SiVEST SA (PTY) LTD

PROPOSED CONSTRUCTION OF THE KAREE WIND ENERGY FACILITY AND ASSOCIATED GRID INFRASTRUCTURE, NEAR CERES, WESTERN CAPE PROVINCE, SOUTH AFRICA

Terrestrial Biodiversity Assessment

DEFF Reference: TBA
Report Prepared by: **EnviroSci (Pty) Ltd**
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TERRESTRIAL BIODIVERSITY ASSESSMENT

EXECUTIVE SUMMARY

South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter referred to as "Mainstream"), has appointed SiVEST SA (Pty) Ltd (hereafter referred to as "SiVEST") to undertake the required BA Processes for the proposed construction of the 200MW Karee Wind Energy Facility (WEF) and associated grid infrastructure near Touws River in the Western Cape Province.

The overall objective of the development is to generate electricity by means of renewable energy technology capturing wind energy to feed into the National Grid.

It is anticipated that the proposed Karee WEF will comprise thirty-five (35) wind turbines with a maximum total energy generation capacity of up to approximately 200MW. The electricity generated by the proposed WEF development will be fed into the national grid via a 132kV overhead power line.

In terms of the Environmental Impact Assessment (EIA) Regulations, which were published on 04 December 2014 [GNR 982, 983, 984 and 985) and amended on 07 April 2017 [promulgated in Government Gazette 40772 and Government Notice (GN) R326, R327, R325 and R324 on 7 April 2017], various aspects of the proposed development are considered listed activities under GNR 327 and GNR 324 which may have an impact on the environment and therefore require authorisation from the National Competent Authority (CA), namely the Department of Environment, Forestry and Fisheries (DFFE), prior to the commencement of such activities. Specialist studies have been commissioned to assess and verify the project under the new Gazetted specialist protocols.

The regulatory requirements are also discussed with regard the NEMA and the National Water Act in Section 4 of this report. The PROTOCOL FOR SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR THE ENVIRONMENTAL IMPACTS ON BIODIVERSITY and Appendix 6 of the NEMA EIA Regulations, have been adhered to.

This report fulfils the Biodiversity Specialist Assessment Report criteria for assessment listed under the various Theme Sensitivity Protocols, where the following sensitivity ratings were contained in the Screening Tool Report

- Animal Species Combined – Medium related to a potential occurrence of the Critically Endangered Riverine Rabbit (*Bunolagus monticularis*)
- Plant Species – Medium sensitivity due to the potential presence of Species 44 (Protocol does not allow for the listing of the names of species under threat within public documents and is only made known to the specialist conducting the assessment).

- Terrestrial Biodiversity – Very High sensitivity related to the presence of an CBAs, Ecological Support Area (ESA) and the NFEPA listed under Point 2 above.

The verification of any of the Very High Sensitivity rated habitats / species localities is thus critical as the proposed development should then avoid these areas. During the screening assessment, a four day site visit of the area was conducted in November 2021, in which the habitats / species listed above were considered, together with a description of the general environment and species assemblages found present. This spatial data will then be supplied to the Applicant to develop the layout outside of these areas (inclusive of suitable buffers) as a mechanism of impact avoidance using fine scale mapping data.

The study area had received some much-needed winter rainfall, which aided in critically assessing the ecological character of the site, with particular reference to any linkages between the aquatic and terrestrial environment as indicated in the Screening Tool Results (CBA, ESA & NFEPA). The information collected, was also compared to previous assessments within the region by members of EnviroSci, used in the assessment of the wind farms that have been completed.

In summary four key terrestrial habitats were observed and mapped and then rated based on their sensitivity to the proposed development. These habitats included:

1. *Ruschia* quartzites
2. Shale plains
3. Tanqua karoo - *Pteronia pallens* / *Zygophyllum shrubland*
4. Renosterveld & Fynbos

The sensitivity assessment mentioned considered the habitats observed and these were categorised or rated based on the presence/absence of the following:

- Unique or sensitive habitats
- Presence of importance or listed taxa (faunal & floral)
- Intact and functional habitat associated with sensitive areas indicated in the DFFE Screening Tool results

Several High Sensitivity Habitats were observed and mapped, and these were then considered No-Go for any new infrastructure, while Moderate and Low sensitivity areas could be considered for development. The only exception being road crossings and transmission lines which would be considered acceptable within No-Go areas, if these areas are spanned and/ or located within existing disturbance footprints (e.g. roads within existing farm tracks) and/or suitably mitigated.

The following direct impacts were identified, which are aligned with those contained in the Biodiversity Assessment Protocol and will be assessed in greater detail in this EIA phase of the assessment: Construction and to a degree the Operational and Decommissioning Phases where relevant

Construction & Decommissioning Phases

- Impact 1: Loss of species of special concern
- Impact 2: Loss of terrestrial habitats – flora and vegetation
- Impact 3: Loss of terrestrial species - fauna

Operational phase

- Impact 4: Loss of terrestrial species - fauna

The project overall has a small footprint spread out over a large area, allowing for retention of much of the natural environment so that the systems should remain largely unaffected. Therefore, the wind farm is such that it carries a low intensity impact on terrestrial resources but requiring the clearing of areas with terrestrial vegetation.

A variety of environmental features were observed within the study area and these were mapped and buffered as necessary for their protection. The current layout has the potential, to a large degree, avoided the most sensitive features and buffer areas, greatly reducing the potential overall impact and environmental risk. The overall and cumulative impacts, as assessed, are linked to instances where complete avoidance was not possible, or the nature of the activities involve a potential risk. Overall, it is expected that the impact on the environment would be Low (-). Noteworthy areas, that should be avoided, include the Very High Sensitivity areas as shown in this report.

Based on the findings of this study, the specialist finds no reason to withhold to an authorisation of any of the proposed activities, assuming that key mitigations measures are implemented. Lastly no preference is provided with regard the grid connections, as it assumed based on the uniform characteristics of the site, while making use of existing tracks, however technical considerations have resulted in Substation Option 2 being selected. Further it is recommended that WTG 20 should be moved out of the Renosterveld / Fynbos area.

However, this must all still be assessed once the roads layout has been provided, coupled to a micrositing walkdown once all information is available.

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

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix 1 CV
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Attached to Report
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1 and 1.3 of this report
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.3 and 5
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.3
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 5.1
g) an identification of any areas to be avoided, including buffers;	Section 5 & 6
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Section 6 & 8

k) any mitigation measures for inclusion in the EMPr;	Section 6
l) any conditions for inclusion in the environmental authorisation;	Section 5. 6 and 8
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 6
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 8
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q) any other information requested by the competent authority.	N/A
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Yes - Appendix 2

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TERRESTRIAL BIODIVERSITY ASSESSMENT

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Glossary of Terms

- **Alien vegetation**: Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
- **Biome**: A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
- **Indigenous vegetation**: Vegetation occurring naturally within a defined area.
- **RDL (Red Data listed):** Species Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
- **SCC (Species of Conservation Concern)**: The term SCC in the context of this report refers to all RDL (Red Data) and IUCN (International Union for the Conservation of Nature) listed species as well as protected species of relevance to the project.

List of Abbreviations

AER	Along Existing Roads – cables that are included in existing road servitudes
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DDD	Data Deficient
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme Report
EN	Endangered
EO	Environmental Office
ESA	Ecological Support Area
GA	General Authorisation (WUA type)
GBIF	Global Biodiversity Information Facility
GIS	Geographic Information System
LC	Least Concern
NFEPA	National Freshwater Ecosystem Priority Atlas (Nel, *et al*. 2011).
NT	Near Threatened
OHL	Overhead Line – transmission line cable that is not buried
ORC	Off road cable – underground or overhead transmission cable not within a road reserve
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SQ	Subquaternary catchment = Quinary catchment
VU	Vulnerable
WEF	Wind Energy Facility

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1. INTRODUCTION

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1.1 Terms of Reference

Please refer to Specialist ToR provided.

1.2 Specialist Credentials

Please see Appendix 1 - Specialist CVs

1.3 Assessment Methodology

These assessments were conducted using the following assessment process based on 4 days field work conducted in November 2021, early summer, but after several good winter months with rainfall, therefore many of the plants were showing improved growth and most had or were flowering after a prolonged period of drought in the region:

Methodology summary

(Excluding birds and avifaunal)

A desktop and literature review of the area under investigation was conducted to collate as much information as possible prior to any detailed fieldwork. The purpose of the desktop assessment is to rank relevant areas according to their ecological sensitivity and to identify areas of ecological risk prior to the site visit.

Other relevant literature for e.g. Global Biodiversity Information Facility, Virtual Atlas Projects, iNaturalist, relevant Red Data books, ordinances and all systematic bioregional / conservation plans.

Fieldwork was limited to visual sightings by means of transect walks and plot-based sampling, while particular attention will also be paid to the occurrence Red Data species or Protected species as follows:

Vegetation units was sampled by means of the following techniques as per each site:

- Data collection was plot-based and in the form of vegetation samples within selected reference areas to categorise the various vegetation units.
- Results from the data analysis provided a description of the dominant and typical species occurring on the site(s), and included:
    - Threatened, endemic or rare species, with an indication of the relative functionality and conservation importance of the specific community in the area under investigation
    - Invasive or exotic species present and localities in the area
    - The functional and conservation importance of all vegetation communities in the investigation area

Mammals were sampled by means of the following techniques:

- Fieldwork will include visual sightings by means of transect walks to evaluate the presence of mammal taxa. During the site visit, specific attention will be given to signs (droppings, burrows, vocalisations, etc.) of taxa and the presence of suitable habitat
- Camera traps were deployed for the maximum possible time with important or strategic habitat, thus any images collected will form part of the EIA phase of the assessment
- A full list of species observed and expected to occur will then be included
- Specific reference will be made to the occurrence of Red Data species

Herpetofauna (reptiles & amphibians) were sampled by means of the following techniques:

- Visual observations (including nocturnal surveys)
- Installation of pitfall traps and two drift fence arrays. Data collected from these will also be included in the EIA phase
- Active searching techniques; and
- Vocalisations (for amphibians)

Invertebrates will be sampled by means of the following techniques:

- Random linear transects using a standard handnets while focussing on specific indicator groups;
- All taxa caught, were identified to species level if appropriate literature is available (as in the case of butterflies), otherwise the concept known as RTU's (Recognisable Taxonomic Units) or morphospecies was applied;
- The presence of conservation important taxa was also be verified by intensive searching of likely habitat types or burrows.
- Additional information of faunal community residing on the area of investigation were sourced from distributional data/records (both recent and historical), relevant literature, the private sector and other atlas projects.

Habitat areas (based on the species compositions of the vegetation analysis, topography and soils) was then be ranked into High / No-Go, Medium or Low classes in terms of their significance based on the Ecological Sensitivity and Conservation Importance based. A sensitivity and habitat map (including buffer zones if applicable) was produced based on the above information. This combined with the aquatic sensitivity map will then be used by the proponent to finalise the development layout in the remaining phases of the project.

2. ASSUMPTIONS AND LIMITATIONS

To obtain a comprehensive understanding of the dynamics of both the flora and fauna of communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not feasible and are thus mostly based on instantaneous sampling. This limitation is common to many impact assessment type studies, but the findings are deemed adequate for the purposes of decision-making support regarding project acceptability, unless otherwise stated.

Therefore, due to the scope of the work presented in this report, a long-term investigation of the proposed site was not possible and as such not perceived as part of the Terms of Reference. However, a concerted effort was made to sample and assess as much of the potential site, as well as make use of any supporting literature, species distribution data and aerial photography.

It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

TECHNICAL DESCRIPTION

2.1 Project Location

The proposed WEF and associated grid infrastructure is located approximately 12km and 20km north (respectively) of Touws River in the Western Cape Province and is within the Witzenberg Local Municipality, in the Cape Winelands District Municipality (**Error! Reference source not found.**).

Figure 1: Regional Context Map

2.1.1 WEF

The WEF application site as shown on the locality map below (**Figure *2***) is approximately 11 841 hectares (ha) in extent and incorporates the following farm portions:

- Farm Sadawa No 239
- Farm Tierberg No 258; and
- Farm Voetpads Kloof No 253.

A smaller buildable area (1753.1 ha) has however been identified as a result of a preliminary suitability assessment undertaken by Mainstream and this area is likely to be further refined with the exclusion of sensitive areas determined through various specialist studies being conducted as part of the BA process.

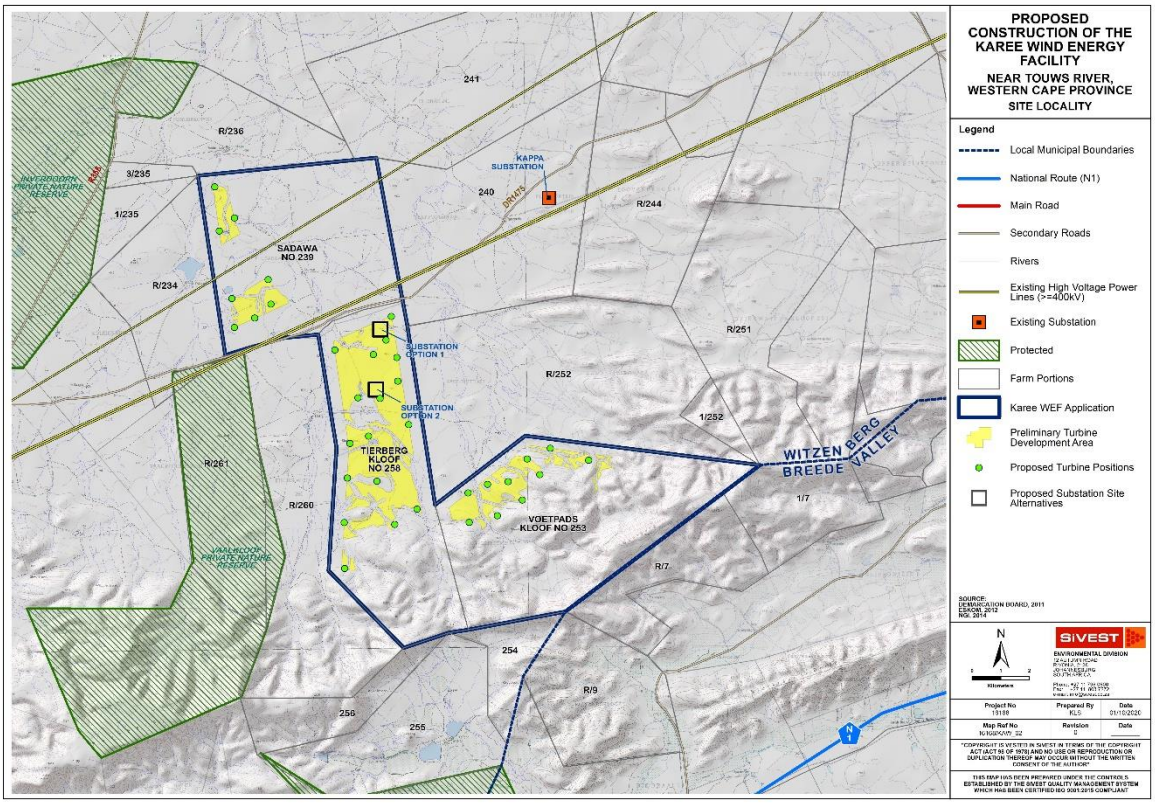

Figure 2: Karee WEF Site Locality

2.1.2 Grid Connection

At this stage, it is proposed that the 132kV power lines will connect the Karee WEF on-site substation to the national grid via Kappa Substation (**Figure 3**).

