Savannah Environmental (Pty) Ltd | Directors: KM Jodas, J Thomas, M Matsabu
Company Reg No.: 2006/000127/07
VAT Reg No.: 4780226736

CONSOLIDATED SPECIALIST SITE SENSITIVITY VERIFICATION REPORTS

FE KUDU WIND ENERGY FACILITY NEAR ABERDEEN, DR BEYERS NAUDE LOCAL MUNICIPALITY, EASTERN CAPE PROVINCE
(DFFE REFERENCE: TBA)

A project site[1] consisting of a single affected property, has been identified as the preferred area for the development of the turbines and the associated infrastructure of the FE Kudu Wind Energy Facility. The project site and development area[2] is located on Portion 2 of Farm Oorlogspoort 85.

The identification of the project site and development area was undertaken through a site selection process which included a regional screening process assessing aspects including wind speed, predominant wind direction, grid connection costs, site accessibility, site topography and ecological features. This confirmed the suitability of the development area for a wind energy facility, and provided an upfront understanding of the potential social and environmental challenges which may be present within the project site and surrounding areas.

The project site/development area has an extent of ~9 170ha, which is considered sufficient in extent (allowing sufficient space to avoid any major environmental sensitivities) and suitable from a technical perspective for the development of up to 80 wind turbines with a contracted capacity of up to 600MW. The smaller facility development footprint[3] will be sited within the development area, with an estimated disturbance area of up to 185ha of the development area. The infrastructure associated with the 600MW FE Kudu Wind Energy Facility will include:

Access to the facility will be via an existing (unnamed) gravel road originating off the DR02310 which turns off from the R61 between Beaufort West and Aberdeen. A main access road up to 8m in width will provide access to the facility. It is likely sections of this road will require upgrading and widening to 8m to accommodate the movement of heavy vehicles.

FE Kudu (Pty) Ltd has confirmed that the project site is particularly suitable for wind energy development from a technical perspective due to the strength of the wind speed, predominant wind direction, grid connection costs, site accessibility, site topography and ecological features. The unique features of this site eliminates the possibility of alternatives with similar site conditions. Alternatives are restricted to on-site aspects such as turbine footprints and layouts, roads and related infrastructure option (refer to Chapter 3 for further details). Depending on the final turbine selection, the estimated total contracted capacity for the wind farm is up to 600MW.

[1] The project site is that identified area within which the development area and development footprint are located. It is the broader geographic area assessed as part of the BA process, within which indirect and direct effects of the project may occur. The project site is ~9 170ha in extent. The project site is the entire extent of the property for the wind farm, namely Portion 2 of Farm Oorlogspoort 85.
[2] The development area is that identified area where the 600MW wind energy facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~9 170ha in extent.
[3] The development footprint is the defined area (located within the development area) where the wind farm and other associated infrastructure for the facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

+27 (0)11 656 3237 +27 (0)86 684 0547 info@savannahsa.com www.savannahsa.com
First Floor, Block 2, 5 Woodlands Drive Office Park, Cnr Woodlands Drive & Western Service Road, Woodmead, 2191

SITE SENSITIVITY VERIFICATION METHODOLOGY:

The various site sensitivity verification reports were compiled by the independent specialists appointed for this project and is based on specialist desktop information and field work undertaken as part of the BA process.

SITE SENSITIVITY VERIFICATION:

The table below and reference to specialist assessments serve to:

- Verify land use and sensitivities identified in the screening report; and
- Confirm / contest the need for the various specialist inputs called for in terms of the screening tool report.

Environmental Theme/Specialist Assessment	Sensitivity Rating Identified in Terms of the DFFE Screening Tool	Specialist Input on the Sensitivities Identified in Terms of the DFFE Screening Tool	Verification of Site-Specific Sensitivity and Motivation of the Need for Specialist Investigation
Agricultural Impact Assessment	Screening tool rating: **High** Required an agricultural impact assessment (in accordance with the protocol prescribed in GNR 320).	Verified Sensitivity rating by Specialist: **Low to Medium** The specialist disputes the Sensitivity Rating identified by the DFFE Screening Tool.	The specialist findings showed that most of the infrastructure components of the FE Kudu Wind Energy Facility are located well within areas with Medium Sensitivity. Medium agricultural sensitivity is mainly due to the high land capability of Low-Moderate (Class 07) areas and the depth of the soil which ranged between 0.6 and 1.5m. Low agricultural sensitivity is due to the Low (Class 05) land capability and the absence of any field crop boundaries. Areas shown as having field crops did not show any signs of cultivation during the site visit. The Low Sensitivity areas have shallow effective soil depth, and the arid climate reduces the land capability of the area significantly. Approximately 29 wind turbines are found on Low agricultural sensitivity, while the rest is on Medium agricultural sensitivity. A SSVR is included in **Appendix P5,** and a Soils and Agricultural Potential Impact Assessment is included as **Appendix L** of the Basic Assessment Report.
Landscape/Visual Impact Assessment Shadow Flicker Assessment	Screening tool rating: **Very High** (General Assessment Protocols)	Verified Sensitivity rating by Specialist: **High – Visual** **Medium – Shadow Flicker** The specialist disputes the Sensitivity Rating identified by the DFFE Screening Tool.	The very high sensitivity for landscape in the screening tool is owing to the slope of between 1:4 and 1:10, and mountains/high ridges. Based on the specialist findings, the overall sensitivity of the visual environment for the FE Kudu Wind Facility is disputed and is rated as high due to: » The avoidance of placement of turbines on any mountain tops or ridges » Possible placement of turbines on slopes of between 1:4 and 1:10 » Low occurrence of homesteads within 5km » Low VAC of the receiving environment » The placement of the development within the Beaufort REDZ » Scenic R61 arterial road located more than 3km from the site » Limited existing built infrastructure within the study area Based on the specialist findings, the shadow flicker sensitivity is moderate owing to the single homestead located in the development area, and it is assumed that they are in fact aware of and to a certain extent accepting of the shadow flicker associated with these turbines. No homesteads outside of the development envelope were identified during the preliminary shadow flicker assessment.

			A SSVR is included in **Appendix P8.** A Visual Impact Assessment has been undertaken for the FE Kudu Wind Energy Facility and is included in this BA Report as **Appendix I.**
Archaeological and Cultural Heritage Impact Assessment	Screening tool rating: **Low**	Verified Sensitivity rating by Specialist: **Very High or High** The specialist disputes the Sensitivity Rating identified by the DFFE Screening Tool.	The results of the Heritage Impact Assessment (including archaeology and cultural heritage) in terms of site sensitivity are summarised as follows: » The cultural value of the Karoo Landscape is very high and the location of the proposed development will impact this significance. » Some significant archaeological resources were identified in the development area giving it a high sensitivity. A SSVR is included in **Appendix P6.** A Heritage Impact Assessment (which covers both archaeological and cultural aspects of the development area and development footprint) has been undertaken for the FE Kudu Wind Energy Facility and is included in this Basic Assessment Report as **Appendix H.** The HIA complies with the requirements of the NHRA.
Palaeontology Impact Assessment	Screening tool rating: **Very High**	Verified Sensitivity rating by Specialist: **Very High** The specialist confirms the Sensitivity Rating identified by the DFFE Screening Tool.	The results of the Heritage Impact Assessment (including palaeontology) in terms of site sensitivity are summarised as follows: » No highly significant palaeontological resources were identified within the development area, » However the geology underlying the development area is very sensitive for impacts to significant fossils giving it a very high sensitivity.

			A SSVR is included in **Appendix P6.** A Heritage Impact Assessment (which covers the paleontological aspects of the development area and development footprint) has been undertaken for the FE Kudu Wind Energy Facility and is included in this Basic Assessment Report as **Appendix H.** The HIA complies with the requirements of the NHRA.
Terrestrial Biodiversity Impact Assessment	Screening tool rating: **Very High** Required a terrestrial biodiversity impact assessment (Terrestrial Biodiversity Assessment Protocols)	Verified Sensitivity rating by Specialist: **Medium** The specialist disputes the Sensitivity Rating identified by the DFFE Screening Tool.	The overall combined Terrestrial Biodiversity theme indicates that the majority site consists of Very High sensitivity areas due to the presence of CBA2, ESA1 & ESA2. The site verification confirms that a small portion of the site is designated CBA 2 along the southern boundary with more extensive ESA 1 across the site associated with the alluvial areas and watercourses. Based on the presence of these features within the site, a full terrestrial biodiversity assessment is required. Based on the confirmed habitat and the field surveys, the classification of very high sensitivity for Terrestrial Biodiversity according to the Screening Tool is partially supported, as the verified sensitivity is very high for portions of the site, but fine scale mapping has reduced the overall sensitive area with portions designated medium sensitivity before mitigation. A SSVR is included in **Appendix P1**. A Terrestrial Biodiversity Impact Assessment has been undertaken for the FE Kudu Wind Energy Facility and is included as **Appendix D** of the Basic Assessment Report.
Aquatic Biodiversity Impact Assessment	Screening tool rating: **Very high** Required an Aquatic Biodiversity impact assessment (in accordance with the protocol prescribed in GNR 320, Aquatic Biodiversity Assessment Protocols).	Verified Sensitivity rating by Specialist: **Very high** The specialist confirms the Sensitivity Rating identified by the DFFE Screening Tool.	The baseline assessment investigated the watercourses present within the project site and identified numerous drainage features comprising of an extensive braided watercourse network, presenting ephemeral conditions with scattered vernal pools present within the project site. The non-perennial and ephemeral systems that drain the project area are largely unnamed and form tributaries of the Ouplaas River in the eastern portion of the project area, the 3 unnamed rivers in the middle portion of the project area, the Tulpleegte River in the western portion, and the Kariega River in the southern portion of the project area. Due to the sensitivity of the catchment and soils to erosion, together with the flat topography and braided alluvial fan nature of the watercourses within the project area, an increase in anthropogenic activities poses a risk to the ecological integrity of the watercourses notably from a hydrological perspective. The presence of aquatic macroinvertebrates and vernal biota highlights the sensitivity of the watercourses. Any proposed activities in proximity to the watercourses should not further contribute to the deterioration of the instream and riparian zones as this will compromise the ecological integrity of the reach and Management Class may not be achieved.

			According to the DFFE screening tool the aquatic systems have a very high sensitivity rating. Based on the survey findings, the specialist confirms the Very High aquatic theme sensitivity. A SSVR is included in **Appendix P2**. An Aquatic Impact Assessment has been undertaken for the FE Kudu Wind Energy Facility and is included as **Appendix E** of the Basic Assessment Report.
Avian Impact Assessment	Screening tool rating: **Low** Required an Avian Impact Assessment (in accordance with the protocol prescribed in GNR 320, Avian Biodiversity Assessment Protocols).	Verified Sensitivity rating by Specialist: **High** The specialist disputes the Sensitivity Rating identified by the DFFE Screening Tool.	The DFFE Screening tool classifies the site as having **low** avian sensitivity. However, the Screening Tool identified the animal species theme as having high sensitivity. This is based on the potential presence of the following Red Data (RD) species: » Southern Black Korhaan » Ludwig's Bustard The occurrence of SCC at the Project Site was confirmed during the six pre-construction monitoring surveys (January 2021 to October 2022) with observations of Ludwig's Bustard, Blue Crane (Globally Vulnerable and Regionally Near-threatened), Karoo Korhaan (Regionally Near-threatened), Kori Bustard (Globally and Regionally Near-threatened), Martial Eagle (Globally and Regionally Endangered), Southern Black Korhaan, Sclater's Lark (Globally and Regionally Near-threatened), and Lanner Falcon *Falco* (Regionally Vulnerable) recorded on-site. Based on the confirmed habitat and the field surveys, the classification of Low sensitivity for avifauna according to the Screening Tool is not supported, as sensitive bird species were identified and the sensitivity rating has been increased to High sensitivity. A SSVR is included in **Appendix P3**. An Avifauna Impact Assessment has been undertaken for the FE Kudu Wind Energy Facility and is included as **Appendix F** of the Basic Assessment Report. The assessment has been undertaken in accordance with the requirements of the BirdLife SA Best Practice Guidelines for Wind Developments.
Civil Aviation Assessment	Screening tool rating: **Low**	Verified Sensitivity rating: **Low** The Sensitivity Rating identified by the DFFE Screening Tool is confirmed.	The project site is not located within close proximity of any aerodromes, landing strips or infrastructure. The low rating is supported, and no study is required in this regard. The South African Civil Aviation Authority (SACAA) and Air Traffic Navigation Services (ATNS) will be consulted throughout the Basic Assessment process to obtain input and details of any requirements for further studies.

Defence Assessment	Screening tool rating: **Low**	Verified Sensitivity rating: **Low** The Sensitivity Rating identified by the DFFE Screening Tool is confirmed.	The project site is not located within close proximity of any military base or infrastructure. The low rating is supported, and no study is required in this regard. The South African National Defence Force will be consulted throughout the Basic Assessment process.
RFI Assessment	Screening tool rating: **Low**	Verified Sensitivity rating: **Low** The Sensitivity Rating identified by the DFFE Screening Tool is confirmed.	The project site is located within an area that as classified as having low sensitivity for telecommunication. Telecommunication stakeholders have been requested to provide comment on the proposed development. The low rating is supported, and no study is required in this regard
Social Impact Assessment	The screening report does not indicate a rating for this theme.		A Social Impact Assessment has been undertaken for the FE Kudu Wind Energy Facility and is included in the Basic Assessment Report as **Appendix K.** No SSVR is required for this theme.
Noise Impact Assessment	Screening tool rating: **Very High**	Verified Sensitivity rating by Specialist: **Low** The specialist disputes the Sensitivity Rating identified by the DFFE Screening Tool.	The DFFE Screening tool classifies the site as having Very High Sensitivity due to the potential presence of numerous sensitive noise receptors around the project site. However, there were no potential noise-sensitive receptors located in these areas and the finding of the screening tool is disputed. There is one structure (NSR04) used for residential purposes that was not identified by the screening tool report. During the Noise Impact Assessment, residential areas, and potential noise-sensitive developments/receptors/ communities (NSR) were identified using aerial images as well as a physical site visit, with only one location identified that is used on a temporary basis for residential purposes. According to the specialist the significance of the noise impact is of low sensitivity. A SSVR is included in **Appendix P7**. A Noise Impact Assessment has been undertaken for the FE Kudu Wind Energy Facility and is included in the Basic Assessment Report as **Appendix J.**

Bats Impact Assessment	Screening tool rating: **High**	Verified Sensitivity rating by Specialist: **High** The specialist confirms the Sensitivity Rating identified by the DFFE Screening Tool.	The DFFE Screening tool classifies the site as having high bat sensitivity. This is based on the presence of wetlands and watercourses that can potentially create optimal roosting habitats for sensitive bat species. No confirmed roosts have been identified on site to date. A SSVR is included in **Appendix P4**. A Bat Impact Assessment has been undertaken for the FE Kudu Wind Energy Facility and is included in the Basic Assessment Report as **Appendix I.** This study has been completed in accordance with the South African Best Practise Guidelines for Surveying Bats in Wind Energy Facility Developments.
Traffic Impact Assessment	The screening report does not indicate a rating for this theme.		A Traffic Impact Assessment has been undertaken for the FE Kudu Wind Energy Facility and is included in the Basic Assessment Report as **Appendix M.** No SSVR is required for this theme.
Plant Species Assessment	Screening tool rating: **Medium** Necessitating a plant species assessment (General Assessment Protocols).	Verified Sensitivity by Specialist: **Low** The specialist disputes the Sensitivity Rating identified by the DFFE Screening Tool.	The DFFE Screening Tool indicates that there are potentially several sensitive plant species from the FE Kudu Wind Energy Facility study area, with the result that the majority of the site is mapped as Medium Sensitivity for the Plant Species Theme. Based on site investigations and site sensitivity verification, no flora Species of Conservation Concern, including endemic, or range restricted species, or having an elevated conservation status were found to occur. **No plant species assessment is required**. A SSVR is included in **Appendix P1**. A Terrestrial Biodiversity Impact Assessment has been undertaken for the FE Kudu Wind Energy Facility and is included as **Appendix D** of the Basic Assessment Report.
Animal Species	Screening tool rating: **High** Necessitating an animal species assessment (in accordance with Animal Species Assessment Protocols prescribed in GN 43855)	Verified Sensitivity rating by Specialist: **Low** The specialist disputes the Sensitivity Rating identified by the DFFE Screening Tool.	The DFFE Screening Tool identified the entire site as having a medium and high animal sensitivity theme due to the presence of several bird species of concern. A medium sensitivity was assigned due to the possible presence of the Karoo Padloper, *Chersobius boulengeri*. Given the scarcity and low activity levels of this species, this indicates that it is unlikely to be present. The presence of the Karoo Padloper was not confirmed at the site. The site inspection suggests that it is highly unlikely that this species is present on the site as the low gravel hills present do not contain much rock shelter for this species. In some areas it may occur within plains habitats. However, as this species was not observed, it is considered unlikely that the Karoo Padloper is present. As such, the site is considered low sensitivity for this species. No animal species assessment (in accordance with Animal Species Assessment Protocols prescribed in GN 43855) is required.

			A SSVR is included in **Appendix P1**. A Terrestrial Biodiversity Impact Assessment has been undertaken for the FE Kudu Wind Energy Facility and is included as **Appendix D** of the Basic Assessment Report.

The following site sensitivity verification reports are included in this document:

Appendix P1:	Terrestrial Ecology Site Sensitivity Verification Report
Appendix P2:	Aquatic Ecology Site Sensitivity Verification Report
Appendix P3:	Avifauna Site Sensitivity Verification Report
Appendix P4:	Bats Site Sensitivity Verification Report
Appendix P5:	Soil & Agricultural Potential Site Sensitivity Verification Report
Appendix P6:	Heritage Site Sensitivity Verification Report
Appendix P7:	Noise Site Sensitivity Verification Report
Appendix P8:	Visual Site Sensitivity Verification Report

The specialist studies undertaken for this project are required to comply with either the above Protocols or, alternatively, with the requirements of Appendix 6 of the NEMA EIA Regulations of 2014 (as amended 2017 & 2021).

APPENDIX P1:
TERRESTRIAL ECOLOGY SITE SENSITIVITY VERIFICATION REPORT

Terrestrial Biodiversity Site Sensitivity Verification

FE Kudu Wind Energy Facility (Aberdeen)

Date: 18/09/2023
Version: Draft Report
Author: J. Pote

Terrestrial Biodiversity Site Sensitivity Verification

FE Kudu Wind Energy Facility (Aberdeen)

Compiled by: **Jamie Pote** (Pr. Sci. Nat.)
Postnet Suite 57, Private Bag X13130, Humewood, Port Elizabeth, 6013, South Africa
jamiepote@live.co.za +27 (0)76 888 9890

Compiled for: Savannah Environmental

Date of report: **18/09/2023**

Revised Draft Report

Revisions

Report/Revision Version:	Date:	Approved by:
First Draft	14/08/2023	Jamie Pote
Revisions/Comments		
Final Report		

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1 Site Sensitivity Verification Report

1.1.1 Purpose of Report

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*", as published on 20 March, 2020 in National Gazette, No. 43110 in terms of NEMA (Act 107 of 1998) sections 24(5)(a), (h) and 44, lists protocols and minimum report requirements for environmental impacts on terrestrial biodiversity and provides the criteria for the assessment and reporting of impacts on terrestrial biodiversity for activities requiring environmental authorisation. The assessment and minimum reporting requirements of this protocol are associated with a level of environmental sensitivity identified by the National web based Environmental Screening Tool. Prior to commencing with a specialist assessment, the current use of the land and the environmental sensitivity of the site under consideration, identified by the screening tool, must be confirmed by undertaking a **site sensitivity verification**, which must include the following.

1. The site sensitivity verification must be undertaken by an environmental assessment practitioner or a specialist.
2. The site sensitivity verification must be undertaken through the use of:
    a. a desk top analysis, using satellite imagery.
    b. a preliminary on -site 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.
    b. contains a motivation and evidence 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 Screening Tool was used to generate the potential environmental sensitivity of the site which has then been compared to various online and other databases and information sources in order to verify and confirm the validity of the screening tool findings. This was further supported with on-site observations and analysis of most recent aerial photography.

This terrestrial biodiversity site verification has been undertaken as per 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).

1.1.2 Data sources and references

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 National Biodiversity Assessment (NBA, 2019) – description of vegetation types, species (including endemic) and vegetation unit conservation status.

- National and Regional Legislation including Provincial Nature Conservation Ordinance (P.N.C.O). NEM:BA Threatened or Protected Species (ToPS).
- 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 Protected Areas Expansion Strategy (NPAES, 2018) and South Africa Protected Area database (2020) – protected area information.
- Bioregional Planning: Northwest Biodiversity Sector Plan (2015).
- Critical Biodiversity Areas of the Northern Cape (2016) – 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.

1.1.3 Site visit

A preliminary site verification for screening purposes was conducted between 25 and 28 April 2023. This initial site visit did not include any detailed habitat or species assessments, the purpose being to obtain an overview of the site only and to identify possible risks to the proposed activity and undertake preliminary habitat mapping. A follow up site visit was conducted between 24 & 26 May 2023 in order to supplement the initial findings, undertake further species surveys as well as refine sensitivity mapping.

1.1.4 Assumptions, Uncertainties and Gaps in Knowledge

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

- No assessment has been made of aquatic aspects relating to any wetlands, pans and rivers/seeps and/or estuaries outside of the scope of a terrestrial biodiversity report and have been undertaken by an aquatic specialist.
- No specific faunal assessment has been undertaken, but animals have been assessed in term of the terrestrial Biodiversity Assessment requirements.
- Any flora surveys based upon a limited sampling time-period, may not reflect the actual species composition of the site due to seasonal variations in flowering times.
- As far as possible, site collected data has been supplemented with desktop and database-centred distribution data as well as previous studies undertaken in the area.

1.1.5 Site and Activity Description

The site – Kudu, is situated between **Beaufort West to the north-west and Aberdeen to the south-east, in the Eastern Cape** province, slightly northwest of the R61 district road. The site is situated within a

commercial livestock and game farming area (Refer to Figure 1), generally comprising dryland grazing. The portion assessed is approximately 9 000 Ha in extent. The area falls within a low, predominantly summer rainfall area.

1.1.6 National Environmental Screening Tool

The DFFE National Environmental Screening Tool indicates the following:

- Terrestrial Biodiversity – Very High & Low
- Animal Species – High, Medium, & Low
- Plant Species – Medium & Low
- Aquatic Biodiversity – Very High & Low

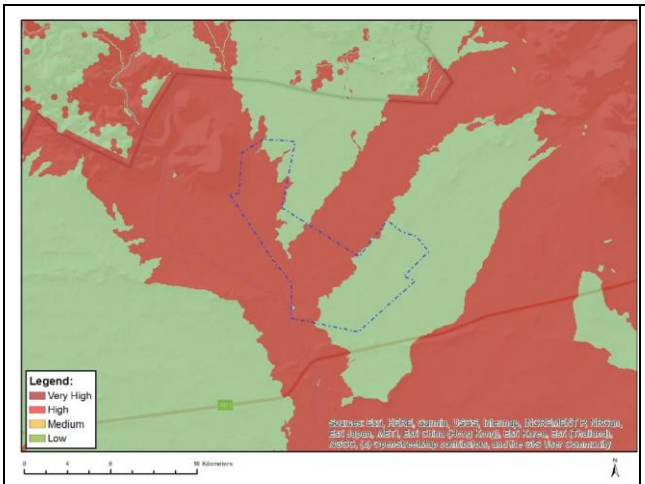

Figure 1: Terrestrial Biodiversity Sensitivity

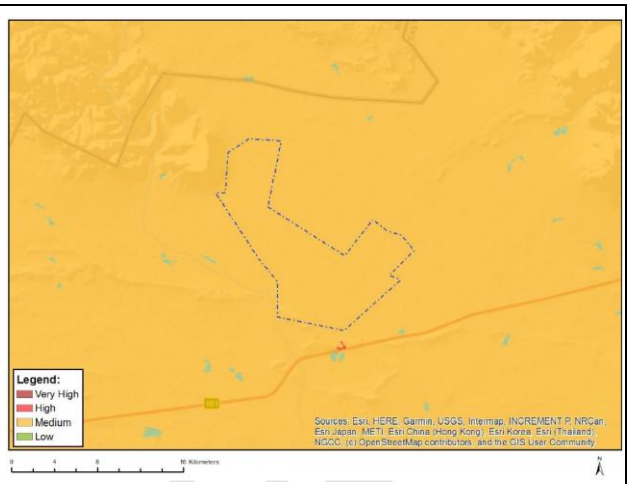

Figure 2: Plant Species Sensitivity

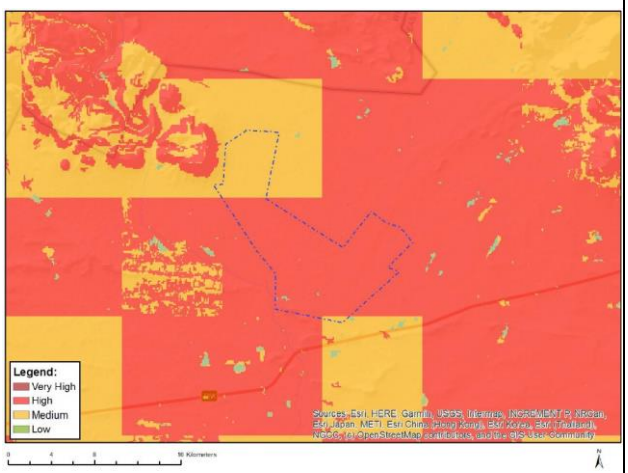

Figure 3: Animal Species Sensitivity

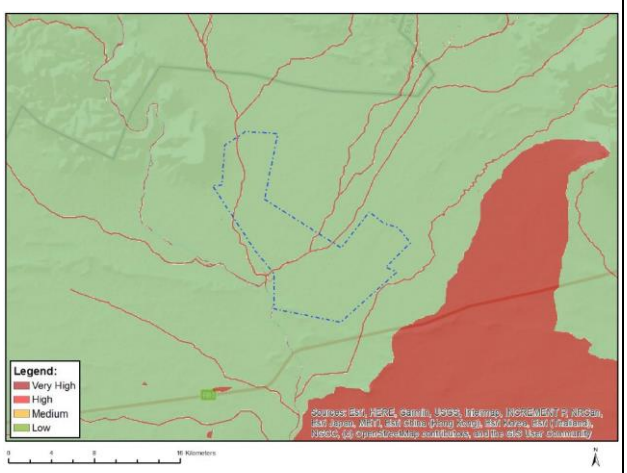

Figure 4: Aquatic Sensitivity

SENSITIVITY	DESCRIPTION - FEATURE(S) IN PROXIMITY
Terrestrial Sensitivity	
Very High	CBA 2, ESA 1 & 2
High	None
Medium	None
Low	Present
Plant Sensitivity	
Very High	None
High	None
Medium	Sensitive species 1212 & 1039, *Peersia frithii, Tridentea virescens, Cliffortia montana*

SENSITIVITY	DESCRIPTION - FEATURE(S) IN PROXIMITY
Low	Present
Animal Sensitivity	
Very High	*None*
High	*Neotis ludwigii, Afrotis afra* (Birds)
Medium	*Neotis ludwigii, Afrotis afra* (Birds) & *Chersobius boulengeri* (reptile)
Low	Present
Aquatic Sensitivity	
Very High	Rivers & Wetlands
High	None
Medium	None
Low	Present

The following is deduced from the DFFE National Environmental Screening Tool:

- As apparent from the National Environmental Screening Tool, the terrestrial biodiversity theme is Very High.
- Several flora (plant) species regarded as being of concern are flagged and will be assessed further in the report, however none were found to be present during the site visit and are furthermore not deemed likely to be present, as the site is outside of the known range.
- Faunal (animal) species regarded as being of concern is flagged. This species is confirmed to not be present, supported by the fact that suitable habitat is not present.
- The aquatic sensitivity is Very High, supported by on site observations. Refer to separate aquatic assessment for specific findings outside the scope of this terrestrial biodiversity assessment.
- The terrestrial flora and fauna impacts are assessed further in the relevant report sections for flora and fauna in the accompanying report.

The site assessment has physically screened for the presence of any species as listed in the National Environmental Screening Tool, as well as other possible species or sensitivities that are not identified in the screening tool. Not all features are directly affected, but being in proximity, the risks associated with the activity will be investigated further and addressed in the report.

1.1.7 Findings, Outcomes and Recommendations

Terrestrial Biodiversity

Site verification of the Terrestrial Biodiversity sensitivities is summarised in *Table 1* and depicted in *Figure 5*. Designated Critical Biodiversity Area 2 and Ecological Support Area 1 does intersect with the site or project area. Rivers and Wetlands are also indicated.

Table 1: Terrestrial Biodiversity Features.

Feature		COMMENT
Critical Biodiversity Area	Present	CBA 2 is present overlapping a portion of the site.
Ecological Support Area	Present	ESA 1 is present overlapping a significant portion of the site.

Plant Species (Flora)

National Environmental Screening Tool flagged a single flora species, which is thought to be extinct. The WEF site does not provide suitable habitat, and none were found to occur along the proposed powerline

route at the time of assessment. Construction of pylons for the powerline is unlikely to pose any risk if it were to be present due to the limited impact and footprint.

Animal Species (Fauna)

A reptile species is listed in the screening tool; however, the preferred habitat for this species is not considered to be abundant within the site. Refer to Avifaunal report regarding bird species.

Aquatic

Wetland and River features are present in the broader area. Refer to Aquatic assessment report regarding aquatic aspects.

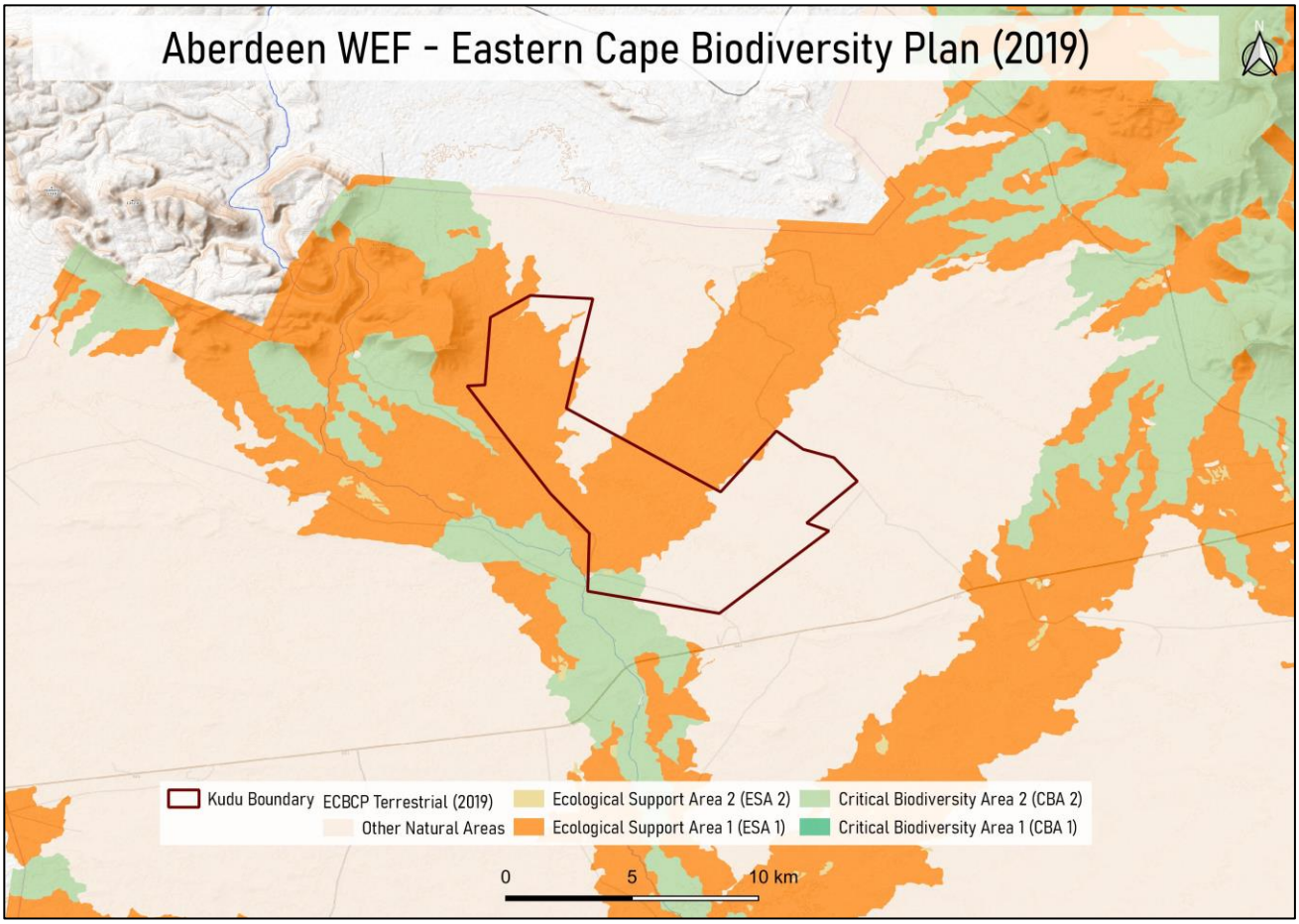

Figure 5: Map indicating Eastern Cape Biodiversity Plan (ECBCP, 2019) and Rivers and Wetlands.

1.1.8 Conclusions

The site verification thus confirms that a portion of the site overlaps with designated terrestrial Critical Biodiversity and Ecological Support Areas, associated with broader landscape level ecological processes and conservation priorities of the affected vegetation units. It further confirms that the listed plant species were not recorded at the time of assessment. Refer to summary in table below.

Feature		COMMENT
Critical Biodiversity Area	Present	ECBCP (2019) designated CBA 2 is present, overlapping a small portion of the site along the southern boundary. This is the norther edge of a

Feature		COMMENT
		larger CBA 2 area situated to the south (downstream) from the site and in a likely less degraded portion of the vegetation unit. The portion of CBA within the site boundary is traversed by the existing gravel road and the small section of proposed access road will likely have a negligible and acceptable loss.
Ecological Support Area	Present	ECBCP (2019) designated ESA 1 is present overlapping a significant portion of the site. The ESA has however been refined in conjunction with the aquatic specialist and designated as aquatic and ecological corridors. The refined corridor more or less aligns with the ECBCP (2019) designated ESA corridors but are narrower and more refined.

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APPENDIX P2:
AQUATIC ECOLOGY SITE SENSITIVITY VERIFICATION REPORT

Aquatic Biodiversity Site Sensitivity Verification Report for the Proposed FE Kudu Wind Energy Facility and Associated Infrastructure

Aberdeen, Eastern Cape Province

Report Date: September 2023

CLIENT

Prepared by:

The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany.com

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1 Introduction

1.1 Background

The Biodiversity Company was appointed by Savannah Environmental (Pty) Ltd (Savannah) to conduct an Aquatic Biodiversity Site Sensitivity Verification (SSV) for the for the proposed FE Kudu Wind Energy Facility (WEF) and associated infrastructure. The SSV is required to confirm the current land use and environmental sensitivity of the proposed project areas as identified by the Department of Forestry; Fisheries and the Environment (DFFE) National Web-Based Environmental Screening Tool. The applicant, FE Kudu (Pty) Ltd, is proposing the development of a wind energy facility and associated infrastructure between Beaufort West to the north-west and Aberdeen to the south-east, in the Eastern Cape Province of South Africa.

This assessment was conducted in accordance with the Environmental Impact Assessment Regulations, 2014 (Government Notice (GN) 326, 7 April 2017) (EIA Regulations) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the Assessment Protocol. The Screening Tool has characterised the aquatic biodiversity sensitivity theme for the Project Area of Influence (PAOI) as "*Very High*" and therefore specialist assessments were completed for the project. A single dry season survey was conducted on the 23rd to the 25th of May 2023 by a qualified freshwater ecologist.

This report, after taking into consideration the findings and recommendations provided by the specialists herein, should inform and guide the Environmental Assessment Practitioner, enabling informed decision making as to the ecological viability of the proposed project and to provide an opinion on the whether any Environmental Authorisation (EA) process or licensing is required for the project.

1.2 Project Area and Description

The project is located approximately 40 km west of Aberdeen in the Eastern Cape Province (Figure 1-1). The project is located within the Dr Beyers Naude Local Municipality and the greater Sarah Baartman District Municipality. The project site comprises a single affected property, Portion 2 of Farm Oorlogspoort 85. The project is known as the FE Kudu Wind Energy Facility. The project is planned as part of a cluster of renewable energy projects, which includes a second facility, FE Tango Wind Energy Facility, located approximately 20 km to the east of the site.

The entire extent of the site falls within the Beaufort West Renewable Energy Development Zones (i.e. REDZ Focus Area 11). The undertaking of a basic assessment process for the project is in-line with the requirements stated in GNR 114 of 16 February 2018.

The Kudu Wind Energy Facility will have a contracted capacity of up to 600 MW and comprise wind turbines with a capacity of up to 7.5 MW each. The project has a preferred project site of approximately ~9 170ha. Access to the site will be via an existing road off of the nearby R61. The FE Kudu Wind Energy Facility project site is proposed to accommodate the following infrastructure:

- Up to 60 wind turbines, turbine foundations and turbine hardstands.
- An on-site substation hub incorporating:

  - A132 kV on-site facility substation (OSS);
  - Switchyard with collector infrastructure;
  - Battery Energy Storage System (BESS); and
  - Operation and Maintenance buildings.
- A balance of plant area incorporating:
  - Temporary laydown areas; and
  - A construction camp laydown and temporary concrete batching plant.
- Power lines internal to the wind farm, trenched and located adjacent to internal access roads, where feasible. The intention is for internal project cabling to follow the internal roads.
- Access roads (gravel) to the site and between project components with a width up to 8 m for primary access routes.

A technically viable development footprint was proposed by the developer and assessed as part of the studies.

The details of the project is as follows:

Project Name	**FE Kudu Wind Energy Facility**
Location	Portion 2 of Farm Oorlogspoort 85
Applicant	FE Kudu (Pty) Ltd
Contracted capacity	Up to 600 MW (turbines up to 7.5 MW in capacity)
Number of turbines	Up to 80 turbines[1]
Turbine hub height	Up to 164 m
Turbine top tip height	Up to 250 m
Rotor swept area	up to 21 m^2
Capacity of on-site substation	132 kV
Area occupied by the on-site substation	~ 2 ha in extent
Underground cabling	Underground cabling, with a capacity of 33 kV, will be installed to connect the turbines to the on-site facility substation.
Battery Energy Storage System (BESS)	Solid state battery technology (e.g. Lithium-ion technology) as a preferred technology. BESS will be housed in containers approximately 20 m long, 3 m wide, and 5 m high with an approximate footprint of up to 5 ha.
Operation and maintenance (O&M) buildings	~ 1ha in extent
Balance of plant area	Temporary laydown areas with an extent up to 6 ha. Temporary warehouse of 1 ha Temporary site camp establishment and concrete batching plants of 1 ha.
Access and internal roads – Main road	Main access road to the site and between project components with a width up to 8 m and a servitude of 13.5 m.
Access and internal roads – internal network	Road network between project components with a width up to 8 m
Turbine hardstand footprint	~up to 7500 m^2 per turbine
Turbine foundation footprint	~ 1000 m^2 per turbine

[1] 42 north turbines, and 41 south turbines

The project is intended to provide electricity to the national grid through the Department of Mineral Resource and Energy's (DMRE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme or other public or private off-taker programmes.

The proposed project will require clearing of natural vegetation for the construction of the WEF, and the associated infrastructure which includes access roads, turbines and grid connections (substation, BESS and cabling), as well as any construction areas and laydown areas. These project aspects could potentially have negative impacts to the freshwater ecosystems and associated biota.

