Scoping and Environmental Impact Assessment for the proposed Kap Vley Wind Energy Facility near Kleinzee in the Northern Cape

UPDATED DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

VOLUME 2
Appendices G to R

June 2018

DEA Reference number:
14/12/16/3/3/2/1046

CSIR Report number:
CSIR/IU/021MH/IR/2018/0002/B

Prepared for:
Kap Vley Wind Farm (Pty) Ltd - a subsidiary of
juwi Renewable Energies (Pty) Ltd

Prepared by:
Council for Scientific and Industrial Research
(CSIR)
PO Box 320
Stellenbosch
7599

our future through science

Scoping and Environmental Impact Assessment for the proposed Kap Vley Wind Energy Facility near Kleinzee in the Northern Cape

UPDATED DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

APPENDIX G:

Terrestrial Ecology Impact Assessment Report

Fauna and Flora Terrestrial Ecological Specialist Study

Scoping and Environmental Impact Assessment for the Proposed Development of the Kap Vley Wind Energy Facility near Kleinzee, Northern Cape Province:

IMPACT ASSESSMENT REPORT

Report prepared for:

CSIR – Environmental Management Services

P O Box 320

Stellenbosch

7600

Report prepared by:

Simon Todd

60 Forrest Way

Glencairn

7975

3Foxes Biodiversity Solutions

Revised June 2018

EXECUTIVE SUMMARY

juwi Renewable Energies (Pty) Ltd ('juwi') is proposing the development of the Kap Vley Wind Energy Facility (WEF) and associated powerline located 35 km south east of Kleinzee in the Northern Cape Province. It is anticipated that the Kap Vley Wind Farm will have a maximum output capacity of 300 MW from a maximum of 45 turbines. The development is currently in the EIA Phase and juwi has appointed Simon Todd Consulting to provide a Terrestrial Ecological (Fauna and Flora) specialist study as part of the EIA process. The purpose of the study is to describe and detail the ecological features of the proposed site; provide an assessment of the ecological sensitivity of the site; identify and assess the likely impacts associated with the proposed development of the Kap Vley WEF and to identify mitigation measures to avoid and/or reduce negative impacts on terrestrial ecology.

The Kap Vley WEF site is located within an area that is recognised as an area of biodiversity significance. This is reflected in the inclusion of the area as a Tier 1 and Tier 2 Critical Biodiversity Area (CBA) as well as a Primary Focus Area for future conservation expansion. Extensive fieldwork was conducted across the site for the current study and confirms the presence of numerous plant species and habitats of conservation concern at the site. A number of avoidance and mitigation measures have however been implemented by the developer in the layout and planning phases of the development to reduce impacts on these features as far as possible. This includes a detailed vegetation surveys and a full walk-through of the entire development footprint to identify and map populations of species of conservation concern as well as map sensitive features and no-go areas. These areas are delineated with the specific purpose of avoiding high residual impacts at the site and maintaining the ecological functioning of the area. Following several iterations to the proposed layout, all turbines have been excluded from No-Go and High Sensitivity areas.

The detailed on-site mapping of the distribution of plant SCCs has allowed for impact on these species to be avoided and/or minimised. Significant avoidance of important populations of these species has been implemented and no more than 2% of the on-site population of any of these species would be impacted by the development. No local or regional populations of these species would be compromised by the development or elevated to a higher level of conservation concern as a result of the development.

Due to the extensive on-site mitigation that has been implemented, direct impacts on fauna and flora are likely to be Low after the additional recommended construction-phase mitigation. It is only the potential impact on the affected CBAs and the loss of future conservation options which are likely to result in impacts of moderate significance after mitigation. As development within CBAs is not considered desirable, this raises the potential need for off-site mitigation measures to be implemented to mitigate this impact to a low level. A stand-alone offset study has been developed (included in Appendix Q of the Draft EIA Report) to inform the utility and feasibility of developing a

biodiversity offset to mitigate the residual impacts of the development on CBAs. The Biodiversity Offset Study finds that suitable offset areas are available in the broader area and if implemented, would contribute to meeting conservation targets for the affected habitat types. Based on the results and analysis contained within the offset study, an offset is considered a viable possibility that can be used to offset the residual impact of the current development and is a recommended outcome of this study as well.