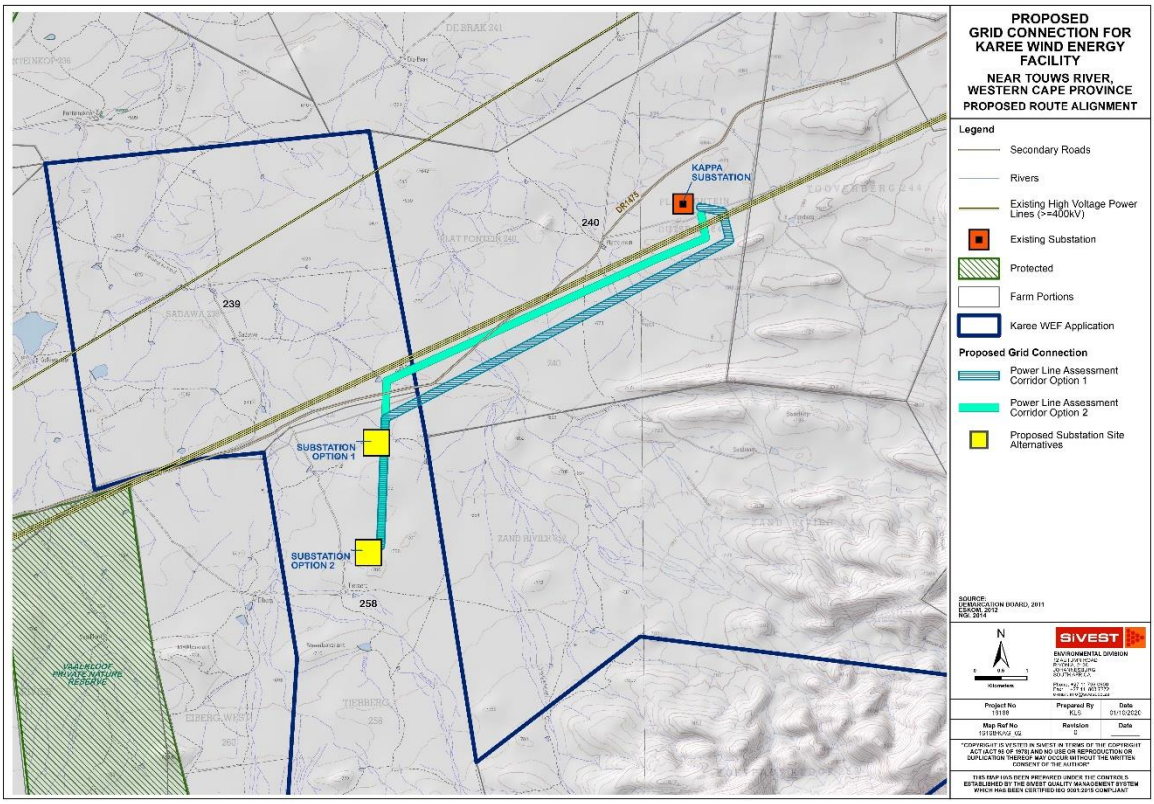

Figure 3: Proposed 132kV Power Line Route Alignment

2.2 Project Description

It is anticipated that the proposed Karee WEF will comprise up to thirty-five (35) wind turbines with a maximum total energy generation capacity of up to approximately 200MW. The electricity generated by the proposed WEF development will be fed into the national grid via a 132kV overhead power line. The 132kV overhead power line will however require a separate EA and is subject to a separate BA process, which is currently being undertaken in parallel to the WEF BA process.

2.2.1 Wind Farm Components

- Up to 35 wind turbines, each between 4MW and 6.6MW, with a maximum export capacity of approximately 200MW. This will be subject to allowable limits in terms of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). The final number of turbines and layout of the WEF will, however, be dependent on the outcome of the Specialist Studies conducted during the BA process;
- Each wind turbine will have a hub height of between 120m and 200m and rotor diameter of up to approximately 200m;
- Permanent compacted hardstand areas / platforms (also known as crane pads) of approximately 100m x 100m (total footprint of approx. 10000m2) per turbine during construction and for on-going maintenance purposes for the lifetime of the proposed development;
- Each wind turbine will consist of a foundation of up to approximately 30m in diameter. In addition, the foundations will be up to approximately 3m in depth;

- Electrical transformers (690V/33kV) adjacent to each wind turbine (typical footprint of up to approximately 2m x 2m) to step up the voltage to between 11kV and 33kV;
- One (1) new 11kV - 33/132kV on-site substation including associated equipment and infrastructure, occupying an area of approximately 2ha (i.e. 20 000m2). The proposed substation will be a step-up substation and will include an Eskom portion and an IPP portion, hence the substation has been included in the WEF BA and in the grid infrastructure (substation and 132kV overhead power line) BA to allow for handover to Eskom. Following construction, the substation will be owned and managed by Eskom. The current applicant will retain control of the low voltage components (i.e. 33kV components) of the substation, while the high voltage components (i.e. 132kV components) of this substation will likely be ceded to Eskom shortly after the completion of construction;
- A Battery Energy Storage System (BESS) will be located next to the onsite 33/132kV substation and included in the 2ha substation area. The storage capacity and type of technology would be determined at a later stage during the development phase, but most likely comprise an array of containers, outdoor cabinets and/or storage tanks;
- The wind turbines will be connected to the proposed substation via 11 to 33kV underground cabling and overhead power lines.
- Road servitude of 8m and a 20m underground cable or overhead line servitude.
- Internal roads with a width of up to approximately 5m wide will provide access to each wind turbine. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary. Turns will have a radius of up to 50m for abnormal loads (especially turbine blades) to access the various wind turbine positions. It should be noted that the proposed application site will be accessed via the DR1475 District Road and DR1475, MR316 and MR319 WCG provincial Roads;
- One (1) construction laydown / staging area of up to approximately 3ha to be located on the site identified for the substation. It should be noted that no construction camps will be required in order to house workers overnight as all workers will be accommodated in the nearby town;
- Operation and Maintenance (O&M) buildings, including offices, a guard house, operational control centre, O&M area / warehouse / workshop and ablution facilities to be located on the site identified for the substation. This will be included in the 2ha substation area.
- A wind measuring lattice (approximately 120m in height) mast has already been strategically placed within the wind farm application site in order to collect data on wind conditions;
- No new fencing is envisaged at this stage. Current fencing is standard farm fence approximately 1-1.5m in height. Fencing might be upgraded (if required) to be up to approximately 2m in height; and
- Water will either be sourced from existing boreholes located within the application site or will be trucked in, should the boreholes located within the application site be limited.
- Optic fibre overhead or underground line from the Adamskraal Substation to the proposed on-site substation.

2.2.2 Grid Components

The proposed grid connection infrastructure to serve the Karee WEF will include the following components:

- One (1) new 11-33/132kV on-site substation, situated on a site of occupying an area of up to approximately 2ha. The proposed substation will be a step-up substation and will include an Eskom portion and an IPP portion, hence the substation has been included in both the BA for the WEF and in the BA for the grid infrastructure to allow for handover to Eskom. The applicant will remain in control of the low voltage components (i.e. 33kV components) of the substation, while the high voltage components

(i.e. 132kV components) of this substation will likely be ceded to Eskom shortly after the completion of construction; and

- One (1) new 132kV overhead power line connecting the on-site substation to Kappa Substation and thereby feeding the electricity into the national grid. Power line towers being considered for this development include self-supporting suspension monopole structures for relatively straight sections of the line and angle strain towers where the route alignment bends to a significant degree. Maximum tower height is expected to be approximately 25m.

2.3 Alternatives

2.3.1 Wind Energy Facility

No other activity or site alternatives are being considered. Renewable Energy development in South Africa is highly desirable from a social, environmental and development point of view and a wind energy facility is considered suitable for this site due to the high wind resource in this area.

The choice of technology selected for the Karee WEF is based on environmental constraints and technical and economic considerations. No other technology alternatives are being considered as wind energy facilities are more suitable for the site than other forms of renewable energy due to the high wind resource.

The size of the wind turbines will depend on the development area and the total generation capacity that can be produced as a result. The choice of turbine to be used will ultimately be determined by technological and economic factors at a later stage.

Design and layout alternatives will be considered and assessed as part of the EIA. These include alternatives for the Substation locations and also for the construction / laydown area. The proposed preliminary layout is shown in **Error! Reference source not found.** below.

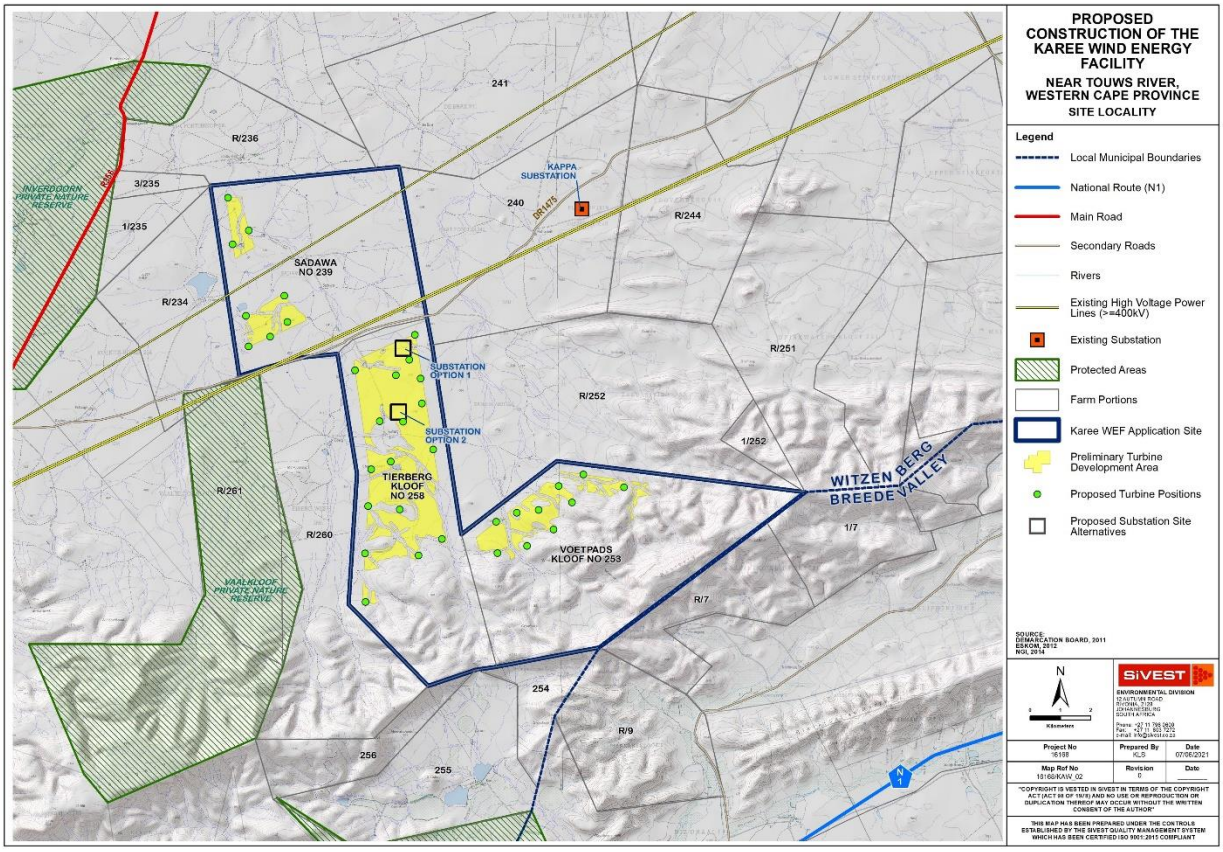

Figure 4: Preliminary Turbine layout and development area

2.3.2 Grid Components

The grid connection infrastructure proposals include two (2) substation site alternatives, each of which are 25 hectares in extent, and two (2) power line route alignment alternatives (**Figure 5**). These alternatives will be considered and assessed as part of the BA process and will be amended or refined to avoid identified environmental sensitivities.

All power line route alignments will be assessed within a 150m wide assessment corridor (75m on either side of power line). These alternatives are described below:

- Power Line Corridor Option 1 is between 8.9km and 10.9km in length, linking either Substation Option 1 or Substation Option 2 to Kappa Substation; and
- Power Line Corridor Option 2 is between 8.4km and 10.3km in length, linking either Substation Option 1 or Substation Option 2 to Kappa Substation.

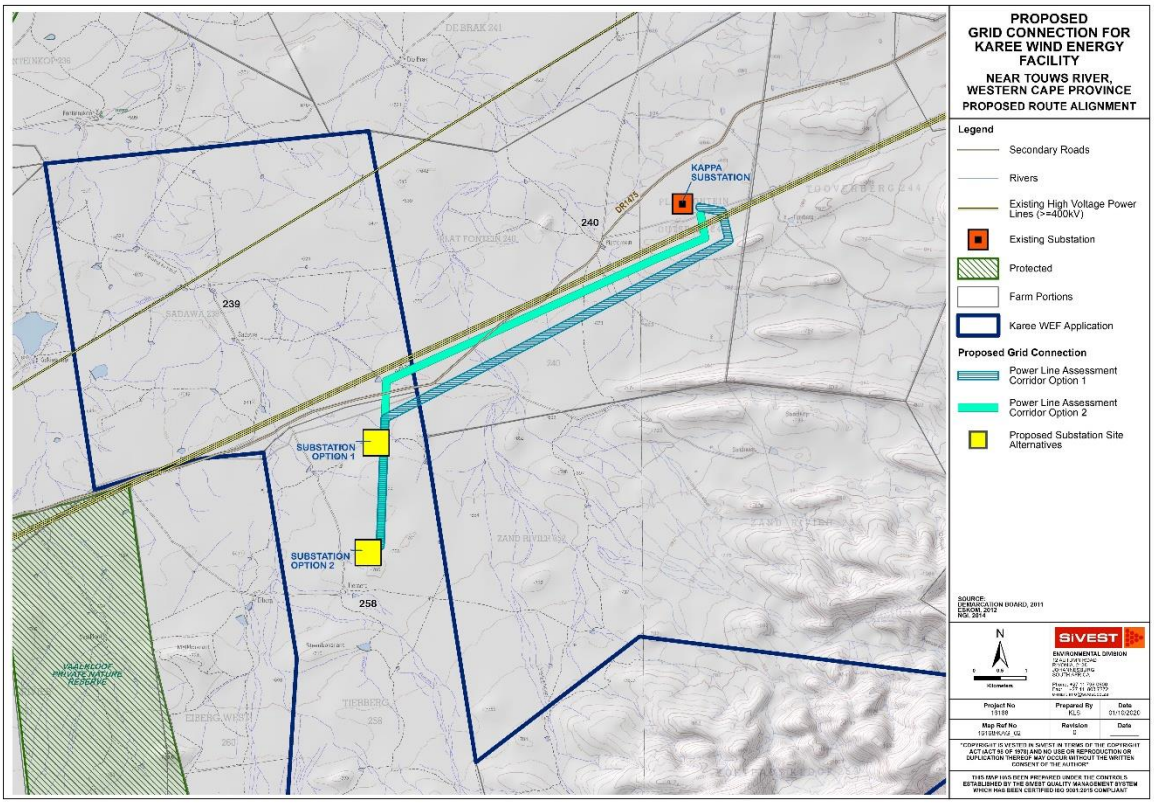

Figure 5: Proposed Substation and Power line options

2.3.3 No-go Alternative

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

The 'no-go' option is a feasible option; however, this would prevent the proposed development from contributing to the environmental, social and economic benefits associated with the development of the renewable energy sector.

3. LEGAL REQUIREMENT AND GUIDELINES

The following is pertinent to this study:

- Section 24 of The Constitution of the Republic of South Africa;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);

- Nature and Environmental Conservation Ordinance (No. 19 of 1974);
- National Forest Act (No. 84 of 1998); and
- National Heritage Resources Act (No. 25 of 1999) – could apply if cultural use or heritage is linked to any natural resources

4. DESCRIPTION OF THE RECEIVING ENVIRONMENT

The site is dominated by three terrestrial vegetation types, spanning Karoo, Fynbos and Renosterveld habitat types. According to Mucina and Rutherford (2007 – amended 2018), the following vegetation units have been described for the site (Figure 12):

1. Tanqua Karoo SKv5
2. Majtiesfontein Quartzite Fynbos FFq3
3. Majtiesfontein Shake Renosterveld FRs6

As their naming implies, the spatial distribution of these is directly related to the underlying geology and soils, which are linked to the Dwyka/Ecca (Shales) and Witterberg (quartizitic sandstones) located under the areas where turbines are located. Based on the current turbine layout (Figure 6), most of the turbines are located within the Tanqua Karoo and Majtiesfontein Quartzite Fynbos vegetation units.