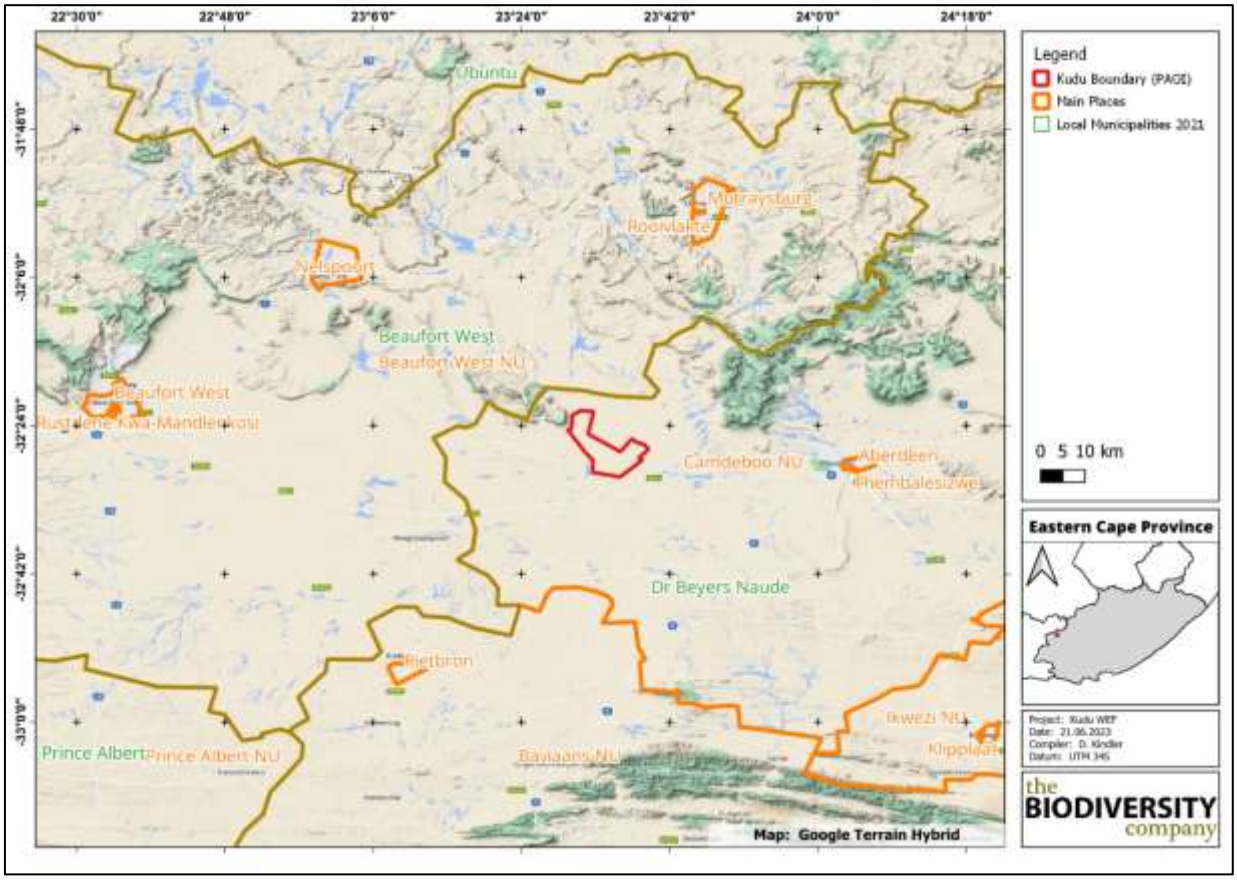


Figure 1-1 Locality of the project area

The farm boundary was used as the Project Area of Influence (PAOI) to incorporate the proposed development footprint and represents the total project area of assessment. A map illustrating the proposed project infrastructure and PAOI is presented on the next page in Figure 1-2. The proposed project infrastructure presents the optimized layout (August 2023) which planned to avoid sensitive aquatic and terrestrial features following specialist feedback following the respective studies May 2023 site investigations.

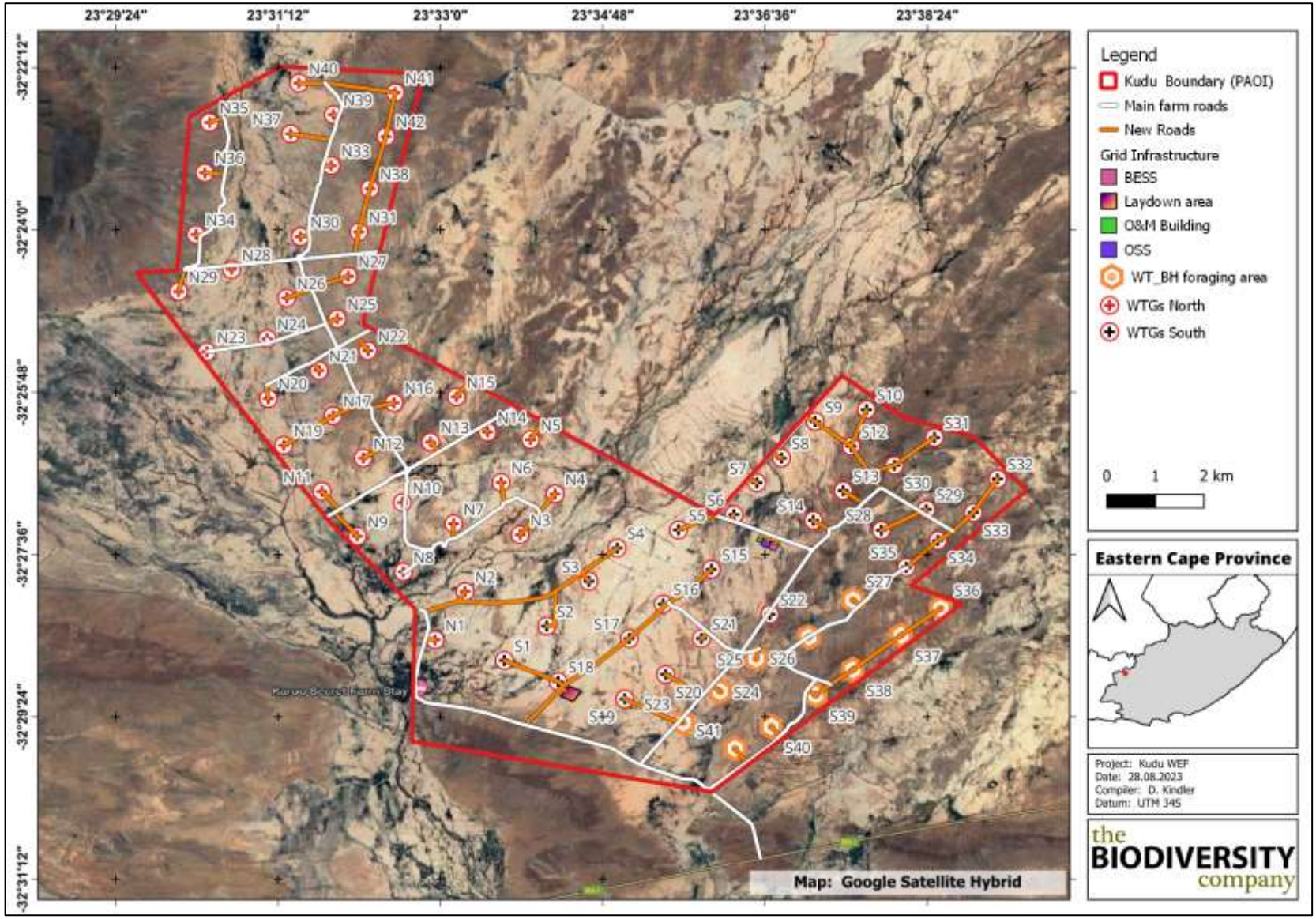


Figure 1-2 Spatial layout of the proposed project infrastructure (Optimized)

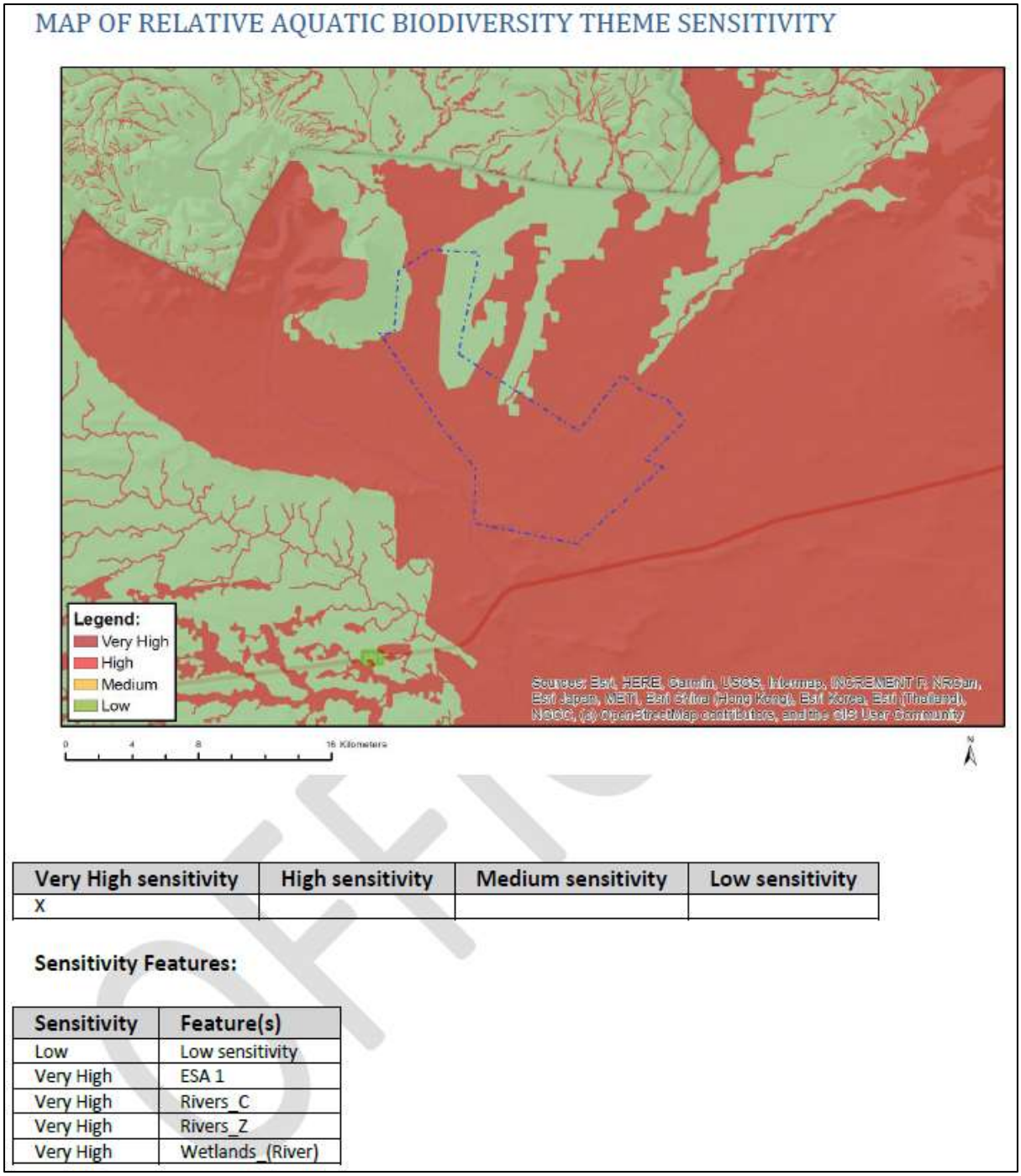
1.3 Specialist Details

Report Name	**Aquatic Biodiversity Site Sensitivity Verification Report for the Proposed FE Kudu Wind Energy Facility and Associated Infrastructure**
Submitted to	savannah environmental
Survey Date	23-25 May 2023
Fieldwork Surveyor & Report Writer	**Dale Kindler** dale@thebiodiversitycompany.com  Dale Kindler (MSc Aquatic Health) is a registered Professional Natural Scientist (Pr. Sci. Nat. 114743). He has 10 years' experience in conducting Aquatic Specialist Assessments and is SASS 5 Accredited with the Department of Water and Sanitation (DWS). Dale has completed numerous specialist studies locally and internationally, ranging from Basic Assessments (BA) to Environmental Impact Assessments (EIAs), following IFC standards.
Reviewer	**Prasheen Singh** prasheen@thebiodiversitycompany.com  Prasheen Singh (MSc in Aquatic Health) is a registered Professional Scientist in the field of Aquatic Science (Pr. Sci. Nat. 116822) and he is a accredited SASS5 Practitioner. He is an Aquatic Ecologist whose 10 years' experience comprises numerous Aquatic Scientific Studies, Peer Reviews, Research, and having served as a SANAS accredited Technical Signatory at an Ecotoxicology Laboratory. Over and above his qiualification he has completed training courses for wetlands, river eco-status monitoring, hydropedology, and ecosystem restoration.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the EIA Regulations, 2014 (as amended). We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principles of science.

2 Site Sensitivity Verification

2.1 Environmental Screening Tool

This approach has also taken cognisance of the recently published Minimum Criteria for Reporting on Identified Environmental Themes (DWS, 2020). The aquatic biodiversity theme sensitivity as indicated in the screening tool report indicates "Very High" sensitivity areas as presented in Figure 2-1.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity
Very High	ESA 1
Very High	Rivers_C
Very High	Rivers_Z
Very High	Wetlands_(River)

Figure 2-1 Aquatic Biodiversity Combined Sensitivity (National Web based Environmental Screening Tool)

2.2 Site General Habitat Description

2.2.1 Ecologically Important Landscape Features

The following spatial features describes the general area and associated freshwater resources (ecologically important landscape features). This assessment is based on spatial data that are provided by various sources such as the provincial environmental authority and the South African National Biodiversity Institute (SANBI). The desktop analysis and their relevance to this project are listed in Table 2-1.

Table 2-1 Summary of the proposed project to ecologically important landscape features

Desktop Information Considered	Features	Section
Powerline Corridor	**Relevant** – The PAOI falls within the Eastern corridor	-
Renewable Energy Development Zones (REDZ)	**Relevant** – The PAOI falls within the Beaufort West REDZ.	-
Strategic Water Source Areas (SWSA)	**Irrelevant** – PAOI is not located within the surface water or groundwater SWSAs	2.2.4
NFEPA Rivers	**Relevant** – NFEPA features located in PAOI	2.2.5
Conservation Plan	**Relevant** – Overlaps with Ecological Support Areas and Other Natural Areas	0
Ecosystem Threat Status	**Relevant** – Overlaps with the *Least Threatened* non-perennial river ecosystems	2.2.7
Ecosystem Protection Level	**Relevant** – Overlaps with poorly protected non-perennial river ecosystems	2.2.8
Protected Areas	**Relevant** – The PAOI does not occur or influence any protected areas.	

2.2.2 Hydrological Setting

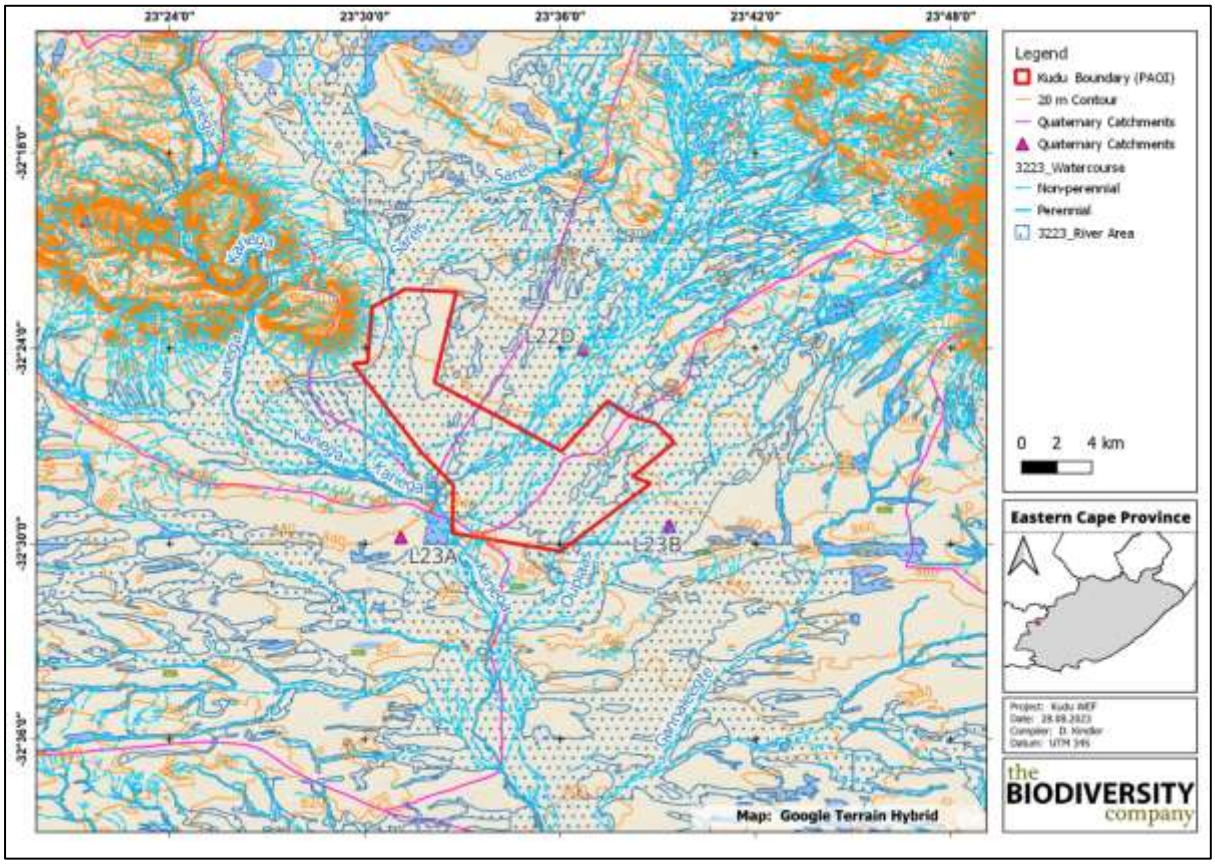


Figure 2-2 Hydrological setting associated with the project area

As presented in Figure 2-2, the project area is drained by several ephemeral and non-perennial watercourses, which falls within the L22C, L22D, L23A and L23B quaternary catchments (sub-catchments), and the larger Mzimvubu-Tsitsikama Water Management Area (WMA 7 - NWA, 2016). The non-perennial and ephemeral systems that drain the PAOI are largely unnamed and form tributaries of the Ouplaas River in the eastern portion of the PAOI, the 3 unnamed rivers in the middle portion of the PAOI, the Tulpleegte River in the western portion, and the Kariega River in the southern portion of the PAOI. The river systems draining the PAOI flows in a southerly direction into the Kariega River at the quaternary catchment

boundary south of the project area. The Kariega River falls within the upper reaches of the Gamtoos drainage basin, which drains into the Indian Ocean.

2.2.3 Freshwater Ecological Setting

The study area is located across a single Freshwater Ecoregion, the Karoo (Ecoregion ID: 573 - Figure 2-3), with the rivers draining either directly into the Indian Ocean (e.g. Gamtoos River) The succulent Karoo is separated from the Nama Karoo by the Bokkeveldberg Mountains. The aquatic fauna of the Karoo Freshwater Ecoregion, in comparison to northern African river systems is depauperate with a southern temperate (Cape) ichthyofauna (Abel *et al.,* 2008). Dry for most of the year (Barnes, 1998b), riverbeds in the Nama Karoo descend sharply from escarpments to meander across the flat plains of the Central Plateau. Lined by belts of riverine *Vachellia karroo* thicket, the riverbeds create a network of riparian habitats that extends across the landscape (Barnes, 1998b). Other riparian species include *Tamarix usneoides* and *Euclea, Ozoroa*, and *Acacia shrubs* (Barnes & Anderson, 1998). Notable aquatic ecology in these basins include the several endemic Cyprinid species. According to the expected fish species list, a total of 3 indigenous species are expected within the Kariega River system, with fewer species expected within the associated tributaries based on species habitat requirements. The species assemblage expected within the study area are typically widely distributed over a large geographic range.

The study area falls within the Great Karoo Level 1 aquatic ecoregion [Kleynhans, Thirion and Moolman (2005)]. The arid ecoregion is characterised by plains with moderate to low relief.

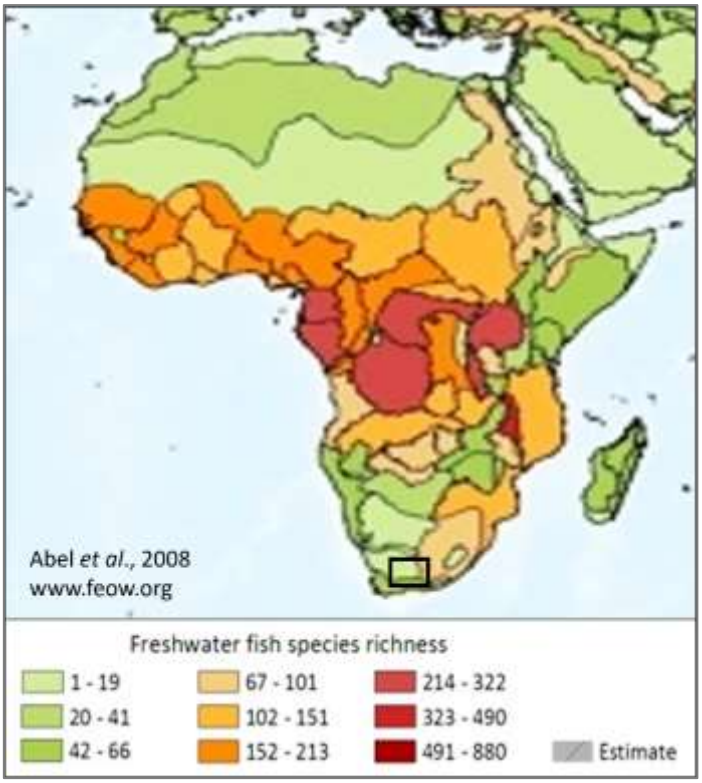


Figure 2-3 Freshwater Ecoregions of the World (Abell et al., 2008)

2.2.4 Strategic Water Source Areas

Strategic Water Source Areas (SWSAs) are areas that supply a disproportionate amount of mean annual runoff to a geographical region of interest. The areas supplying ≥ 50% of South

Africa's water supply (which were represented by areas with a mean annual runoff of ≥ 135 mm/ year) represent national Strategic Water Source Areas (SANBI, 2013). According to Le Maitre (2018), ''SWSAs are defined as areas of land that either: (a) supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or (b) have high groundwater recharge and where the groundwater forms a nationally important resource; or (c) areas that meet both criteria (a) and (b). They include transboundary Water Source Areas that extend into Lesotho and Swaziland. According to Lötter and Le Maitre (2021), the 2018 SWSAs data set for surface water was identified based on a generalised 1.7 x 1.7 km resolution Mean Annual Runoff dataset, while the 2021 data set was delineated at a finer resolution of 90 x 90 m. The purpose of the update was to refine the spatial resolution such that SWSAs can be reliably integrated into a range of catchment- and local-level planning, management and regulatory processes.

According to the SWSAs of South Africa, Lesotho and Swaziland, the project area is not located within the surface water or groundwater SWSAs (Figure 2-4). Therefore, the proposed WEF is unlikely to have any significant impact to downstream water resources.

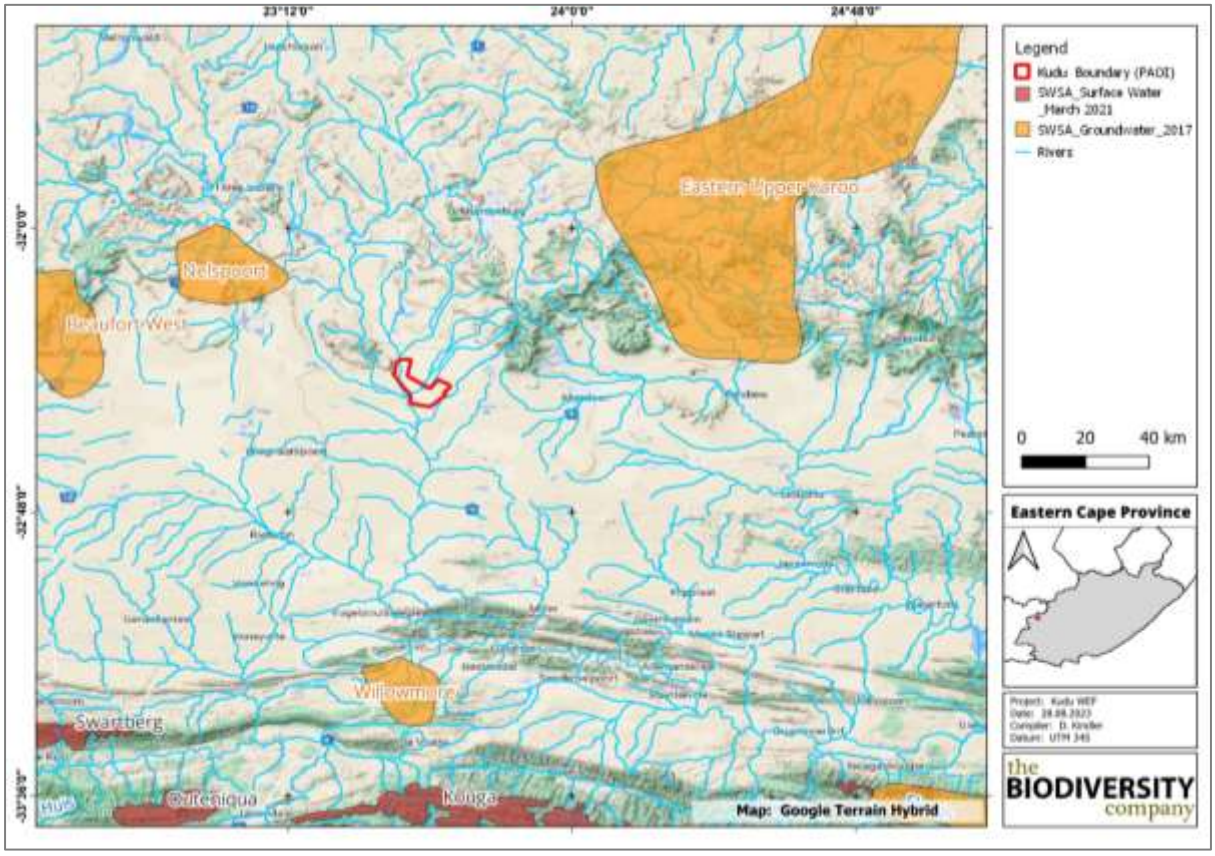


Figure 2-4 The project area in relation to the SWSA's

2.2.5 National Freshwater Ecosystem Priority Areas (NFEPA)

The National Freshwater Ecosystem Priority Areas (NFEPA) database forms part of a comprehensive approach to the sustainable and equitable development of South Africa's scarce water resources. This database provides guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the National Water Act (Act 36 of 1998). This directly applies to the National Water Act, which feeds into Catchment Management Strategies, water

resource classification, reserve determination, and the setting and monitoring of resource quality objectives (Nel *et al.,* 2011). The NFEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's biodiversity goals (NEM:BA) (Act 10 of 2004), informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act (Nel *et al*., 2011). In an attempt to better conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e. ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver *et al*., 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEM:BA) biodiversity goals (Nel *et al.,* 2011).

The project area is located across six Sub-Quaternary Reaches (SQRs) that have NFEPA status assigned to these catchments (Table 2-2). The Ouplaas River SQR L23B-7249 in the eastern portion of the PAOI, the 3 unnamed SQRs L22D-7392, L22D-7471 and L22D-7545 in the middle portion of the PAOI, and the Tulpleegte SQR L22C-7367 in the western portion of the PAOI all form an *upstream management areas.* The Kariega River SQR L22D-7550 in the southern portion of the PAOI forms a *Fish Corridor catchment*. The Kariega, Tulpleegte Ouplaas rivers and the unnamed rivers are NFEPA rivers, which flow into the downstream Kariega River, a listed NFEPA River serving as a *Fish Sanctuary Area* (Figure 2-5). Several wetland FEPA's are present in the PAOI (Table 2-2 and Figure 2-6).

Conserving the water quality, riverine and wetland habitat and associated ecological functioning within the project area and associated catchments, will aid in the protection of riverine habitat supporting fish species occurring within the entire catchment and water quality for the aquatic and terrestrial biota downstream of the project area (lower reaches of the associated watercourses and the Kariega River). The Kariega River serves as a *Fish Sanctuary Area* for threatened fish species such as Smallscale Redfin (*Pseudobarbus asper*). *Pseudobarbus asper* are listed as **Vulnerable**, showing population declines from anthropogenic activities within the watercourses and associated catchment areas, which includes predation impacts from invasive fish species (Jordaan and Chakona, 2018). The catchments in which human activities occur need to be managed to maintain water quality and prevent further degradation of local and downstream water resources in order to contribute to national biodiversity goals and support sustainable use of water resources.

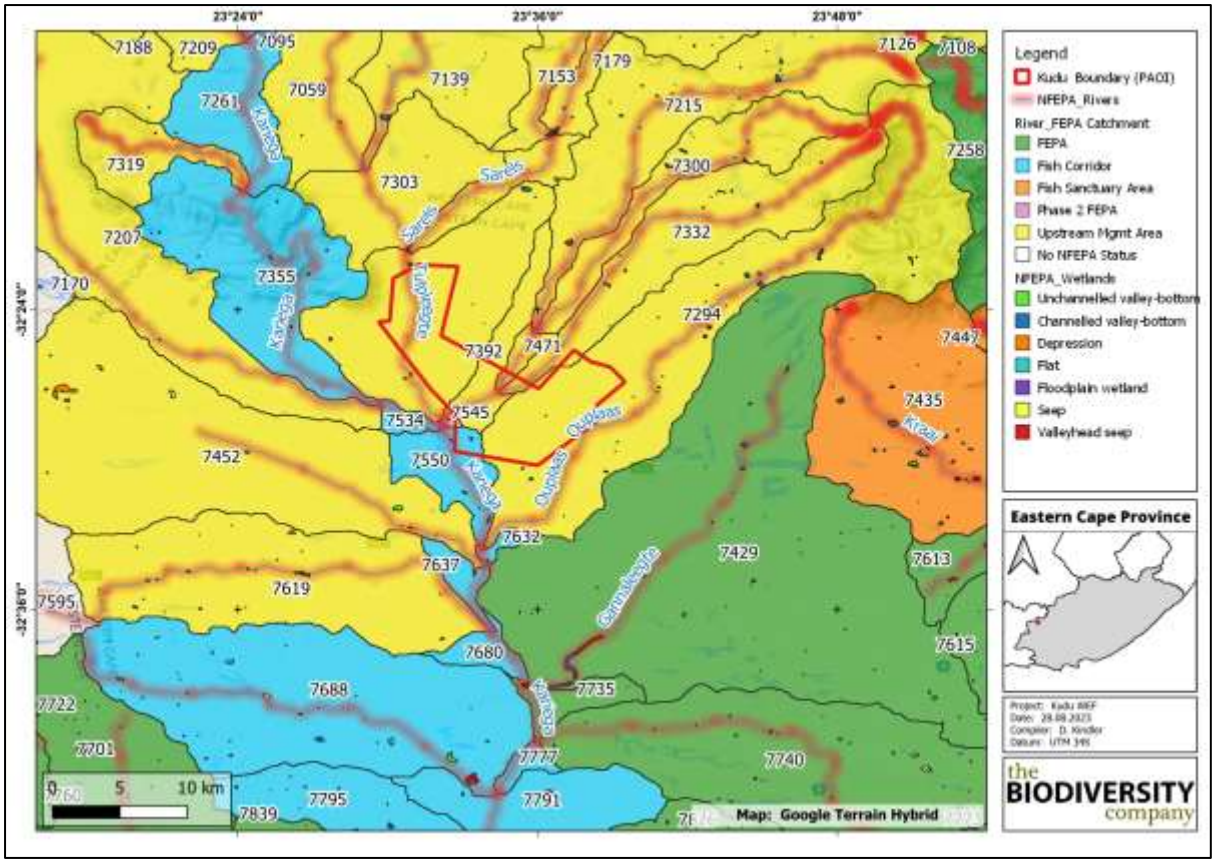


Figure 2-5 Aquatic FEPAs associated with the project area (Nel et al., 2011)

Table 2-2 NFEPAs listed for the project area

Type of FEPA map category	Biodiversity features
Tulpleegte SQR L22C-7367	
No listed features	
Unnamed SQR L22D-7392	
No listed features	
Ouplaas SQR L23B-7249	
No listed features	
Unnamed SQR L22D-7471	
No listed features	
Unnamed SQR L22D-7332	
FEPA: Wetland ecosystem type	Lower Nama Karoo_Channelled valley-bottom wetland
FEPA: Wetland ecosystem type	Lower Nama Karoo_Unchannelled valley-bottom wetland
Kariega SQR L22D-7550	
Fish Support Area: Fish sp	*Enteromius anoplus*
Fish Support Area: Fish sp	*Pseudobarbus asper*
Gannaleegte SQR L23B-7429	
FEPA: River ecosystem type	Ephemeral - Great Karoo - Lower foothill
FEPA: River ecosystem type	Ephemeral - Great Karoo - Lowland river

Type of FEPA map category	Biodiversity features
FEPA: River ecosystem type	Ephemeral - Great Karoo - Upper foothill
FEPA: Wetland ecosystem type	Lower Nama Karoo_Flat
FEPA: Wetland ecosystem type	Lower Nama Karoo_Floodplain wetland
FEPA: Wetland ecosystem type	Lower Nama Karoo_Unchannelled valley-bottom wetland
FEPA: Wetland ecosystem type	Lower Nama Karoo_Valleyhead seep

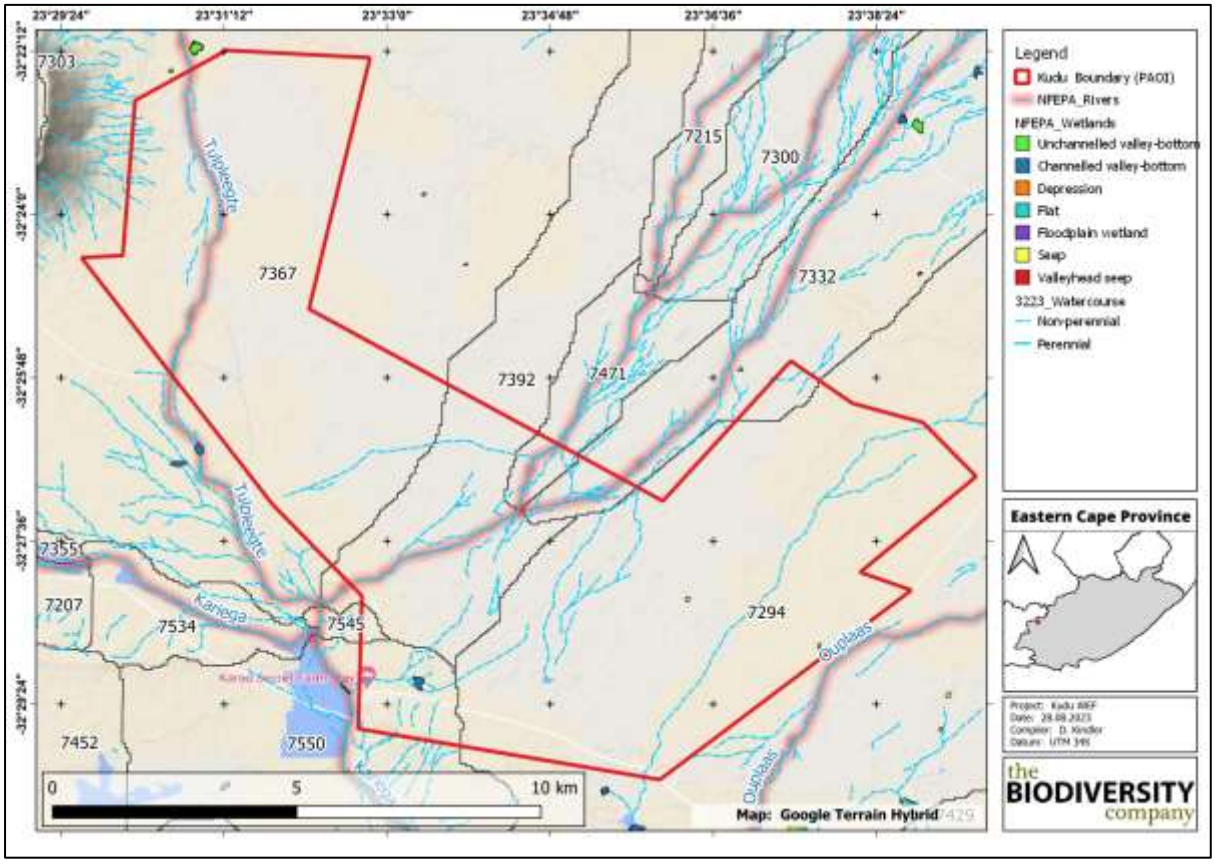


Figure 2-6 Wetland FEPAs associated with the project area (Nel et al., 2011)

2.2.6 Freshwater Critical Biodiversity Area and Ecological Support Areas

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species (MTPA, 2014). Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI, 2017). Ecological Support Areas (ESA) are the areas of land that are adjacent to and can envelope CBAs. These areas are not essential for achieving biodiversity targets, but they play a vital role in supporting the ecological functioning of adjacent CBAs and/or in delivering ecosystem services. Other natural Areas (ONA) are all remaining natural areas not included in the above CBA or ESA categories. No desired state or management objective is provided for ONA's.

Figure 2-7 shows the project area superimposed on the freshwater CBA map. The project overlaps with an ESA1 which is associated with the watercourses, while portions of the PAOI overlap with ONA's. The infrastructure does not overlap with CBAs.

For areas classified as ESA1, the following ECBCP (2019) objectives apply:

- These areas are not required to meet biodiversity targets, but they still perform essential roles in terms of connectivity, ecosystem service delivery and climate change resilience.
- These systems may varying in condition and maintaining function is the main objective, therefore:
    - Ecosystems still in natural, near natural state should be maintained.
    - Ecosystems that are moderately disturbed/degraded should be restored.

The nature of the development, i.e., a WEF development comprising wind turbines and associated servitude infrastructure (roads and powerlines), will lead to modification of the ESAs and consequently, the footprint area will no longer be congruent with ESAs. The ECBCP (2019) states that road land uses are not consistent with the land management objectives of CBAs and ESAs. In cases where technical options are limited, these activities may only take place in CBAs and ESAs under specific conditions of authorisation and contingent on biodiversity offsets. Therefore, the transportation network must avoid impacts (direct or indirect) on ESAs, especially connectivity of the landscape and local corridors. Considering that turbines are a greater risk to birds and bats, than aquatic biota, expert studies for terrestrial biodiversity will be required where these are earmarked within ESAs. To maintain ecosystem functioning, the proposed turbine footprints must avoid ESA's notably where they intersect aquatic features. The Optimized Layout has largely avoided the ESAs and associated aquatic features and are deemed acceptable and appropriately placed, with limited influence of ESAs.

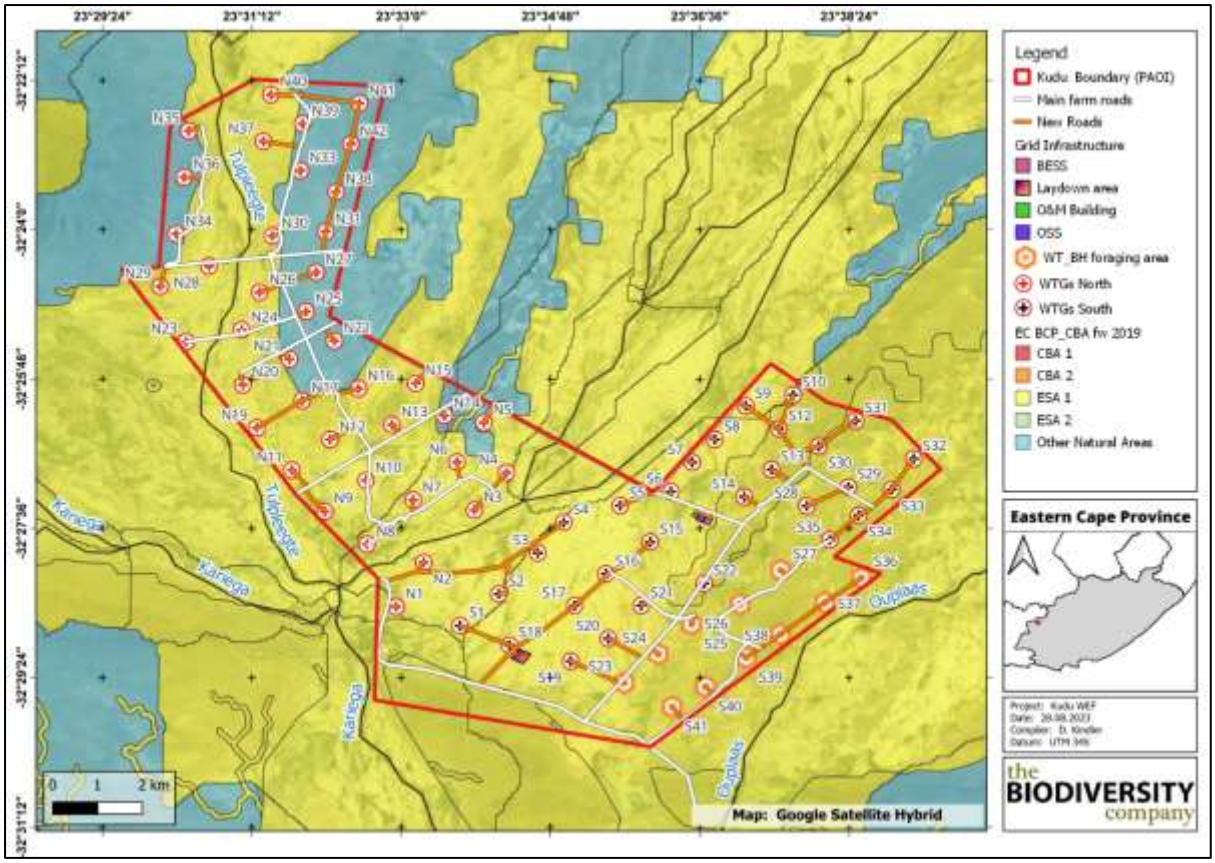


Figure 2-7 Illustration of the Critical Biodiversity Areas within the project area

2.2.7 Aquatic Ecosystem Threat Status

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was released with the National Biodiversity Assessment (NBA) (Van Deventer *et al.,* 2018). The Ecosystem threat status of river and wetland ecosystem outlines the degree to which the ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Van Deventer et al., 2019). Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), based on the proportion of each ecosystem type that remains in good ecological condition (Van Deventer *et al*., 2019). The Ecosystem Threat Status (ETS) of each river assessed was based on the extent to which the system had been modified from its natural condition (SANBI, 2022). According to the SAIIAE dataset, the project area is drained by the interconnected *Least Threatened* Ouplaas, Tulpleegte and Kariega rivers and unnamed tributaries (Figure 2-8 and Figure 2-2).

