximately 24km road length between the N2 National Road and the R65. • Road D1299 carries very low traffic volumes.	Mpumalanga Government

3 Site Alternatives Evaluation

As the sites are in a similar location, particularly in terms of the major road network, the main differentiation between sites from a transportation perspective was in terms of local access and available infrastructure. The Substation site was evaluated, however grid connection and integration lines were not evaluated from a transportation perspective as the effects of these do not have significant impacts on the transportation related assessment criteria. The full completed assessment sheet for Traffic and Transportation is included in the following sections covering both the preferred and alternative sites.

3.1 Preferred Site

Table 3-1: Advantages and Disadvantages of Preferred site

Site: Emvelo WEF	**Sub-Station Site: Advantages**	**Sub-Station Site: Disadvantages**
Traffic and Transportation: Accessibility	• Located within 3km from Class 4 road (D532) where direct access to properties is allowed along rural roads. • Access to site from the north (R65) is via an existing gravel road section which has no significant constraints and has a relatively wide road reserve. • Laydown storage area is located within reach of turbine locations via internal roads. • Located within 11km to the main Road R65	• Located approximately 20km from the N2 - Class 1 paved road. • The complete length of the internal road is currently gravel. • Accessibility from the south (N2) may be relatively challenging due to some constraints (narrow bridges) and noticeable horizontal and vertical curves along this road section. • Low level bridges might require upgrading.

3.2 Alternative Site

Table 3-2: Advantages and Disadvantages of Alternative site

Site: Emvelo WEF	**Laydown Area: Advantages**	**Laydown Area: Disadvantages**
Traffic and Transportation: Accessibility	• There are no alternative sites proposed for the On-site Substation and O&M Buildings. • Laydown storage area is located directly adjacent to the main paved road Class 2 (R65). • Possible direct access from the R65 for beneficial for ease of access/transportation of material/components to the laydown storage site. • Relatively flat along potential access road length presenting minimal vertical sight distance issues for the main access point.	• Laydown storage area is currently served by an Informal access and may require an application for formal access. • Limited access roads/no established access roads to the various turbine locations and will require upgrading/construction of new internal access roads. • Laydown storage area is isolated relative to most turbine locations. • Situated on a bend (R65) and may pose horizontal sight distance issues for the main access point.

4 Way Forward

Specialist inputs into the scoping assessment will be combined to determine the preferred site, not only from a traffic and transportation assessment. Once selected, the site layout plan will be developed and a final Impact Assessment including specialist studies for traffic and transportation will need to be conducted. Scoping allows for the identification of the anticipated impacts, particularly those that will require details specialist investigations.

This section of the report aims to predict the potential impacts likely to occur from the undertaking of the proposed activities that will need to be evaluated during the Impact Assessment phase of the EIA regardless of the alternative site selected.

4.1 Project Life Cycle

The project life cycle for a new substation and power line includes the following primary activities:

- **Feasibility phase** - This includes selecting a suitable location for the substation and buffer as well as a corridor for the line route, which is assessed as part of the EIA. Servitude negotiations are also initiated during this phase.
- **Planning and design phase** - This phase, which is only undertaken should environmental authorisation be obtained, includes the following:
  - Aerial survey of the route;
  - Selection of the most appropriate structures;
  - Eskom and environmental specialists (e.g., ecologist, heritage) conduct a walk-down survey to determine the exact locations of the towers, based on sensitive environmental features and technical criteria; and
  - Preparation of relevant planning documentation, including technical and design documentation.
- **Construction phase** – During the implementation of the project, the construction activities related to the installation of the necessary infrastructure and equipment is undertaken.
- **Operational phase** - This includes operational activities associated with the maintenance and control of the substation and the power line.
- **Decommissioning** - This phase will include measures for complying with the prevailing regulatory requirements, rehabilitation and managing environmental impacts to render the affected area suitable for future desirable use.

The potential impact is expected to be minimal or insignificant during the planning, and the rehabilitation phase. This is due to low volumes of traffic expected to be generated by the two phases. Considering this, only the Construction, Operational and Decommissioning phases are anticipated to require investigation during the Impact Assessment Phase of the EIA process for the selected site.

4.2 Anticipated Traffic and Transportation Related Impacts

This section describes the anticipated construction phase related impacts to be assessed as part of the specialist assessment of the Impact Assessment phase of the EIA. The results (Impact Assessment Rating) of the high-level screening of impacts for both the preferred and alternative sites are included in the following section and are based on the prescribed Hacking Methodology (Part 2: Ranking the Significance of Environmental Aspects and Impacts) which is included in Appendix B.

The adopted methodology follows the requirements of Appendix 2 of GN R982, of the 2014 EIA Regulations in terms of the identification of potential significance of environmental aspects during scoping. As per the adopted impact assessment methodology, the overall significance (risk) of the impacts associated with the significant aspects can be determined by considering the risk as follows.

- **Significance of Environmental Impact (Risk) = Probability x Consequence.**

Whereby consequence is based on the criteria for ranking the severity, duration, and spatial extent of impacts. Figure 4-1 shows the various ranking criteria followed during the iterative process of the assessment.

Significance of Environmental Impact (Risk)

- **High**
  - ***Negative Aspect -*** *Will always/often exceed legislation or standards. Has characteristics that could cause significant negative impacts.*
  - ***Positive Aspects -*** *Compliance with all legislation and standards. Has characteristics that could cause significant positive impacts.*
- **Moderate**
  - ***Negative Aspect -*** *Has characteristics that could cause negative impacts.*
  - ***Positive Aspects -*** *Has characteristics that could cause positive impacts.*
- **Low**
  - ***Negative Aspect -*** *Will never exceed legislation or standards/Unlikely to cause significant negative impacts.*
  - ***Positive Aspects -*** *Will always comply with all legislation and standards/Unlikely to cause significant positive impacts.*

Probability of an impact

- **High**
  - *Definite Continuous*
- **Medium**
  - *Possible Frequent*
- **Low**
  - *Unlikely Seldom*

Consequence of an impact

- **Severity**
  - ***L/M/H*** *- Where the severity of an impact varies with distance, the severity should be determined at the point of compliance or the point at which sensitive receptors will be encountered. This position corresponds to the spatial extent of the impact*
- **Duration**
  - ***L -*** *Quickly reversible; Less than the project life; Short-term*
  - ***M -*** *Reversible over time; Life of the project; Medium-term*
  - ***H -*** *Permanent; Beyond closure; Long-term*
- **Spatial Extent**
  - ***L -*** *Localised; Within site boundary; Site*
  - ***M -*** *Fairly widespread; Beyond site boundary; Local*
  - ***H -*** *Widespread; Far beyond site boundary; Regional/national*

Figure 4-1: Criteria for Ranking Impacts

4.2.1 Deterioration of road network conditions

Heavy vehicle traffic during both construction and decommissioning phase of the development are expected to cause additional wear and tear on the surrounding road network. The gravel roads to the sites are also expected to sustain damage during the construction and decommissioning phase of the project (i.e., surface distress - gravel loss leading to damage to the existing gravel road layers and rutting).

4.2.2 Impact of dust along gravel access roads

Heavy vehicles are expected to cause dust along unpaved access roads to the site during the transportation of various components to the site leading to possible loss of visibility from a safety point of view, health, damage to roadside vegetation and environmental impact such as air pollution.

4.2.3 Impact of additional traffic volumes on road sections, intersection capacity and traffic safety

The project will inevitably result in the disruption of traffic on Local, Regional, and National Routes but to some varying degrees. The severity of the impacts will depend on the order of the road (how many lanes, width, length, turns, etc.), the receiving environment and vicinity of land uses and towns. Additional traffic on the road network could result in changes to the operations of that road network. Additionally, the severity of the impacts will depend on the expected traffic volumes to be generated by the proposed development. A full traffic impact study will be required to estimate the volume of traffic associated with the transportation of personnel and materials/components to site during the construction and operational phases. The standards, manuals, and guideline documents to be used are as follows (as applicable):

- Technical Methods for Highways (TMH) 16: Volume 1 and Volume 2 - South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual; and
- Technical Recommendations for Highways (TRH) 26 South African Road Classification and Access Management Manual (Version 1.0 August 2012).

4.2.4 Impact of abnormal loads

The project will inevitably result in the movement of abnormal loads on Local, Regional and National Routes, but to varying degrees. The severity of the impacts will depend on the travelling speed, vehicle size and loaded height of the abnormal vehicles expected. Thus, additional abnormal traffic on the road network could result in changes to the operational performance/level of service of that road network. The standards, manuals, and guideline documents to be used are as follows (as applicable):

- The National Road Traffic Regulations (1999) promulgated under Section 75 of the National Road Traffic Act (Act No. 93 of 1996) regulate the conveyance of abnormal loads and dangerous goods on public roads; and
- TRH 11 Dimensional and Mass Limitations and Other Requirements for Abnormal Load Vehicles.

4.3 Potential Impact Assessment Rating

Table 4-1: Impact Assessment Rating - Road Network Conditions

Impact Phase: Construction							
Potential impact description: **Deterioration of Road Network Conditions** Detailed description of impact Road damage - Additional wear and tear on the surrounding road network caused by development heavy vehicles. Gravel roads to various sites are also expected to sustain damage during the construction and decommissioning phase of the project (i.e., surface distress - gravel loss leading to damage to the existing gravel road layers and rutting).							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Medium	Low	Negative	Medium	Medium	High
With Mitigation	Low	Low	Low	Neutral	Low	Low	Medium
Can the impact be reversed?			YES				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			Mitigated				
Mitigation measures to reduce residual risk or enhance opportunities: • *Limit number and frequency of heavy and overloaded vehicles where possible* • *Do exceed legally permissible axle mass load of heavy vehicles* • *Continuous Monitoring, Maintenance and upgrading of affected road pavement sections*							
Residual impact	*Yes, but acceptable as of low negative significance negative impact as most toads are currently in fair to good conditions*						

Table 4-2: Impact Assessment Rating – Impact of Dust along Gravel Access Roads

Impact Phase: Construction							
Potential impact description: **Impact of dust along gravel access roads** Detailed description of impact Heavy vehicles are expected to cause dust along unpaved access roads to the site during the transportation of various components to the site leading to possible loss of visibility from a safety point of view, health, damage to roadside vegetation and environmental impact such as air pollution.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Low	Low	Low	Negative	Low	Low	High
With Mitigation	Low	Low	Low	Neutral	Low	Low	High
Can the impact be reversed?			YES				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			Managed				
Mitigation measures to reduce residual risk or enhance opportunities: • *Regular wet grading and wetting for dust suppression to minimize the negative impact* • *Limit dust generation activities during strong wind periods*							
Residual impact	*Yes, but acceptable as of low negative significance*						

Table 4-3: Impact Assessment Rating – Impact of Additional Peak Hour Traffic Volumes, Intersection Capacity and Traffic Safety

Impact Phase: Construction							
Potential impact description: **Impact of additional traffic volumes on road sections and intersection capacity and traffic safety** Detailed description of impact Disruption of traffic on Local, Regional, and National Routes due to additional peak hour traffic volumes associated with the transportation of personnel and materials/components to site during the construction. Additional traffic on the road network could result in changes to the normal operations of that road network.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Medium	Low	Negative	High	Medium	High
With Mitigation	Low	Low	Low	Neutral	Low	Low	High
Can the impact be reversed?			YES				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			Yes, can be managed and mitigated				
Mitigation measures to reduce residual risk or enhance opportunities: • *Schedule development traffic movement to not coincide with existing peaks where possible* • *Encourage use of public transportation* • *Implementation of approved Traffic Management Plan*							
Residual impact	*Yes, but acceptable as of low negative significance due to construction phase period being significantly lower than project life*						

Table 4-4: Impact Assessment Rating – Impact of Abnormal Loads

Impact Phase: Construction							
Potential impact description: **Impact of abnormal loads** Detailed description of impact The project will inevitably result in the movement of abnormal loads on Local, Regional and National Routes, but to varying degrees. The severity of the impacts will depend on the travelling speed, vehicle size and loaded height of the abnormal vehicles expected. Thus, additional abnormal traffic on the road network could result in changes to the operational performance/level of service of that road network.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	High	Low	Negative	Medium	High	High
With Mitigation	Medium	Medium	Low	Neutral	Medium	Medium	Medium
Can the impact be reversed?			NO				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			NO but can be managed and mitigated				
Mitigation measures to reduce residual risk or enhance opportunities: • *Ensure heavy vehicle safety and overloading checks* • *Legally permissible maximum dimension and axle mass load of heavy vehicles* • *Implementation of approved Traffic Management Plan - Warning devices and use of escort vehicles, traffic officers, etc* • *Maintain reasonable travel speed to avoid unnecessary traffic congestion*							
Residual impact	*Yes, unacceptable high negative impact if no measures are implemented*						

Table 4-5: EIA Risk Assessment

	PRIOR TO MITIGATION										POST MITIGATION								
Reference	Impact Description	Phase	Severity	Extent	Duration	Consequence of Impact	Probability	Confidence	Status	Significance of Impact	Mitigation Measures	Severity	Extent	Duration	Consequence of Impact	Probability	Confidence	Status	Significance of Impact
All Sites	Deterioration of road network condition	Construction	High	Medium	Low	Medium	Medium	High	Negative	Medium	Limit number and frequency of heavy and overloaded vehicles where possible, Upgrading of pavement, Do not exceed legally permissible axle mass load of heavy vehicles	Low	Low	Low	Low	Low	High	Neutral	Low
All Sites	Increase in dust along unsurfaced gravel access roads	Construction	High	Medium	Low	Medium	High	High	Negative	Medium	Regular wet grading and wetting for dust suppresion to minimise the negative impact	Low	Low	Low	Low	Low	High	Neutral	Low
All Sites	Increase in peak hour traffic volumes	Construction	High	Medium	Low	Medium	High	High	Negative	Medium	Limit use of private cars, Schedule development traffic movement to not coincide with existing peaks where possible, Encourage use of public transportation, •Implementation of approved Traffic Management Plan	Low	Low	Low	Low	Low	High	Neutral	Low
All Sites	Impact of abnormal loads	Construction	High	High	Low	High	Medium	High	Negative	High	Ensure heavy vehicle safety and overloading checks, Implementation of approved Traffic Management Plan - Warning devices and use of escort vehicles, traffic officers, etc, Maintain reasonable travel speed to avoid unnecessary traffic congestion	Low	Low	Low	Low	Medium	Medium	Neutral	Medium

4.4 Cumulative Impact Assessment Rating

It is understood that there are currently no planned or approved Renewable Energy Facilities within 35 km of the Mulilo WEF Cluster based on the data using the REEA_OR_2022_Q4. Hence the only developments to be considered are 2 of the 3 proposed Mulilo WEF Clusters namely, Emvelo WEF and Sheepmoor WEF.

The addition of other WEFs in the area is expected to increase the overall impact due to increased construction-related activities. However, some impacts will be unavoidable but can remain within acceptance tolerances.

The overall impacts are expected to be of low to moderate negative significance post mitigation through appropriate measures.

Table 4-6: Cumulative Impact Assessment Rating - Road Network Conditions

Impact Phase: Construction							
Potential impact description: **Deterioration of Road Network Conditions** Detailed description of impact Road damage - Additional wear and tear on the surrounding road network caused by development heavy vehicles. Gravel roads to various sites are also expected to sustain damage during the construction and decommissioning phase of the project (i.e., surface distress - gravel loss leading to damage to the existing gravel road layers and rutting).							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Medium	Medium	Negative	High	Medium	High
With Mitigation	Low	Low	Low	Neutral	Low	Low	Medium
Can the impact be reversed?			YES				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			Mitigated				
Mitigation measures to reduce residual risk or enhance opportunities: • *Limit number and frequency of heavy and overloaded vehicles where possible* • *Do exceed legally permissible axle mass load of heavy vehicles* • *Continuous Monitoring, Maintenance and upgrading of affected road pavement sections*							
Residual impact	*Yes, but acceptable as of low negative significance negative impact as most toads are currently in fair to good conditions*						

Table 4-7: Cumulative Impact Assessment Rating – Impact of Dust along Gravel Access Roads

Impact Phase: Construction							
Potential impact description: **Impact of dust along gravel access roads** Detailed description of impact Heavy vehicles are expected to cause dust along unpaved access roads to the site during the transportation of various components to the site leading to possible loss of visibility from a safety point of view, health, damage to roadside vegetation and environmental impact such as air pollution.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Medium	Low	Negative	High	Medium	High
With Mitigation	Low	Low	Low	Neutral	Low	Low	High
Can the impact be reversed?			YES				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			Managed				
Mitigation measures to reduce residual risk or enhance opportunities: • *Regular wet grading and wetting for dust suppression to minimize the negative impact* • *Limit dust generation activities during strong wind periods*							
Residual impact	*Yes, but acceptable as of low negative significance*						

Table 4-8: Cumulative Impact Assessment Rating – Impact of Additional Peak Hour Traffic Volumes, Intersection Capacity and Traffic Safety

Impact Phase: Construction							
Potential impact description: **Impact of additional traffic volumes on road sections and intersection capacity and traffic safety** Detailed description of impact Disruption of traffic on Local, Regional, and National Routes due to additional peak hour traffic volumes associated with the transportation of personnel and materials/components to site during the construction. Additional traffic on the road network could result in changes to the normal operations of that road network.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	High	Medium	Negative	High	High	High
With Mitigation	Medium	Medium	Low	Negative	Medium	Nedium	High
Can the impact be reversed?			YES				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			Yes, can be managed and mitigated				
Mitigation measures to reduce residual risk or enhance opportunities: • *Schedule development traffic movement to not coincide with existing peaks where possible* • *Encourage use of public transportation* • *Implementation of approved Traffic Management Plan*							
Residual impact	*Yes, but acceptable as of low negative significance due to construction phase period being significantly lower than project life*						

Table 4-9: Cumulative Impact Assessment Rating – Impact of Abnormal Loads

Impact Phase: Construction							
Potential impact description: **Impact of abnormal loads** Detailed description of impact The project will inevitably result in the movement of abnormal loads on Local, Regional and National Routes, but to varying degrees. The severity of the impacts will depend on the travelling speed, vehicle size and loaded height of the abnormal vehicles expected. Thus, additional abnormal traffic on the road network could result in changes to the operational performance/level of service of that road network.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	High	Medium	Negative	High	High	High
With Mitigation	Medium	Medium	Medium	Neutral	Medium	Medium	Medium
Can the impact be reversed?			NO				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			NO but can be managed and mitigated				
Mitigation measures to reduce residual risk or enhance opportunities: • *Ensure heavy vehicle safety and overloading checks* • *Legally permissible maximum dimension and axle mass load of heavy vehicles* • *Implementation of approved Traffic Management Plan - Warning devices and use of escort vehicles, traffic officers, etc* • *Maintain reasonable travel speed to avoid unnecessary traffic congestion*							
Residual impact	*Yes, unacceptable high negative impact if no measures are implemented*						

Table 4-10: Cumulative EIA Risk Assessment

Reference	PRIOR TO MITIGATION										POST MITIGATION								
	Impact Description	Phase	Severity	Extent	Duration	Consequence of Impact	Probability	Confidence	Status	Significance of Impact	Mitigation Measures	Severity	Extent	Duration	Consequence of Impact	Probability	Confidence	Status	Significance of Impact
All Sites	Deterioration of road network condition	Construction	High	Medium	Medium	Medium	High	High	Negative	Medium	Limit number and frequency of heavy and overloaded vehicles where possible, Upgrading of pavement, Do not exceed legally permissible axle mass load of heavy vehicles	Low	Low	Low	Low	Low	Medium	Neutral	Low
All Sites	Increase in dust along unsurfaced gravel access roads	Construction	High	Medium	Low	Medium	High	High	Negative	Medium	Regular wet grading and wetting for dust suppresion to minimise the negative impact	Low	Low	Low	Low	Low	High	Neutral	Low
All Sites	Increase in peak hour traffic volumes	Construction	High	High	Medium	High	High	High	Negative	High	Limit use of private cars, Schedule development traffic movement to not coincide with existing peaks where possible, Encourage use of public transportation, •Implementation of approved Traffic Management Plan	Medium	Medium	Low	Medium	Medium	High	Negative	Medium
All Sites	Impact of abnormal loads	Construction	High	High	Medium	High	High	High	Negative	High	Ensure heavy vehicle safety and overloading checks, Implementation of approved Traffic Management Plan - Warning devices and use of escort vehicles, traffic officers, etc, Maintain reasonable travel speed to avoid unnecessary traffic congestion	Medium	Medium	Medium	Medium	Medium	Medium	Negative	Medium

4.5 Assumptions and Limitations

The following assumptions and limitations accompany the Scoping exercise:

- In accordance with the purpose of Scoping, the report does not include detailed specialist investigations on the receiving environment, which will only form part of the EIA phase. The environment in the project area was primarily assessed through site visits and appraisals, desktop screening, incorporating existing information from previous studies, and input received from authorities and IAPs. A refinement of all maps will also be undertaken in the EIA phase, if necessary;
- The construction phase is expected to have the highest traffic impact of all the phases as it will primarily comprise of transporting equipment, turbine components, personnel, construction, and other facility materials comprising of normal, heavy, and abnormal load vehicles. For the construction phase of the wind farm, the following assumptions will be made for trip estimations purposes:
    - Construction period;
    - Vehicle options for transportation of material and equipment delivery;
    - Facility components specifications as per the technical details;
    - Vehicle options for transportation of daily commuters and labour workforce;
- The operational phase is expected to have comparatively minimal traffic impact as the only transport required will be associated with monitoring, operation, and maintenance. For the operational phase of the wind farm, the following assumptions will be made for trip estimations purposes:
    - Onsite permanent staff consisting of operational and maintenance teams;
    - Daily labour transportation modes;
    - Occasional major repair/servicing events.
- The decommissioning phase is expected to take place after envisaged facility lifespan of 20 – 25 years if there is no longer an economical / technical basis for an energy plant. Hence, the Wind Energy Facility would be decommissioned and the land rehabilitated. Therefore, it is assumed that this phase will generate the same trips and traffic impact relative to the construction phase and over the same period.

4.6 Plan of Study for EIA Phase

This section outlines key tasks which are required to produce the Traffic and Transportation Impact Assessment Specialist Study for the EIA Phase of the project.

4.6.1 Site Investigation and Desktop Study Requirements

Site investigations and desktop screening have been carried out during the initial Site Assessment Visit.

4.6.2 Data Collection Requirements

To understand the effects of additional traffic on the road network, an understanding of existing road network traffic conditions is required. Thus 12-hour manual classified traffic counts data should be collected at key intersections around the proposed development. While the exact locations and number of intersections to be counted is dependent on the final site selected, up to 5 manual classified traffic counts are anticipated. Additional

SANRAL CTO station data will be collected to develop an understanding of general traffic patterns along the major road network.

Locations of survey intersections are indicated in Figure 4-2 and listed below.

1. Intersection of National Road N2 and Road D532/Station Street;
2. Intersection of Road D532 and Road D1299;
3. Intersection of R65 and Road D532 (south);
4. Intersection of R65 and Road D532 (north); and
5. Intersection of R65 and Road D1299;

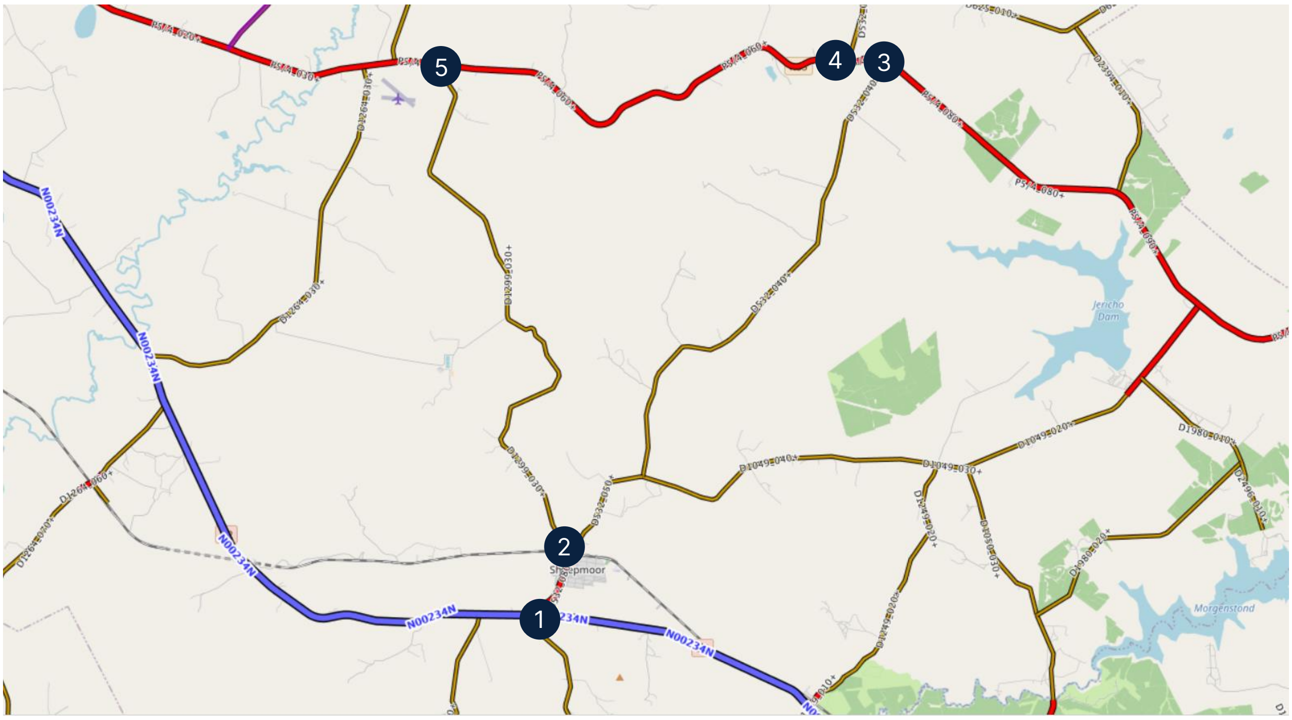

Figure 4-2: Locations of traffic counts

4.6.3 Access Arrangements Requirements

An analysis of access routes and site access positions will be re-evaluated based on the final layout of the turbine positions. Site distance assessment will also be included in the evaluation of access, particularly during the construction phase, to ensure safety and its appropriateness. It has been assumed that site access will be gained using existing roads.

4.6.4 Trip Generation, Assignment and Distribution

Traffic volumes for the construction, operational and decommissioning phases will be estimated based on information received from the client. It is assumed that the client will make information available about the construction, decommissioning and operational approach as well as the preferred origin of vehicles and staff where possible.

4.6.5 Traffic Impact and Mitigation

Base year and forecast year capacity analysis will be undertaken at key local junctions to determine the current traffic operational conditions and the potential impact of the anticipated development trips on the surrounding road network. The analysis will be carried out using SIDRA microsimulation tool to evaluate the level of service and operational performance during the construction, operational and decommissioning phases. Traffic mitigation or management measures as well as residual impacts for the development will be outlined.

4.6.6 Updating of Impact Significance and Ratings

An update on the impact of the development on predicted traffic and pavement loading, along with significance ratings will be included. Additionally, the assessment of traffic impacts during the project lifecycle will inform the EIA phase, where an environmental significance scale will be used to evaluate the importance of a particular impact.

4.6.7 Updating of Transportation Plan

An update to the high-level transportation plan for the construction phase will be conducted based on comments and inputs from various stakeholders. This update will involve amongst others a review of origins and destinations of equipment and the transportation route (options) from the point of delivery to the site.

4.6.8 Consultation Requirements

Consultation with relevant national/provincial/local road authorities is required to ensure approval of the EIA Traffic and Transportation Specialist Assessment. The following authorities will need to be consulted as part of the Impact Assessment procedure:

- SANRAL;
- Mpumalanga Provincial Roads Department; and
- Msukaligwa Local Municipality/Gert Sibande District Municipality.

The extent of consultations will depend on the site selected and whether new access intersections will be required.

4.6.9 Recommendations

The final traffic and transportation assessment will outline conclusions and recommendations to mitigate any traffic impacts of the proposed development on road users and surrounding communities.

Where construction of site access/intersections, new external/internal roads or upgrading of existing roads is required, the impact of such related construction activities will be managed and mitigated through traffic control and traffic accommodation measures. An example of a stop-and-go operation typically implemented during upgrades on access points is shown in Figure 4-3.

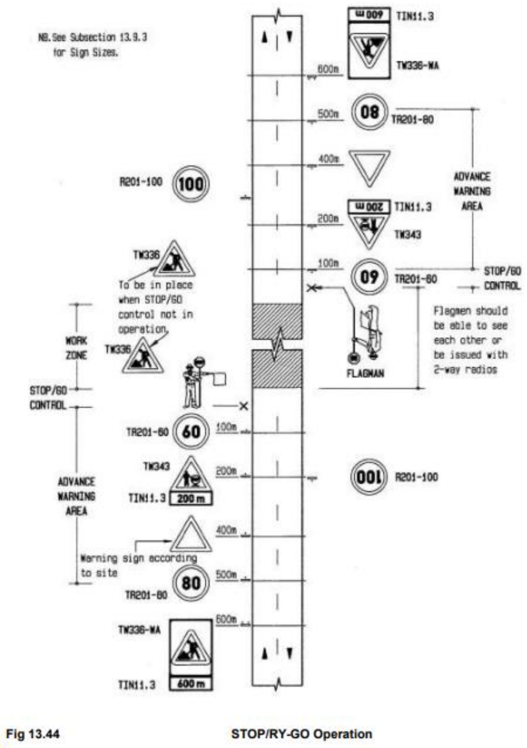

Figure 4-3: Stop and Go (SARTSM Volume 2)

5 Recommendations

Based on the nature and extent of the proposed Emvelo WEF development, some level of disturbance can be expected on the immediate road network and regionally because of the construction and operational phases. The overall potential impact is expected to be moderate to low during both the construction phase and operational phase, respectively.

During the site visit it was observed that the Provincial Road R65 carries lower traffic volumes than the N2 National Road which already carries a high proportion of trucks including abnormal vehicles. Thus, the preferred local transportation route is the R65 due to its substantially lower existing traffic volumes.

It is the opinion of the traffic engineering project team that the impacts associated with the project can be assessed and mitigated to an acceptable level for the preferred sites. In this regard the preferred sites for the Emvelo WEF on-site substation, O&M buildings are recommended for Environmental Authorisation from a traffic and transportation perspective.

Appendix A **Site Visit Report**

SMEC
South Africa
Member of the Surbana Jurong Group

SMEC INTERNAL REF. P1J1

Site Visit Report

Proposed Mulilo Cluster WEF, near Ermelo, Mpumalanga Province

Prepared for Arcus

8 June 2023

Through our specialist expertise, we deliver advanced infrastructure solutions for our clients and partners.

Leveraging our 70-year history of delivering nation-building infrastructure, we provide technical expertise and advanced engineering services to resolve complex challenges.

Through our network of global specialists collaborating with local partners, we connect you with the best teams and capabilities to deliver innovative and sustainable solutions.

We're redefining exceptional

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1 Introduction

1.1 Background

SMEC was appointed by Arcus/ERM (Mulilo Renewable Energy Developments (Pty) Ltd) to conduct a Traffic Impact Assessment (TIA) as part of the Scoping and Environmental Impact Assessment Process (S&EIA) for the proposed development of a commercial wind farm cluster, Mulilo Cluster Wind Energy Facilities (WEF), located near Ermelo, Mpumalanga Province. The proposed Mulilo Cluster WEF will consist of three separate facilities with power generating capacity of between 200 MW-360 MW per facility. Each WEF site will consist of an on-site substation, O&M buildings, laydown areas and associated facility infrastructure. The extent of the post-development infrastructure is summarised in **Table 1-1** below.

Table 1-1: Proposed Development - Mulilo Cluster Wind Energy Facilities (WEF)

No.	Development Site	No. of Turbines	Output Capacity (MW)	Extent (ha)
1	Rochdale WEF	30	240	150 ha
2	Sheepmoor WEF	45	360	150 ha
3	Emvelo WEF	25	200	150 ha

1.2 Study Area

Figure 1-1 shows the location of the proposed Mulilo Cluster Wind Energy Facilities (WEF) development sites and the surrounding road network.

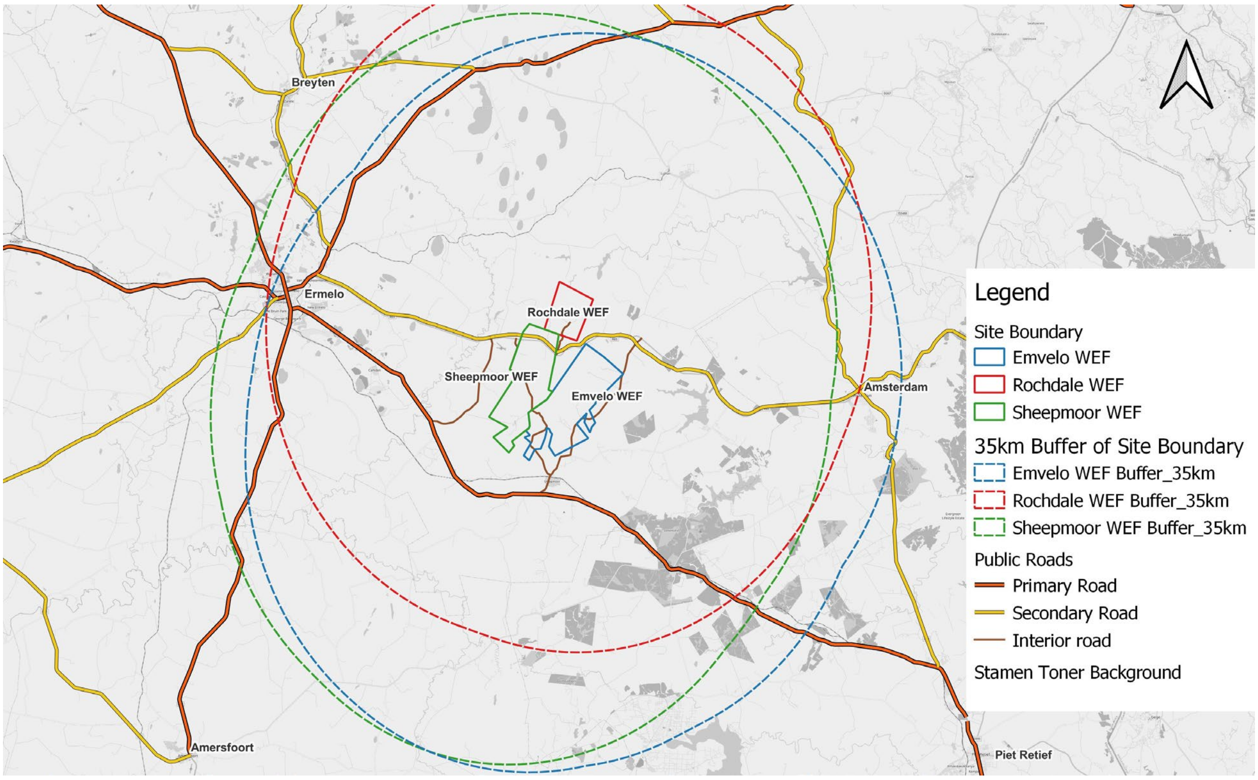

Figure 1-1: Locality Map

2 Objectives

This report forms part of the initial specialist site visit required to produce a Site Sensitivity Report which will inform the subsequent Transport Scoping Assessment phase of the project and ultimately the Specialist Study: Traffic and Transpiration Impact Assessment. A site visit was undertaken on the following date:

- Wednesday, 31 May 2023.

The objective of the site visit was to obtain an overview of current transportation infrastructure network and needs identification within the study area which will be critical in the assessment of the expected transport related impacts of the proposed Mulilo Cluster WEF. Thus, the scope of the site visit was limited to the following aspects:

- Identifying and observing conditions of the surrounding road network;
- Identifying intersections to be considered in the study area;
- Confirming existing intersection layouts/configuration and controls;
- Evaluating site accessibility;
- Evaluating current limitations in terms of lateral clearances required for vehicle movement; and
- Determining existing surrounding land uses;

3 Road Network

This section provides a general description of the available transportation infrastructure in terms of the neighbouring public road network and access within the study area. Figure 3 1 shows the primary road network within the study area which consists of the following roads:

- National Road N2;
- Road D532;
- R65; and
- Road D1299.