None of these are listed as a Threatened Ecosystem as per the National Environmental Management Biodiversity Act, this is due to the vast area these vegetation units occupy, with little in terms of human / agricultural use.

Appendix 3 lists the typical species assemblages based on previous observations made within the region which include species records for both flora and fauna, housed in Global Biodiversity Information Facility (GBIF accessed December 2021). A potential 1571 species has been previously recorded in the Quarter Degree Square grids that cover the site (3319bb & 3320aa), of which ca. 80% are plant species. The remainder, which excludes birds and bats as these are assessed separately, include the following taxa:

- Mammals 36 Species
- Reptiles 35 Species
- Amphibians 8 Species
- Fish 5 Species
- Insects 90 Species
- Spiders / Scorpions 5 Species
- Fungi 11 Species

This was then compared to observation made within a 4 day site-specific assessment conducted in November 2021, conducted after a period of significant winter rains, more than previous years, which some response by the flora, but the prolonged drought in the region has affected that growth of the plants, especially those in

the low-lying plains areas, that have shallow soils. However, a clear delineation of the various terrestrial habitats within the site based the respective plant species composition as shown in Figure 7 could be defined.

Vegetation and flora

The species composition clearly followed a gradient from the higher lying areas in the south, will a marked reduction in plant species diversity and abundance in habitats observed in the northern parts of the study area, i.e. the shale dominated areas associated with the Tanqua Karoo vegetation unit was rather depauperate (Plate 1) when compared to both the Majtiesfontein vegetation units in the south (Plate 2).

Figure 7 therefore represents the finer scale mapping of the habitats/vegetation units found on site and could be summarised as follows:

5. *Ruschia* quartzites

Although plant species were spread widely within the site, the sandstone/quartzite dominated soils did show a high density of succulent species, mostly growing taller than the remaining species observed, especially when rocky areas were encountered. These areas were also dominated by various *Ruschia* species, in particular *R. spinosa*, accompanied by *Psilocaulon sp*, and *Pteronia pallens* specimens.

6. Shale plains

These almost barren areas, contained little in terms of vegetation, probably due to the extreme heat / dry conditions that occur within these areas, coupled to the fact to higher clay percentage within the soils

7. Tanqua karoo - *Pteronia pallens / Zygophyllum shrubland*

These areas were dominated taller shrubs *Zygophyllum retrofractum* and *Pteronia pallens*, the latter being an indicator of intense grazing pressure in the past.

8. Renosterveld & Fynbos

This vegetation unit was largely confirmed to inhabit the slopes of the south portion of the site, and due to the habitat complexity (slope/aspect and rock areas), the diversity and abundance of species was far higher than the lower lying areas of the site. Due to the diversity of this vegetation unit, as well as passed EnviroSci experience in trying to rehabilitate such areas for other wind farms in the region, this vegetation unit should be excluded from the development footprint. This has largely occurred with the exception of Turbine 20, but any associated roads etc should also avoid this area.

Note some of the species observed and listed below are also observed in the Fynbos dominated unit, indicating a slow transition between the two vegetation types, rather than a distinct boundary as indicated in the National Vegetation Map (Figure 6).

Species observed included:

Dicerothamnus rhinocerotis (L.f.) Koekemoer
Aspalathus alpestris
Asparagus capensis var. capensis
Athanasia flexuosa
Chrysocoma oblongifolia
Eriocephalus ericoides subsp. ericoides
Euryops cuneatus
Oedera genistifolia
Passerina truncata subsp. truncata
Pteronia sordida
Antimima dasyphylla
Cotula macroglossa
Rumex lanceolatus
Ursinia nana
Chlorophytum lewisiae
Romulea tortuosa
Trachyandra thyrsoidea
Crassula lanceolata subsp. lanceolata
Bromus pectinatus
Ehrharta calycina
Ehrharta capensis
Hyparrhenia hirta
Hypodiscus sulcatus
Pentaschistis rigidissima
Lotononis comptonii
Hesperantha truncatula
Romulea malaniae

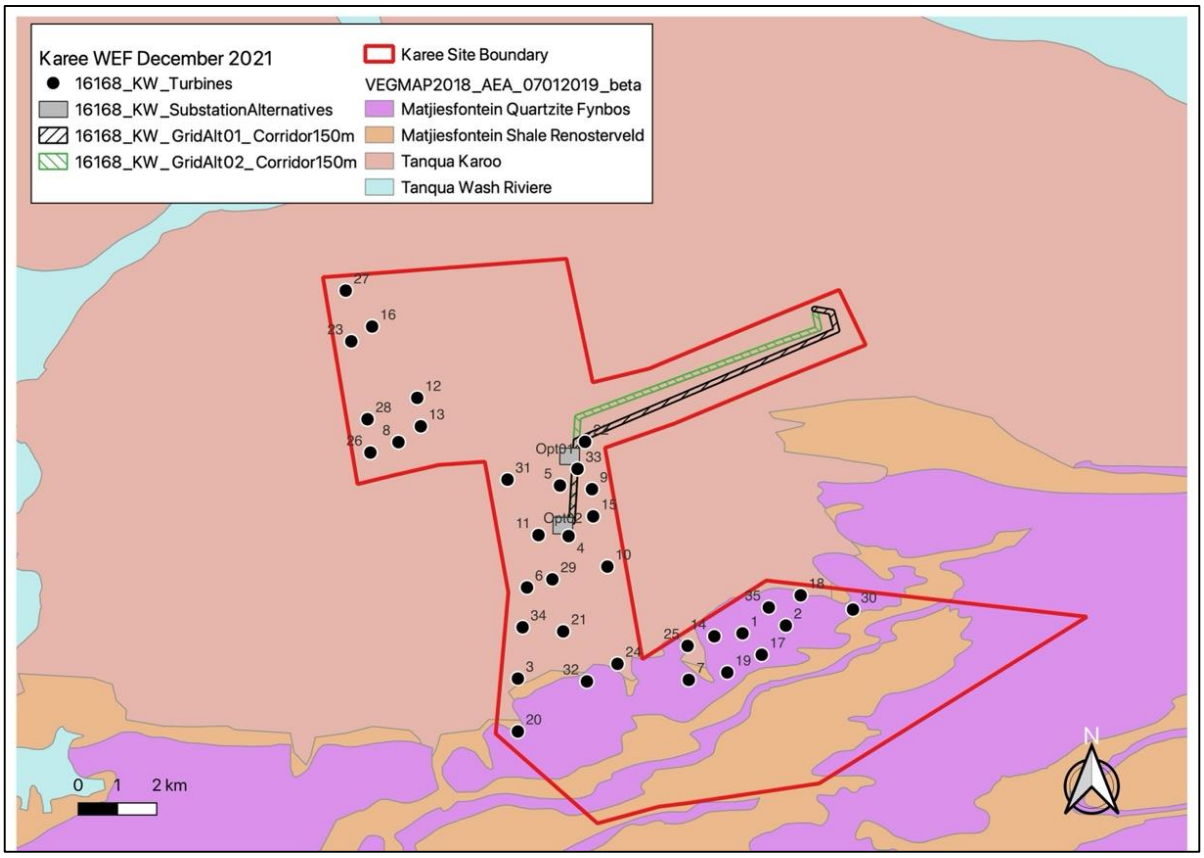

Figure 6: National Vegetation Map as per Mucina and Rutherford (2007) amended NBSA 2018

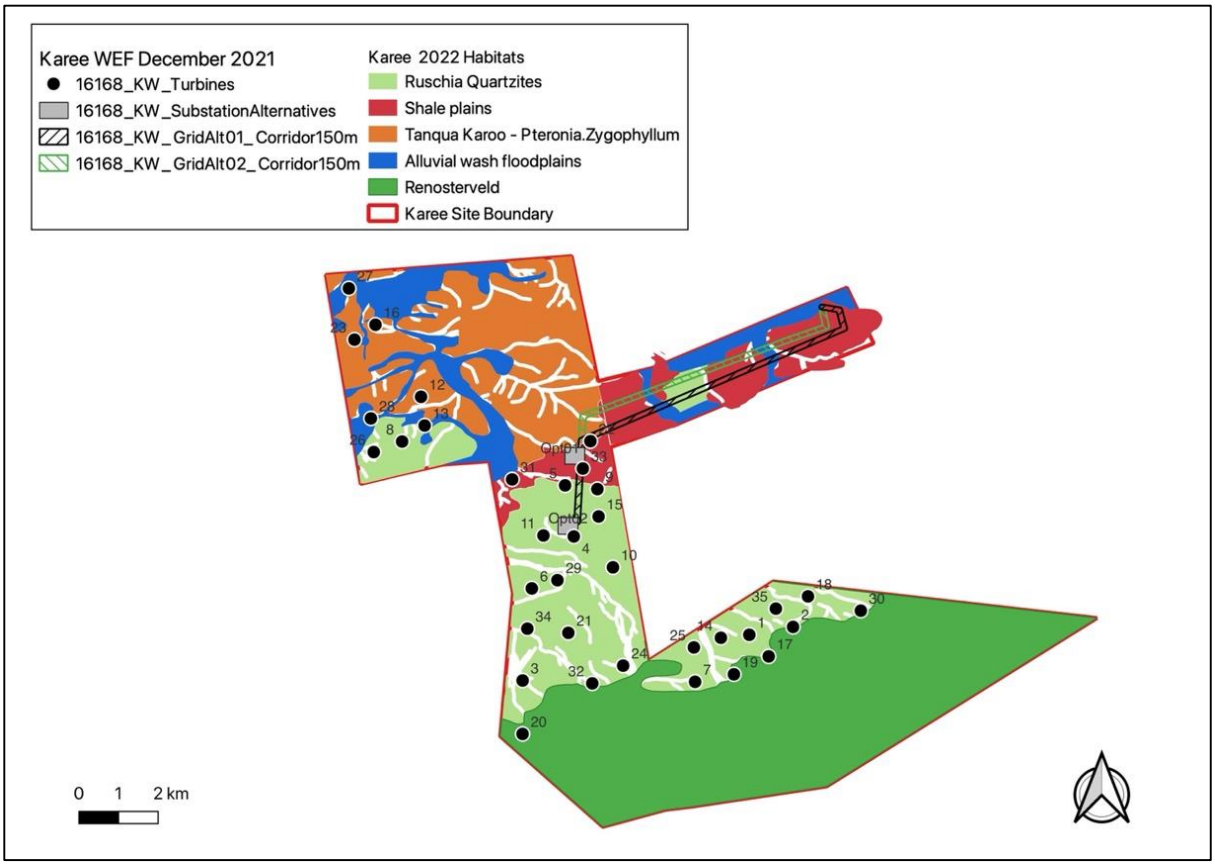

Figure 7: Spatial representation of the observed vegetation units at a finer scale, dominated by three terrestrial habitat units

Plate 1: An aerial view from the central portion of the site, near the proposed substation sites, looking southwards, noting the slow transition in vegetation cover (fynbos/renosterveld) on the high lying areas, to the Tanqua Karoo vegetation in the central areas, ending in the alluvial areas associated with the Karee River floodplain system in the foreground

Plate 2: A ground view of the habitat transition within the site, dominated by the sparsely vegetated shale / quartzite plains in the central portion of the site

No rare or listed plant species were observed during the survey period within the proposed turbine positions; however several species are protected in terms of the Western Cape legislation. The disturbance, destruction and/or relocation, whichever is more relevant, of these species would require the relevant permits from the provincial authority. it is highly recommended that a detailed walkdown of the final layout is conducted, during a suitable time of the year. This will result in a complete species list for the actual footprints and / or assist with any micrositing that may be required to avoid any important habitat, as the relocation of certain species during a search and rescue operation is not always successful, thus avoidance is found to be a better solution.

The DFFE Screening Tool lists Plant Species 35, which were actively searched for, but suitable habitat and or the presence / absence of this species was not confirmed. Most of these are associated with fynbos and or rocky outcrop environments, not found within the proposed development areas.

Sensitive species 651
Braunsia stayneri
Drosanthemum worcesterense
Leobordea globulosa
Amphithalea spinosa
Melolobium stipulatum
Aspalathus intricata subsp. intricata Aspalathus intricata subsp. oxyclada
Leucadendron sp. nov. (Acocks 23716 NBG)
Leucospermum catherinae
Globulariopsis wittebergensis Nenax elsieae
Nenax velutina
Ixia oxalidiflora
Sensitive species 984
Sensitive species 607
Rhodocoma vleibergensis

Hypodiscus sulcatus
Restio esterhuyseniae
Restio karooicus
Anisodontea procumbens
Eriocephalus microphyllus var. carnosus Agathosma acocksii
Sensitive species 1199
Phylica retorta
Phiambolia hallii
Calobota elongata
Asparagus mollis
Protea convexa
Erica glandulipila
Sensitive species 142
Restio aridus
Heliophila elata
Eriocephalus grandiflorus
Octopoma nanum

Fauna

As previously mentioned approximately 179 animal species have been previously observed within the two quarter degrees square areas associated with the study area. These are predominantly Mammal (20%), Reptile (19%) and Insect species (50%), which for the most part highly mobile and or habitat specific. These as listed in the Species Checklist created for the assessment (Appendix 3) were then searched for during the site visit. The only exception being the fish and amphibian species as no permanent or suitable habitat was observed within the study area, although habitats do occur downstream of the project area.

The DFFE screening tool results only include one important species (High & Medium Sensitivity), namely the Critically Endangered Riverine Rabbit (*Bunolagus monticularis*). Riverine rabbits are habitat-specific associated with dense patches of riverine bush along seasonal rivers similar to those found downstream of the site (Doring & Groot rivers). The Riverine rabbit is the only indigenous burrowing species in Africa, and thus requires deep, soft alluvial soils. It is therefore important that the Alluvial Wash Floodplains with riparian areas, which also contain both *Lycium* and *Salsola* plant species, a favoured food source for this rabbit, are avoided as far as possible by the proposed development. The Riverine Rabbit has been observed within a 15-20km radius of the site.

In terms of fauna the following are species which potentially occur at the site and are listed as protected species, with those species highlighted in BOLD being observed in this and past assessments:

Schedule 1: Specially Protected Fauna as per the Western Cape Nature Conservation Ordinance (No. 3 of 2000) that may occur within the region or have suitable habitat present

- *Felis nigripes* - Black-footed cat/Miershooptier
- *Felis silvestris* - African wild cat/Afrika wildekat
- ***Ictonyx striatus* - Striped polecat/Stinkmuishond**
- *Mellivora capensis* - Honey badger/Ratel
- ***Otocyon megalotis* - Bat-eared fox/Bakoorvos**
- *Proteles cristatus* – Aardwolf/Maanhaarjakkals
- *Vulpes chama* - Cape fox / Silver jackal Silwervos
- *Orycteropus afer* - Aardvark / Ant-bear Erdvark / Aardvark

- *Atelerix frontalis* – South African hedgehog
- Family: Chamaeleonidae - Chamaeleons, all species
- Family: Cordylidae Girdled lizards, all species

Virtually all indigenous fauna which do not fall under Schedule 1 are classified under Schedule 2, except those species classified as pests. In terms of mammals most rodents, shrews, elephant shrews, bats, hares and rabbits, carnivores such as mongoose, genets, and meerkat, antelope such as klipspringer, steenbok, Mountain reedbuck and duiker are included. In terms of other vertebrates, all tortoises, lizards, most harmless snakes and all frogs are listed under Schedule 2. The full list is contained within the Schedule and it not repeated here.