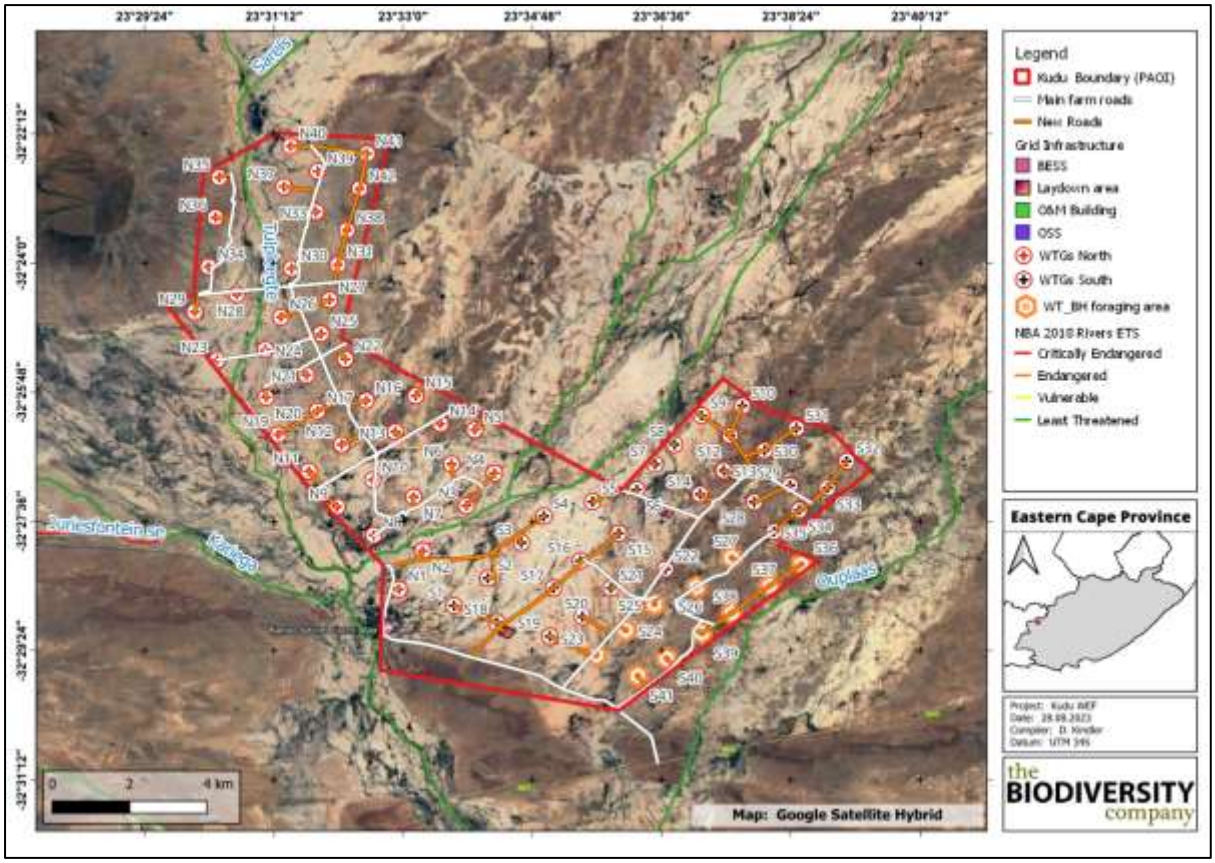


Figure 2-8 Illustration of the Ecosystem Threat Status of the project area (NBA, 2018)

2.2.8 Aquatic Ecosystem Protection Level

Ecosystem protection level indicates whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Van Deventer *et al.,* 2018). The Ecosystem Protection Level (EPL) of each river assessed was based on the extent (expressed as a percentage) to which the system has their biodiversity target located within protected areas and are in a natural or near-natural ecological condition. Rivers in protected areas need to be in good condition (A or B ecological category) to be considered as protected. Well protected rivers have 100% of their biodiversity target located within protected areas, while moderately protected and poorly protected river ecosystem types have at least 50% and 5% of their biodiversity target in protected areas, respectively. Not protected rivers form less than 5% (SANBI, 2022). The project area was superimposed on the ecosystem protection level map to assess the protection status of aquatic ecosystems associated with the project (Figure 2-9). This indicates that the aquatic ecosystems associated with the project area are all rated as *Poorly Protected*. This highlights the need to limit project related impacts to the watercourses and associated ephemeral drainage network through the implementation of avoidance strategies together with ongoing and adaptive mitigation.

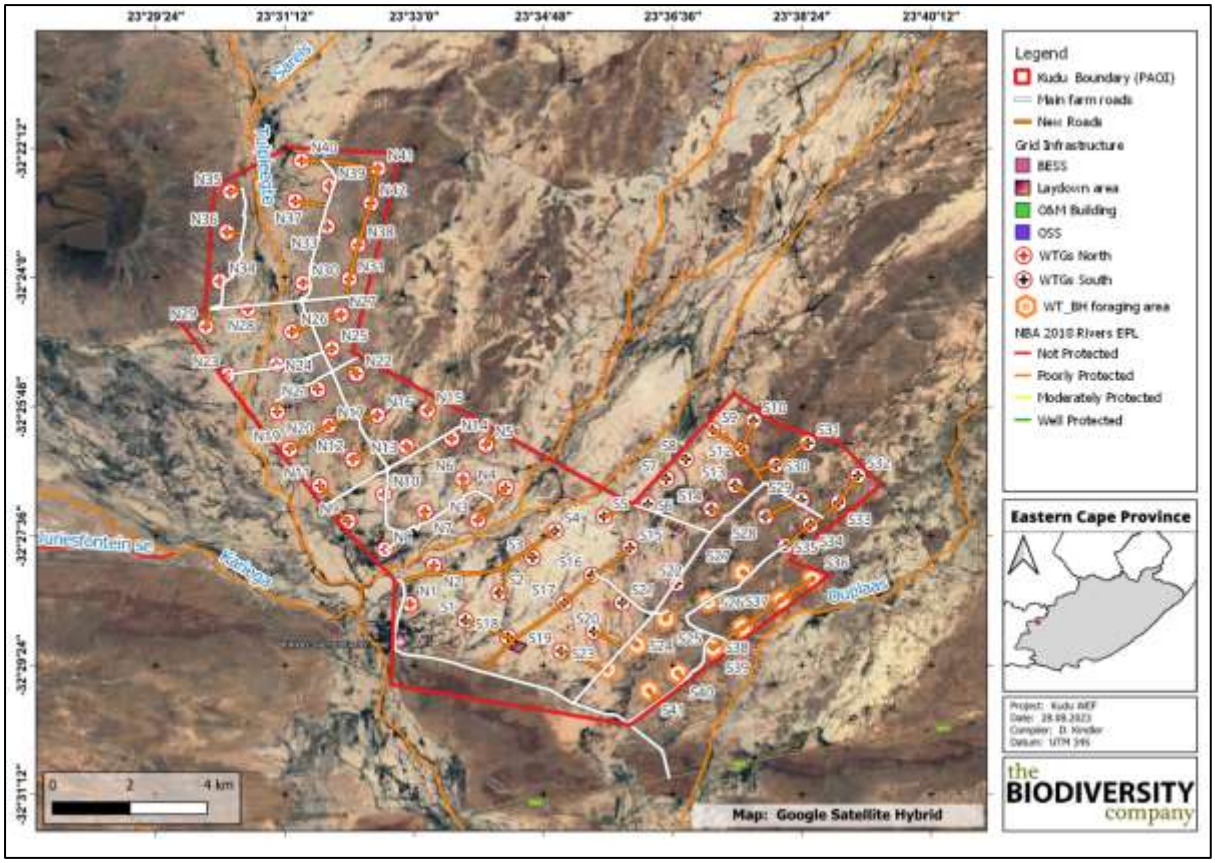


Figure 2-9 Illustration of the Ecosystem Protection Level of the project area (NBA, 2018)

2.2.9 National Wetland Map 5

The National Wetland Map 5 (NWM5) spatial data was published in October 2019 (Van Deventer *et al*. 2019), in collaboration with the SANBI, with the specific aim of spatially representing the location, type and extent of wetlands in South Africa. The data represents a synthesis of a wide number of official watercourse data, including rivers, inland wetlands and estuaries. This database does recognise the presence of freshwater features within the extent of the project area, however these features are rivers as presented in Figure 2-10 and is associated with the Kariega and Tulpleegte rivers.

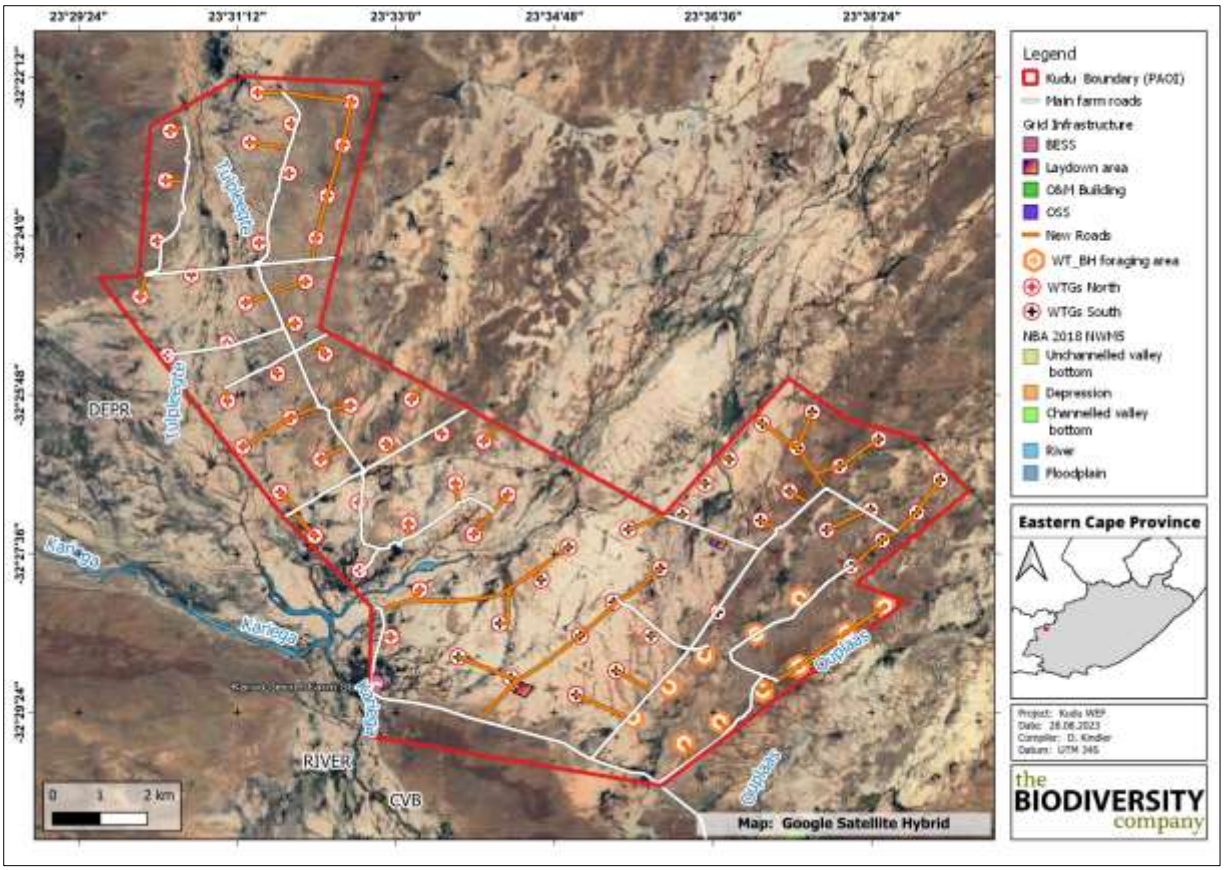


Figure 2-10 Map illustrating the NWM5 for the project area

2.2.10 Desktop Status of Watercourses

The desktop DWS (2014) listed Present Ecological Status (PES) of the watercourses' catchments in relation to the project area are illustrated in Figure 2-11. The watercourses have been assigned desktop PES. The watercourses are all ecologically interlinked and are currently affected by various land use activities such as agriculture and need to be managed to prevent degradation of the catchment condition, water quality and ecological integrity of the downslope watercourses. Catchment mismanagement within a SQR is well documented to degrade its catchment and associated watercourses due to damaged ecological drivers. A summary of the PES, stream orders, and Ecological Importance (EI) and Ecological Sensitivity (ES) for the relevant SQRs are presented in Table 2-3.

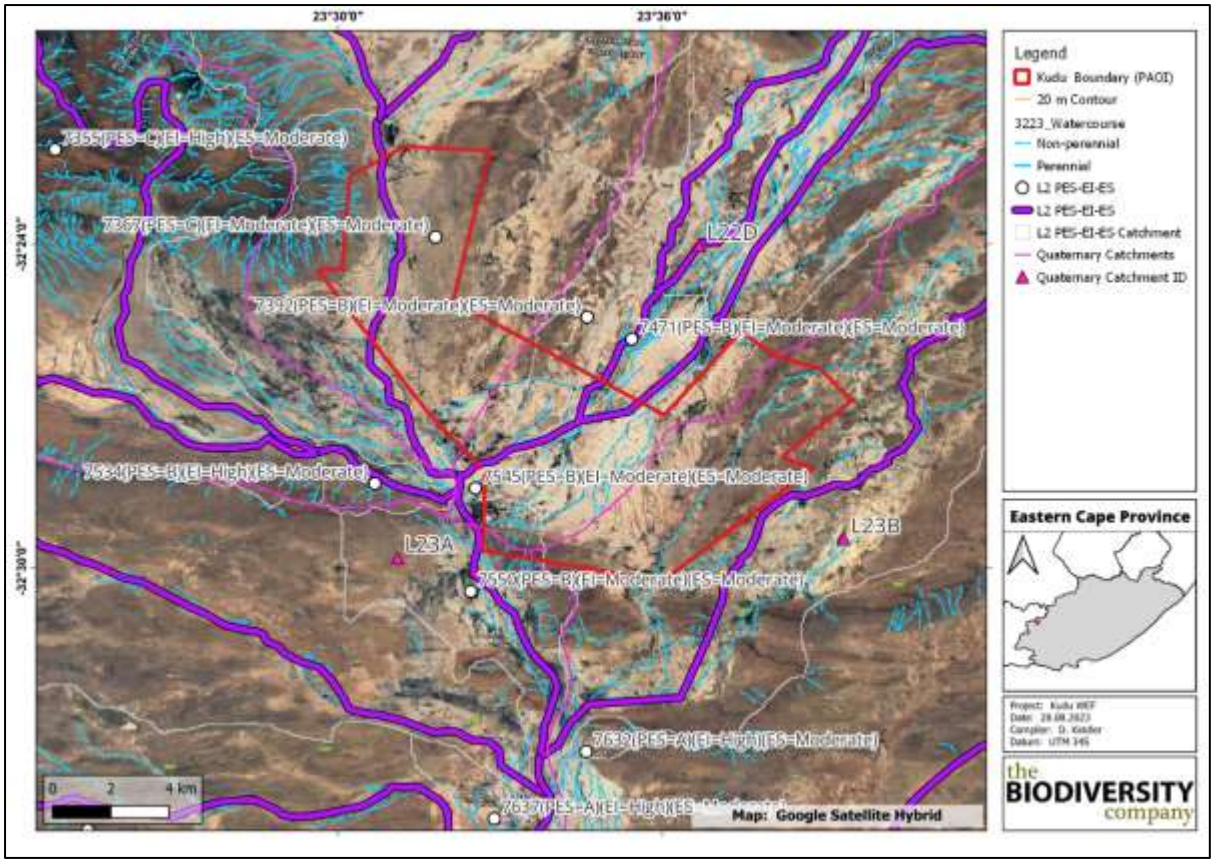


Figure 2-11 Illustration of the Present Ecological State within the relevant catchments (DWS, 2014)

Table 2-3 Desktop Ecological summary for the relevant quaternary catchments

SQR	Stream order	Length (km)	PES (DWS, 2014)	ES	EI	Default Ecological Category
Ouplaas Catchment (This SQR drains the eastern border of the PAOI)						
L23B-7249	**1**	**53.47**	**B (Largely Natural)**	**High**	**Moderate**	**B (Largely Natural)**
PES-EIS Justification	Habitat & continuity (fish): Upper catchment stream; numerous anti-erosion berms in flat lower catchment. General, habitat (invertebrates) & flow: Upper catchment well vegetated; little development; extensive erosion in lower catchment. Riparian/wetland zone & continuity: Alluvial system + floodplain agric. Physico-chemical: little activity in upper section other than crossings + a weir/berm; area is well vegetated; off-channel dams + patches of cult; lower section barren with little veg cover; non-perennial system.					
Unnamed Catchment (This SQR drains the middle of the PAOI)						
L22D-7392	**2**	**4.09**	**B (Largely Natural)**	**Moderate**	**Moderate**	**C (Moderately Modified)**
PES-EIS Justification	Habitat & continuity (fish): Upstream impacts. Riparian/wetland zone & continuity: Sq that is dominated by alluvial structures + mostly natural. Physico-chemical: Off-channel + instream dam; low-level crossing; non-perennial; little veg in area.					
Unnamed Catchment (This SQR drains the middle of the PAOI)						
L22D-7471	**2**	**5.23**	**B (Largely Natural)**	**Moderate**	**Moderate**	**C (Moderately Modified)**
PES-EIS Justification	Habitat & continuity (fish): Upstream impacts. General, habitat (invertebrates) & flow: Cross-channel erosion berms. Riparian/wetland zone & continuity: Alluvial system + floodplain agric. Physico-chemical: Short reach; non-perennial; few berms; area v bare.					
Tulpleegte Catchment (This SQR drains the middle of the PAOI)						
L22D-7545	**3**	**0.59**	**B (Largely Natural)**	**Moderate**	**Moderate**	**C (Moderately Modified)**

SQR	Stream order	Length (km)	PES (DWS, 2014)	ES	EI	Default Ecological Category
PES-EIS Justification		Habitat & continuity (fish): 0.6km reach; upstream impacts. Riparian/wetland zone & continuity: Small sq + natural + berms. Physico-chemical: V small reach; non-perennial.				
Tulpleegte Catchment (This SQR drains the western of the PAOI)						
L22C-7367	**3**	**14.06**	**B (Largely Natural)**	**Moderate**	**Moderate**	**C (Moderately Modified)**
PES-EIS Justification		Habitat & continuity (fish): Upstream impacts; erosion. General, habitat (invertebrates) & flow: Catchment disturbed due to exposed land surface + erosion. Riparian/wetland zone & continuity: Large sq that is dominated by alluvial structures + mostly natural. Physico-chemical: Long reach; berms; crossings; possibly an A/B ito wq.				
Kariega Catchment (This SQR drains the western of the PAOI)						
L22A-7550	**4**	**10.12**	**B (Largely Natural)**	**Moderate**	**Moderate**	**C (Moderately Modified)**
PES-EIS Justification		Habitat & continuity (fish): Upstream impacts; diversion weir in lower reach. General, habitat (invertebrates) & flow: Disturbed landscape + river channel; due to erosion + erosion treatment. Riparian/wetland zone & continuity: Alluvial floodplain systems + natural other then R61 crossing. Physico-chemical: Low level crossing; R61 crossing; non-perennial; barren area.				

2.2.11 Expected Fish Species and Conservation Status

An expected species list was generated from DWS (2014), and Skelton (2001) for the PAOI watercourses and the associated downstream Kariega River SQR. A total of 3 fish species are expected to occur within the watercourses potentially influenced (cumulatively) by the project and these are presented in Table 2-4.

The expected species are generated on a reach basis, and the occurrence of all species in the system is unlikely as different species are specialists of different habitats which are present along a reach. The local watercourses within the PAOI presented largely dry conditions during the May 2023 survey, with only the Tulpleegte River and several smaller unnamed watercourses presenting surface water (standing and not flowing). Due to the non-perennial and episodic nature of the watercourses the presence of fish within the project area is unlikely. The downstream Kariega River is however likely to support fish. The conservational status (Figure 2-12) of the fish species was assessed against the latest International Union for Conservation of Nature (IUCN) red list of threatened species database to identify Species of Conservation Concern (SCC) (IUCN, 2023).

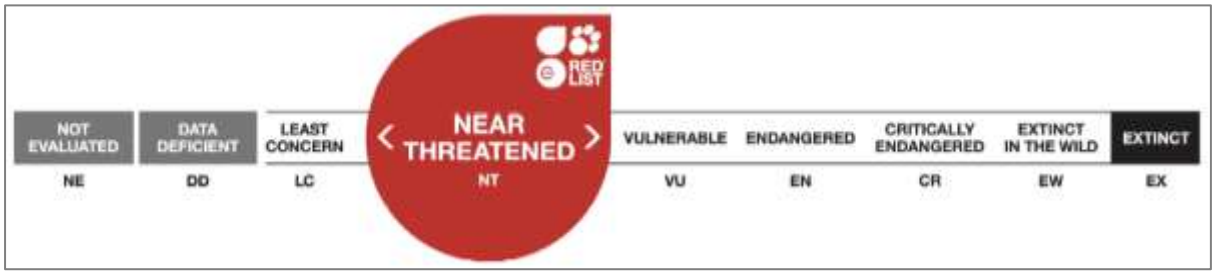


Figure 2-12 IUCN red list categories illustrating the conservational status of the floral and faunal species (IUCN, 2023)

The small barb species previously known as *Enteromius anoplus* (Chubbyhead barb) is expected within the downstream systems, and was thought to be widely distributed across southern Africa with an IUCN listed status of Least Concern (LC) due to an extensive distribution range. However, according to a recent genetic study conducted by Kambikambi *et al.* (2021), *Enteromius anoplus* was reclassified into four distinct genetic lineages separated by selected major river systems, indicating distinct species endemic to different drainage

basins. These results render the current IUCN Red List assessment of *E. anoplus* obsolete. Kambikambi *et al.* (2021), suggest that there is thus the need for generating baseline information, including knowledge of ecological requirements, habitat utilization, distribution, life history and feeding ecology to support conservation and protection of these endemic fish. In absence of a threatened status these fish should be conserved through the precautionary principle and be treated as highly threatened for proposed developments until otherwise proven to be less threatened. The Gamtoos drainage basin was not included in the aforementioned study, therefore the expected *E. anoplus* should be treated as a highly threatened Gamtoos endemic species that remains undescribed.

An additional indigenous species of conservational concern is expected within the downstream Kariega River (*Fish Sanctuary Area*) namely *Pseudobarbus asper* (Smallscale Redfin) which is listed as Vulnerable (VU) requiring management of water quality, habitat and predation impacts from invasive fish species (Jordaan and Chakona, 2018).

Both *Enteromius anoplus* and *Pseudobarbus asper* are SCC taxa potentially influenced from the proposed project on a cumulative scale with water quality impacts of key concern to their survival.

Table 2-4 Expected fish species for the SQRs potentially influenced by the project

Species	Common Name	IUCN (2023)*	Ouplaas and Gannaleegte	Downstream Kariega River
Enteromius anoplus	Chubbyhead barb	Unknown	Yes	Yes
Labeo umbratus	Moggel	LC		Yes
Pseudobarbus asper	Smallscale Redfin	VU		Yes
Total expected species	**3**		**1**	**3**

*LC – Least Concern; VU – Vulnerable

2.2.12 Investigation Sites

Every effort was made to visit every watercourse within the PAOI, with access roads, farm fences and wet muddy clay soil conditions limiting extensive coverage. The larger dominant watercourses were visited. It should be noted that the majority of the assessed watercourses were dry at the time of the survey and not suitable for biological sampling due to the absence of surface waters. Therefore, a total of 2 sampling sites were assessed during the study, with emphasis placed on the systems within the PAOI that had surface water present 2 additional sites were not sampled however these presented surface water. Figure 2-13 illustrates the sampling sites for the study, and Table 2-5 presents site photographs, Global Positioning System (GPS) coordinates and comments for each site.

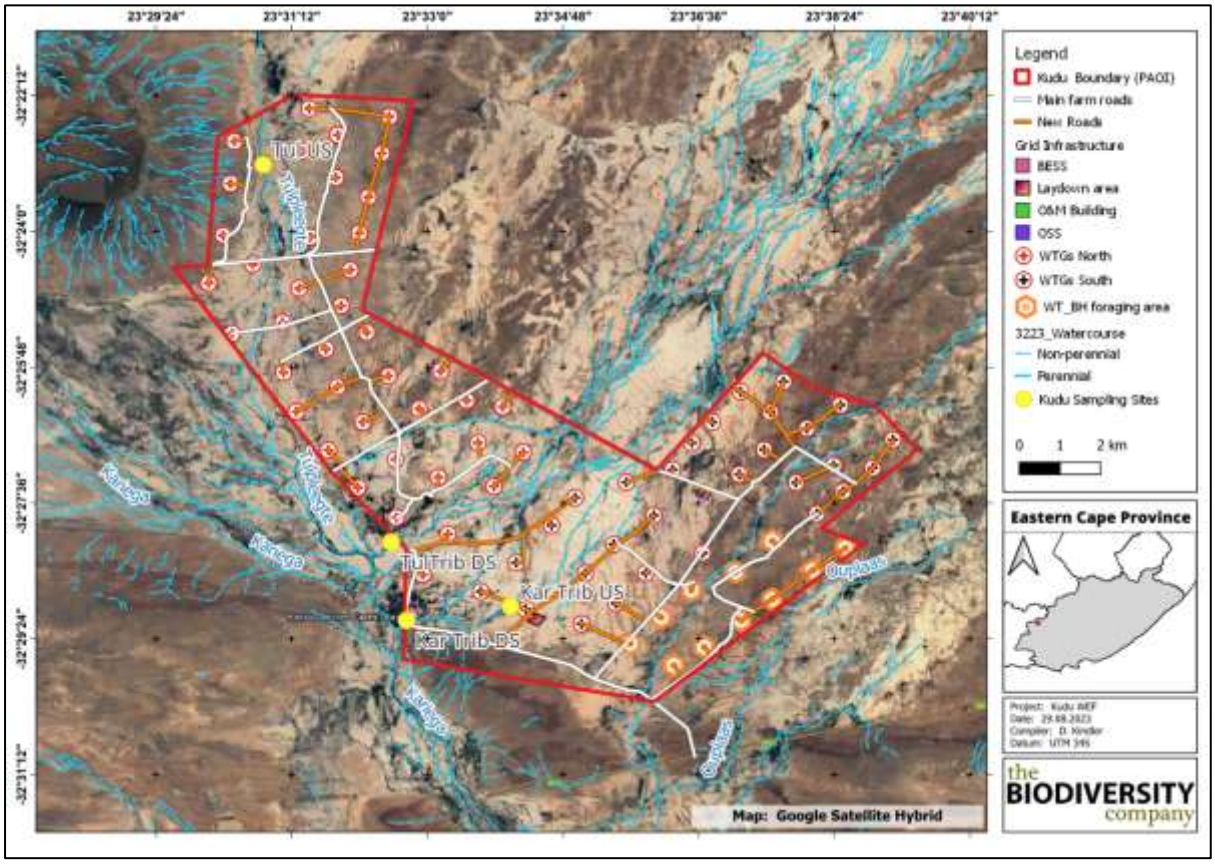


Figure 2-13 Study sampling points

Table 2-5 Investigation site photographs and coordinates (May 2023)

Site	Upstream	Downstream
Tul US		
Comments	Site Tul US is located in the upper reaches of the Tulpleegte River, a non-perennial river in the North-western portion of the project area. The site was located at an instream weir that had inundated the upstream areas and was holding water at the time of the survey. The watercourse was not flowing. The channel has been subjected to catchment erosion and sedimentation.	
GPS-coordinates	32°23'7.06"S; 23°30'49.30"E	
Tul Trib DS		
Comments	Site Tul Trib DS is located in the lower reaches of an unnamed ephemeral tributary of the Tulpleegte River to the centre of the project area. The watercourse was not flowing. The channel was largely intact and traversed by the existing main farm road.	
GPS-coordinates	32°28'7.20"S; 23°32'31.16"E	
Kar Trib US		
Comments	Site Kar Trib US is in the upper reaches of an unnamed ephemeral tributary of the Kariega River in the middle to western portion of the project area. The site was located at an instream earthen impoundment that had inundated the upstream areas and was holding water at the time of the survey. The watercourse was not flowing. The channel has been subjected to some catchment erosion and sedimentation.	
GPS-coordinates	32°28'58.32"S; 23°34'6.25"E	
Kar Trib DS	Photos corrupted	
Comments	Site Kar Trib DS is located downstream of site Kar Trib US is in the lower reaches of the unnamed Kariega River tributary. The channel was largely intact and traversed by the existing main farm road near the Karoo Secret Farm Stay Building.	
GPS-coordinates	32°29'9.32"S; 23°32'43.57"E	

2.2.13 Present Ecological Status of Sampled Watercourses

The on-site assessment of the watercourses presented largely dry conditions in the smaller tributaries, with surface water presence in the larger tributaries and main river systems. Cumulatively these non-perennial systems displayed ephemeral characteristics which is typical for watercourses in an arid region (Figure 2-14). Channel habitat modification has taken place through land use activities as discussed below, however the ecosystems and adjacent terrestrial habitat is considered open and largely intact, although modified. Portions of the watercourses are braided within the site, creating an extensive alluvial fan landscape surrounding the watercourses which intersect terrestrial habitat, highlighting their interdependence. Despite their current level of modification and ephemeral nature, the watercourses are sensitive to further modification as these systems do provide drinking opportunities (following rainfall) and habitat for foraging, nesting and refugia for terrestrial biota and avifauna (see associated terrestrial report for project). Therefore, the watercourses in the project area are regarded as sensitive environments in relation to changes in habitat integrity, flow and water quality (ecological drivers) requiring avoidance from the project related disturbance activities and maintenance of baseline conditions.

Figure 2-14 Illustration of some of the ephemeral watercourses scattered across the project area (May 2023)

The SASS5 score and SASS5 ecological classes obtained for the sampled systems during the survey are presented in Table 2-6. An illustration of selected macroinvertebrates are presented in Figure 2-15.

Table 2-6 Macroinvertebrate assessment results (May 2023)

Site	Kar Trib US	Tul Trib DS
SASS5 Score	21	36
No. of Taxa	5	8
ASPT*	4.2	4.5
Category (Dallas, 2007)	Seriously Modified (class E/F)	Largely Modified (class D)
Biotope Score % & Comment	2 Low diversity of substrates, dominated by sand and mud with low diversity of flow classes and limited marginal vegetation	11 Low diversity of substrates, dominated by sand and mud with low diversity of flow classes and limited marginal vegetation

*ASPT: Average score per taxon; **Nama Karoo Ecoregion as a substitute – Interpret with caution

Based on the *in situ* water quality section and sampled habitat, the systems currently support aquatic biota, albeit a low diversity with a low portion of moderately sensitive taxa present. Should additional sites be intensively sampled, additional taxa are likely to be recorded due to differences in available habitat distributed across a watercourse reach, highlighting the need to avoid the watercourses for the project.

These low diversities and modified ecological categories are expected for these non-perennial systems that presented ephemeral characteristics. The sampled communities reflected this, as a large portion of the sampled community where adults that are known to fly between waterbodies, which is a common feature of arid region communities. The presence of some taxa in juvenile life stages (Chironomidae) and sessile snails (Bulininae) indicated that both the sampled watercourses have had some resident water allowing recruitment of these taxa. According to personal communication with landowners, the resident water can be attributed to the two rainfall events that occurred two weeks before the survey. The presence of resident water can be attributed to larger/ deeper pools due to the presence of impoundments present within the catchment and PAOI. The resultant ecological categories must be used with caution, and the sampled communities are not considered to be seriously and largely modified, but rather largely intact for ephemeral watercourses. Therefore, the specialist recommends a *class B (Largely Natural)* ecological category.

Figure 2-15 Examples of sampled macroinvertebrates juvenile Chironomidae (left), adult Corixidae (Centre) and adult Hydrophilidae & Bulininae (right)

Sampling for fish was conducted in sampled both systems, however despite adequate habitat suitability for fish, no fish were collected. The absence of fish is likely due to the ephemeral nature of the watercourses that may not be conducive to support fish year-round.

The PES assessment for the sampled watercourses is based on the collective data collected during the May 2023 survey and the results are provided in Table 2-7. The Kariega River tributary was not suitable for a full PES assessment, therefore only the Tulpleegte was PES status was derived.

Table 2-7 Present Ecological Status of the watercourse (May 2023)

Aspect Assessed	Tulpleegte
Instream Ecological Category (IHIA)	C
Riparian Ecological Category (IHIA)	C
Aquatic Invertebrate Ecological Category	Not Applicable = SASS5 used (class B)
Fish Community	-
Ecostatus	**C**
PES (DWS, 2014)	**B (Largely Natural)**
Management Class	**C**

The results of the PES assessment derived a *moderately modified (class C)* status for the Tulpleegte River which includes its major tributaries within the PAOI. The anthropogenic activities within the catchment have resulted in large modifications to the riparian and instream habitat integrity of the watercourse. These activities have contributed to alteration of hydrology and some erosion of the river banks, with evidence of flow and channel modification, cumulatively reducing the biotic integrity of the sampled watercourses. The biotic integrity must be interpreted with caution due to the ephemeral nature of the watercourses and limited availability of surface water to support a diverse aquatic ecosystem.

The Tulpleegte River and its tributary fell short of the DWS (2014) PES. However, the PES data is outdated and the status was derived from a large reach of the watercourse (Table 2-3). Despite this, the specialist recommends that the *moderately modified (class C)* status be set as the Management Class for the project areas watercourses.

Due to the sensitivity of the catchment and soils to erosion, together with the flat topography and braided alluvial fan nature of the watercourses within the PAOI, an increase in anthropogenic activities poses a risk to the ecological integrity of the watercourses notably from a hydrological perspective. The presence of aquatic macroinvertebrates and vernal biota highlights the sensitivity of the watercourses. Any proposed activities in proximity to the watercourses should not further contribute to the deterioration of the instream and riparian zones as this will compromise the ecological integrity of the reach and Management Class may not be achieved.

2.2.14 Vernal Aquatic Biota

Ephemeral watercourses in arid environments may present aquatic biota not typically found in temperate watercourses. These ephemeral watercourses often present as vernal pools that intermittently hold water for short periods (from a few days to months) following sufficient rainfall, where by the standing surface water may support vernal biota. Vernal pool plants and animals are very sensitive to the duration and timing of ponding. Vernal pools as described by Los Huertos (2020) are “seasonal wetlands that form in shallow basins and alternate on an annual basis between a stage of standing water and extreme drying conditions”. An example of a vernal system although modified from natural conditions due to altered catchment hydrology was sampled in the upper reaches of the Tulpleegte River at site Tul US which presented as an impoundment. This pool held a number of clam shrimp (Conchostraca) which were sampled and photographed. Photographs of the clam shrimp are presented in Figure 2-17. It is expected that more of the impoundments as well as the natural vernal pools in the form of pans present across the project area will support vernal biota, which may include Anostraca (fairy shrimp), Notostraca (tadpole shrimps such as *Triops* and *Lepidurus* species).

The Tulpleegte River would be subjected to period flooding, although a rare event in the arid climate, the clam shrimp and likely other vernal biota (and their egg bank) would historically been dispersed across the project areas watercourse network, with potential occurrence in many of the non-sampled waterholding depressions and impoundments.

Clam shrimp are members of the crustacean order Conchostraca (subclass Branchiopoda) and are non-selective algal and detritus feeders. According to Day *et al*., (1999), some species (e.g. *Cycleslheria hislopi*) may occasionally occur in the littoral zone of lakes and in river systems and some species have extremely local distributions. Temperature is a significant factor controlling the occurrence of conchostracans. Breeding occurs continuously throughout the adult stage where the female produces egg cysts (resting eggs) which are dispersed by wind, waterfowl, and by humans. Cysts can survive extremely unfavourable circumstances. Hatching time is often variable and is triggered by specific environmental conditions, with some eggs not hatching after the first inundation of habitat following rains. This results in the formation of an egg bank, to serve as a survival strategy against subsequent episodes of drought-related reproductive failure (Day *et al*., 1999).

Figure 2-16 Vernal pool sampled at site Tul US (May 2023)

Figure 2-17 Examples of sampled clam shrimp at site Tul US (May 2023)

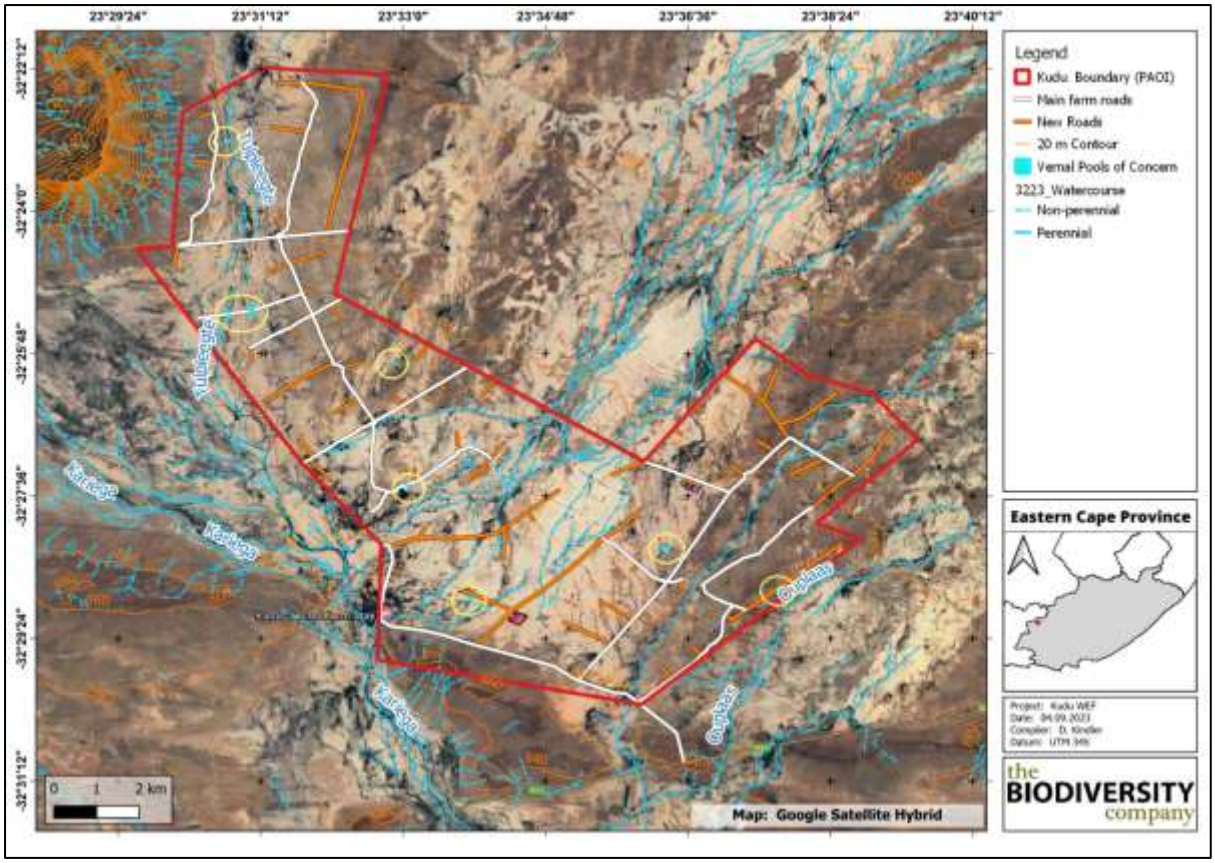


Figure 2-18 Vernal pools (circle in yellow) identified in the project area

The conservation status of species of this order was assessed against the latest IUCN database for threatened species (IUCN, 2023), and where not available the Day *et al*. (1999) status was considered. No conservation statuses were found for the South African species, while as a comparative example the Serbian species are rated as 'Vulnerable'. Relative to its area, southern Africa has one of the richest anostracan faunas in the world, of which 80% are endemic, highlighting that conchostracans may be similarly endemic. The presence of these temporary lifeforms and lack of conservation status highlights the importance and sensitivity of these watercourses and the project should treat these biota as highly threatened using the *Precautionary Principle* approach.

It is therefore recommended that all the watercourses and off channel depressions (pans and wetlands - Figure 2-18) and associated buffer areas be avoided by any activities relating to the project using the Best Practicable Environmental Option (BPEO).

2.2.15 Sensitivity and Buffer Assessment

As noted in the geomorphological description of the project area, the watercourses considered in this assessment represented ephemeral system characteristics that have naturally been subjected to instream erosion and sedimentation compounded by intensive surface flow alterations. As can be observed in Figure 2-14 in the IHIA section, riparian areas were not well defined for all watercourses across the project area and comprised of a mix of herbaceous species with sparse woody species present. The larger systems presented a typical riverine *Vachellia karroo* thicket along the riparian zones (Figure 2-19), with the thickness of these zones becoming sparser and more non-existent as the size of the watercourse decreased. Despite alteration, these areas were considered to be largely intact.

Figure 2-19 Typical arid zone watercourse and associated instream and riparian areas in the project area

The ecological sensitivity of the watercourses draining the PAOI was determined to be largely uniform across the project area. The watercourses presented evidence of reliance/ dependence on these systems by terrestrial biota and frogs for drinking (in times of surface water presence after rainfall), foraging, nesting and refugia, with animal tracks observed in the substrates in majority of the watercourses. Despite the absence of water and aquatic taxa in majority of the braided channels at the time of the survey, all of the watercourses in the project area are regarded as sensitive environments in relation to changes in habitat integrity, flow and water quality (ecological drivers).