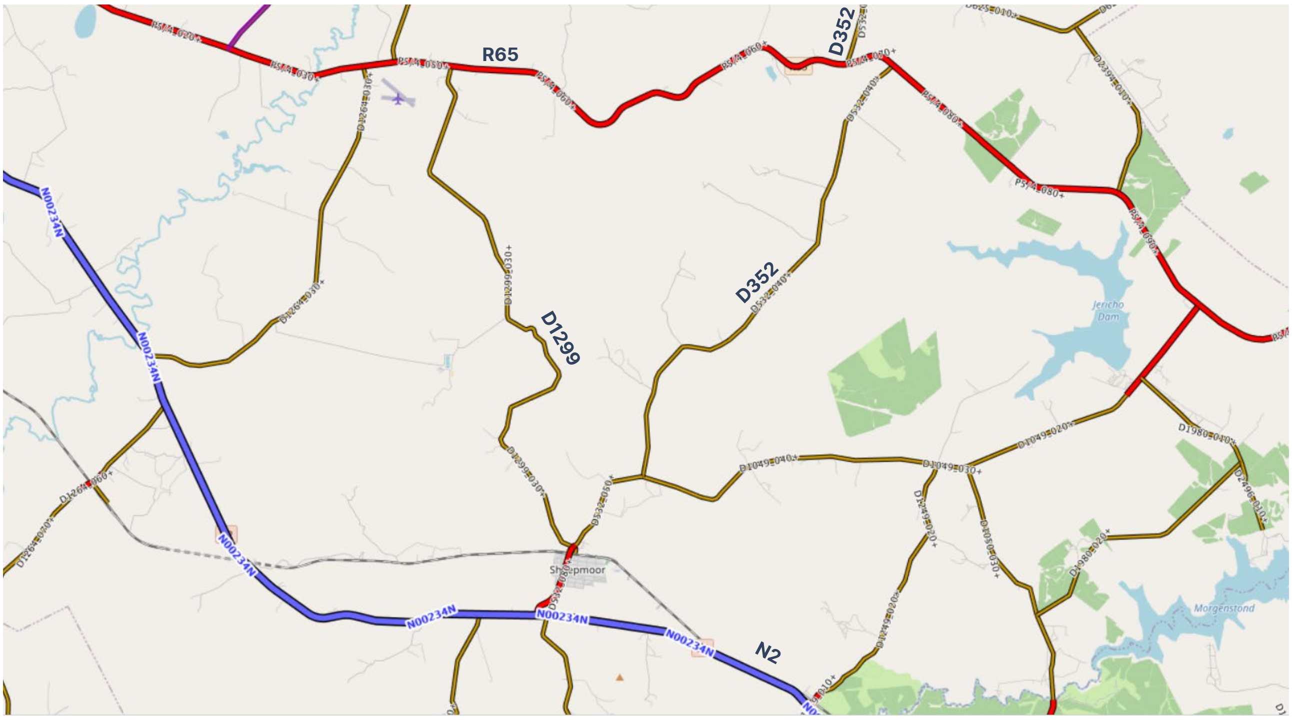

Figure 3-1: Surrounding Road Network

3.1 N2 National Road

The N2 National Road is located to the south of the Sheepmoor WEF and Emvelo WEF. The N2 National Road is a major primary east-west link between the towns of Ermelo and Piet Retief which are situated to the west and east of the proposed development, respectively. The typical cross-section of the N2 National Road is shown in Image 1 and described below:

- Single carriageway (undivided road) with a single lane per direction;
- Typical lane width – 3.5m;
- Typical shoulder width – 0.3m;
- Overall minimum cross-section width – 7.6m;
- General posted speed limit – 80km/h to 120km/h;
- Road surface – flexible pavement; and
- Road conditions – several potholes with some sections currently undergoing routine maintenance.

Image 1: Typical cross-section of the N2 National Road

3.2 Road D532/Station St

Road D532 is located to the east of the Emvelo WEF. Road D532 is a primary north-south local road providing access to the N2 National Road and the R65 which are situated to the south and north of the proposed development, respectively. A paved section of Road D532 of approximately less than 3km road length from the N2 National Road passes through the town of Sheepmoor where it is named Station St. The remainder of the road length continues as an unpaved/gravel road up to the R65. The typical cross-section of Road D532 is shown in Image 2, Image 3 and described below:

- Single carriageway (undivided road) with a single lane per direction:
- Typical lane width – 3.3m;
- Typical shoulder width – 0m;
- Overall cross-section width – 6.6m (Station St) and up to 10m (Road D532);
- General speed limit – 60km/h;
- Road surface – flexible pavement (Station St) to unpaved/gravel/earth (Road D532); and
- Road conditions – fair.

Image 2: Typical cross-section of Station St

Image 3: Typical cross-section of the Road D532

3.3 R65

The R65 is located to the north of the Sheepmoor WEF and Emvelo WEF and lies south of the Rochdale WEF. The R65 is a primary east-west regional road connecting the towns of Amsterdam and Ermelo which are situated to the east and west of the proposed development, respectively. The typical cross-section of the R65 is indicated in Image 4 and described below:

- Single carriageway (undivided road) with a single lane per direction;
- Typical lane width – 3.8m;
- Typical shoulder width – 0m, 1.5m-2.0m;
- Overall minimum cross-section width – 7.6m-11.6;
- General posted speed limit – 80km/h to 120km/h;
- Road surface – flexible pavement; and
- Road conditions – Good.

Image 4: Typical cross-section of the R65

3.4 Road D1299

Road D1299 is located east and west of the Sheepmoor WEF and Emvelo WEF, respectively, and lies south of the Rochdale WEF. Road D1299 is a primary north-south local road providing access to the N2 National Road (through Road D532) and the R65 which are situated to the south and north of the proposed development, respectively. The typical cross-section of the R65 is indicated in image 1 and described below:

- Single carriageway (undivided road);
- Typical overall cross-section width – up to 8.0m;
- General speed limit – 60km/h;
- Road surface – gravel; and
- Road conditions – Fair.

Image 5: Typical cross-section of Road D1299

4 Site Access

Access to the Mulilo Cluster WEF development sites is possible through the following junctions of the road network identified in the previous sections.

- 1. Intersection of National Road N2 and Road D532/Station Street;
- 2. Intersection of Road D532 and Road D1299;
- 3. Intersection of R65 and Road D532 (south);
- 4. Intersection of R65 and Road D532 (north); and
- 5. Intersection of R65 and Road D1299;

Figure 4-1 shows the location of key intersections within the study area. These intersections lead to the existing internal road network (Road D532 and Road D1299) which will allow for direct access to the preferred and alternative development sites.

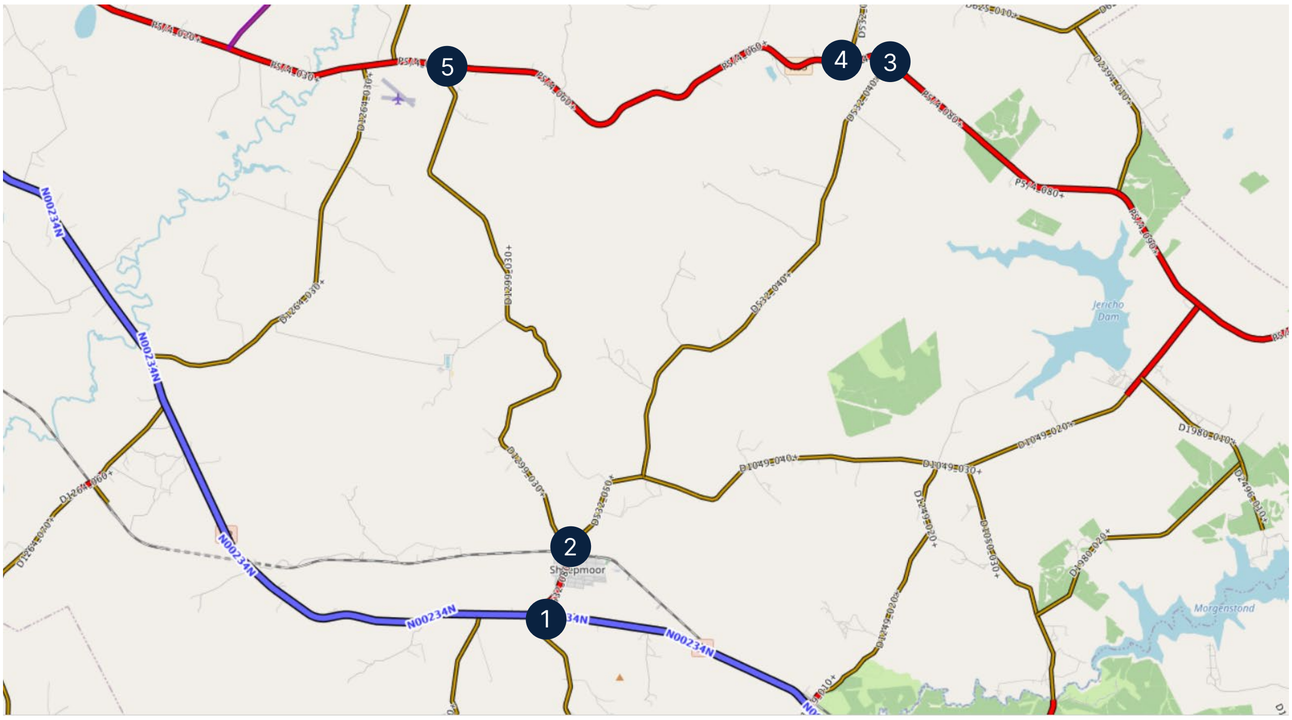

Figure 4-1: Location of key intersections

5 Potential Constraints

Several drainages structures/bridges/culverts were observed along the selected routes. Lateral clearances of the existing river bridges and culverts along both the N2 National Road and the R65 were limited to visual observations while both visual observations and measurements were undertaken for structures encountered along Road D532 and Road D1299.Generally, the measured lateral clearances of bridges spanned from 3.0m to 7.5m wide. In addition, exposed drainage structures and encroaching vegetation were noted. Several photographs showing the condition and state of the receiving road infrastructure are indicated in Table 5-1 and Table 5-2.

Table 5-1: Visual observations along Road D532

Road D532		
 • 3.0m wide single crossing structure • One vehicle crossing structure	 • 4.8m wide single crossing structure • Single crossing structure/narrow bridge	 • Exposed drainage structure • Circular concrete pipe/culvert
 • No barriers/parapets/railings • With parapets and fencing	 • 4.8m wide sigle crossing • No barriers/parapets/railings	 • 7.6m wide • Steel barriers/railings

Table 5-2: Visual observations along Road D1299

Road D1299		
		
• Low crossing • One vehicle crossing structure	• Overgrown/obstructive vegitation	• 4.5m wide single crossing • No barriers/parapets/railings
		
• Narrow road section approching bridge	• 7.5m wide • No barriers/parapets/railings	• 6.5m wide • No barriers/parapets/railings

6 Summary

The following represents a summary of observations during the site visit:

- Generally, a high number of heavy vehicles were observed along the N2 National Road with medium to low traffic volumes along the R65 and very low traffic volumes along both Road D532 and Road D1299;
    - Existing traffic volumes will be surveyed during the Traffic Impact Assessment stage;
- Some drainages structures along Road D532 and Road D1299 appeared to have limitations in terms of the lateral dimensions;
    - Lateral clearances will be evaluated based on the dimensional requirements of the vehicle size/type and load which are expected during the construction phase;
    - Structures may require further investigations for abnormal load carrying capacity;
- 5 existing intersections were identified as potential access locations from/to the development sites;
    - Surveys will be undertaken at these junctions for the purpose of capacity analysis during the Traffic Impact Assessment stage; and
- The existing landscape and topography are generally hilly/rolling with farmlands being the predominant land use.

7 Conclusion

The contents of this report do not include detailed investigations on the receiving environment but merely provide a high-level overview of the existing transport related environment which is expected to accommodate the proposed development. Observations will be used to inform the Scoping report.

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Appendix B Hacking Methodology

AN INNOVATIVE APPROACH
TO STRUCTURING
ENVIRONMENTAL IMPACT ASSESSMENT
REPORTS

Part 2: Ranking the Significance of
Environmental Aspects and Impacts

By: T. Hacking

Anglo American plc

(Currently Environmental Manager at Konkola Copper Mines plc, Zambia)

Abstract

This paper (Part 2) describes a qualitative/ semi-quantitative approach to assessing the significance of environmental aspects and environmental impacts. The approach is intended as a tool for use together with the general framework presented in Part 1.

INTRODUCTION

Owing to the complexity of many of the systems that need to be considered when undertaking an Environmental Impact Assessment (EIA), it is not always possible to obtain quantitative data on which to base the impact assessment. Therefore, it is often necessary to use qualitative or semi-quantitative methods to determine the significance of environmental impacts.

The significance ranking approach presented in this paper is intended as a tool for use together with the general framework presented in Part 1 and is the final step in completing the structured and systematic approach. In Part 1 it was shown how environmental impacts can be linked to the project activities via the responsible "mechanisms", which are defined as *environmental aspects* in the ISO 14 000 series of standards. It was explained that significant impacts would only be present if significant aspects are present. Hence, a method for ranking the significance of aspects is required. Once the significance aspects have been identified, it is necessary to rank the significance of the impacts that could result form them.

SIGNIFICANCE OF ENVIRONMENTAL ASPECTS

The significance of environmental aspects can be determined and ranked by considering the criteria presented in Table 1. In some cases it may be necessary to undertake the impact assessment to determine whether a particular aspect is significant. Therefore, a fair degree of iteration is unavoidable during the assessment process.

Table 1 – Criteria used to determine the significance of environmental aspects

Significance Ranking	**Negative Aspects**	**Positive Aspects**
H (High)	Will always/often exceed legislation or standards. Has characteristics that could cause significant negative impacts.	Compliance with all legislation and standards. Has characteristics that could cause significant positive impacts.
M (Moderate)	Has characteristics that could cause negative impacts.	Has characteristics that could cause positive impacts.
L (Low)	Will never exceed legislation or standards. Unlikely to cause significant negative impacts.	Will always comply with all legislation and standards. Unlikely to cause significant positive impacts.

The aspect identification and ranking process is largely a screening exercise whereby the aspects that do not have the potential to cause significant impacts are eliminated. Aspects ranked "high" and "moderate" are significant and the possible impacts associated with their presence will need to be determined. Aspects ranked "low" do not warrant further attention.

The significance of the aspects should be ranked on the assumption that the management recommended in the EIA will be in place i.e. *with management.* This represents the scenario that the proponent wishes to have considered for approval. The environmental aspects associated with the proposed project activities during the construction, operational, closure phases (where appropriate) need to be identified. The influence of various project alternatives on the significance of the aspects must also be considered.

It may be desirable to also undertake a *without management* aspect ranking, since this highlights the sensitivity of the key risk areas to management and, hence, the management priorities. However, the dilemma in such an exercise is deciding on how much management to include. In the case of a mining project, for example, does one assume that the tailings dam will be completely absent or merely operated poorly? A useful rule of thumb is to assume that all the management required for operational reasons will be in place, but that any management specifically for environmental control will be absent. The danger in presenting *without management* ranking scenario in an EIA report is that it does not represent the scenario that the proponent wishes to have approved.

SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Where significant environmental aspects are present ("high" or "moderate"), significant environmental impacts ***may*** result. The significance of the impacts associated with the significant aspects can be determined by considering the risk:

Significance of Environmental Impact (Risk) = Probability x Consequence

The consequence of impacts can be described by considering the severity, spatial extent and duration of the impact.

Severity of Impacts

Table 2 presents the ranking criteria that can used to determine the severity of impacts on the bio-physical and socio-economic environment. Table 3 provides additional ranking criteria for determining the severity of negative impacts on the bio-physical environment.

Table 2 – Criteria for ranking the *Severity* of environmental impacts

Type of Criteria	Negative			Positive		
	H-	**M-**	**L-**	**L+**	**M+**	**H+**
Qualitative	Substantial deterioration. Death, illness or injury.	Moderate deterioration. Discomfort.	Minor deterioration. Nuisance or minor irritation.	Minor improvement.	Moderate improvement.	Substantial improvement .
Quantitative	Measurable deterioration.		Change not measurable i.e. will remain within current range.		Measurable improvement.	
	Recommended level will often be violated.	Recommended level will occasionally be violated.	Recommended level will never be violated.		Will be within or better than recommended level.	
Community Response	Vigorous community action.	Widespread complaints.	Sporadic complaints.		No observed reaction.	Favourable publicity

Table 3 – Criteria for ranking the *Severity* of negative impacts on the bio-physical environment

Environment	Ranking Criteria		
	Low (L-)	**Medium (M-)**	**High (H-)**
Soils and land capability	Minor deterioration in land capability. Soil alteration resulting in a low negative impact on one of the other environments (e.g. ecology).	Partial loss of land capability. Soil alteration resulting in a moderate negative impact on one of the other environments (e.g. ecology).	Complete loss of land capability. Soil alteration resulting in a high negative impact on one of the other environments (e.g. ecology).
Ecology (Plant and animal life)	Disturbance of areas that are degraded, have little conservation value or are unimportant to humans as a resource. Minor change in species variety or prevalence.	Disturbance of areas that have some conservation value or are of some potential use to humans. Complete change in species variety or prevalence.	Disturbance of areas that are pristine, have conservation value or are an important resource to humans. Destruction of rare or endangered species.
Surface and Groundwater	Quality deterioration resulting in a low negative impact on one of the other environments (ecology, community health etc.)	Quality deterioration resulting in a moderate negative impact on one of the other environments (ecology, community health etc.).	Quality deterioration resulting in a high negative impact on one of the other environments (ecology, community health etc.).

Spatial Extent and Duration of Impacts

The duration and spatial scale of impacts can be ranked using the following criteria:

Table 4 – Ranking the *Duration* and *Spatial Scale* of impacts

	Ranking Criteria		
	L	**M**	**H**
Duration	Quickly reversible Less than the project life Short-term	Reversible over time Life of the project Medium-term	Permanent Beyond closure Long-term
Spatial Scale	Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/national

Where the severity of an impact varies with distance, the severity should be determined at the point of compliance or the point at which sensitive receptors will be encountered. This position corresponds to the spatial extent of the impact.

Consequence of Impacts

Having ranked the severity, duration and spatial extent, the overall consequence of impacts can be determined using the following qualitative guidelines:

Table 5 – Ranking the *Consequence* of an impact

			SEVERITY = L		
DURATION	Long-term	**H**			
	Medium-term	**M**			**MEDIUM**
	Short-term	**L**	**LOW**		
			SEVERITY = M		
DURATION	Long-term	**H**			**HIGH**
	Medium-term	**M**		**MEDIUM**	
	Short-term	**L**	**LOW**		
			SEVERITY = H		
DURATION	Long-term	**H**			
	Medium-term	**M**			**HIGH**
	Short-term	**L**	**MEDIUM**		
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/national
			SPATIAL SCALE		

To use Table 5, firstly go to one of the three “layers” based on the severity ranking obtained from Table 2 and/ or Table 3. Thereafter determine the consequence ranking by locating the intersection of the appropriate duration and spatial scale rankings.

Overall Significance of Impacts

Combining the consequence of the impact and the probability of occurrence, as shown by Table 6, provides the overall significance (risk) of impacts.

Table 6 – Ranking the *Overall Significance* of impacts

PROBABILITY	Definite Continuous	**H**	**MEDIUM**		**HIGH**
	Possible Frequent	**M**		**MEDIUM**	
	Unlikely Seldom	**L**	**LOW**		**MEDIUM**
			L	**M**	**H**
			CONSEQUENCE (from Table 5)		

The overall significance ranking of the negative environmental impacts provides the following guidelines for decision making:

Table 7 – Guidelines for decision-making

Overall Significance Ranking	Nature of Impact	Decision Guideline
High	Unacceptable impacts.	Likely to be a fatal flaw.
Moderate	Noticeable impact.	These are unavoidable consequence, which will need to be accepted if the project is allowed to proceed.
Low	Minor impacts.	These impacts are not likely to affect the project decision.

Priority of Primary Impacts

In some cases environmental aspects could result in impacts on a number of environments. For example, the release of contaminated runoff could pollute surface water, which in turn could adversely impact on the ecology. In such cases the impact on the environment in which the first or primary impact occurs should be considered first. In the example “surface water” is the environment on which the primary impact occurs. If it can be shown that the impact on the primary environment will be insignificant, then secondary impacts need not be considered.

CONCLUSIONS

While the significance ranking methodology presented in above is not a substitute for more sophisticated qualitative methods, it is a step forward from the arbitrary methods that are often used to determine the significance of environmental impacts. In many instances it is impractical or prohibitively costly to source the data required to undertake a fully quantitative assessment and, hence, a qualitative or semi-quantities approach is the best option available. If used in conjunction with the general framework outlined in Part 1, it provides a systematic and structured approach to undertaking an EIA.

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SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for 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)

REPORT TITLE
Mulilo Amsterdam WEFs - Rochdale, Sheepmoor and Emvelo projects

Kindly note the following:

1. This form must always be used for assessment that are in support of 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 August 2023. 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.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the 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 act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Traffic Impact Assessment: Proposed Hugo Wind Energy Facility (WEF)
Specialist Company Name	SMEC South Africa (Pty) Ltd
Specialist Name	Victor de ABREU
Specialist Identity Number	6310295131087
Specialist Qualifications:	Master of Science in Engineering
Professional affiliation/registration:	Professional Engineer (ECSA) – Membership No. 950108, 16/03/1995
Physical address:	267 Kent Avenue, Ferndale, Johannesburg, 2194, South Africa
Postal address:	PO Box 72927
Postal address	Pinegowrie, 2023
Telephone	+27 11 369 0600
Cell phone	+27 82 416 9393
E-mail	Victor.deAbreu@smec.com

2. DECLARATION BY THE SPECIALIST

I, Victor de Abreu declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements 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 National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 NEMA Act.

Signature of the Specialist

SMEC South Africa (Pty) Ltd

Name of Company:

05 Aug 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Victor de Abreu________, 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

SMEC South Africa (Pty) Ltd

Name of Company

5 Aug 2024

Date

DAmerica

Signature of the Commissioner of Oaths

05|08|2024

Date

DAVIDENE AMERICA
Senior Proposal Administrator
Commissioner of Oaths
Area: Johannesburg North
Date: 31 January 2022
Reference: RO-05/01/2022
267 Kent Avenue, Ferndale, Randburg, 2194

EMVELO WIND ENERGY FACILITY AND GRID CONNECTION
MPUMALANGA, SOUTH AFRICA
BAT (CHIROPTERA) SCOPING REPORT

October 2023

Produced for

Emvelo Wind Energy Facility (Pty) Ltd

Produced by

Camissa Sustainability Consulting

Amsterdam, Netherlands

CONTENTS

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix 2
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix 3
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 4
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5.1, Section 6
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 4
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 4
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 6
g) an identification of any areas to be avoided, including buffers;	Section 6, Figure 5
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Appendix 1 (Figure 5)
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Section 5

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
k) any mitigation measures for inclusion in the EMPr;	Section 6
l) any conditions for inclusion in the environmental authorisation;	Section 6
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 6
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 7
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	NA
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	NA
q) any other information requested by the competent authority.	NA
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Appendix 5: Site Sensitivity Verification Report

1 INTRODUCTION

Emvelo Wind Energy Facility (Pty) Ltd are proposing the development of a commercial wind energy project located near Ermelo, within the Msukaligwa Local Municipality and the Gert Sibande District Municipality, in the Mpumalanga Province. The project forms part of a development cluster that is expected to comprise three separate (~200 MW to 360 MW) Wind Energy Facilities (WEFs).

This scoping report covers the Emvelo WEF which is proposed to comprise up to 45 turbines with a maximum output capacity of up to 200 MW. The WEF will be located on nineteen (19) land parcels and will have an anticipated lifespan of 20 – 25 years. The final design will be determined and amended based on the outcome of the specialist studies undertaken during the S&EIA process. The proposed turbine footprints and associated facility infrastructure will cover an area of up to 150 ha after rehabilitation, depending on final layout design. The proposed technical details of Emvelo WEF are presented below:

Developer / Applicant	Emvelo WEF
DFFE Reference	To be confirmed
WEF Generation Capacity	Up to 200 MW
Site Access	Locality to be confirmed. Total width up to 15 m (12 m after rehabilitation) consisting of up to 3m width for underground 33 kV reticulation.
Number of Turbines	Up to 45
Hub Height from ground level	Up to 150 m
Blade Length	Up to 110 m
Rotor Diameter	Up to 220 m
Length of internal roads	Unknown at this point.
Width of internal roads	Up to 12 m to be rehabilitated to up to 9 m.
On-site substation capacity	Up to 132 kV
Proximity to grid connection	Approximately 30 km
Grid Connection Capacity	Up to 132 kV
Temporary turbine construction laydown and storage areas.	Crane platforms and hardstand laydown area up to 36 ha (Up to 0.8 ha per turbine)
Permanent footprint area dimensions, including roads, turbine hardstand areas, O&M buildings and battery pad.	O&M: Up to 0.5 ha Hardstand areas: Up to 0.75 ha Total area of final footprint (including roads): up to 180 ha
Operations and maintenance buildings (O&M building) with parking area	Up to 0.5 ha
BESS Area	Approximately 400 x 400 m
Height of fencing	2.8 m
Type of fencing	Where site offices are required, temporary screen fencing used to screen offices from the wider landscape.

In addition to the wind energy infrastructure, it is proposed that an on-site substation with a capacity up 132 kV and an up to 132 kV Overhead Powerline (OHPL) of approximately 30 km (300 m corridor) in distance, traversing eighteen (18) land parcels, be constructed to connect the proposed WEF to the Eskom Uitkoms Substation.

1.1 Scope and Objectives

This scoping report presents a Bat (Chiroptera) Specialist Impact Assessment for the Emvelo WEF and associated grid connection. Collisions with wind turbine blades are a leading cause of bat mortality globally (Cryan, 2011; O'Shea et al., 2016). Given the nature, scale, and uncertainty of these impacts to bats, specialist studies are required to assess the risks of renewable energy infrastructure on bats (Rodrigues 2015, MacEwan et al. 2020, SANBI 2020, Bennun et al. 2021).

The objectives of this assessment are to present the baseline ecological condition of the project site for bats, and to use these characterisations to predict and assess the potential impact of the project on bat species and their habitats as well as to provide actions to mitigate impacts if required. The specific terms of reference that guided the compilation of this scoping report were:

- Project Description
- Site Sensitivity Verification Report (SSVR)
- Methodology
- Assumptions and Limitations
- Desktop Screening
- Mapping
- Sensitivity Analysis and/or modelling, including sensitivity and no-go features overlain on the development site
- Defining the legal, planning and policy context
- Description of the Baseline Environment
- Determination of potential impacts (direct, indirect, cumulative)
- Determination of residual risks
- Reporting
- Recommendation and input into project design
- Management Plan and/or Monitoring Programme
- Sensitivity Verification Reporting in terms of GN 320 of 20 March 2020 and/or a Compliance Statement in terms of GN 320 / GN 1150 of 20 March 2020
- Incorporate and address Public Comment following PPP
- Submission of Shapefiles

2 ASSUMPTIONS AND LIMITATIONS

The core techniques used to assess bat activity in this study are acoustic monitoring and roost surveys, both of which have several limitations which will influence the findings and recommendations of this study.

Acoustic monitoring allows for rapid, passive collection of a large volume of bat activity data which can help identify the bat species present within a particular location and their associated spatio-temporal relative activity patterns. In the context of wind farms, acoustic monitoring is therefore a useful technique however, there are several constraints that must be acknowledged. These are discussed in detail by Voigt et al. (2021), Adams et al. (2012), and Kunz et al. (2007a) and fundamentally, include that acoustic monitoring cannot provide an indication of bat abundance or population size at a site. In addition, population demographics such as age and sex of bats cannot generally be determined from echolocation calls. Due to the large volume of data collected by bat detectors it is impractical and prohibitively time-consuming to inspect each file for echolocation calls and to identify the associated bat species. Specialised statistical software uses bat call reference libraries to automate the identification process but developing such libraries is challenging given the variation individual species display in their echolocation call structure and overlap between species. This study used the Wildlife Acoustics library "Bats of South Africa Version 5.4.2", but this excludes reference calls for most South African species thus these may have been overlooked. However, given the duration of the monitoring and spatial coverage of the detectors, the acoustic data provides a reasonable inventory of the species present, and a good indication of the relative magnitude of bat activity. Lastly, bat activity is notably variable in response to a number of factors such as land use change, climactic variability, variations in prey abundance and meteorological conditions which can vary over different time scales. Since this study is limited to 12 months, the baseline conditions presented here may not be representative of activity over longer time frames meaning risk may be misinterpreted.

The major limitation with roost surveys is finding roosting bats. Bats use a diversity of roosting sites including trees, buildings, crevices, and underground sites (caves and mines). The presence of these features at a site can help to target roost searches but evidence of bats may not always be apparent even if bats are present. Importantly, the absence of bat evidence in these situations does not equate to evidence of bat absence (Collins 2006). Thus, this study uses a precautionary approach and will apply buffers to roosts (largely buildings and rocky crevices) even if bats were not located given their potential role in supporting roosting bats.

It is difficult to assess the risk to bats during operation of the proposed facility based on acoustic data collected during pre-construction surveys. For example, Hein et al. (2013) showed that pre-construction bat activity was not a significant indicator of collision risk. Lintott et al. (2016) argued that environmental impact assessments do not predict the risks to bats accurately. This may partly be because it is hypothesized that bats may be attracted to wind turbines (Cryan and Barclay 2009, Guest et al. 2022) which some evidence suggests may be the case (Horn et al. 2008, Richardson et al. 2021). While this report makes predications about the potential risk to bats posed by the project, these carry a degree of uncertainty and must be verified by using post-construction surveys to ensure that the predictions are accurate and bat behaviour has not altered from pre-construction levels (Lintott et al. 2016).

Risk to bats was determined based on median bat activity per night derived from the bat activity dataset collected with acoustic monitoring. Median values were compared to those in Table 5 in MacEwan et al. (2020b) which provides height-specific fatality risk categories (high, medium, low) based on bat activity sampled in different South African terrestrial ecoregions. The Project Area of Influence (PAOI) is situated in the Highveld Grasslands ecoregion (Dinerstein et al. 2019) however reference values are not available for this ecoregion in MacEwan et al. (2020b). Instead, median values were compared to reference values for the Drakensberg Grasslands, Woodlands and Forest ecoregion. While bat activity levels differ between these two ecoregions this difference is small (MacEwan et al. 2020a). The lack of a direct reference for the Highveld Grasslands ecoregion is therefore not a major limitation and the comparison is suitable to provide an evaluation of risk.

3 LEGAL REQUIREMENTS AND GUIDELINES

The scoping and EIA processes for this project is being undertaken in terms of Government Notice (GN) No. R. 983 of 4 December 2014 (as amended to GNR 327), promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) EIA Regulations, 2014 (as amended). In addition, there are various international, regional, and local legislation, policies, regulations, guidelines, conventions, and treaties in place for the protection of biodiversity, under which bats would also be protected or considered. These create a policy environment and impact management framework aiming to prevent excessive impacts to biodiversity and which was used to assess risk of this specific project. Specific policies include the following:

- Convention on Biological Diversity Post-2020 Global Biodiversity Framework
- United Nations Sustainable Development Goals
- Convention on the Conservation of Migratory Species of Wild Animals (1979)
- Convention on Biological Diversity (1993)
- Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)

- National Environmental Management Act, 1998 (NEMA, Act No. 107 of 1998)
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
- Northern Cape Nature Conservation Act (Act 9 of 2009)
- The Equator Principles (2013)
- International Finance Corporation Performance Standards (PS6)
- The Red List of Mammals of South Africa, Swaziland, and Lesotho (2016)
- South Africa National Biodiversity Strategy and Action Plan (2005)
- Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa
- Mitigating biodiversity impacts associated with solar and wind energy development. IUCN Guidelines for project developers (2021)
- South African Good Practise Guidelines for Surveying Bats in Wind Energy Facility Developments – Pre-Construction (2020)
- South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (2020)
- South African Bat Fatality Threshold Guidelines (2018)
- Mitigation Guidance for Bats at Operational Wind Energy Facilities in South Africa (2018)

4 SURVEY METHODOLOGY

The Project Area of Influence (PAOI) was defined as the Area of Interest (AoI) of the development cluster plus a 10 km buffer given that bats are flying mammals (Scottish Natural Heritage 2019). This area was studied at a desktop level to determine which bat species (i.e., impact receptors) are likely to occur within the PAOI, to provide information on their natural history and conservation status, and to contextualise the project site within the larger social-ecological environment with respect to bats.

Bats were also studied through 12 months of field surveys in the AoI which began on 26 April 2022 and ended on 13 May 2023. Monitoring is continuing at two locations until November 2023 and these additional data will be incorporated into the final EIA reporting for the development cluster. Bat activity was sampled at 10 locations (Figure 1, Table 1) within the AoI with Wildlife Acoustics, Inc. SM4 bat detectors. At eight locations (AM4 – AM11), SMM-U2 microphones were positioned at the top of a 10 m aluminium mast. At the remaining two locations (AM1 and AM3), microphones were positioned on meteorological towers at 10 m, 50 m, and 90 m respectively.

Sampling took place nightly, from 30 minutes before sunset to 30 minutes after sunrise, and this report summarises 383 nights of bat activity data. This monitoring period therefore spans of all four seasons providing a representative account of temporal bat activity patterns across a year. Acoustic data retrieved from each bat detector were processed using Kaleidoscope® Pro (Version 5.4.2, Wildlife Acoustics, Inc.). Bats were automatically identified using the embedded "Bats of South Africa Version 5.4.0" reference library and verified by inspecting echolocation files. The number of acoustic files recorded was used as a measure to quantify bat activity, whereby each file was considered one bat pass of the microphone.

Roost surveys were undertaken which entailed discussions with landowners to locate any known roosts or potential roosts with evidence of bats. In addition, buildings at farmsteads within the PAOI, as well as accessible rocky outcrops/crevices, were systematically surveyed during field visits in November 2022 (spring), and January 2023 (summer). The surveys aimed to directly observe roosting bats, locate evidence of roosting bats (e.g., culled insect remains, fur-oil-stained exit and entry points, guano/droppings), and assess the likelihood for each potential roost to support bats.

Table 1: Summary of the Bat Acoustic Monitoring Sampling Locations and Effort

Bat Detector	Coordinates	# Sample Nights	Altitude (m)	Habitat Features
AM1 (Met mast)	-26.612298°S 30.317572°E	10m: 336 50 m: 226 90 m: 296	1,778	In Wakkerstroom Montane Grassland, 400 m west of small escarpment, 560 m north of farm dam, 440 m west of woodland patch, 560 m northeast of wetland
AM3 (Met Mast)	-26.587572°S 30.284137°E	10 m: 288 50 m: 383 90 m: 274	1,748	In Wakkerstroom Montane Grassland, 420 m west of farmstead, 420 m east of stream and seep wetland
AM4	-26.665933°S 30.321221°E	208	1,550	In Eastern Highveld Grassland, 360 m west of cultivated area, 230 m southeast of woodland, 240 m north east of stream, 430 m south east of depression wetland
AM5	-26.611025°S 30.363393°E	241	1,515	In Eastern Highveld Grassland, on border of cultivated areas and disturbed grassland, 470 m southeast of stream, wetland and woodland patch, 2.4 km northwest of farmstead
AM6	-26.562101°S 30.296970°E	190	1,732	In Wakkerstroom Montane Grassland, at edge of woodland patch, 80 m east of depression wetland, 255 m west of stream
AM7	-26.640015°S 30.306442°E	142	1,655	Within wooded valley, 60 m west of stream, 300 m east of seep wetland
AM8	-26.621551°S 30.277550°E	85	1,735	In Wakkerstroom Montane Grassland, 680 m west of woodland patch,167 m north of seep wetland
AM9	-26.549013°S 30.315353°E	51	1,667	In Eastern Highveld Grassland adjacent to wetland and surrounded by trees
AM10	-26.592367° S 30.336850°E	163	1,696	In Wakkerstroom Montane Grassland, above small escarpment in shallow wooded valley
AM11	-26.632172°S 30.265925°E	163	1,694	In Eastern Highveld Grassland adjacent to tree edge line, 220 m south east of wetland, installed at farmstead

5 SPECIALIST FINDINGS

5.1 Ecological Baseline

The Project Area of Influence (PAOI) is situated in the Grassland Biome and comprises predominantly Eastern Highveld Grassland vegetation (Figure 1). The landscape associated with this vegetation consists of slight to moderately undulating plains with small scattered rocky outcrops. The vegetation is short, dense grassland (Mucina and Rutherford 2006). Wakkerstroom Montane Grassland occurs in the middle of the PAOI, on low mountains and undulating plains. Here the vegetation comprises short montane grassland on plateaus and flat areas. On steep, east facing slopes and in drainage areas, short forest and thicket occurs. Both vegetation types are endemic, and Eastern Highveld Grassland is classified as Vulnerable while Wakkerstroom Montane Grassland is classified as Least Concern (SANBI 2018). The PAOI includes some low hills and wetland depressions and has largely been transformed by cultivation in the west, commercial forestry in the east and urban sprawl, including extensive areas of alien invasive trees. The PAOI is in a summer rainfall region and has a cool-temperate climate with dry winters, frequent occurrence of frost and large differences in both diurnal and seasonal temperature extremes (Mucina and Rutherford 2006).