In terms of fauna, the following, inter alia, are protected and may not be hunted, captured or harmed without a permit:

- All tortoises [3 species observed which include Angulate tortoise (*Chersina angulate - Plate 3*), Karoo Padloper (*Homopus femoralis*) & Southern Tent Tortoise (*Psammobates tentorius tentorius*)];
- All lizards;
- All frogs;
- Most snakes [4 species have been observed in the past on site, namely Cape cobra (*Naja nivea*), Mole snake (*Pseudoaspis cana*), Karoo sand snake (*Psammophylax rhombeatus rhombeatus*), and Puff adder (*Bitis arietans arietans – Plate 4)*;
- All indigenous antelope;
- Aardvark;
- Most small carnivores such as Honey Badger, Cape Fox, Bat-eared Fox;
- Large Grey Mongoose etc.; and

With the exception of the tortoises, lizards and snakes, the species listed above typically leave the area once construction commences, thus permits for the relocation of lizards, snakes and tortoises must be obtained.

Photo Plate 3: One of the many Angulate tortoises (*Chersina angulata*) observed on site that had succumbed to the previous drought conditions

Photo Plate 4: Another coming siting within the region, namely the Puffadder (*Bitis arietans arietans*), with two sited during the assessment on site

The provincial Biodiversity Spatial Plan Critical Biodiversity Area (CBA) spatial layers (Figure 8). Noting that the aquatic systems associated with the study area have been rated as Critical Biodiversity Areas Type 1, Ecological Support Areas (Type 1 & 2), associated with aquatic/riverine systems. Turbines 18, 27 and 31 are three such structures that are located within CBAs, and these should be considered for micrositing, to outside these areas (Figure 8), noting that currently all the other turbines are located outside any CBA areas. Substation option 1 is the only other structure (building) that is located with an ESA.

The DFFE screening tool indicated that several Very High sensitivity features were located within the study area. The presence of these Very High Sensitivity features was confirmed during this assessment (See Appendix 2 for Verification Statement), but also extended to include additional areas as delineated in Figure 9.

The study area is also not located within an International Bird Area (IBA) or a Strategic Water Resource Area and did not contain any wetland clusters or listed Threatened Ecosystems.

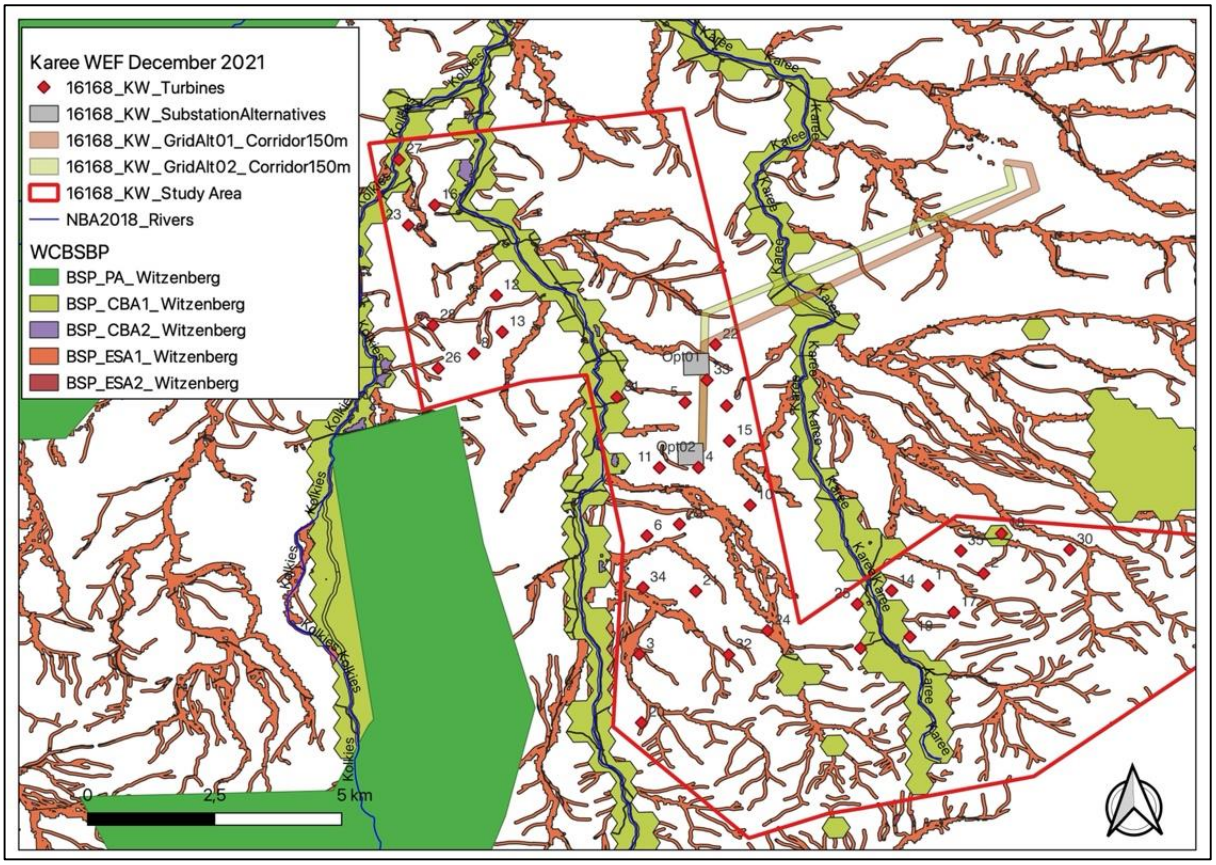

Figure 8: The Critical Biodiversity Areas as per the Western Cape Biodiversity Spatial Plan (2017)

5. SPECIALIST FINDINGS / IDENTIFICATION AND ASSESSMENT OF IMPACTS

Using the baseline description and field data while considering the current disturbances and site characteristics, the following features were identified, then categorized into one of number pre-determined sensitivity categories to provide protect and/or guide the layout planning and design processes of the corridor and a suitable alignment for the grid within. Sensitivity areas (with their buffers) were categorized as follows:

Very High = No Go	Legislated “no go” areas or setbacks and areas or features that are considered of such significance that impacting them may be regarded as fatal flaw or strongly influence the project impact significance profile
High	Areas or features that are considered to have a high sensitivity or where project infrastructure would be highly constrained and should be avoided as far as possible. Infrastructure located in these areas are likely to drive up impact significance ratings and mitigations
Medium	Buffer areas and or areas that are deemed to be of medium sensitivity
Low	Areas of low sensitivity or constraints
Neutral	Unconstrained areas (left blank in mapping)

Table 1 below provides an overview of the sensitivity of various features (with buffers distances where relevant) as it relates to the main project component types for the project. The features are shown spatially in Figures 9. The sensitivity ratings of No go, High, Medium and Low were determined through an assessment of the habitat sensitivity and related constraints. However, these No-Go areas relate in general terms to the project and there are areas where encroachment on these areas would occur (i.e., existing road crossings within Very High sensitivity areas) but this is only considered acceptable if these areas have already been impacted.

Table 1: Results of the sensitivity rating / constraints assessment

Development Component	Waterbody type	Sensitivity rating of the respective waterbody type against the development type and the required buffer	Sensitivity rating override if an impact such as a road already occurs within the proposed footprint
WTG areas	Renosterveld / Fynbos	No-go	
	Shale plains, Tanqua Karoo and Ruschia Quartzites	Low – thus acceptable	
Hardstands, Buildings / Substations & BESS	Renosterveld / Fynbos	No-go	
	Shale plains, Tanqua Karoo and Ruschia Quartzites	Low – thus acceptable	
Roads	Renosterveld / Fynbos	No-go	LOW if an existing tracks / road or impact is already present, that must then be included in the potential road network
	Shale plains, Tanqua Karoo and Ruschia Quartzites	Low – thus acceptable	
Overhead Lines	Renosterveld / Fynbos	Assumption is that the overhead lines could span these areas, but the towers/pylons should adhere to the buffer distances as indicated where possible as some of the alluvial system are very broad	
	Shale plains, Tanqua Karoo and Ruschia Quartzites		

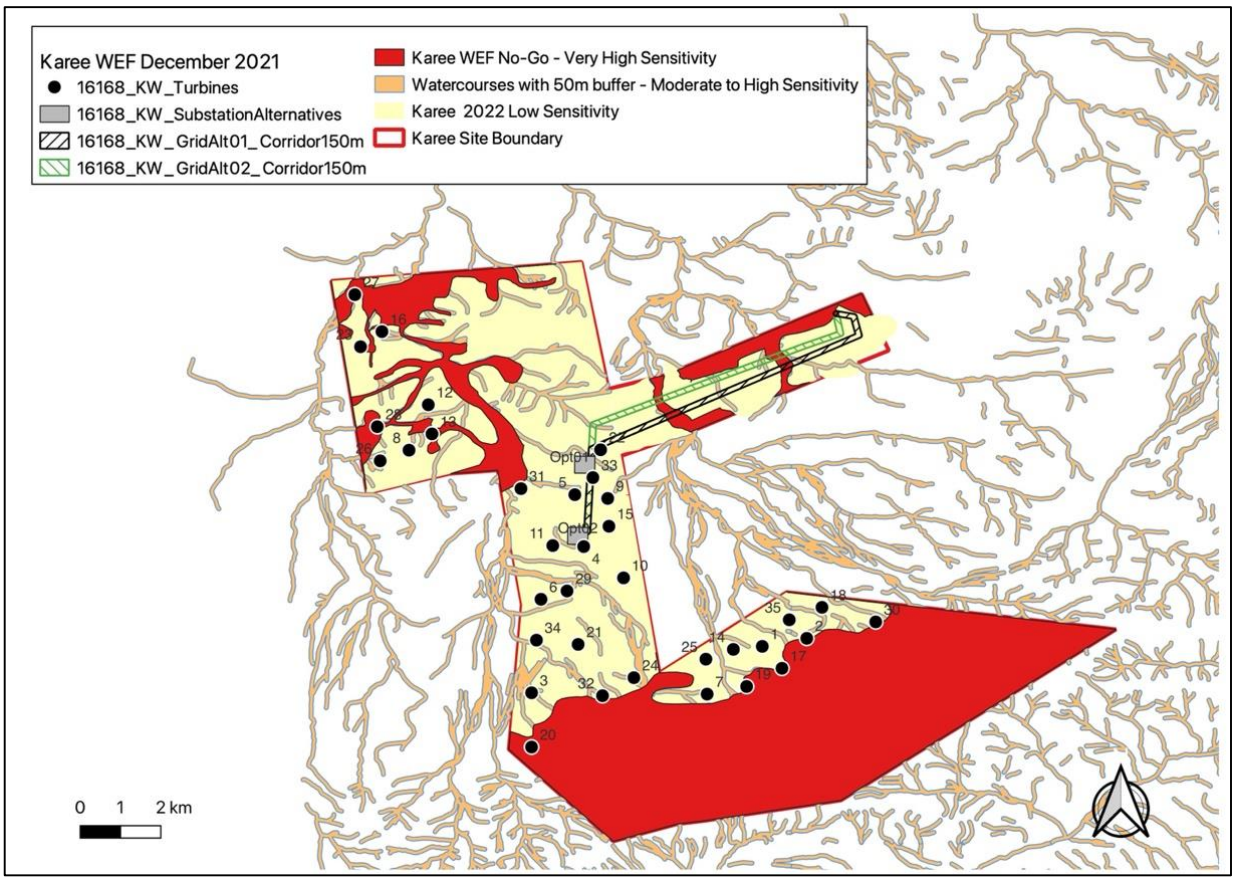

Figure 9: Habitat sensitivity map inclusive of terrestrial and aquatic habitats assessed

The following impacts were then assessed, which are aligned with those contained in the Biodiversity Assessment Protocols and included in the table below and assessed against the proposed alignment and potential activities:

Biodiversity Assessment Protocol Impacts found applicable to this project	**Impacts assessed in this report below**
Faunal and vegetation communities inhabiting the site	Impact 1, 2, 3 and 4
Fragmentation (physical loss of ecological connectivity and or CBA corridors)	Impact 1, 2, 3 and 4
Changes in numbers and density of species	Impact 1, 2, 3 and 4
No-Go Impact	Impact 5
Cumulative Impacts	Impact 6

As highlighted above, the following impacts on the environment have been identified and will be assessed in greater detail as follows, as well as separately the No-Go and Cumulative impacts:

Construction & Decommissioning Phases

- Impact 1: Loss of species of special concern
- Impact 2: Loss of terrestrial habitats – flora and vegetation
- Impact 3: Loss of terrestrial species - fauna

Operational phase

- Impact 4: Loss of terrestrial species - fauna

5.1 Construction & Decommissioning Phase

Table 2: Rating of impacts for the construction and decommissioning phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S
Construction/ Decommissioning Phase																				
Impact 1: Loss of species of special concern	The construction activities will result in the disturbance of both aquatic and terrestrial habitats that may contain listed and or protected plant or animal species. However, none of these were observed during this assessment within the tower positions proposed	1	1	1	1	1	1	5	-	LOW (-ve)	Develop and implement an Rehabilitation and Monitoring plan post Environmental Authorisation. This must be developed following the finalisation of the turbine / road layout and a walk down has been completed. This plan should include relocation of suitable plant species, but more important protect any topsoil stores and promote the collection of vegetative material and propagules / seed to assist with the revegetation of the site Where possible, temporary construction lay-down or assembly areas should be sited on transformed areas; and Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re-	1	1	1	1	1	1	5	-	LOW (-ve)

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S
											establishment of plant cover is desirable to prevent erosion.									
Impact 2: Loss of terrestrial habitats – flora and vegetation	The construction of the proposed infrastructure will require the need to clear vegetation which could then have a secondary impact on ecological connectivity and especially Critical Biodiversity Areas, linked to the large riverine corridors.	2	3	2	2	3	2	24	-	MEDIUM (-ve)	A pre-construction walkthrough by the ecologist is recommended, who can assist with the development of the Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. All alien plant re-growth, which is currently low within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints. Where possible, temporary construction lay-down or assembly areas should be sited on transformed areas; and Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re-establishment of plant	1	3	2	1	2	2	18	-	LOW (-ve)

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S
											cover is desirable to prevent erosion.									
Impact 3: Loss of terrestrial species - fauna	Although most of the species observed are mobile, the increase in vehicle movement could result in an increase in road mortalities.	2	3	2	2	3	2	24	-	MEDIUM (-ve)	Clear demarcation during the construction phase of all undisturbed sensitive areas that are not within the direct footprint of the REF to ensure that there is no uncontrolled access by construction vehicles and labourers; Educate contractors as to the importance of the undisturbed conservations areas and importance of avoiding them; All vehicles must stick to designated and prepared roads and adhere to the speed limit on site of 40km/hr; Mitigating the risk of poaching by fencing in the accommodation compounds of the construction crews, to prevent individuals from wandering in the veld after hours; banning the possession of dogs on site by construction and maintenance staff.	1	3	2	1	2	2	18	-	LOW (-ve)

5.2 Operation

Table 3: Rating of impacts for the operational phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S
Operation Phase																				
Impact 4: Loss of terrestrial species - fauna	Although most of the species observed are mobile, the increase in vehicle movement could result in an increase in road mortalities.	2	3	2	2	3	2	24	-	MEDIUM (-ve)	Clear demarcation during the construction phase of all undisturbed sensitive areas that are not within the direct footprint of the REF to ensure that there is no uncontrolled access by construction vehicles and labourers; Educate contractors as to the importance of the undisturbed conservations areas and importance of avoiding them; All vehicles must stick to designated and prepared roads and adhere to the speed limit on site of 40km/hr; Mitigating the risk of poaching by fencing in the accommodation compounds of the	1	3	2	1	2	2	18	-	LOW (-ve)

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S
											construction crews, to prevent individuals from wandering in the veld after hours; banning the possession of dogs on site by construction and maintenance staff.									