Given the varied geomorphological features of the watercourses, flat topography and absence of a clear and consistent riparian zone, no riparian delineation could be assigned to the local watercourse networks. Despite this, the watercourse/ drainage extent was mapped with associated sensitivity assigned by identifying vegetation features on aerial imagery and confirmation through ground truthing during the survey. A diagrammatic example of the typical watercourse extent as well as where appropriate buffer areas are located is provided in Figure 2-20. The watercourse layouts and their respective delineated sensitive areas are depicted in Figure 2-21 and all infrastructure should avoid the high and medium sensitivity areas and apply a 32 m buffer from the edge of the watercourse as per the sensitivity maps. This 32 m buffer would also apply to the vernal pools. The High sensitivity areas (red areas) are to be treated as no-go areas, allowing only minimum critical watercourse crossing in these areas.

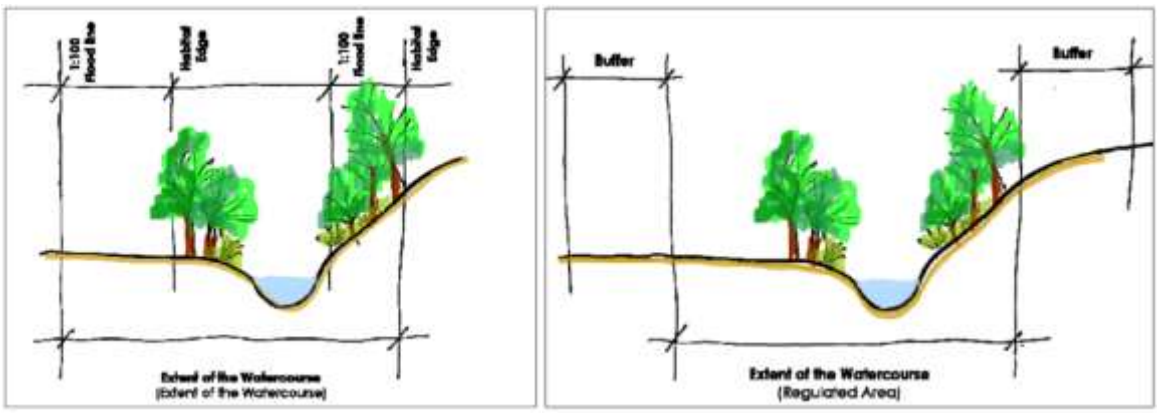


Figure 2-20 Illustration of the extent of a watercourse and the Regulated Area (DWA, 2012)

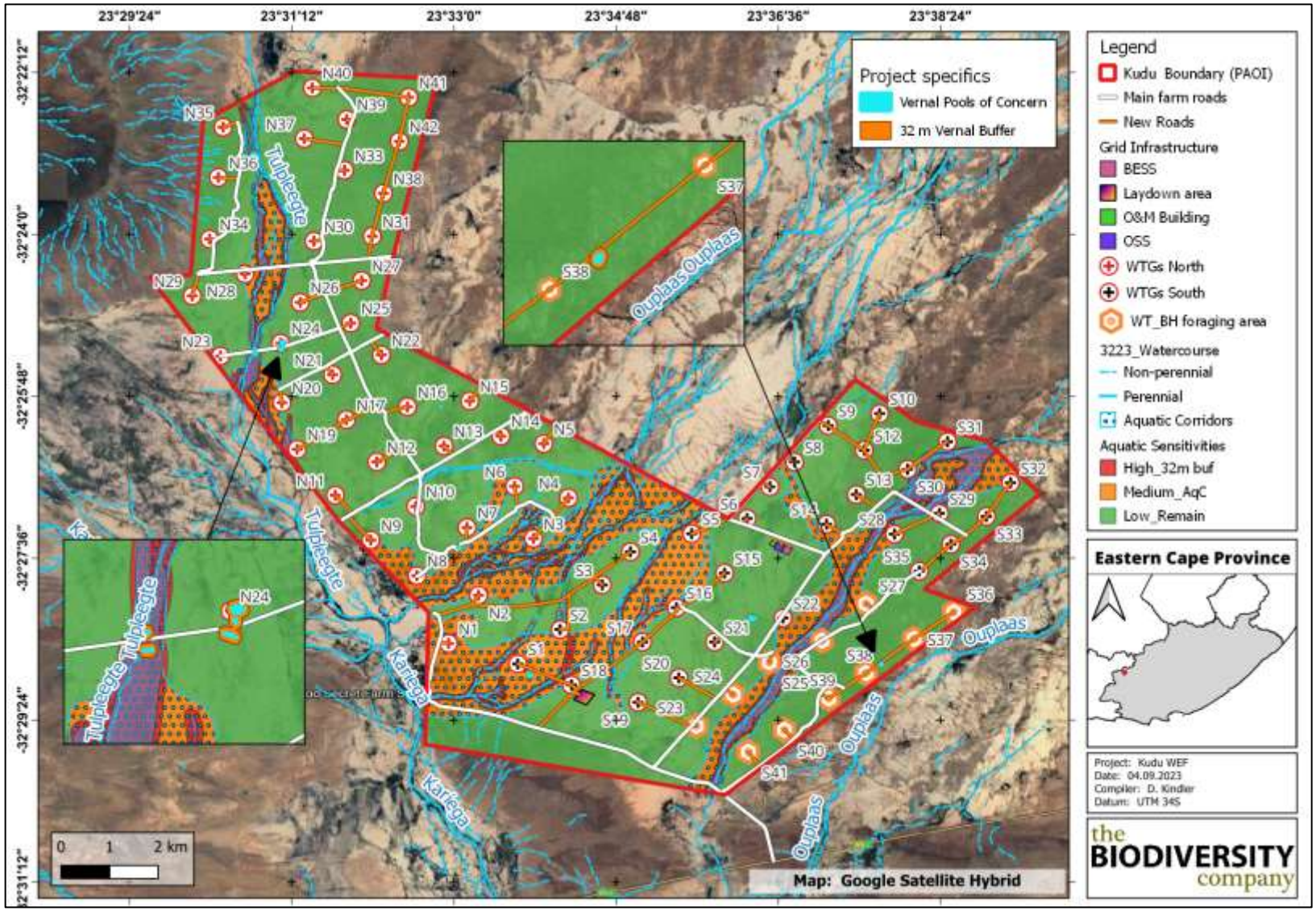


Figure 2-21 Project related infrastructure and associated sensitivity of freshwater resources

2.3 Screening Tool Comparison

Table 2-8 provides a comparison between the Environmental Screening Tool and the specialist determined Site Habitat and System Characterisation. The specialist-assigned sensitivity ratings are based largely on the functionality assessment processes followed in the previous section, and consideration is given to any observed or likely presence of SCC.

Table 2-8 Sensitivity features associated with Aquatic Biodiversity Combined Sensitivity (National Web based Environmental Screening Tool)

Sensitivity	Features	Specialist Verification
Low	Low sensitivity	**Yes Low sensitivity areas present**, portions of the property are not sensitive
Very High	ESA1	**Yes ESA1 present**, overlaps with an ESA1 which is associated with the watercourses.
Very High	Rivers_C*	**Yes**, the riverine ecosystems present in catchment have been modified and would largely conform to the '*Moderately Modified condition (River_C*)'. The modification stems largely from surface flow alterations with some agricultural influence.
Very High	Rivers_Z*	**Yes**, the tributary ecosystems present in catchment have been modified by historical modification which includes agriculture and surface flow alterations, and their condition conforms with desktop model of being 'not intact according to natural land cover'. However, this is limited to some sections being modified with large portions remaining intact.
Very High	Wetlands_(River)	**Yes**, the Kariega and Tulpleegte river ecosystems are present in catchment as per NWM5 dataset.

*Screening tool uses metadata from 2018 NBA

The freshwater ecology of the immediate project area and further downstream areas are considered sensitive to disturbance from a hydrological and biological perspective, however due to the ephemeral nature of the watercourses, this sensitivity applies more to the watercourses' physical characteristics that influence the hydrological and biological aspects in times of surface water presence/ inundation. This will include all watercourses within the project area which are considered sensitive due to their relatively small spatial scale when compared to adjacent terrestrial habitat with a large demand for the ecosystem services which they provide. Construction and operation activities must take cognisance of this and avoid any unnecessary disturbance of the watercourses and adjacent habitat (Figure 2-22).

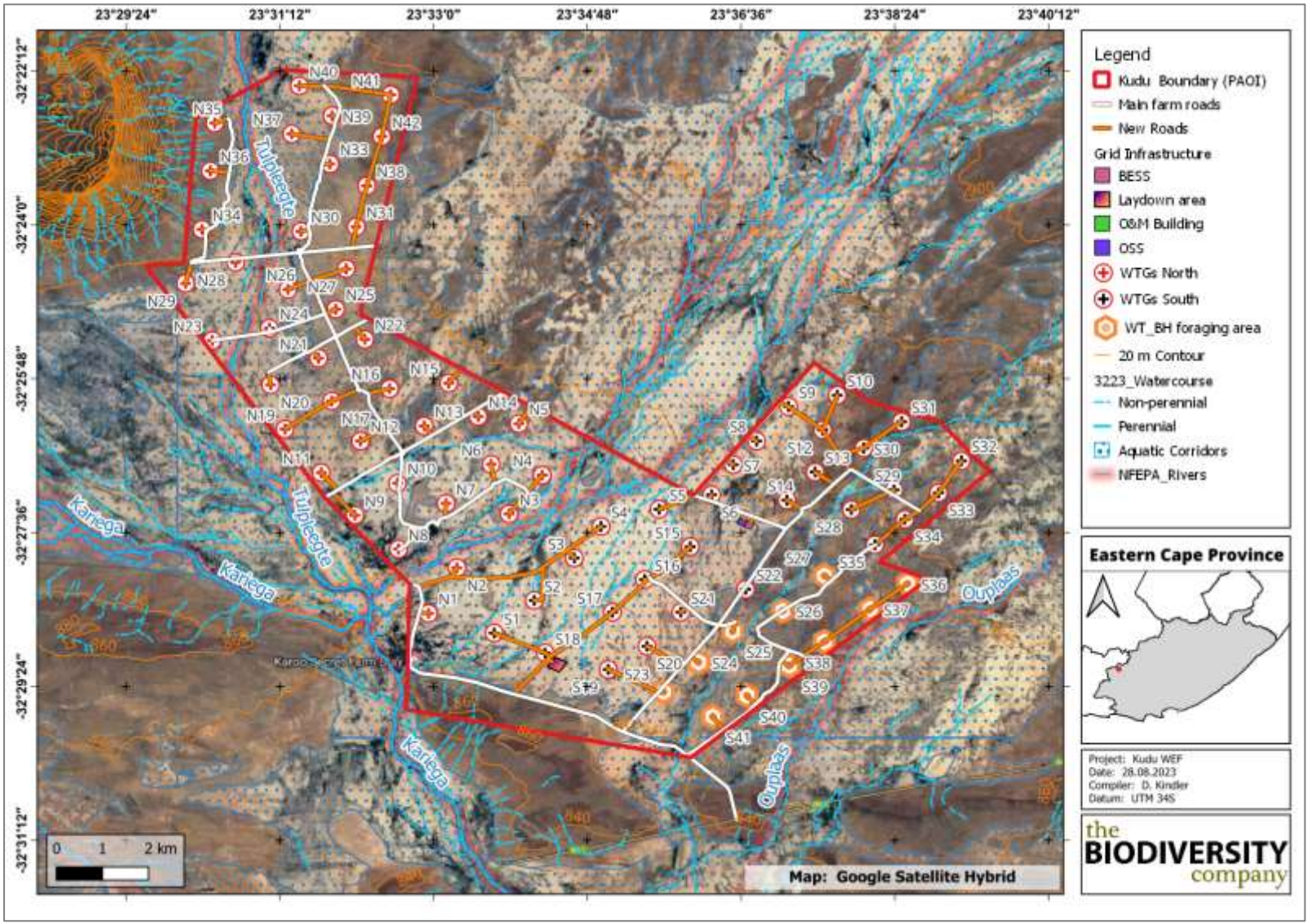


Figure 2-22 Proposed infrastructure in relation to aquatic features

3 Impact Assessment

The section below and associated tables serve to indicate and summarise the significance of perceived impacts on the aquatic ecology of the project area. Potential impacts were evaluated against the data captured during the desktop and field assessment to identify relevance to the project area. The relevant impacts associated with the construction of the proposed development were then subjected to a prescribed impact assessment methodology which were provided by Savannah Environmental as is presented in Table 3-1.

Table 3-1 Impact assessment methodology

Extent of impact	Rating
Site specific	Very low (1)
Footprint & surrounding areas	Low (2)
Local area	Moderate (3)
Regional	High (4)
Entire habitat unit / Entire system	Very high (5)
Duration of impact	**Rating**
The lifetime of the impact will be of a very short duration (0–1 years)	Very short term (1)
The lifetime of the impact will be of a short duration (2-5 years)	Short term (2)
Medium term (5–15 years)	Moderate term (3)
Long term (> 15 years)	Long term (4)
Permanent	Permanent (5)
Consequence/Magnitude of impact	**Rating**
Small and will have no effect on the environment	None (0)
Minor and will not result in an impact on processes	Minor (2)
Low and will cause a slight impact on processes	Low (4)
Moderate and will result in processes continuing but in a modified way	Moderate (6)
High (processes are altered to the extent that they temporarily cease)	High (8)
Very high and results in complete destruction of patterns and permanent cessation of processes	Very high (10)
Probability of impact	**Rating**
Very improbable (probably will not happen)	Very improbable (1)
Improbable (some possibility, but low likelihood)	Improbable (2)
Probable (distinct possibility)	Probable (3)
Highly probable (most likely)	Highly probable (4)
Definite (impact will occur regardless of any prevention measures)	Definite (5)
Status	**Rating**
Positive	Positive
Negative	Negative
Neutral	Neutral
Reversibility	**Rating**
None	None
Low	Low
Moderate	Moderate
High	High
Irreplaceable loss of resources?	**Rating**

Yes	Yes
No	No
Can impacts be mitigated?	**Rating**
Yes	Yes
No	No
Significance	**Rating**
< 30 points	Low
30-60 points	Medium
> 60 points	High

3.1 Present Impacts to Aquatic Ecology

Considering the anthropogenic activities and influences within the landscape, several negative impacts to aquatic biodiversity were observed within the PAOI, however limited in intensity unless otherwise stated. These include:

- Historic land modification from reference conditions;
- Farm roads and main roads (and associated altered surface hydrology and wash of hydrocarbons into watercourses. Both formal and informal river crossing structures have altered instream flow characteristics);
- Historical dryland agriculture (and associated altered surface hydrology);
- Grazing and trampling of natural vegetation by livestock in aquatic and riparian areas and adjacent alluvial fan areas;
- Minor encroachment of riparian areas by Alien and/or Invasive Plants (IAP);
- Erosion from steep slopes, river banks and roads (especially roads lacking anti-erosion measures);
- The ephemeral watercourses have numerous anti-erosion berms (instream weirs/ impoundments) across the flat topography, negatively influencing the flow and functioning of the watercourses and their immediate catchment;
- Low to moderate levels of instream sedimentation; and
- Fences and associated maintenance resulting in habitat fragmentation.

3.2 Aquatic Impact Assessment

Anthropogenic activities drive habitat modification and destruction causing displacement of aquatic and terrestrial fauna and flora, and possibly direct mortality. Land clearing for development infrastructure (all inclusive) destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites and wildlife movement corridors such as rivers, streams and drainage lines and their associated riparian area, or other locally important features such as off channel wetlands or vernal pools. The removal of natural vegetation from these areas and their respective buffers will reduce the habitat available for fauna and may reduce ecological integrity and species diversity within the area depending on the intensity and footprint of clearing and destruction caused.

3.2.1 Alternatives considered

This section of the report presents the assessment of the preliminary WEF layout (Figure 3-1), which informed alternatives for the proposed development. The alternative (proposed) layouts were derived following collaboration with the terrestrial ecologist, which resulted in the formation of the optimized WEF layouts as presented in Figure 3-2. The optimized WEF layouts relocated portions of the proposed roads outside of watercourses and their associated aquatic corridors and 32 m buffers, with other portions aligned to existing roads. Furthermore, crossings over the delineated aquatic corridors were minimised and restricted to one crossing per watercourse, to limit hydrological functioning related impacts of the watercourses. Where it is not feasible to avoid watercourses for road crossings, the project should prioritise crossing watercourses where riverine thicket is absent, rather than removing riverine or riparian thicket vegetation.

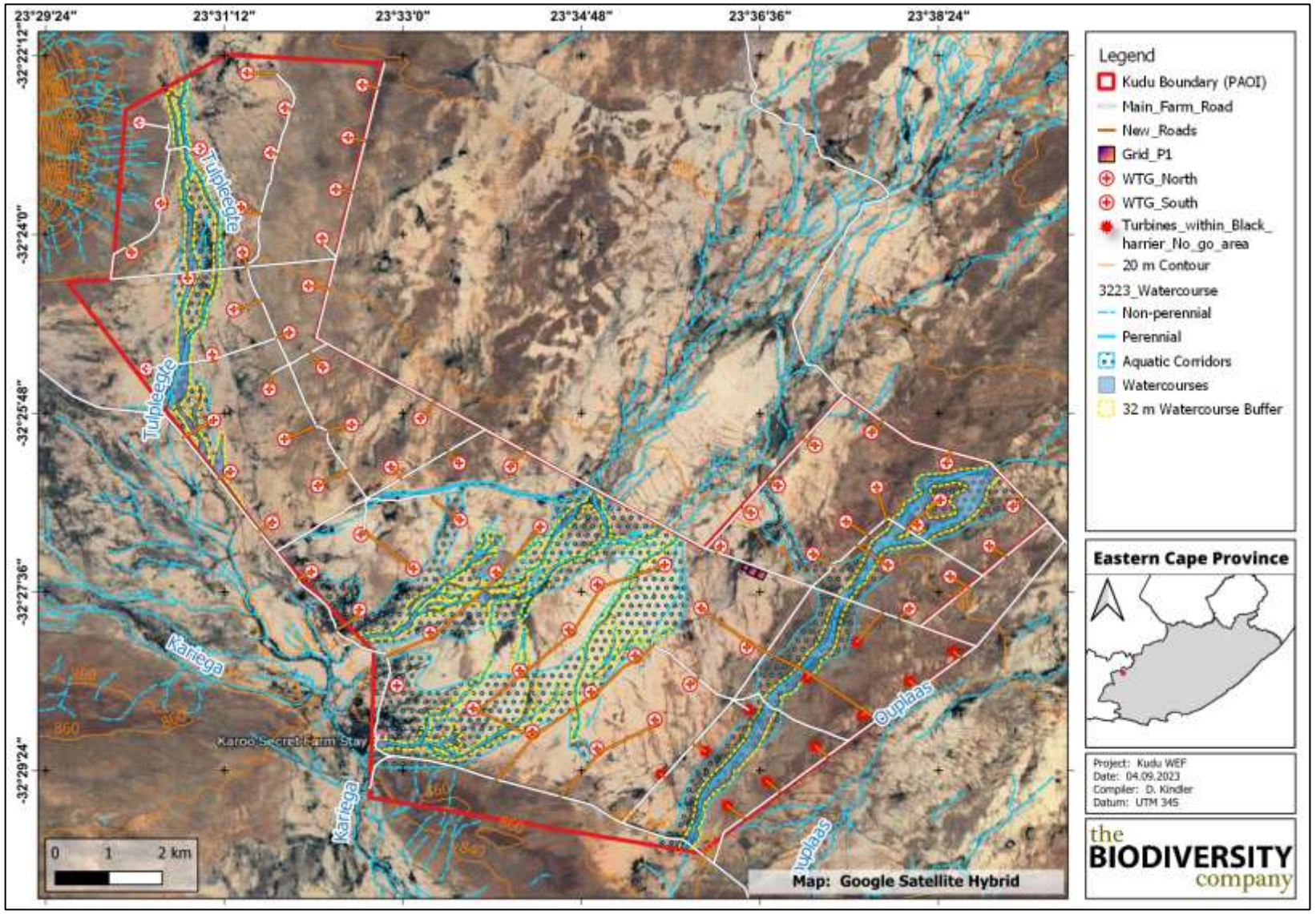


Figure 3-1 Preliminary WEF layout and associated sensitivity of freshwater resources

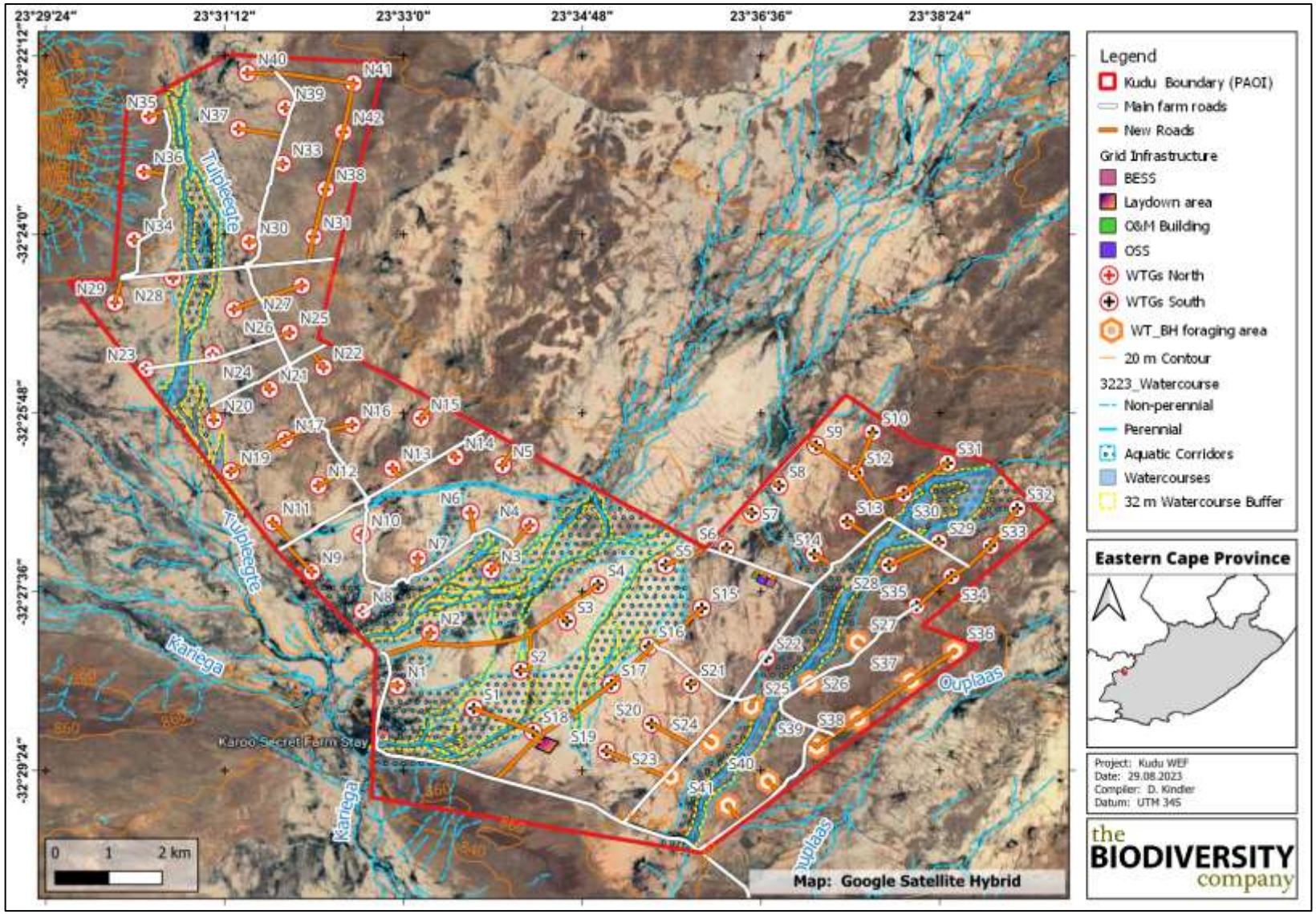


Figure 3-2 Optimized WEF layout and associated sensitivity of freshwater resources

3.2.2 Loss of Irreplaceable Resources

The proposed project will require clearing of natural vegetation for the construction of the WEF, and the associated infrastructure which includes access roads, turbines, turbine platforms and grid connections (substation, BESS and cabling), as well as any construction areas and laydown areas. These project aspects overlap with an ESA1 which is associated with the watercourses and the adjacent terrestrial habitat. Following construction, the project footprint area will no longer be congruent with an ESA, notably due to the establishment of the road network and expected alterations to hydrology of the extensively braided watercourse and alluvial fan network. The Optimized Layout has largely avoided the aquatic features and are deemed acceptable and appropriately placed, with some influence on ESAs. Only small portions of the ESAs will be altered (Figure 2-7).

The aquatic corridors were mapped to incorporate the well-defined watercourses. Numerous smaller drainage lines and channels have not been delineated, due to the large number present within the very flat alluvial landscape. In terms of the freshwater resources and processes within the PAOI, the minor watercourses and drainage lines are not a significant priority, and would be deemed an acceptable loss, provided measures are implemented to accommodate flows as mentioned above. This could include box (or other non-flow concentrating type) culverts under raised access roads to allow lateral movement of water and to minimise localised flooding and/or drying out along the road network.

3.2.3 Anticipated Impacts

The impacts anticipated for the proposed development activities are considered in order to predict and quantify these impacts and assess and evaluate the magnitude on the identified aquatic biodiversity (Table 3-2). As presented in Section 2.2.15, it is evident that the following project related activities may result in the loss or degradation of the watercourses, most of which are functional and provide ecological services, as the optimized road network is expected to traverse several ephemeral drainage features. Impacts would therefore be expected directly within the drainage network through damage to the watercourse habitat, notably where construction disturbance will take place, and indirectly along the minor drainage lines through altered hydrology. Impacts have the potential for downstream impacts if left unmitigated.

Impacts include changes to the hydrological regime such as alteration of surface run-off patterns, runoff velocities and or volumes associated with vegetation clearing, earthworks, levelling, soil stockpiling and the establishment of grid infrastructure (turbines, turbine platforms: typically 100 x 100 m, substation, BESS and cabling), and the associated road network (linear infrastructure). This would include watercourse crossing infrastructure for the roads (numerous crossings along new roads and with many existing along the main road). Earthworks will expose and mobilise earth materials which could result in sedimentation of the receiving systems. A number of machines, vehicles and equipment (cranes for turbine lifting) will be required, aided by chemicals and concrete mixes for the project, notably for permanent turbine platforms, substation, BESS and road network. Leaks, spillages or breakages from any of these could result in contamination of the receiving water resources. Contaminated water resources are likely to influence the associated biota in time of surface water presence. Only a limited amount of water is utilised during construction for the batching of cement for wind turbines and other construction activities. The raised road network may require larger

water volumes for construction, requiring careful considerations to water handling activities and potential contamination related impacts.

The presence of a compacted road network, and in this case a raised road is proposed, increases hard surfaces within the catchment, resulting in an increase in and alteration of runoff volumes and flow paths during high precipitation events and may be significant if poorly designed stormwater management infrastructure is implemented. The catchment alterations will have a direct impact on the sediment movement and drainage characteristics both locally within the influenced drainage network and associated downslope areas. Where turbine platforms and roads are constructed within the drainage features and associated marginal zones, a direct loss or disturbance of watercourse habitat with associated alteration of hydrology can be expected. As presented in this report, the soil and watercourse banks are highly erodible and susceptible to increased degradation from construction related disturbance. The same applies to watercourse crossing structures (box culverts) within drainage areas, as these are expected to be constructed in areas where no access roads exist. In turn, habitat disturbance may degrade habitat quality and produce watercourse and surrounding watercourse/ ecological corridor (Ecological Support Area) fragmentation. A negative shift in the biotic integrity of the watercourses within the PAOI would be expected based on the severity of baseline habitat alterations or losses. It should be taken into account that due to the arid nature of the region and limited rainfall, the Karoo may take decades to re-establish habitat cover, therefore rehabilitation may be challenging, highlighting the need to avoid disturbance of these areas. This concern has been addressed in the revised layout for the WEF and therefore is no longer of major concern, yet must still be considered for the life of the project. The grid infrastructure is located away from key aquatic features, and the position of these structures is deemed acceptable. There is however an intact vernal pool located roughly 15 meters from the proposed road between turbines S37 and S38 (Figure 3-3).

Figure 3-3 Vernal Pool (Turquoise) in proximity to road between turbines S37 and S38 (Google Earth 9/2022)

There are several artificial vernal pools located roughly 20 meters from the proposed road between turbines N23 and N24 (Figure 3-4). It is suggested that this infrastructure be relocated slightly and meander to avoid these aquatic features while catering for natural surface runoff (box culverts) to continue to feed into these aquatic features to sustain the functioning of these systems and their likely vernal biota.

Figure 3-4 Vernal Pools (Turquoise) in proximity to road between turbines N23 and N24 (Google Earth 8/2023)

It is important to highlight that these arid climate systems receive majority of their rainfall during short rainfall events and only present surface flow for limited time periods. Some rainfall events can be considered as massive for the region with resultant flooding expected, notably from increased hardened surfaces in the form of project infrastructure (buildings, platforms and roads) and localised catchment hydrology alterations (landscaping). Therefore, careful consideration should be given to the hydrology of these systems with special attention given to stormwater and watercourse crossing designs and resultant discharge velocities from these structures. Risks will be lowered through avoidance mitigation of road network, with key consideration given to accommodating lateral flows (interconnectivity) of water and sediment between watercourses and alluvial areas where seasonal flooding occurs.

These disturbances will be the greatest during the construction phase as the related disturbances could result in direct loss and/or damage, while to a lesser degree in the operation phase (i.e. as and when maintenance occurs). The road network will increase surface runoff velocities and is of key concern for the maintenance of baseline watercourse conditions. These construction and operational phase disturbances could also result in the spread of alien vegetation which in turn would affect the functioning of the aquatic ecosystems.

Table 3-2 Anticipated impacts for the proposed WEF activities on aquatic habitat and biodiversity

Aspect	Project activities that can cause loss/ impacts to watercourse	Secondary impacts to watercourses
Destruction, fragmentation and degradation of habitats and ecosystems	1. Physical removal of vegetation, including riparian areas and buffer zones for project infrastructure. 2. Physical alteration of surface topography and cover for road network and servitudes. 3. Physical alteration of riparian and instream areas for river crossing infrastructure. 4. Soil management and soil wash from earth works, soil stock piles, crop lands and road network. 5. Soil dust precipitation. 6. Indiscriminate dumping of waste products. 7. Spread of alien plants.	• Disturbance/ displacement/ loss of riparian, marginal and instream riverine habitat (Habitat fragmentation). • Reduced dispersal/ migration of fauna (in times of flow). • Erosion in key areas (steep and/or exposed areas). • Increase in sediment inputs & turbidity and associated smothering and loss of instream habitat. • Input of toxicants from construction and operation vehicles (lateral movement into natural areas). • Degradation of watercourse flora and fauna through the spread of alien and invasive species. • Displacement/loss of flora & fauna (including SCC). • Reduction of ecological integrity • Loss of ecosystem services.
Water quality	1. Pollution of water resources due to dust effects, improper storage of chemicals and spills, construction materials (notably cement), fuel and machinery leaks. 2. Pollution of water resources from indiscriminate dumping of waste products.	• Physical changes such as increased turbidity levels. • Chemical changes (e.g. pH, salinity and toxicants). • Contamination of watercourse with toxicants and faunal mortality (direct and indirectly). • Disruption/alteration of ecological life cycles due to water quality perturbation. • Alteration/degradation of riparian and instream habitat integrity and lowered biodiversity potential. • Loss of SCCs • Groundwater pollution. • Loss of ecosystem services.
Flow dynamics	1. Physical removal of vegetation, including riparian areas. 2. Physical alteration of surface topography for road network.	• Alteration to flow patterns and velocities (flow dynamics) across catchment due to altered surface roughness, slope and road network. • Erosion in key areas (steep and/or exposed areas). • Ponding in where surface runoff has not been catered for (flat topography). • Erosion (notably headcut erosion) of exposed surfaces and bank collapse due to changes in the catchment's sediment balance. • Alteration/degradation of downstream aquatic habitat and biota through erosion and sedimentation.
Compiled by Dale Kindler (Pr. Sci. Nat. 114743)		

3.2.4 Unplanned Events

The planned activities will have anticipated impacts as discussed; however, unplanned events may occur on any project and may have potential impacts which will need mitigation, management and pre-allocated funding for emergency situations.

Table 3-3 is a summary of the findings of an unplanned event assessment from an aquatic ecology perspective. Note, not all potential unplanned events may be captured herein, and this must therefore be managed throughout all phases of the project according to recorded events.

Table 3-3 Summary of unplanned events for aquatic biodiversity and their management measures

Unplanned Event	Potential Impact	Mitigation
Flooding during construction	Significant habitat degradation of downstream areas.	A flood emergency response plan should be drafted, with adequate stormwater management required.
Spills into the surrounding environment and watercourses	Contamination of habitat as well as water resources associated with a spillage of hazardous construction materials.	A spill response kit must be available at all times. The incident must be reported on and if necessary, an experienced aquatic ecologist must investigate the extent of the impact and provide rehabilitation recommendations.
Uncontrolled erosion	Sedimentation of downslope watercourses	Erosion control measures must be put in place. Measures must include monthly inspections across the project footprint and should be adaptive based on site-conditions.
Fire	Uncontrolled/unmanaged fire that spreads to the surrounding natural habitat.	Appropriate/Adequate fire management plan need to be implemented to protect the veld from potential damage and livestock loss.

Before construction takes place, the project must develop emergency response procedures to be followed in the event of a hazardous material spill. This emergency protocol must: 1) Define responsibilities; 2) Specify notification requirements; 3) Identify response actions; 4) Itemise the necessary clean-up equipment; and 5) Define clean-up objectives.

3.2.5 Assessment of Impact Significance

The assessment of impact significance considers pre-mitigation as well as implemented post-mitigation scenarios. Mitigation measures must be implemented to negate potential impacts to water resources. The mitigation actions required to lower the risk of the impact are provided in Section 3.2.6 of this report.

3.2.5.1 Planning Phase

The planning phase activities are considered a low and insignificant risk as they typically involve desktop assessments and initial site inspections (light vehicle and foot traffic). This would include preparations and desktop work in support of environmental and social screening assessments, finalising placement of infrastructure sites and consultation with various contractors involved with a diversity of proposed project related activities going forward.

3.2.5.2 Construction Phase

The following potential main impacts on the watercourses and associated biodiversity dependent on these systems (based on the framework above) were considered for the construction phase of the proposed WEF. This phase refers to the period during construction when the proposed project infrastructure is constructed; and is considered to have a large

direct impact on aquatic habitat and associated ecosystem functioning. This phase typically involves the removal of indigenous vegetation for infrastructure (laydown yards, turbine platforms, grid connection infrastructure, underground cabling and road network - with watercourse crossings), landscaping to desired topography, establishment of infrastructure, and end of construction rehabilitation. This involves earthworks activities (digging and soil stockpiling) and the use of construction materials, chemicals and machinery, all of which influence watercourses and includes adjacent habitats such as riparian zones and buffers. The footprint of the turbine platforms and grid connection infrastructure has a small, localised impact, while the clearance and creation of access and service roads has a greater potential for environmental impact due to the extent and width of the roads (width 8 m and a servitude of 13.5 m) across the PAOI. The following construction phase related impacts to aquatic ecology were considered:

- Disturbance/ displacement/ loss of watercourse habitat (Habitat fragmentation) (Table 3-4),
- Contamination of watercourse and biotic community effects (Table 3-5); and
- Alteration of catchment hydrology and associated habitat ecology impacts (Table 3-6).

Table 3-4 Impacts to watercourse habitat and biotic community associated with the construction phase

Impact Nature: Disturbance/ displacement/ loss of watercourse habitat (Habitat fragmentation)		
Construction phase activities that result in the disturbance, destruction, loss and fragmentation of freshwater habitats, ecosystems and biotic community responses to the alteration of the catchment for development footprint (laydown yards, turbine platforms, grid infrastructure, cabling and road network - with associated watercourse crossings). This involves activities directly within watercourses (direct), and activities adjacent to watercourses (indirect).		
	Without mitigation (Impact Rating)	**With mitigation (Impact Rating)**
Extent	Local area (3)	Site specific (1)
Duration	Permanent (5)	The lifetime of the impact will be of a short duration (2-5 years) (2)
Magnitude	Moderate and will result in processes continuing but in a modified way (6)	Low and will cause a slight impact on processes (4)
Probability	Definite (5)	Probable (distinct possibility) (3)
Significance	**High (70)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes, however not entirely. The optimized layout has lowered the number of interceptions with watercourses, vernal pools and associated buffers.	
Mitigation:		
See section 3.2.6 of this report.		
Residual Impacts:		
The loss of currently intact vegetation is an unavoidable consequence of the project and cannot be entirely mitigated. Avoidance mitigation for freshwater features, with minimal watercourse crossings. The residual impact would however be low for the construction phase with focus on limiting both erosion and inundation required.		

Table 3-5 Contamination of watercourse and biotic community effects associated with the construction phase

Impact Nature: Pollution of water resources from construction activities		
Pollution (cement and hydrocarbons) stemming from construction activities that enters the natural environment and downslope watercourses, with associated impacts to soils, habitat integrity and ecological function. In turn, these impacts reduce the aquatic and terrestrial biodiversity dependent on the affected freshwater ecosystems, notably in times of surface water availability.		
	Without mitigation (Impact Rating)	**With mitigation (Impact Rating)**
Extent	Local area (3)	Site specific (1)
Duration	Moderate term (5–15 years) (3)	Very short term (0–1 years) (1)
Magnitude	Moderate and will result in processes continuing but in a modified way (6)	Minor and will not result in an impact on processes (2)
Probability	Definite (5)	Probable (distinct possibility) (3)
Significance	**Medium (60)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, although this impact cannot be well mitigated as some level of pollution is unavoidable.	
Mitigation:		
See section 3.2.6 of this report.		
Residual Impacts:		
Some level of pollution is inevitable due to the nature of the construction activities and cannot be entirely mitigated. The residual impact would however be low and of short duration for the construction phase provided mitigation is responsibly implemented.		

Table 3-6 Impacts to catchment hydrology associated with the proposed construction phase

Impact Nature: Alteration of catchment hydrology and associated habitat ecology impacts from construction activities		
Construction phase activities that result in the reshaping and change in vegetative cover density for infrastructure with associated alterations of slope, runoff quantities and velocities, infiltration capacity and sediment movement from baseline conditions. This is expected to occur across the catchment, with associated impacts to slope stability, habitat integrity and ecological function. This is especially of concern due to the complex and extensively braided watercourse network compounded by the flat topography between the well-defined drainage features prone to ponding. This is especially true as seen by the level of existing surface flow alterations and impoundments. If not carefully considered, the new road network could limit flows from reaching vernal pools, negatively impacting these systems.		
	Without mitigation (Impact Rating)	**With mitigation (Impact Rating)**
Extent	Local area (3)	Footprint & surrounding areas (2)
Duration	Permanent (5)	Moderate term (5–15 years) (3)
Magnitude	Moderate and will result in processes continuing but in a modified way (6)	Low and will cause a slight impact on processes (4)
Probability	Definite (5)	Probable (distinct possibility) (3)
Significance	**High (70)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes, although this impact cannot be well mitigated as the hydrology alterations are unavoidable. However, the optimized layout has lowered the number of interceptions with watercourses and associated buffers	
Mitigation:		
See section 3.2.6 of this report.		

Impact Nature: Alteration of catchment hydrology and associated habitat ecology impacts from construction activities
Residual Impacts:
Alteration of the catchment hydrology is inevitable due to the nature of the construction activities and cannot be entirely mitigated. The residual impact would however be low and of moderate duration for the construction phase.

3.2.5.3 Operation Phase

During the operation phase, the wind turbines will operate continuously for more than 20 years, largely unattended. Maintenance levels are low in comparison to other renewal energy projects, with maintenance only taking place when required. The operational phase impacts are related to regular (daily/ weekly/ monthly) maintenance activities and associated increase in maintenance vehicles across the project footprint, which are anticipated to have minimal indirect impacts on aquatic ecosystems. The only potentially toxic or hazardous materials which would be present in relatively small amounts would be of lubricating oils and hydraulic and insulating fluids for maintenance. Therefore, contamination of surface or groundwater or soils is highly unlikely. Additionally, there is no water consumption impact associated with the operation of wind turbines.

The modification of the catchment drainage will alter watercourse habitats through altered drainage from baseline conditions with increased erosion and sedimentation of the downslope areas, especially in exposed/ denuded areas and increased hardened surfaces (notably from roads). A localised long-term impact (more than 20 years) of low intensity (depending on the distance between the turbines and the freshwater features) could be expected that would have a very low overall significance post-mitigation in terms of its impact on the identified aquatic ecosystems in the area. Stormwater management will therefore be crucial within the proposed operations footprint.

The following operational phase related impacts to aquatic ecosystems were considered:

- Continued fragmentation and degradation of habitats and ecosystems (Table 3-7);
- Contamination of watercourse and biotic community effects (Table 3-8);
- Alteration of catchment hydrology and associated habitat ecology impacts (Table 3-9).