Critical Biodiversity Areas (CBA), areas of high biodiversity value that must be maintained in a natural state, are located throughout the PAOI, classified as either “CBA Irreplaceable” (Figure 1) and “CBA Optimal”. The former category comprises 1) areas required to meet conservation targets and those with irreplaceability values greater than 80 %, 2) areas which represent critical linkages or pinch-points in the landscape that must remain natural, and 3) Critically Endangered ecosystems (MTPA 2014). The latter category comprises areas that are not ‘irreplaceable’, but they are the most optimal land configuration to meet all biodiversity targets. Ecological Support Areas (ESA), not essential for meeting biodiversity targets but important in supporting the functioning of CBAs and delivering important ecosystem services, are also located throughout the PAOI.

The south of the PAOI falls within a National Protected Areas Expansion Strategy (NPAES) Focus area (Moist Escarpment Grasslands), targeted for protected area expansion for improved ecosystem representation, ecological sustainability and resilience to climate change. Chrissiesmeer Protected Environment and Jericho Dam Nature Reserve overlap the north and east of the PAOI respectively (Figure 1).

Bat roosting sites in the PAOI are relatively limited and unlikely to support large congregations of bats, with no underground sites (e.g., caves, mines, sinkholes) known to be present. The closest known major bat roost is approximately 70 km north of the PAOI. Although occasional ridges and rocky outcrops are features of the landscape (Mucina and Rutherford 2006) these are not extensive. Bats are likely to roost in buildings associated with farmsteads within and bordering the AoI especially Cape Serotine and Egyptian Free-tailed Bat (Monadjem et al. 2020). Trees growing at these farmsteads and elsewhere on site where they form clumps, could also provide roosting spaces for bats, as well as the limited rocky outcrops even though most are alien invasive species. Completed surveys of some buildings in the of the PAOI did not reveal the presence of roosting bats and as such were assessed as being of low relative suitability. However, these could be used by bats as night-roosts (locations used by bats to feed on captured prey, or to rest between foraging bouts) and should therefore still be considered, and avoided where possible, in the spatial planning.

Sensitive features in the PAOI at which bat foraging activity may be concentrated include farm buildings where they would forage for insects attracted to lighting (Rydell 1992, Jung and Kalko 2010), dams and wetland areas (Sirami et al. 2013), within and along the edge of woodland/tree patches, and over cultivated areas (Bohmann et al. 2011, Noer et al. 2012). Free-tailed bats (Molossidae) will fly at high altitudes, and their foraging habitat is essentially all airspaces (McCracken et al. 2008, Nguyen et al. 2019).

Based on current taxonomic information and bat occurrence data, 23 species could occur within the PAOI (Table 2). The majority have a low likelihood of occurrence however the potential suite of species includes 10 high risk species, including fruit bats (Pteropodiae) and free-tailed bats (Molossidae) which are vulnerable to wind energy impacts in South Africa (MacEwan 2016, Aronson 2022).

Table 2: Bat Species Potentially Occurring within the Amsterdam WEF PAOI

Common Name Species Name	Key Habitat Requirements*	Prob. Of Occurrence	Conservation Status		Wind Energy Risk$^{\delta}$
			IUCN†	RSA$^{!}$	
Natal Long-fingered bat *Miniopterus natalensis*	Temperate or subtropical species. Primarily in savannahs and grasslands. Roosts in caves, mines, and road culverts. Clutter- edge forager. Migratory.	**Confirmed (4,420 passes)**	LC/U	LC	High
Lessor Long-fingered bat *Miniopterus fraterculus*	Temperate species, associated with grasslands. Cave-dependant but also roosts in tunnels and mines. Habitat includes savannah bushveld, moister mistbelt and coastal forest habitats. Clutter-edge forager. Migratory.	Moderate	LC/U	LC	High
Cape Serotine *Laephotis capensis*	Arid semi-desert, montane grassland, forests, savannah and shrubland. Roosts in vegetation and human-made structures. Clutter-edge forager.	**Confirmed (45,125 passes)**	LC/S	LC	High
Mauritian tomb bat *Taphozous mauritianus*	Savannah woodland preferring open habitat. Roosts on rock faces, the outer bark of trees or on the outer walls of buildings under the eaves of roofs. Forages in urban areas and over cultivation. Open- air forager.	High	LC/U	LC	High
Little Free-tailed bat *Chaerephon pumilus*	Semi-arid savannah, forested regions, woodland habitats. Roosts in narrow cracks in rock and trees but also in buildings. Open-air forager.	**Confirmed (1,216 passes)**	LC/U	LC	High

	Forages in urban areas and over cultivation.				
Midas Free-tailed bat *Mops midas*	Hot low-lying savannah and woodland. Roosts in narrow cracks in rock and trees but also in buildings. Open-air forager.	Low	LC/D	LC	High
Egyptian Free-tailed bat *Tadarida aegyptiaca*	Desert, semi-arid scrub, savannah, grassland, and agricultural land. Roosts in rocky crevices, caves, vegetation, and human-made structures. Open-air forager.	**Confirmed (18,842 passes)**	LC/U	LC	High
Wahlberg's Epauletted fruit bat *Epomophorus wahlbergi*	Roost in dense foliage of large, leafy trees. Associated with forest and forest-edge habitats but will forage in urban environments.	Low	LC/S	LC	High
African Straw-coloured fruit bat *Eidolon helvum*	Non-breeding migrant in the PAOI.	Low	NT/D	LC	High
Egyptian Rousette *Rousettus aegyptiacus*	Distribution influenced by availability of suitable caves roosts.	Low	LC/S	LC	High
Temminck's Myotis *Myotis tricolor*	Montane forests, rainforests, coastal forests, savannah woodlands, arid thicket, and fynbos. Roosts communally in caves (and mines) and closely associated with mountainous terrain. Migratory. Clutter-edge forager.	Low	LC/U	LC	Medium-High
Welwitsch's Myotis *Myotis welwitschii*	Mainly open woodland and savannah but also high-altitude grassland, tropical dry forest, montane tropical moist forest, savannah and shrublands. Clutter-edge forager.	Low	LC/U	LC	Medium-High
Yellow-bellied house bat *Scotophilus dinganii*	Occurs throughout the Savannah Biome but avoids open habitats such as grasslands and Karoo scrub. Roosts in hollow trees and buildings. Clutter-edge forager.	**Confirmed (165 passes)**	LC/U	LC	Medium-High
Dusky Pipistrelle *Pipistrellus hesperidus*	Woody habitats, such as riparian vegetation and forest patches. Recorded roosting in narrow cracks in rocks and under the loose bark of dead trees. Clutter-edge forager.	Low	LC/U	LC	Medium-High
Rusty Pipistrelle *Pipistrellus rusticus*	Savannah woodland and associated with open water bodies. Roosts in trees and old buildings. Clutter-edge forager.	Low	LC/U	LC	Medium-High
Long-tailed Serotine *Eptesicus hottentotus*	Montane grasslands, marshland and well-wooded riverbanks, mountainous terrain near water. Roosts in caves, mines, and rocky crevices. Clutter-edge forager.	**Confirmed (239 passes)**	LC/U	LC	Medium
Egyptian Slit-faced bat *Nycteris thebaica*	Savannah, desert, arid rocky areas, and riparian strips. Gregarious and roosts in caves but also in mine adits, Aardvark holes, rock crevices, road culverts, roofs, and hollow trees. Clutter forager.	Medium	LC/U	LC	Low
Geoffroy's Horseshoe bat *Rhinolophus clivosus*	Savannah woodland, shrubland, dry, riparian forest, open grasslands, and semi- desert. Roosts in caves, rock crevices, disused mines, hollow baobabs, and buildings. Clutter forager.	Medium	LC/U	LC	Low
Bushveld Horseshoe bat *Rhinolophus simulator*	Occurs in caves within areas of moist savannah, adjacent to rivers and savannah woodland, montane habitats, and coastal mosaics. Commonly associated with riparian forest and along wooded drainage lines. Roosts in caves and mines. Clutter forager.	Medium	LC/D	LC	Low
Blasius's Horseshoe bat *Rhinolophus blasii*	Savannah woodlands and are dependent on the availability of daylight roosting sites such as caves, mines, or boulder piles.Clutter forager.	Low	LC/D	NT	Low
Darling's Horseshoe bat *Rhinolophus darlingi*	Mesic woodland savannahs. Roosts in caves, boulder piles, mines, culverts, large hollow trees and disused buildings. Clutter forager.	Low	LC/U	LC	Low
Sundevall's Leaf-nosed bat *Hipposideros caffer*	Savannah, bushveld and/or coastal forests, near to rivers and other water sources. Roosts in caves, sinkholes, rock fissures, hollow trees, mines, and culverts. Clutter forager.	Low	LC/D	LC	Low
Percival's Short-eared Trident bat *Cloeotis percivali*	Savannah and woodland areas. Roosts in caves and mine tunnels. Clutter forager.	Low	LC/U	EN	Low

*Child et al. (2016), *Monadjem et al. (2020); [ǀ] Child et al. (2016); [†]IUCN (2021); [δ] MacEwan et al. (2020b)

5.2 Pre-Construction Bat Monitoring Results

At least six bat species were confirmed to occur in the PAOI (Table 2) which includes four species classified as high risk from wind energy development: Natal Long-fingered bat, Cape Serotine, Little Free-tailed bat, and Egyptian Free-tailed bat. All of these species have a conservation status of Least Concern, both globally and regionally and no red data species with a higher conservation status have yet been detected within the PAOI. Although these species are currently classified as Least Concern, Rodhouse et al. (2019), Davy et al. Davy et al. (2020) and Frick et al. (2017) have all shown that in North America, Least Concern bats may be experiencing impacts due to wind farms that could result in changes to their conservation status.

A total of 70,107 bat passes were recorded over 383 sample nights. Most activity data were attributed to Cape serotine (64 % of total activity) and Egyptian free-tailed bat (27 % of total activity). These two species comprise the majority of bat fatalities at South African wind farms (Aronson 2022). Natal long-fingered bat accounted for 6 % of total activity. The remaining three species (Little free-tailed bat, Long-tailed serotine and Yellow-bellied house bat) were seldomly recorded and the magnitude of their activity suggests they would be at low risk of impacts. As such, the remainder of this report focuses on impacts to Egyptian free-tailed bat, Cape serotine and Natal long-fingered bat.

Based on MacEwan et al (2020b), Cape serotine activity was predominantly low but high activity was recorded at AM8, AM9 and AM11 which sampled bat activity at 10 m (Table 3). The latter two monitoring stations were located at a farm dam and at a farmstead respectively indicating higher activity in relation to these habitat features in the landscape. While this species was recorded at 50 m and 90 m, the magnitude of its activity was relatively low at height and based on the dataset, this species is predicted to be a low collision risk. However, bats in the same family (Vespertilionidae) are known to be attracted to wind turbines in the United Kingdom (Richardson et al. 2021). Thus, although the data suggests a low collision risk, the installation of wind turbines in the landscape can alter bat activity patterns. In some areas where turbines are planned, medium levels of activity were recorded at 10 m for example at AM4, AM5, and AM6.

Table 3: Median number of bat passes per hour per night for Cape serotine over the pre-construction monitoring, and associated risk based on MacEwan et al. (2020b).

site	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
AM1-10	0.19	0.18	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00
AM1-50		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	
AM1-90		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
AM3-10	1.35	0.56		0.08	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.49
AM3-50	0.00	0.00	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AM3-90	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AM4	0.29	1.20		0.39	0.08	0.00	0.00	0.08	0.93	0.74	0.00	
AM5	0.19			0.39	0.07		0.00	0.08	0.54	0.79	0.56	0.88
AM6				1.01	0.30	0.00	0.00	0.23	0.61	0.00	0.28	
AM7				0.00	0.00	0.00	0.00	0.00	0.20		0.00	
AM8				0.08	0.00	0.00	0.76	0.08	2.18			
AM9		8.19	8.53	0.00								
AM10	0.19	0.00	0.26	0.08	0.08							0.00
AM11	25.90	20.76	12.50	6.14	3.10							15.07

Risk Rating
High
Medium
Low
No Data

Table 4: Median number of bat passes per hour per night for Egyptian free-tailed bat over the pre-construction monitoring, and associated risk based on MacEwan et al. (2020b).

site	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
AM1-10	0.10	0.18	0.86	0.00	0.15	0.00	0.00	0.08	0.08	0.52	0.75	0.29
AM1-50		0.18	0.34	0.56	0.15		0.00	0.08	0.08	0.17	0.28	
AM1-90		0.00	0.17	0.25	0.08	0.00	0.00	0.00	0.08	0.18	0.38	
AM3-10	0.09	0.00		0.23	0.22	0.00	0.00	0.08	0.33	0.17	0.62	0.39
AM3-50	0.10	0.04	0.51	0.62	0.30	0.00	0.00	0.08	0.16	0.45	0.52	0.20
AM3-90	0.00			0.08	0.15	0.00	0.00	0.08	0.17	0.44	0.24	0.00
AM4	0.00	0.00		0.39	0.23	0.00	0.07	0.39	1.95	2.57	0.55	
AM5	0.00			0.23	0.30		0.22	0.39	1.59	2.00	1.83	0.59
AM6				0.08	0.08	0.00	0.00	0.00	0.37	0.17	0.00	
AM7				0.00	0.00	0.00	0.00	0.00	0.08		0.00	
AM8				0.15	0.08	0.07	0.00	0.08	0.57			
AM9		0.31	0.60	0.00								
AM10	0.00	0.00	0.00	0.08	0.08							0.00
AM11	0.39	0.45	1.55	2.23	0.54							1.13

Risk Rating
High
Medium
Low
No Data

Egyptian free-tailed bat is flexible in its foraging strategy, and it is thought that the habitat below has little influence on this species (Monadjem et al. 2020). These bats are open-air foragers based on their morphology and echolocation (Norberg and Rayner 1987) which means they tends to forage high in the air. The data showed that at 50 m and 90 m, moderate collision risk is predicted apart from during autumn and spring when high risk is predicted (Table 4). High risk is predicted near AM4 and AM5 during spring, which sampled bat activity at 10 m. It is possible that in this part of the site, high risk could also be expected higher in the air, given that this species is active at high altitudes.

Activity of Natal long-fingered bat was predominantly low but high activity was recorded during spring at AM1 and AM9. Medium activity was also recorded during spring at AM11 (Table 5). As such, overall impacts to this species are anticipated to be low, especially since activity levels at 50 m and 90 m were assessed as low based on MacEwan et al (2020b).

Table 5: Median number of bat passes per hour per night for Natal long-fingered bat over the pre-construction monitoring, and associated risk based on MacEwan et al. (2020b).

site	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
AM1-10	0.10	0.09	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AM1-50		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	
AM1-90		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
AM3-10	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AM3-50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AM3-90	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AM4	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
AM5	0.00			0.23	0.00		0.00	0.00	0.00	0.00	0.00	0.00
AM6				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
AM7				0.00	0.00	0.00	0.00	0.00	0.00		0.00	
AM8				0.00	0.00	0.00	0.04	0.08	0.24			
AM9		3.30	2.86	0.04								
AM10	0.00	0.00	0.00	0.00	0.00							0.00
AM11	0.19	0.27	0.75	0.24	0.08							0.00

Risk Rating
High
Medium
Low
No Data

6 IDENTIFICATION AND ASSESSMENT OF IMPACTS

Impacts to bats that are likely to occur because of the construction, operation and decommissioning of the wind energy facility and grid connection are identified and assessed in the following section. The unit of analysis against which impacts were assessed is the local bat community and their associated habitats within the PAOI. Impacts considered for assessment include habitat modification and disturbance, fatality due to collisions with wind turbine blades, and light pollution since these are the major impacts likely to be associated with the project (Kunz et al. 2007b, Cryan and Barclay 2009). For each impact, the respective mitigation measures were categorised into those aimed at first avoiding impacts, then minimising impacts, and finally restoring areas impacted (Figure 2).

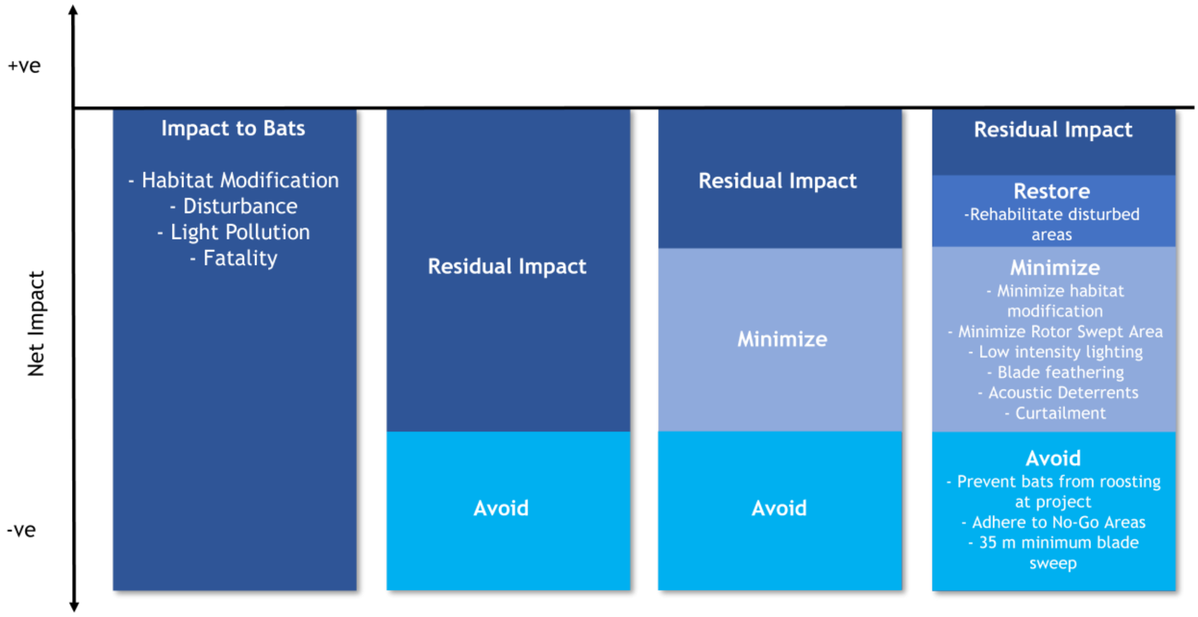

Figure 2: Mitigation Hierarchy applied to the Project with Mitigation Measures.

6.1 Wind Energy Facility

6.1.1 Construction Phase

Impacts

Removal of vegetation, noise and dust generated during construction activities, and the presence of new infrastructure in the landscape, will negatively and indirectly impact bats by removing habitat used for foraging and commuting, through disturbance, and displacement (Kunz et al. 2007b, Millon et al. 2015, Millon et al. 2018, Bennun et al. 2021, Leroux et al. 2022).

Construction of WEF infrastructure could result in destruction (direct impact) of bat roosts (rocky crevices, buildings) and disturbance (indirect impact) of bat roosts potentially resulting in roost abandonment. Bat mortality can occur if roosts which contain bats are destroyed. Installation of new infrastructure in the landscape (e.g., buildings, turbines, road culverts) can provide new roosting spaces for some bat species, attracting them to areas with wind turbines and potentially increasing the likelihood of collisions.

Mitigation - Avoid

Habitat modification impacts can be avoided by buffering habitat and landscape features (Table 6) that bats use to spatially limit the potential for bats to interact with project infrastructure, and to avoid impacting key bat habitat (Barré et al. 2018, Leroux et al. 2022). This study assumes that all buildings and rocky outcrops are potentially roosts and must be buffered since numerous species use these features for roosting. All other habitat features were buffered by 200 m as per best practise (Rodrigues 2015, MacEwan et al. 2020).

To align with regional conservation and integrated development planning, the Mpumalanga Biodiversity Sector Plan Handbook (MTPA 2014) was consulted to further define spatial risk in the AoI. The intention here was to align biodiversity conservation policy objectives with renewable energy policy objectives, attempting to minimise trade-offs between conflicting goals (Jackson 2011, Gasparatos et al. 2017). The handbook includes a map of terrestrial areas that are important for conserving biodiversity and ecological processes – Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) respectively. CBA Irreplaceable Areas were categorised as High Risk (Table 6) because the conservation goals for these areas are to maintain them in a natural state with no loss of ecosystems, functionality or species, and with no flexibility in land-use options (MTPA 2014). The remaining areas were assigned low or medium risk where all infrastructure development should be prioritized. These included modified land, ESA, CBA optimal, and other Natural Areas (Table 6). Although the primary objective of the CBA optimal areas is to maintain these spaces in a natural state with no loss of ecosystems, functionality or species, some flexibility in land-use options is permitted (MTPA 2014). Similarly, in ecological supports areas (ESAs), the objective is to maintain habitats in a natural, or near-natural, state with limited loss of ecosystems or functionality. Hence, these areas were classified as medium risk, permitting the siting of turbines in these spaces. All turbines will be subjected to a post-construction bat fatality monitoring program which will monitor residual impacts at turbines located in CBA optimal and ecological support areas, as well as turbines in low-risk areas. The results of this monitoring will inform management actions where needed to ensure alignment with the MTPA objectives to limit impacts to biodiversity.

Table 6: Features used to assign spatial risk categories in the AoI for bats (Chiroptera)

Risk Level			
Low	**Medium**	**High**	**No-Go**
Heavily modified land	CBA Optimal	CBA Irreplaceable Areas	Farm Dams (200 m buffer)
Moderately modified land	ESA Landscape corridor		Wetlands (200 m buffer)
	ESA Local corridor		Houses (200 m buffer)
	Other Natural Areas		Buildings (200 m buffer)
			Rivers (200 m buffer)
			Wetlands (200 m buffer)
			Rocky Outcrops (200 m buffer)

No infrastructure (including O&M buildings) may be placed within buffered No-Go areas (Figure 3). However, road infrastructure may need to be routed through sensitive areas for practical reasons. Existing road networks should be used as much as possible in these cases to limit the creation of additional roads which have known impacts on wildlife (Perumal et al. 2021).

To avoid bats roosting in new project infrastructure, road culverts and buildings must be properly sealed to prevent bats from roosting. If bats colonize these spaces, a suitable qualified bat ecologist must be engaged to remove them.

Disturbance effects can be avoided by restricting construction activities to daylight hours (i.e., no construction at night) and avoiding blasting near rocky outcrops.

Mitigation - Minimize and Restore

Modification and disturbance of bat habitat is likely to have species specific effects depending on species foraging guild, season, and distance to wind turbines (Barré et al. 2018, Leroux et al. 2022). For example, clutter edge species (e.g., Cape serotine) are more likely to be impacted by habitat modification given their greater association with physical habitat features compared to high-flying species (e.g., Egyptian free-tailed bat). As such, buffers may not be effective to fully remove all impacts. Beyond avoidance, measures to minimize further impacts include minimizing the clearing of vegetation, minimizing disturbance and destruction of rocky outcrops, and applying good construction abatement control practices to reduce emissions and pollutants (e.g., noise, erosion, waste) created during construction. Where trees, rocky outcrops or buildings need to be removed (although this must be avoided), these features must be examined by a suitably qualified bat ecologist before construction commences to search for roosting bats. Following construction, all areas disturbed must be rehabilitated through native species planting within all areas under the projects control.

<table>
<tr><th colspan="8">Impact Phase: Construction</th></tr>
<tr><td colspan="8">Potential impact description: MODIFICATION & DISTURBANCE OF BAT HABITAT (ROOSTING, FORAGING, COMMUTING)
Detailed description of impact
Removal of vegetation, noise and dust generated during construction activities, and the presence of new infrastructure in the landscape, will negatively and indirectly impact bats by removing habitat used for foraging and commuting, through disturbance, and displacement. Construction of WEF infrastructure could result in destruction and/or disturbance to bat roosts, and inadvertently provide new roosting spaces for some bat species in risky locations.</td></tr>
<tr><th></th><th>Severity</th><th>Extent</th><th>Duration</th><th>Status</th><th>Probability</th><th>Significance</th><th>Confidence</th></tr>
<tr><td>Without Mitigation / Enhancement</td><td>L</td><td>L</td><td>L</td><td>Negative</td><td>L</td><td>L</td><td>M</td></tr>
<tr><td>With Mitigation / Enhancement</td><td>L</td><td>L</td><td>L</td><td>Neutral</td><td>L</td><td>L</td><td>M</td></tr>
<tr><td colspan="3">Can the impact be reversed?</td><td colspan="5">YES provided appropriate rehabilitation is implemented. By removing wind turbines, the impact of displacement will be removed, however, this impact will persist for a long duration during operation of the WEF.</td></tr>
<tr><td colspan="3">Will impact cause irreplaceable loss or resources?</td><td colspan="5">YES land will be cleared for the development, but this could be rehabilitated after the operation of the facility. However, it is likely that not all areas may be successfully rehabilitated, and it is inevitable that some habitat will be permanently lost.</td></tr>
<tr><td colspan="3">Can impact be avoided, managed or mitigated?</td><td colspan="5">YES by applying buffers to key habitat features and avoiding placement of project infrastructure within buffered areas. Removing wind turbines will mitigate the impact of displacement.</td></tr>
<tr><td colspan="8">Mitigation measures to reduce residual risk or enhance opportunities:
<u>Avoid:</u>
- Limit potential for bats to roost in project infrastructure (e.g., buildings, turbines, road culverts) by ensuring they are properly sealed such that bats cannot gain access.
- No construction activities at night.
- No placement of infrastructure (except roads) in no-go areas (Figure 3).
- No blasting near rocky crevices.

<u>Minimise:</u>
- Minimise clearing of vegetation
- Minimise disturbance and destruction of rocky outcrops, trees and buildings, and where this is required, these features should be examined for roosting bats.
- Apply good construction abatement control practices to reduce emissions and pollutants (e.g., noise, erosion, waste) created during construction.

<u>Restore:</u>
- Rehabilitate all areas disturbed during construction (including aquatic habitat).</td></tr>
<tr><td colspan="2">Residual impact</td><td colspan="6">Residual impacts are likely to be minor although buffer distances have been shown to be ineffective at avoiding and minimizing risk to bats because these are two small for some species (Barré et al. 2018).</td></tr>
</table>

6.1.2 Operational Phase

Impacts

Bat mortality (direct impact) through collisions with wind turbine blades is the principal impact of wind energy facilities on bats (Cryan and Barclay 2009, Arnett et al. 2016).

Construction of project infrastructure will increase ecological light pollution from artificial lighting associated with the substation and other operational and maintenance buildings. Light pollution can alter ecological dynamics (Horváth et al. 2009). Lighting attracts and can cause direct mortality of insects, reducing the prey base for bats, especially bat species that are light-phobic. These species may also be displaced from previous foraging areas due to lighting. Other bat species forage around lights, attracted by higher numbers of insects. This may bring these species into the vicinity of the project and indirectly increase the risk of collision with wind turbines.

Mitigation - Avoid

Collisions can be avoided by not placing wind turbines in the vicinity of bat habitats which for bats includeds both physical landscape features themselves (near wetlands, vegetation etc.) and open airspace away from these features (Schnitzler et al. 2003). Risk of collision impact is related to bat morphology with fast flying, open-air species more likely to be impacted than low-flying species who forage closer to the ground or in edge spaces near vegetation (Thaxter et al. 2017, Aronson 2022, Figure 4). Impacts to low-flying species can be avoided by ensuring blades do not sweep close to ground level.

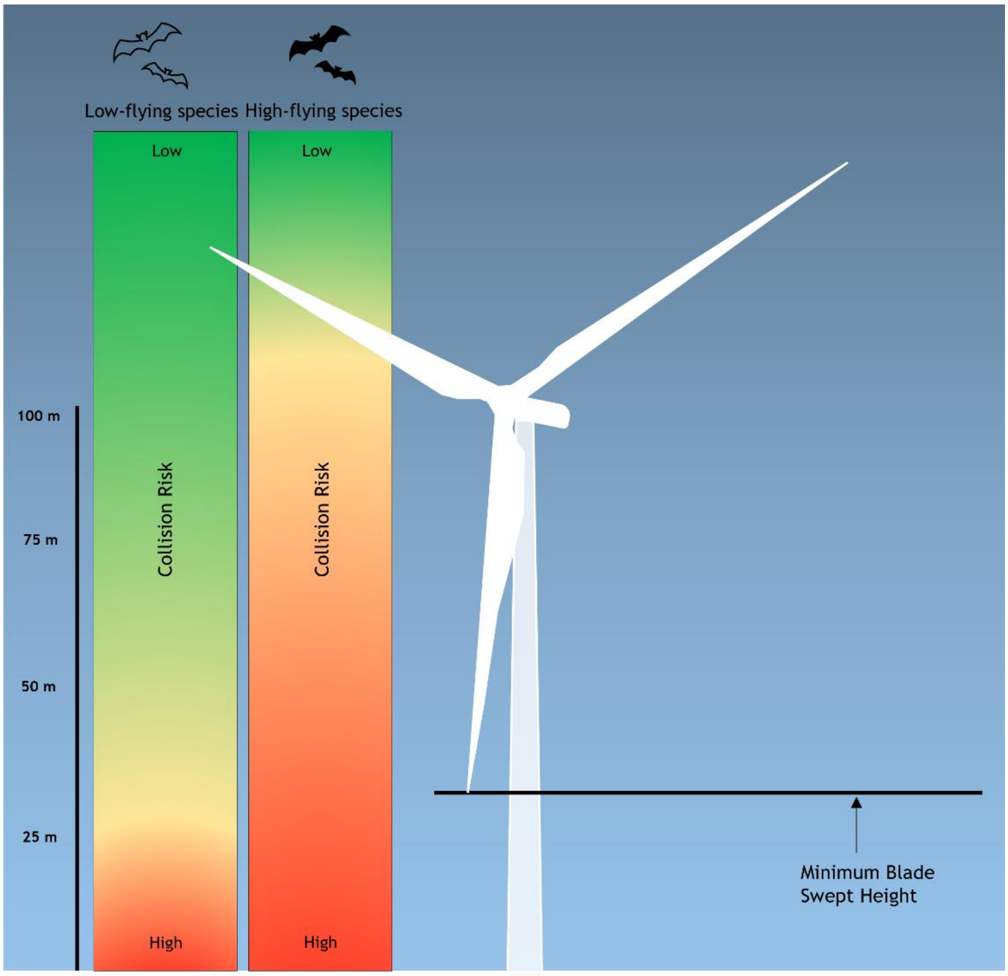

Figure 4: Conceptual Framework used to differentiate risk between low and high-flying bat species and the relationship with turbine size.

The species principally at collision risk from the proposed project are Cape serotine and Egyptian free-tailed bat since other species were recorded less often. High risk was identified for Cape serotine at ground level (represented by 10 m) at some locations (Table 3) and low risk at height (above 50 m). Activity is likely to decrease exponentially between these two heights (Wellig et al. 2018) meaning risk would decrease from high at 10 m to low at 50 m. The size of the rotor swept area should account for this because the lower the blades sweep the ground, the higher risk they will present to bats. It is therefore recommended to maintain a minimum blade sweep of 30 m to avoid collision impacts as much as possible. There is limited published emperical evidence for this specific height but based on the activity of Cape serotine this is likely to be a reasonable height were risk would reduce from high to moderate or low.

Collision impacts can also be avoided by not installing wind turbines within or adjacent to key bat habitats. To ensure no parts of the wind turbines, including the blade tips, intrude into bat buffers, all buffers were adjusted (increased by 77 m) to account for the blade length and hub height of the assessed turbine in line with Mitchell-Jones and Carlin (2014) and based on the following equation:

[Eq. 1]

$$b = \sqrt{(buffer + bl)^2 - (hh - fh)^2}$$

$$b = \sqrt{(200 + 110)^2 - (140 - 0)^2}$$

$$b = 277\,m$$

Where:
b = adjusted/blade tip buffer
buffer = 200 m[1]
bl: Turbine blade length = 110 m
hh: Hub height = 140 m
fh: Feature height = 0 m

The specific turbine height assessed in this report has a 140 m hub height and 220 m rotor diameter, based on the minimum blade sweep of 30 m. This represents a likely hub height and the maximum blade length being applied for. This reports therefore assesses the worst-case scenario for bats; namely the largest rotor swept area. Should the turbine size change, the adjusted/blade tip buffers must be updated to account for any changes in the hub height or blade length.

Based on the above buffers, one turbine, WTG 32, is located within a no-go area and must be relocated (Figure 3).

To avoid impacts due to light pollution from the substation and operation and maintenance buildings, the project should avoid using excessive lighting and infrastructure must not be constructed within the no-go buffers. This will increase the distance between this lighting sources and bat habitats, avoiding the impact as much as possible. **The Laydown Area and the Alternative Laydown Area are both located within no-go areas and must be relocated (Figure 3).**

Mitigation - Minimize and Restore

For some high-flying species such as Egyptian free-tailed bat, the habitat or land use below does not generally influence their activity (Monadjem et al. 2020) which makes habitat based mitigations (e.g., buffers) less effective. This species was recorded at 50 m and 90 m, where median activity levels suggest high risk during autumn and spring (Table 4). Mitigation to avoid impacts to higher-flying species should include the choice of turbine design since this has the potential to influence bat fatality [e.g., Barclay et al.(2007)] but the impact of turbine size on bat fatality is poorly understood. Generally, impacts to high-flying species should be avoided by

[1] 50 m for drainage lines, resulting in a buffer to blade tip of 65 m, and 500 m buffer for roosts resulting in a buffer to blade tip of 585 m.

limiting the size of the rotor swept area as much as practicable since they are active across much of the rotor swept zone.

However, due to the characteristics of the species present on site, i.e., high risk, open-air foraging species, residual impacts could occur since there is still likely to be a high degree of risky airspace even with a minimized rotor swept area. In addition, some bats may be attracted to turbines (Horn et al. 2008, Cryan and Barclay 2009, Richardson et al. 2021, Guest et al. 2022, Leroux et al. 2022) once installed and operational and therefore additional mitigation measures would be needed to minimize impacts.

The first additional mitigation measure to minimize residual collision impacts is the use of blade feathering to prevent free-wheeling of blades below the turbine cut-in speed. This has been shown to reduce bat fatality with the benefit of not impacting on energy production (Young et al. 2011, Good et al. 2012).

During operation, bat fatality monitoring must be undertaken to search for bat carcasses beneath wind turbines to measure the residual impact of the WEF on bats for a minimum of two years (Aronson et al. 2020) assuming the application of the above mitigation measures. Mitigation measures that are known to further minimise bat fatality if needed based on the fatality monitoring results include curtailment and/or acoustic deterrents (Arnett et al. 2013, Romano et al. 2019, Weaver et al. 2020). These techniques must be used if post-construction fatality monitoring indicates that species fatality thresholds have been exceeded (MacEwan et al. 2018) to minimise impacts, maintain the impacts to bats within acceptable limits of change and prevent declines in the impacted bat population. The bat fatality thresholds for the project will be calculated during the EIA phase once the final turbine layout has been provided.

According to the threshold guidance (MacEwan et al. 2018), should the annual fatality threshold be exceeded, curtailment and/or acoustic deterrents must be used to reduce fatality levels to below the threshold. For frugivorous bats, conservation important or rare/range restricted bats, i.e., Species of Special Concern (SSC), the annual fatality threshold is 1 individual. The likelihood of SSC's being present on site is low (Table 2). A Biodiversity Management Plan (BMP) for bats must be developed by a bat ecologist before commencement of operation once the final turbine has been developed which includes the post-construction fatality monitoring plan design, fatality thresholds calculations and rationale, an initial curtailment plan, and an adaptive management response plan that provides a timeous action pathway for mitigation should fatality thresholds be exceeded.

Regarding light pollution, effects from lighting might still impact bats and insects after avoidance measures depending on the intensity. This can be minimised by using motion-sensor lighting, minimising sky-glow by using hoods, and by using low pressure sodium lights at the substation and operation and maintenance buildings.