5.3 No go Impact

Table 4: Rating of impacts (No-go)

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S
No-Go																				
Impact on terrestrial resources should the project not go ahead (i.e. the No Go Alternative)	Should the project not proceed, then current status quo with regard the environment would remain unchanged. Overall, the area is largely in a natural state. But present day impacts do occur in localised areas and included the following: • Increase in unpalatable species due to past grazing activities	1	3	2	1	2	2	18	-	LOW (-ve)	Improve current grazing management, although this is occurring within the surrounding conservation areas and or areas that are used for any hunting / game farming Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region	1	3	2	1	2	2	18	-	LOW (-ve)

	Erosion as a result of road crossings; • Several farm dams; and • Undersized culverts within present day road crossings.									Install properly sized culverts with erosion protection measures at the present road / track crossings									

5.4 Cumulative Impacts

A cumulative impact assessment was conducted by assessing this project in relation to any other proposed projects within a 35km radius, which included, Tooverberg, Perdekraal Projects, Witteberg and the various Komsberg Projects. The report author has been involved in the assessment of all the listed projects within the exception of the Touws River and Montagu Solar projects. However, all of the reports were based on the premise that all layouts were developed on the basis of impact avoidance, with particular reference to the avoidance of Very High Sensitivity areas. Consequently, all the impacts that remain could be mitigated mostly through revegetation and / or proper stormwater management. Thus all the impacts would be Medium to Low depending on the scale of the sites, but found acceptable.

Note that EnviroSci is also currently involved in Search & Rescue and or Revegetation auditing of several of the Komsberg Wind Farm Projects, which include the Roggeveld Wind Farm and the Brand Valley / Rietkloof WEFs.

Table 5: Rating of cumulative impacts

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS	S		E	P	R	L	D	I / M	TOTAL	STATUS	S
Cumulative Phase																				
Cumulative Impact of various proposed wind farms and associated grid lines on the natural environment	The cumulative assessment considers the various proposed renewable projects that occur within a 35km radius of this site, where the author has either been involved in the assessment of these projects and or review of the past assessments as part of any required Water Use Licenses	1	1	1	1	1	1	5	-	LOW (-ve)	The premise of all the reviewed or assessed projects has been the avoidance of impacts on the Very High Sensitivity environments, which have been achieved by the various proposed layouts. The only remaining impacts will be the crossing of internal roads over minor watercourse / drainage lines or areas rated as LOW sensitivity.	1	3	2	1	2	2	18	-	LOW (-ve)

5.5 Overall Impact Rating

Table 6: Overall Impact Significance for the WEF (Pre- and Post-Mitigation)

Nature of impact and Phase	Overall Impact Significance (Pre - Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
Construction Phase			
Impact 1: Loss of species of special concern	Low	Develop and implement an Rehabilitation and Monitoring plan post Environmental Authorisation. This must be developed following the finalisation of the turbine / road layout and a walk down has been completed. This plan should include relocation of suitable plant species, but more important protect any topsoil stores and promote the collection of vegetative material and propagules / seed to assist with the revegetation of the site Where possible, temporary construction lay-down or assembly areas should be sited on transformed areas; and Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re- establishment of plant cover is desirable to prevent erosion.	Low
Impact 2: Loss of terrestrial habitats – flora and vegetation	Medium	A pre-construction walkthrough by the ecologist is recommended, who can assist with the development of the Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. All alien plant re-growth, which is currently low within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints. Where possible, temporary construction lay-down or assembly areas should be sited on transformed areas; and Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re- establishment of plant	Low

		cover is desirable to prevent erosion.	
Impact 3: Loss of terrestrial species - fauna	Medium	Clear demarcation during the construction phase of all undisturbed sensitive areas that are not within the direct footprint of the REF to ensure that there is no uncontrolled access by construction vehicles and labourers; Educate contractors as to the importance of the undisturbed conservations areas and importance of avoiding them; All vehicles must stick to designated and prepared roads and adhere to the speed limit on site of 40km/hr; Mitigating the risk of poaching by fencing in the accommodation compounds of the construction crews, to prevent individuals from wandering in the veld after hours; banning the possession of dogs on site by construction and maintenance staff.	Low
Operation Phase			
Impact 4: Loss of terrestrial species - fauna	Medium	Clear demarcation during the construction phase of all undisturbed sensitive areas that are not within the direct footprint of the REF to ensure that there is no uncontrolled access by construction vehicles and labourers; Educate contractors as to the importance of the undisturbed conservations areas and importance of avoiding them; All vehicles must stick to designated and prepared roads and adhere to the speed limit on site of 40km/hr; Mitigating the risk of poaching by fencing in the accommodation compounds of the construction crews, to prevent individuals from wandering in the veld after hours; banning the possession of dogs on site by construction and maintenance staff.	Low

No-Go	Low	Improve current grazing management, although this is occurring within the surrounding conservation areas and or areas that are used for any hunting / game farming Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region Install properly sized culverts with erosion protection measures at the present road / track crossings	Low
Cumulative Impacts	Low	The premise of all the reviewed or assessed projects has been the avoidance of impacts on the Very High Sensitivity environments, which have been achieved by the various proposed layouts. The only remaining impacts will be the crossing of internal roads over minor watercourse / drainage lines or areas rated as LOW sensitivity.	Low

6. COMPARATIVE ASSESSMENT OF ALTERNATIVES

Key

PREFERRED	The alternative will result in a low impact / reduce the impact / result in a positive impact
FAVOURABLE	The impact will be relatively insignificant
LEAST PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

6.1 Wind Energy Facility

Table 7: Comparative assessment of WEF components

Alternative	Preference	Reasons (incl. potential issues)
SUBSTATION SITE ALTERNATIVES		
Substation Option 1	Does not avoid an CBA (aquatic system)	With minor layout adjust the water course can be avoided
Substation Option 2	Avoids all sensitive systems	All Very High / No-go areas have been avoided and well outside any minor water courses.

6.2 Grid components

Table 8: Comparative assessment of Grid components

Alternative	Preference	Reasons (incl. potential issues)
GRID ALTERNATIVES		
Option 1	Can span all sensitive systems	OHL towers can be placed outside of systems, with assumption that the associated substation is moved (See Table 7 above), assuming no tracks are created within the no-go areas
Option 2	Can span all sensitive systems	

6.3 No-Go Alternative

Should the project not proceed, then current status quo with regard the aquatic environment would remain unchanged.

Land owners should undertake the following:

- Improve grazing management practices
- Improve the current stormwater and energy dissipation features not currently found along some of the tracks and roads within the region

- Install properly sized culverts or drifts with erosion protection measures at the present road / track crossings

7. CONCLUSION AND SUMMARY

7.1 Summary of Findings

The project overall has a small footprint spread out over a large area, allowing for retention of much of the natural environment so that the systems should remain largely unaffected. Therefore, the wind farm is such that it carries a low intensity impact, but requiring the clearing of areas with terrestrial vegetation, especially when considering the associated roads, cables and other infrastructure.

A variety of environmental features were observed within the study area and these were mapped and buffered as necessary for their protection. The current layout has the potential, to a large degree, avoided these sensitive features and buffer areas, greatly reducing the potential overall impact and environmental risk. The overall and cumulative impacts, as assessed, are linked to instances where complete avoidance was not possible, or the nature of the activities involve a potential risk to aquatic resources even at great distance.

Overall, it is expected that the impact on the environment would be Low (-). Noteworthy areas, that should be avoided, include the Very High Sensitivity areas as shown in this report.

7.2 Conclusion and Impact Statement

Based on the findings of this study, the specialist finds no reason to withhold to an authorisation of any of the proposed activities, assuming that key mitigations measures are implemented. Lastly no preference is provided with regard the grid connections, as it assumed based on the characteristics of the site, that all the systems could be avoided, while making use of existing tracks, however technical considerations have resulted in Substation Option 2 being selected.

In conclusion, the results of this assessment, the aquatic study and various other constraints determinations, a final Buildable Area (Go – Area) was developed in October 2022, as shown in Figure 15 below. This was then compared to the various sensitivities of the habitats observed and found to have taken cognizance of these, i.e. the buildable areas will impact on Low sensitivity area, thus resulting in Low impact ratings as discussed in this assessment.

Going forward, the turbine, roads and ancillary structures should thus take this into account, however it is noted that the buildable areas are not contiguous and would have to cross some sensitive areas in particular access roads, cables and overhead lines. Therefore, any mitigations around route selections mentioned in this report must be considered (e.g. use existing tracks) and must be considered in the walkdown surveys post authorisation.

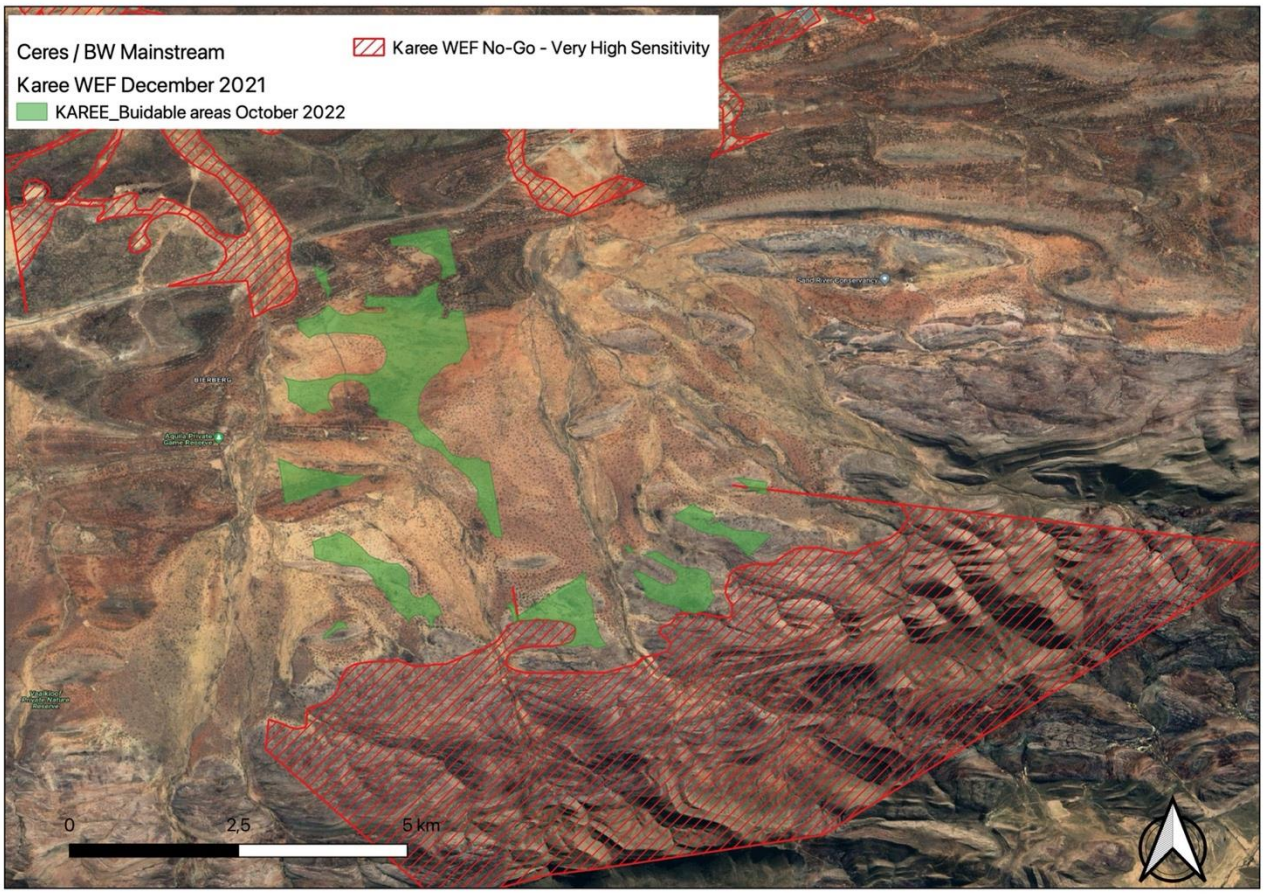

Figure 15: Final buildable area developed after consideration of the constraints layers produced during this and other studies in the EIA

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Appendix 1 Specialist CV

CURRICULUM VITAE
Dr Brian Michael Colloty
7212215031083

1 Rossini Rd
Pari Park
Gqeberha, 6070
083 498 3299

Profession: Ecologist & Environemental Assessment Practitioner (Pr. Sci. Nat. 400268/07)
Member of the South African Wetland Society
Specialisation: Ecology and conservation importance rating of inland habitats, wetlands, rivers & estuaries
Years experience: 25 years

SKILLS BASE AND CORE COMPETENCIES

- 25 years experience in environmental sensitivity and conservation assessment of aquatic and terrestrial systems inclusive of Index of Habitat Integrity (IHI), WET Tools, Riparian Vegetation Response Assessment Index (VEGRAI) for Reserve Determinations, estuarine and wetland delineation throughout Africa. Experience also includes biodiversity and ecological assessments with regard sensitive fauna and flora, within the marine, coastal and inland environments. Countries include Mozambique, Kenya, Namibia, Central African Republic, Zambia, Eritrea, Mauritius, Madagascar, Angola, Ghana, Guinea-Bissau and Sierra Leone. Current projects also span all nine provinces in South Africa.
- 15 years experience in the coordination and management of multi-disciplinary teams, such as specialist teams for small to large scale EIAs and environmental monitoring programmes, throughout Africa and inclusive of marine, coastal and inland systems. This includes project and budget management, specialist team management, client and stakeholder engagement and project reporting.
- GIS mapping and sensitivity analysis

TERTIARY EDUCATION

- 1994: B Sc Degree (Botany & Zoology) - NMU
- 1995: B Sc Hon (Zoology) - NMU
- 1996: M Sc (Botany - Rivers) - NMU
- 2000: Ph D (Botany – Estuaries & Mangroves) – NMU

EMPLOYMENT HISTORY

- 1996 – 2000 Researcher at Nelson Mandela University – SAB institute for Coastal Research & Management. Funded by the WRC to develop estuarine importance rating methods for South African Estuaries
- 2001 – January 2003 Training development officer AVK SA (reason for leaving – sought work back in the environmental field rather than engineering sector)
- February 2003- June 2005 Project manager & Ecologist for Strategic Environmental Focus (Pretoria) – (reason for leaving – sought work related more to experience in the coastal environment)
- July 2005 – June 2009 Principal Environmental Consultant Coastal & Environmental Services (reason for leaving – company restructuring)
- June 2009 – August 2018 Owner / Ecologist of Scherman Colloty & Associates cc
- August 2018 Owner / Ecologist - EnviroSci (Pty) Ltd

SELECTED RELEVANT PROJECT EXPERIENCE

World Bank IFC Standards

- Botswana South Africa 400kv transmission line (400km) biodiversity assessment on behalf of Aurecon - current
- Farim phosphate mine and port development, Guinea Bissau – biodiversity and estuarine assessment on behalf of Knight Piesold Canada – 2016.
- Tema LNG offshore pipeline EIA – marine and estuarine assessment for Quantum Power (2015).
- Colluli Potash South Boulder, Eritrea, SEIA marine baseline and hydrodynamic surveys co-ordinator and coastal vegetation specialist (coastal lagoon and marine) (on-going).
- Wetland, estuarine and riverine assessment for Addax Biofeuls Sierra Leone, Makeni for Coastal & Environmental Services: 2009
- ESHIA Project manager and long-term marine monitoring phase coordinator with regards the dredge works required in Luanda bay, Angola. Monitoring included water quality and biological changes in the bay and at the offshore disposal outfall site, 2005-2011