Ecological Impact Statement:

The proposed Kap Vley WEF site is considered to be in a broadly sensitive environment due to the presence of numerous species and habitats of conservation concern. These have however been mapped in detail and the resulting information used to inform the layout of the proposed wind farm. As a result of these avoidance measures, on-site impacts on fauna and flora have been reduced to Low Significance after mitigation and are considered acceptable. However, impacts on CBAs and Protected Area Expansion Strategy Focus Areas cannot be mitigated to a low level and impacts are predicted to be of Moderate significance post-mitigation. Such residual impacts associated with the development can be reduced to an overall Low Significance through the implementation of a biodiversity offset which has been separately investigated and found to be a viable option. As such, the development, with the implementation of an offset is considered to have acceptable terrestrial ecological impacts and is therefore supported from a terrestrial ecological point of view.

Short CV/Summary of Expertise – Simon Todd

SIMON TODD CONSULTING
ECOLOGICAL SPECIALIST SERVICES
Assessment/Management/Research

Simon Todd Pr.Sci.Nat
C: 082 3326502
O: 021 782 0377
Simon.Todd@3foxes.co.za
60 Forrest Way
Glencairn
7975

Ecological Solutions for People & the Environment

Simon Todd is Director and principal scientist at 3Foxes Biodiversity Solutions and has over 20 years of experience in biodiversity measurement, management and assessment. He has provided specialist ecological input on more than 200 different developments distributed widely across the country, but with a focus on the three Cape provinces. This includes input on the Wind and Solar SEA (REDZ) as well as the Eskom Grid Infrastructure (EGI) SEA and Karoo Shale Gas SEA. He is on the National Vegetation Map Committee as representative of the Nama and Succulent Karoo Biomes. Simon Todd is a recognised ecological expert and is a past chairman and current deputy chair of the Arid-Zone Ecology Forum. He is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

Skills & Primary Competencies

- Research & description of ecological patterns & processes in Nama Karoo, Succulent Karoo, Thicket, Arid Grassland, Fynbos and Savannah Ecosystems.
- Ecological Impacts of land use on biodiversity
- Vegetation surveys & degradation assessment & mapping
- Long-term vegetation monitoring
- Faunal surveys & assessment.
- GIS & remote sensing

Tertiary Education:

- 1992-1994 – BSc (Botany & Zoology), University of Cape Town
- 1995 – BSc Hons, Cum Laude (Zoology) University of Natal
- 1996-1997- MSc, Cum Laude (Conservation Biology) University of Cape Town

Employment History

- 2009 – Present – Sole Proprietor of Simon Todd Consulting, providing specialist ecological services for development and research.
- 2007 Present – Senior Scientist (Associate) – Plant Conservation Unit, Department of Botany, University of Cape Town.

- 2004-2007 – Senior Scientist (Contract) – Plant Conservation Unit, Department of Botany, University of Cape Town
- 2000-2004 – Specialist Scientist (Contract) - South African National Biodiversity Institute
- 1997 – 1999 – Research Scientist (Contract) – South African National Biodiversity Institute

A selection of recent work is as follows:

Strategic Environmental Assessments

Co-Author. Chapter 7 - Biodiversity & Ecosystems - Shale Gas SEA. CSIR 2016.

Co-Author. Chapter 1 Scenarios and Activities – Shale Gas SEA. CSIR 2016.

Co-Author – Ecological Chapter – Wind and Solar SEA. CSIR 2014.

Co-Author – Ecological Chapter – Eskom Grid Infrastructure SEA. CSIR 2015.

Contributor – Ecological & Conservation components to SKA SEA. CSIR 2017.

Recent Specialist Ecological Studies in the Vicinity of the Current Site

- Fauna Specialist Study for the proposed Eskom Kleinsee 300MW WEF. Savannah Environmental 2012.
- Fauna and Flora Specialist Study for the Project Blue Wind and Solar Energy Facility, Near Kleinsee. Savannah Environmental 2012.
- Fauna and Flora for the G7 Richtersveld Wind Farm. Environmental Resources Management 2011.
- Preconstruction Walk-Through of the Juno-Gromis 400kV Power Line. Nsovo Environmental 2016.
- Specialist Faunal Assessment of the West Coast Resources Mine Expansion. Myezo Environmental. 2016.
- Fauna and Flora specialist Scoping & EIA Study for the Tormin Mineral Sands Inland and Coastal Mining expansion. SRK. 2016.