<table>
<tr><th colspan="8">Impact Phase: Operation</th></tr>
<tr><td colspan="8">Potential impact description: BAT FATALITY
Detailed description of impact
Bat mortality (direct impact) through collisions and/or barotrauma with wind turbine blades is the principal impact of wind energy facilities on bats.</td></tr>
<tr><th></th><th>Severity</th><th>Extent</th><th>Duration</th><th>Status</th><th>Probability</th><th>Significance</th><th>Confidence</th></tr>
<tr><td>Without Mitigation / Enhancement</td><td>M</td><td>L</td><td>M</td><td>Negative</td><td>H</td><td>M</td><td>H</td></tr>
<tr><td>With Mitigation / Enhancement</td><td>L</td><td>L</td><td>M</td><td>Negative</td><td>M</td><td>M</td><td>H</td></tr>
<tr><td colspan="3">Can the impact be reversed?</td><td colspan="5">YES Removing the WEF will remove the impact to the bat community and hence the impact is reversible at the community or population level, but not at the level of individual bats who have been killed.</td></tr>
</table>

Will impact cause irreplaceable loss or resources?	YES Bat fatality is highly likely and hence impacts to individual bats will result in a loss of resources. Curtailment and deterrents do not fully remove the impact to bats.
Can impact be avoided, managed or mitigated?	YES by adhering to mitigation measures. Curtailment and deterrents can successfully reduce bat fatality (Arnett 2011, Arnett et al. 2016, Weaver et al. 2020), but not completely.
Mitigation measures to reduce residual risk or enhance opportunities: Avoid: No placement of turbines and infrastructure (apart from the OHL) within no-go areas (Figure 3). **Turbine WTG 32 must be relocated. The Laydown and Alternative Laydown Areas must be relocated.** Maintain a minimum blade sweep of 30 m to avoid impacts to lower flying bats such as clutter-edge species (e.g., Cape serotine, Natal long-fingered bat). Minimise: - Minimise the rotor diameter - Feather blades to prevent free-wheeling below the turbine cut-in speed - Implement post-construction fatality monitoring and apply curtailment or deterrents if fatality thresholds are exceeded.	
Residual impact	Curtailment and deterrents can successfully reduce bat fatality (Arnett 2011, Arnett et al. 2016, Weaver et al. 2020), but not completely. Through the application of fatality thresholds, residual impacts should be minimized.

Impact Phase: Operation							
Potential impact description: LIGHT POLLUTION Detailed description of impact Light pollution can alter ecological dynamics.							
	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation / Enhancement	L	L	M	Negative	L	L	M
With Mitigation / Enhancement	L	L	M	Negative	L	L	H
Can the impact be reversed?	YES The impact is reversible but only after a long time, when the WEF is decommissioned.						
Will impact cause irreplaceable loss or resources?	YES The impact may result in a loss of insects.						
Can impact be avoided, managed or mitigated?	YES by adhering to mitigation measures. The mitigation measures are easily applied and demonstrably feasible (Stone et al. 2015).						
Mitigation measures to reduce residual risk or enhance opportunities: Avoid: - No placement of substations and operational and maintenance buildings within no-go areas (Figure 3). - Avoid excessive lighting Minimise: - Use of motion-sensor lighting, avoid sky-glow by using hoods, increase spacing between lighting units, and use low pressure sodium lights (Rydell 1992, Stone 2012).							
Residual impact	Given the limited extent of light pollution currently in the region, the application of the above mitigation measures is likely to result in minor residual impacts.						

6.1.3 Decommissioning Phase

Impacts

Impacts during the decommissioning phase will be indirect and involve disturbance to bats through excessive noise and dust, and damage to vegetation.

Mitigation - Avoid

Disturbance effects can be avoided by restricting decommissioning activities to daylight hours (i.e., no works at night).

Mitigation - Minimize and Restore

Disturbance can be minimized by applying good abatement control practices to reduce emissions and pollutants (e.g., noise, erosion, waste) created during decommissioning works. All areas disturbed must be rehabilitated through native species planting within all areas under the projects control.

Impact Phase: Decommissioning							
Potential impact description: DISTURBANCE OF BATS Detailed description of impact Impacts during the decommissioning phase will be indirect and involve disturbance to bats through excessive noise and dust, and damage to vegetation.							
	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation / Enhancement	L	L	L	Negative	L	L	H
With Mitigation / Enhancement	L	L	L	Negative	L	L	H
Can the impact be reversed?			-				
Will impact cause irreplaceable loss or resources?			-				
Can impact be avoided, managed or mitigated?			-				
Mitigation measures to reduce residual risk or enhance opportunities: Avoid: - No decommissioning activities at night. Minimise: - Apply good abatement control practices to reduce emissions and pollutants (e.g., noise, erosion, waste) created during decommissioning activities. Restore: - Rehabilitate all areas disturbed during construction (including aquatic habitat).							
Residual impact	Residual impacts are likely to be minor since ceasing project activities on site is likely to benefit bats.						

6.2 Grid Connection

6.2.1 Construction Phase

The direct impact of grid connection infrastructure is collisions with powerlines. Insectivorous bats are unlikely to collide with powerlines since they can avoid these obstacles using echolocation but fruit bats do collide with powerlines (Tella et al. 2020), although the likelihood of occurrence for fruit bats species in the AoI is low (Table 2). Indirect impacts include loss of habitat to construct substations and OHL pylons, and ecological light pollution (Longcore and Rich 2004).

<table>
<tr><th colspan="8">Impact Phase: Construction</th></tr>
<tr><td colspan="8">Potential impact description: MODIFICATION & DISTURBANCE OF BAT HABITAT (ROOSTING, FORAGING, COMMUTING)
Detailed description of impact
Vegetation clearing for grid connection infrastructure (access roads, substation buildings, pylons), as well as noise and dust generated during the construction phase, will impact bats by removing habitat used for foraging and commuting, through disturbance, and displacement (Kunz et al. 2007b, Millon et al. 2018, Bennun et al. 2021). This impact is likely to have species specific effects; clutter edge species (e.g., Cape serotine) are more likely to be impacted by habitat modification given their greater association with physical habitat features compared to high-flying species (e.g., Egyptian free-tailed bat).

Construction of grid connection infrastructure could result in destruction (direct impact) of bat roosts (trees, buildings) and disturbance (indirect impact) of bat roosts potentially resulting in roost abandonment. Bat mortality can occur if roosts which contain bats are destroyed. Installation of new infrastructure in the landscape (e.g., buildings, road culverts) can inadvertently provide new roosting spaces for some bat species, attracting them to areas with wind turbines and potentially increasing the likelihood of collisions.</td></tr>
<tr><th></th><th>Severity</th><th>Extent</th><th>Duration</th><th>Status</th><th>Probability</th><th>Significance</th><th>Confidence</th></tr>
<tr><td>Without Mitigation / Enhancement</td><td>L</td><td>L</td><td>L</td><td>Negative</td><td>L</td><td>L</td><td>H</td></tr>
<tr><td>With Mitigation / Enhancement</td><td>L</td><td>L</td><td>L</td><td>Neutral</td><td>L</td><td>L</td><td>H</td></tr>
<tr><td colspan="3">Can the impact be reversed?</td><td colspan="5">YES provided appropriate rehabilitation is implemented. By removing wind turbines, the impact of displacement will be removed, however, this impact will persist for a long duration during operation of the grid connection.</td></tr>
<tr><td colspan="3">Will impact cause irreplaceable loss or resources?</td><td colspan="5">YES land will be cleared for the development, but this could be rehabilitated after the operation of the facility. However, it is likely that not all areas may be successfully rehabilitated, and it is inevitable that some habitat will be permanently lost.</td></tr>
<tr><td colspan="3">Can impact be avoided, managed or mitigated?</td><td colspan="5">YES by applying buffers to key habitat features and avoiding placement of project infrastructure within buffered areas.</td></tr>
<tr><td colspan="8">Mitigation measures to reduce residual risk or enhance opportunities:
<u>Avoid:</u>
- Limit potential for bats to roost in project infrastructure (e.g., buildings, turbines, road culverts) by ensuring they are properly sealed such that bats cannot gain access.
- No construction activities at night.
- No placement of pylons within 200 m of key habitat features specifically including tree clumps, buildings, dams/wetlands, and rivers/streams (see No-Go Areas in Figure 3). The OHL itself is permitted to cross over No-Go Areas for practical routing reasons but pylon positions must avoid No-Go Areas where feasible. Therefore the maximum possible span should be implemented to avoid the sensitive area while ensuring the technical feasibility of the development.
- No blasting near rocky crevices.
- The construction compounds, laydown areas, and batching plants must avoid No-Go areas.
- Being the shorter route and interacting with fewer habitat features, the preferred alternative is recommended (Figure 5).

<u>Minimise:</u>
- Minimise clearing of vegetation
- Minimise disturbance and destruction of rocky outcrops, trees and buildings, and where this is required, these features should be examined for roosting bats.
- Apply good construction abatement control practices to reduce emissions and pollutants (e.g., noise, erosion, waste) created during construction.

<u>Restore:</u>
- Rehabilitate all areas disturbed during construction (including aquatic habitat).</td></tr>
</table>

Residual impact	Residual impacts are likely to be minor although buffer distances have been shown to be ineffective at avoiding and minimizing risk to bats because these are two small for some species (Barré et al. 2018).

6.2.2 Operational Phase

Impact Phase: Operation							
Potential impact description: LIGHT POLLUTION Detailed description of impact Construction of grid infrastructure will increase ecological light pollution from artificial lighting associated with the substation and other operational and maintenance buildings. Light pollution can alter ecological dynamics (Horváth et al. 2009). Lighting attracts and can cause direct mortality of insects, reducing the prey base for bats, especially bat species that are light-phobic. These species may also be displaced from previous foraging areas due to lighting. Other bat species forage around lights, attracted by higher numbers of insects. This may bring these species into the vicinity of the project and indirectly increase the risk of collision with wind turbines.							
	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation / Enhancement	L	L	M	Negative	L	L	M
With Mitigation / Enhancement	L	L	M	Negative	L	L	H
Can the impact be reversed?			YES The impact is reversible but only after a long time, when the grid connection is decommissioned.				
Will impact cause irreplaceable loss or resources?			YES The impact may result in a loss of insects.				
Can impact be avoided, managed or mitigated?			YES by adhering to mitigation measures. The mitigation measures are easily applied and demonstrably feasible (Stone et al. 2015).				
Mitigation measures to reduce residual risk or enhance opportunities: Avoid: - No placement of substations and operational and maintenance buildings within no-go areas (Figure 3). - Avoid excessive lighting Minimise: - Use of motion-sensor lighting, avoid sky-glow by using hoods, increase spacing between lighting units, and use low pressure sodium lights (Rydell 1992, Stone 2012).							
Residual impact	Given the limited extent of light pollution currently in the region, the application of the above mitigation measures is likely to result in minor residual impacts.						

6.2.3 Decommissioning Phase

Impact Phase: Decommissioning							
Potential impact description: DISTURBANCE OF BATS Detailed description of impact Impacts during the decommissioning phase will be indirect and involve disturbance to bats through excessive noise and dust, and damage to vegetation.							
	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation / Enhancement	L	L	L	Negative	L	L	H
With Mitigation / Enhancement	L	L	L	Negative	L	L	H
Can the impact be reversed?			-				

Will impact cause irreplaceable loss or resources?	-
Can impact be avoided, managed or mitigated?	-
Mitigation measures to reduce residual risk or enhance opportunities: Avoid: - No decommissioning activities at night. Minimise: - Apply good abatement control practices to reduce emissions and pollutants (e.g., noise, erosion, waste) created during decommissioning activities. Restore: - Rehabilitate all areas disturbed during construction (including aquatic habitat).	
Residual impact	Residual impacts are likely to be minor since ceasing project activities on site is likely to benefit bats.

6.3 Cumulative Impacts

For the purposes of the cumulative impact assessment (CIA), cumulative impacts are defined as the total impacts resulting from the successive, incremental, and/or combined effects of a project when added to other existing, planned and/or reasonably anticipated future projects, as well as background pressures (IFC 2013). The project considered here is the Emvelo Wind Energy Facility. The goal of this assessment is to evaluate the potential resulting impact to the vulnerability and/or risk to the sustainability of the bat species affected (IFC 2013).

6.3.1 Step 1: VECs and spatial-temporal boundary

Following guidance in IFC (2013), the first step in the CIA was to determine the Valued Environmental Components (VECs), the bat species most likely to be affected by cumulative impacts, and the temporal and geographic scope of the analysis. Of the species recorded in the PAOI during the acoustic monitoring, and based on bat distribution records (ACR 2020), Cape serotine (*Laephotis capensis*) and Egyptian free-tailed bat (*Tadarida aegyptiaca*) are most likely to be impacted cumulatively. This is because they are the most widespread bat species in South Africa (Monadjem et al. 2020), classified as high risk species to wind energy impacts (MacEwan et al. 2020), the most impacted by operating wind energy facilities in the country (Aronson 2022), and baseline monitoring showed relatively high levels of activity for some areas of the project.

The temporal time frame over which cumulative impacts are considered was 25 years, the typical lifespan of a renewable energy facility. However, cumulative effects could extend beyond this timeframe if development of the cluster of three projects is phased over time.

The Ecologically Appropriate Area of Analysis (EAAA) for the assessment was determined by considering the ecology of the identified species likely to be affected since cumulative impacts should be evaluated across scales potentially affected species are likely to occur (Voigt et al. 2012, Lehnert et al. 2014). Data on the spatial ecology of the Egyptian free-tailed bat and Cape serotine, specifically the sizes of their foraging or community ranges, are not available. Data from European free-tailed bat, *Tadarida teniotis*, in Portugal (Marques et al. 2004) and Serotine bat, *Eptesicus serotinus*, in England (Robinson and Stebbings 1997) were used as surrogates. Feeding areas for some *T. teniotis* individuals were over 30 km from their roost while the maximum distance between *E. serotinus* feeding areas was over 41 km.

Cumulative impact assessment in South African typically consider developments within a radius of 35 km which therefore is potentially in line with the movement ecology of the two VECs. Hence the EAAA was a 35 km radius around the PAOI.

6.3.2 Step 2: Other Activities and External Drivers

The second step in the CIA was to identify other past, existing, or planned activities within the EAAA and to assess the external influences and stressors on the two VECs. With reference to the Renewable Energy Application database (Q4, 2022), currently no wind energy projects are located within the EAAA. However, also considered are the two other projects being develop as part of the larger project: Sheepmoor WEF and Rochdale WEF. At least a moderate level of wind energy development can be expected over the following 25 years in the EAAA.

There are no documented major past threats to Egyptian free-tailed bat and Cape serotine or current threats to them other than renewable energy (Child et al. 2016). Egyptian free-tailed bats can also be threated indirectly by roost disturbance, especially caves. This CIA considers renewable energy the primary impact to these VECs.

6.3.3 Step 3: Baseline Status of VECs

Egyptian free-tailed bat is very widely distributed, locally common and recorded from many protected areas in South Africa however, although the population is stable, the population size is unknown (Child et al. 2016). It is classified as Least Concern nationally and globally. This species is present in the PAOI and based on its activity levels, it is at high risk of collision during autumn and spring (Table 4). It is flexible in its habitat requirements and one reason for its wide distribution is its affinity to roost in buildings or other man-made structures (Monadjem et al. 2020).

Cape serotine is also widely distributed in South Africa with a large population and hence is classified as Least Concern nationally and globally. However, it is possible that this species comprises a complex of closely related species (Monadjem et al. 2020). The population trend is stable, but the population size is unknown. Although this species is present in the PAOI its activity levels suggest low risk of collision (Table 3) although no data between 10 m and 50 m were recorded on site to verify this. This species was recorded at 50 m, so it is reasonable to assume some level of risk between 10 m and 50 m. Cape serotine is also flexible in its habitat requirements and its use of buildings and other anthropogenic structures as roosts has possibly led to its numbers increasing.

6.3.4 Step 4: Assess Cumulative Impacts on VECs

The key potential impacts that could affect the long-term sustainability and/or viability of the Egyptian free-tailed bat and Cape serotine in the EAAA are collisions with wind turbines. This may lead to local extinctions and fragmentation of the national population since bats have low reproductive rates (Barclay and Harder 2003). Other impacts may include displacement from foraging and commuting areas due to wind turbines (Millon et al. 2018, Leroux et al. 2022).

6.3.5 Step 5: Assess Significance of Predicted Cumulative Impacts

Rodhouse et al. (2019), Davy et al. (2020) and Frick et al. (2017) have all shown that in North America, Least Concern bats may be experiencing impacts due to wind farms that could result in changes to their conservation status. This may be a future scenario for widespread, common Least Concern bats species in South Africa. As such, the significance of cumulative impacts is assessed as High without mitigation. The application of mitigation measures is anticipated to reduce the overall cumulative impact of the project to a moderate level.

Impact Phase: Operation							
Potential impact description: CUMULATIVE IMPACTS Detailed description of impact The total impacts resulting from the successive, incremental, and/or combined effects of the project when added to other existing, planned and/or reasonably anticipated future projects, as well as background pressures.							
	Severity	Extent	Duration	Status	Probability	Significance	Confidence

Without Mitigation / Enhancement	M	H	M	Negative	M	H	M
With Mitigation / Enhancement	L	H	M	Negative	M	M	H
Can the impact be reversed?	YES Removing the WEF will remove the impact to the bat community and hence the impact is reversible at the community or population level, but not at the level of individual bats who have been killed.						
Will impact cause irreplaceable loss or resources?	YES Bat fatality is highly likely and hence impacts to individual bats will result in a loss of resources. Curtailment and deterrents do not fully remove the impact to bats.						
Can impact be avoided, managed or mitigated?	YES by adhering to mitigation measures. Curtailment and deterrents can successfully reduce bat fatality (Arnett 2011, Arnett et al. 2016, Weaver et al. 2020), but not completely.						
Mitigation measures to reduce residual risk or enhance opportunities: The mitigation measures proposed in this report (buffering key habitats used by bats, use of appropriate lighting technology, blade feathering, and using curtailment and/or acoustic deterrents) should be applied to all future projects so that there is a collective management responsibility (IFC 2013).							
Residual impact	Curtailment and deterrents can successfully reduce bat fatality (Arnett 2011, Arnett et al. 2016, Weaver et al. 2020), but not completely. Through the application of fatality thresholds across all projects in the cumulative impact area, residual impacts should be minimized.						

6.3.6 Step 6: Management of Cumulative Impacts

Management interventions for bats at operating wind farms in South Africa are benchmarked against fatality thresholds. These thresholds attempt to manage impacts to bats by considering potential population level effects, with the threshold values set below the rate at which populations may decline due to anthropogenic pressures (MacEwan et al. 2018). Thresholds will be set for this project during the EIA and these should be determined for all other future wind energy developments. In theory, should each individual development apply thresholds and appropriate mitigation measures if these are exceeded, the EAAA VEC populations should not decline.

The mitigation measures proposed in this report (buffering key habitats used by bats, use of appropriate lighting technology, blade feathering, and using curtailment and/or acoustic deterrents) should be applied to all future projects so that there is a collective management responsibility (IFC 2013).

7 CONCLUSION

This scoping report assessed impacts to bats that could occur because of the construction, operation and decommission of the Emvelo WEF and grid connection. The assessment was based on 12 months of baseline data on bat activity recorded at the project. Based on these data, the key issue for the WEF will be managing collision impacts to Cape serotine and Egyptian free-tailed bat.

The first mitigation measure proposed to manage risk is to adhere to the no-go buffers which aim to spatially avoid impacts by buffering key habitat features used by bats. This measure is likely to be effective for most bat species recorded at the project, but additional mitigation measures are needed to avoid impacts to free-tailed bats, which forage high in the air, and to reduce residual impacts. Turbine design can be effective, and it is recommended to maintain a minimum blade sweep of at least 30 m. However, free-tailed bats will still collide with turbine blades above this height and as such, the rotor diameter must be limited as much as practicable to minimise the space where collisions might occur. The specific dimensions will be investigated further during the EIA phase of the project. Additionally, blade feathering must be implemented to limit the rotation of turbine blades below the turbine cut-in speed when electricity is not being generated. **Based on the proposed project development layout, turbine WTG 32 and the two laydown alternatives are located in no-go areas and this infrastructure must be relocated out of the no-go areas.**

Mitigation measures to minimise residual impacts after the application of the above measures include curtailment and acoustic deterrents. As such, the project should consider the cost and feasibility of these measures during the EIA phase. The residual impacts must be monitored using post-construction fatality monitoring for a minimum of two years (Aronson et al. 2020). Curtailment and/or acoustic deterrents must be used if this monitoring indicates that species fatality thresholds have been exceeded (MacEwan et al. 2018) to maintain the impacts to bats within acceptable limits of change and prevent declines in the impacted bat populations.

The proposed project can be approved to continue to the EIA phase, considering that the overall impact to bats was assessed as moderate after the application of the mitigation measures proposed to avoid and minimise impacts to bats. However, on a species level, the project presents differential risk and impacts to bats must be managed adaptively during the operational phase, particularly for those species (e.g. Egyptian free-tailed bat and Cape serotine) for which high risk is predicted during some periods. This adaptive management will be guided by the Environmental Management Programme for bats which must include the development of a Biodiversity Management Plan (BMP) to manage impacts to bats during the operation of the facility. The BMP for bats must be developed by a bat ecologist before the commencement of operation and must include the post-construction fatality monitoring plan design, fatality thresholds calculations and rationale, a curtailment plan, and an adaptive management response plan that provides a timeous action pathway for mitigation, including roles and responsibilities, should fatality thresholds be exceeded.

7.1 Plan of study for EIA

Additional data are being collected from two locations in the PAOI and this will further inform the final impact assessment. The following tasks will be undertaken during the EIA phase of the development:

- Update the bat activity baseline to include additional bat acoustic monitoring data.
- Update the impact assessment as required based on the additional data collected.
- Update the cumulative impact assessment to reflect if additional wind farm developments are approved in the EAAA.
- Compile the Environmental Management Programme for bats.
- Confirmation that all project infrastructure (except roads) avoids No-Go areas.
- Calculate fatality threshold based on the turbine layout.

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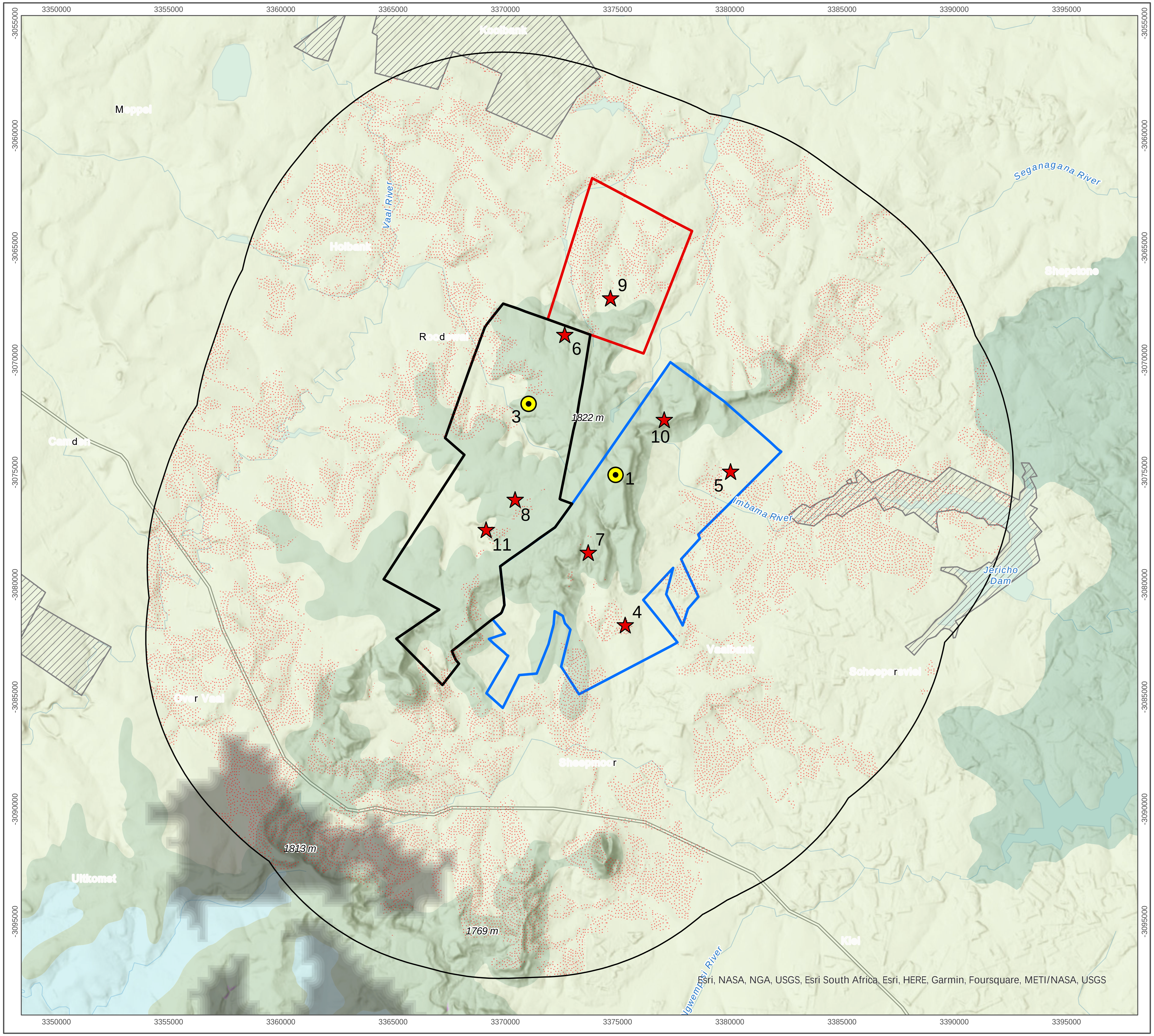
Appendix 1: Figures

CAMISSA
SUSTAINABILITY CONSULTING

PAOI
Emvelo WEF
Rochdale WEF
Sheepmoore WEF
Bat Detector Location
Short Mast
Met Mast
Protected Area
NPAES
CBA Irreplaceable
Vegetation Types
Amersfoort Highveld Clay Grassland
Eastern Highveld Grassland
KaNgwane Montane Grassland
Northern Afrotemperate Forest
Wakkerstroom Montane Grassland

1:160,000
0 3 6 km
Date: 20/06/2023



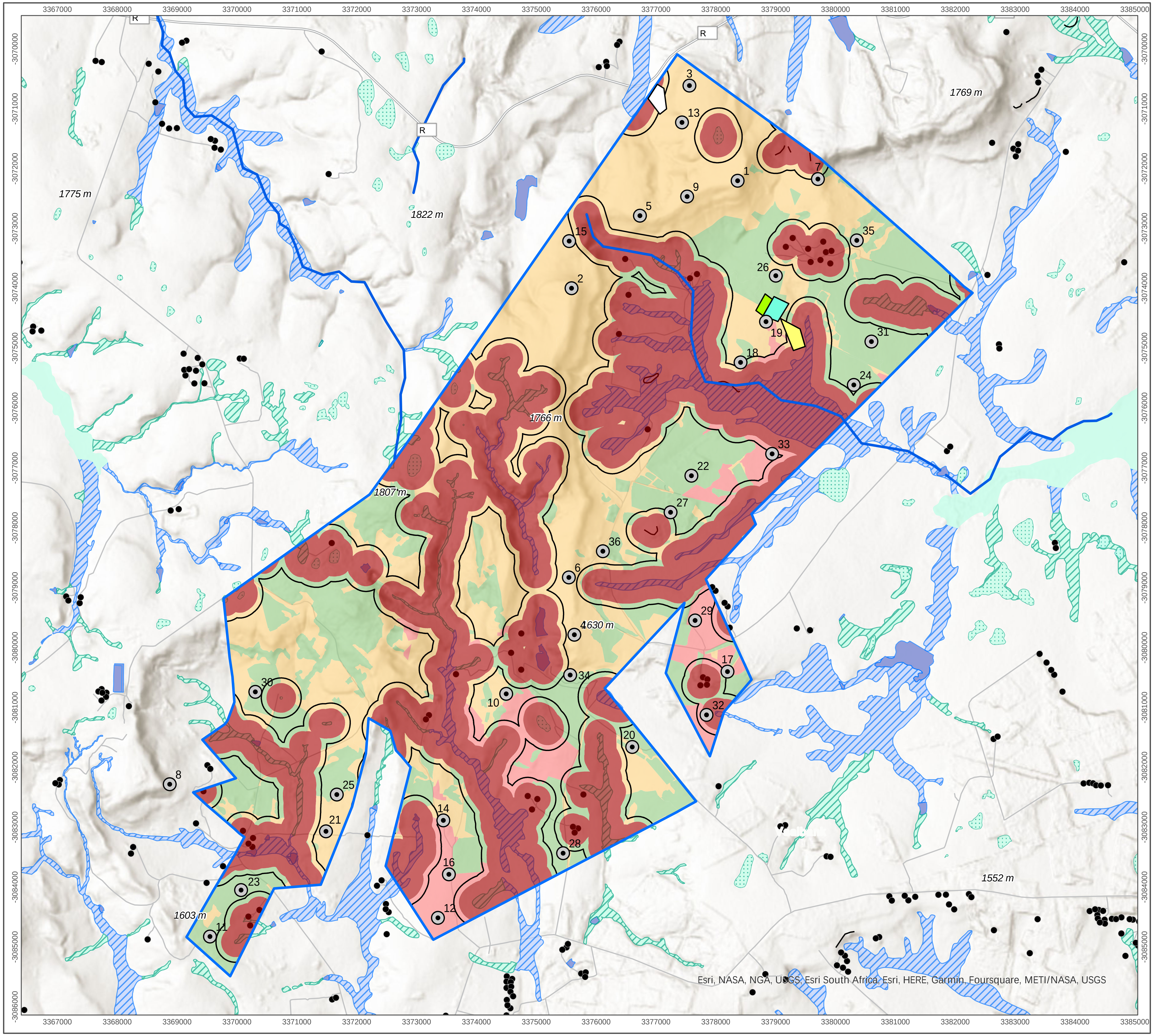
Emvelo Wind Energy Facility
Contextual Map
Figure 1

CAMISSA
SUSTAINABILITY CONSULTING

- Emvelo WEF
- Proposed Turbine Layout
- Building
- Rocky Outcrop
- NBA Rivers
- Laydown Area
- Alternative Laydown Area
- O&M Buildings
- Substation
- Channelled valley-bottom wetland
- Floodplain wetland
- Depression wetland
- Seep wetland
- NBA Artifical Wetlands

Constraints

- Low
- Medium
- High
- No-Go
- 77 m Blade Buffer No-Go Area



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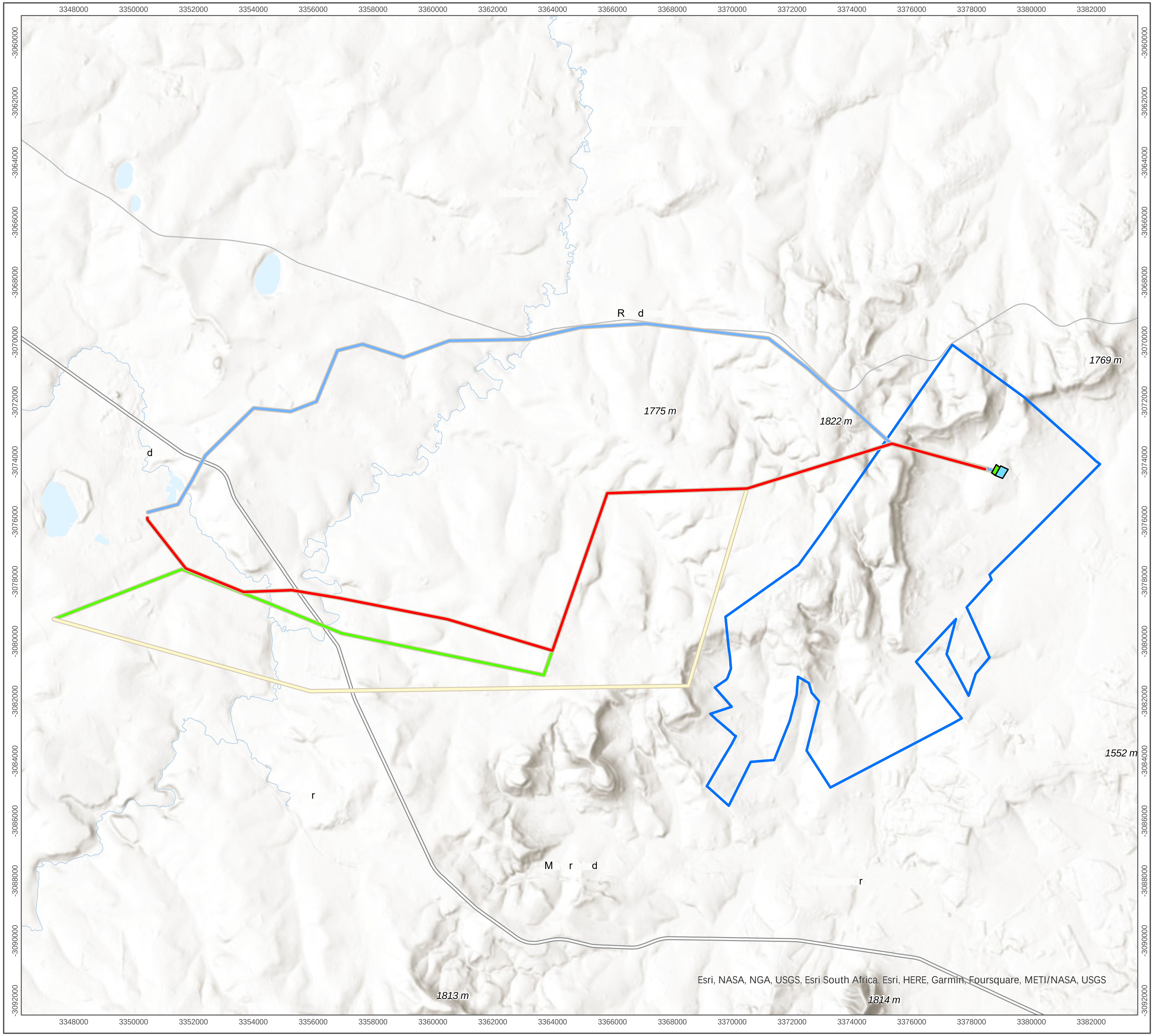
0 1 2 km

Date: 07/08/2023

Emvelo Wind Energy Facility
Constraints Map
Figure 3

CAMSSA SUSTAINABILITY CONSULTING

- Emvelo WEF
- OHL Alternative 1
- OHL Alternative 2
- OHL Alternative 3
- OHL Preferrred
- O&M Buildings
- Substation



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Date: 07/08/2023

Emvelo Wind Energy Facility
Grid Connection
Figure 5

Appendix 2: Specialist CV

CURRICULUM VITAE JONATHAN ARONSON

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1 BACKGROUND

Jonathan is a research ecologist with 13 years of experience working on bat and wind energy interactions. He has been at the forefront of bats and wind energy research in South Africa and has worked on more than 100 WEF projects in South Africa, Kenya, Ethiopia, Mozambique, Zambia, Uzbekistan, Azerbaijan, Pakistan, Vietnam, and the UK. He has presented his research at the International Bat Research Conference, the Conference on Wind Energy and Wildlife Impacts, and at numerous local and international bat workshops and symposia.

He is experienced in undertaking pre-construction and operational monitoring projects for bats, impact assessments, mitigation strategy design (including the design of curtailment programs), due diligence exercises, ecological surveys, GIS screening studies and providing strategic advice. He has delivered training to local search teams at operational wind farms in South Africa, Pakistan and Vietnam on bat and bird carcass search methodologies, including providing on-going support and mentoring.

Jonathan has also helped shaped wind-wildlife best practise and policy, co-authoring the Good Practise Guidelines for Surveying Bats at Wind Energy Facilities in South Africa, and developing monitoring guidelines for bat fatality at operational wind power projects. He is a founding member of the South African Bat Assessment Advisory Panel (SABAAP) and a registered as a Professional Natural Scientist (Ecological Science) with SACNASP.