South African

- Plant and animal search and rescue for the Karusa and Soetwater Wind Farms on behalf of Enel Green Power, Current
- Plant and animal search and rescue for the Nxuba, Oyster Bay and Garob Wind Farms on behalf of Enel Green Power, 2018 - 2019
- Plant and Animal Search and Rescue for the Port of Ngqura, Transnet Landside infrastructure Project, with development and management of on site nursery, Current
- Plant and Animal Search and Rescue for the Port of Ngqura, OTGC Tank Farm Project (2019)
- Plant search and rescue, for NMBM (Driftsands sewer, Glen Hurd Drive), Department of Social Development (Military veterans housing, Despatch) and Nxuba Wind Farm, - current
- Wetland specialist appointed to update the Eastern Cape Biodiversity Conservation Plan, for the Province on behalf of EOH CES appointment by SANBI – current. This includes updating the National Wetland Inventory for the province, submitting the new data to CSIR/SANBI.
- CDC IDZ Alien eradication plans for three renewable projects Coega Wind Farm, Sonop Wind Farm and Coega PV, on behalf of JG Afrika (2016 – 2017).
- Nelson Mandela Bay Municipality Baakens River Integrated Wetland Assessment (Inclusive of Rehabilitation and Monitoring Plans) for CEN IEM Unit - Current
- Rangers Biomass Gasification Project (Uitenhage), biodiversity and wetland assessment and wetland rehabilitation / monitoring plans for CEM IEM Unit – 2017
- Gibson Bay Wind Farm implementation of the wetland management plan during the construction and operation of the wind farm (includes surface / groundwater as well wetland rehabilitation & monitoring plan) on behalf of Enel Green Power - 2018
- Gibson Bay Wind Farm 133kV Transmission Line wetland management plan during the construction of the transmission line (includes wetland rehabilitation & monitoring plan) on behalf of Eskom – 2016.
- Tsitsikamma Community Wind Farm implementation of the wetland management plan during the construction of the wind farm (includes surface / biomonitoring, as well wetland rehabilitation & monitoring plan) on behalf of Cennergi – completed May 2016.
- Alicedale bulk sewer pipeline for Cacadu District, wetland and water quality assessment, 2016
- Mogalakwena 33kv transmission line in the Limpopo Province, on behlaf of Aurecon, 2016
- Cape St Francis WWTW expansion wetland and passive treatment system for the Kouga Municipality, 2015
- Macindane bulk water and sewer pipelines wetland and wetland rehabilitation plan 2015
- Eskom Prieska to Copperton 132kV transmission line aquatic assessment, Northern Cape on behalf of Savannah Environmental 2015.
- Joe Slovo sewer pipeline upgrade wetland assessment for Nelson Mandela Bay Municipality 2014
- Cape Recife Waste Water Treatment Works expansion and pipeline aquatic assessment for Nelson Mandela Bay Municipality 2013
- Pola park bulk sewer line upgrade aquatic assessment for Nelson Mandela Bay Municipality 2013
- Transnet Freight Rail – Swazi Rail Link (Current) wetland and ecological assessment on behalf of Aurecon for the proposed rail upgrade from Ermelo to Richards Bay
- Eskom Transmission wetland and ecological assessment for the proposed transmission line between Pietermaritzburg and Richards Bay on behalf of Aurecon (2012).
- Port Durnford Exarro Sands biodiversity assessment for the proposed mineral sands mine on behalf of Exxaro (2009)
- Fairbreeze Mine Exxaro (Mtunzini) wetland assessment on behalf of Strategic Environmental Services (2007).
- Wetland assessment for Richards Bay Minerals (2013) – Zulti North haul road on behalf of RBM.
- Biodiversity and aquatic assessments for 118 renewable projects in the past 9 years in the Western, Eastern, Northern Cape, KwaZulu-Natal and Free State provinces. Clients included RES-SA, Red Cap, ACED Renewables, Mainstream Renewable, GDF Suez, Globeleq, ENEL, Abengoa amongst others. Particular aquatic sensitivity assessment and Water Use License Applications on behalf of Mainstream Renewable Energy (8 wind farms and 3 PV facilities.), Cennergi / Exxaro (2 Wind farms), WKN Wind current (2 wind farms & 2 PV facilities), ACED (6 wind farms) and Windlab (3 Wind farms) were also conducted. Several of these projects also required the assessment of the proposed transmission lines and switching stations, which were conducted on behalf of Eskom.
- Vegetation assessments on the Great Brak rivers for Department of Water and Sanitation, 2006 and the Gouritz Water Management Area (2014)
- Proposed FibreCo fibre optic cable vegetation assessment along the PE to George, George to Graaf Reinet, PE to Colesburg, and East London to Bloemfontein on behalf of SRK (2013-2015).

Appendix 2 – Site Verification Report

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

INTRODUCTION

In accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a 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).

SITE SENSITIVITY VERIFICATION

Using the result of the specialist ecological impact assessment, that made use of past and current spatial databases, aerial images and field work conducted within and adjacent to the site over a number of years / seasons, various habitats were delineated and the rated in terms of their sensitivity.

OUTCOME OF SITE SENSITIVITY VERIFICATION

Similar to the results of the Screening Tool, the study area contained three types of sensitivity, namely Very High Medium and Low (Figure 1-3). However, the extent of the Very High Sensitivity areas was found be greater in extent as shown in Figure 4.

NATIONAL ENVIRONMENTAL SCREENING TOOL

Based on the DFFE Screening Tool, the site contains areas of very high sensitivity due to the presence of CBAs, Ecological Support Areas, NFEPAs and rivers. The remaining area within the development footprint is deemed to be of Medium (Animals) or Low sensitivity (Figure 1-3).

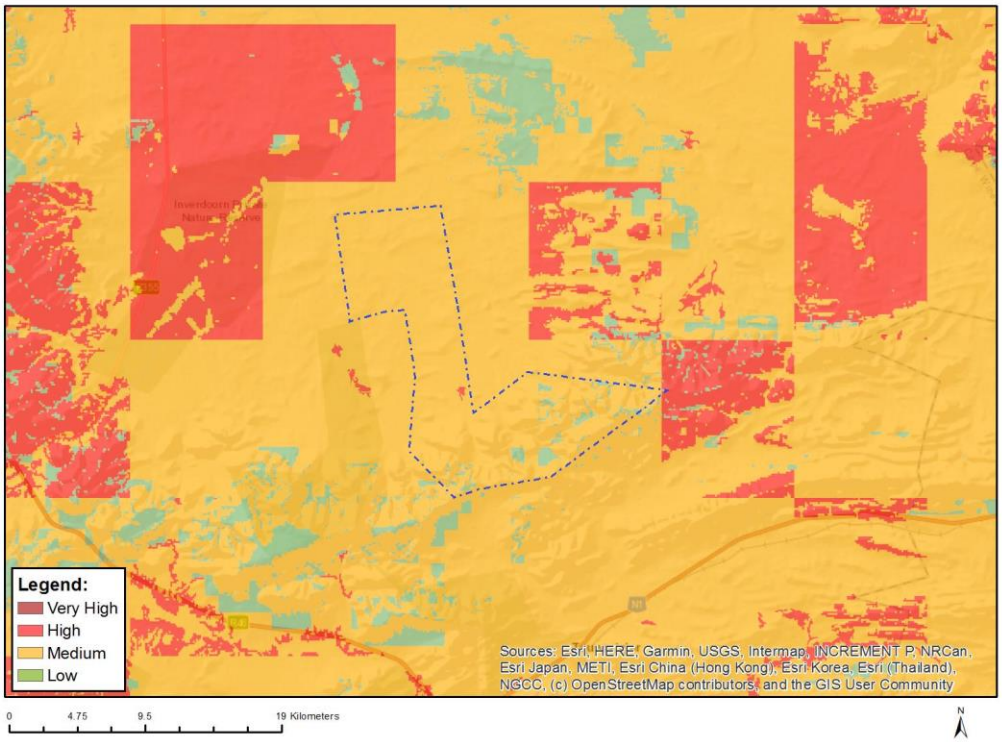

Figure 1. DFFE Screening Tool outcome for the animal biodiversity theme

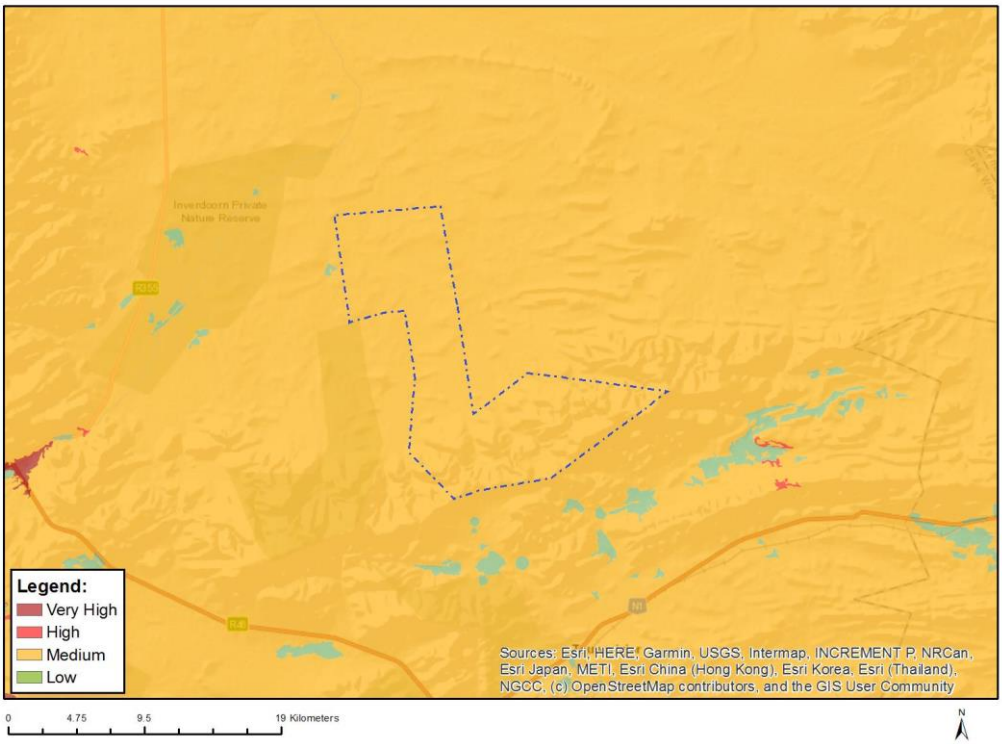

Figure 2. DFFE Screening Tool outcome for the Plant biodiversity theme

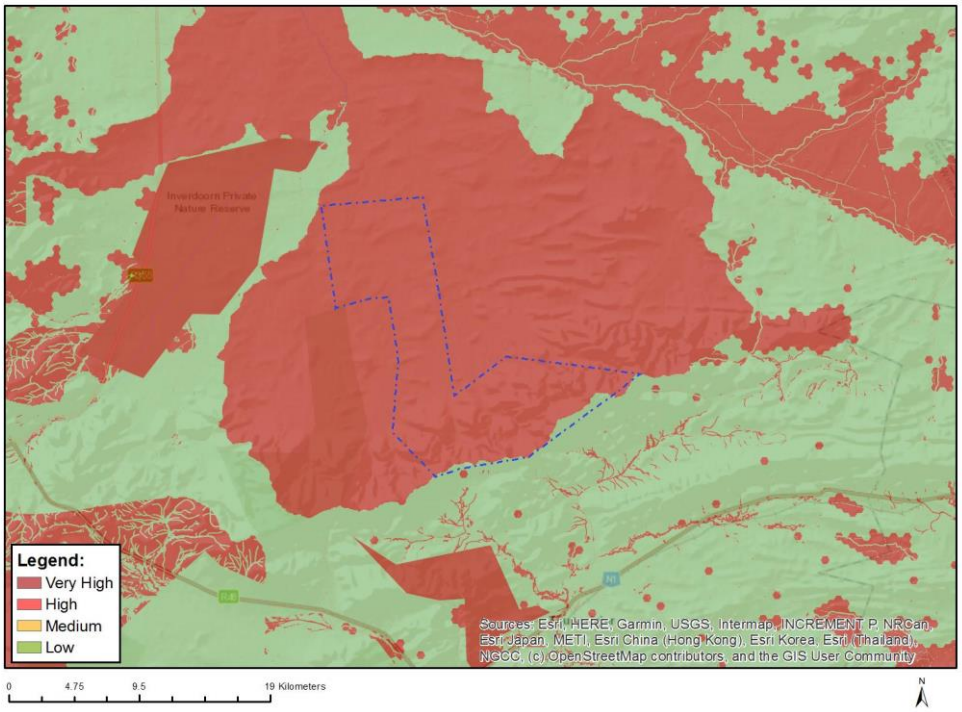

Figure 3. DFFE Screening Tool outcome for the Terrestrial biodiversity theme

Figure 4 below shows the sensitivity map produced following the ecological assessment as well as a ground-truthing exercises, with mapping of the observed features at a finer scale.

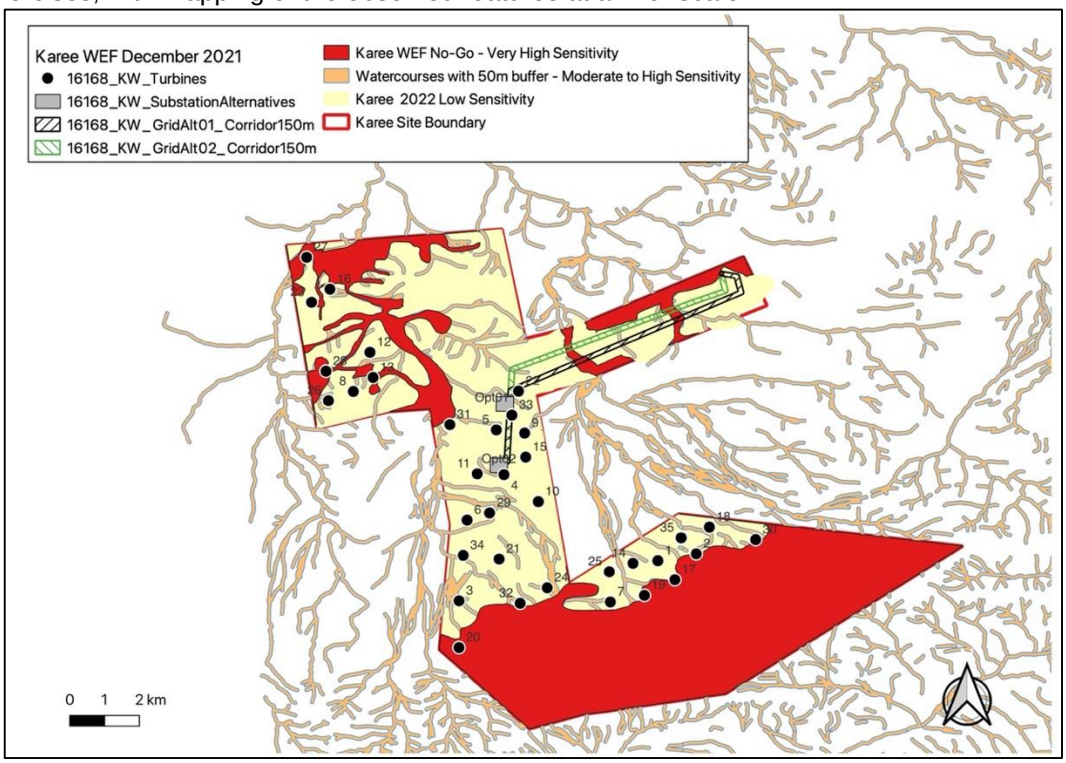

Figure 4. Environmental sensitivity map produced by the aquatic specialist

CONCLUSION

In conclusion, the DFFE Screening Tool identified three sensitivity ratings within the development study area, very high, medium and low. Although there is some overlap with the findings on site and the Screening Tool's outcome, the extent of the Very High sensitivity areas was found to be greater than the extent in the Screening Tool.

However and appropriate layout can be developed to minimise the impact on the Very High areas, but must be verified once the final layout inclusive of roads has been developed.