Table 3-7 Impacts to watercourse habitat and biotic community associated with the operational phase

Impact Nature: Continued disturbance/ displacement/ loss of watercourse habitat		
Disturbance created during the construction phase will leave the project area and watercourses vulnerable to erosion (highly erodible catchment) and encroachment by alien vegetation. The operational phase activities will result in the continued destruction, loss and fragmentation of habitats, ecosystems and biotic community responses. This includes the operation of watercourse crossing structures.		
	Without mitigation (Impact Rating)	**With mitigation (Impact Rating)**
Extent	Low (2)	Site specific (1)
Duration	Long term (> 15 years) (4)	The lifetime of the impact will be of a short duration (2-5 years) (2)
Magnitude	Moderate and will result in processes continuing but in a modified way (6)	Low and will cause a slight impact on processes (4)
Probability	Definite (5)	Probable (distinct possibility) (3)
Significance	**Medium (60)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High

Impact Nature: Continued disturbance/ displacement/ loss of watercourse habitat		
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes, with proper management and avoidance and appropriate structures implemented at construction, this impact can be mitigated to a low level.	
Mitigation:		
See section 3.2.6 of this report.		
Residual Impacts:		
The ESA areas will be degraded by the WEF and grid development activities, however the area is not pristine with historical modification present. However, the highest impacts stem from the construction phase, while operational impacts are of low intensity. Despite mitigation, erosion is expected across the project footprint, influencing downslope watercourses and habitat, especially where roads intercept with watercourses or lateral drainage. The residual impact following mitigation would however be low.		

Table 3-8 Contamination of watercourses and biotic community effects associated with the operational phase

Impact Nature: Pollution of water resources from operational activities		
The operation and maintenance of the proposed development will result in minimal pollution impacts from lubricating oils and hydraulic and insulating fluids for turbine maintenance, and hydrocarbons (fuels, oil, etc) from leaking maintenance vehicles which escape into the environment along the road network, entering downslope watercourses during rainfall events, with impacts to water quality and ecological functioning.		
	Without mitigation (Impact Rating)	**With mitigation (Impact Rating)**
Extent	Local area (3)	Site specific (1)
Duration	The lifetime of the impact will be of a short duration (2-5 years) (2)	Very short term (0–1 years) (1)
Magnitude	Moderate and will result in processes continuing but in a modified way (6)	Minor and will not result in an impact on processes (2)
Probability	Definite (5)	Probable (distinct possibility) (3)
Significance	**Medium (55)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, although this impact cannot be well mitigated as some level of pollution is unavoidable, although minimal.	
Mitigation:		
See section 3.2.6 of this report.		
Residual Impacts:		
Some level of pollution is inevitable due to the nature of the operational activities and cannot be entirely mitigated. The residual impact would be low and of very short duration following the implementation of mitigation.		

Table 3-9 Impacts to catchment hydrology associated with the operational phase

Impact Nature: Alteration of catchment hydrology and associated habitat ecology impacts from operational activities		
As a result of the landscaping to new topography and change in vegetative cover type in the project footprint, together with increased hardened surfaces from grid infrastructure, turbine platforms and road network, new functioning regimes pertaining to surface runoff, infiltration and sediment movement patterns will influence the adjacent natural habitat characteristics. This in turn will influence habitat integrity and ecological functioning, notably from localised increases in return flows (surface runoff), erosion and instream sedimentation impacts. This would be applicable to habitat and watercourse features in proximity to the proposed infrastructure, notably the areas downslope of the road network.		
	Without mitigation (Impact Rating)	**With mitigation (Impact Rating)**
Extent	Local area (3)	Footprint & surrounding areas (2)
Duration	Long term (> 15 years) (4)	The lifetime of the impact will be of a short duration (2-5 years) (2)

Impact Nature: Alteration of catchment hydrology and associated habitat ecology impacts from operational activities		
Magnitude	High (processes are altered to the extent that they temporarily cease) (8)	Low and will cause a slight impact on processes (4)
Probability	Definite (5)	Probable (distinct possibility) (3)
Significance	**High (75)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, although this impact cannot be well mitigated as the hydrology alterations are unavoidable. However, the operational activities need to avoid direct impacts to watercourses and associated buffers, notably erosion.	
Mitigation:		
See section 3.2.6 of this report.		
Residual Impacts:		
Residual impacts following mitigation are largely related to altered surface runoff and erosion due to altered hydro-dynamics and erodibility of the associated catchment.		

3.2.5.4 Cumulative Impacts

Cumulative impacts are assessed in context of the extent of the proposed project area; other developments in the SQR and Quaternary catchment areas; and general habitat loss and transformation resulting from other activities in the area. The impacts of projects are often assessed by comparing the post-project condition to a pre-existing baseline condition. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline, at a point in time, may represent a significant change from the original state of the system. This section describes the potential impacts of the project that are cumulative for freshwater fauna and flora.

Localised cumulative impacts include the cumulative effects from anthropogenic activities that are close enough (such as nearby farming activities within the area) to potentially cause additive effects on the environment or sensitive receivers. These include disruption of ecological corridors or habitat such as watercourses, impacts to groundwater and surface water quality, and transport of soils and instream habitat smothering impacts associated with catchment and road reserve erosion.

Long-term cumulative impacts due to the proposed electricity generation and transmission footprint, comprising the wind turbines and servitudes in the upper reaches of the Kariega River combined with the low density agricultural activities currently present in these upper reaches (Figure 3-5 and Figure 3-6), has the potential to degrade watercourse habitat across the catchment. The cumulative impact of the project was rated as medium should the project go ahead and involve the implementation of mitigation.

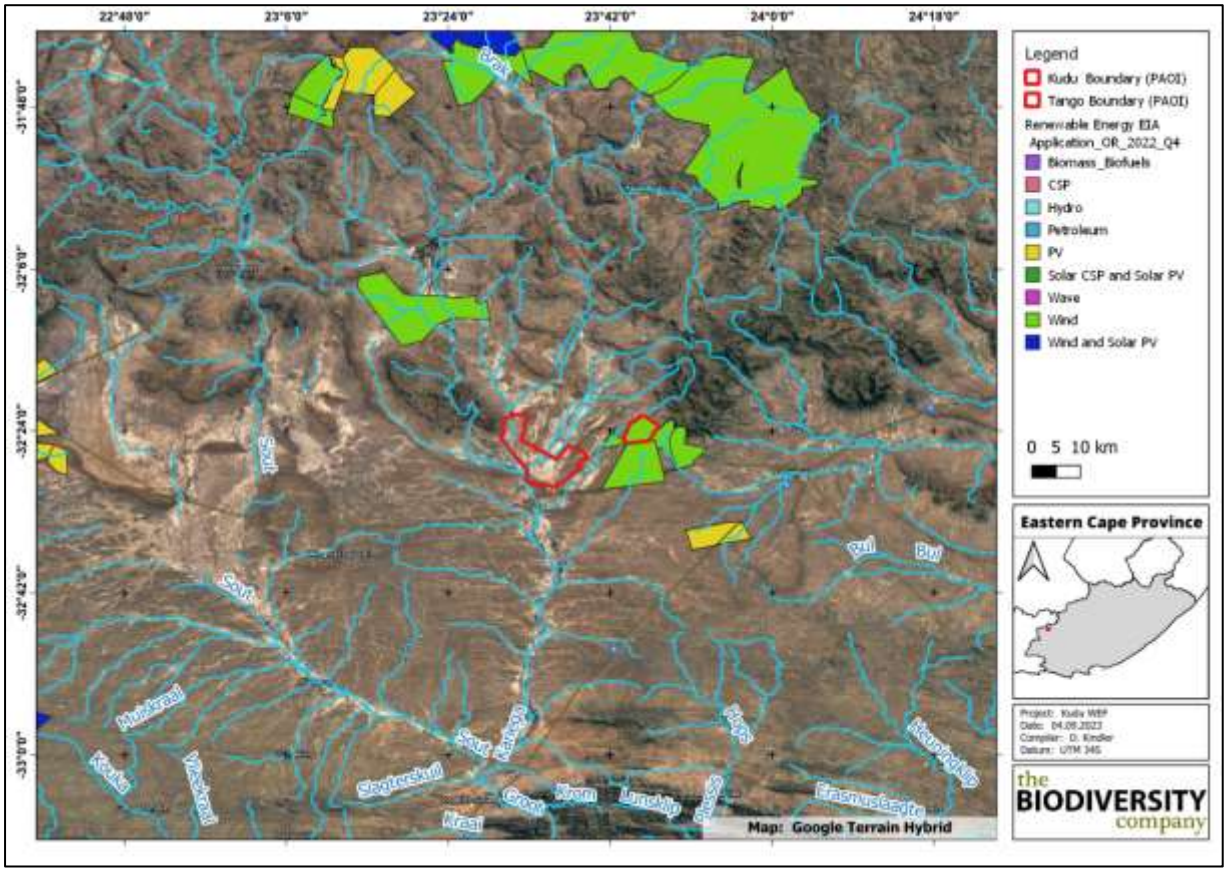


Figure 3-5 Cumulative renewable applications in region

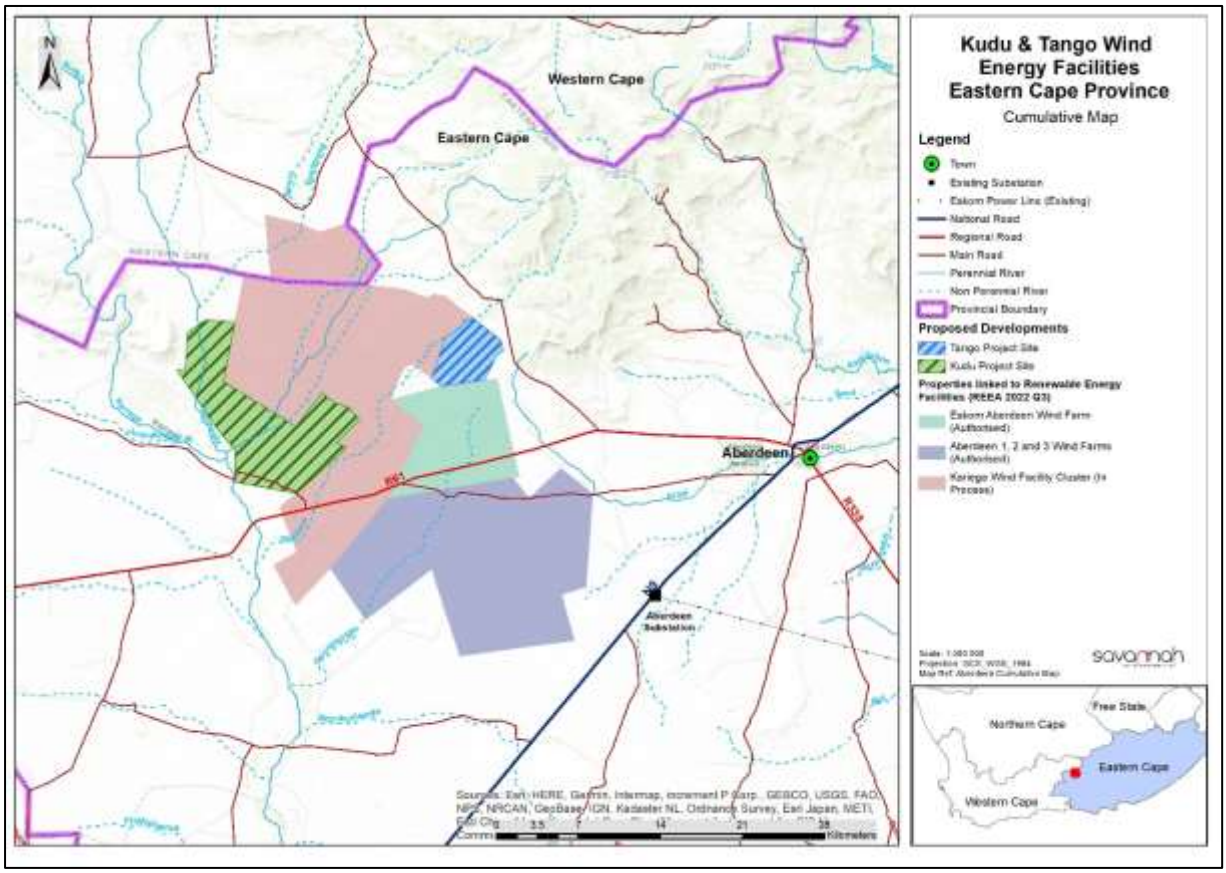


Figure 3-6 Cumulative renewable applications in region (Savannah, 2023)

Table 3-10 Cumulative impacts to aquatic ecology associated with the proposed project

Impact Nature: Cumulative loss/ disturbance of habitat and ecological functioning of watercourses in the region		
The development of the proposed infrastructure will contribute to cumulative habitat loss within the local ESAs, watercourses and adjacent habitat together with the potential for increased contaminants and sediment entering the watercourses. The loss/alteration of habitat lowers the buffering capacity of the catchment to water quality impacts, which will have negative impacts on the ecological processes of the associated watercourse in the PAOI, with no impacts of significance expected in the region.		
	Overall impact of the proposed project (with mitigation) considered in isolation	**Cumulative impact of the project together with the existing and proposed projects in the area**
Extent	Footprint & surrounding areas (2)	Local area (3)
Duration	Long term (> 15 years) (4)	Long term (> 15 years) (4)
Magnitude	Low and will cause a slight impact on processes (4)	Moderate and will result in processes continuing but in a modified way (6)
Probability	Probable (distinct possibility) (3)	Highly probable (4)
Significance	**Medium (30)**	**Medium (52)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes, although this impact cannot be well mitigated as some level of hydrological and habitat modification is unavoidable. Avoidance of watercourse areas will be of highest importance to mitigate impacts. However some watercourse crossing are required.	
Mitigation:		
See section 3.2.6 of this report.		
Residual Impacts:		
Some level of modification is inevitable due to the nature of the construction and operational activities and cannot be entirely mitigated. The residual impact would be medium and of long term duration for the life of the project following the implementation of mitigation.		

3.2.5.5 Decommissioning Phase

During decommissioning, the potential freshwater impacts will be very similar to that of the Construction Phase, although the potential for water quality and flow related risks will be lower.

During decommissioning, disturbance to the freshwater ecosystems should be limited as far as possible. Disturbed areas may need to be rehabilitated and revegetated. Mitigation and follow up monitoring of residual impacts (alien vegetation growth and erosion) will be required.

3.2.6 Mitigation

In light of the expected impacts from proposed activities the following mitigation measures have been proposed to lower the intensity of the impacts on the ecological integrity of the catchment and its downslope watercourses.

3.2.6.1 Mitigation Measure Objectives

The focus of mitigation measures should be to reduce the significance of potential environmental impacts associated with the Project to thereby:

- Prevent the unnecessary destruction, and fragmentation of the watercourses (including the riparian areas and vernal pools where applicable) through avoidance strategies;

- Prevent the loss of the faunal community (aquatic, vernal and terrestrial) associated with the watercourse habitat; and
- Limiting the construction area to the defined project areas and only impacting those areas where it is unavoidable to do so otherwise, such as at the existing areas of disturbance along the existing road network.

3.2.6.2 Development specific mitigation measures

The following development specific mitigation measures are provided:

- A buffer of 32 m is allocated to the watercourse delineations. Adherence to the buffer areas outside of the areas earmarked for the proposed project infrastructure. These should be visibly demarcated in areas where construction will verge the buffers to avoid encroachment into these areas;
- Buffer zones must be treated as no-go areas and maintained as conservation areas; and
- The project area is susceptible to surface ponding with a high water retention time expected, due to the flat topography comprising clay soils. To cater for this, the project will require a raised road.

3.2.6.3 Roads and Cabling (Linear infrastructure)

The PAOI already has an existing road network comprising several watercourse crossings. Despite the presence of this existing infrastructure, the project requires additional roads. These must be aligned with the existing road network as far as possible and must avoid the establishment of new watercourse crossing infrastructure in undisturbed areas (where feasible). The proposed road network construction is regarded as a low risk to the watercourses should construction occur outside of the delineated sensitive drainage features and implement the necessary mitigation. The minimisation of the optimized layout to limited watercourse crossings is deemed sufficient to maintain this low risk rating, provided all mitigation for the crossings points in responsibly implemented. Similarly, the cabling construction is regarded as a low risk to the watercourses should construction occur outside of the delineated sensitive drainage features and implement the necessary mitigation. Should road and cable placement be within the watercourse areas impacts would be expected.

The following powerline and road mitigation measures are provided:

- The recommended buffer zones must be strictly adhered to during the construction phase of the project, with exception of the activities and structures required to traverse the watercourse. Any supporting aspects and activities not required to be within the buffer area must adhere to the buffer zone;
- Areas where construction is to take place must be clearly demarcated. Any areas not demarcated must be completely avoided;
- Landscape and re-vegetate all cleared areas as soon as possible to limit flow path creation and erosion potential;
- It is strongly recommended that the project make use of existing road networks, before new areas are cleared for new access roads. The optimized road layouts are deemed sufficient;

- The project must focus on responsible stormwater management during construction and operation (see Hydrological Management Measures);
- Install sedimentation/erosion protection measures prior to construction in the form of several rows of sand bags, silt traps and/ or fences, this is particularly important in the access roads leading to any drainage channel and around active working areas for culvert installations;
- Energy dissipation, such as stone berms or blocks must be strategically placed along the road margins for the entire road network as surface runoff leaves the roads and enters the surrounding environment with the potential for severe erosion and damage to road margins. The steeper the slope of the road, the more regular the berms should be spaced and can be as close as one meter apart where necessary. This is for the life of the project;

Figure 3-7 Example of road margin erosion prevention

- The road margins should be hydroseeded with vigorous growing indigenous grasses that are drought tolerant to lower erosion of these key areas;
- An inspection of the road and cabling network and surrounding influenced areas must be completed within 1 month following the end of construction activities and within a week after the first rainfall event that results in surface runoff. Thereafter, routine monitoring should take place for the life of the project. Should erosion be developing this must be immediately addressed through appropriate and adaptive measures.

3.2.6.4 Hydrological Management Measures (Watercourse Crossings)

Culverts and bridges are structures built into a road, to allow water to pass under roads to protect the roads from erosion and flooding. The construction and operational risks of these structures can be lowered following the correct implementation of mitigation actions. The following measures must be implemented to prevent alterations to the hydrological regime of catchments surface flow and downslope watercourses:

- Preparation of crossing points and installation of the crossing structures must be undertaken during the low flow period to avoid the need for river diversions and associated impacts;
- To minimise the impact on both surface water flow and interflow, portions of the road must include a coarse rock layer that has been specifically incorporated to increase the porosity and permeability of the sub-layers of the road. This is most applicable in

depressions and the supporting structures of drainage crossings, even if these drainage lines seem inferior;

- All crossings along the road route must allow for sufficient dispersion of water through the road to prevent the concentration of flow and the resultant scouring and incision of the discharge areas;
- Ensure that hydrological connectivity between areas upstream and downstream of construction activities are maintained throughout the construction phase;
- The maintenance of natural interflow in the watercourses must be maintained using several culverts that span the extent of the macro-channel, thus box type culverts are preferred over pipe culverts to avoid concentrating flows, scouring and erosion. This is applicable where crossings are required;
- The width of the culvert should be at least equal to the average stream bed width, otherwise multicell box culverts must be used;
- Box culverts that have a solid flat cement base (cube shaped) must be avoided as they result in a uniform depth and flow of water covering the full width of the culvert floor, resulting in an insufficient depth of water for the passage of aquatic biota during periods of flow;
- Alternatively, arch shaped box culverts with natural riverine bottoms allow for the natural stream depth and flow characteristics, with associated maintenance of a low flow channel that aquatic biota can utilise;
- The use of precast arch shaped (with an open base) box culverts, could result in substantial cost savings associated with lower difficulty and less time spent on site (speed of construction) in comparison to building bridges, which in turn will lower the environmental impact at the crossing sites;
- Inlets and outlets of each culvert must be positioned below the stream bed for the continuation of the streambed and natural movement of riverine substrates as discussed for Arch shaped box culverts;
- The gradient and horizontal alignment of the culverts must be the same as the existing watercourse bed;
- The culverts to be utilised must be able to accommodate at least a 1:50 year flood;
- Rocky material (aggregate) must be placed at the base of the culvert discharge point(s) to avoid the concentrated flow from eroding and scouring the receiving area. Ideally this layer should incorporate a double layer with the bottom layer partially sunken into the riverbed, with the second layer placed on top of the base layer. Due to the increased flow velocities created by smooth concrete and box culverts flow dynamics, the sediments in the discharge area are expected to be washed away. The double aggregate layer will limit this for most flow events;
- For best environmental practice implementation and least long term environmental impact, each watercourse crossing structure should incorporate larger box (single or multicell) culverts with natural riverine bottoms over the smaller culvert pipes; and

- Ensure that the beds and banks of the watercourses at the road crossing areas are restored to the natural base level to prevent erosion or upstream ponding post construction.

3.2.6.5 Wind Turbines

The biggest impact to watercourses associated with the wind turbines is the placement of the wind turbine platforms (cement platforms) and the associated hardened surface to accommodate the cranes to lift the turbines in place. Hydrology impacts relating to surface runoff from these structures is regarded to be of low significance.

The following wind turbine mitigation measures are provided:

- The wind turbine platforms and the associated hardened surface to accommodate the cranes must be constructed outside of the delineated drainage network and buffer where possible. This avoidance measure limits platforms from being built within or near drainage features; and
- During the construction phase, site management must be undertaken at the laydown area, batching plant and the individual turbine construction areas. This should specifically address on-site stormwater management and prevention of pollution measures from any potential pollution sources during the construction activities such as hydrocarbon spills. Any stormwater that does arise within the construction sites must be handled in a suitable manner to trap sediments and reduce flow velocities.

3.2.6.6 Erosion and Sedimentation of Catchment and Downstream Watercourses

The alteration of surface topography and hydrology and the increase in exposed soil surfaces along road networks and disturbed areas, will inevitably be accompanied by an increase in erosion and sedimentation as rainwater erodes and washes exposed soils into downslope watercourses. This is a key consideration for the project due to the high erodibility of the catchment soils.

- Loose soils are particularly prone to loss due to wind or water. It is therefore preferable that construction takes place during the dry season to reduce the erosion potential of the exposed surfaces;
- Practice good soil management across the PAOI;
- All removed soil and material must not be stockpiled within the watercourses. Stockpiling should take place outside of drainage systems. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
- Avoid the creation of concentrated flow paths wherever possible;
- Devise and implement a stormwater management plan for the project footprint;
- Install sandbags as a temporary measure around key areas of soil loss to prevent soils washing into the local watercourses;
- Signs of erosion must be addressed immediately to prevent further erosion of the area to prevent headcut erosion from forming;

- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching;
- Any exposed earth should be rehabilitated promptly by planting suitable drought tolerant vegetation (vigorous indigenous grasses) to protect the exposed soil;
- Relandscape to gentler gradients and re-vegetate all cleared areas as soon as possible to limit erosion potential. Sandbags and geotextiles should be used to assist until vegetation has established in these reworked areas;
- A 1:3 gradient is considered best practice to ensure vegetation establishment and limit erosion and topsoil loss.
- Stem any headcut/ erosion gulley as it occurs by bulldozing, filling, re-contouring to gentler gradients and re-vegetating; and
- The rehabilitation of watercourse banks should take place as an offset to altered land use with associated negative ecological impacts. Key areas where erosion has occurred should be rehabilitated through bank reprofiling to gentler gradients and the revegetation of the reworked banks.

3.2.6.7 Water Quality Management Measures

The use of various construction materials and equipment has the potential to be contaminate local soils and surface waters, with associated impacts on terrestrial and freshwater habitat and biota. The following mitigation measures are provided to lower the risk and intensity of these impacts:

- Restrict construction activities within the designated areas as indicated on the construction layout plan;
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the drainage systems;
- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly;
- All chemicals and toxicants to be used for the construction must be stored outside the watercourses and in a bunded area or their buffer zones;
- Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) or construction materials on site (e.g. concrete) in such a way as to prevent them leaking and entering the environment;
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
- Servicing of vehicles and refuelling may not take place on site or in close proximity of any watercourse;
- No vehicle or machinery is allowed to be washed within a watercourse or its buffer area, and should preferably take place off site;
- Drip trays or any form of oil absorbent material must be placed underneath construction vehicles/machinery and equipment when not in use;

- Drip trays or other suitable secure weather-proof containers should be kept on site in the event of a vehicle leakage or spillages;
- Mixing of concrete must under no circumstances take place within the drainage systems. Scrape the area where mixing and storage of sand and concrete occurred to clean once finished;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. These should not be placed near any watercourse or in buffer zones. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation); and
- The contractor is responsible for cleaning up any spillages (e.g. concrete, oil, fuel), immediately and contaminated soil must be removed and disposed of appropriately.

3.2.6.8 Spread of Alien and Invasive Vegetation

Disturbance of soil and vegetation has the potential to be accompanied by the proliferation and spread of alien and invasive species. The following mitigation is recommended:

- Keep disturbances to within footprints and outside of buffer zones;
- Control new stands of alien species as they arise;
- Land users are required by law, to remove and / or control Category 1 alien and invasive vegetation according to the National Environmental Management: Biodiversity Act (NEMBA: Act 10 of 2004) (September 2020 List – GN1003). Additionally, unless authorised, in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse;
- It is recommended that Category 1 species are prioritised for control, with control of herbaceous weedy species (which would need to include follow-up control);
- Foliar herbicide spray must not be used within any of the sensitive riparian areas, rather opt for mechanical removal or direct dribbled application to stumps (use a dye); and
- Quarterly vegetation rehabilitation surveys need to be conducted of the vegetation within the project footprint to stay on top of the alien vegetation for the life of the project. This will improve the biotic integrity of the watercourses over the long term.

3.2.6.9 General Mitigation Measures

The following general mitigation measures are provided:

- Construction activities must take place during the low flow period (as much as possible). In addition to this, basic stormwater structures such as berms must be

designed and implemented prior to and throughout the duration of the construction activities;

- A qualified Hydrologist with experience in arid areas must develop a suitable and adaptive Stormwater management plan to ensure no erosion takes place and that clean water reports back to the local watercourses;
- Stormwater runoff from the infrastructure should enter the drainage systems through diffuse channels fitted with flow attention / energy dissipation structures in the form of green infrastructure;
- The water resources outside of the specific project site area must be avoided;
- Prevent uncontrolled access of vehicles through the watercourse that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas;
- Laydown yards, camps and storage areas must be beyond the watercourse and associated buffer areas;
- The access road and associated road margins, and silt traps must be inspected on a monthly basis for signs of erosion. When erosion is observed, the area should be rehabilitated within 7 days. In addition, inspections following a >50 mm/ 24 hr rainfall event must occur within 7 days of the event;
- No dumping of construction material on-site may take place;
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported; and
- Make sure all excess consumables and building materials / rubble are removed from site and deposited at an appropriate waste facility.

4 Monitoring and management programme

Based on the outcomes of this assessment, further actions are recommended:

- Annual auditing of the recommended mitigation actions for the project infrastructure must be conducted and amended to suit the needs of the local conditions;
- Alien invasive vegetation assessments must be conducted in accordance with the terrestrial component of this overall application;

It is noted that the mitigation actions provided in this assessment must make use of the proposed mitigation actions as an Environmental Management Programme (EMP). The outcome based management plan for freshwater resources is presented in Table 4-1.

Table 4-1 Outcome Based Management Plan

Outcome	Action	Timeframe
Limit watercourse habitat degradation	Implement buffer and no-go areas.	Project lifespan
	Implement stormwater management plan.	Project lifespan
	Revegetate disturbed areas.	Project lifespan
	Implement erosion control measures such as energy dissipation and vegetative cover.	Project lifespan

Outcome	Action	Timeframe
	Implement alien invasive plan removal and monitoring programme.	Project lifespan
Limit water quality degradation	Implement buffer and no-go areas.	Project lifespan
	Implement stormwater management plan.	Project lifespan
	Implement erosion control measures such as energy dissipation and vegetative cover.	Project lifespan
	Revegetate disturbed areas.	Project lifespan
	Implement alien invasive plan removal and monitoring programme.	Project lifespan
	Implement stockpile and waste management strategies whereby exposure to direct runoff can be reduced.	Project lifespan
Effective Water Resource Management	Implement water quality monitoring studies in times of flow.	Project lifespan
	Implement annual vernal biota monitoring studies	Project lifespan

The monitoring plan has been designed to be achievable and realistic for the nature of the project. The plan must provide details as to the frequency of the monitoring efforts, the location of these efforts and what should be monitored. The primary focus for the monitoring plan is to evaluate the success of the rehabilitation efforts.

Seasonal monitoring: The applicant must appoint an independent contractor to conduct seasonal (wet season) monitoring for a period of two years after the completion of the rehabilitation measures. The monitoring should be conducted during October/ November or shortly after the first summer rains, and then towards the end of the growing season. The monitoring should inspect the following:

- Recovery of the vegetation layer;
- Extent of alien vegetation establishment;
- Hydrology and inundation of the drainage systems;
- The formation of erosion gullies and sedimentation of the drainage systems; and
- The removal of solid waste from the watercourses and buffer areas.

Vernal biota monitoring: Due to the deficiency in data on vernal biota, species diversity and conservation status across South Africa, the applicant must appoint a freshwater ecologist to conduct seasonal (wet season) monitoring every two to three years for the life of the project. This will exclude years of drought where no rain has fallen, when the vernal biota are in their dormant desiccated egg stages. The monitoring should be conducted during October/ November or shortly after the first summer rains, within two weeks of the first rains. The monitoring should inspect the following:

- Presence/absence of vernal biota and impacts from road network on hydrology for these systems;
- Collection of vernal biota and/or sediment samples for hatching and species identification studies. This should be done for at least 2 surveys until no new species are recorded; and

- Thereafter, surveys should be repeated once every 5 years to monitor the state of the vernal systems and associated vernal biota.

5 Recommendations

The following recommendations are provided for the project:

- A competent Environmental Control Officer (ECO) must oversee the construction and associated rehabilitation phase of the project, with watercourse areas as a priority to limit the listed impacts on the watercourses. Two follow up ECO assessments/ audits must be carried out in the first and sixth months of operation. Ideally one of these audits should take place following a rainfall event. The ECO must be supplied with a copy of this report, and the associated terrestrial biodiversity report, to familiarise themselves with the mitigation and recommendations prior to construction;
- Several aquatic features or aquatic functional zones are present including an extensive braided watercourse network, which may provide some technical challenges due to seasonal flooding. Any footprint within these areas will likely require careful planning in order to minimise changes to flows which could alter species composition and affect ecological processes to both aquatic and terrestrial areas. Furthermore, in general the braided watercourse areas align with the ESA designations. As a minimum any roads traversing these alluvial areas must accommodate lateral flows (interconnectivity) of water and sediment between watercourses and alluvial area where seasonal flooding occurs. This challenge can be overcome through the use of raised access roads fitted with appropriate aggregate base layers and culverts to allow lateral movement of water and to minimise localised flooding and/or drying out;
- The optimized road alignments have been designed to largely avoid most watercourses and their 32 m buffer areas. Multiple crossings across the same watercourse section are not advised, and must be restricted to the minimum number feasible;
- There are several artificial and natural vernal pools located in close proximity to the proposed road between turbines N23 and N24, and turbines S37 and S38, respectively. It is suggested that this infrastructure be relocated slightly and meander to avoid these aquatic features while catering for natural surface runoff (box culverts) to continue to feed into these aquatic features to sustain the functioning of these systems and their likely vernal biota;
- A qualified freshwater ecologist conduct seasonal (wet season) monitoring of the vernal biota every two to three years to record species diversity and monitor that the project is not impacting on these populations;
- A qualified Hydrologist with experience in arid areas must develop a suitable and adaptive Stormwater management plan to ensure no erosion takes place and that clean water reports back to the local watercourses which includes the vernal pools;
- An adaptive rehabilitation plan needs to be implemented from the onset of the project. The key focus should be placed on stormwater and erosion prevention strategies for the development area. The plan should be adhered to for all stages of the project life;
- Therefore, an infrastructure monitoring and service plan must be compiled and implemented during the operational phase. This will include monitoring the road

reserve route, all stormwater discharge points, energy dissipation structures, and stability of watercourse habitat in the project footprint. This service plan should be adaptive based on on-site conditions;

- This report must consider the associated terrestrial biodiversity report and associated mitigation and recommendations; and
- A walkdown must be conducted on the final layout to confirm the larger watercourses are adequately avoided, and that the smaller drainage features (regardless of how insignificant they may appear) will have adequate flow catering structures in place. This must be conducted prior to final design sign off and construction.

6 Conclusion

6.1 Baseline Ecology

The baseline assessment investigated the watercourses present within the PAOI. Numerous drainage features are present comprising of an extensive braided watercourse network, presenting ephemeral conditions with scattered vernal pools present. Several watercourses presented surface water at the time of the survey, however not all of them were suitable for the assessment of aquatic biota. The sampled watercourses were tributaries of the Tulpleegte and Kariega rivers. The results of the PES assessment derived a moderately modified (class C) status for the Tulpleegte. The anthropogenic activities within the catchment have resulted in large modifications to the riparian and instream habitat integrity of the watercourse. These activities have contributed to alteration of hydrology and some erosion of the river banks, with evidence of flow and channel modification, cumulatively reducing the biotic integrity of the sampled watercourses. The biotic integrity must be interpreted with caution due to the ephemeral nature of the watercourses and limited availability of surface water to support a diverse aquatic ecosystem.

Despite modification, the instream water quality in the sampled systems was suitable for aquatic biota, which was supporting a low diversity of aquatic macroinvertebrates. This low diversity is a common feature of arid region communities due to surface water limitations. Sampling for fish was conducted, however despite adequate habitat suitability for fish, no fish were collected. The absence of fish is likely due to the ephemeral nature of the watercourses that may not be conducive to support fish year-round. It is likely that the absence of sufficient rainfall leading up to the survey may have limited the presence of fish at the time of the survey. Despite this, fish are likely present within the Kariega River immediately downstream of the PAOI, highlighting the need to limit water quality and habitat impacts during the execution of the project to conserve fish and aquatic life within the downstream watercourse and those potentially occurring within the sampled watercourses. Additionally, vernal biota namely clam shrimp (Conchostraca) were sampled in the upper reaches of the Tulpleegte River. The specialist recommends that the moderately modified (class C) status be set as the Management Class for the watercourses traversed by the project infrastructure.

Due to the sensitivity of the catchment and soils to erosion, together with the flat topography and braided alluvial fan nature of the watercourses within the PAOI, an increase in anthropogenic activities poses a risk to the ecological integrity of the watercourses notably from a hydrological perspective. The presence of aquatic macroinvertebrates and vernal biota highlights the sensitivity of the watercourses. Any proposed activities in proximity to the watercourses should not further contribute to the deterioration of the instream and riparian

zones as this will compromise the ecological integrity of the reach and Management Class may not be achieved.

The aquatic features presented in this report require a buffer of 32 m and are to be treated as a no-go zone and avoided as far as is feasible. The optimized layout has implemented the avoidance strategy and positioned majority of the turbine platforms and road networks outside the buffer areas. There are however some watercourse crossings proposed and these are deemed acceptable and appropriately placed. There are however several artificial and natural vernal pools located in close proximity to the proposed road between turbines N23 and N24, and turbines S37 and S38, respectively. It is suggested that this infrastructure be relocated slightly and meander to avoid these aquatic features while catering for natural surface runoff (box culverts) to continue to feed into these aquatic features to sustain the functioning of these systems and their likely vernal biota. Ensuring that aquatic features and buffers are intact increases the resilience of a watercourse to future disturbances. These buffers would ensure adequate ecological integrity maintenance from the adjacent proposed wind energy facilities.

6.2 Impact Assessment

An impact statement is required as per the NEMA regulations with regards to the proposed development. As a result of the ephemeral and braided nature of the watercourses and susceptibility to erosion and the flat topography likely to be seasonally flooded, the construction and operation phase activities would influence the hydrology, water quality and soil movement within the affected watercourses and vernal pools, notably where the proposed infrastructure traverse these aquatic features and their associated 32 m buffer. This 32 m buffer would also apply to the vernal pools. The optimized layout has largely avoided the ESAs and associated aquatic features with some watercourse crossings proposed and these are deemed acceptable and appropriately placed. There is however the exception of portions of the roads that come in close proximity to the vernal pools and fall within their buffers. These need to be avoided. Provided the mitigation and recommendations are implemented responsibly the project will present low rated residual impacts to the watercourses.

Specialist Opinion

Based on the survey findings, the specialist agrees with the “Very High” aquatic theme sensitivity as per the National Web based Environmental Screening Tool. The project infrastructure does pose risk to the watercourses and it is the specialist’s opinion that following the implementation of avoidance mitigation, recommendations and remedial measures, the risks can be lowered. Therefore, authorisation of the proposed development can be carefully considered by the authorities.

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Van Deventer, H., Smith-Adao, L., Collins, N.B., Grenfell, M., Grundling, A., Grundling, P-L., Impson, D., Job, N., Lötter, M., Ollis, D., Petersen, C., Scherman, P., Sieben, E., Snaddon, K., Tererai, F. and Van der Colff D. 2019. South African National Biodiversity Assessment 2018: Technical Report. Volume 2b: Inland Aquatic (Freshwater) Realm. CSIR report number CSIR/NRE/ECOS/IR/2019/0004/A. South African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.500.12143/6230.

Appendix A Specialist Declaration

I, Dale Kindler declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Dale Kindler

Freshwater Ecologist

The Biodiversity Company

28 August 2023

APPENDIX P3:
AVIFAUNA SITE SENSITIVITY VERIFICATION REPORT

APPENDIX I: SITE SENSITIVITY VERIFICATION – WEF

RECONNAISSANCE REPORT
(IN TERMS OF PART B OF THE ASSESSMENT PROTOCOLS PUBLISHED IN GN 320 ON 20 MARCH 2020 AND GN 43855 ON 30 OCTOBER 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 information sources were used to compile this report:

- Bird distribution data from the Second Southern African Bird Atlas Project (SABAP2) was obtained (https://sabap2.birdmap.africa/) to ascertain which species occur in the pentads where the proposed Project is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5' × 5'). Each pentad is approximately 9 × 8 km in size. To get a representative impression of the bird species in the area a consolidated dataset was obtained for a total of nine (9) pentads some of which intersect and others that are near the Project Site, henceforth referred to as "the Broader Area". The nine pentad grid cells are the following: 3220_2340, 3220_2345, 3220_2350, 3225_2340, 3225_2345, 3225_2350, 3230_2340, 3230_2345, and 3230_2350. To date, a total of 123 full protocol lists (i.e. intensive bird listing surveys lasting at least two hours each) and 188 ad hoc protocol lists (surveys lasting less than two hours but still yielding valuable data) have been completed for the nine pentads where the Project Site is located.
- The SABAP2 data was regarded as a reliable reflection of the avifauna which occur in the Broader Area, but the data was also supplemented with data collected during the on-site surveys and with general knowledge of the area.
- A classification of the vegetation types in the Project Site was obtained from the First Atlas of Southern African Birds (SABAP1) and the National Vegetation Map (2018) compiled by the South African National Biodiversity Institute (Mucina & Rutherford 2006).
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red List Book of Birds of South Africa, Lesotho and Swaziland (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 latest (2022.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015; http://www.birdlife.org.za/conservation/important-bird-areas) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- An intensive internet search was conducted to source information on the impacts of wind energy facilities on avifauna.
- Satellite imagery (Google Earth © 2022) was used to view the broader area on a landscape level and to help identify bird habitat on the ground.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the Project Site relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the Project Site.
- The following sources were consulted to determine the investigation protocol that is required for the site:

- 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 om 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 Project Sites in southern Africa. Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa.

- The primary source of information on avifauna in the area came from the pre-construction monitoring which was conducted at the FE Kudu WEF Project Site and surrounds across four seasons during 2021–2022.

OUTCOME OF SITE RECONNAISSANCE

➢ **Natural Environment**

The Project Site falls within the Nama-Karoo Biome (Mucina & Rutherford 2006). The Nama-Karoo covers an extensive part of the south-central plateau of South Africa - an area of 248 284 km^2 (Mucina and Rutherford, 2006). The biome is characterized by low rainfall (70 to 500 mm per year) that falls mostly in late summer (Mucina & Rutherford 2006) resulting in a high summer aridity index (Rutherford & Westfall 1985). The biome is classified as arid (Mucina & Rutherford 2006). Summers are hot (maximum >30^{o}C), winters are cold (minimum close to 0^{o}C) and frost is common. The vegetation of the Nama-Karoo is dominated by chamaephytes (low-growing shrubs) and hemicryptophytes (graminoids) in a grassy, dwarf shrubland.

The main vegetation types within the Project Site are Southern Karoo Riviere (Inland Saline Vegetation Bioregion) and Eastern Lower Karoo (Lower Karoo Bioregion). The Southern Karoo Riviere vegetation type occurs along the rivers of the semi-arid regions of the Nama-Karoo. It is dominated by *Vachellia karroo* trees and is tolerant of severe flooding. Associated species include *Diospyros dichrophylla*, *Lycium oxycarpum*, *Cenchrus ciliaris* and *Gymnosporia heterophylla*. The Eastern Lower Karoo is characterised by flat plains interrupted by some dolerite dykes, butts, and mesas (koppies). The dominant vegetation is low to middle-height microphyllous shrubland with drought-resistant 'white' grasses becoming abundant in places, especially on sandy and silty bottomlands. Leaf-succulent dwarf shrubs of the families Aizoaceae and Crassulaceae can also be encountered.