2 PROFESSIONAL HISTORY

Director/Founder, Camissa Sustainability Consulting (2020 – current)
International Finance Corporation (IFC) ESG Sustainability Advice & Solutions Department (2020 – current)
Senior Ecologist, Arcus Consultancy Services South Africa (Pty) Ltd (2019 - 2020)
Ecology Specialist, Arcus Consultancy Services South Africa (Pty) Ltd (2013 – 2019)
Director/Founder, Gaia Environmental Services Pty (Ltd) (2011 - 2013)

3 QUALIFICATIONS

MSc (Environment and Resource Management; Energy and Climate Specialization)
Vrije Universiteit Amsterdam (2020 – 2021)

MSc (Zoology)
University of Cape Town (2009 – 2011)

BSc - Honours (Freshwater Biology)
University of Cape Town (2007)

BSc (Zoology)
University of Cape Town (2003 – 2006)

4 AFFILIATIONS

South African Bat Assessment Advisory Panel (2013 to 2020)
Professional Natural Scientist (Ecological Science) – SACNASP Registration #400238/14

5 PROJECT EXPERIENCE

Research Projects

- Current State of Knowledge of Wind Energy Impacts on Bats in South Africa
- Darling National Demonstration Wind Farm Project. Designed and implemented a research project investigating bat fatality in the Western Cape

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Strategic Advice

- Risk screening for five wind farms in Uzbekistan and Azerbaijan (International Finance Corporation)
- Review of Terms of Reference for Bat Pre-construction Monitoring projects in India (International Finance Corporation)
- Stakeholder Advisory Committee for Good Practices Handbook Post-Construction Monitoring of Bird and Bat Fatalities at Onshore Wind Energy Facilities (International Finance Corporation)
- Review of Bird Fatality data from De Aar 1 and De Aar 2 Wind Farms (Mulilo)
- Management and mitigation recommendations for bats at three proposed wind farms (Rainmaker Energy)
- Peer Review for Three Bat Monitoring Reports for the Bokpoort II Solar Developments (Golder Associates)
- Peer Review of Operational Monitoring at the Jeffreys Bay Wind Farm, including updating the operational mitigation strategy for bats (Globeleq South Africa Management Services)
- Oyster Bay Wind Energy Facility. Reviewing a pre-construction bat monitoring study and providing input into a stand-alone study (RES Southern Africa)
- Review and design mitigation strategies for bats at the Kinangop Wind Park, Kenya (African Infrastructure Investment Managers)

Operational Monitoring Projects for Bats and Birds

- Pakistan Super Six Wind Farms (Consortium of six Companies)
- Loi Hai 2 and Phu Lac 2 Wind Farms (International Finance Corporation)
- Waainek, Chaba and Grassridge Wind Farms (EDF Energy)
- Golden Valley 1 Wind Farm (Biotherm Energy)
- Darling Wind Farm (ENERTRAG)
- Eskom Sere Wind Farm (Endangered Wildlife Trust)
- West Coast One Wind Energy Facility (Aurora Wind Power)
- Fazakerly Waste Water Treatment Works (United Utilities)
- Beck Burn Wind Farm (EDF Energy)
- Gouda Wind Energy Facility (Blue Falcon 140)
- Hopefield Wind Farm (Umoya Energy)

Pre-Construction Monitoring and Environmental Impact Assessments for Bats

- Taaibos and Soutrivier Wind Energy Facilities (WKN Windcurrent SA)
- Pofadder Wind Energy Facility (Atlantic Renewable Energy Partners (Pty) Ltd)
- Ummbila Emoyeni Wind Energy Facility (Windlab Developments South Africa (Pty) Ltd)
- Kleinberg Wind Energy Facility (Mulilo)
- Klipfontein & Zoute Kloof Solar PV Projects (Resource Management Services)
- Swellendam Wind Energy Facility (The Energy Team/Calidris)
- Swellendam Wind Energy Facility (Veld Renewables)
- Ingwe Wind Energy Facility (ABO Wind renewable energies)
- Duiker Wind Energy Facility (ABO Wind renewable energies)
- Pienaarspoort Wind Energy Facility (ABO Wind renewable energies)
- Choje Wind and Solar Energy Facility (Wind Relic)
- Wobben WEC Wind Project (Integrated Wind Power)
- Nuweveld Wind Energy Facility (Red Cap Energy)
- Banna Ba Phifu Wind Energy Facility (WKN Windcurrent SA)
- Kwagga Wind Energy Facility (ABO Wind renewable energies)
- Unika 1 Wind Farm in Zambia (SLR Consulting)
- Namaacha Wind Farm (Consultec)
- Paulputs Wind Energy Facility (WKN Windcurrent SA)
- Putsonderwater Wind Energy Facility (WKN Windcurrent SA)
- Zingesele Wind Energy Facility (juwi Renewable Energies)

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- Highlands Wind Energy Facility (WKN Windcurrent SA)
- Kap Vley Wind Energy Facility (juwi Renewable Energies)
- Universal and Sonop Wind Energy Faculties (JG Afrika)
- Kolkies and Karee Wind Energy Facility (Mainstream Renewable Power South Africa)
- Komsberg East and West Wind Energy Facility (African Clean Energy Developments)
- Spitskop West Wind Energy Facility (RES Southern Africa/Gestamp)
- Spitskop East Wind Energy Facility (RES Southern Africa)
- Patryshoogte Wind Energy Facility (RES Southern Africa)
- Elliot Wind Energy Facility (Rainmaker Energy)
- Pofadder Wind Energy Facility (Mainstream Renewable Power South Africa)
- Swartberg Wind Energy Facility (CSIR)
- Clover Valley and Groene Kloof Wing Energy Facility (Western Wind Energy)

Ecological Surveys

- Mokolo Bat Cave Assessment for water pipeline development (GIBB)
- Killean Wind Farm Bat acoustic surveys for this proposed site in Scotland, UK. (Renewable Energy Systems)
- Maple Road, Tankersely. Bat acoustic surveys including a walked transect for this proposed site near Barnsley, UK (Rula Developments).
- Wild Bird Global Avian Influenza Network for Surveillance (Percy Fitzpatrick Institute of African Ornithology)
- Tree-Grass Dynamics Research Project (University of Cape Town)
- Zululand Tree Project (University of Cape Town)

Environmental Due Diligence Projects

- Klawer Wind Farm (SLR Consulting)
- Excelsior Wind Farm (IBIS Consulting)
- Golden Valley Wind Farm (IBIS Consulting)
- Perdekraal Wind Farm (IBIS Consulting)
- Copperton Wind Energy Facility (SLR Consulting)
- Roggeveld Wind Farm (IBIS Consulting)
- Kangas Wind Farms (ERM)
- Excelsior Wind Farms (ERM)
- Golden Valley Wind Farms (ERM)

Amendment Applications for Wind and Solar Farms

- Bokpoort Solar Amendment (Royal HaskoningDHV)
- Haga Haga (CES - Environmental and social advisory services)
- Paulputs (Arcus Consultancy Services South Africa)
- Suurplaat (Savannah Environmental)
- Kap Vley (juwi)
- San Kraal (Arcus Consultancy Services South Africa)
- Phezukomoya (Arcus Consultancy Services South Africa)
- Gemini (Savannah Environmental)
- Castle Wind Farm (juwi)
- Namas (Savannah Environmental)
- Zonnequa (Savannah Environmental)
- Ukomeleza (CES - Environmental and social advisory services)
- Great Kei (CES - Environmental and social advisory services)
- Motherwell (CES - Environmental and social advisory services)
- Dassiesridge (CES - Environmental and social advisory services)
- Great Karoo (Savannah Environmental)
- Gunstfontein (Savannah Environmental)

- Komserberg East and West (Aurecon South Africa)
- Soetwater (Savannah Environmental)
- Karusa (Savannah Environmental)
- Zen (Savannah Environmental)

Screening Studies

- Feasibility assessment for four potential wind farms in the Northern Cape (ABO Wind renewable energies)
- Feasibility assessment for four potential wind farms in Mozambique (Ibis Consulting)
- Assessment of the Feasibility of a Wind Farm in the Northern Cape (juwi Renewable Energies)
- Assessment of the Feasibility of two Wind Farms in the Eastern Cape (WKN Windcurrent SA)

6 PUBLICATIONS

Aronson, J.B. (2022). Current State of Knowledge of Wind Energy Impacts on Bats in South Africa. Acta Chiropterologica, 24(1):221-238.

Aronson, J.B., Shackleton, S., and Sikutshwa, L. (2019). Joining the puzzle pieces: reconceptualising ecosystem-based adaptation in South Africa within the current natural resource management and adaptation context. Policy Brief, African Climate and Development Initiative.

MacEwan, K., Aronson, J.B, Richardson, E., Taylor, P., Coverdale, B., Jacobs, D., Leeuwner, L., Marais, W., Richards, L. (2018). South African Bat Fatality Threshold Guidelines for Operational Wind Energy Facilities – South African Bat Assessment Association (1st Edition).

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Aronson, J.B., Thomas, A. and Jordaan, S. 2013. Bat fatality at a Wind Energy Facility in the Western Cape, South Africa. African Bat Conservation News 31: 9-12.

7 TRAINING

- Conference on Wildlife and Wind Energy Impacts, Netherlands, April 2022.
- National Wind Coordinating Collaborative (NWCC) Wind Wildlife Research Meeting, December 2020.
- Conference on Wildlife and Wind Energy Impacts, Stirling, August 2019.
- GenEst Carcass Fatality Estimator Workshop, Stirling, August 2019.
- GenEst Carcass Fatality Estimator Workshop, Kirstenbosch Research Centre (KRC), October 2018.
- Windaba Conference and Exhibition - Africa's Premier Wind Energy Conference; Cape Town, 2013 – 2019
- Bats & Wind Energy Workshop, The Waterfront Hotel & Spa, Durban, July 2016.
- Endangered Wildlife Trust (EWT) Bats & Wind Energy Training Course, Oct 2013.
- Endangered Wildlife Trust (EWT) Bats & Wind Energy Training Course, Jan 2012.

Appendix 3: Specialist Declaration

Appendix 4: SACNASP Certificate

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Jonathan Barry Aronson

Registration number: 400238/14

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule I of the Act)

Ecological Science **23 July 2014**

CUSTOS SCIENTIARUM NATURALIUM

23 July 2014

Pretoria	President	Executive Director

Appendix 5: Site Sensitivity Verification Report

SITE SENSITIVITY VERIFICATION
(IN TERMS OF PART A OF THE ASSESSMENT PROTOCOLS PUBLISHED IN GN 320 ON 20 MARCH 2020

1 INTRODUCTION

In accordance with Regulation 16(1)(b)(v) of the EIA Regulations, a Screening Report is required to accompany any application for Environmental Authorisation. The National Web based Environmental Screening Tool was used to generate this Screening Report for the Emvelo WEF. Subsequently, this document presents a site sensitivity verification (SSV) to confirm the current land use and environmental sensitivity of the proposed project area as identified by Screening Tool.

2 SITE SENSITIVITY VERIFICATION FRAMEWORK

The SSV was undertaken at the desktop level as well as using on-site information collected as part of the 12-month pre-construction bat acoustic monitoring being undertaken for the project in accordance with best practise standards for wind energy projects (MacEwan et al. 2020).

Desktop resources included published scientific articles, texts (Monadjem et al. 2010, Child et al. 2016, Monadjem et al. 2020), and databases (ACR 2020, IUCN 2021) on South African bats. These were used to determine which bat species (i.e., impact receptors) are likely to occur at the project as well as to provide information on their natural history and conservation status. Bat activity data were collected from the field using acoustic monitoring. Field work also included inspection of rocky crevices and buildings which may be used as roosts by bats. See **Section 4** of the Scoping Report for detail description of methodology and survey findings.

As per the Species Environmental Assessment Guideline (SANBI 2020), the best practise bat guidance was used to assign sensitivity to the impact receptors (specifically bat species) in the PAOI. Sensitivity was obtained by calculating the median number of bat passes/hour per night (n = 383 sample nights). These were then compared to the reference values in the bat guidelines to assign a sensitivity rating to the PAOI (Table 1).

Table 1: Height-specific bat activity (passes/hour) and fatality risk for the Drakensberg Grasslands, Woodlands and Forest ecoregion

Height Category	Fatality Risk (Sensitivity)		
	Low	Medium	High
Ground level	< 0.23	0.23 - 1.76	> 1.76
Rotor sweep	< 0.04	0.04 - 0.39	> 0.39

3 SITE SENSITIVITY VERIFICATION OUTCOME

Based on current taxonomic information and field data, no threatened species were recorded or expected to occur on site. The acoustic monitoring results show that the median number of bat passes/hour per night at height (50 m and 90 m) would classify the PAOI as low sensitivity for Cape serotine (Table 2) and moderate to high sensitivity for Egyptian free-tailed bat (Table 3).

Table 2: Median number of bat passes per hour per night for Cape serotine over the pre-construction monitoring, and associated risk based on MacEwan et al. (2020b).

site	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
AM1-10	0.19	0.18	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00
AM1-50		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	
AM1-90		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
AM3-10	1.35	0.56		0.08	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.49
AM3-50	0.00	0.00	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AM3-90	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Risk Rating
High
Medium
Low
No Data

site	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
AM4	0.29	1.20		0.39	0.08	0.00	0.00	0.08	0.93	0.74	0.00	
AM5	0.19			0.39	0.07		0.00	0.08	0.54	0.79	0.56	0.88
AM6				1.01	0.30	0.00	0.00	0.23	0.61	0.00	0.28	
AM7				0.00	0.00	0.00	0.00	0.00	0.20		0.00	
AM8				0.08	0.00	0.00	0.76	0.08	2.18			
AM9		8.19	8.53	0.00								
AM10	0.19	0.00	0.26	0.08	0.08							0.00
AM11	25.90	20.76	12.50	6.14	3.10							15.07

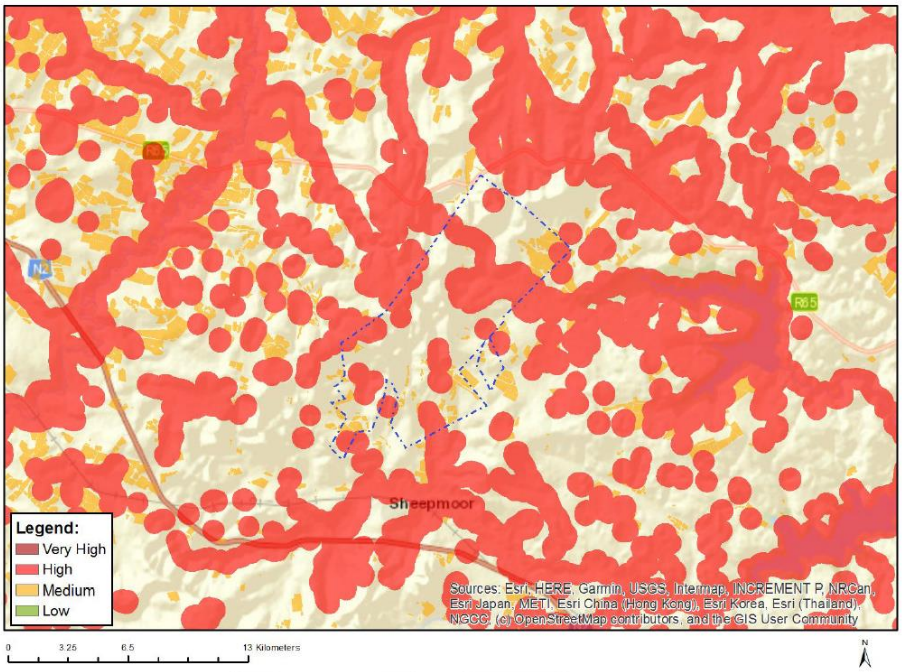
Table 2: Median number of bat passes per hour per night for Egyptian free-tailed bat over the pre-construction monitoring, and associated risk based on MacEwan et al. (2020b).

site	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	
AM1-10	0.10	0.18	0.86	0.00	0.15	0.00	0.00	0.08	0.08	0.52	0.75	0.29	Risk Rating
AM1-50		0.18	0.34	0.56	0.15		0.00	0.08	0.08	0.17	0.28		High
AM1-90		0.00	0.17	0.25	0.08	0.00	0.00	0.00	0.08	0.18	0.38		Medium
AM3-10	0.09	0.00		0.23	0.22	0.00	0.00	0.08	0.33	0.17	0.62	0.39	Low
AM3-50	0.10	0.04	0.51	0.62	0.30	0.00	0.00	0.08	0.16	0.45	0.52	0.20	No Data
AM3-90	0.00			0.08	0.15	0.00	0.00	0.08	0.17	0.44	0.24	0.00	
AM4	0.00	0.00		0.39	0.23	0.00	0.07	0.39	1.95	2.57	0.55		
AM5	0.00			0.23	0.30		0.22	0.39	1.59	2.00	1.83	0.59	
AM6				0.08	0.08	0.00	0.00	0.00	0.37	0.17	0.00		
AM7				0.00	0.00	0.00	0.00	0.00	0.08		0.00		
AM8				0.15	0.08	0.07	0.00	0.08	0.57				
AM9		0.31	0.60	0.00									
AM10	0.00	0.00	0.00	0.08	0.08							0.00	
AM11	0.39	0.45	1.55	2.23	0.54							1.13	

The Screening Tool classified areas within the site boundary as high sensitivity according to the Bats theme (Figure 1). High sensitivity features were wetlands and rivers buffered by 500 m. As a result, the PAOI is classified as high sensitivity overall. The tool did not reveal the presence of any species of conservation concern (SSC).

The outcome of the SSV is that the overall sensitivity of the site varies by bat species and season, linked to their relative activity levels. However, the two sensitivities are based on different data types. The Screening Tool is based on broad scale habitat data whereas the SSV is based on bat collision risk with wind turbines derived from activity data collected within the project boundary and is therefore a better approximation of the project sensitivity because collision is the primary impact. As such the SSV disputes the current environmental sensitivity of the proposed project area, arguing that the sensitivity should be reduced to low for Cape serotine (Table 2), medium-high for Egyptian free-tailed bat (Table 3).

MAP OF RELATIVE BATS (WIND) THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Within 500 m of a river
High	Wetland
High	Within 500 m of a wetland
Medium	Croplands

Figure 1: Map of Bats (Wind) Theme Sensitivity

4 REFERENCES

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SCOPING PHASE FOR THE PROPOSED MULILO CLUSTER WEF, NEAR ERMELO, MPUMALANGA PROVINCE

<u>Emvelo Wind Energy Facility</u>

AQUATIC IMPACT ASSESSMENT

FOR

ERM Southern Africa (Pty) Ltd

BY

EnviroSci (Pty) Ltd

Dr Brian Colloty

1 Rossini Rd
Pari Park
Gqeberha
6070

DATE

20 April 2024

REVISION 1

Executive Summary

ERM Southern Africa (Pty) Ltd appointed EnviroSci (Pty) Ltd to conduct an aquatic assessment of the proposed Mulilo Amsterdam Wind Energy Facility cluster between Ermelo and Amsterdam in the Mpumalanga Province. This report is focused on assessing the Emvelo Wind Energy Facility and its associated Overhead Line alternative corridors

This assessment includes delineating any natural waterbodies, as well as assessing the potential consequences of the proposed project – The study area) on the surrounding wetlands and or watercourses. This was based on information collected during various site visits conducted within the region from March 2022 and a site-specific assessment in April & September 2023. Substantiated by the National Wetland Inventory v5.2 spatial data (NWI).

These surveys adhered to the assessment criteria contained in the DWAF 2005 / 2008 delineation manuals and the National Wetland Classification System. This report will inform the Environmental Authorisation process, as well as the required Water Use License Application that will be initiated, once the final project layout is available, i.e. once all the constraints, if any from this and other specialists have been considered in the design process.

The PROTOCOL FOR SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR THE ENVIRONMENTAL IMPACTS ON AQUATIC BIODIVERSITY (Government Gazette 43110, 20 March 2020), superseding the Appendix 6 NEMA requirements, was also adhered to as results of the DFFE Screening tool indicated that portions of the study area are located within a VERY HIGH SENSITIVITY area, requiring this assessment. This is due to following being highlighted by the DFFE Screening Tool Results:

- Very High CBA: Aquatic rivers
- Very High CBA: Wetlands
- Very High ESA: Important sub catchments
- Very High ESA: Strategic Water Source Area (SWSA)
- Very High ESA: Wetland clusters
- Very High ESA: Wetlands
- Very High FEPA Subcatchment
- Very High Rivers_AB
- Very High Rivers_B
- Very High Rivers_C
- Very High SWSA (Surface Water) _Upper Usutu
- Very High SWSA (Surface Water) _Upper Vaal
- Very High Wetlands_Mesic Highveld Grassland Bioregion (Seep)
- Very High Wetlands_Mesic Highveld Grassland Bioregion (Valley-bottom)
- Very High Wetlands_Mesic (Riverine)
- Very High Wetlands_Mesic Highveld Grassland Bioregion (Depression)
- Very High Wetlands_Mesic Highveld Grassland Bioregion (Floodplain)
- Very High Wetlands_Mesic Highveld Grassland Bioregion (Seep)

The proposed Wind Energy Facility (WEF) is located in the Inkomati-Usuthu Water Management Area, within the upper catchment of the Usuthu River (SQ W54A) and Mpama River (SQ W53B), while the proposed grid connection options are located in the Upper Vaal River (SQ C11A & C11B) in the Vaal Water Management Area. Thus, several permanent rivers and a variety of wetland hydrogeomorphic types are anticipated both associated with the riverine valleys and bench or plateaux areas located between river valleys on higher lying areas.

The study region is further characterised by several National Biodiversity Assessment (2018) Wetland Clusters, National Freshwater Ecosystem Area (NFEPAs), Threatened Ecosystems and Strategic Water Resources Areas.

The geology is mostly shales or sandstone of the Vryhied Group, with several intrusions associated with dolerite sills and dykes in areas associated with the Karoo Supergroup. This typically allows for the development of riverine areas, some with floodplains, interspersed by the rocky inselbergs and small ridges and or bench / plateaus observed.

Overall, these catchment and subsequent rivers / watercourses and wetlands range from a Largely Natural to transformed states. Current impacts occur in localised areas and included the following:

- Mining
- Large scale farming
- Forestry
- Erosion due small road crossings and tracks;
- Grazing; and
- Small to large river impoundments, and off channel farm dams.

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all the watercourses within the site have been assigned a condition score of C (Nel et al. 2011), indicating that they are Moderately Modified, but still have biological significance, while the NBA (2018) data indicated that most mainstem system near the WEF, had a River Conservation Score of B (Usuthu) and B on the Vaal River. These scores were substantiated by observations made in the field within the study area, and due to the impacts or disturbance observed these scores would be upheld. The final EIA report will be supplied with more detailed analysis of the respective systems once the proposed layout has been refined, as there are just too many systems to assess individually at this stage.

Any ratings will the also be substantiated with an assessment of the study area catchments linked to Critical Biodiversity Areas (CBA) and Ecological Support Areas, as shown in the Mpumalanga CBA spatial data.

The National Freshwater Ecosystems Priority Areas (NFEPA) (Nel *et al*., 2011), also earmarked sub-quaternaries, based either on the presence of important biota (e.g. rare or endemic fish species) or conversely the degree of riverine degradation, i.e. the greater the catchment degradation the lower the priority to conserve the catchment. The important catchments areas are then classified as Freshwater Ecosystems Priority Areas (FEPAs). The study area falls within several FEPA and Upstream FEPA catchments associated with the Usuthu & Vaal river systems. This is large due to the presence of several important fish and aquatic invertebrate habitats that as well as the provision and maintenance of flows within the lower catchments.

This report also indicates the significant watercourses and wetlands delineated within the study area, inclusive of the respective buffers. Any activities within these areas and or the 100m (riverine) 500m (wetland) regulated zones will require a Water Use license under Section 21 c & i of the National Water Act (Act 36 of 1998). The respective Water Use Licenses must be finalised once the preferred layout has been determined especially if any access roads will need to cross these areas, but it is advised that any new crossing over watercourses and wetlands areas are avoided.

Using the baseline description, aquatic features were identified, then categorised into one of number pre-determined sensitivity categories to provide protection and/or guide the layout planning processes. The sensitivity ratings of High (No-Go) to Low were determined through an assessment of the habitat sensitivity and related constraints. However, these No-Go areas (with buffers) relate in general terms to the project and there are areas where encroachment on these areas would occur (i.e. existing road crossings within systems) and this is considered acceptable since these areas are already disturbed.

These proposed constraints / buffers do not include bird buffers / constraints as theirs buffers along aquatic features are at times far larger around aquatic features, than those required for the known aquatic species within this region.

Development Component	Habitat type	Sensitivity rating of the respective habitat type against the development type	Buffer distance (m)	Development acceptability	Sensitivity rating override if an impact such as a road or other disturbance already occurs within the proposed footprint and confirmed by the specialist
WTG towers	Channelled Valley Bottom Wetlands	No-Go	105m	No WTGs should be placed in any of these areas, regardless of the state, type and functionality of the respective aquatic ecosystem	None
	Pans and Depressions		95m		
	Rivers and Floodplains		65m		
	Seeps		65m		
	Minor watercourses		35m		
Hardstands, Buildings / Substations & BESS	Channelled Valley Bottom Wetlands	No-Go	105m	None of these types of infrastructure should be placed in any of these areas	None
	Pans and Depressions		95m		
	Rivers and Floodplains		65m		
	Seeps		65m		
	Minor watercourses		35m		
Roads & Underground cables alignment roads	Channelled Valley Bottom Wetlands	High	105m	New roads and underground cables would not be deem appropriate within any of these areas, unless some form of disturbance already occurs, such as an existing track or bridge	Only existing tracks or disturbed areas may be used
	Pans and Depressions		95m		
	Rivers and Floodplains				
	Seeps		65m		
	Minor watercourses		35m		

Development Component	Habitat type	Sensitivity rating of the respective habitat type against the development type	Buffer distance (m)	Development acceptability	Sensitivity rating override if an impact such as a road or other disturbance already occurs within the proposed footprint and confirmed by the specialist
OHL	Channelled Valley Bottom Wetlands	High	105m	OHL towers must be placed outside of these area so that only the cables span these systems. <u>The exception being that Pans & Depression inclusive of buffers must be avoided completely</u>	
	Pans and Depressions		95m		
	Rivers and Floodplains		65m		
	Seeps		65m		
	Minor watercourses		35m		

In summary, any structures such as turbines/towers, crane pads, hardstands, buildings, substations and BESS, should be placed outside of the observed Very High Sensitivity watercourses, while any remaining structures (Roads and transmission lines) could cross or span the other sensitivity areas. Noting Low Sensitivity = Moderate areas but with existing impacts e.g., current roads, farm tracks of previously disturbed areas

The following direct impacts were assessed with regard the aquatic systems in this scoping impact assessment phase based on the assumptions that any of the delineated Very High no-Go sensitivity areas shown in this assessment will either be avoided by the WEF components or spanned by the grid connections, noting that some access roads must cross some of these areas, but should preferably be within previously disturbed areas:

- Impact 1: Loss of habitat containing protected species or Species of Special Concern
- Impact 2: Loss of any critical corridors, important catchment areas and connected habitats that are linked to any Critical Biodiversity Areas or Ecological Support Areas
- Impact 3: The potential spread of alien vegetation
- Impact 4: Loss of riparian and or wetland habitat
- Impact 5: Changes to the hydrological regime and increased potential for erosion
- Impact 6: Changes to water quality
- Impact 7: Cumulative Impacts

During this assessment, several sensitive aquatic habitats were observed and are shown in the maps provided in this report. Noteworthy areas, were then avoided by the required infrastructure, and include the main riverine and wetland systems, while the access roads could will make use of existing roads thus previously disturbed areas. <u>The current preferred laydown area is located within a sensitive aquatic areas and will need to be adjusted.</u>

If this is carried out, then the specialist has no objection to the authorisation of the proposed activities assuming that all mitigations and buffer zones are implemented.

Mitigation should focus on these areas and include measures to halt erosion and rehabilitate habitat in the sections affected by the construction. Without the implementation of mitigation measures, the project has potential to cause a Moderate cumulative impact upon aquatic biodiversity. However, with the adoption of mitigation, the proposed project will have a Low impact upon aquatic biodiversity.

As the proposed activities have the potential to create erosion the following recommendations are reiterated:

- Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment, and suitable dust and erosion control mitigation measures should be included in the generic EMPr, if not included already to mitigate.

- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination / leaks. Washing and cleaning of equipment should also be done in berms or bunds, to trap any cement / hazardous substances and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel. It is therefore suggested that all construction camps, lay down areas, batching plants or areas and any stores should be located more than 50 m from any demarcated watercourses.

- It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas along aquatic features, using selected species detailed in this report.

- All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.

- It is further recommended from the project onset that all watercourse areas (inclusive of buffers) are included into any existing EMPr as reference, this to ensure a net benefit to the aquatic environment. This should from part of the suggested walk down as part of the final EMP preparation.

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ACRONYMS

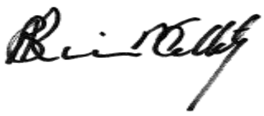
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DWS	Department of Water and Sanitation formerly the Department of Water Affairs
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
GIS	Geographic Information System
NFEPA	National Freshwater Ecosystem Priority Atlas (Nel, *et al*. 2011).
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SQ	Subquaternary catchment
WUL	Water Use License
WULA	Water Use License Application

SPECIALIST REPORT DETAILS

Report prepared by: Dr. Brian Colloty Pr.Sci.Nat. (Ecology) / Member SAEIES.

Expertise / Field of Study: BSc (Hons) Zoology, MSc Botany (Rivers), Ph. D Botany Conservation Importance rating (Estuaries) and interior wetland / riverine assessment consultant from 1996 to present.

I, **Dr. Brian Michael Colloty** declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs and or Department of Human Settlement, Water and Sanitation.

Signed:  ……………… Date:20 April 2024…………

Appendix 1 of this report contains a detailed CV

1. Introduction

ERM Southern Africa (Pty) Ltd appointed EnviroSci (Pty) Ltd to conduct an aquatic assessment of the proposed Mulilo Amsterdam Wind Energy Facility cluster between Ermelo and Amsterdam in the Mpumalanga Province. This report is focused on assessing the Emvelo Wind Energy Facility and its associated Overhead Line alternative corridors (Figure 1).

This assessment includes delineating any natural waterbodies, as well as assessing the potential consequences of the proposed project – The study area) on the surrounding wetlands and or watercourses. This was based on information collected during various site visits conducted within the region from March 2022 and a site-specific assessment in April & September 2023. Substantiated by the National Wetland Inventory v5.2 spatial data (NWI).

These surveys adhered to the assessment criteria contained in the DWAF 2005 / 2008 delineation manuals and the National Wetland Classification System. This report will inform the Environmental Authorisation process, as well as the required Water Use License Application that will be initiated, once the final project layout is available, i.e. once all the constraints, if any from this and other specialists have been considered in the design process.

The PROTOCOL FOR SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR THE ENVIRONMENTAL IMPACTS ON AQUATIC BIODIVERSITY (Government Gazette 43110, 20 March 2020), superseding the Appendix 6 NEMA requirements, was also adhered to as results of the DFFE Screening tool indicated that portions of the study area are located within a VERY HIGH SENSITIVITY area, requiring this assessment. This is due to following being highlighted by the DFFE Screening Tool Results for the WEF study area and OHL assessment corridors:

- Very High CBA: Aquatic rivers
- Very High CBA: Wetlands
- Very High ESA: Important sub catchments
- Very High ESA: Strategic Water Source Area (SWSA)
- Very High ESA: Wetland clusters
- Very High ESA: Wetlands
- Very High FEPA Subcatchment
- Very High Rivers_AB
- Very High Rivers_B
- Very High Rivers_C
- Very High SWSA (Surface Water) _Upper Usutu
- Very High SWSA (Surface Water) _Upper Vaal
- Very High Wetlands_Mesic Highveld Grassland Bioregion (Seep)
- Very High Wetlands_Mesic Highveld Grassland Bioregion (Valley-bottom)
- Very High Wetlands_Mesic (Riverine)
- Very High Wetlands_Mesic Highveld Grassland Bioregion (Depression)
- Very High Wetlands_Mesic Highveld Grassland Bioregion (Floodplain)
- Very High Wetlands_Mesic Highveld Grassland Bioregion (Seep)

Several important national, provincial and municipal scale conservation plans were also reviewed, with the results of those studies being included in this report. Most conservation plans are produced at a high level, so it is therefore important to verify the actual status of the study area during this initial phase, prior to the final layout plan being produced.

1.1 Aims and objectives

The aim of this report is to firstly provide a summary of the aquatic baseline and identify any No-Go areas. The report also makes recommendations with regard to further management and mitigation, to further reduce, avoid or mitigate the potential impacts and ultimately ensure the responsible and sustainable use of South

Africa's aquatic resources. The proposed layout was then assessed with regard the potential impacts and mitigations later in this report.

Certain aspects of the development could trigger the need for Section 21, Water Use License Applications (WULAs) (or general authorisation [GA] applications) such as river crossings or any activities within 500m of a wetland. Once the final layout receives Environmental Authorisation, these applications must then be submitted to the Department of Water and Sanitation (DWS).

Information regarding the state and function of the observed water bodies, including suitable no-go buffers areas is thus also provided. Information with regard to the state and function of the observed water bodies, suitable no-go buffers and assessment of the potential impacts are also provided, but it is the intent that where possible sensitive areas such as the wetlands will be avoided or spanned (OHL).

1.2 Assumptions and Limitation

To obtain a comprehensive understanding of the dynamics of both the flora and fauna of the aquatic communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. No baseline long-term monitoring was undertaken as part of this assessment. However, a concerted effort was made to assess as much of the potential site, as well as make use of any available literature, species distribution data and aerial photography. Furthermore, based on the previous assessments undertaken between 2003 and 2023 in the area and this was not foreseen as a huge limiting factor. Detailed site visits conducted within the region from March 2022 and a site-specific assessment in April & September 2023 were also conducted. The level of investigation undertaken is sufficient to inform this assessment.

It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

For the purposes of this report, it is assumed that any existing roads and tracks will be used, while structures will be placed outside the wetlands and or watercourses. A further assumption is that water will be sourced from a licensed resource and not illegally abstracted from any surrounding watercourses, particularly if dust suppression is required for example at the laydown areas or along main / district roads.

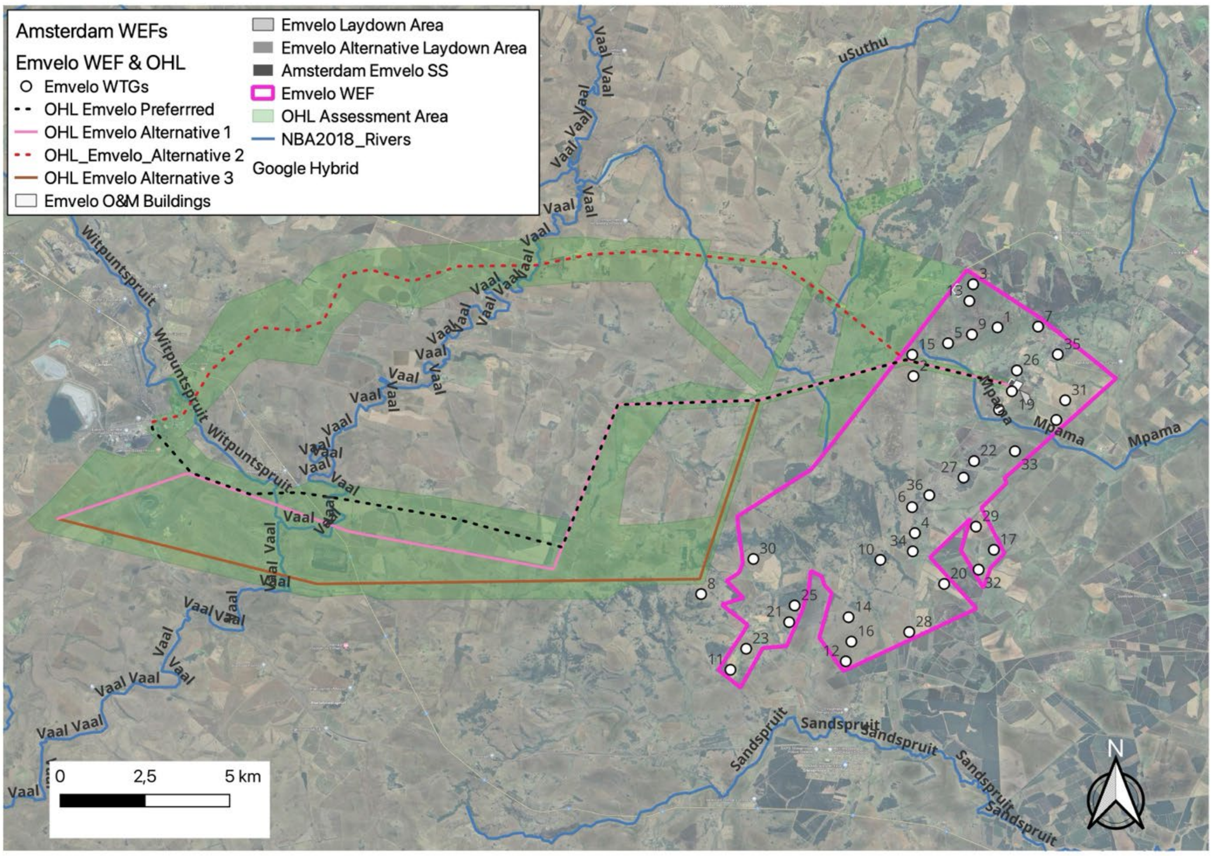


Figure 1: The proposed Wind Energy Facility (WEF) site boundaries, possible infrastructure layout (excluding roads/hardstand and crane pads) and Overhead Line (OHL) assessment corridors with the potential OHL alignment alternatives

2. Terms of Reference

The proposed methods used in this assessment have been developed with the renewable industry in mind, coupled to the minimum requirements stipulated by DFFE and the Department of Water and Sanitation. These have been successful in assessing the direct, indirect and cumulative impacts of ca 190 renewable energy projects (2010 – 2023), of which 24 have been constructed:

- Desktop analysis
- Site investigation
- Compilation of one draft and one final site screening / sensitivity report for the project which adheres to the following (this list is not exhaustive):
  - The Initial Site Sensitivity Verification reporting requirements for environmental themes set out in Government Gazette No. 43110 which was promulgated on 20 March 2020 in terms of section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).
  - Identification and mapping of any discrepancies with the environmental sensitivity as identified on the national web based environmental screening tool.
  - Identification of sensitive areas to be avoided (including corresponding spatial data) and the determination of the respective buffers (if applicable) for each site.
  - Initial recommendations for the layout and allowable development footprint from a surface water and aquatic biodiversity perspective (including corresponding spatial data).
  - Recommendations regarding the areas to be utilised for solar technologies within the project site from a surface water and aquatic biodiversity perspective (including corresponding spatial data)
- Assess the potential impacts, based on a supplied methodology, including cumulative impacts and for pre-construction, construction, operations and decommissioning phases.