Appendix 3 – Species checklists

#	Family	Scientific name	Common name	Red list Category	Last recorded
AMPHIBIANS					
1	Pyxicephalidae	*Amietia fuscigula*	Cape River Frog	Least Concern (2017)	2012/03/02
2	Pyxicephalidae	*Strongylopus grayii*	Clicking Stream Frog	Least Concern	2000/05/01
REPTILES					
1	Agamidae	*Agama atra*	Southern Rock Agama	Least Concern (SARCA 2014)	1986/06/15
2	Agamidae	*Agama hispida*	Spiny Ground Agama	Least Concern (SARCA 2014)	1999/09/14
3	Chamaeleonidae	*Bradypodion gutturale*	Little Karoo Dwarf Chameleon	Least Concern (SARCA 2014)	1900/06/15
4	Colubridae	*Dipsina multimaculata*	Dwarf Beaked Snake	Least Concern (SARCA 2014)	1900/06/15
5	Cordylidae	*Cordylus cordylus*	Cape Girdled Lizard	Least Concern (SARCA 2014)	1900/06/15
6	Cordylidae	*Karusasaurus polyzonus*	Karoo Girdled Lizard	Least Concern (SARCA 2014)	1981/06/15
7	Gekkonidae	*Chondrodactylus bibronii*	Bibron's Gecko	Least Concern (SARCA 2014)	1999/09/14
8	Gekkonidae	*Goggia incognita*	Southern Striped Pygmy Gecko	Not listed (2017-09-26)	1900/06/15
9	Gekkonidae	*Pachydactylus capensis*	Cape Gecko	Least Concern (SARCA 2014)	2014/07/05
10	Gekkonidae	*Pachydactylus formosus*	Southern Rough Gecko	Least Concern (SARCA 2014)	1981/06/15
11	Gekkonidae	*Pachydactylus weberi*	Weber's Gecko	Least Concern (SARCA 2014)	1900/06/15
12	Gerrhosauridae	*Tetradactylus tetradactylus*	Cape Long-tailed Seps	Least Concern (SARCA 2014)	1900/06/15
13	Lacertidae	*Meroles knoxii*	Knox's Desert Lizard	Least Concern (SARCA 2014)	1900/06/15
14	Lacertidae	*Pedioplanis laticeps*	Karoo Sand Lizard	Least Concern (SARCA 2014)	2018/08/18
15	Lacertidae	*Pedioplanis lineoocellata pulchella*	Common Sand Lizard	Least Concern (SARCA 2014)	1999/09/14
16	Lamprophiidae	*Psammophylax rhombeatus*	Spotted Grass Snake	Least Concern (SARCA 2014)	1900/06/15
17	Leptotyphlopidae	*Namibiana gracilior*	Slender Thread Snake	Least Concern (SARCA 2014)	1900/06/15
18	Scincidae	*Acontias lineatus*	Striped Dwarf Legless Skink	Least Concern (SARCA 2014)	2019/05/02
19	Scincidae	*Trachylepis sulcata sulcata*	Western Rock Skink	Least Concern (SARCA 2014)	2006/08/05
20	Scincidae	*Trachylepis variegata*	Variegated Skink	Least Concern (SARCA 2014)	1900/06/15
21	Testudinidae	*Chersina angulata*	Angulate Tortoise	Least Concern (SARCA 2014)	2013/01/01
22	Testudinidae	*Chersobius boulengeri*	Karoo Padloper	Near Threatened (SARCA 2014)	1900/06/15
23	Testudinidae	*Psammobates tentorius subsp. ?*	Tent Tortoise (subsp. ?)	Least Concern (SARCA 2014)	1900/06/15
24	Testudinidae	*Psammobates tentorius tentorius*	Karoo Tent Tortoise		2019/11/11
25	Testudinidae	*Psammobates tentorius verroxii*	Verrox's Tent Tortoise		2015/09/28
MAMMALS					
1	Bathyergidae	*Georychus capensis*	Cape Mole-rat	Least Concern (2016)	1954/06/10
2	Bovidae	*Antidorcas marsupialis*	Springbok	Least Concern (2016)	2021/07/06
3	Bovidae	*Oryx gazella*	Gemsbok	Least Concern (2016)	2017/03/23
4	Bovidae	*Raphicerus campestris*	Steenbok	Least Concern (2016)	2013/05/09
5	Bovidae	*Sylvicapra grimmia*	Bush Duiker	Least Concern (2016)	2014/07/05
6	Bovidae	*Taurotragus oryx*	Common Eland	Least Concern (2016)	2017/03/22

7	Canidae	*Otocyon megalotis*	Bat-eared Fox	Least Concern (2016)	1979/01/13
8	Felidae	*Caracal caracal*	Caracal	Least Concern (2016)	1980/03/25
9	Felidae	*Felis silvestris*	Wildcat	Least Concern (2016)	
10	Herpestidae	*Cynictis penicillata*	Yellow Mongoose	Least Concern (2016)	
11	Leporidae	*Lepus sp.*	Hares		2012/05/14
12	Macroscelididae	*Elephantulus edwardii*	Cape Elephant Shrew	Least Concern (2016)	1929/12/07
13	Molossidae	*Tadarida aegyptiaca*	Egyptian Free-tailed Bat	Least Concern (2016)	
14	Muridae	*Gerbilliscus afra*	Cape Gerbil	Least Concern (2016)	1929/06/28
15	Muridae	*Mus (Nannomys) minutoides*	Southern African Pygmy Mouse	Least Concern	1929/12/07
16	Muridae	*Otomys irroratus*	Southern African Vlei Rat (Fynbos type)	Least Concern (2016)	1954/03/02
17	Muridae	*Otomys unisulcatus*	Karoo Bush Rat	Least Concern (2016)	1980/01/01
18	Muridae	*Parotomys brantsii*	Brants's Whistling Rat	Least Concern (2016)	1980/01/01
19	Muridae	*Rhabdomys pumilio*	Xeric Four-striped Grass Rat	Least Concern (2016)	1954/04/02
20	Nesomyidae	*Petromyscus collinus*	Pygmy Rock Mouse	Least Concern (2016)	1980/01/01
21	Soricidae	*Suncus varilla*	Lesser Dwarf Shrew	Least Concern (2016)	1929/08/07
ODONATA					
1	Aeshnidae	*Anax imperator*	Blue Emperor	LC	2017/03/23
2	Coenagrionidae	*Ischnura senegalensis*	Tropical Bluetail	LC	2017/03/23
3	Libellulidae	*Crocothemis sanguinolenta*	Little Scarlet	LC	2015/12/17
4	Libellulidae	*Orthetrum capicola*	Cape Skimmer	LC	2015/12/17
5	Libellulidae	*Palpopleura deceptor*	Deceptive Widow	LC	2017/03/23
6	Libellulidae	*Pantala flavescens*	Wandering Glider	LC	2017/03/23
7	Libellulidae	*Sympetrum fonscolombii*	Red-veined Darter or Nomad	LC	2017/03/23
8	Libellulidae	*Tramea limbata*	Ferruginous Glider	LC	2017/03/23
ARACHNIDA					
1	BUTHIDAE	*Uroplectes carinatus*			2015/02/15
LEPIDOPTERA					
1	EREBIDAE	*Grammodes stolida*			2017/03/23
2	EREBIDAE	*Utetheisa pulchella*			2017/03/23
3	HESPERIIDAE	*Spialia spio*	Mountain sandman	Least Concern (SABCA 2013)	2009/08/30
4	LYCAENIDAE	*Crudaria capensis*	Cape grey	Least Concern (SABCA 2013)	1994/11/18
5	LYCAENIDAE	*Leptomyrina lara*	Cape black-eye	Least Concern (SABCA 2013)	2019/05/30
6	LYCAENIDAE	*Thestor protumnus aridus*	Boland skolly	Least Concern (SABCA 2013)	1993/09/18
7	NYMPHALIDAE	*Stygionympha irrorata*	Karoo hillside brown	Least Concern (SABCA 2013)	2004/04/13
8	NYMPHALIDAE	*Torynesis mintha mintha*	Mintha veined widow	Least Concern (SABCA 2013)	2004/04/13
9	NYMPHALIDAE	*Vanessa cardui*	Painted lady	Least Concern (SABCA 2013)	2017/03/23
10	PIERIDAE	*Pontia helice helice*	Southern meadow white	Least Concern (SABCA 2013)	1924/11/21

Appendix 4: Detailed aquatic assessment methodology

This study followed the approaches of several national guidelines with regards to wetland assessment. These have been modified by the author, to provide a relevant mechanism of assessing the present state of the study area aquatic systems, applicable to the specific environment and, in a clear and objective manner, identify and assess the potential impacts associated with the proposed development site based on information collected within the relevant farm portions.
Current water resource classification systems make use of the Hydrogeomorphic (HGM) approach, and for this reason, the National Wetland Classification System (NWCS) approach will be used in this study. It is also important to understand the legal definition of a wetland, the means of assessing wetland conservation and importance and the relevant legislation aimed at protecting wetlands. These aspects will be discussed in greater depth in this section of the report, as they form the basis of the study approach to assessing wetland impacts.
For reference the following definitions are as follows:

- **Drainage line**: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may not be present.
- **Perennial and non-perennial:** Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.
- **Riparian**: The area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
- **Wetland**: Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).
- **Water course**: As per the National Water Act means -

(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

8.1 Waterbody classification systems

Since the late 1960's, wetland classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith *et al*., 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects. **Coupled to this was the inclusion of other criteria within the classification systems to differentiate between river, riparian and wetland systems, as well as natural versus artificial waterbodies.**
The South African National Biodiversity Institute (SANBI) in collaboration with several specialists and stakeholders developed the newly revised and now accepted National Wetland Classification Systems (NWCS) (Ollis *et al*., 2013). This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, with including structural features at the finer or lower levels of classification (Ollis *et al*., 2013).
Wetlands develop in a response to elevated water tables, linked either to rivers, groundwater flows or seepage from aquifers (Parsons, 2004). These water levels or flows then interact with localised geology and soil forms, which then determines the form and function of the respective wetlands. Water is thus the common driving force, in the formation of wetlands (DWAF, 2005). It is significant that the HGM approach has now been included in the wetland classifications as the HGM approach has been adopted throughout the water resources management realm with regards to the determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) and WET-Health assessments for aquatic environments. All these systems are then easily integrated using the HGM approach in line with the Eco-classification process of river and wetland reserve determinations used by the Department of Water and Sanitation (DWS). The Ecological Reserve of a wetland or river is used by DWS to assess the water resource allocations when assessing WULAs

The NWCS process is provided in more detail in the methods section of the report, but some of the terms and definitions used in this document are present below:

Definition Box

Present Ecological State is a term for the current ecological condition of the resource. This is assessed relative to the deviation from the Reference State. Reference State/Condition is the natural or pre-impacted condition of the system. The reference state is not a static condition, but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES is determined per component - for rivers and wetlands this would be for the drivers: flow, water quality and geomorphology; and the biotic response indicators: fish, macroinvertebrates, riparian vegetation and diatoms. PES categories for every component would be integrated into an overall PES for the river reach or wetland being investigated. This integrated PES is called the EcoStatus of the reach or wetland.
EcoStatus is the overall PES or current state of the resource. It represents the totality of the features and characteristics of a river and its riparian areas or wetland that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. The EcoStatus value is an integrated ecological state made up of a combination of various PES findings from component EcoStatus assessments (such as for invertebrates, fish, riparian vegetation, geomorphology, hydrology, and water quality).
Reserve: The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.
Reserve requirements: The quality, quantity and reliability of water needed to satisfy the requirements of basic human needs and the Ecological Reserve (inclusive of instream requirements).
Ecological Reserve determination study: The study undertaken to determine Ecological Reserve requirements.
Licensing applications: Water users are required (by legislation) to apply for licenses prior to extracting water resources from a water catchment or any other activity that qualifies as a water use.
Ecological Water Requirements: This is the quality and quantity of water flowing through a natural stream course that is needed to sustain instream functions and ecosystem integrity at an acceptable level as determined during an EWR study. These then form part of the conditions for managing achievable water quantity and quality conditions as stipulated in the **Reserve Template**
Water allocation process (compulsory licensing): This is a process where all existing and new water users are requested to reapply for their licenses, particularly in stressed catchments where there is an over-allocation of water or an inequitable distribution of entitlements.
Ecoregions are geographic regions that have been delineated in a top-down manner on the basis of physical/abiotic factors. • NOTE: For purposes of the classification system, the 'Level I Ecoregions' for South Africa, Lesotho and Swaziland (Kleynhans *et al.* 2005), which have been specifically developed by the Department of Water Affairs & Forestry (DWAF) for rivers but are used for the management of inland aquatic ecosystems more generally, are applied at Level 2A of the classification system. These Ecoregions are based on physiography, climate, geology, soils and potential natural vegetation.

8.2 Wetland definition

Although the National Wetland Classification System (NWCS) (Ollis *et al*., 2013) is used to classify wetland types it is still necessary to understand the definition of a wetland. Terminology currently strives to characterise a wetland not only on its structure (visible form), but also to relate this to the function and value of any given wetland.
The Ramsar Convention definition of a wetland is widely accepted as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" (Davis 1994). South Africa is a signatory to the Ramsar Convention and therefore its extremely broad definition of wetlands has been adopted for the proposed NWCS, with a few modifications.
Whereas the Ramsar Convention included marine water to a depth of six metres, the definition used for the NWCS extends to a depth of ten metres at low tide, as this is recognised as the seaward boundary of the shallow photic zone (Lombard et al., 2005). An additional minor adaptation of the definition is the removal of the term 'fen' as fens are considered a type of peatland. The adapted definition for the NWCS is, therefore, as follows (Ollis *et al*., 2013):
WETLAND: an area of marsh, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed ten metres.
This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten metres. The only legislated definition of wetlands in South Africa, however, is contained within the National Water Act (Act No. 36 of 1998) (NWA), where wetlands are defined as "land which is transitional between terrestrial and aquatic systems, where the water table is usually at, or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports, or would support, vegetation adapted to life in saturated soil." This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition. It should be noted that the NWA definition is not concerned with marine systems and clearly distinguishes wetlands from estuaries, classifying the latter as a watercourse (Ollis *et al*., 2013). Table 1 below provides a comparison of the various wetlands included within the main sources of wetland definitions used in South Africa. Although a subset of Ramsar-defined wetlands was used as a starting point for the compilation of the first version of the National Wetland Inventory (i.e. "wetlands", as defined by the NWA, together with open waterbodies), it is understood that

subsequent versions of the Inventory include the full suite of Ramsar-defined wetlands in order to ensure that South Africa meets its wetland inventory obligations as a signatory to the Convention (Ollis *et al.*, 2013).
Wetlands must therefore have one or more of the following attributes to meet the above definition (DWAF, 2005):

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

It should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e. those associated with the drainage lines and rivers.

Table 2: Comparison of ecosystems considered to be 'wetlands' as defined by the proposed NWCS, the NWA and ecosystems included in DWAF's (2005) delineation manual.

Ecosystem	NWCS "wetland"	National Water Act wetland	DWAF (2005) delineation manual
Marine	YES	NO	NO
Estuarine	YES	NO	NO
Waterbodies deeper than 2 m (i.e. limnetic habitats often described as lakes or dams)	YES	NO	NO
Rivers, channels and canals	YES	NO[1]	NO
Inland aquatic ecosystems that are not river channels and are less than 2 m deep	YES	YES	YES
Riparian[2] areas that are permanently / periodically inundated or saturated with water within 50 cm of the surface	YES	YES	YES[3]
Riparian [3] areas that are not permanently / periodically inundated or saturated with water within 50 cm of the surface	NO	NO	YES[3]

[1] Although river channels and canals would generally not be regarded as wetlands in terms of the National Water Act, they are included as a 'watercourse' in terms of the Act

[2] According to the National Water Act and Ramsar, riparian areas are those areas that are saturated or flooded for prolonged periods and would be considered riparian wetlands, as opposed to non –wetland riparian areas that are only periodically inundated and the riparian vegetation persists due to having deep root systems drawing on water many meters below the surface.

[3] The delineation of 'riparian areas' (including both wetland and non-wetland components) is treated separately to the delineation of wetlands in DWAF's (2005) delineation manual.