The Project Site also contains several non-perennial rivers with their associated drainage line woody vegetation. These areas are of particular importance to avifauna for roosting, nesting, and foraging. Raptors may also use these areas to hunt other bird species. There is a prominent mountain and its associated rocky cliffs and ridges ~2km east of the Project Site, which could be utilized by several priority species, especially raptors.

Whilst the distribution and abundance of the bird species in and near the Project Site is mostly associated with natural vegetation, as this comprises virtually all the habitat, it is also necessary to examine the anthropogenic modifications to the environment that have relevance for birds.

➢ **Modified Environment**

The following avifaunal-relevant anthropogenic habitat modifications were recorded within the Project Site:

- **Surface Water:** The Project Site contains sources of permanent surface water, namely, boreholes with water troughs, or cement dams. There are also several ground dams. The land use in the broader area is mostly small stock and game farming. The entire area is divided into large grazing camps, with associated boreholes and drinking troughs. In this arid environment, open water is a big drawcard for birds which use the open water troughs to bath and drink.
- **Alien Trees:** The Project Site is generally devoid of trees, except for isolated clumps of trees at homesteads and boreholes, where a mixture of alien and indigenous trees grow. The trees could attract a variety of bird species for the purposes of nesting and roosting.
- **Agriculture:** The land use in the broader area is mostly small stock (sheep) and game farming. The Project Site and nearby areas contain irrigated fields, usually lucerne, or planted grazing pasture for sheep. Birds could utilise these areas for foraging.

➢ **DFFE Screening Tool**

The Project Site and immediate environment is classified as **HIGH** sensitivity for avifauna according to the Animal Species Theme (**Figure 1**). The sensitivity classification is linked to the possible occurrence of Ludwig's Bustard *Neotis ludwigii* (Globally and Regionally Endangered), Southern Black Korhaan *Afrotis afra* (Globally and Regionally Vulnerable) and Black Harrier *Circus maurus* (Globally and Regionally Endangered). The Project Site contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for specialist assessments 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). SCCs are listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered, Near-threatened or Vulnerable.

The occurrence of SCC at the Project Site was confirmed during the 12-month pre-construction monitoring programme (January 2021 to January 2022) with observations of Ludwig's Bustard, Blue Crane *Grus paradisea* (Globally Vulnerable and Regionally Near-threatened), Karoo Korhaan *Eupodotis vigorsii* (Regionally Near-threatened), Kori Bustard *Ardeotis kori* (Globally and Regionally Near-threatened), Martial Eagle *Polemaetus bellicosus* (Globally and Regionally Endangered), Southern Black Korhaan, Sclater's Lark *Spizocorys sclateri* (Globally and Regionally Near-threatened), and Lanner Falcon *Falco biarmicus* (Regionally Vulnerable) recorded on-site. Based on the confirmed habitat and the field surveys, the classification of **HIGH** sensitivity for avifauna in the Screening Tool is therefore supported.

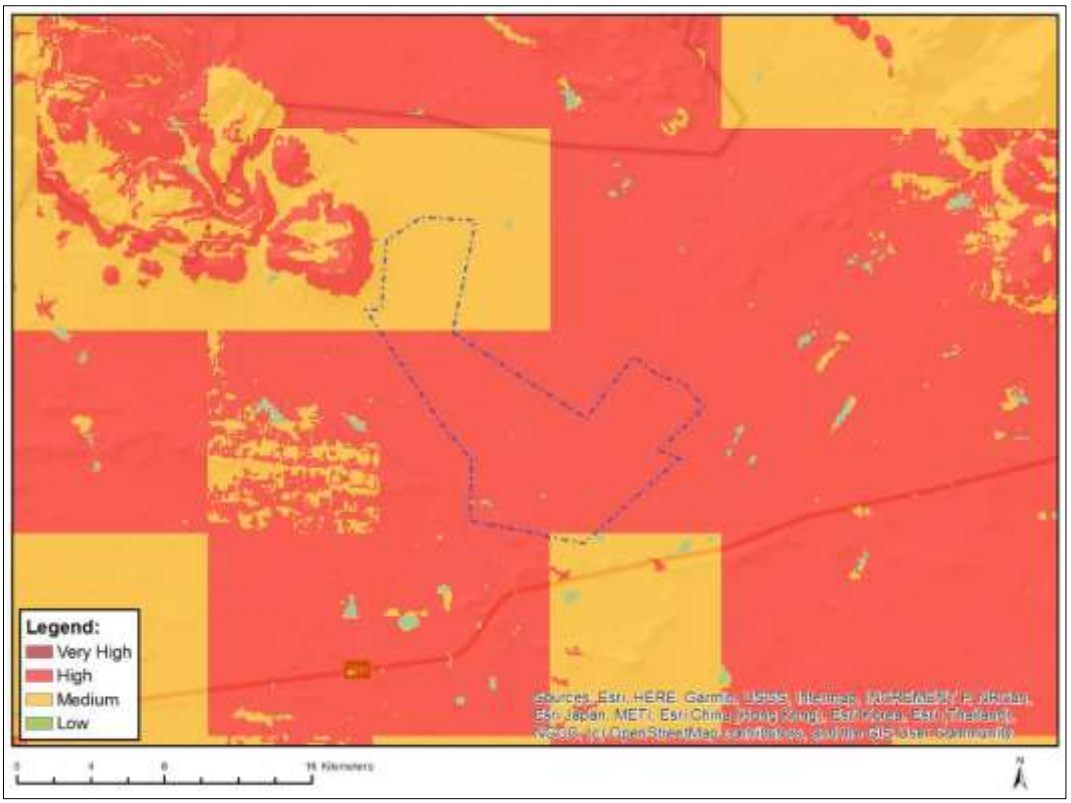


Figure 1: The classification of the FE Kudu WEF Project Site according to the animal species theme in the DFFE National Screening Tool. The High and Medium sensitivity classification is linked to the potential occurrence of Ludwig's Bustard (Globally and Regionally Endangered) and Southern Black Korhaan (Globally and Regionally Vulnerable).

CONCLUSION

The occurrence of SCC at the Project Site was confirmed during the 12-month pre-construction monitoring programme (January 2021 to January 2022) with observations of Ludwig's Bustard, Blue Crane *Grus paradisea* (Globally Vulnerable and Regionally Near-threatened), Karoo Korhaan *Eupodotis vigorsii* (Regionally Near-threatened), Kori Bustard *Ardeotis kori* (Globally and Regionally Near-threatened), Martial Eagle *Polemaetus bellicosus* (Globally and Regionally Endangered), Southern Black Korhaan, Sclater's Lark *Spizocorys sclateri* (Globally and Regionally Near-threatened), and Lanner Falcon *Falco biarmicus* (Regionally Vulnerable) recorded on-site. Based on the confirmed habitat and the field surveys, the classification of **HIGH** sensitivity for avifauna in the Screening Tool is therefore supported.

APPENDIX P4:
BATS SITE SENSITIVITY VERIFICATION REPORT

FE Kudu Wind Energy Facility, Eastern Cape Province

Site Sensitivity Verification Report

11 September 2023

Project No.: 0669510

The business of sustainability

Document details	
Document title	FE Kudu Wind Energy Facility, Eastern Cape Province
Document subtitle	Site Sensitivity Verification Report
Project No.	0669510
Date	11 September 2023
Version	1.0
Author	Craig Campbell
Client Name	FE Kudu (Pty) Ltd

Document history

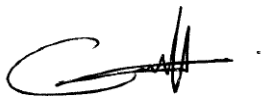
				ERM approval to issue		
Version	Revision	Author	Reviewed by	Name	Date	Comments
Draft	1.0	Monique du Plessis	Craig Campbell Dieter Rodewald	Dieter Rodewald	11.09.23	Draft for Client Consideration

Signature Page

11 September 2023

FE Kudu Wind Energy Facility, Eastern Cape Province

Site Sensitivity Verification Report



Craig Campbell
Pr.Sci.Nat (Ecological Sciences)

Dieter Rodewald
Partner

ERM Southern Africa (Pty) Ltd.
1st Floor | Great Westerford | 240 Main Road | Rondebosch | 7700 | Cape Town | South Africa

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1. INTRODUCTION

The National Gazette, No. 43110 of 20 March 2020: "National Environmental Management Act (107/1998) 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 ('the Regulations'), when applying for Environmental Authorisation" includes the requirement that a Site Sensitivity Verification must be produced. The outcome of the Initial Site Sensitivity must be provided in a report format which:

a) Confirms or dispute 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; and

c) Is submitted together with the relevant reports prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

This initial site sensitivity report is produced to consider only the bats theme and to address the requirements of a) to c) above.

2. INITIAL SITE VERIFICATION

Table 1 and Figure 1 below show the sensitivities for bats identified by the Department of Forestry, Fisheries and the Environments' (DFFE) Screening Tool for the Kudu WEF. There are some suitable habitats and waterbodies that can be used for drinking water, roosting, foraging, and commuting in the study area. Bats are known to use linear landscape features such as rivers and tree lines for commuting routes to get to and from foraging sites, roost sites, and to access water sources.

Table 1: DFFE Screening Tool Output in the Bat (Wind) Theme (Kudu Wind Energy Facility)

Theme	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low Sensitivity
Bats (Wind) Theme		X		
Sensitivity		**Feature(s)**		
High		Within 500 m of a river		
High		Wetland		
High		Within 500 m of a wetland		

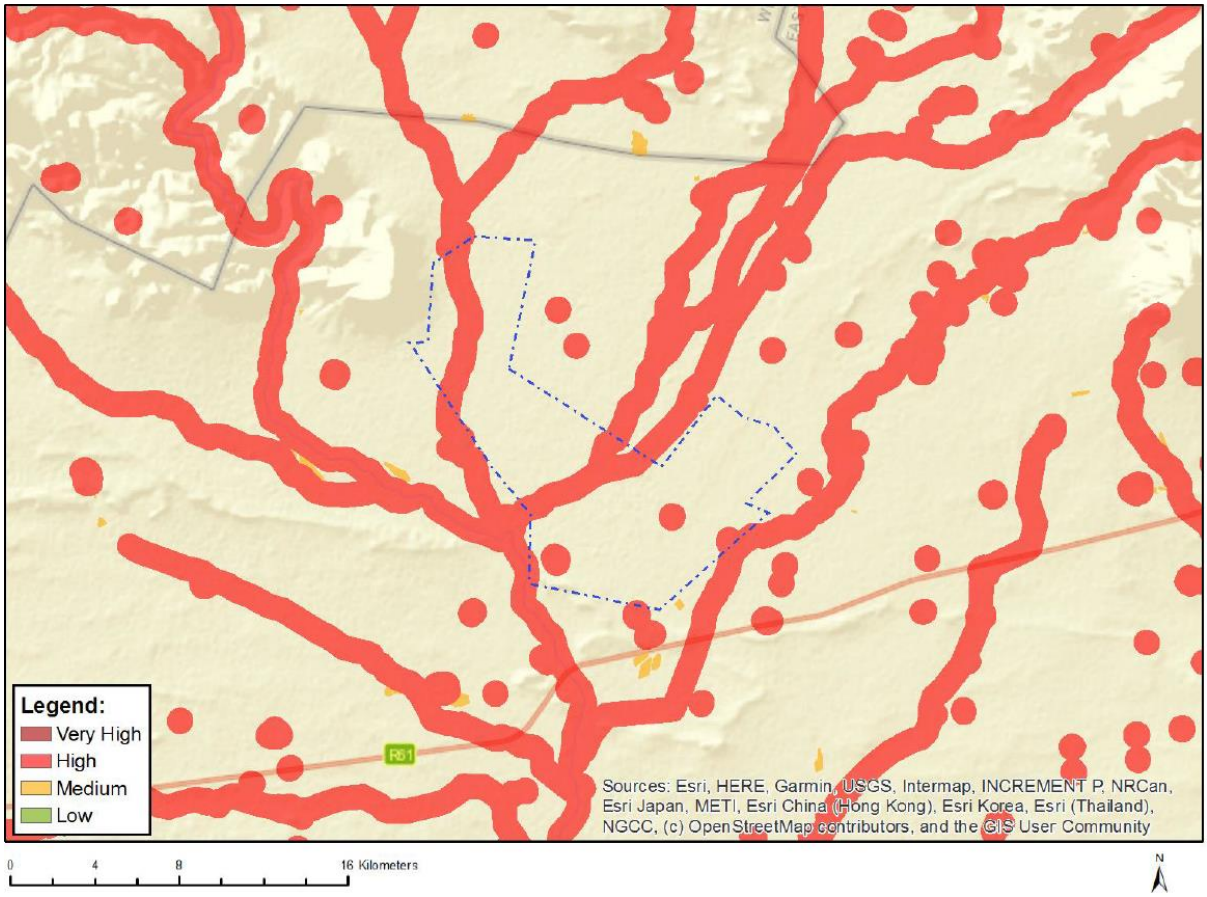

Figure 1: DFFE Screening Tool Output for the Bats (Wind) Theme (FE Kudu Wind Energy Facility)

The baseline environment for bats at the proposed development sites was defined utilising a desktop study of available bat locality data, literature and mapping resources. This information was examined to determine the potential location and abundance of bats, including their potential habitats, which may be sensitive to the Kudu WEF development.

3. OUTCOME OF THE INITIAL SITE VERIFICATION

After the selected resources were mapped, they were aggregated to produce initial constraints maps for the respective developments, under the assumption that areas where resources are concentrated will be more important for bats (**Error! Reference source not found.**)

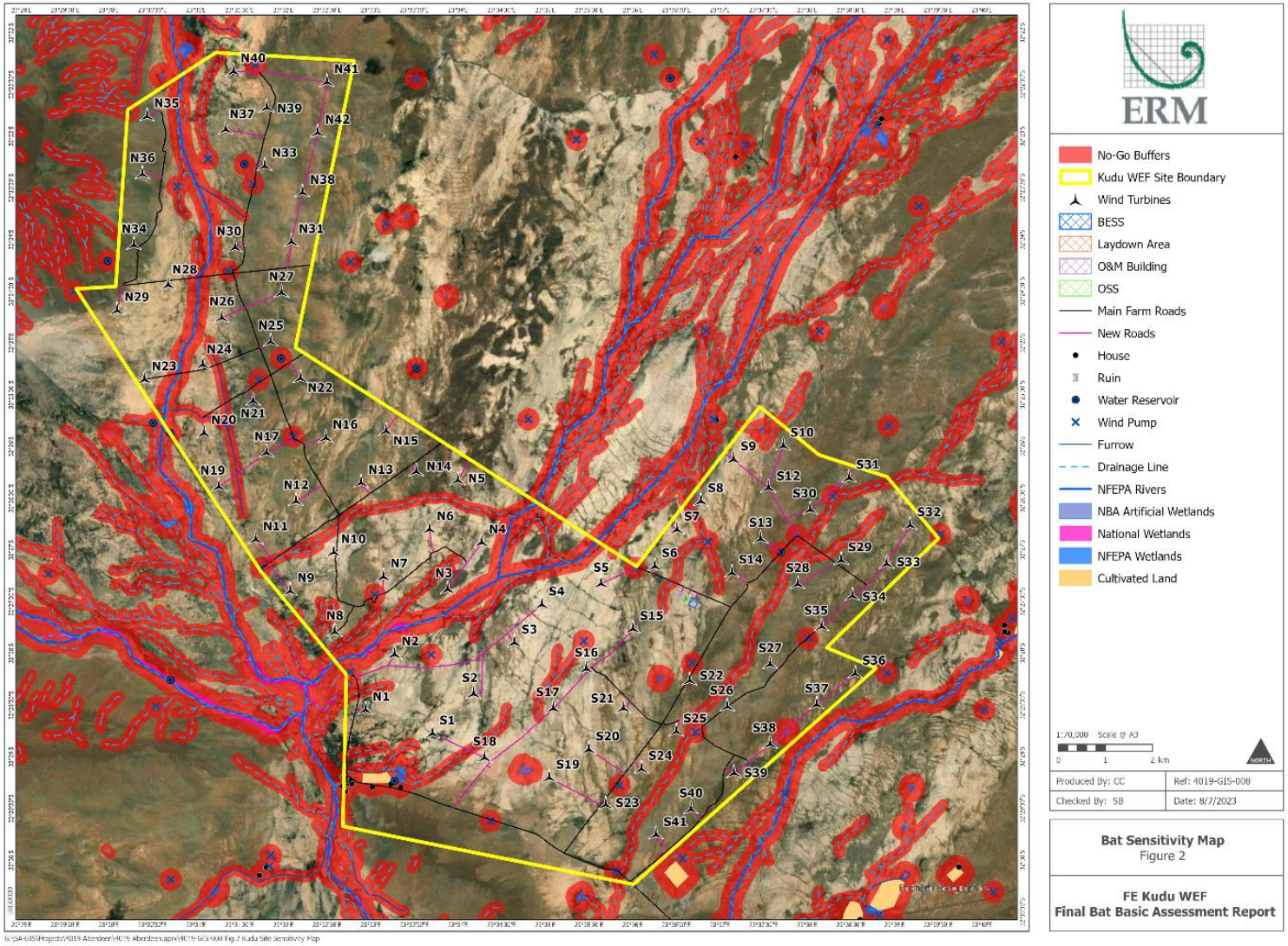

Figure 2: Initial Constraints Map for FE Kudu WEF

4. CONCLUSION

The DFFE Screening Tool identified two sensitivity ratings within the FE Kudu WEF development footprint, namely, high and medium. The constraints mapped by the specialist (Figure 2) were based on the full pre-construction monitoring campaign identifying specific areas of high sensitivity and, in the specialist's opinion, confirms the current use of land and environmental sensitivity as identified by the national web based environmental screening tool. Additionally, evidence suggests additional high sensitivity areas for consideration, as demonstrated in Figure 2, which should be considered No-Go areas with the remainder of the site potentially hosting medium to low sensitivity for bats.

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ERM Cape Town
240 Main Road
1st Floor Great Westerford
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7700

T: +27 21 681 5400
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APPENDIX P5:
SOIL & AGRICULTURAL POTENTIAL SITE SENSITIVITY VERIFICATION REPORT

TerraAfrica

SOIL. AGRICULTURE. ENVIRONMENT.

Site Sensitivity Verification Report for the Proposed Kudu Wind Energy Facility

Submitted by TerraAfrica Consult cc

Date of Submission:

20 September 2023

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1. Introduction

FE Kudu (Pty) Ltd is proposing the development of a wind energy facility and associated infrastructure on a site located approximately 40km west of Aberdeen in the Eastern Cape Province. The project is located within the Dr Beyers Naude Local Municipality and the greater Sarah Baartman District Municipality. The project site comprises a single affected property, Portion 2 of Farm Oorlogspoort 85. The project is known as the FE Kudu Wind Energy Facility. The project is planned as part of a cluster of renewable energy projects, which includes a second facility, FE Tango Wind Energy Facility, located approximately 20km to the east of the site. The entire extent of the site falls within the Beaufort West Renewable Energy Development Zones (i.e., REDZ Focus Area 11).

The site visit and site sensitivity verification report are the first phase of a phased approach for the environmental authorisation process required for the planned Wind Energy Facility. Once the most suitable areas with the lowest combined sensitivity risk are identified, the number of Wind turbines will be decided, and the layouts of the projects will be finalised. When the final layouts are available, the data gathered during the site visits will be reprocessed to compile the agricultural impact assessment reports for each of the projects. TerraAfrica Consult cc was appointed by Savannah Environmental (Pty) Ltd to conduct the site sensitivity verification that will is the first phase of the agricultural assessment of the Basic Assessment (BAR) process for the Kudu Wind WEF.

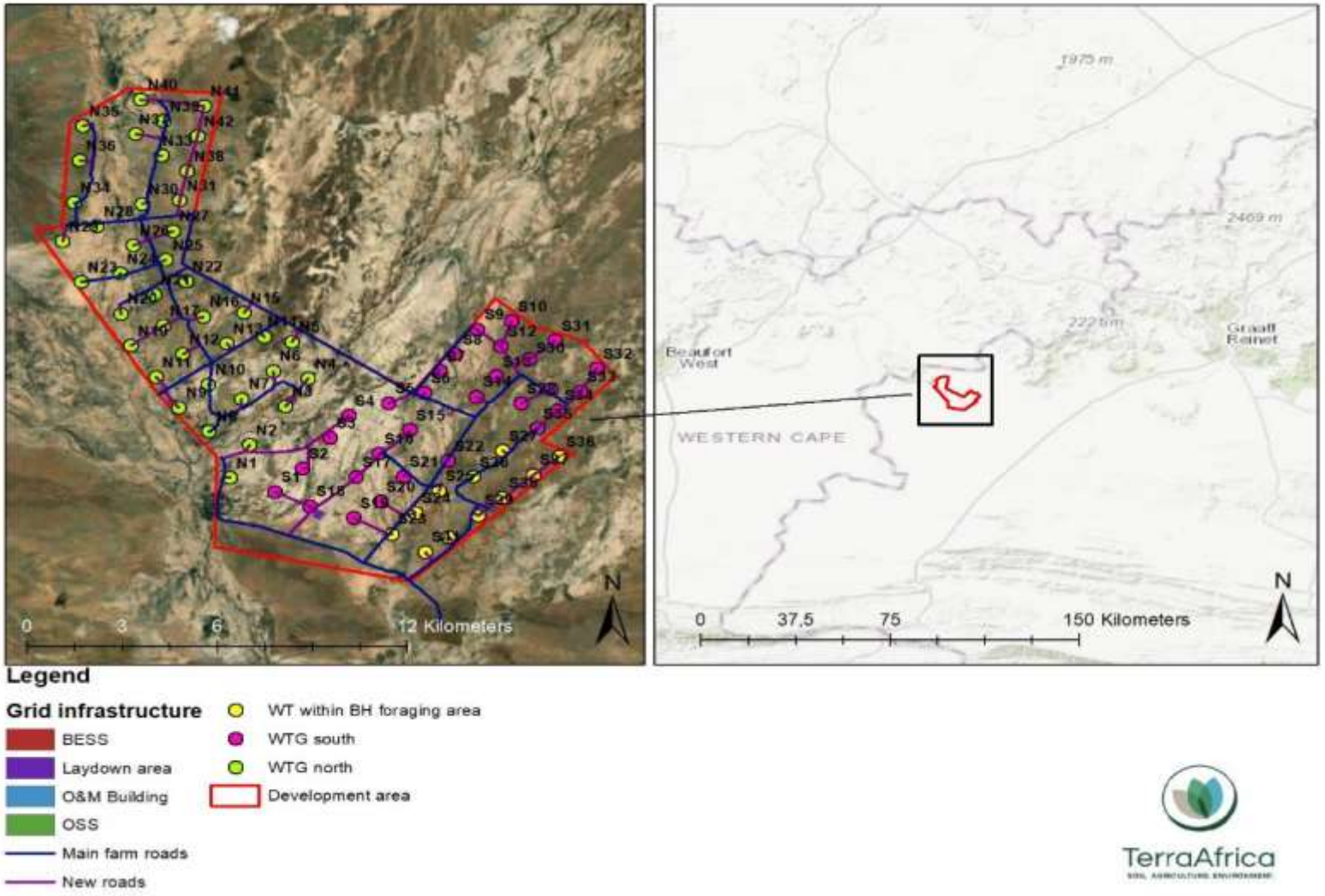
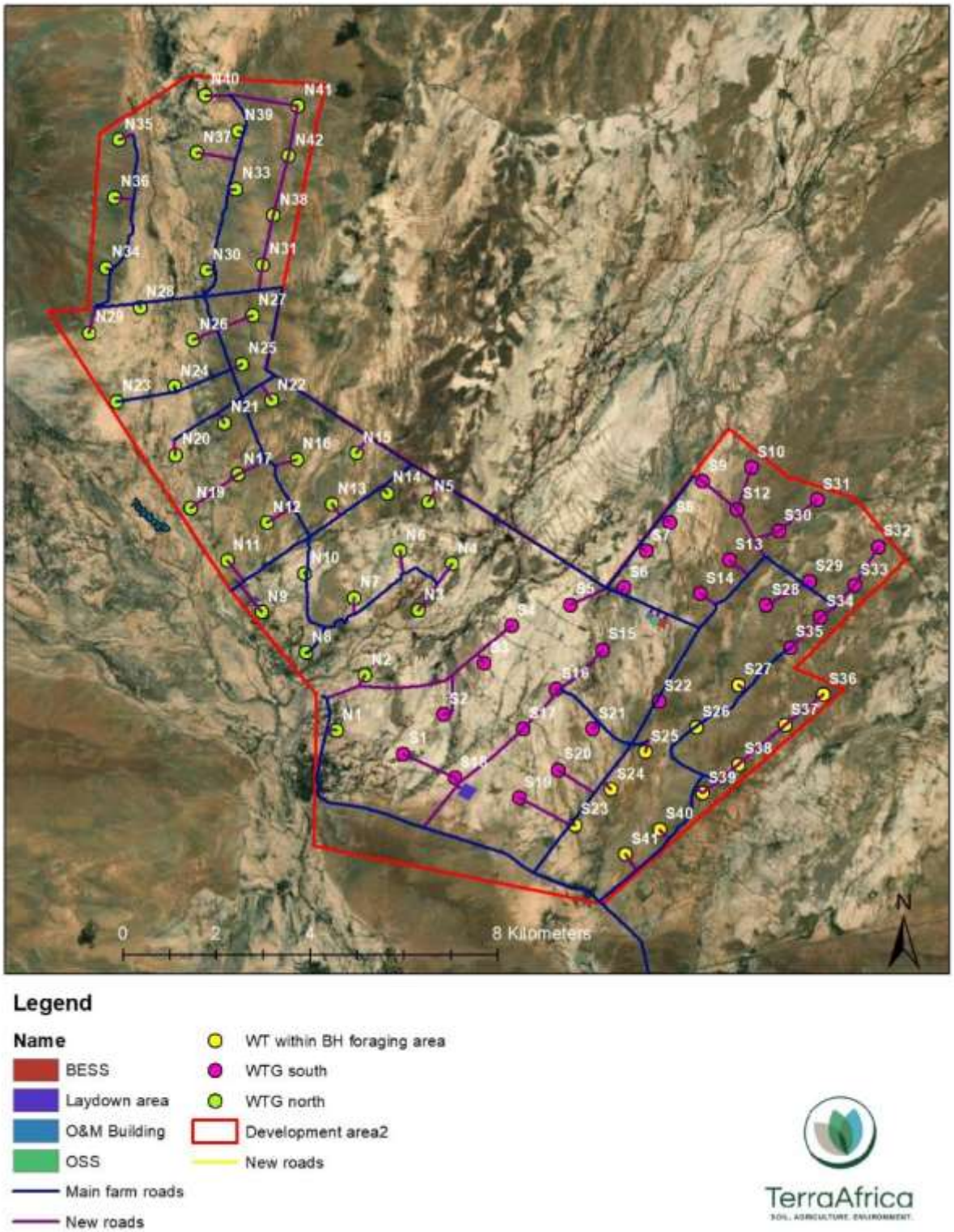


Figure 1: Locality of the proposed development area.



Legend

Name	
BESS	WT within BH foraging area
Laydown area	WTG south
O&M Building	WTG north
OSS	Development area2
Main farm roads	New roads
New roads	

TerraAfrica

Figure 2: Layout of the proposed development

2. Terms of reference

The terms of reference for the data collection and site verification report, follows the requirements of protocol for agricultural assessment as outlined in the GNR 320 of NEMA. The protocols, including the protocol for agricultural assessment, state that the methodology for gathering information for the report, must include data from:

- a desktop analysis, using satellite imagery;
- a preliminary on-site inspection; and
- any other available and relevant information.

The protocol specify that the report must:

- confirm or dispute the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status;
- contain a motivation and evidence (e.g., photographs) of either the verified or different use of the land and environmental sensitivity; and
- be submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations (EIA Regulations).

3. Details of specialist

Mariné is a scientist registered with the South African Council for Natural Scientific Professions (SACNASP) and is specialised in the fields of Agricultural Science and Soil Science. Her SACNASP Registration Number is 400274/10. Mariné holds a BSc. degree in Agricultural Science (with specialisation in Plant Production) from the University of Pretoria and a MSc. Degree in Environmental Science from the University of the Witwatersrand. She has consulted in the subject fields of soil, agriculture, pollution assessment and land use planning for the environmental sector of several African countries including Botswana, Mozambique, Democratic Republic of Congo, Liberia, Ghana and Angola. She has also consulted on the soil and agricultural assessment of a gas infrastructure project in Afghanistan. Mariné's project experience conducting assessments for renewable energy projects include solar and wind energy facilities in the Western, Northern and Eastern Cape as well as the North West, Free State and KwaZulu Natal Provinces. Her contact details are provided in Appendices 1 and 2 attached.

Jan-Dirk is a candidate scientist registered with the South African Council for Natural Scientific Professions (SACNASP) and is specialized in the field of Soil Science. His SACNASP registration number is 400274/13. Jan-Dirk holds a BSc. Degree in Agricultural Science (with

specialization in Soil Science) from the University of the Free State and a MSc. Degree in Soil Science from the University of the Free State.

4. Methodology

The proposed development area was superimposed on three data sets to determine the anticipated sensitivities of the properties to the development. The data sets are:

- The National Land Capability Evaluation Raster Data Layer was obtained from the Department of Agriculture, Land Reform and Rural Development (DALRRD) to determine the land capability classes of the development area assessment zone according to this system. The data was developed using a spatial evaluation modelling approach (DALRRD, 2017).
- The long-term grazing capacity for South Africa 2018 was analysed for the development area and surrounding area. The values indicated for the different areas represent long term grazing capacity with the understanding that the veld is in a relatively good condition (DALRRD, 2018).
- The Eastern Cape Province Field Crop Boundaries (November 2019) was analysed to determine whether the proposed PV development area falls within the boundaries of any crop production areas. The crop production areas may include rainfed annual crops, non-pivot and pivot irrigated annual crops, horticulture, viticulture, old fields, small holdings and subsistence farming (DALRRD, 2019).
- Land type data for the development area was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 – 2006). The land type data is presented at a scale of 1:250 000 and entails the division of land into land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units.

For the site verification visit, the development area was on the 19th to 22nd June 2023 (Winter). The soil profiles were examined to a maximum depth of 1.5 m using a hand-held auger. Observations on site were made regarding soil texture, structure, colour and soil depth at each survey point. A cold 10% hydrochloric acid solution was used on site to test for the presence of carbonates in the soil. Qfield software were used to the log the coordinates of each of the survey points. The soils are described using Soil Classification: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018). Photographic evidence of soil properties, current land uses, and farm infrastructure were taken with a digital camera.

5. Baseline description

5.1 Land types

The study area consists of the Ia43, Ag9, and Fc410, land types. The Ia land type consists of deep alluvial soils comprising more than 60% of land type, while the Da land type consists of duplex soils (sandier topsoil abruptly overlying more clayey subsoil) allocated to more than 50% of land type. The Ag land type has freely drained, shallow (<300 mm deep), red, eutrophic, apedal soils that cover more than 40% of the land type.

5.2 Soil properties

The following soil forms are identified within the development area and included the Addo, Clovelly, Glenrosa, Mispah, Swartland and Valsrivier soil forms. The position of the soil within the development area is illustrated in Figure 3 and the properties of each soil form found below.

- The Addo soil consists of an bleached orthic horizon with a brown aluvic neocarbonate underneath. A soft carbonate is present underneath the neocarbonate.
- The Clovelly soil form consist of a chromic topsoil with a dystrophic yellow-brown apedal underneath. The yellow-brown is also aluvic with a saprolithic horizon underneath.
- The Glenrosa soil forms has a chromic orthic horizon.. The material underneath the orthic was classified as saprolithic material that contain calcrete.
- The Mispah consists of a calcareous chromic topsoil and fractured rock underneath
- The Swartland soil form consists of a bleached orthic horizon with a brown non-vertic pedocutanic horizon underneath. The pedocutanic is also non-calcareous. A saprolithic horizon is found underneath the pedocutanic.
- The Valsrivier soil form consist of an chromic orthic horizon with a pedocutanic underneath. The pedocutanic was brown withinout vertic properties and is also calcareous.

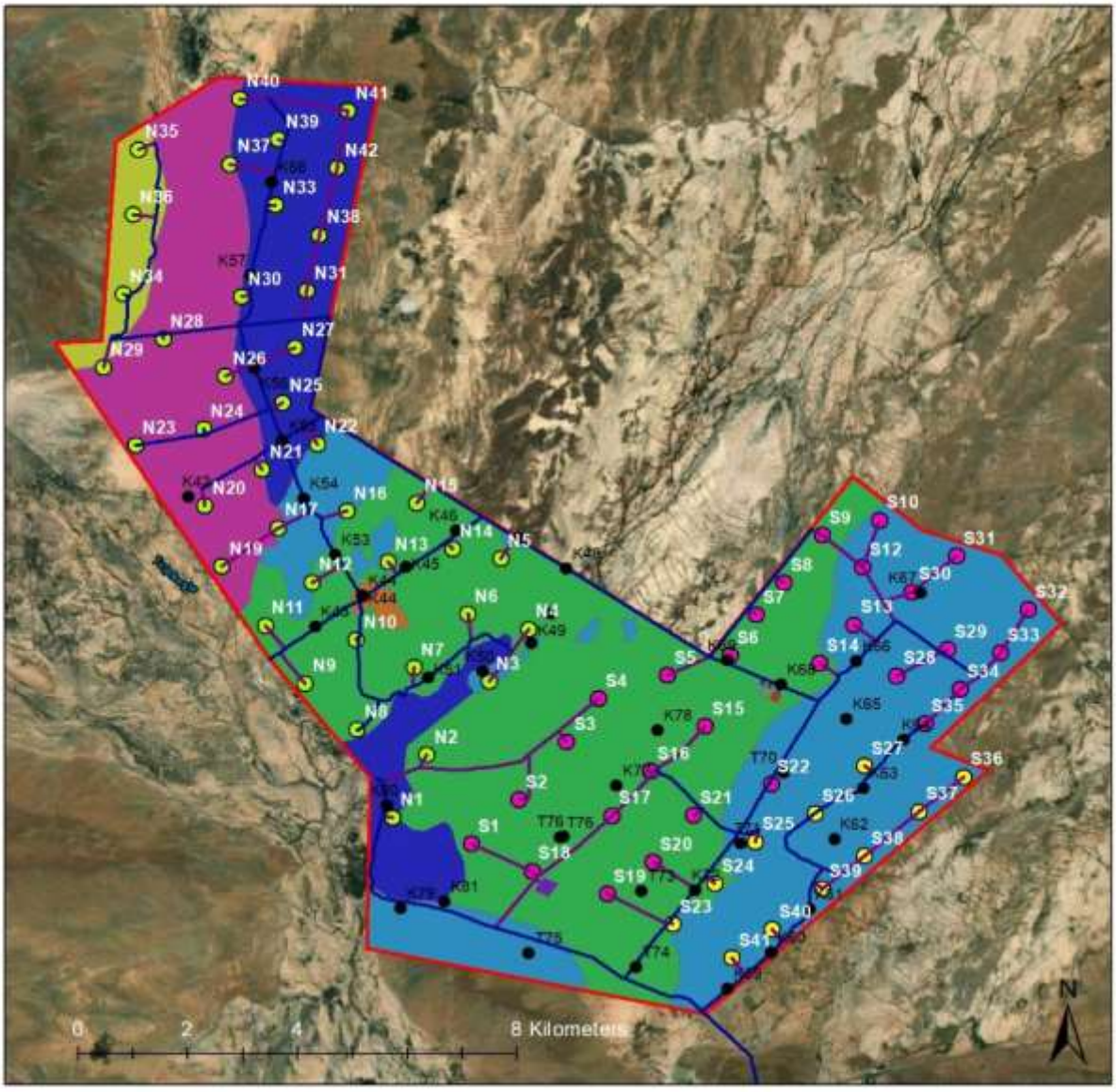


Figure 3: Soil classification map of the Kudu Wind Energy Facility development area.

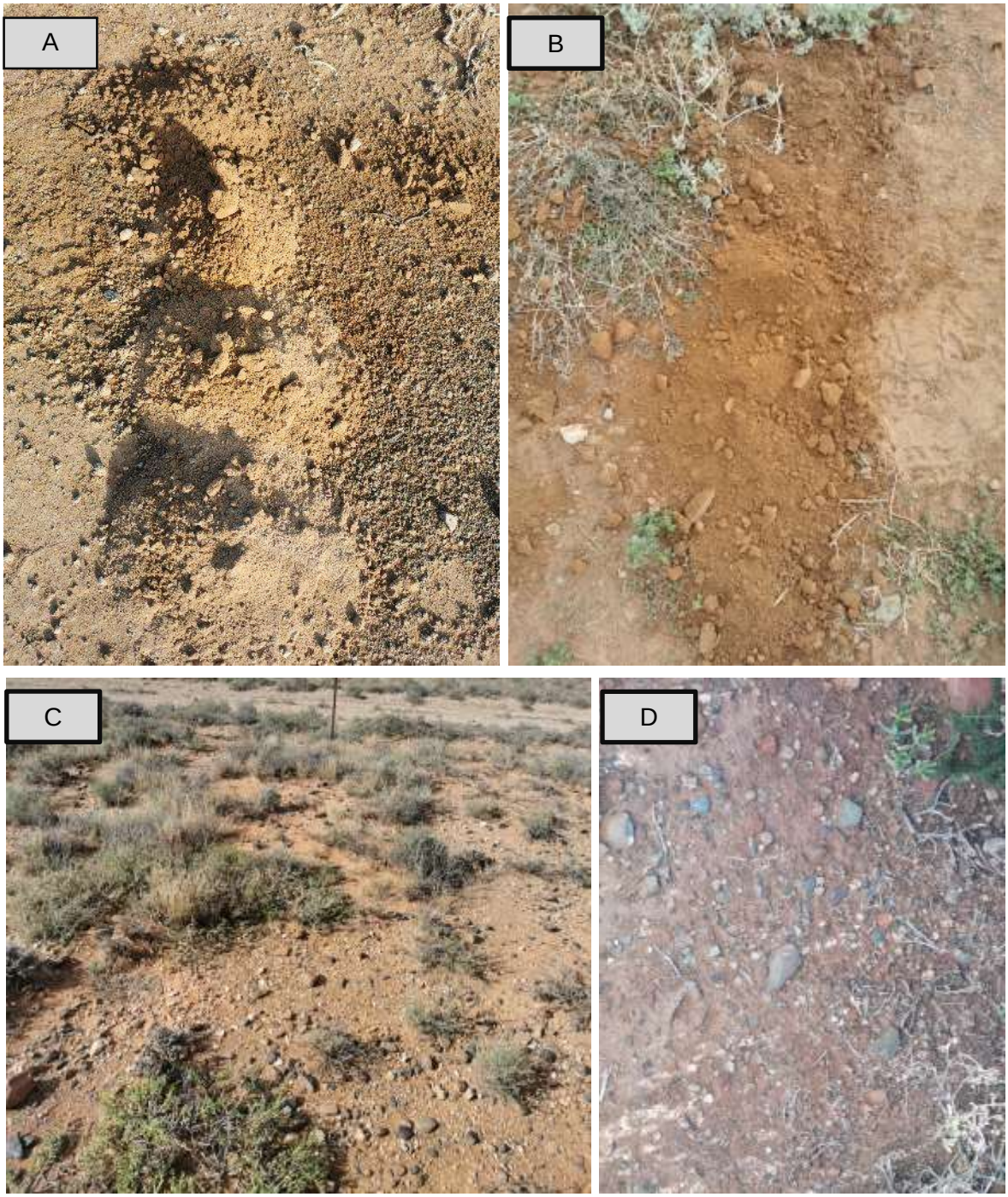


Figure 4: Addo (A), Clovelly (B), Glenrosa (C) and Mispah (D) soil forms.