- Provide mitigations regarding project related impacts, including engineering services that could negatively affect demarcated wetland areas.
- Supply the client with geo-referenced GIS shape files of the wetland / riverine areas.
- Provide one draft report for comment, with a maximum of two rounds of comments addressed per project phase (max of 2).

3. Project Description

The following information was provided by the client:

Emvelo WEF is proposed to comprise up to 45 turbines with a maximum output capacity of up to 200 MW. The WEF will be located on nineteen (19) land parcels and will have an anticipated lifespan of 20 – 25 years. The final design which will be requested for approval in the EA, will be determined based on the outcome of the specialist studies undertaken for the EIA phase of the development. The proposed turbine footprints and associated facility infrastructure will cover an area of up to 180 ha after rehabilitation, depending on final layout design.

It is proposed that an on-site substation with a capacity up 132 kV and an up to 132 kV Overhead Powerline (OHPL) of approximately 30 km (300 m corridor) in distance, traversing eighteen (18) land parcels, be constructed to connect the proposed WEF to the Eskom Uitkoms Substation.

Emvelo WEF			
Landowner	**Farm Name**	**Farm No.**	**Portion No.**
DC Geldenhuys Family Trust	Remainder of the Farm Schiedam No. 274	274	RE
Randell's Ranch Trust (Philip Randall)	Portion 2 of the Farm Schiedam No. 274	274	2
Antonette Swart	Remainder Portion 1 of the Farm Schiedam No. 274	274	1
Henry Goodwin Geldenhuys	Portion 6 of the Farm Schiedam No. 274	274	6
Loufried Testamentere Trust	Portion 5 of the Farm Schiedam No. 274	274	5
Josef & Merinda Loraine Benjamin van Tonder	Remaining Extent Ptn 1 of the Farm Vaalbank No. 285	285	1
Josef & Merinda Loraine Benjamin van Tonder	Portion 5 of the Farm Vaalbank No. 285	285	5
Johan Saaiman Trust	Portion 9 of the Farm Waaihoek No. 286	286	9
Johannes Stephanus Roberts	Remainder Portion 2 of the Farm Waaihoek No. 286	286	2
Johannes Stephanus Roberts	Remainder Portion 6 of the Farm Waaihoek No. 286	286	6
Johannes Stephanus Roberts	Remainder Portion 13 of the Farm Waaihoek No. 286	286	13
JMJ Trust	Portion 7 of the Farm Waaihoek No. 286	286	7
JMJ Trust	Portion 10 of the Farm Waaihoek No. 286	286	10
JMJ Trust	Portion 5 of the Farm Waaihoek No. 286	286	5
Josua Meyer Trust	Waaihoek	286	14
Josua Meyer Trust	Waaihoek	286	3

Emvelo WEF			
Landowner	**Farm Name**	**Farm No.**	**Portion No.**
Josua Meyer Trust	Waaihoek	286	12
NWJ Vorster Trust	Remaining Extent of the Farm Klipfontein No. 283	283	RE
Josua Meyer Trust	Bosjesspruit	291	7
Emvelo WEF Grid Connection			
Randell's Ranch Trust (Philip Randall)	Schiedam	274	2
National Government - of the Republic of South Africa	Onverwacht	273	1
Shammah Trust	Portion 7 of the Farm Onverwacht No. 273	273	7
Harrob Beleggings Pty Ltd (Jan Roberts)	Portion 8 of the Farm Onverwacht No. 273	273	8
Harrob Beleggings Pty Ltd (Jan Roberts)	Portion 3 of the Farm Onverwacht No. 287	287	3
Van Der Merwe Broers Trust	Portion 9 of the Farm Zwartwater No. 288	288	9
Merwe Johannes Jacobus Van Der	Portion 10 of the Farm Zwartwater No. 288	288	10
Kansvat Beleggings Pty Ltd	Zwartwater	288	2
National Government of SA	Zwartwater	288	1
Dream World Inv 450 Pty Ltd	Weltevreden	289	10
Dream World Inv 450 Pty Ltd	Weltevreden	289	11
Dream World Inv 450 Pty Ltd	Weltevreden	289	6
Van Der Merwe Broers Trust	Weltevreden	289	RE/3
National Government of SA	Witpunt	267	RE/7
National Government of SA	Mooiplaats	290	7
National Government of SA	Mooiplaats	290	8
Kayipheli Trust	Witpunt	267	29
Eskom Holdings Ltd	Camden Power Station	329	RE

4. Methodology

This study followed the approaches of several national guidelines with regards to wetland assessment. These have been modified by the author, to provide a relevant mechanism of assessing the present state of the study systems, applicable to the specific environment and in a clear and objective manner, assess the potential impacts associated with the proposed development site based on information collected within the relevant farm portions of a number of years for this and other proposed projects.

Current water resource classification systems make use of the Hydrogeomorphic (HGM) approach, and for this reason, the National Wetland Classification System (NWCS) approach will be used in this study. It is also important to understand wetland definition, means of assessing wetland conservation and importance as well as understanding the pertinent legislation with regards to protecting wetlands. These aspects will be discussed in greater depth in this section of the report, as they form the basis of the study approach to assessing wetland impacts.

4.1 Waterbody classification systems

Since the late 1960's, wetland classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith *et al*., 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects. **Coupled to this was the inclusion of other criteria within the classification systems to differentiate between river, riparian and wetland systems, as well as natural versus artificial waterbodies.**

The South African National Biodiversity Institute (SANBI) in collaboration with several specialists and stakeholders developed the newly revised and now accepted National Wetland Classification Systems (NWCS) (Ollis *et al*., 2013). This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, with including structural features at the finer or lower levels of classification (Ollis *et al*., 2013).

Wetlands develop in a response to elevated water tables, linked either to rivers, groundwater flows or seepage from aquifers (Parsons, 2004). These water levels or flows then interact with localised geology and soil forms, which then determines the form and function of the respective wetlands. Water is thus the common driving force, in the formation of wetlands (DWAF, 2005). It is significant that the HGM approach has now been included in the wetland classifications as the HGM approach has been adopted throughout the water resources management realm with regards to the determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) and WET-Health assessments for aquatic environments. All these systems are then easily integrated using the HGM approach in line with the Eco-classification process of river and wetland reserve determinations used by the Department of Human Settlement, Water and Sanitation (DHSWS). The Ecological Reserve of a wetland or river is used by DHSWS to assess the water resource allocations when assessing WULAs.

The National Wetland Classification System process is provided in more detail in the methods section of the report, but some of the terms and definitions used in this document are presented below:

Definition Box

Present Ecological State is a term for the current ecological condition of the resource. This is assessed relative to the deviation from the Reference State. Reference State/Condition is the natural or pre-impacted condition of the system. The reference state is not a static condition but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES is determined per component - for rivers and wetlands this would be for the drivers: flow, water quality and geomorphology; and the biotic response indicators: fish, macroinvertebrates, riparian vegetation and diatoms. PES categories for every component would be integrated into an overall PES for the river reach or wetland being investigated. This integrated PES is called the EcoStatus of the reach or wetland.

EcoStatus is the overall PES or current state of the resource. It represents the totality of the features and characteristics of a river and its riparian areas or wetland that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. The EcoStatus value is an integrated ecological state made up of a combination of various PES findings from component EcoStatus assessments (such as for invertebrates, fish, riparian vegetation, geomorphology, hydrology and water quality).

Reserve: The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.

Reserve requirements: The quality, quantity and reliability of water needed to satisfy the requirements of basic human needs and the Ecological Reserve (inclusive of instream requirements).

Ecological Reserve determination study: The study undertaken to determine Ecological Reserve requirements.

Licensing applications: Water users are required (by legislation) to apply for licenses prior to extracting water resources from a water catchment.

Ecological Water Requirements: This is the quality and quantity of water flowing through a natural stream course that is needed to sustain instream functions and ecosystem integrity at an acceptable level as determined during an EWR study. These then form part of the conditions for managing achievable water quantity and quality conditions as stipulated in the **Reserve Template**

Water allocation process (compulsory licensing): This is a process where all existing and new water users are requested to reapply for their licenses, particularly in stressed catchments where there is an over-allocation of water or an inequitable distribution of entitlements.

Ecoregions are geographic regions that have been delineated in a top-down manner on the basis of physical/abiotic factors. • NOTE: For purposes of the classification system, the 'Level I Ecoregions' for South Africa, Lesotho and Swaziland (Kleynhans *et al.* 2005), which have been specifically developed by the Department of Water Affairs & Forestry (DWAF) for rivers but are used for the management of inland aquatic ecosystems more generally, are applied at Level 2A of the classification system. These Ecoregions are based on physiography, climate, geology, soils and potential natural vegetation.

4.2 Wetland definition

Although the National Wetland Classification System (NWCS) (Ollis *et al*., 2013) is used to classify wetland types, it is still necessary to understand the definition of a wetland. Terminology currently strives to characterise a wetland not only on its structure (visible form), but also to relate this to the function and value of any given wetland.

The Ramsar Convention definition of a wetland is widely accepted as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" (Davis 1994). South Africa is a signatory to the Ramsar Convention and therefore its extremely broad definition of wetlands has been adopted for the proposed NWCS, with a few modifications.

Whereas the Ramsar Convention included marine water to a depth of six metres, the definition used for the NWCS extends to a depth of ten metres at low tide, as this is recognised as the seaward boundary of the shallow photic zone (Lombard et al., 2005). An additional minor adaptation of the definition is the removal of the term ‘fen’ as fens are considered a type of peatland. The adapted definition for the NWCS is, therefore, as follows (Ollis *et al*., 2013):

WETLAND: an area of marsh, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed ten metres.

This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten metres. The only legislated definition of wetlands in South Africa, however, is contained within the National Water Act (Act No. 36 of 1998) (NWA), where wetlands are defined as “land which is transitional between terrestrial and aquatic systems, where the water table is usually at, or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports, or would support, vegetation adapted to life in saturated soil.” This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition. It should be noted that the NWA definition is not concerned with marine systems and clearly distinguishes wetlands from estuaries, classifying the latter as a watercourse (Ollis *et al*., 2013). Table 1 below provides a comparison of the various wetlands included within the main sources of wetland definitions used in South Africa.

Although a subset of Ramsar-defined wetlands was used as a starting point for the compilation of the first version of the National Wetland Inventory (i.e. “wetlands”, as defined by the NWA, together with open waterbodies), it is understood that subsequent versions of the Inventory include the full suite of Ramsar-defined wetlands in order to ensure that South Africa meets its wetland inventory obligations as a signatory to the Convention (Ollis *et al.*, 2013).

Wetlands must therefore have one or more of the following attributes to meet the above definition (DWAF, 2005):

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

It should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e. those associated with the drainage lines and rivers.

Table 1: Comparison of ecosystems considered to be 'wetlands' as defined by the proposed NWCS, the NWA and ecosystems included in DWAF's (2005) delineation manual.

Ecosystem	NWCS "wetland"	National Water Act wetland	DWAF (2005) delineation manual
Marine	YES	NO	NO
Estuarine	YES	NO	NO
Waterbodies deeper than 2 m (i.e. limnetic habitats often described as lakes or dams)	YES	NO	NO
Rivers, channels and canals	YES	NO[1]	NO
Inland aquatic ecosystems that are not river channels and are less than 2 m deep	YES	YES	YES
Riparian[2] areas that are permanently / periodically inundated or saturated with water within 50 cm of the surface	YES	YES	YES[3]
Riparian [3] areas that are not permanently / periodically inundated or saturated with water within 50 cm of the surface	NO	NO	YES[3]

[1] Although river channels and canals would generally not be regarded as wetlands in terms of the National Water Act, they are included as a 'watercourse' in terms of the Act

[2] According to the National Water Act and Ramsar, riparian areas are those areas that are saturated or flooded for prolonged periods and would be considered riparian wetlands, as opposed to non –wetland riparian areas that are only periodically inundated and the riparian vegetation persists due to having deep root systems drawing on water many meters below the surface.

[3] The delineation of 'riparian areas' (including both wetland and non-wetland components) is treated separately to the delineation of wetlands in DWAF's (2005) delineation manual.

4.3 National Wetland Classification System method

During this study, due to the nature of the wetlands and watercourses observed, it was determined that the newly accepted NWCS be adopted. This classification approach has integrated aspects of the HGM approach used in the WET-Health system as well as the widely accepted eco-classification approach used for rivers.

The NWCS (Ollis *et al*., 2013) as stated previously, uses hydrological and geomorphological traits to distinguish the primary wetland units, i.e. direct factors that influence wetland function. Other wetland assessment techniques, such as the DWAF (2005) delineation method, only infer wetland function based on abiotic and biotic descriptors (size, soils & vegetation) stemming from the Cowardin approach (Ollis *et al.,* 2013).

The classification system used in this study is thus based on Ollis *et al*. (2013) and is summarised below:

The NWCS has a six-tiered hierarchical structure, with four spatially nested primary levels of classification (Figure 2). The hierarchical system firstly distinguishes between Marine, Estuarine and Inland ecosystems (**Level 1**), based on the degree of connectivity the particular system has with the open ocean (greater than 10 m in depth). Level 2 then categorises the regional wetland setting using a combination of biophysical attributes at the landscape level, which operate at a broad bioregional scale.

This is opposed to specific attributes such as soils and vegetation. **Level 2** has adopted the following systems:

- Inshore bioregions (marine)
- Biogeographic zones (estuaries)
- Ecoregions (Inland)

Level 3 of the NWCS assess the topographical position of inland wetlands as this factor broadly defines certain hydrological characteristics of the inland systems. Four landscape units based on topographical position are used in distinguishing between Inland systems at this level. No subsystems are recognised for Marine systems, but estuaries are grouped according to their periodicity of connection with the marine environment, as this would affect the biotic characteristics of the estuary.

Level 4 classifies the hydrogeomorphic (HGM) units discussed earlier. The HGM units are defined as follows:

- Landform – shape and localised setting of wetland
- Hydrological characteristics – nature of water movement into, through and out of the wetland
- Hydrodynamics – the direction and strength of flow through the wetland

These factors characterise the geomorphological processes within the wetland, such as erosion and deposition, as well as the biogeochemical processes.

Level 5 of the assessment pertains to the classification of the tidal regime within the marine and estuarine environments, while the hydrological and inundation depth classes are determined for inland wetlands. Classes are based on frequency and depth of inundation, which are used to determine the functional unit of the wetlands and are considered secondary discriminators within the NWCS.

Level 6 uses six descriptors to characterise the wetland types based on biophysical features. As with Level 5, these are non-hierarchal in relation to each other and are applied in any order, dependent on the availability of information. The descriptors include:

- Geology;
- Natural vs. Artificial;
- Vegetation cover type;
- Substratum;
- Salinity; and
- Acidity or Alkalinity.

It should be noted that where sub-categories exist within the above descriptors, hierarchical systems are employed, and these are thus nested in relation to each other.

The HGM unit (Level 4) is the **focal point of the NWCS**, with the upper levels (Figure 3 – Inland systems only) providing means to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, while the lower levels provide more descriptive detail on the particular wetland type characteristics of a particular HGM unit. Therefore Level 1 – 5 deals with functional aspects, while Level 6 classifies wetlands on structural aspects.

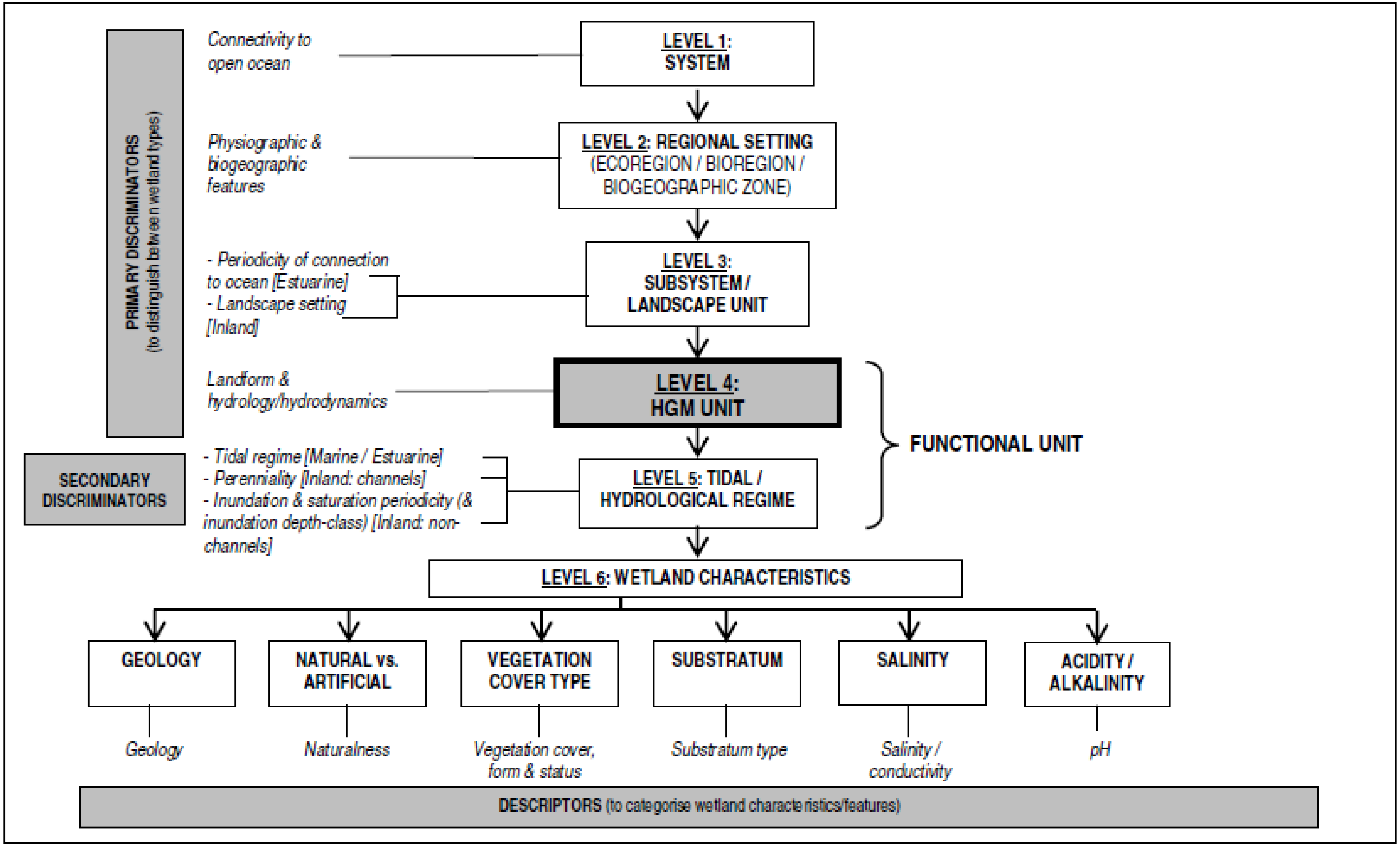


Figure 2: Basic structure of the NWCS, showing how 'primary discriminators' are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with 'secondary discriminators' applied at Level 5 to classify the tidal/hydrological regime, and 'descriptors' applied at Level 6 to categorise the characteristics of wetlands classified up to Level 5 (From Ollis *et al.*, 2013).

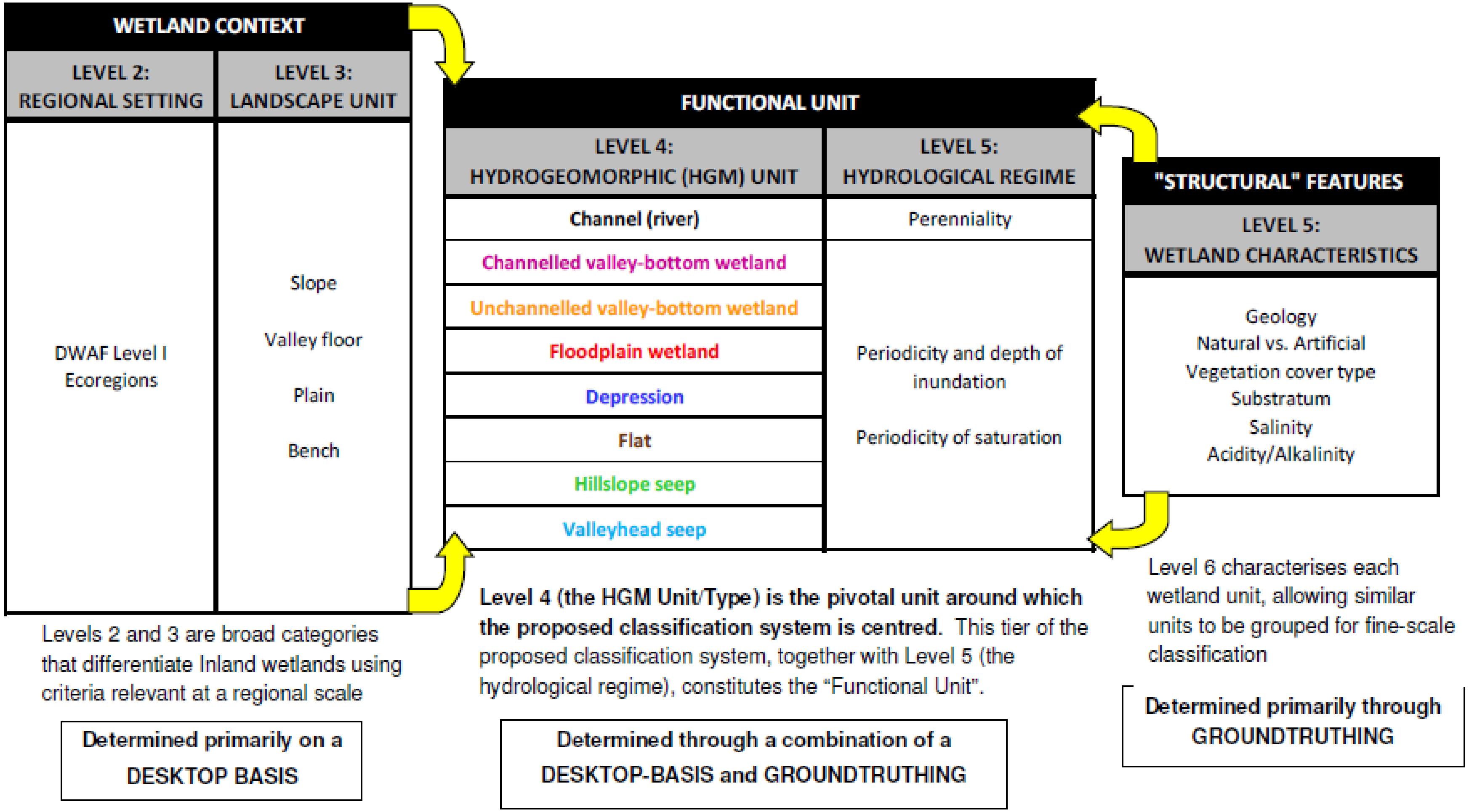


Figure 3: Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis *et al.*, 2013).

4.4 Waterbody condition

To assess the PES or condition of the observed wetlands, a modified Wetland Index of Habitat Integrity (DWAF, 2007) was used. The Wetland Index of Habitat Integrity (WETLAND-IHI) is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The output scores from the WETLAND-IHI model are presented in the standard DWAF A-F ecological categories (Table 2) and provide a score of the PES of the habitat integrity of the wetland system being examined. The author has included additional criteria into the model-based system to include additional wetland types. This system is preferred when compared to systems such as WET-Health – wetland management series (WRC 2009), as WET-Health (Level 1) was developed with wetland rehabilitation in mind and is not always suitable for impact assessments. This coupled with the degraded state of the wetlands in the study area, indicated that a complex study approach was not warranted, i.e. conduct a Wet-Health Level 2 and WET-Ecosystems Services study required for an impact assessment.

Table 2: Description of A – F ecological categories based on Kleynhans *et al*., (2005)

<table>
<tr><th>ECOLOGICAL CATEGORY</th><th>ECOLOGICAL DESCRIPTION</th><th>MANAGEMENT PERSPECTIVE</th></tr>
<tr><td>A</td><td>Unmodified, natural.</td><td>Protected systems; relatively untouched by human hands; no discharges or impoundments allowed</td></tr>
<tr><td>B</td><td>Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.</td><td>Some human-related disturbance, but mostly of low impact potential</td></tr>
<tr><td>C</td><td>Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.</td><td rowspan="2">Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation</td></tr>
<tr><td>D</td><td>Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.</td></tr>
<tr><td>E</td><td>Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.</td><td rowspan="2">Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality</td></tr>
<tr><td>F</td><td>Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.</td></tr>
</table>

The WETLAND-IHI model is composed of four modules. The “Hydrology”, “Geomorphology” and “Water Quality” modules all assess the contemporary driving processes behind wetland formation and maintenance. The last module, “Vegetation Alteration”, provides an indication of the intensity of human land use activities on the wetland surface itself and how these may have modified the condition of the wetland. The integration of the scores from these 4 modules provides an overall PES score for the wetland system being examined. The WETLAND-IHI model is an MS Excel-based model, and the data required for the assessment are generated during a site visit.

Additional data may be obtained from remotely sensed imagery (aerial photos; maps and/or satellite imagery) to assist with the assessment. The interface of the WETLAND-IHI has been developed in a format which is similar to DWA’s River EcoStatus models which are currently used for the assessment of PES in riverine environments.

4.5 Aquatic ecosystem importance and function

South Africa is a Contracting Party to the Ramsar Convention on Wetlands, signed in Ramsar, Iran, in 1971, and has thus committed itself to this intergovernmental treaty, which provides the framework for the national protection of wetlands and the resources they could provide. Wetland conservation is now driven by the South African National Biodiversity Institute, a requirement under the National Environmental Management: Biodiversity Act (No 10 of 2004).

Wetlands are among the most valuable and productive ecosystems on earth, providing important opportunities for sustainable development (Davies and Day, 1998). However, wetlands in South Africa are still rapidly being lost or degraded through direct human induced pressures (Nel *et al.,* 2004).

The most common attributes or goods and services provided by wetlands include:

- Improve water quality;
- Impede flow and reduce the occurrence of floods;
- Reeds and sedges used in construction and traditional crafts;
- Bulbs and tubers, a source of food and natural medicine;
- Store water and maintain base flow of rivers;
- Trap sediments; and
- Reduce the number of water-borne diseases.

In terms of this study, the wetlands provide ecological (environmental) value to the area acting as refugia for various wetland associated plants, butterflies and birds.

In the past wetland conservation has focused on biodiversity as a means of substantiating the protection of wetland habitat. However not all wetlands provide such motivation for their protection, thus wetland managers and conservationists began assessing the importance of wetland function within an ecosystem.

Table 3 below summarises the importance of wetland function when related to ecosystem services or ecoservices (Kotze *et al*., 2008). One such example is emergent reed bed wetlands that function as transformers converting inorganic nutrients into organic compounds (Mitsch and Gosselink, 2000).

Table 3: Summary of direct and indirect ecoservices provided by wetlands from Kotze *et al*., 2008

Ecosystem services supplied by wetlands	Indirect benefits	Hydro-geochemical benefits		Flood attenuation
				Stream flow regulation
			Water quality enhancement benefits	Sediment trapping
				Phosphate assimilation
				Nitrate assimilation
				Toxicant assimilation
				Erosion control
				Carbon storage
				Biodiversity maintenance
	Direct benefits			*Provision of water for human use*
				Provision of harvestable resources[2]
				Provision of cultivated foods
				Cultural significance
				Tourism and recreation
				Education and research

Conservation importance of the individual wetlands was based on the following criteria:

- Habitat uniqueness;
- Species of conservation concern;
- Habitat fragmentation or rather, continuity or intactness with regards to ecological corridors; and
- Ecosystem service (social and ecological).

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetland was found in a near natural state (high PES). Should any of the habitats be found modified the conservation importance would rate as MEDIUM, unless a Species of Conservation Concern (SCC) was observed, in which case it would receive a HIGH rating. Any system that was highly modified (low PES) or had none of the above criteria, received a LOW conservation importance rating. Wetlands with HIGH and MEDIUM ratings should thus be excluded from development with incorporation into a suitable open space system, with the maximum possible buffer being applied. Natural wetlands or Wetlands that resemble some form of the past landscape but receive a LOW conservation importance rating could be included into stormwater management features and should not be developed to retain the function of any ecological corridors.

4.6 Relevant wetland legislation and policy

Locally the South African Constitution, seven (7) Acts and two (2) international treaties allow for the protection of wetlands and rivers. These systems are protected from destruction or pollution by the following:

- Section 24 of The Constitution of the Republic of South Africa, 1996;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- The Ramsar Convention, 1971 including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000);
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983); and
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- Nature and Environmental Conservation Ordinance, 1974 (No. 19 of 1974)
- National Forest Act, 1998 (No. 84 of 1998)
- National Heritage Resources Act, 1999 (No. 25 of 1999)

NEMA and the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) would also apply to this project. These Acts have categorised many invasive plants together with associated obligations on the landowner.

4.7 Provincial legislation and policy

Currently riverine and wetland buffers distances are calculated using the model described by Macfarlane & Bredin (2017). Site specific information was collected during the visit and is used to determine site and development specific range of buffers. In short, the buffer distances are based on the current condition of the waterbody, the state of the remainder of the site, the potential impacts posed by the type and scale of the of development, as wells as the proposed alteration of hydrological flows. The model also takes cognisance of the level of mitigation possible, coupled to the reversibility of the impacts. Based then on the information known for the site the buffer model provided the following:

Channelled Valley Bottom Wetlands	65m
Pans and Depressions	105m
Rivers and Floodplains	95m
Seeps	65m
Minor watercourses	35m

Artificial dams were not buffered.

5. Description of the affected environment

This baseline description was a summer and winter survey of the study area that spanned a total of two weeks and conducted in February / March 2022 (late summer) and a site-specific assessment in April (Autumn) & September (Later winter) 2023.

The study area was dominated by a variety of aquatic features associated with catchments and rivers, characterised as follows:

- Mainstem Rivers: Floodplain dominated systems with floodplain wetlands (Plate 1). A few reaches did contain very narrow riparian zones, consisting mostly of a single row of willow trees associated with the Vaal River
- Valley Bottom Wetlands (Channelled and Unchanneled) (Plate 2)
- Endorheic pans (Plate 3)
- Seep wetlands (Plate 4)

The proposed Wind Energy Facility (WEF) is located in the Inkomati-Usuthu Water Management Area, within the upper catchment of the Usuthu River (SQ W54A) and Mpama Rivers (SQ W53B), while the proposed grid connection options are located in the Upper Vaal River (SQ C11A & C11B) in the Vaal Water Management Area (Figure 4). Thus, several permanent rivers and a variety of wetland hydrogeomorphic types are anticipated both associated with the riverine valleys and bench or plateaux areas located between river valleys on higher lying areas (Figure 5).

The study region is further characterised by several National Biodiversity Assessment (2018) Wetland Clusters, National Freshwater Ecosystem Area (NFEPAs) and Strategic Water Resources Areas (Figure 6)

The geology is mostly shales or sandstone of the Vryhied Group, with several intrusions associated with dolerite sills and dykes in areas associated with the Karoo Supergroup. This typically allows for the development of riverine areas, some with floodplains, interspersed by the rocky inselbergs and small ridges and or bench / plateaus observed.

Overall, these catchment and subsequent rivers / watercourses and wetlands range from a Largely Natural to transformed states. Current impacts occur in localised areas and included the following:

- Mining
- Large scale farming
- Forestry
- Erosion due small road crossings and tracks;
- Grazing; and
- Small to large river impoundments, and off channel farm dams.

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all the watercourses within the site have been assigned a condition score of C (Nel et al. 2011), indicating that they are Moderately Modified, but still have biological significance, while the NBA (2018) data indicated that most mainstem system near the WEF, had a River Conservation Score of B (Usuthu) and B on the Vaal River. These scores were substantiated by observations made in the field within the study area, and due to the impacts or disturbance observed these scores would be upheld. The final EIA report will be supplied with more detailed analysis of the respective systems once the proposed layout has been refined, as there are just too many systems to assess individually at this stage.

Any ratings will the also be substantiated with an assessment of the study area catchments linked to Critical Biodiversity Areas (CBA) and Ecological Support Areas, as shown in the Mpumalanga CBA spatial data.

The National Freshwater Ecosystems Priority Areas (NFEPA) (Nel *et al*., 2011), also earmarked sub-quaternaries, based either on the presence of important biota (e.g. rare or endemic fish species) or conversely the degree of riverine degradation, i.e. the greater the catchment degradation the lower the priority to conserve the catchment. The important catchments areas are then classified as Freshwater Ecosystems Priority Areas (FEPAs). The study area falls within several FEPA and Upstream FEPA catchments associated with the Usuthu & Vaal river systems. This is large due to the presence of several important fish and aquatic invertebrate habitats that as well as the provision and maintenance of flows within the lower catchments.