8.3 National Wetland Classification System method

Due to the nature of the wetlands and watercourses observed, it was determined that the newly accepted NWCS should be adopted. This classification approach has integrated aspects of the HGM approach used in the WET-Health system as well as the widely accepted eco-classification approach used for rivers.
The NWCS (Ollis *et al*., 2013) as stated previously, uses hydrological and geomorphological traits to distinguish the primary wetland units, i.e. direct factors that influence wetland function. Other wetland assessment techniques, such as the DWAF (2005) delineation method, only infer wetland function based on abiotic and biotic descriptors (size, soils & vegetation) stemming from the Cowardin approach (Ollis *et al.,* 2013).

The classification system used in this study is thus based on Ollis *et al*. (2013) and is summarised below:
The NWCS has a six-tiered hierarchical structure, with four spatially nested primary levels of classification (Figure 2). The hierarchical system firstly distinguishes between Marine, Estuarine and Inland ecosystems (**Level 1**), based on the degree of connectivity the particular system has with the open ocean (greater than 10 m in depth). Level 2 then categorises the regional wetland setting using a combination of biophysical attributes at the landscape level, which operate at a broad bioregional scale.
This is opposed to specific attributes such as soils and vegetation. **Level 2** has adopted the following systems:

- Inshore bioregions (marine)
- Biogeographic zones (estuaries)
- Ecoregions (Inland)

Level 3 of the NWCS assess the topographical position of inland wetlands as this factor broadly defines certain hydrological characteristics of the inland systems. Four landscape units based on topographical position are used in distinguishing between Inland systems at this level. No subsystems are recognised for Marine systems, but estuaries are grouped according to their periodicity of connection with the marine environment, as this would affect the biotic characteristics of the estuary.
Level 4 classifies the hydrogeomorphic (HGM) units discussed earlier. The HGM units are defined as follows:

- Landform – shape and localised setting of wetland
- Hydrological characteristics – nature of water movement into, through and out of the wetland
- Hydrodynamics – the direction and strength of flow through the wetland

These factors characterise the geomorphological processes within the wetland, such as erosion and deposition, as well as the biogeochemical processes.
Level 5 of the assessment pertains to the classification of the tidal regime within the marine and estuarine environments, while the hydrological and inundation depth classes are determined for inland wetlands. Classes are based on frequency and depth of inundation, which are used to determine the functional unit of the wetlands and are considered secondary discriminators within the NWCS.
Level 6 uses six descriptors to characterise the wetland types based on biophysical features. As with Level 5, these are non-hierarchal in relation to each other and are applied in any order, dependent on the availability of information. The descriptors include:

- Geology;
- Natural vs. Artificial;
- Vegetation cover type;
- Substratum;
- Salinity; and
- Acidity or Alkalinity

It should be noted that where sub-categories exist within the above descriptors, hierarchical systems are employed, and these are thus nested in relation to each other.
The HGM unit (Level 4) is the focal point of the NWCS, with the upper levels (Figure 3 Figure – Inland systems only) providing means to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, while the lower levels provide more descriptive detail on the particular wetland type characteristics of a particular HGM unit. Therefore Level 1 – 5 deals with functional aspects, while Level 6 classifies wetlands on structural aspects.

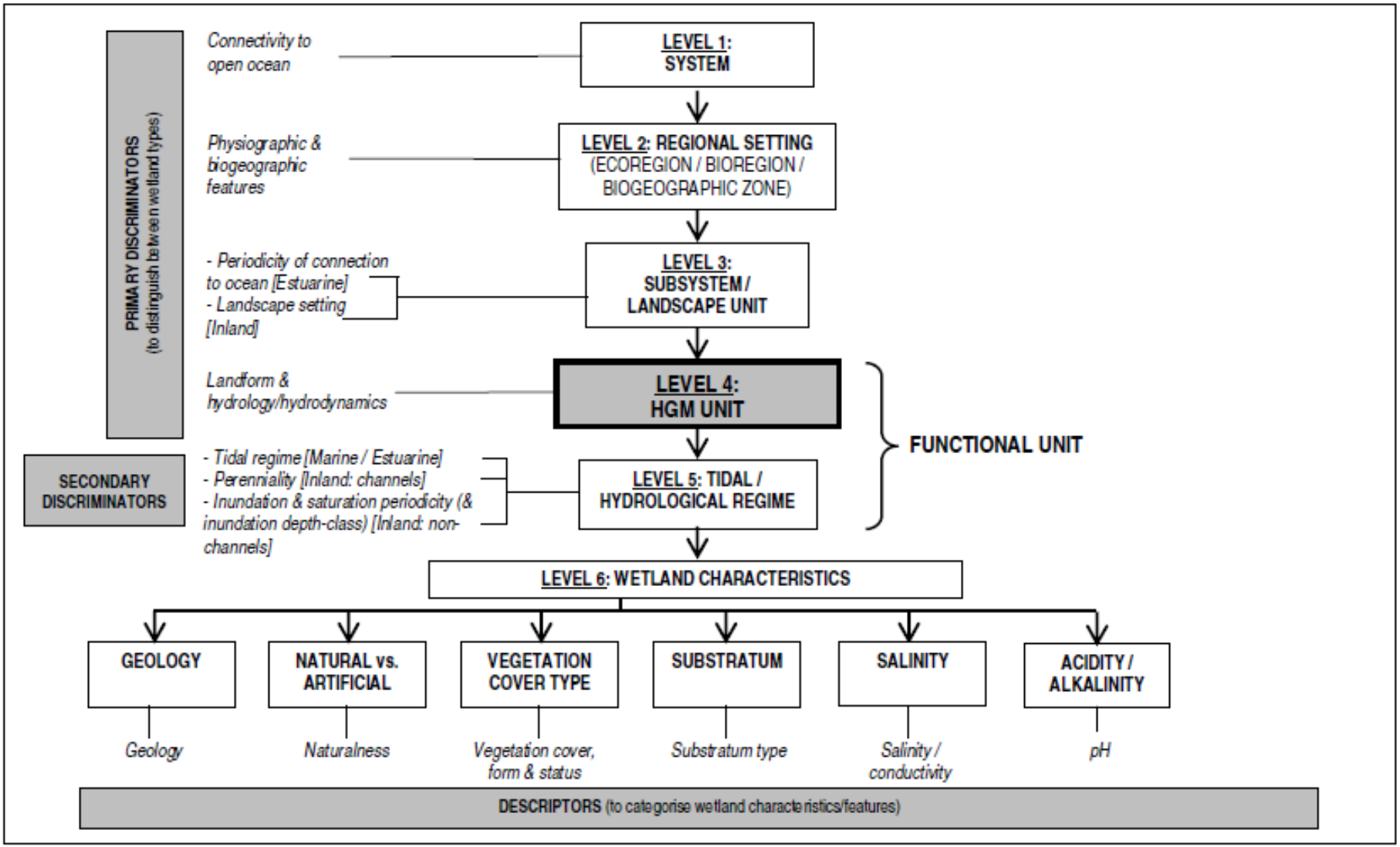

Figure 2: Basic structure of the NWCS, showing how 'primary discriminators' are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with 'secondary discriminators' applied at Level 5 to classify the tidal/hydrological regime, and 'descriptors' applied

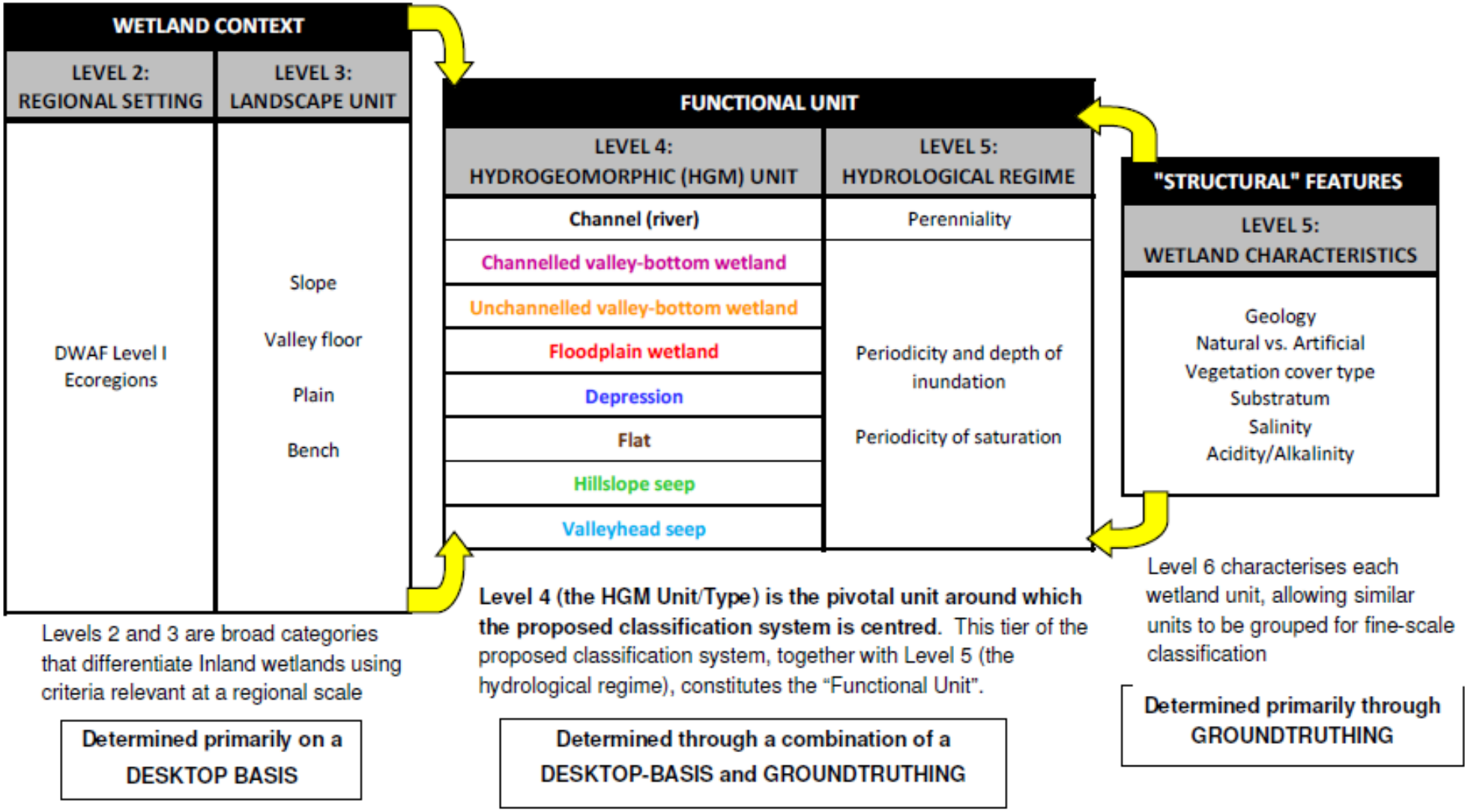

Figure 3: Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis *et al*., 2013)

8.4 Waterbody condition

To assess the PES or condition of the observed wetlands, a modified Wetland Index of Habitat Integrity (DWAF, 2007) was used. The Wetland Index of Habitat Integrity (WETLAND-IHI) is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The output scores from the WETLAND-IHI model are presented in the standard DWAF A-F ecological categories (Table) and provide a score of the PES of the habitat integrity of the wetland system being examined. The author has included additional criteria into the model-based system to include additional wetland types. This system is preferred when compared to systems such as WET-Health – wetland management series (WRC 2009), as WET-Health (Level 1) was developed with wetland rehabilitation in mind and is not always suitable for impact assessments. This coupled with the degraded state of the wetlands in the study area, indicated that a complex study approach was not warranted, i.e. conduct a Wet-Health Level 2 and WET-Ecosystems Services study required for an impact assessment.

Table 3: Description of A – F ecological categories based on Kleynhans *et al*., (2005)

ECOLOGICAL CATEGORY	ECOLOGICAL DESCRIPTION	MANAGEMENT PERSPECTIVE
A	Unmodified, natural.	Protected systems; relatively untouched by human hands; no discharges or impoundments allowed
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	Some human-related disturbance, but mostly of low impact potential
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	**Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation**
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	**Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality**
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	

The WETLAND-IHI model is composed of four modules. The “Hydrology”, “Geomorphology” and “Water Quality” modules all assess the contemporary driving processes behind wetland formation and maintenance. The last module, “Vegetation Alteration”, provides an indication of the intensity of human land use activities on the wetland surface itself and how these may have modified the condition of the wetland. The integration of the scores from these 4 modules provides an overall PES score for the wetland system being examined. The WETLAND-IHI model is an MS Excel-based model, and the data required for the assessment are generated during a site visit.
Additional data may be obtained from remotely sensed imagery (aerial photos; maps and/or satellite imagery) to assist with the assessment. The interface of the WETLAND-IHI has been developed in a format which is similar to DWA’s River EcoStatus models which are currently used for the assessment of PES in riverine environments.

8.5 Aquatic ecosystem importance and function

South Africa is a Contracting Party to the Ramsar Convention on Wetlands, signed in Ramsar, Iran, in 1971, and has thus committed itself to this intergovernmental treaty, which provides the framework for the national protection of wetlands and

the resources they could provide. Wetland conservation is now driven by the South African National Biodiversity Institute, a requirement under the National Environmental Management: Biodiversity Act (No 10 of 2004).
Wetlands are among the most valuable and productive ecosystems on earth, providing important opportunities for sustainable development (Davies and Day, 1998). However, wetlands in South Africa are still rapidly being lost or degraded through direct human induced pressures (Nel *et al.,* 2004).
The most common attributes or goods and services provided by wetlands include:

- Improve water quality;
- Impede flow and reduce the occurrence of floods;
- Reeds and sedges used in construction and traditional crafts;
- Bulbs and tubers, a source of food and natural medicine;
- Store water and maintain base flow of rivers;
- Trap sediments; and
- Reduce the number of water-borne diseases.

In terms of this study, the wetlands provide ecological (environmental) value to the area acting as refugia for various wetland associated plants, butterflies and birds.
In the past wetland conservation has focused on biodiversity as a means of substantiating the protection of wetland habitat. However not all wetlands provide such motivation for their protection, thus wetland managers and conservationists began assessing the importance of wetland function within an ecosystem.
Table below summarises the importance of wetland function when related to ecosystem services or ecoservices (Kotze *et al.,* 2008). One such example is emergent reed bed wetlands that function as transformers converting inorganic nutrients into organic compounds (Mitsch and Gosselink, 2000).

Table 4: Summary of direct and indirect ecoservices provided by wetlands from Kotze *et al*., 2008

Ecosystem services supplied by wetlands	Indirect benefits	Hydro-geochemical benefits	Flood attenuation	
			Stream flow regulation	
			Water quality enhancement benefits	Sediment trapping
				Phosphate assimilation
				Nitrate assimilation
				Toxicant assimilation
				Erosion control
			Carbon storage	
		Biodiversity maintenance		
	Direct benefits	*Provision of water for human use*		
		Provision of harvestable resources[2]		
		Provision of cultivated foods		
		Cultural significance		
		Tourism and recreation		
		Education and research		

Conservation importance of the individual wetlands was based on the following criteria:

- Habitat uniqueness;
- Species of conservation concern;
- Habitat fragmentation or rather, continuity or intactness with regards to ecological corridors; and
- Ecosystem service (social and ecological).

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetland was found in a near natural state (high PES). Should any of the habitats be found modified the conservation importance would rate as MEDIUM, unless a Species of Conservation Concern (SCC) was observed, in which case it would receive a HIGH rating. Any system that was highly modified (low PES) or had none of the above criteria, received a LOW conservation

importance rating. Wetlands with HIGH and MEDIUM ratings should thus be excluded from development with incorporation into a suitable open space system, with the maximum possible buffer being applied. Natural wetlands or Wetlands that resemble some form of the past landscape but receive a LOW conservation importance rating could be included into stormwater management features and should not be developed to retain the function of any ecological corridors.