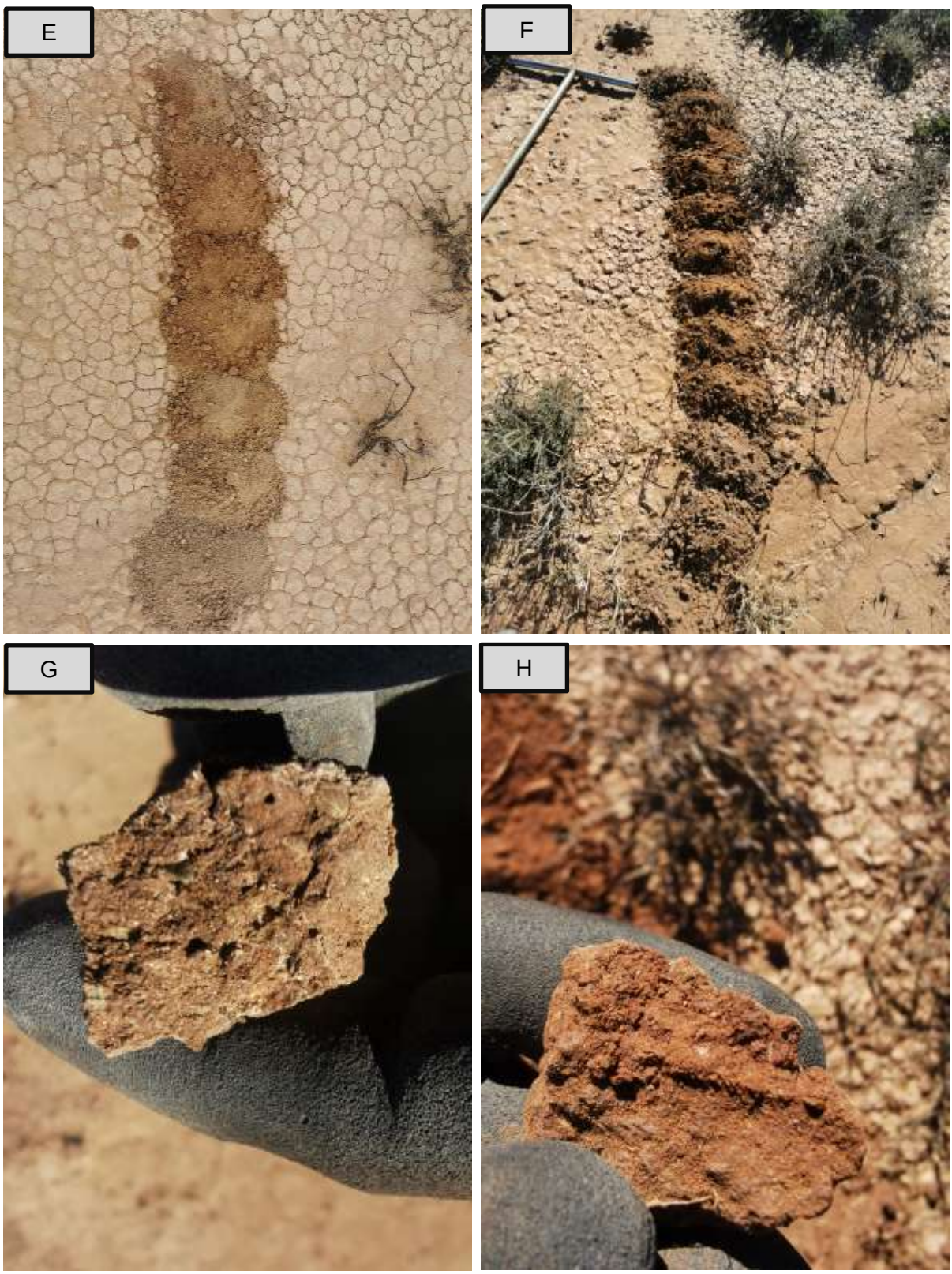


Figure 5: Swartland (E) and Valsrivier (F) soil forms.

5.3 Land capability

5.3.1 Land capability according to desktop data (DALRRD, 2016)

The Kudu WEF includes four different land capability classes within the development area as stated by the land capability data (DALRRD, 2016). Figure 6 shows the position of the different classes within the farm portion that form the proposed development area. Most of the development area largely consists of land with Low-Moderate (Class 06 and 07) and Moderate (Class 08) land capability. Moderate (Class 08) land capability is found mainly on the center and northwestern boundaries of the development area, whereas Low-Moderate (Class 06 and 07) land capability is found on the northeastern and eastern side. Small areas of Very low-Low (Class 04) and Low (Class 05) land capability is found in the northwestern and southern boundaries.

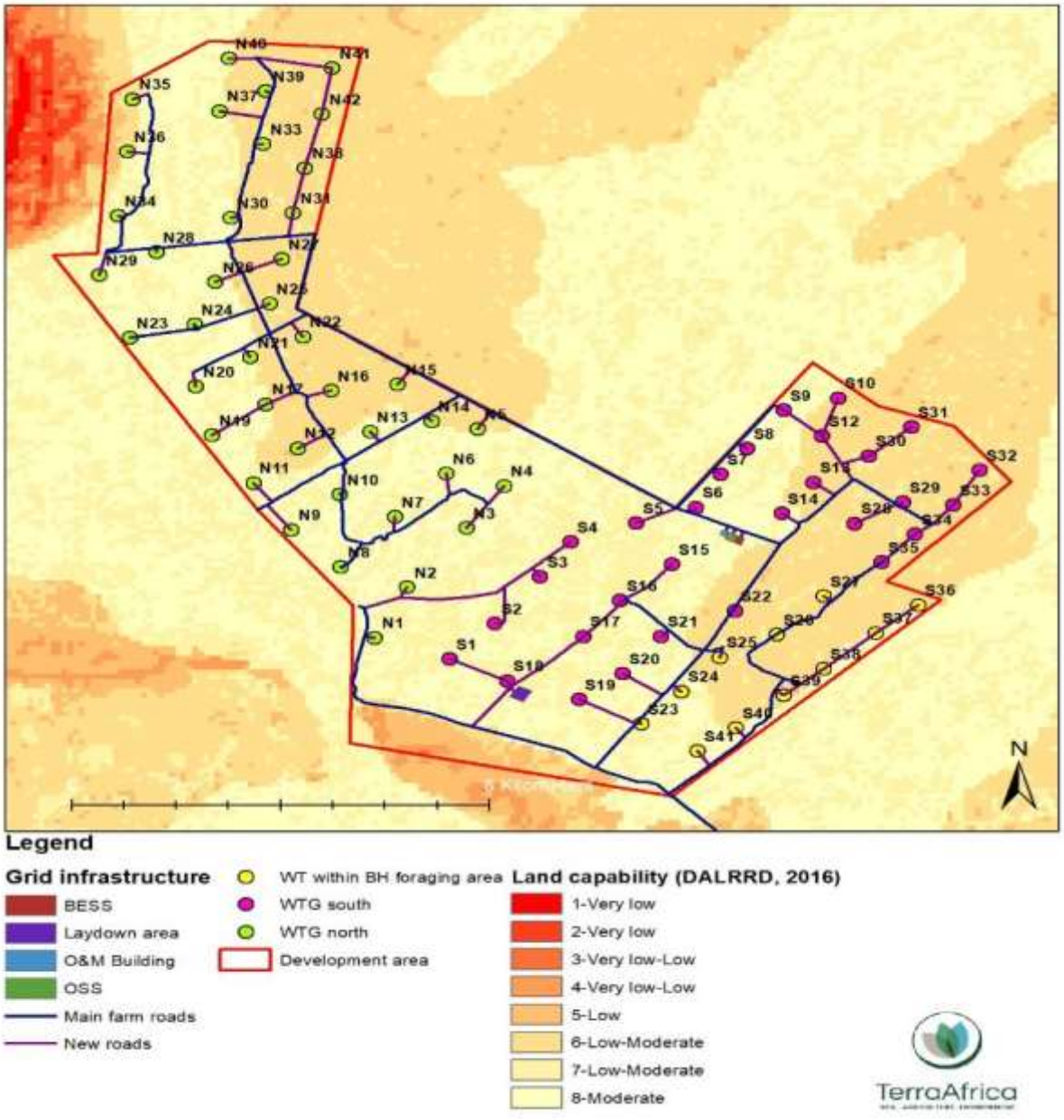


Figure 6: Land capability of the proposed Kudu Wind Energy Facility (ALRRD, 2017)

5.3.2 Verified land capability classification.

Most of the development area has Low-Moderate (Class 07) land capability (4941.19ha) with most of the wind turbines falling within these areas. Turbines N21, 25, 27, 30, 31, 33, 38, 39, 40, 41 and 42, are the only turbines falling on a higher land capability of Moderate (Class 08). The Low-Moderate and Moderate land capability is attributed to the deep effective soil depth of the Swarrland, Addo and Valsrivier soil forms, whereas the Low land capability is assigned to the Glenrosa and Mispah soil forms which have a shallow effective soil depth. The BESS, O&M building, OSS and Laydown area all fall on Low-Moderate (Class 07) land capability areas. The lower land capability of the development footprint is confirmed by the absence of any cultivated fields as verified during the site visit and the farmers.

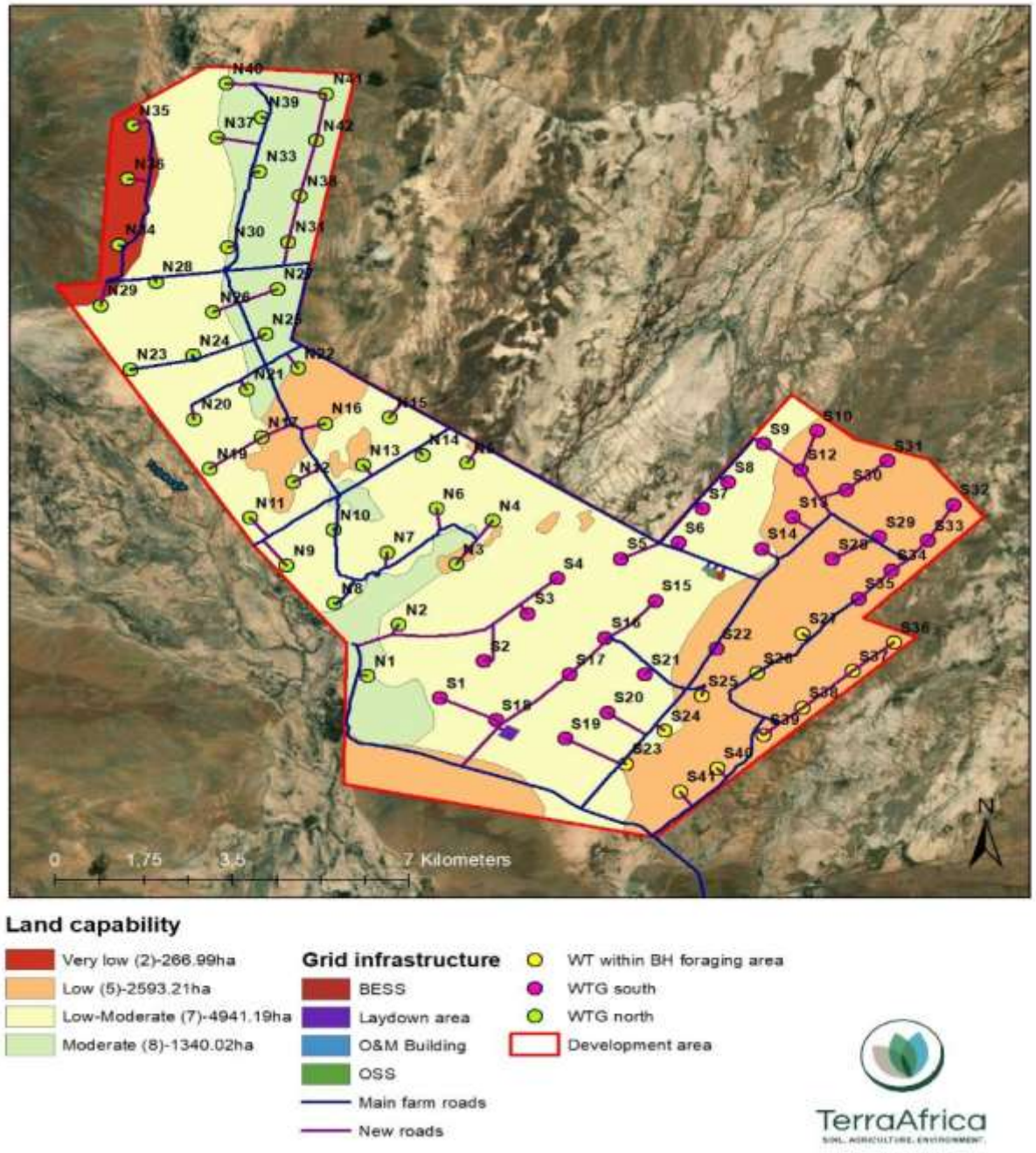


Figure 7: Refined land capability of the proposed Kudu Wind Energy Facility.

5.4 Agricultural land use

5.4.1 Crop production

The field crop boundary map (Figure 8) shows that rainfed annual crops/planted pastures are present within the development area. During the site visit no crop fields or planted pastures were found. The main land use of the development area is livestock farming with various areas having water prevision for the animals (Figure 9).

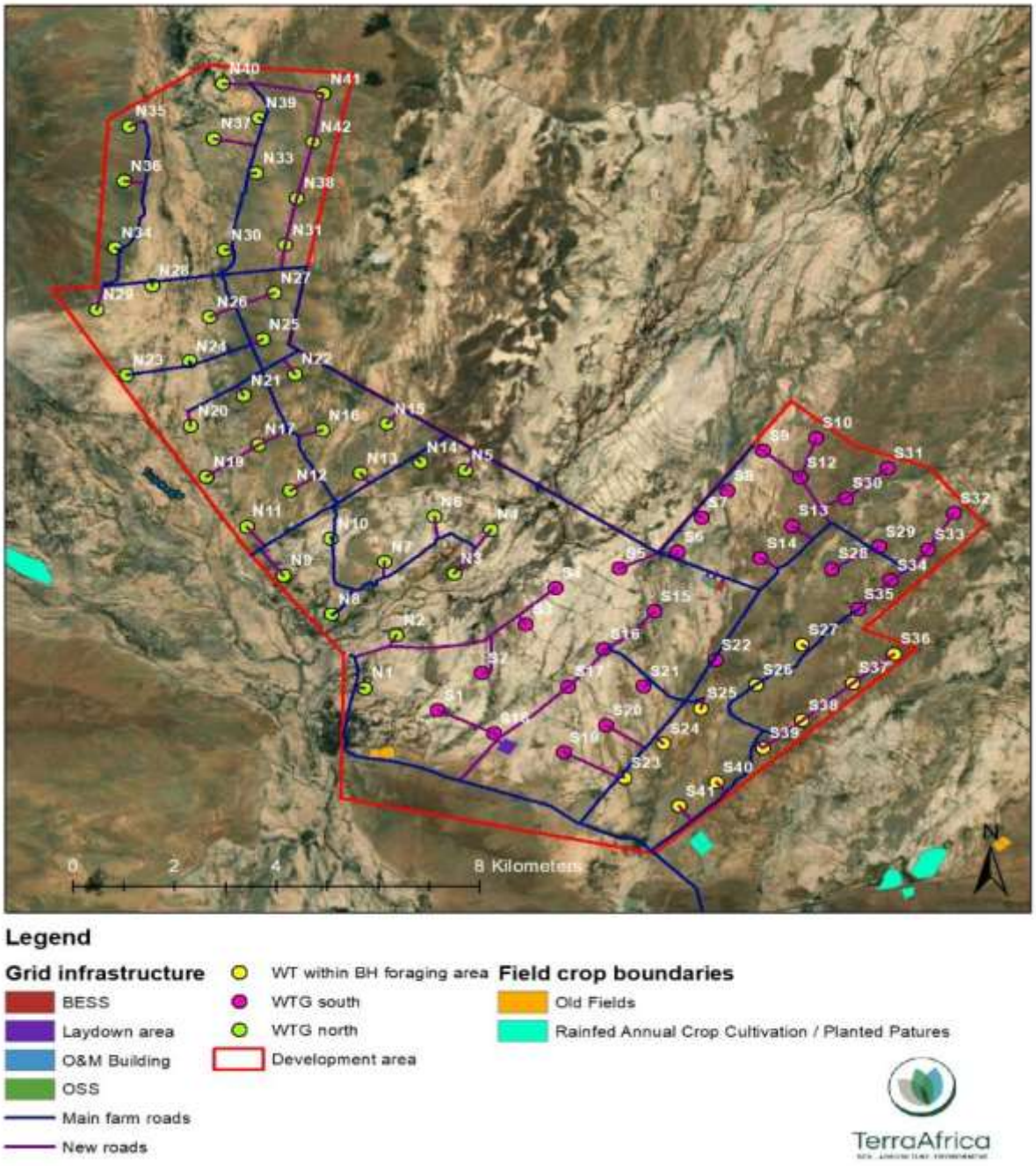


Figure 8: Location of field crop boundaries within around the proposed Kudu Wind Energy Facility (DALRRD, 2019).

5.4.2 Animal capacity

Following the metadata layer obtained from DALRRD, the grazing capacity for most of the study area, is 20 ha/LSU, with 24ha/LSU and 26ha/LSU found in the eastern side (refer to Figure 10). This unit used for large animals such as cattle can be converted to small animal units or small stock units (SSU). The conversion factor is 4 small stock units that equates one large stock unit. Since livestock farming in the region within which the development area is located is dominated by small stock farming, the grazing capacity of the 20ha/LSU which dominated the area can be converted to 5 ha/SSU and can thus provide forage to 1828 small stock units.

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Figure 9: Photo evidence of grazing small stock within the study area with signs of water provision for animals.

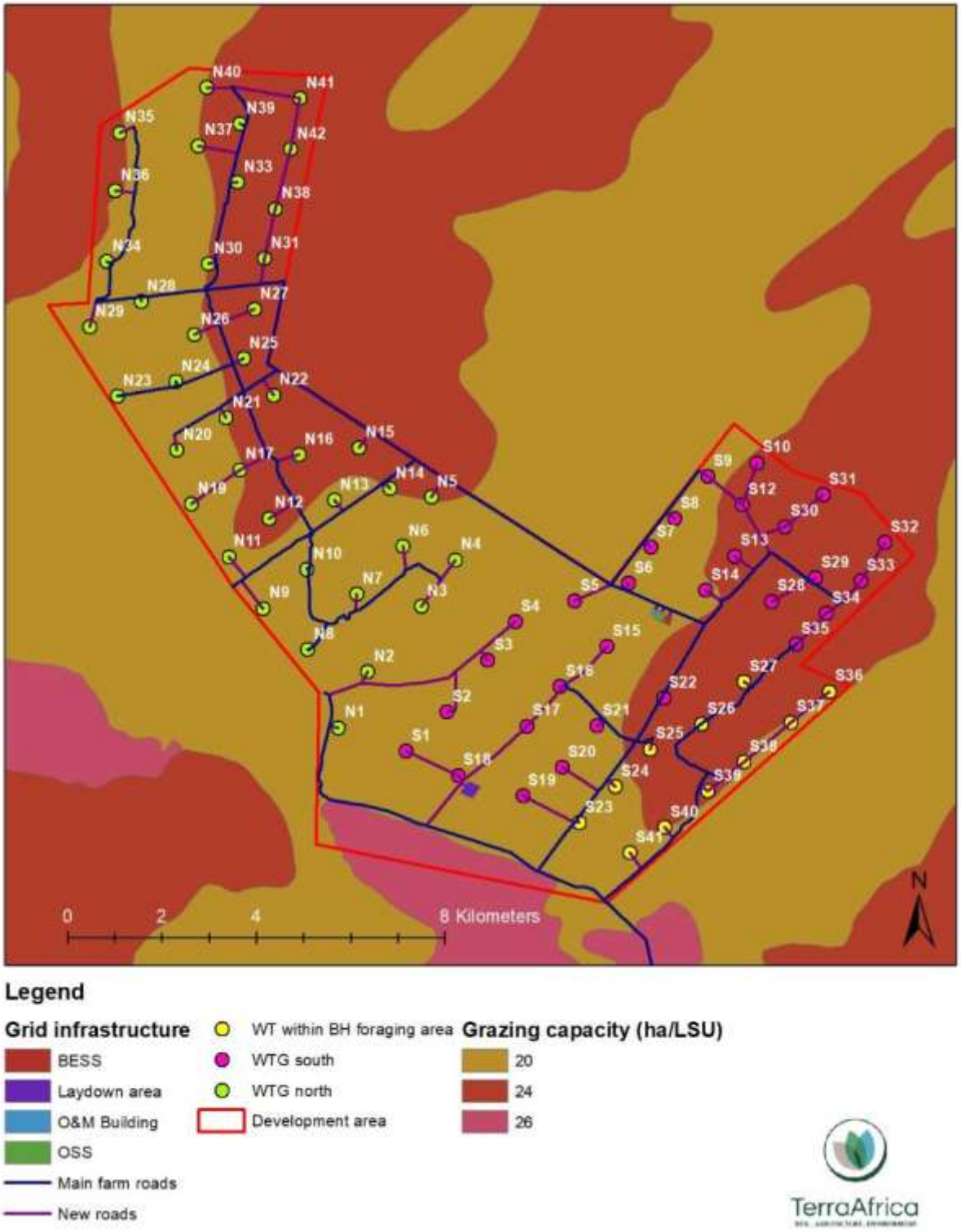


Figure 10: Grazing capacity of the proposed Kudu Wind Energy Facility (data source: DALRRD, 2018).

6. Agricultural sensitivity

6.1 Sensitivity according to the environmental screening tool

The screening report for the proposed Tango Wind Energy Facility was evaluated prior to the site visit. The screening report for the development area was generated by Savannah in 2023.. The agricultural sensitivity map is shown Figure 11.

The screening report was generated by Savannah Environmental (Pty) Ltd for the proposed development area (Refer to Figure 11). According to the agricultural sensitivity, the development area consists predominantly of land with Medium sensitivity. One small area shows a High agricultural sensitivity and are allocated to old fields and soils with a land capability ranging from Very low (Class 01) to Moderate (Class 08). Medium sensitive areas are allocated to areas with Low-Moderate (Class 06 & 07) and Moderate (Class 08) land capability. Low sensitivity is found in the far south corner of the development area and are allocated to areas with a land capability of Very low (Class 01) to Low (Class 05).

6.2 Verified agricultural sensitivity of the Kudu Wind Energy Facility

Following the consideration of the desktop data as well as data gathered during the site verification visit, the development area can be classified into four different sensitivity classes. The sensitivity classification is shown in Figure 12.

Most of the infrastructure components are located well within areas with Medium Sensitivity (refer to Figure 12). Medium agricultural sensitivity is mainly due to the high land capability of of Low-Moderate (Class 07) areas and the depth of the soil which ranged between 0.6 and 1.5m. Low agricultural sensitivity is due to the Low (Class 05) land capability and the absence of any field crop boundaries. Areas shown as having field crops did not show any signs of cultivation during the site visit. The Low Sensitivity areas have shallow effective soil depth, and the arid climate reduces the land capability of the area significantly. Approximately 29 wind turbines are found on Low agricultural sensitivity, while the rest is on Medium agricultural sensitivity.

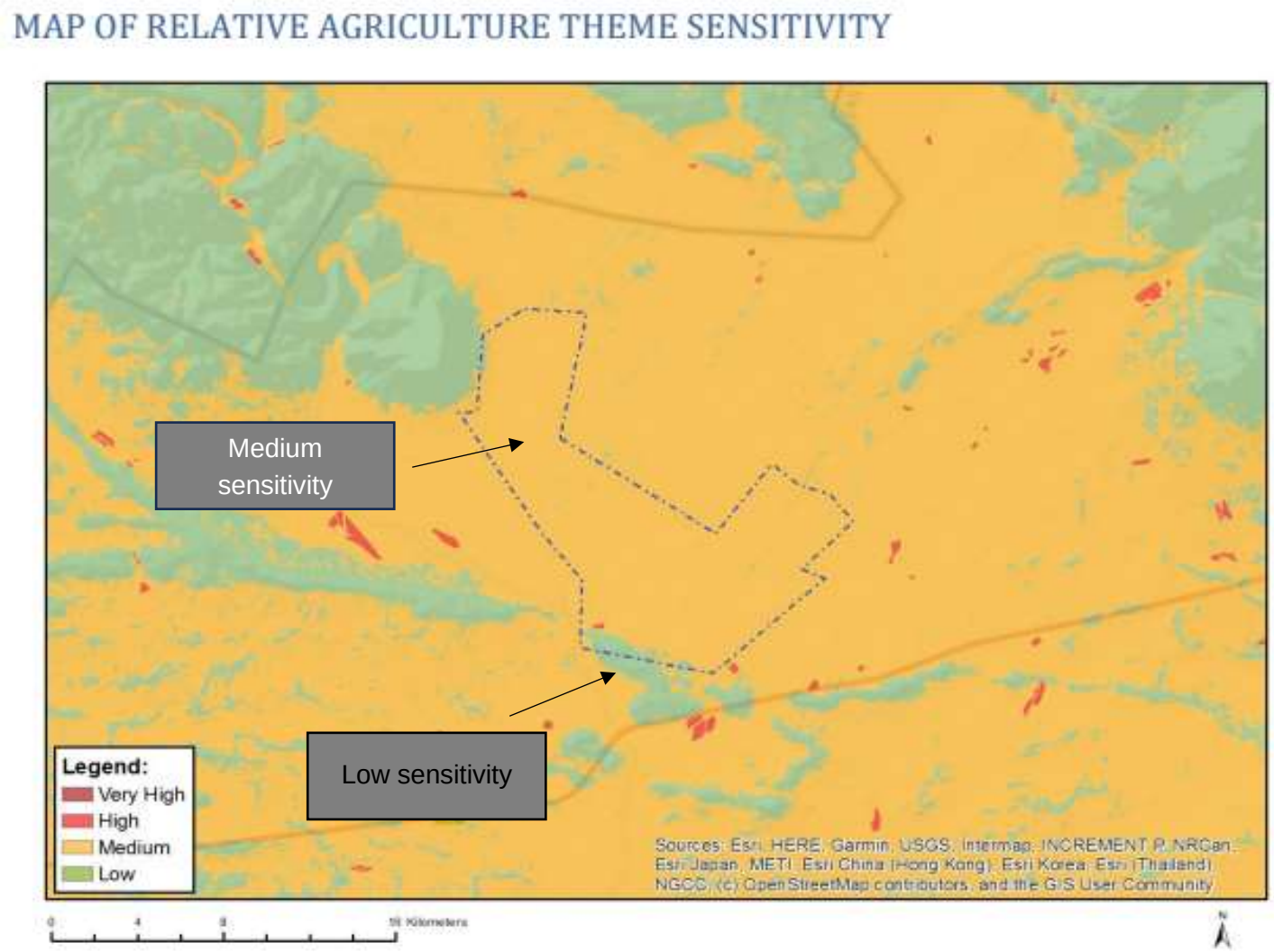


Figure 11: Map of agricultural sensitivity according to the screening report of the Environmental Screening Tool.

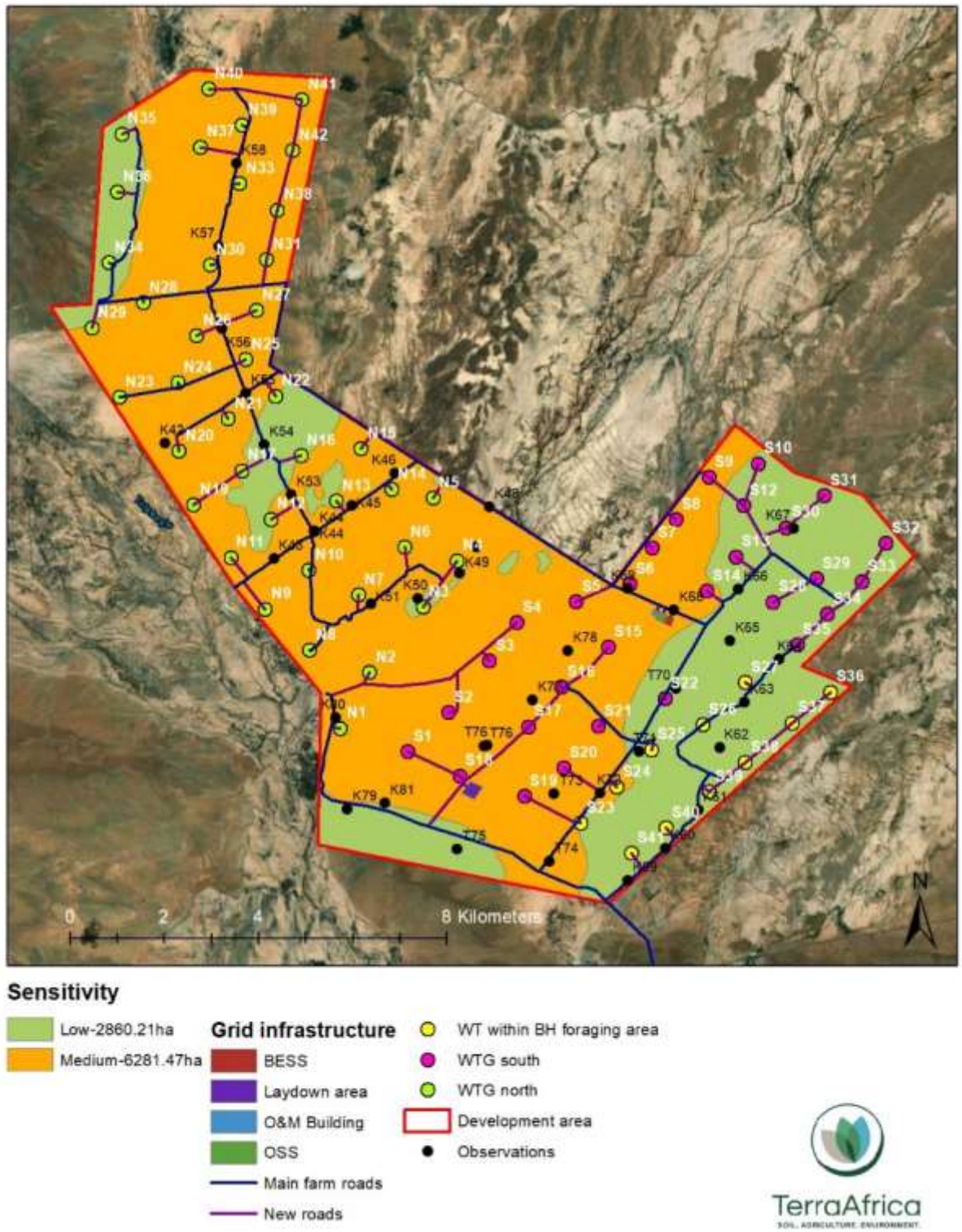


Figure 12: Agricultural sensitivity of the development area.

7. Conclusion

Following the desktop analysis of available data, as well as a site verification visit, it is concluded that the Kudu WEF, consists mainly of the Glenrosa and Swartland soil forms. The Glenrosa has shallow soil depths which decreases the effective soil depth and thus lowers the land capability to Low (Class 05). The Swartland conversely has a much deeper depth and thus a more effective soil depth which gives it a Low-Moderate (Class 07) land capability.

The area is dominated by Medium agricultural sensitive areas with only 29 turbines out of 80 falling on Low agricultural sensitivity. Although most of the area is allocated a Medium sensitivity, the area is only used for livestock grazing as was observed during the site visit. Additionally, no field crops were present within the development area.

It is in my professional opinion that the development footprint be suitable for the development. Areas with Low and Medium agricultural sensitivity is considered acceptable. During the site verification visit, it was verified that there are no areas with high agricultural sensitivity within the development area.

8. Reference list

Crop Estimates Consortium, 2019. *Field crop boundary data layer (Eastern Cape)*, 2019. Pretoria. Department of Agriculture, Land Reform and Rural Development.

Department of Agriculture, Land Reform and Rural Development, 2018. *Long-term grazing capacity for South Africa*: Data layer. Government Gazette Vol. 638, No. 41870. 31 August 2018. Regulation 10 of the Conservation of Agricultural Resources Act (CARA): Act 43 of 1983. Pretoria. Government Printing Works.

Land Type Survey Staff (1972 – 2006). *Land Types of South Africa data set*. ARC – Institute for Soil, Climate and Water. Pretoria.

The Soil Classification Working Group, 2018. *Soil Classification – Taxonomic System for South Africa.* Dept. of Agric., Pretoria.

APPENDIX P6:
HERITAGE SITE SENSITIVITY VERIFICATION REPORT

CTS HERITAGE

SITE SENSITIVITY VERIFICATION
(IN TERMS OF PART A OF THE ASSESSMENT PROTOCOLS PUBLISHED IN GN 320 ON 20 MARCH 2020)

1 Introduction

FE Kudu (Pty) Ltd is proposing the development of a wind energy facility and associated infrastructure on a site located approximately 40km west of Aberdeen in the Eastern Cape Province. The project is located within the Dr Beyers Naude Local Municipality and the greater Sarah Baartman District Municipality. The project site comprises a single affected property, Portion 2 of Farm Oorlogspoort 85. The project is known as the FE Kudu Wind Energy Facility. The project is planned as part of a cluster of renewable energy projects, which includes a second wind energy facility with a capacity of up to 240MW (FE Tango Wind Energy Facility), located approximately 20km east of the FE Kudu Wind Energy Facility.

CTS Heritage was appointed by Savannah Environmental to undertake a Site Verification and Sensitivity analysis that forms part of the Environmental Authorisation (EA) for the proposed Kudu Wind Farm and its associated grid connections.

2 Site sensitivity verification

The site sensitivity verification was undertaken as follows:

- A Desktop Study was conducted of relevant reports previously written (please see the reference list for the age and nature of the reports used)
- An archaeologist conducted an assessment of archaeological resources likely to be disturbed by the proposed development. The archaeologist conducted his site visit from 20 to 24 June 2023.
- A palaeontologist conducted an assessment of palaeontological resources likely to be disturbed by the proposed development. The palaeontologist conducted his site visit in from 20 to 24 June 2023.
- A cultural landscape assessment was conducted that covers the proposed development area with fieldwork completed in July 2023.

A Heritage Impact Assessment (HIA) process has been undertaken and is reported on in a separate HIA report that will be submitted to the South African Heritage Resources Agency (SAHRA) as is required in terms of Section 38(8) of the National Heritage Resources Act (NHRA).

3 Outcome

In terms of site sensitivity with specific consideration of heritage resources, clarity on the broader context and its cultural value is important to understand overall heritage sensitivity and in order to contextualise site specific findings. Please find both contextual information as well as site specific information below.

Cultural Landscape and the Built Environment

The concept of cultural landscape gives spatial and temporal expression to the processes and products of the interaction between people and the environment. It may thus be conceived as a particular configuration of topography, geology, vegetation, land use and settlement pattern and associations which establishes some coherence of natural and cultural processes.

The overall landscape of the study area is a vast, open, barren, largely featureless plain. It lies to the west of an area of high scenic value framed to the north by the south-west sector of the Camdeboo Mountains, notably the Sleeping Giant. The R61 and N9 are regional linkage routes traversing a representative Karoo landscape and having some scenic heritage value in terms of its sense of remoteness.

The Camdeboo Plains and mountain backdrop, with its core lying east of the proposed development area, is of high local historical, aesthetic architectural and social significance. Of particular heritage significance is the town of Aberdeen, which is worthy of Grade IIIA heritage status in terms of the following:

- Historical value dating to the mid-19th century and including its local role in the South African War.
- Architectural and aesthetic value in terms of its street pattern, streetscape and townscape, concentration of conservation worthy buildings, and its relationship with its setting, notably its mountain backdrop to the north.
- Cultural landscape value as providing a focal and destination point within a vast open flat landscape and at the intersection of two regional routes.

The cultural landscape to the west of Aberdeen and forming part of the landscape affected by the proposed WEF has historical value in terms of forming part of a pattern of land grants dating to the mid-19th century. Natural features and patterns of use over time contribute to its landscape character (watercourses, topographical features, routes, farmsteads, stone kraals). While the landscape itself is not worthy of formal protection in terms of the NHRA, it possesses conservation-worthy landscape elements for aesthetic (visual, place making) and historical reasons.

Archaeology

The historic to modern farming use of the landscape has contributed to the built environment pattern of settlement in the area with typical Karoo werfs, many now ruined, dotting the landscape. A number of farm dams have been made in the past by using earthmoving equipment to push up dirt banks along the watercourses. Nearly 60 additional observations were made of various archaeological sites falling within the Kudu WEF area. Two areas previously recorded during the Kariega WEF study identified ruins and built environment heritage located near the northeastern end of the Kudu WEF associated with a stock kraal settlement on the way to the Benekraal werf as well as the Rooidraai werf near the southern end of the development area noted earlier. No impacts on these built environment heritage resources are anticipated but are noted as part of the broader assessment of heritage resources in the region.

Given the lack of natural rock shelters on the landscape and absence of dolerite boulders favoured by rock engravers during the Later Stone Age, the vast majority of the observations consisted of open air scatters of Middle and Later Stone Age artefact scatters. The vast majority of the archaeological sites recorded consisted of Middle Stone Age open site scatters of tools made of hornfels and siltstone which are abundant and easily sourced within the local area. The Later Stone Age scatters tended to contain high quality hornfels that appeared to be introduced into the area and were far less patinated and weathered than the extensive MSA material. Artefacts were seen throughout the study site and areas within the floodplain of the Kariegarivier containing less visible surface material are likely to hold buried archaeological material. The modern dirt furrows and sand banks created in the 1950s have no doubt contributed substantially to the build up of sediment burying many of these scatters.

Table 1: Sites of significance identified within or near to the development area for Kudu WEF

POINT ID	Description	Type	Period	Density	Co-ordinates		Grading	Mitigation
001	Rooidraai farm. “Karoo Secret” Cottage, early 20th century with corrugated iron roof, more modern stoep added later	Structure	Historic	n/a	-32.488176	23.550344	IIIC	No impact anticipated
062	Rooidraai main werf, mostly modern additions but early 20th century buildings present, lots of labourers’ cottages.	Structure	Historic, Modern		-32.487224	23.54628	IIIC	No impact anticipated

Palaeontology

The Kudu WEF project area on the northern margins of the Aberdeen *Vlaktes* are underlain at depth by potentially fossiliferous continental (fluvial / lacustrine) bedrocks of the Lower Beaufort Group (Adelaide Subgroup). These bedrocks probably belong largely or entirely to the Middle Permian Abrahamskraal Formation rather than the Late Permian Teekloof Formation as currently mapped. However, basal channel sandstones of the Poortjie Member (Teekloof Formation) might extend into the NW edges of the Kudu WEF project area on the lower footslopes of the Oorlogspoortberge. There are no historical records of fossil vertebrates from the project area; this is probably largely due to the extremely poor levels of bedrock exposure found here. Fragmentary remains of large dinocephalians have recently been recorded from the Aberdeen *Vlaktes* just to the south as well as from the slopes of the Oorlogskloofberge to the west. During the recent 3-day palaeontological field visit no occurrences of fossil vertebrates were recorded.

A background scatter of petrified (silicified) wood blocks reworked from the Lower Beaufort Group bedrocks occurs within surface gravels of eluvial and alluvial origin in several sectors of the Kudu WEF project area. Locally abundant, ferruginised moulds and poorly-preserved petrified wood occurs in association with channel sandstone basal conglomerates on the NW margins of the Kudu WEF project area (Oorlogspoortberge eastern footslopes). Most of the fossil wood material is poorly preserved and of very limited scientific value. Mitigation of the recorded fossil wood sites is not recommended here, given the abundance and widespread occurrence of better-preserved material regionally in the northern Aberdeen *vlaktes* and the fact that the material is not *in situ*.

Most of the low-relief terrain within the WEF project area is covered by a thin to thick blanket of Late Caenozoic superficial deposits, including alluvial gravels and sands, eluvial and colluvial surface gravels, calcrete hard pans, pan sediments and gravelly to sandy soils. Apart from reworked fossil wood blocks and Late Caenozoic calcretised plant root casts of widespread occurrence and limited palaeontological interest, no fossils of Caenozoic age have been recorded within these younger sediments.

Kudu WEF is mapped relative to significant heritage resources including cultural landscape elements, archaeology and palaeontology in Figure 1 and 2 below.

4 National Environmental Screening Tool

According to the DFFE Screening Tool analysis, the development area has Very High levels of sensitivity for impacts to palaeontological heritage and High levels of sensitivity for impacts to archaeological and cultural heritage resources. The results of this assessment in terms of site sensitivity are summarised below:

- The cultural value of the pristine Karoo Landscape is very high and the location of the proposed development will impact this significance (Very High)
- Some significant archaeological resources were identified within the development area (High)
- No highly significant palaeontological resources were identified within the development area, however the geology underlying the development area is very sensitive for impacts to significant fossils (Very High)

As per the findings of this assessment, and its supporting documentation, the outcome of the sensitivity verification confirms the results of the DFFE Screening Tool for Palaeontology and disputes the results of the screening tool for archaeology and cultural heritage - this should be considered to be Very High. This evidence is provided in the body of this report and in the appendices (Appendix 1 and 2).

5 Conclusion

It is confirmed that the site sensitivities identified in the specialist study have been verified as per section 4 above.