Notably the following fish are commonly found in the study areas systems (Freshwater Biodiversity Information System - FBIS):

Fish Taxon	Conservation status
Enteromius anoplus (Weber, 1897)	Least concern
Enteromius pallidus (Smith, 1841)	Least concern
Enteromius paludinosus (Peters, 1852)	Least concern
Pseudocrenilabrus philander (Weber, 1897)	Least concern

The FBIS site data from 44 sites (https://freshwaterbiodiversity.org/map/#search//taxon=&search=&siteId=&collector=&category=&yearFrom=&yearTo=&months=&boundary=&userBoundary=&) spanning the study area also indicated a total of 200 aquatic invertebrate species, none currently listed as conservation needy as well as the following aquatic plants that were confirmed in this assessment

Plant Taxon	Conservation Status
Agrostis continuata Stapf	Not evaluated
Andropogon eucomus Nees	Least concern
Andropogon lacunosus J.G.Anderson	Least concern
Arundinella nepalensis Trin.	Not evaluated
Berula thunbergii (DC.) H.Wolff	Least concern
Brachiaria bovonei (Chiov.) Robyns	Least concern
Carex rhodesiaca Nelmes	Least concern
Chironia purpurascens (E.Mey.) Benth. & Hook.fil.	Least concern
Crinum bulbispermum (Burm.f.) Milne-Redh. & Schweick.	Least concern
Cyperus denudatus L.f.	Least concern
Cyperus macranthus Boeckeler	Not evaluated
Cyperus melanospermus (Nees) Valck.Sur.	Not evaluated
Cyperus nitidus Lam.	Not evaluated
Denekia capensis Thunb.	Not evaluated
Drosera collinsae N.E.Br. ex BurttDavy	Least concern
Echinochloa jubata Stapf	Least concern
Eleocharis dregeana Steud.	Least concern
Eleocharis limosa (Schrad.) Schult.	Least concern
Festuca caprina Nees	Not evaluated
Fimbristylis complanata (Retz.) Link	Least concern
Fuirena pubescens (Poir.) Kunth	Least concern
Geranium multisectum N.E.Br.	Least concern
Geranium wakkerstroomianum R.Knuth	Least concern
Gladiolus papilio Hook.f.	Not evaluated
Gunnera perpensa L.	Least concern
Hesperantha hygrophila Hilliard & B.L.Burtt	Least concern
Isolepis costata Hochst. ex A.Rich.	Not evaluated
Juncus effusus L.	Least concern
Juncus oxycarpus E.Mey. ex Kunth	Least concern

Lagarosiphon muscoides Harv.	Least concern
Leersia hexandra Sw.	Least concern
Limosella major Diels	Least concern
Miscanthus junceus (Stapf) Pilg.	Least concern
Nymphoides thunbergiana (Griseb.) Kuntze	Least concern
Odontelytrum abyssinicum Hack.	Least concern
Ornithogalum flexuosum (Thunb.) U.Müll.-Doblies & D.Müll.-Doblies	Not evaluated
Pennisetum macrourum Trin.	Least concern
Persicaria decipiens (R.Br.) K.L.Wilson	Least concern
Persicaria madagascariensis (Meisn.) S.Ortiz & Paiva	Not evaluated
Pterygodium nigrescens (Sond.) Schltr.	Least concern
Ranunculus multifidus Forssk.	Least concern
Rhynchospora brownii Roem. & Schult.	Least concern
Rorippa nudiuscula (E.Mey. ex Sond.) Thell.	Least concern
Sacciolepis typhura (Stapf) Stapf	Least concern
Schoenoplectus muriculatus (Kük.) Browning	Not evaluated
Schoenoplectus paludicola (Kunth) J.Raynal, 1976	Least concern
Typha capensis (Rohrb.) N.E.Br.	Not evaluated
Veronica anagallis-aquatica L.	Not evaluated
Xyris gerrardii N.E.Br.	Least concern

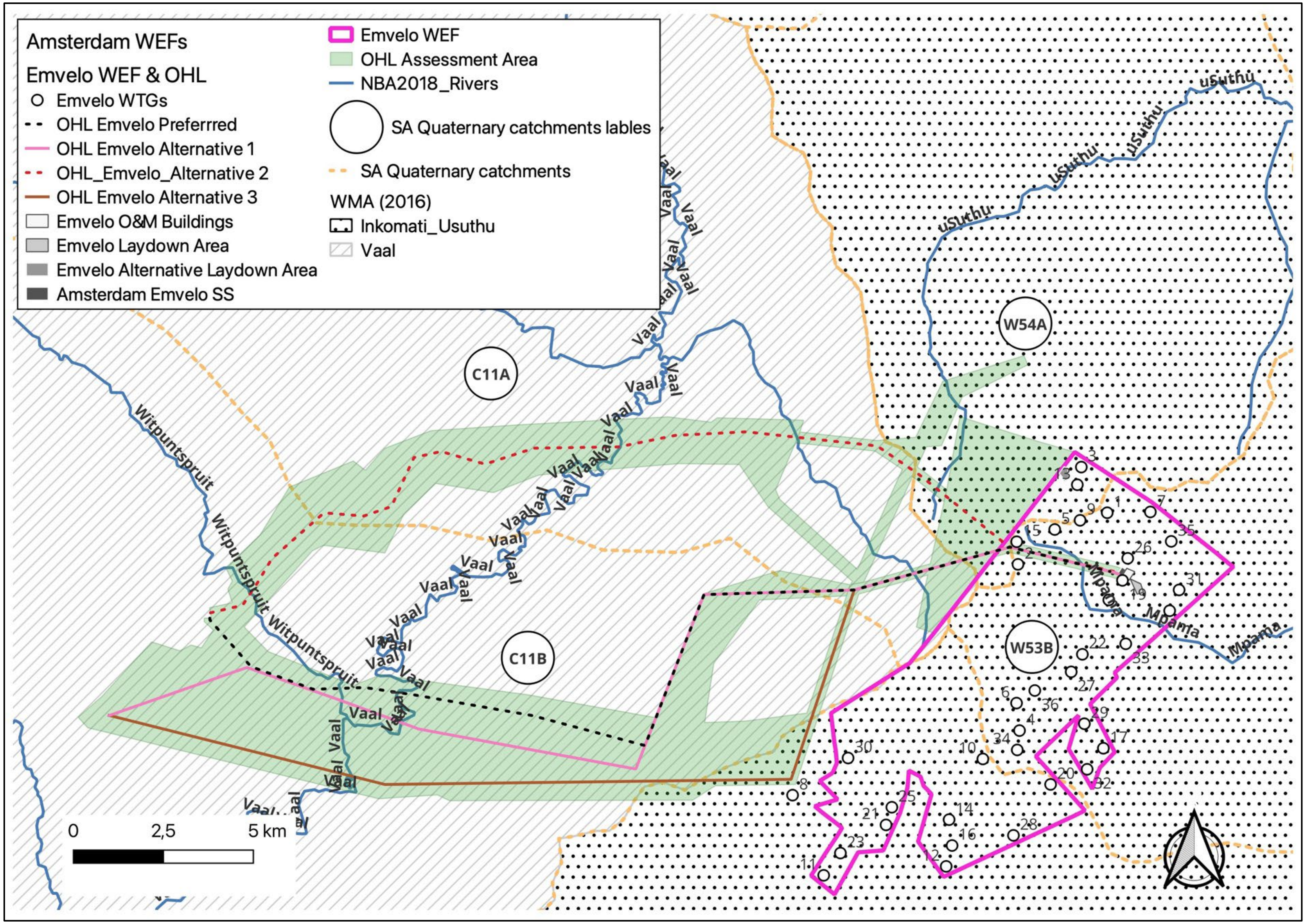


Figure 4: Project locality map indicating the various quaternary catchment boundaries (orange dotted lines) in relation to the study area (Source DWS and NGI).

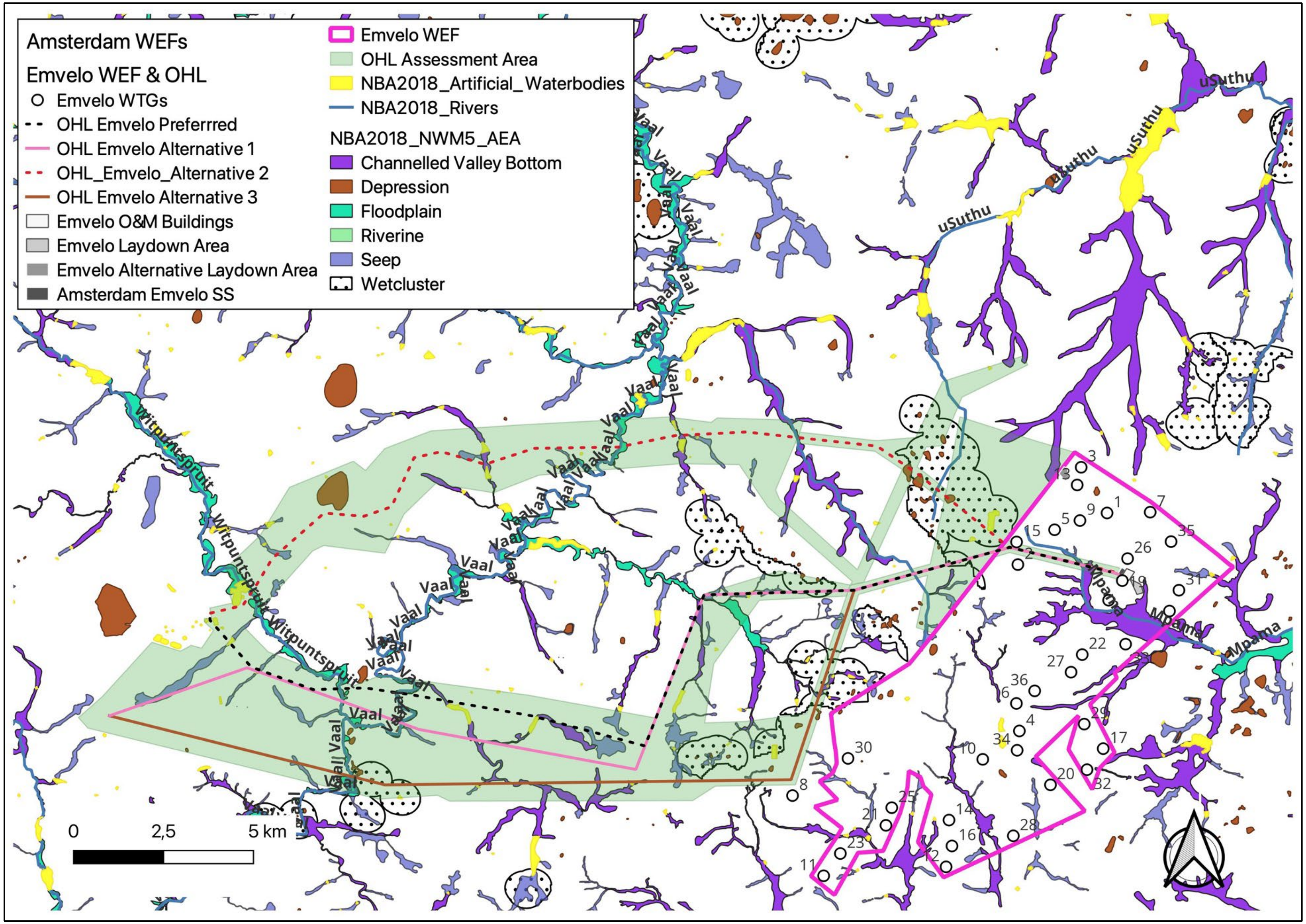


Figure 5: Various waterbodies identified in the National Wetland Inventory V5.2 (2020)

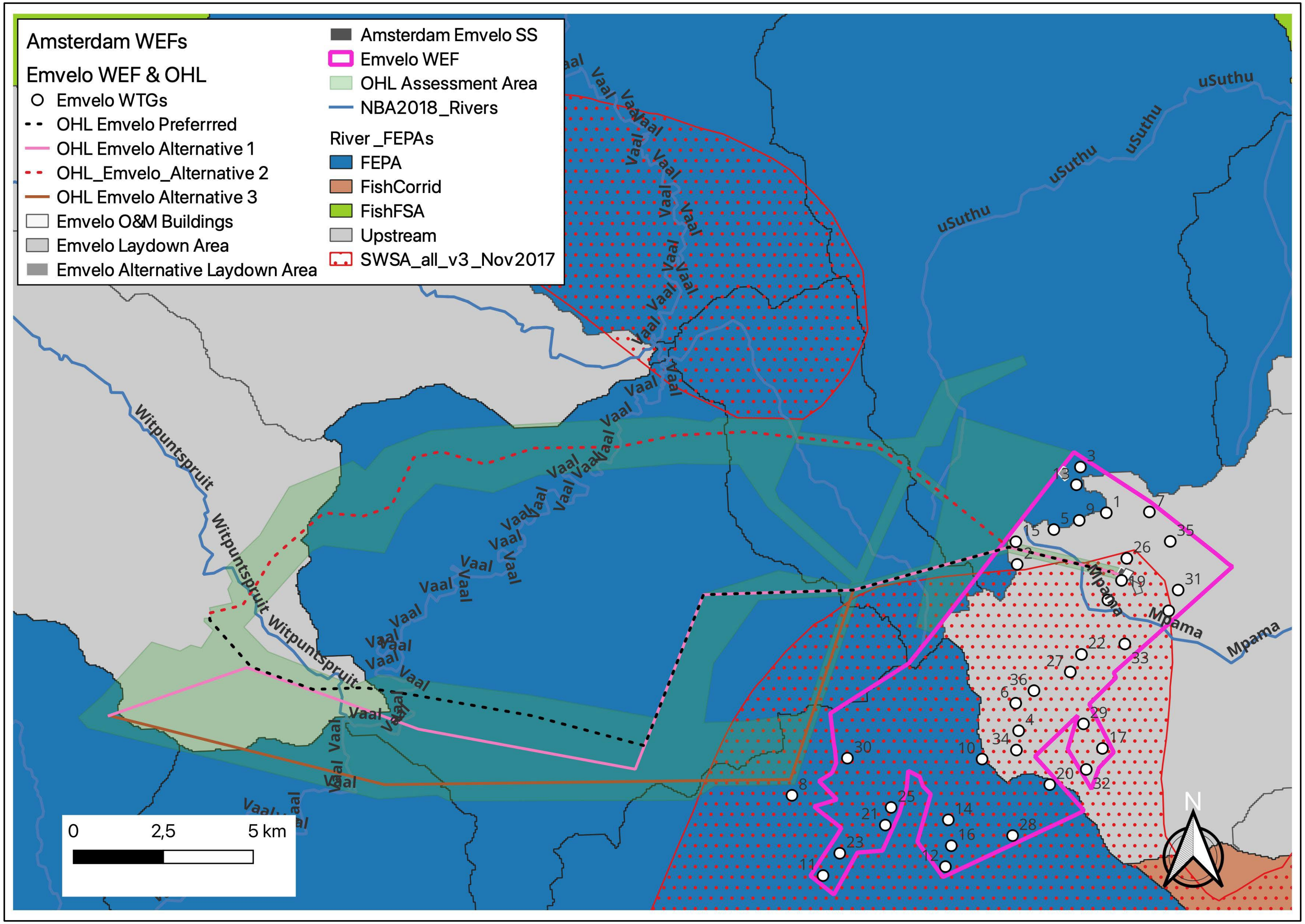


Figure 6: The respective Subquaternary catchments rated in terms of Freshwater Ecosystem Priority Areas (FEPAs) and Strategic Water Resource Areas in relation to the study area

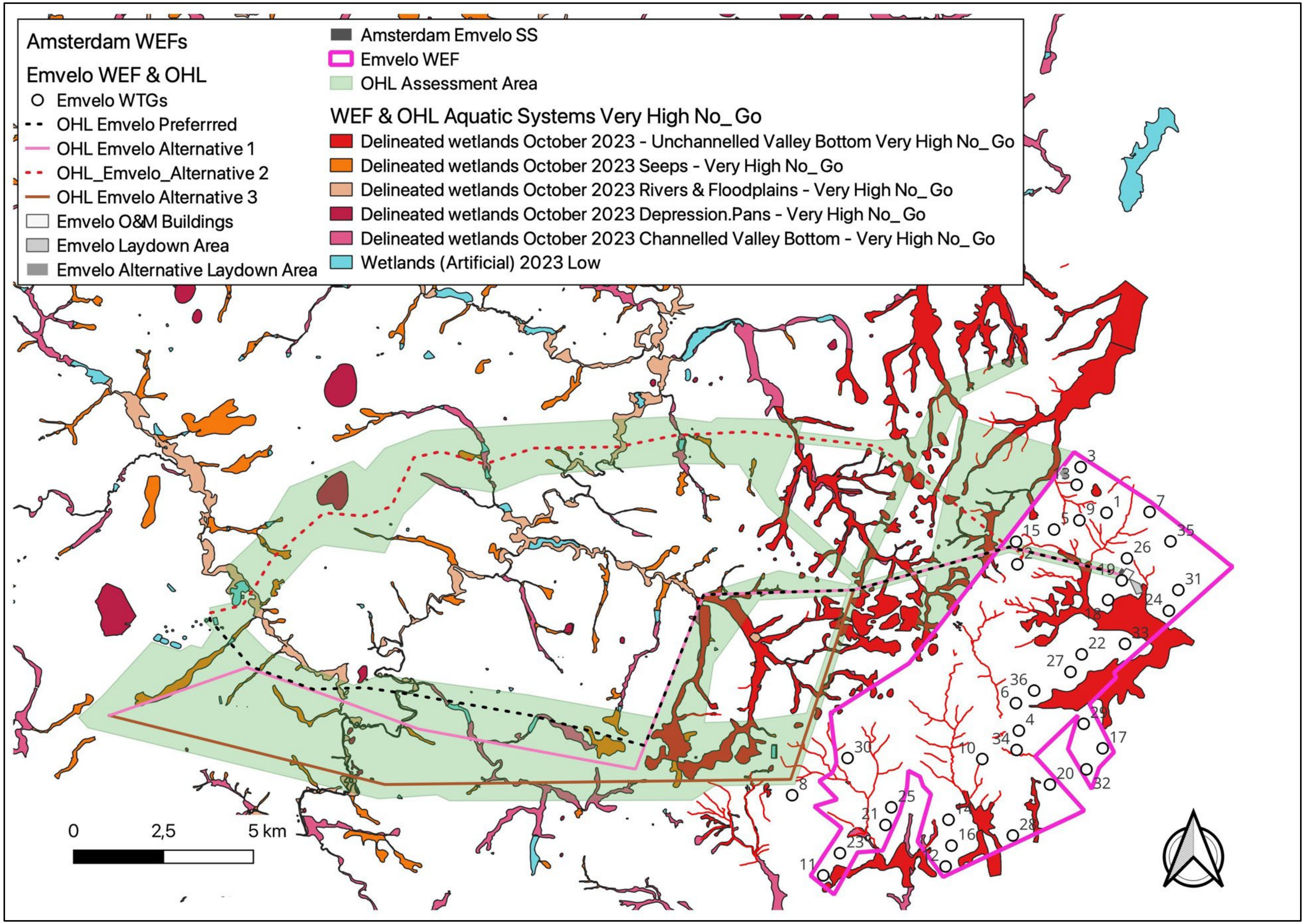


Figure 7: The confirmed watercourses and wetlands within the study area,

Plate 1: A view of a mainstem watercourse (tributary of the Mpama River), with transformed floodplain

Plate 2: A view of channelled valley bottom wetland within a transformed catchment (crop production & grazing)

Plate 3: One of the smaller Endorheic Pans that is located near the OHL between the WEF and Ermelo

Plate 4: Seepage wetland in the headwater areas of the Vaal River / Usutu River catchment divide

6. Present Ecological State and conservation importance

The PES of a river represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The PES scores have been revised for the country and based on the current models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). The current PES system also incorporates Ecological Importance (EI) and Ecological Sensitivity (ES) separately as opposed to Ecological Importance and Sensitivity (EIS) in the old model, although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the updated models, with the default REC being B, when little or no information is available to assess the system or when only one of the above-mentioned parameters are assessed or the overall PES is rated between a C or D.

The Present Ecological State scores (PES) for the main watercourses in the study area were rated as follows (DWS, 2014 – where B = Largely Natural and C = Moderately Modified):

Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
1630	B	Moderate	High
1710	B	Moderate	High
1678	C	High	Moderate
1693	C	High	High
1770	C	High	High

These scores were substantiated by observations made in the field within the study area, and due to the overall lack of impacts or disturbance these scores for each of the watercourses within the site should be upheld.

This was further substantiated by the inclusion of study area catchments into Critical Biodiversity Areas (Type 1 and 2), i.e. the wetland areas near the alignment crossing the Brak River in particular and Ecological Support Area as shown in the Mpumalanga CBA MAP spatial data and Wetland Clusters (Figure 8).

Once the layout has be refined to the preferred alternatives and an internal roads layout is provided, then site specific PES / EIS scores for specific crossings can be provided in the EIA phase.

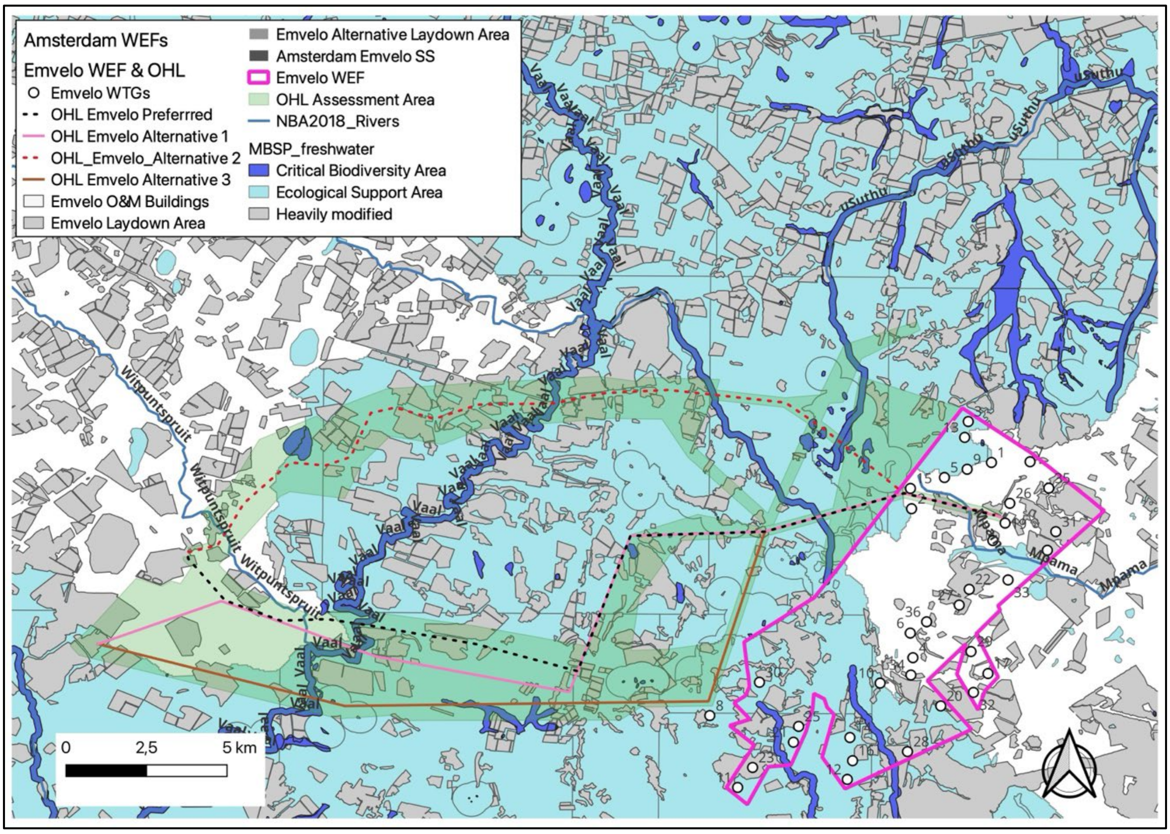


Figure 8: Critical Biodiversity Areas as per the Mpumalanga Biodiversity Spatial Plan

7. Permit requirements

Based on an assessment of the proposed activities and past engagement with DWS, the following WULs/ GA's could be required based on the following thresholds as listed in the following Government Notices, however ultimately the Department Water and Sanitation (DWS) will determine if a GA or full WULA will be required during the pre-application process (Phase 1):

- **DHSWS Notice 538 of 2016, 2 September in GG 40243**– Section 21 a & b, Abstraction and Storage of water.
- **Government Notice 509 in GG 40229 of 26 August 2016 –** Section 21 c & i, Impeding or diverting the flow of water in a watercourse and or altering the bed, banks, course or characteristics of a watercourse.

	Water Use Activity	**Applicable to this development proposal**
S21(a)	Taking water from a water resource	Only water if water is abstracted from a local river or borehole
S21(b)	Storing water	If the total volume stored is greater than 40 000 m^3 then a full Water Use License will be required. This is however unlikely due to the scale of the project and the need for such large volumes.
S21(c)	Impeding or diverting the flow of water in a watercourse	Yes – several new crossings of watercourses (i.e. activities within 500m of a wetland or 100m of a watercourse will be required. A GA process can potentially be followed if Risk Assessment Matrix indicates all impacts are LOW.
S21(d)	Engaging in a stream flow reduction activity	Not applicable
S21(e)	Engaging in a controlled activity	Not applicable
S21(f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit	Not applicable
S21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource	Not applicable – Only portable toilets will be required
S21(h)	Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process	Not applicable
S21(i)	Altering the bed, banks, course or characteristics of a watercourse	Yes – several new crossings of watercourses (i.e. activities within 500m of a wetland or 100m of a watercourse will be required. A GA process can potentially be followed if Risk Assessment Matrix indicates all impacts are LOW.
S21(j)	Removing, discharging or disposing of water found underground for the continuation of an activity or for the safety of persons	Not applicable
S21(k)	Using water for recreational purposes	Not applicable

8. Sensitivity Assessment

Using the baseline description and field data while considering the current disturbances and site characteristics, the following features were identified, then categorised into one of number pre-determined sensitivity categories to provide protect and/or guide the layout planning:

High = No Go	"No go" areas or setbacks and areas or features that are considered of such significance that impacting them may be regarded as fatal flaw or strongly influence the project impact significance profile Therefore areas or features that are considered to have a high sensitivity or where project infrastructure would be highly constrained and should be avoided as far as possible. Infrastructure located in these areas are likely to drive up impact significance ratings and mitigations
Medium	Buffer areas and or areas that are deemed to be of medium sensitivity but should still be avoid as this would minimise impacts and or the need for additional Water Use Authorisation
Low	Areas of low sensitivity or constraints, such as artificial systems with little to no biological value or would not result in any future licensing requirements e.g. dry earth wall farm dams
Neutral	Unconstrained areas (left blank in mapping)

Table 4 below provides an overview of the sensitivity of various aquatic features (with buffers distances included) as it relates to the main project component types for the project. The features are shown spatially in Figure 7 above.

The sensitivity ratings of High No-go and Low were determined through an assessment of the aquatic habitat sensitivity and related constraints. However, these No-Go areas (with buffers) relate in general terms to the project and there are areas where encroachment on these areas would occur (i.e. existing road crossings within systems, but this is considered acceptable since these areas have already been impacted.

These proposed constraints / buffers do not include bird and or bat specialist buffers / constraints as theirs buffers along aquatic features are at times far larger around aquatic features, than those required for the known aquatic species within this region.

Table 4: Results of the sensitivity rating / constraints assessment

Development Component	Habitat type	Sensitivity rating of the respective habitat type against the development type	Buffer distance (m)	Development acceptability	Sensitivity rating override if an impact such as a road or other disturbance already occurs within the proposed footprint and confirmed by the specialist
WTG towers	Channelled Valley Bottom Wetlands	No-Go	105m	No WTGs should be placed in any of these areas, regardless of the state, type and functionality of the respective aquatic ecosystem	None
	Pans and Depressions		95m		
	Rivers and Floodplains		65m		
	Seeps		65m		
	Minor watercourses		35m		
Hardstands, Buildings / Substations & BESS	Channelled Valley Bottom Wetlands	No-Go	105m	None of these types of infrastructure should be placed in any of these areas	None
	Pans and Depressions		95m		
	Rivers and Floodplains		65m		
	Seeps		65m		
	Minor watercourses		35m		
Roads & Underground cables alignment roads	Channelled Valley Bottom Wetlands	High	105m	New roads and underground cables would not be deem appropriate within any of these areas, unless some form of disturbance already occurs, such as an existing track or bridge	Only existing tracks or disturbed areas maybe used
	Pans and Depressions		95m		
	Rivers and Floodplains				
	Seeps		65m		
	Minor watercourses		35m		
OHL	Channelled Valley Bottom Wetlands	High	105m	OHL towers must be placed outside of these area so that only the cables span these systems. The exception being that Pans & Depression inclusive of buffers must be avoided completely	
	Pans and Depressions		95m		
	Rivers and Floodplains		65m		
	Seeps		65m		
	Minor watercourses		35m		

9. Impact assessment

During the impact assessment several potential key issues / impacts were identified and these were assessed based on the methodology supplied by ERM.

9.1 Alternatives Assessment

The 2014 EIA Regulations require that any feasible and reasonable activity, location and technology alternatives considered must be described and comparatively assessed. However, as some of the proposed infrastructure has not avoided any sensitivity aquatic areas, the applicant will be advised that the alternatives either be revised to avoid any of these areas or not used in future design iterations as applicable.

9.2 No-Go Option

With regard the No-Go option it is assumed that the site would continue to degrade due to the prevalence of grazing and or erosion within the water courses. This would continue into the long-term with a Low intensity that would impact on the regional scale due to loss of important habitat. Little in the way of mitigation could be proposed due to the social needs of the surrounding residents and or landowners, coupled to the need for access.

10. Potential aquatic ecosystems impacts

- Impact 1: Loss of habitat containing protected species or Species of Special Concern
- Impact 2: Loss of any critical corridors, important catchment areas and connected habitats that are linked to any Critical Biodiversity Areas or Ecological Support Areas
- Impact 3: The potential spread of alien vegetation
- Impact 4: Loss of riparian and or wetland habitat
- Impact 5: Changes to the hydrological regime and increased potential for erosion
- Impact 6: Changes to water quality
- Impact 7: Cumulative Impacts

The Tables 5 – 11 below assesses the impact significance for each impact. It was determined that the impacts upon aquatic biodiversity associated with the project are of Low significance, after mitigation. This assumes that the mitigations listed below are considered coupled to the fact that the overall layouts have avoid any of the High / No-Go areas, unless making use of areas with impacts such as existing farm roads. However, it is assumed that the final layout will orientate the hardstands, crane pads, blade laydowns and construction camps outside of any of the No-Go areas. The current preferred laydown area is located within a sensitive aquatic areas and will need to be adjusted.

The loss of irreplaceable aquatic habitat and/or important aquatic obligate biota is therefore highly unlikely. The impacts are easily mitigated (provided the mitigation measures and monitoring plan within the EMP and this report are implemented and adhered to during all phases of the project).

Table 5: Impact assessment summary for Impact 1 – Loss of habitat containing protected species or Species of Special Concern

<table>
<tr><td colspan="6">Impact Phase: Construction and Decommissioning</td></tr>
<tr><td colspan="6">Nature of the impact: Loss of vegetation and in particular species / habitats that could contain listed as Critically Endangered and or Vulnerable species (direct)</td></tr>
<tr><td colspan="6">Description of Impact: Activities resulting in physical disturbance of aquatic systems which provide ecosystem services, especially where new crossings are made, or large hard engineered surfaces are placed within the buffer zones. Loss can also include a functional loss, through change in vegetation type via alien encroachment, reducing aquatic biodiversity. However no aquatic vegetation or fauna with conservation concern were observed during this assessment, coupled to the fact that any sensitive areas will be avoided.</td></tr>
<tr><td colspan="6">Impact Status: Negative</td></tr>
<tr><td></td><td>E</td><td>D</td><td>R</td><td>M</td><td>P</td></tr>
<tr><td>Without Mitigation</td><td>Local</td><td>Long Term</td><td>Irreversible</td><td>Medium</td><td>Probable</td></tr>
<tr><td>Score</td><td>2</td><td>4</td><td>5</td><td>2</td><td>3</td></tr>
<tr><td>With Mitigation</td><td>Site</td><td>Short Term</td><td>Recoverable</td><td>Low</td><td>Low Probability</td></tr>
<tr><td>Score</td><td>1</td><td>2</td><td>3</td><td>1</td><td>2</td></tr>
<tr><td>Significance Calculation</td><td colspan="3">Without Mitigation</td><td colspan="2">With Mitigation</td></tr>
<tr><td>S=(E+D+R+M)*P</td><td colspan="3">Moderate Negative Impact (39)</td><td colspan="2">Low Negative Impact (14)</td></tr>
<tr><td colspan="6">Was public comment received? Not yet</td></tr>
<tr><td colspan="6">Has public comment been included in mitigation measures? Note still in the draft phase and that comment will be obtained during the NEMA comment periods</td></tr>
<tr><td colspan="6">Mitigation measures to reduce residual risk or enhance opportunities:
• The development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout prior to construction.
• Where large cut and fill areas are required, these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation.
• Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc).
To minimise the impact of the access roads:
• Use existing roads or upgrade existing tracks rather than constructing entirely new roads wherever possible and has been included in the proposed layout.</td></tr>
</table>

- Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly before any construction commences.
- Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils.
- Where required, all pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that head cut erosion does not develop because of the gradient change from the natural ground level to the invert level of the culvert.
- The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist, with a preference for low level drifts where possible.
- Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities.
- Any fauna (frogs, snakes, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted.
- All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated.

It is the contractor’s responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.

Table 6: Impact assessment summary for Impact 2 – Loss of CBAs or potential areas with conservation potential or linked to any important catchments and strategic water resource areas

Impact Phase: Construction and Decommissioning					
Nature of the impact: Loss of any critical corridors and connect habitats that are linked to any future conservation plans (direct) is not expected as these can been avoided, coupled to the fact that hydrological connections will be retained through avoidance or the inclusion of ecological buffers.					
Description of Impact: Activities resulting in physical disturbance of aquatic systems which provide ecosystem services, especially where new crossings are made, or large hard engineered surfaces are placed within the buffer zones and have been included in any Critical Biodiversity Areas. <u>it is assumed that the final layout will orientate the hardstands, crane pads, blade laydowns and construction camps outside of any of the No-Go areas. The current preferred laydown area is located within a sensitive aquatic areas and will need to be adjusted.</u>					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Local	Long Term	Irreversible	Medium	Probable
Score	2	4	5	2	3
With Mitigation	Site	Short Term	Recoverable	Low	Low Probability
Score	1	2	3	1	2
Significance Calculation	**Without Mitigation**			**With Mitigation**	
S=(E+D+R+M)*P	Moderate Negative Impact (39)			Low Negative Impact (14)	
Was public comment received? Not yet					
Has public comment been included in mitigation measures? Note still in the draft phase and that comment will be obtained during the NEMA comment periods					

Mitigation measures to reduce residual risk or enhance opportunities:

- The aquatic systems have been mapped to a finer scale and have taken cognizance of any potential CBAs. As High / No-Go have been avoided by the major infrastructure such as turbines, the aquatic zones associated within the CBA / ESAs have also been avoided. Roads will need to traverse these areas, thus it is important to try and select existing areas with impacts / crossings where possible, coupled to the assumptions above
- The development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout prior to construction.
- Where large cut and fill areas are required, these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation.
- Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc).

To minimise the impact of the access roads:

- Use existing roads or upgrade existing tracks rather than constructing entirely new roads wherever possible and has been included in the proposed layout.
- Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly, before any construction commences.

• Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils. • Where required, all pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that head cut erosion does not develop as a result of the gradient change from the natural ground level to the invert level of the culvert. • The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist, with a preference for low level drifts where possible. • Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities. • Any fauna (frogs, snakes, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted. • All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated. It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.	
Residual impact	Very low and acceptable with adoption of mitigation measures

Table 7: Impact assessment summary for Impact 3 – Potential spread of alien vegetation

Impact Phase: Construction and Operation					
Nature of the impact: Any physical disturbance could result in the spread of alien vegetation (direct)					
Description of Impact: During construction, complete clearing of the roads and turbine areas, as well well any ancillary structures (offices and substations) will be required. This disturbance then allows for the alien species to colonise the soils, if left unmanaged.					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Local	Long Term	Irreversible	Medium	Probable
Score	2	4	5	2	3
With Mitigation	Site	Short Term	Recoverable	Low	Low Probability
Score	1	2	3	1	2
Significance Calculation	**Without Mitigation**			**With Mitigation**	
S=(E+D+R+M)*P	Moderate Negative Impact (39)			Low Negative Impact (14)	
Was public comment received? Not yet					
Has public comment been included in mitigation measures? Note still in the draft phase and that comment will be obtained during the NEMA comment periods					

Mitigation measures to reduce residual risk or enhance opportunities: • Alien vegetation management must be initiated at the beginning of the construction period and must extend into any remaining areas into the operation phase on the facility • The revegetation of any temporary sites as well as any previously degraded areas must begin from the onset of the project, with the involvement of a botanist to assist with the revegetation specifications Regeneration of alien vegetation must be monitored once all areas have been cleared, forming part of a long-term alien vegetation management plan

Residual impact	Very low and acceptable, with adoption of mitigation measures and monitoring

Table 8: Impact assessment summary for Impact 4 – Loss of riparian and or wetland habitat

Impact Phase: Construction and Decommissioning					
Nature of the impact: It was recommended that all wetlands / riverine systems as well as the inclusive of buffers, be avoided. <u>it is assumed that the final layout will orientate the hardstands, crane pads, blade laydowns and construction camps outside of any of the No-Go areas. This also includes the current substation site and O/M Buildings that are located within a sensitive aquatic area.</u>.					
Description of Impact: During construction, complete clearing of the roads and turbine areas, as well any ancillary structures (offices and substations) will be required, which may impact the aquatic function or any corridors or connections between aquatic systems. However, all Very High Sensitivity / No-Go areas have been avoided by the proposed layout by also making use of existing road crossings or considering any of the proposed buffers.					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Local	Long Term	Irreversible	Medium	Probable
Score	2	4	5	2	3
With Mitigation	Site	Short Term	Recoverable	Low	Low Probability
Score	1	2	3	1	2
Significance Calculation	**Without Mitigation**			**With Mitigation**	
S=(E+D+R+M)*P	Moderate Negative Impact (39)			Low Negative Impact (14)	
Was public comment received? Not yet					
Has public comment been included in mitigation measures? Note still in the draft phase and that comment will be obtained during the NEMA comment periods					
Mitigation measures to reduce residual risk or enhance opportunities: • The development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout prior to construction. • Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. • Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc). To minimise the impact of the access roads: • Use existing roads or upgrade existing tracks rather than constructing entirely new roads wherever possible and has been included in the proposed layout.					

• Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly, before any construction commences. • Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils. • Where required, all pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that head cut erosion does not develop as a result of the gradient change from the natural ground level to the invert level of the culvert. • The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist, with a preference for low level drifts where possible. • Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities. • Any fauna (frogs, snakes, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted. • All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated. It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.	
Residual impact	Very low and acceptable with adoption of mitigation measures

Table 9: Impact assessment summary for Impact 5 – Changes to the hydrological regime and increase potential for erosion

Impact Phase: Construction and Decommissioning					
Nature of the impact: Increased hard surfaces can result in increases in runoff generated by the site, thereby resulting in changes to localised hydrological regimes.					
Description of Impact: During construction, complete clearing of the roads and turbine areas, as well any ancillary structures (offices and substations) will be required, which may impact the aquatic function or any corridors or connections between aquatic systems. However, these areas must be by the proposed layout by also making use of existing road crossings or by considering any of the proposed buffers.					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Local	Long Term	Irreversible	Medium	Probable
Score	2	4	5	2	3
With Mitigation	Site	Short Term	Recoverable	Low	Low Probability

<table>
<tr><td>Score</td><td>1</td><td>2</td><td>3</td><td>1</td><td>2</td></tr>
<tr><td>Significance Calculation</td><td colspan="3">Without Mitigation</td><td colspan="2">With Mitigation</td></tr>
<tr><td>S=(E+D+R+M)*P</td><td colspan="3">Moderate Negative Impact (39)</td><td colspan="2">Low Negative Impact (14)</td></tr>
<tr><td colspan="6">Was public comment received? Not yet</td></tr>
<tr><td colspan="6">Has public comment been included in mitigation measures? Note still in the draft phase and that comment will be obtained during the NEMA comment periods</td></tr>
<tr><td colspan="6">Mitigation measures to reduce residual risk or enhance opportunities:

No stormwater discharged may be directed to delineated aquatic zones or the associated buffers.
A stormwater management plan finalised prior to construction, detailing the structures and actions that must be installed to prevent the increase of surface water flows directly into any natural systems.
Effective stormwater management must include measures to slow, spread and deplete the energy of concentrated flows thorough effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed areas

To minimise the impact of the access roads:

Use existing roads or upgrade existing tracks rather than constructing entirely new roads wherever possible and has been included in the proposed layout.
Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas.. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly, before any construction commences.
Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils.
Where required, all pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that head cut erosion does not develop as a result of the gradient change from the natural ground level to the invert level of the culvert.
The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist, with a preference for low level drifts where possible.
Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities.
Any fauna (frogs, snakes, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted.
All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated.

It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.</td></tr>
<tr><td>Residual impact</td><td colspan="5">Very low and acceptable with adoption of mitigation measures</td></tr>
</table>

Table 10: Impact assessment summary for Impact 6 –Changes to surface water quality characteristics

Impact Phase: Construction and Decommissioning					
Nature of the impact: Potential impact on localised surface water quality (indirect)					
Description of Impact: During construction or decommissioning, earthworks will expose and mobilise earth materials, and a number of materials as well as chemicals will be imported and used on site and may end up in the surface water, including soaps, oils, grease and fuels, human wastes, cementitious wastes, paints and solvents, etc. Any spills during transport or while works area conducted in proximity to a watercourse has the potential to affect the surrounding biota. This can result in possible deterioration in aquatic ecosystem integrity and species diversity.					
Impact Status: Negative					
	E	D	R	M	P
Without Mitigation	Local	Long Term	Irreversible	Medium	Probable
Score	2	4	5	2	3
With Mitigation	Site	Short Term	Recoverable	Low	Low Probability
Score	1	2	3	1	2
Significance Calculation	**Without Mitigation**			**With Mitigation**	
S=(E+D+R+M)*P	Moderate Negative Impact (39)			Low Negative Impact (14)	
Was public comment received? Not yet					
Has public comment been included in mitigation measures? Note still in the draft phase and that comment will be obtained during the NEMA comment periods					
Mitigation measures to reduce residual risk or enhance opportunities: • All liquid chemicals including fuels and oil, including for the BESS, must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely. • Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment). • Mechanical plant and bowsers must not be refueled or serviced within 100m of a river channel or wetland. • All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be beyond any demarcated water courses and their respective buffers. • Littering and contamination associated with construction activity must be avoided through effective construction camp management. • No stockpiling should take place within or near a water course. • All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable.					

ECO monitors the site on a daily basis to ensure plant is in working order (minimise leaks), spills are prevented and if they do occur, are quickly rectified.	
Residual impact	Low risk and acceptable, with adoption of mitigation measures and monitoring

Table 11: Impact assessment summary for Impact 7 - Cumulative impact assessment for aquatic biodiversity

Cumulative Impact: Cumulative impacts on the aquatic resources of the area					
Description of Cumulative Impact: The cumulative impact assessment considers the combined impact of the remaining and other renewable projects within a 30km radius, that are also in the development phase and the associated grid lines on the aquatic resources. The rating below is based on the premise that important or sensitive features will be avoided by the various projects, while the mitigations proposed will ensure that the form and or function of downstream areas remain intact.					
Impact Status: Negative					
	E	**D**	**R**	**M**	**P**
Without Mitigation	Local	Long Term	Irreversible	Medium	Probable
Score	2	4	5	2	3
With Mitigation	Site	Short Term	Recoverable	Low	Low Probability
Score	1	2	3	1	2
Significance Calculation	**Without Mitigation**			**With Mitigation**	
S=(E+D+R+M)*P	Moderate Negative Impact (39)			Low Negative Impact (14)	
Can Impacts be Enhanced?	No				
Enhancement: The project should share roads and infrastructure where possible to reduce the overall footprint and reduce stormwater and erosion and sedimentation related impacts The projects should collaborate with provincial roads authority to upgrade the main access routes and improve the crossings and stormwater controls					
Residual impact	Low				

11. Draft Specialists Recommendations for the EA

The DFFE Screening Tool identified two sensitivity ratings within the development footprint, namely, Low and Very High. There is overlap with the findings on site and the Screening Tool's outcome, thus the development footprint must be developed with cognisance of these sensitivities.

Therefore, environmental sensitivity input received from the aquatic ecology specialist was taken forward and considered within the EIA process and the impact to these areas assessed. Appropriate layout and development restrictions were implemented within the development footprint to ensure that the impact to aquatic ecology is deemed acceptable by the aquatic ecologist. <u>However, it is assumed that the final layout will orientate the hardstands, crane pads, blade laydowns and construction camps outside of any of the No-Go areas. The current preferred laydown area is located within a sensitive aquatic areas and will need to be adjusted</u>

The specialist has no objection to the authorisation of the proposed activities assuming that all mitigations and buffer zones are implemented.

Mitigation should focus on these areas and include measures to halt erosion and rehabilitate habitat in the sections affected by the construction. Without the implementation of mitigation measures, the project has potential to cause a Low cumulative impact upon aquatic biodiversity. However, with the adoption of mitigation, the proposed project will have a Very Low impact upon aquatic biodiversity.

12. Monitoring and Management Actions

The following are key recommendations, which are also critical to the proposed mitigations:

- Any of the activities, should also be monitored by the appointed Environmental Officer /Environmental Control Officer (EO/ECO) on a daily basis, especially during periods of river flow during construction.
- Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions and reno mattress as required. No activities should take place outside of the demarcated servitude, to prevent additional cumulative impacts on these systems.
- The EMPr, must include a Construction Specific Monitoring and Rehabilitation Plan related to the water course and wetland crossings, and specifically to the prevention of erosion and sedimentation as these systems are prone to scour, with rehabilitation options being limited due to the sparse nature of the vegetation.
- Monitoring should occur on a monthly basis for 6 months post construction and where any unstable soils occur, these must be protected with temporary stabilisation dependent on the scale of the impact i.e. sand bags - hay bales) until areas become revegetated. If any areas require permanent erosion protection (e.g. gabions or stone pitching) then the WULA/GA must be amended to include these areas.

13.Conclusion and Recommendations

During this assessment, several sensitive aquatic habitats were observed and are shown in the maps provided in this report. Noteworthy areas, were then avoided by the required infrastructure, and include the main riverine and wetland systems, while the access roads could will make use of existing roads thus previously disturbed areas. <u>The current substation site and O/M Buildings are located within a sensitive aquatic areas and the localities will need to be adjusted.</u>

If this is carried out, then the specialist has no objection to the authorisation of the proposed activities assuming that all mitigations and buffer zones are implemented.

Mitigation should focus on these areas and include measures to halt erosion and rehabilitate habitat in the sections affected by the construction. Without the implementation of mitigation measures, the project has potential to cause a Moderate cumulative impact upon aquatic biodiversity. However, with the adoption of mitigation, the proposed project will have a Low impact upon aquatic biodiversity.

As the proposed activities have the potential to create erosion the following recommendations are reiterated:

- Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment, and suitable dust and erosion control mitigation measures should be included in the generic EMPr, if not included already to mitigate.

- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination / leaks. Washing and cleaning of equipment should also be done in berms or bunds, to trap any cement / hazardous substances and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel. It is therefore suggested that all construction camps, lay down areas, batching plants or areas and any stores should be located more than 50 m from any demarcated watercourses.

- It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas along aquatic features, using selected species detailed in this report.
- All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.

It is further recommended from the project onset that all watercourse areas (inclusive of buffers) are included into any existing EMPr as reference, this to ensure a net benefit to the aquatic environment. This should from part of the suggested walk down as part of the final EMP preparation.

14.References

Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998.

Agricultural Resources Act, 1983 (Act No. 43 of 1983).

Department of Water Affairs and Forestry - DWAF (2005). A practical field procedure for identification and delineation of wetland and riparian areas Edition 1. Department of Water Affairs and Forestry, Pretoria. Updated with amendments in 2007.

Department of Water and Sanitation. 2014. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: [W5 (for example)]. Compiled by RQIS-RDM: https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx

Germishuizen, G. and Meyer, N.L. (eds) (2003). Plants of southern Africa: an annotated checklist. Strelitzia 14, South African National Biodiversity Institute, Pretoria.

Holness, S & Oosthuysen, E. 2016. Northern Cape Critical Biodiversity Area map, SANBI BGIS.

Kleynhans C.J., Thirion C. and Moolman J. (2005). A Level 1 Ecoregion Classification System for South Africa, Lesotho and Swaziland. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria.

Macfarlane, D.M. & Bredin, I.P. 2017. Buffer Zone Guidelines for Rivers, Wetlands and Estuaries Buffer Zone Guidelines for Rivers, Wetlands and Estuaries. WRC Report No TT 715/1/17 Water Research Commission, Pretoria.

Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), as amended.

National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.

National Water Act, 1998 (Act No. 36 of 1998), as amended

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

12. Appendix 1 - Specialist CV

CURRICULUM VITAE
Dr Brian Michael Colloty
7212215031083

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083 498 3299

Profession: Ecologist & Environmental Assessment Practitioner (Pr. Sci. Nat. 400268/07)
Member of the South African Wetland Society
Specialisation: Ecology and conservation importance rating of terrestrial habitats, wetlands, rivers & estuaries
Years experience: 25 years

SKILLS BASE AND CORE COMPETENCIES

- 25 years experience in environmental sensitivity and conservation assessment of aquatic and terrestrial systems inclusive of Index of Habitat Integrity (IHI), WET Tools, Riparian Vegetation Response Assessment Index (VEGRAI) for Reserve Determinations, estuarine and wetland delineation throughout Africa. Experience also includes biodiversity and ecological assessments with regard sensitive fauna and flora, within the marine, coastal and inland environments. Countries include Mozambique, Kenya, Namibia, Central African Republic, Zambia, Eritrea, Mauritius, Madagascar, Angola, Ghana, Guinea-Bissau and Sierra Leone. Current projects also span all nine provinces in South Africa.
- 15 years experience in the coordination and management of multi-disciplinary teams, such as specialist teams for small to large scale EIAs and environmental monitoring programmes, throughout Africa and inclusive of marine, coastal and inland systems. This includes project and budget management, specialist team management, client and stakeholder engagement and project reporting.
- GIS mapping and sensitivity analysis

TERTIARY EDUCATION

- 1994: B Sc Degree (Botany & Zoology) - NMU
- 1995: B Sc Hon (Zoology) - NMU
- 1996: M Sc (Botany - Rivers) - NMU
- 2000: Ph D (Botany – Estuaries & Mangroves) – NMU

EMPLOYMENT HISTORY

- 1996 – 2000 Researcher at Nelson Mandela University – SAB institute for Coastal Research & Management. Funded by the WRC to develop estuarine importance rating methods for South African Estuaries
- 2001 – January 2003 Training development officer AVK SA (reason for leaving – sought work back in the environmental field rather than engineering sector)
- February 2003- June 2005 Project manager & Ecologist for Strategic Environmental Focus (Pretoria) – (reason for leaving – sought work related more to experience in the coastal environment)
- July 2005 – June 2009 Principal Environmental Consultant Coastal & Environmental Services (reason for leaving – company restructuring)
- June 2009 – August 2018 Owner / Ecologist of Scherman Colloty & Associates cc
- August 2018 Owner / Ecologist - EnviroSci (Pty) Ltd

SELECTED RELEVANT PROJECT EXPERIENCE

World Bank IFC Standards

- Kenmare Mining Pilivilli, Mozambique - wetland (mangroves, peatlands and estuarine) assessment and biodiversity offset analysis - current
- Botswana South Africa 400kv transmission line (400km) biodiversity assessment on behalf of Aurecon - current
- Farim phosphate mine and port development, Guinea Bissau – biodiversity and estuarine assessment on behalf of Knight Piesold Canada – 2016.
- Tema LNG offshore pipeline EIA – marine and estuarine assessment for Quantum Power (2015).
- Colluli Potash South Boulder, Eritrea, SEIA marine baseline and hydrodynamic surveys co-ordinator and coastal vegetation specialist (coastal lagoon and marine) (on-going).
- Wetland, estuarine and riverine assessment for Addax Biofeuls Sierra Leone, Makeni for Coastal & Environmental Services: 2009
- ESHIA Project manager and long-term marine monitoring phase coordinator with regards the dredge works required in Luanda bay, Angola. Monitoring included water quality and biological changes in the bay and at the offshore disposal outfall site, 2005-2011

South African

- Plant and animal search and rescue for the Karusa, Soetwater, Nxuba, Oyster Bay and Garob Wind Farms on behalf of Enel Green Power, 2018 - 2019
- Plant and Animal Search and Rescue for the Port of Ngqura, Transnet Landside infrastructure Project, with development and management of on site nursery (Current).
- Plant and Animal Search and Rescue for the Port of Ngqura, OTGC Tank Farm Project (2019)
- Plant search and rescue, for NMBM (Driftsands sewer, Glen Hurd Drive), Department of Social Development (Military veterans housing, Despatch) and Nxuba Wind Farm, - current
- Wetland specialist appointed to update the Eastern Cape Biodiversity Conservation Plan, for the Province on behalf of EOH CES appointment by SANBI – current. This includes updating the National Wetland Inventory for the province, submitting the new data to CSIR/SANBI.
- CDC IDZ Alien eradication plans for three renewable projects Coega Wind Farm, Sonop Wind Farm and Coega PV, on behalf of JG Afrika (2016 – 2017).
- Nelson Mandela Bay Municipality Baakens River Integrated Wetland Assessment (Inclusive of Rehabilitation and Monitoring Plans) for CEN IEM Unit - Current
- Rangers Biomass Gasification Project (Uitenhage), biodiversity and wetland assessment and wetland rehabilitation / monitoring plans for CEM IEM Unit – current.
- Gibson Bay Wind Farm implementation of the wetland management plan during the construction and operation of the wind farm (includes surface / groundwater as well wetland rehabilitation & monitoring plan) on behalf of Enel Green Power - current
- Gibson Bay Wind Farm 133kV Transmission Line wetland management plan during the construction of the transmission line (includes wetland rehabilitation & monitoring plan) on behalf of Eskom – 2016.
- Tsitsikamma Community Wind Farm implementation of the wetland management plan during the construction of the wind farm (includes surface / biomonitoring, as well wetland rehabilitation & monitoring plan) on behalf of Cennergi – completed May 2016.
- Alicedale bulk sewer pipeline for Cacadu District, wetland and water quality assessment, 2016
- Mogalakwena 33kv transmission line in the Limpopo Province, on behlaf of Aurecon, 2016
- Cape St Francis WWTW expansion wetland and passive treatment system for the Kouga Municipality, 2015
- Macindane bulk water and sewer pipelines wetland and wetland rehabilitation plan 2015
- Eskom Prieska to Copperton 132kV transmission line aquatic assessment, Northern Cape on behalf of Savannah Environmental 2015.
- Joe Slovo sewer pipeline upgrade wetland assessment for Nelson Mandela Bay Municipality 2014
- Cape Recife Waste Water Treatment Works expansion and pipeline aquatic assessment for Nelson Mandela Bay Municipality 2013
- Pola park bulk sewer line upgrade aquatic assessment for Nelson Mandela Bay Municipality 2013
- Transnet Freight Rail – Swazi Rail Link (Current) wetland and ecological assessment on behalf of Aurecon for the proposed rail upgrade from Ermelo to Richards Bay
- Eskom Transmission wetland and ecological assessment for the proposed transmission line between Pietermaritzburg and Richards Bay on behalf of Aurecon (2012).
- Port Durnford Exarro Sands biodiversity assessment for the proposed mineral sands mine on behalf of Exxaro (2009)
- Fairbreeze Mine Exxaro (Mtunzini) wetland assessment on behalf of Strategic Environmental Services (2007).
- Wetland assessment for Richards Bay Minerals (2013) – Zulti North haul road on behalf of RBM.
- Biodiversity and aquatic assessments for 101 renewable projects in the past 8 years in the Western, Eastern, Northern Cape, KwaZulu-Natal and Free State provinces. Clients included RES-SA, Red Cap, ACED Renewables, Mainstream Renewable, GDF Suez, Globeleq, ENEL, Abengoa amongst others. Particular aquatic sensitivity assessment and Water Use License Applications on behalf of Mainstream Renewable Energy (8 wind farms and 3 PV facilities.), Cennergi / Exxaro (2 Wind farms), WKN Wind current (2 wind farms & 2 PV facilities), ACED (6 wind farms) and Windlab (3 Wind farms) were also conducted. Several of these projects also required the assessment of the proposed transmission lines and switching stations, which were conducted on behalf of Eskom.
- Vegetation assessments on the Great Brak rivers for Department of Water and Sanitation, 2006 and the Gouritz Water Management Area (2014)
- Proposed FibreCo fibre optic cable vegetation assessment along the PE to George, George to Graaf Reinet, PE to Colesburg, and East London to Bloemfontein on behalf of SRK (2013-2015).

15.Appendix 2 - Site Sensitivity Verification Report

<u>Site verification report – Aquatic Ecology</u>

Government Notice No. 645, dated 10 May 2019, includes the requirement that an Initial Site Sensitivity Verification Report must be produced for a development footprint. As per Part 1, Section 2.3, the outcome of the Initial Site Verification must be recorded in the form of a report that-

(a) Confirms or disputes the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool;
(b) Contains a motivation and evidence of either the verified or different use of the land and environmental sensitivity;
(c) Is submitted together with the relevant reports prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

This report has been produced specifically to consider the aquatic ecology theme and addresses the content requirements of (a) and (b) above. The report will be appended to the respective specialist study included in the Basic Assessment Report produced for the project.

<u>Site sensitivity based on the aquatic biodiversity theme included in the Screening Tool and specialist assessment</u>

Based on the DFFE Screening Tool, the WEF and Grid Connection falls within areas of very high sensitivity (Figure 1).

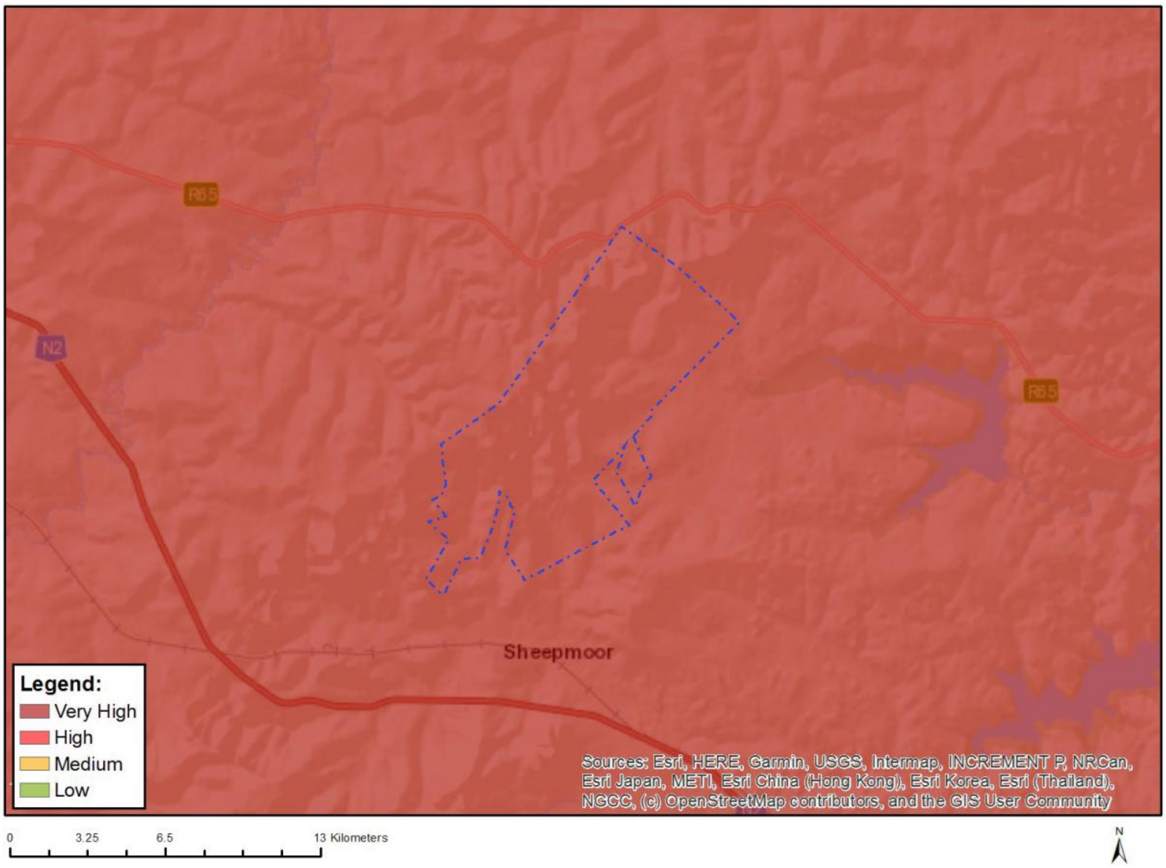

Figure 1a. DFFE Screening Tool outcome for the aquatic biodiversity theme for the WEF site

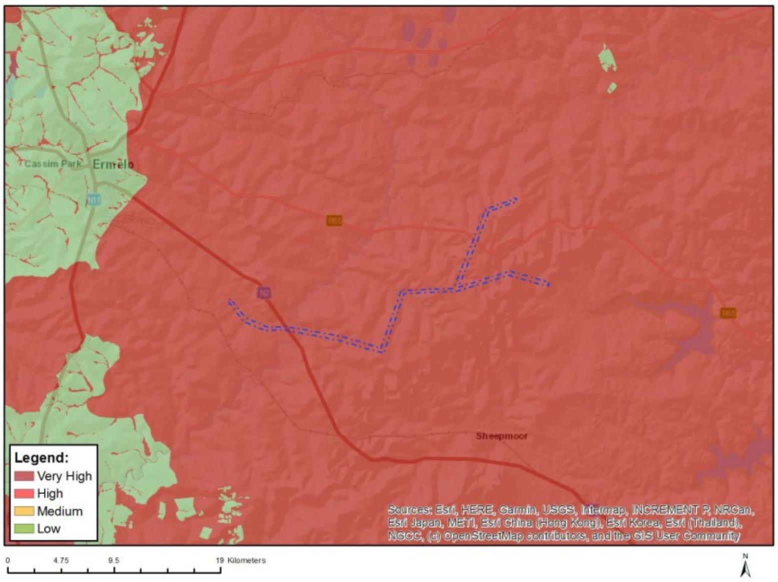

Figure 1b. DFFE Screening Tool outcome for the aquatic biodiversity theme for the Preferred Grid options

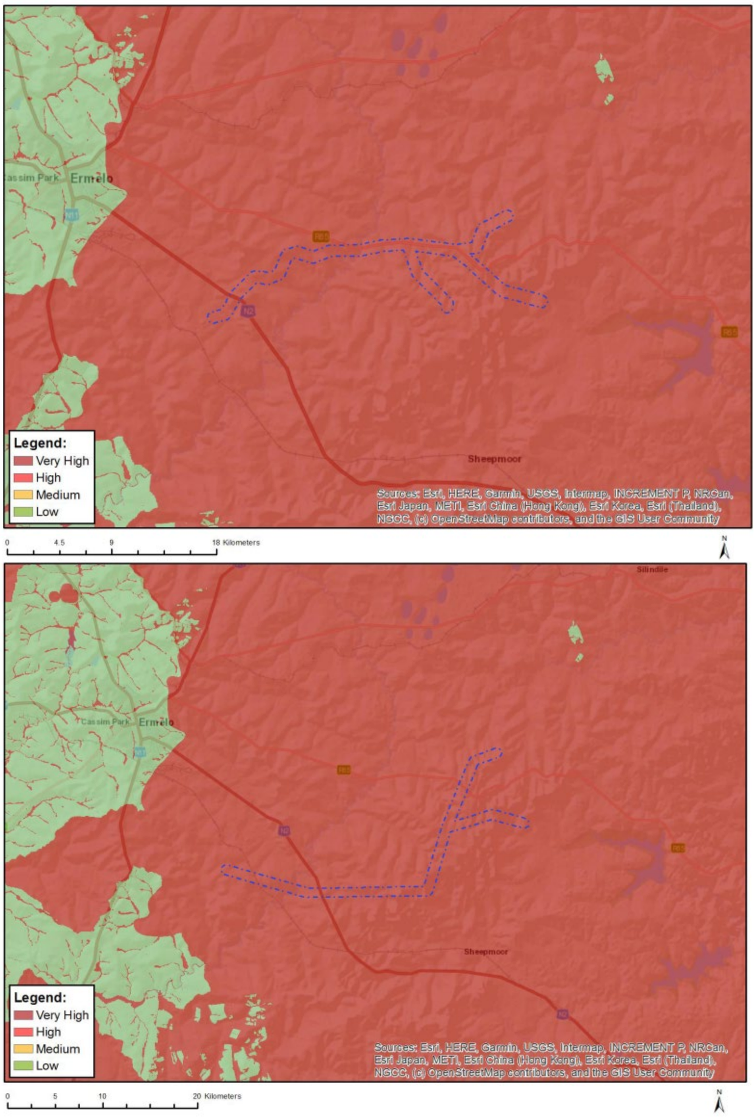

Figure 1c. DFFE Screening Tool outcome for the aquatic biodiversity theme for the OHL Alternatives

Based on the above outcomes, the specialist **agrees** the environmental sensitivities identified on site. However, disputes the exact extent of the systems, as the Screening Tool shows a catchment wide representation of the aquatic waterbodies that were rated as sensitive.

The specialist findings were informed by a site visits undertaken by Dr Brian Colloty over the course of several years. This information was then compared to current wetland inventories, 1: 50 000 topocadastral surveys mapping and the site. A baseline map was then developed which was refined, noting that due to the complex of the topography and geology, some of the river lines were digitised at a scale of 1:2000.

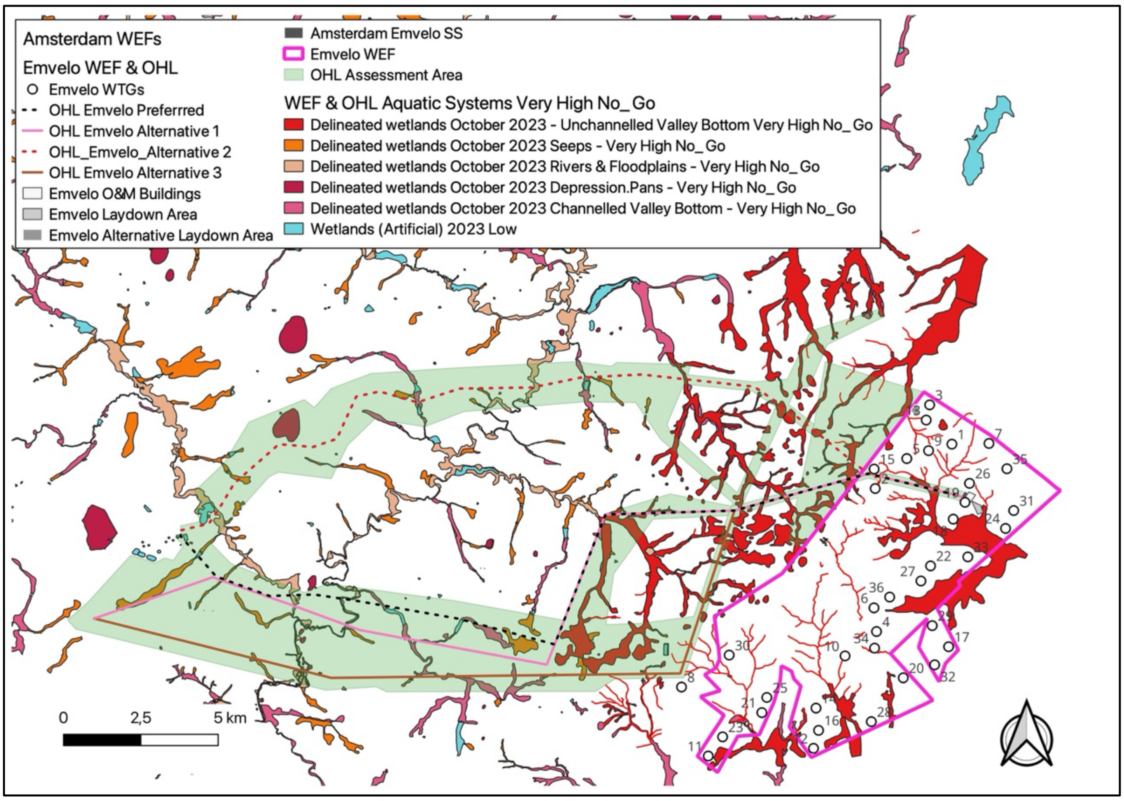

Figure 2. Environmental sensitivity map produced by the aquatic specialist

<u>Motivation of the outcomes of the sensitivity map and key conclusions</u>

In conclusion, the DFFE Screening Tool identified one sensitivity rating within the development footprint, namely, Very High.

Although there is some overlap with the findings on site and the Screening Tool's outcome, the development footprint contains various sensitivities (Very High and Low) that were identified following the undertaking of several site visits and spatial input considerations.

The environmental sensitivity input received from the aquatic ecology specialist will be taken forward and considered within the formal EA process and the impact to these areas assessed. Appropriate layout and development restrictions will be implemented within the development footprint to ensure that the impact to aquatic ecology is deemed acceptable by the aquatic ecologist.

16. Appendix 3: Compliance with the Aquatic Biodiversity Protocol (GN 320, 20 March 2020)

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects: *2.3.1. a description of the aquatic biodiversity and ecosystems on the site, including;* *a) aquatic ecosystem types; and* *b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution, and movement patterns;*	*Section 5 & 6 of this report*
2.3.2. the threat status of the ecosystem and species as identified by the screening tool;	*Section 5 & 6 of this report*
2.3.3. an indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e., if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free -flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area); and	*Section 5 & 6 of this report*
2.3.4. a description of the ecological importance and sensitivity of the aquatic ecosystem including: *a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g., movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and* *b) the historic ecological condition (reference) as well as present ecological state of rivers (in- stream, riparian, and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).*	*Section 5 & 6 of this report*
2.4. The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.	*Section 9 of this report*
2.5. Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions: *2.5.1. Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?* *2.5.2. Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?* *2.5.3. How will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include:* *a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g., suppression of floods, loss of flood attenuation*	*Section 9 of this report*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	*Section where this has been addressed in the Specialist Report*
capacity, unseasonal flooding or destruction of floodplain processes); *b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub -catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns);* *c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g., at the source, upstream or downstream portion, in the temporary I seasonal I permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and* *d) to what extent will the risks associated with water uses and related activities change;*	
2.5.4. how will the proposed development impact on the functioning of the aquatic feature? This must include: *a) base flows (e.g., too little or too much water in terms of characteristics and requirements of the system);* *b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g., seasonal to temporary or permanent; impact of over - abstraction or instream or off stream impoundment of a wetland or river);* *c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g., change from an unchannelled valley-bottom wetland to a channelled valley -bottom wetland);* *d) quality of water (e.g., due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication);* *e) fragmentation (e.g., road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and* *f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g., waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);*	*Section 9 of this report*
2.5.5. how will the proposed development impact on key ecosystems regulating and supporting services especially: *a) flood attenuation;* *b) streamflow regulation;* *c) sediment trapping;* *d) phosphate assimilation;* *e) nitrate assimilation;* *f) toxicant assimilation;* *g) erosion control; and* *h) carbon storage?*	*Section 9 of this report*
2.5.6. how will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator - prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	*Section 9 of this report*
2.6. In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to:	*N/A*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	*Section where this has been addressed in the Specialist Report*
a) size of the estuary; *b) availability of sediment;* *c) wave action in the mouth;* *d) protection of the mouth;* *e) beach slope;* *f) volume of mean annual runoff; and* *g) extent of saline intrusion (especially relevant to permanently open systems).*	
2.7. The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the following information:	*This report*
2.7.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	*Appendix 1*
2.7.2. a signed statement of independence by the specialist;	*Attached to EIA / BAR*
2.7.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	*Section 5 & 6 of this report*
2.7.4. the methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;	*Section 4*
2.7.5. a description of the assumptions made any uncertainties or gaps in knowledge or data;	*Section 1*
2.7.6. the location of areas not suitable for development, which are to be avoided during construction and operation, where relevant;	*Section 8*
2.7.7. additional environmental impacts expected from the proposed development;	*Section 9*
2.7.8. any direct, indirect, and cumulative impacts of the proposed development on site;	*Section 9*
2.7.9. the degree to which impacts, and risks can be mitigated;	*Section 9*
2.7.10. the degree to which the impacts and risks can be reversed;	*Section 9*
2.7.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;	*Section 9*
2.7.12. a suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies;	*Section 4*
2.7.13. proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr);	*Section 10, 11 & 12*
2.7.14. a motivation must be provided if there were development footprints identified as per paragraph 2.4 above that were identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate;	*Section 9*
2.7.15. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	*Section 13*
2.7.16. any conditions to which this statement is subjected.	*Section 11*
2.8. The findings of the Aquatic Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the mitigation	*Yes*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	*Section where this has been addressed in the Specialist Report*
and monitoring measures as identified, that are to be included in the EMPr.	
2.9. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	*Yes*

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Brian Michael Colloty

Registration Number: 400268/07

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule 1 of the Act)

Ecological Science (Professional Natural Scientist)

Effective **7 November 2007** Expires **31 March 2025**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002 Tel: +27 12 399 9000, Fax: +27 86 625 1042

SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for 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)

REPORT TITLE
Mulilo Amsterdam WEFs – Rochdale, Sheepmoor and Emvelo projects

Kindly note the following:

1. This form must always be used for assessment that are in support of 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 August 2023. 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.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the 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 act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Aquatic Biodiversity Assessment – Rochdale WEF Aquatic Biodiversity Assessment – Sheepmoor WEF Aquatic Biodiversity Assessment – Emvelo WEF
Specialist Company Name	EnviroSci (Pty) Ltd
Specialist Name	Dr Brian Colloty
Specialist Identity Number	72122215031083
Specialist Qualifications:	PhD
Professional affiliation/registration:	SACNASP Ecological 400268/07
Physical address:	1 Rossini Rd Pari Park Gqeberha
Postal address:	As above
Postal address	As above
Telephone	083 498 32999
Cell phone	083 498 3299
E-mail	brianc@envirosci.o.za

2. DECLARATION BY THE SPECIALIST

I, Brian Colloty declare that –

- ☐ I act as the independent specialist in this application;
- ☐ I am aware of the procedures and requirements 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 National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- ☐ 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 NEMA Act.

Signature of the Specialist

EnviroSci (Pty) Ltd

Name of Company:

Click or tap to enter a date. 4 10 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Brian Colloty_________, 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

EnviroSci

Name of Company

Click or tap here to enter text. 4 /10/ 2026

Date

Click or tap here to enter text. Kbartman Capt.

Signature of the Commissioner of Oaths K. Bartman

Click or tap to enter a date. 2024.10.04

Date

SOUTH AFRICAN POLICE SERVICE
FIREARMS
2024 -10- 04
WALMER
SOUTH AFRICAN POLICE SERVICE