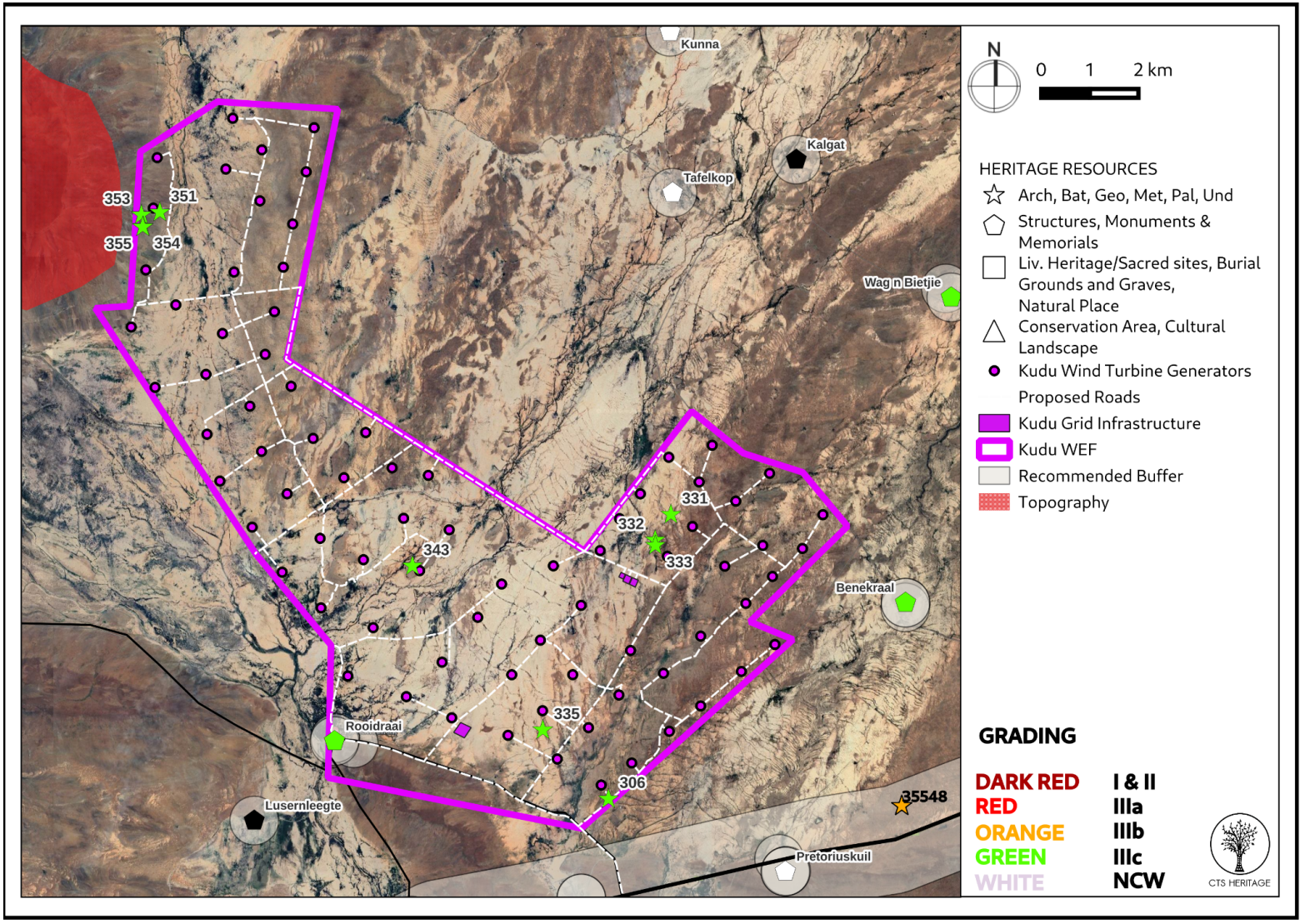


Figure 1: All heritage resources within proximity to the development area

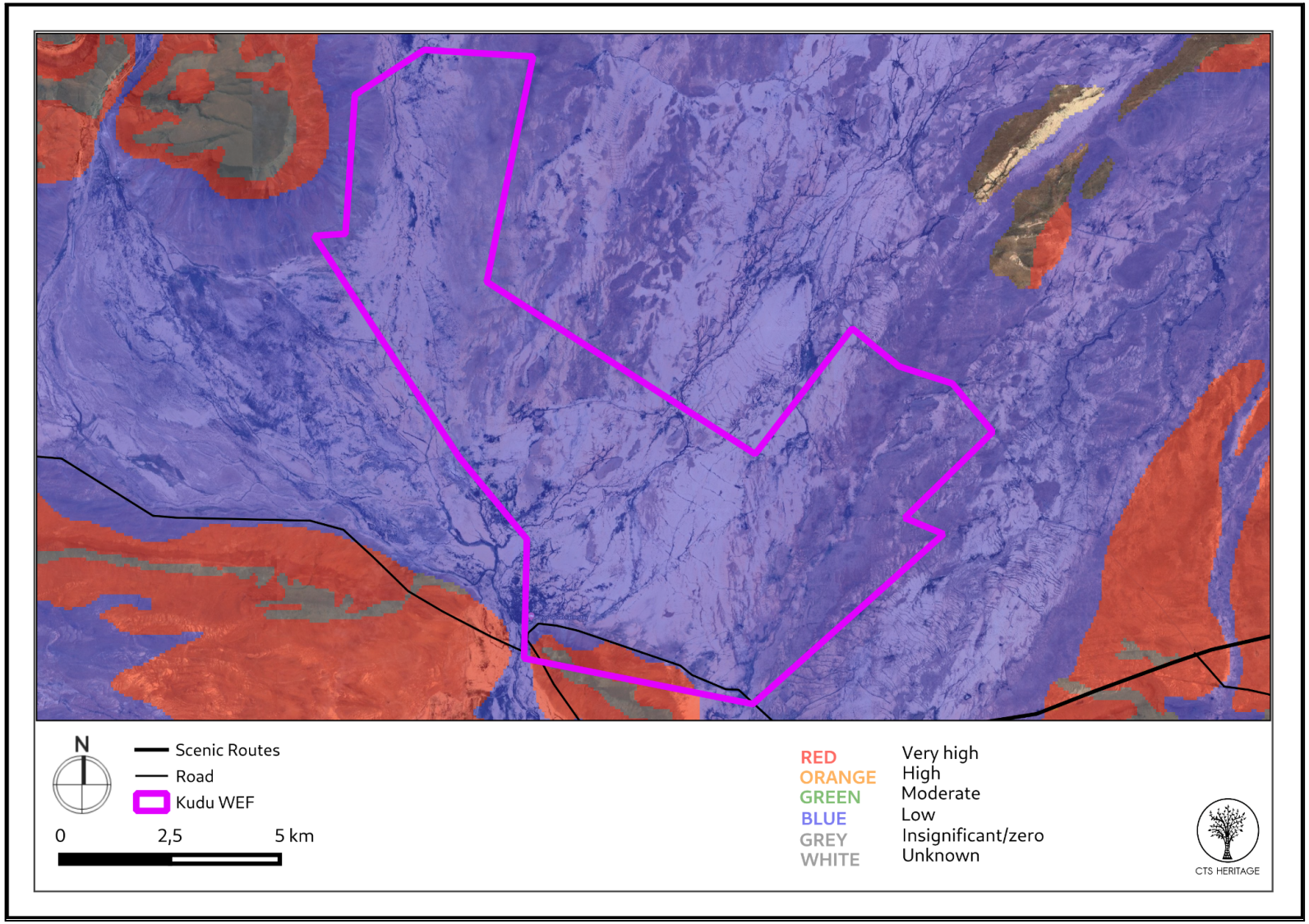


Figure 2: Palaeontological sensitivity of the development area from SAHRIS

APPENDIX P7:
NOISE SITE SENSITIVITY VERIFICATION REPORT

EARES
Enviro Acoustic Research

Name: Morné de Jager
Cell: 082 565 4059
email: morne@eares.co.za
Date: 29 August 2023
Ref: SSV-Kudu

Savannah Environmental
Woodlands Drive Office Park
Woodmead
2191

Attention: Ms. Chantelle Geyer / Karen Judas

Dear Madam

SITE SENSITIVITY VERIFICATION (IN TERMS OF PART A OF THE ASSESSMENT PROTOCOLS PUBLISHED IN GOVERNMENT NOTICE 320 ON 20 MARCH 2020) FOR THE PROPOSED KUDU WIND ENERGY FACILITY NEAR ABERDEEN CONSIDERING THE SENSITIVITY TO NOISE

The above-mentioned issue is of relevance.

Part A of the Assessment Protocols published in GN 320 on 20 March 2020 (i.e., Site sensitivity verification is required where a specialist assessment is required but no specific assessment protocol has been prescribed) is applicable where the Department of Environment, Forestry and Fisheries Screening Tool has the relevant themes to verify.

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 site sensitivity verification 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). The details of the site sensitivity verification are noted below:

Date of Site Visit	15, 16 and 18 July 2022
Specialist Name	Francois Stephanus de Vries (Noise)
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

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 is considered to be of a “very

high" sensitivity to noise. These potentially "very high" sensitive areas (in terms of noise) are indicated on **Figures 1** together with the potential noise-sensitive receptors as identified after the site visit.

Description on how the site sensitivity verification was undertaken

The site sensitivity was verified using:

a) *available aerial images (Google Earth®) (See **Figure 1** for initially identified potential noise-sensitive receptors);*
b) *the statuses of these structures were defined during the site visit done in July 2022.*

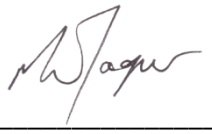
Outcome of the Site Sensitivity Verification

Potential noise-sensitive activities were identified (verified during the July 2022 site visit) and marked as green dots on **Figure 1** below. Based on the site sensitivity verification:

- 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 however no potential noise-sensitive receptors located in these areas and the finding of the online screening tool is disputed; and
- there is one structure (NSR04) used for residential purposes. This was not identified by the online screening tool.

Because there are a number of noise-sensitive receptors within the potential area of influence, the potential impact from noise from the project is assessed in this Noise Specialist Study.

Should you require any further details, or have any additional questions, please do not hesitate to call me on the above numbers.



Signature
Morné de Jager
2023 – 08 – 29

Signature
Francois Stephanus de Vries
2023 – 08 – 29

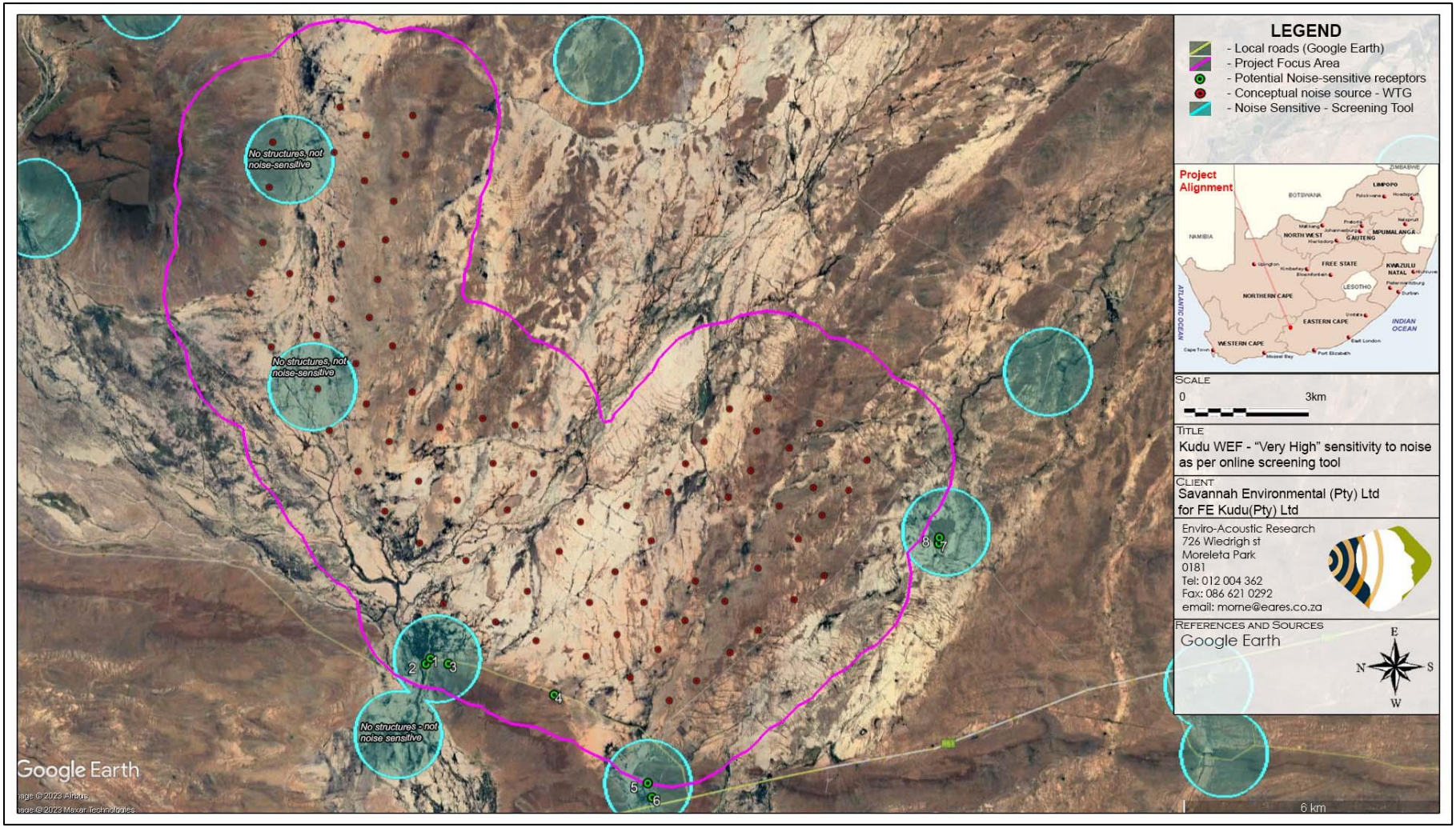


Figure 1: Areas defined to be of "Very High" sensitivity in terms of noise by the online screening tool

APPENDIX P8:
VISUAL SITE SENSITIVITY VERIFICATION REPORT

SITE SENSITIVITY VERIFICATION FOR THE PROPOSED FE KUDU WIND ENERGY FACILITY, EASTERN CAPE PROVINCE

Produced for:

Savannah Environmental (Pty) Ltd
1st Floor, Block 2, 5 Woodlands Drive Office Park,
Cnr Woodlands Drive & Western Service Road
Woodmead, 2191

Produced by:

Lourens du Plessis (PrGISc) t/a LOGIS
PO Box 384, La Montagne, 0184
M: 082 922 9019 E: lourens@logis.co.za W: logis.co.za

- October 2023 -

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1. INTRODUCTION

FE Kudu (Pty) Ltd is proposing the development of a wind energy facility and associated infrastructure on a site located approximately 40km west of Aberdeen in the Eastern Cape Province. The project is located within the Dr Beyers Naude Local Municipality and the greater Sarah Baartman District Municipality. The project site comprises a single affected property, Portion 2 of Farm Oorlogspoort 85. The project is known as the FE Kudu Wind Energy Facility. The project is planned as part of a cluster of renewable energy projects, which includes a second facility, FE Tango Wind Energy Facility, located approximately 20km to the east of the site.

The entire extent of the site falls within the Beaufort West Renewable Energy Development Zones (i.e. REDZ Focus Area 11).

The Kudu Wind Energy Facility will have a contracted capacity of up to 625MW and comprise wind turbines with a capacity of up to 7.5MW each. The project has a preferred project site of approximately ~9 170ha. Access to the site will be via an existing road off of the nearby R61. The FE Kudu Wind Energy Facility project site is proposed to accommodate the following infrastructure:

- Up to 80 wind turbines, turbine foundations and turbine hardstands
- An on-site substation hub incorporating:
  - A132kV on-site facility substation
  - Switchyard with collector infrastructure
  - Battery Energy Storage System (BESS)
  - Operation and Maintenance buildings
- A balance of plant area incorporating:
  - Temporary laydown areas
  - A construction camp laydown and temporary concrete batching plant
- Power lines internal to the wind farm, trenched and located adjacent to internal access roads, where feasible[1].
- Access roads to the site and between project components with a width up to 8m for primary access routes.

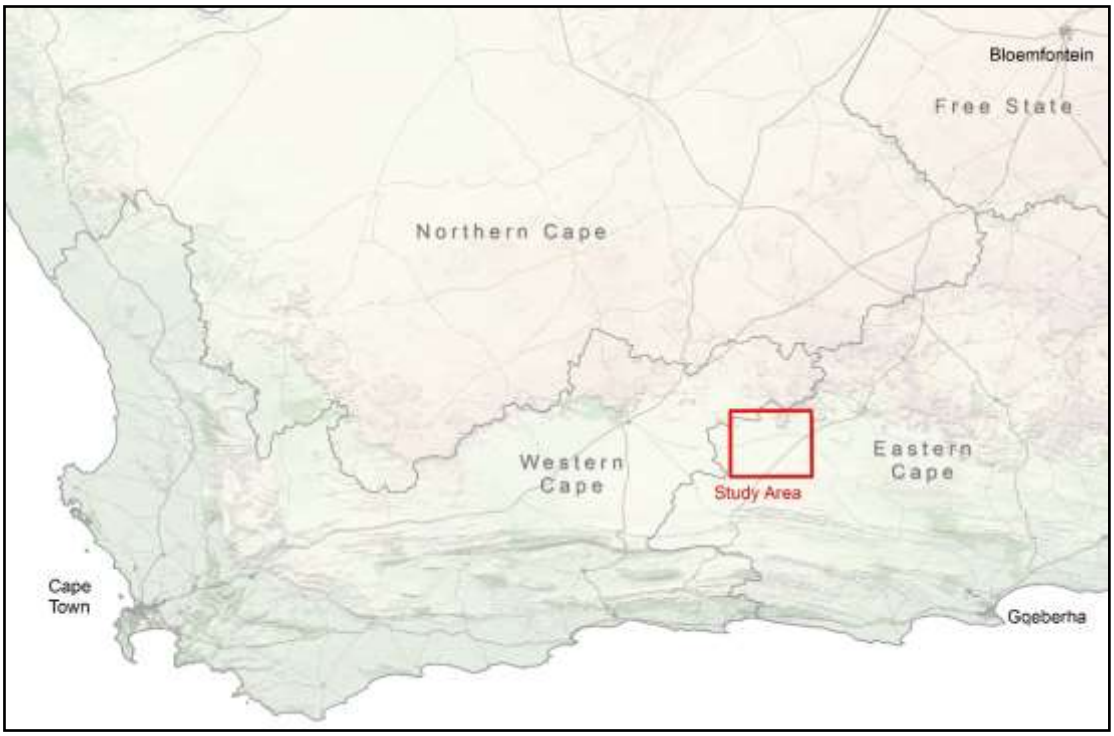


Figure 1: Regional locality of the study area

A technically viable development footprint was proposed by the developer and assessed as part of the studies. The details of the project are as follows:

[1] The intention is for internal project cabling to follow the internal roads.

Table 1: Infrastructure and dimension breakdown of the proposed WEF

Project Name	FE Kudu Wind Energy Facility
Location	Portion 2 of Farm Oorlogspoort 85
Applicant	FE Kudu (Pty) Ltd
Contracted capacity	Up to 600MW (turbines up to 7.5MW in capacity)
Number of turbines	Up to 80 turbines[2]
Turbine hub height	Up to 164m
Turbine top tip height	Up to 250m
Rotor swept area	up to 21m^2
Capacity of on-site substation	132kV
Area occupied by the on-site substation	~ 2ha in extent
Underground cabling	Underground cabling, with a capacity of 33kV, will be installed to connect the turbines to the on-site facility substation.
Battery Energy Storage System (BESS)	Solid state battery technology (e.g. Lithium-ion technology) as a preferred technology. BESS will be housed in containers approximately 20m long, 3m wide, and 5m high with an approximate footprint of up to 5ha.
Operation and maintenance (O&M) buildings	~ 1ha in extent
Balance of plant area	Temporary laydown areas with an extent up to 6ha. Temporary warehouse of 1ha Temporary site camp establishment and concrete batching plants of 1ha.
Access and internal roads – Main road	Main access road to the site and between project components with a width up to 8m and a servitude of 13.5m.
Access and internal roads – internal network	Road network between project components with a width up to 8m
Turbine hardstand	~up to 7500m^2 per turbine
Turbine foundation	~ 1000m^2 per turbine

The project is intended to provide electricity to the national grid through the Department of Mineral Resource and Energy's (DMRE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme or other public or private off-taker programmes.

In accordance with GN 320 and GN 1150 (20 March 2020) of the NEMA EIA Regulations of 2014 (as amended), prior to commencing with a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project areas as identified by the National Web-Based Environmental Screening Tool (i.e., Screening Tool).

2. METHODOLOGY

The site sensitivity verification visual assessment was undertaken using the following information sources:

- Topographical maps and GIS generated data were sourced from the Surveyor General, Surveys and Mapping in Mowbray, Cape Town;
- Chief Directorate National (CDN) Geo-Spatial Information, varying dates. *1:50 000 Topographical Maps and Data.*
- DFFE, 2018/2020. *National Land-cover Database 2018/2020 (NLC2018/2020).*
- DFFE, 2022. *South African Protected Areas Database (SAPAD_OR_2022_Q2).*
- JAXA, 2021. Earth Observation Research Centre. *ALOS Global Digital Surface Model (AW3D30).*
- Google Earth Pro. *Up to date and recent satellite images.*
- Professional judgement based on experience gained from similar projects;

[2] 42 north turbines, and 41 south turbines

- Literature research on similar projects;
- Observations made and photographs taken during site visits;
- 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

3. OUTCOME OF SITE SENSITIVTY VERIFICATION

3.1. DFFE Screening Tool

The DFFE screening tool generated for FE Kudu Wind Facility indicated that the facility has an overall sensitivity of **Very High** relating to the visual aspects of Flicker Theme Sensitivity (Potential temporarily or permanently inhabited residence).

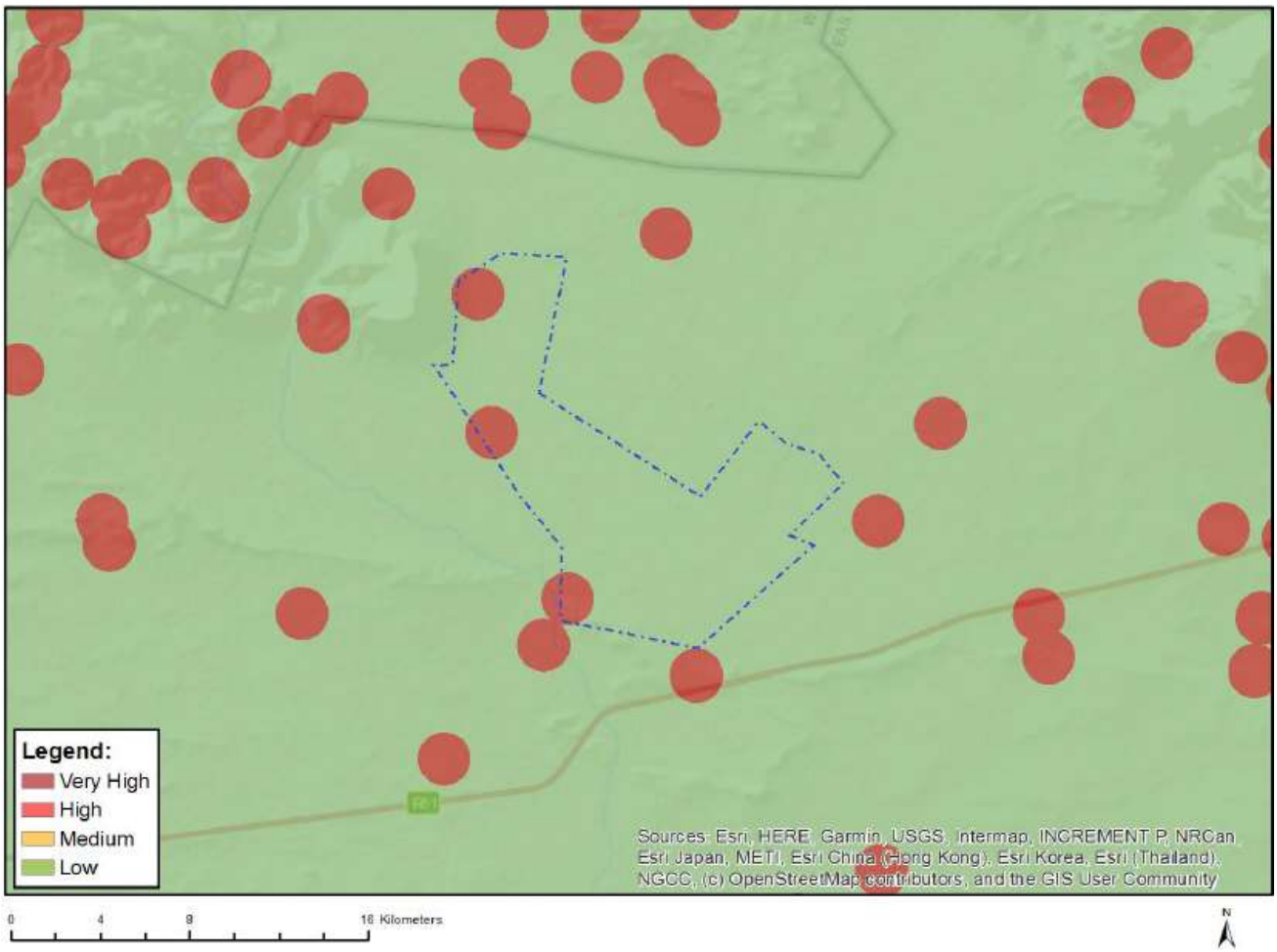


Figure 2: Relative Shadow flicker theme sensitivity as per the DFFE screening tool

Similarly, the DFFE screening tool generated for FE Kudu Wind Facility indicated that the site has a **very high** sensitivity for landscape owing to the fact that the site is located on a slope of between 1:4 and 1:10, and on top of mountains/high ridges.

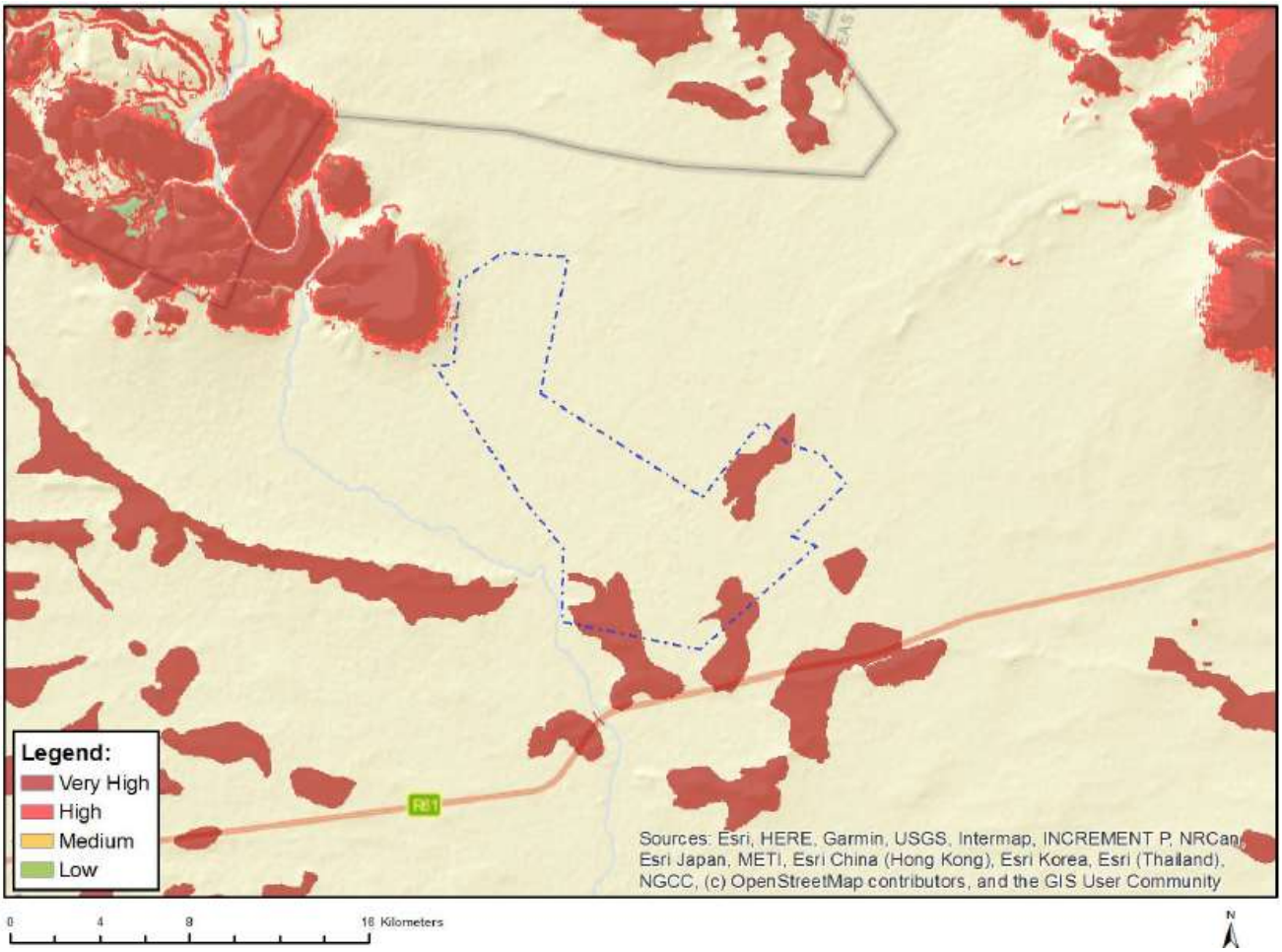


Figure 3: Relative landscape (wind) theme sensitivity as per the DFFE screening tool

3.2. Affected Environment

The proposed development site is located in a rural area, currently zoned as agriculture, at a distance of approximately 37km north west of the town Aberdeen.

Topography, hydrology and vegetation

The study area occurs on land that ranges in elevation from approximately 800m (in the southern and eastern portion of the study area) to 2300m (at the top of the Camdeboo Mountains north east of the site). The terrain surrounding the proposed development area is predominantly flat with an even slope towards the south-west and north-east respectively. This valley, or large plain, known as the Plains of Camdeboo, is flanked to the north east by the *Camdeboo Mountains (Kamdebooberg)* and the Oorlogspoortberge (directly adjacent to the development site to the west).

The proposed development site itself is located at an average elevation of 800 - 900m above sea level. The site is predominantly flat, with limited undulation. The overall terrain morphological description of the study area is *Plains interrupted by some dolerite dykes, butts and mesas*.

The larger region is known as the Great Karoo, consisting predominantly of plains framed by mountains to the north and lower hills in the east. Due to the flat topography and arid climate, the area is characterised by the occurrence of many non-perennial drainage lines traversing across the study area. The Kariega River is located in the western portion of the study area and flows from the north to the south. The non-perennial Kraai River also drains from the southern slops of the Cambedoo Mountains to the east towards the Aberdeen Nature Reserve (also known as the Fonteinbos Nature Reserve) which features a natural spring. The perennial spring, known as *Die Oog* (The Eye), supplies water to the town of Aberdeen, as well as irrigation to a large area of arable land. A number of man-made farm dams are also scattered through the study area.

Vegetation cover in this semi-desert region is primarily *low shrubland and grassland,* and *bare rock and soil* (depending on the season). The vegetation types are described as *Eastern Lower Karoo* (along the plains), *Southern Karoo Riviere* (along the Kariega and Kraai River floodplains) and *Upper Karoo Hardeveld*, and *Karoo Escarpment Grassland* along the mountain ranges.

Land use and settlement patterns

The majority of the study area is sparsely populated (less than 3 people per km^2) and consists of a landscape of wide-open spaces and very little development. The low rainfall and scarcity of water has as a consequence resulted that the region has not been transformed entirely by dryland agriculture or irrigated cultivation of crops. The study area is therefore largely in a natural state, with mainly sheep farming as the primary economic activity. The District is renowned for its wool and mohair production, being the largest mohair producing area in South Africa. Farm residences, or homesteads, dot the landscape at an irregular interval. These homesteads are generally located at great distances from each other (i.e. more than 5km apart).

The site is nestled between the R61 arterial road (south of the site) linking the towns of Aberdeen, Beaufort West and the Camdeboo Mountains. The R61 is one of two major routes which provides motorised access to the region from the town of Aberdeen. Access to the site will most likely be from a secondary gravel road leading off from the R61.

There is only one designated protected area within the region, namely; the Aberdeen Nature Reserve (also known as the Fonteinbos Nature Reserve) which is situated on the banks of the Kraai River, 1km west of the town of Aberdeen and approximately 30km from the FE Kudu Wind Energy Facility. The reserve covers an area of 1,500ha and features a natural spring, which as mentioned above supplies water to the town of Aberdeen, as well as irrigation to an area of arable land.

Other than this protected area, the other identified tourist attractions or destinations in closer proximity to the development site is the town of Aberdeen itself, as well as, the Karoo Secret Farm Stay (located on the farm known as Rooidraai). Aberdeen boasts a well-preserved architectural heritage with an array of examples of Georgian, Victorian, Edwardian, Art Nouveau, Gothic Revival and Flemish Revival styles of architecture interspersed with the typical Karoo style cottages throughout the town.[3] While Karoo Secret Farm Stay, located on the plains of Camdeboo on the south western border of the site, is a working Karoo farm that has a variety of tourist accommodation offerings and activities available including, cycling and hiking trails, opportunities for birding, as well as, various activities for relaxation such as sundowners, swimming, tennis, etc.

Further to this, the entire proposed FE Kudu Wind Energy Facility site is located within the Beaufort West Renewable Energy Development Zone (REDZ). Refer to Error! Reference source not found. for the regional locality of the site in relation to the Beaufort West REDZ. REDZ are described as, *"areas where large scale wind and solar PV energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the environment, while yielding the highest possible socio-economic benefits to the country."*[4]

3.3. Results

In order to determine the overall visual sensitivity of the proposed site in the absence of any mitigation, the following matrix was utilized:

[3] Sources: DEAT (ENPAT Western Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2013-14 (ARC/CSIR), REEA_OR_2022_Q1 and SAPAD2021-22 (DEA).

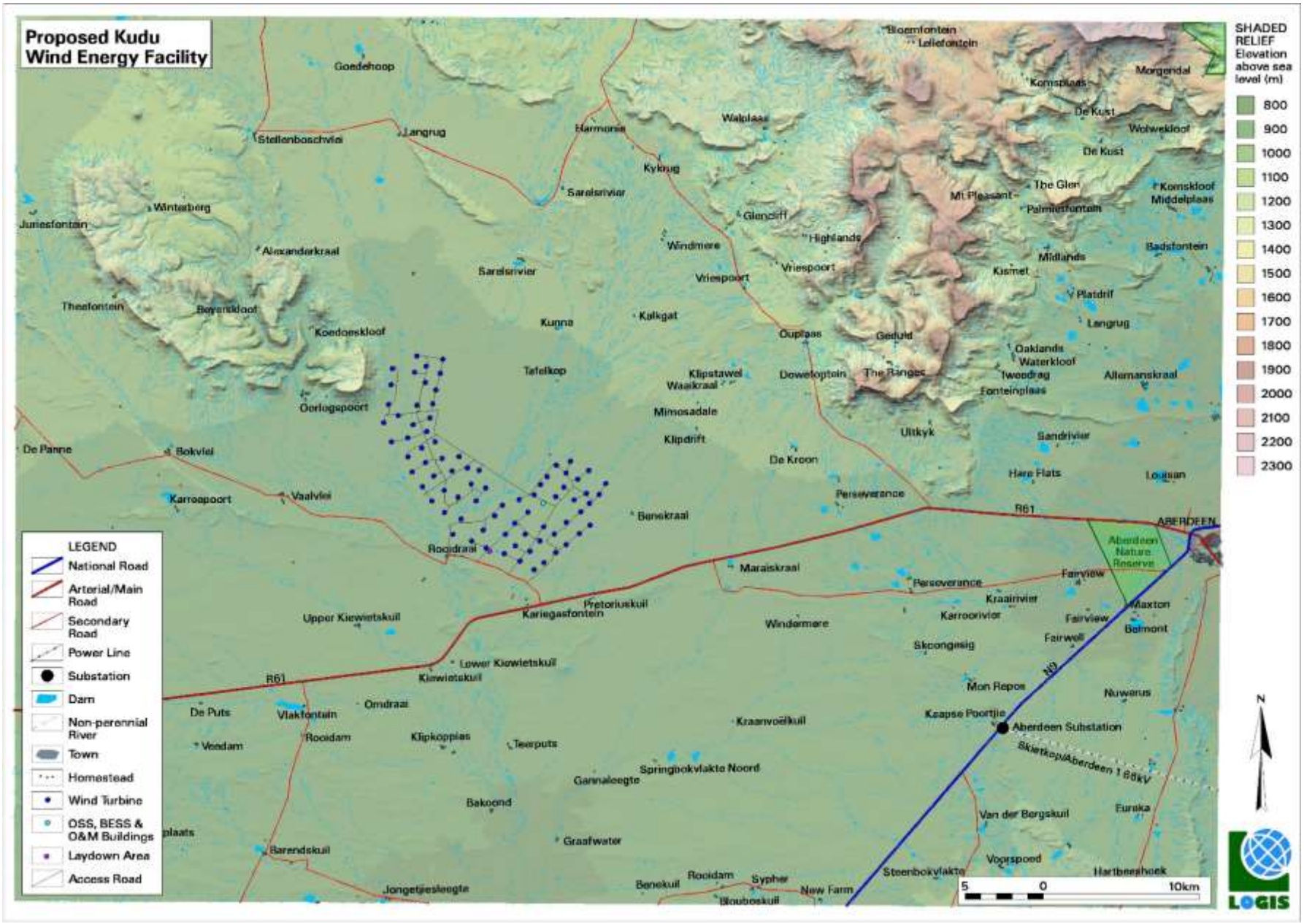
[4] Source: https://redzs.csir.co.za

Table 2: Matrix to determine overall visual sensitivity for the proposed FE Kudu Wind Facility

	Sensitive Receptor	Very High Sensitivity (4)	High Sensitivity (3)	Moderate Sensitivity (2)	Low Sensitivity (1)
1.	**Topographic features incl mountain ridges**	Within 500m	Within 500m - 1km	Within 1 - 2km	>2km
2.	**Steep slopes**	Slopes with more than 1:4	Slopes between 1:4 and 1:10	-	-
3.	**Major rivers, water bodies, perennial rivers and wetlands with scenic value**	Within 250 m	Within 250-500m	Within 500m – 1km	>1km
4.	**Coastal zone**	Within 1km	Within 1 - 2km	Within 2 – 4km	>4km
5.	**Protected area: National Parks**	Within 5km	Within 5 - 10km	Within 10 - 15km	>15km
6.	**Protected areas: Nature Reserves**	Within 3km	Within 3 – 5km	Within 5 – 10km	>10km
7.	**Private reserves and game farms**	Within 1.5km	Within 1.5 – 3km	Within 3 – 5km	>5km
8.	**Cultural landscape**	On the site itself	Within 500m	Within 500m – 1km	>1km
9.	**Heritage Sites Grades I, ii and iii**	On the site itself	Within 500m	Within 500m – 1km	>1km
10.	**Towns and Villages**	Within 2km	Within 2 – 4km	Within 4 – 6km	>6km
11.	**Home/farmsteads**	Within 5km	Within 5 - 10km	Within 10 - 20km	>20km
12.	**National Roads**	Within 1km	Within 1 - 2.5km	Within 2.5 - 5km	>5km
13.	**Provincial/arterial roads**	Within 500m	Within 500m - 1km	Within 1 - 3km	>3km
14.	**Scenic routes**	Within 1km	Within 1 - 2.5km	Within 2.5 - 5km	>5km
15.	**Passenger rail lines**	Within 500m	Within 500m – 1km	Within 1 – 3km	>3km
16.	**Located with Renewable energy development zone**	No	-	-	Yes – Beaufort West REDZ
17.	**VAC**	Low VAC	Moderate VAC	High VAC	Very High VAC
18.	**Shadow Flicker**	YES - Within 1km	YES - Within 1km but not permanently occupied	YES - Within 1km but uninhabited / derelict	No
19.	**Visual Quality**	Natural environment intact with no built infrastructure	Natural environment intact with limited built infrastructure	Natural environment somewhat intact with fair amount of built infrastructure	Built infrastructure is dominant with little to no natural environment remaining
20.	**Presence of existing infrastructure**	Absent	Very low densities	Present in moderate quantities	High densities
	Total	**High (42)**			

Overall visual sensitivity rating:

- Low (0 - 20)
- Moderate (21 - 40
- High (41 - 60)
- Very High (61 - 80)



Map 1: Shaded relief of the study area

4. CONCLUSION

The study area consists of a landscape of wide-open spaces and very little development within the Plains of Camdeboo. It is largely in a natural state, with mainly sheep farming as the primary economic activity. Farm residences, or homesteads, dot the landscape at an irregular interval, resulting in an overall high visual quality.

Visual Absorption Capacity (VAC) of the receiving environment is deemed low by virtue of the nature of the low growing vegetation and the low occurrence of urban development. In addition, the scale and form of the proposed structures mean that it is unlikely that the environment will visually absorb them in terms of texture, colour, form and light/shade characteristics.

The immediate area surrounding the proposed sites is sparsely populated (less than 3 people per km^2) with majority of people residing in the town of Aberdeen, located approximately 25km north west of the site. The site is nestled north of the scenic R61 arterial road which both provide motorised access to the region between Beaufort West and the town of Aberdeen.

Homesteads and farmsteads, by virtue of their visually exposed nature, are considered to be sensitive visual receptors. Residential receptors in natural contexts are more sensitive than those in more built-up contexts, due to the absence of visual clutter in these undeveloped and undisturbed areas. Commuters and possible tourists using the national (N1), the scenic main arterial (R61) and secondary roads may also be negatively impacted upon by the visual exposure to the proposed facilities, however, this intrusion would be fleeting.

The DFFE screening tool generated for the proposed FE Kudu Wind Facility indicated that the facility has a very high sensitivity owing to the fact that the site is located near a potential temporarily or permanently inhabited residence where shadow flicker may be an issue.

Based on the above assessment, it can be found that the shadow flicker sensitivity for the proposed FE Kudu Wind Facility is **moderate** owing to the fact that the single homestead is located on properties involved in the development and it is assumed that they are in fact aware of and to a certain extent accepting of the shadow flicker associated with these turbines. No homesteads outside of the development envelope were identified during the preliminary shadow flicker assessment.

Similarly, the DFFE screening tool generated for FE Kudu Wind Facility indicated that the site has a very high sensitivity for landscape owing to the fact that the site is located on a slope of between 1:4 and 1:10 and on top of mountains/high ridges. From the above assessment, it can be concluded that the landscape visual sensitivity is **high** due to:

- The avoidance of placement of turbines on any mountain tops or ridges
- Possible placement of turbines on slopes of between 1:4 and 1:10
- Low occurrence of homesteads within 5km
- Low VAC of the receiving environment
- The placement of the development within the Beaufort REDZ
- Scenic R61 arterial road located more than 3km from the site
- Limited existing built infrastructure within the study area

5. REFERENCES

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