Specialist Declaration

I, ..Simon Todd..., as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

-
- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: 

Name of Specialist: ____Simon Todd_____

Date: ____22 February 2018_____

LIST OF ABBREVIATIONS

DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
SCC	Species of conservation concern
CBA	Critical Biodiversity Area
ESA	Ecological Support Area
NFEPA	National Freshwater Ecosystem Priority Assessment
NPAES	National Protected Area Expansion Strategy
NC-PAES	Northern Cape Protected Area Expansion Strategy
NC-DENC	Northern Cape Department of Environment and Nature Conservation

COMPLIANCE WITH THE APPENDIX 6 OF THE 2017 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations 7 April 2017	Addressed in the Specialist 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	Page *iii*
ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page *v*
c) an indication of the scope of, and the purpose for which, the report was prepared;	P5
(cA) an indication of the quality and age of base data used for the specialist report;	P9-10
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	P38-
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	P10
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.1
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;	P39
g) an identification of any areas to be avoided, including buffers;	P39
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;	P39
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	P9
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 1.3
k) any mitigation measures for inclusion in the EMPr;	Section 1.6
l) any conditions for inclusion in the environmental authorisation;	
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 1.6
n) a reasoned opinion-	
i. whether the proposed activity, activities or portions thereof should be authorised;	P56-57
(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;	
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	See Main EIA report
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	See Main EIA report
q) any other information requested by the competent authority.	
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.	

Table of Contents

TABLES AND FIGURES

SPECIALIST FAUNA AND FLORA IMPACT STUDY

1.1. INTRODUCTION AND METHODOLOGY

1.1.1. Scope and Objectives

Juwi Renewable Energies (Pty) Ltd ('juwi') has appointed CSIR to undertake the required Environmental Impact Assessment (EIA) process for the proposed Kap Vley Wind Farm located west of Springbok in the Northern Cape Province. It is anticipated that the Kap Vley Wind Farm will have an output capacity of up to 300 MW from a maximum of 45 turbines. A grid connection is also required, but this is assessed as part of an independent Basic Assessment process. The development is currently in the EIA Phase and juwi has appointed 3Foxes Biodiversity Solutions to provide a specialist Terrestrial Biodiversity Impact Assessment Study of the development as part of the EIA process.

The purpose of the Terrestrial Biodiversity Assessment Report is to describe and detail the ecological features of the proposed site; provide an assessment of the ecological sensitivity of the site and identify and assess the likely impacts associated with the proposed development of the site as a wind energy facility. Extensive field assessment as well as a desktop review of the available ecological information for the area is used to identify and characterise the ecological features of the site. This information is used to derive an ecological sensitivity map that presents the ecological constraints for development at the site. Impacts are assessed for the construction, operation, and decommissioning phases of the development. Cumulative impacts on the broader area are also considered and assessed. A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the development, which should be included in the Environmental Management Programme (EMPr) for the development. The full scope of the study is detailed below and is in accordance with Appendix 6 - GN R326 of the EIA Regulations of 2014 as amended (which came into effect on 7 April 2017).

1.1.2. Terms of Reference

The study includes the following activities:

- a description of the environment that may be affected by a specific activity and the manner in which the environment may be affected by the proposed project;
- a description and evaluation of environmental issues and potential impacts (including assessment of direct, indirect and cumulative impacts) that have been identified;
- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts;
- an indication of the methodology used in determining the significance of potential environmental impacts;

- an assessment of the significance of direct indirect and cumulative impacts of the development;
- a description and comparative assessment of all alternatives including cumulative impacts;
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the EMPr;
- an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;
- a description of any assumptions uncertainties, limitations and gaps in knowledge; and
- an environmental impact statement which contains:
    - a summary of the key findings of the environmental impact assessment;
    - an assessment of the positive and negative implications of the proposed activity; and
    - a comparative assessment of the positive and negative implications of identified alternatives.

General Considerations for the study included the following:

- Disclose any gaps in information (and limitations in the study) or assumptions made.
- Identify recommendations for mitigation measures to minimise impacts.
- Outline additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the EMPr for faunal or flora related issues.
- The assessment of the potential impacts of the development and the recommended mitigation measures provided have been separated into the following project phases:
    - Planning and Construction
    - Operational
    - Decommissioning

1.1.3. Assessment Approach

This assessment is conducted according to Appendix 6 – GN R326 EIA Regulations, as amended in terms of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA), as well as best-practice guidelines and principles for biodiversity assessment as outlined by Brownlie (2005) and De Villiers *et al*. (2005).

In terms of NEMA, this assessment demonstrates how the proponent intends to comply with the principles contained in Section 2 of NEMA, which amongst other things, indicates that environmental management should:

- (In order of priority) aim to: avoid, minimise or remedy disturbance of ecosystems and loss of biodiversity (Figure 1);
- Avoid degradation of the environment;
- Avoid jeopardising ecosystem integrity;

- Pursue the best practicable environmental option by means of integrated environmental management;
- Protect the environment as the people's common heritage;
- Control and minimise environmental damage; and
- Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic or stressed ecosystems.

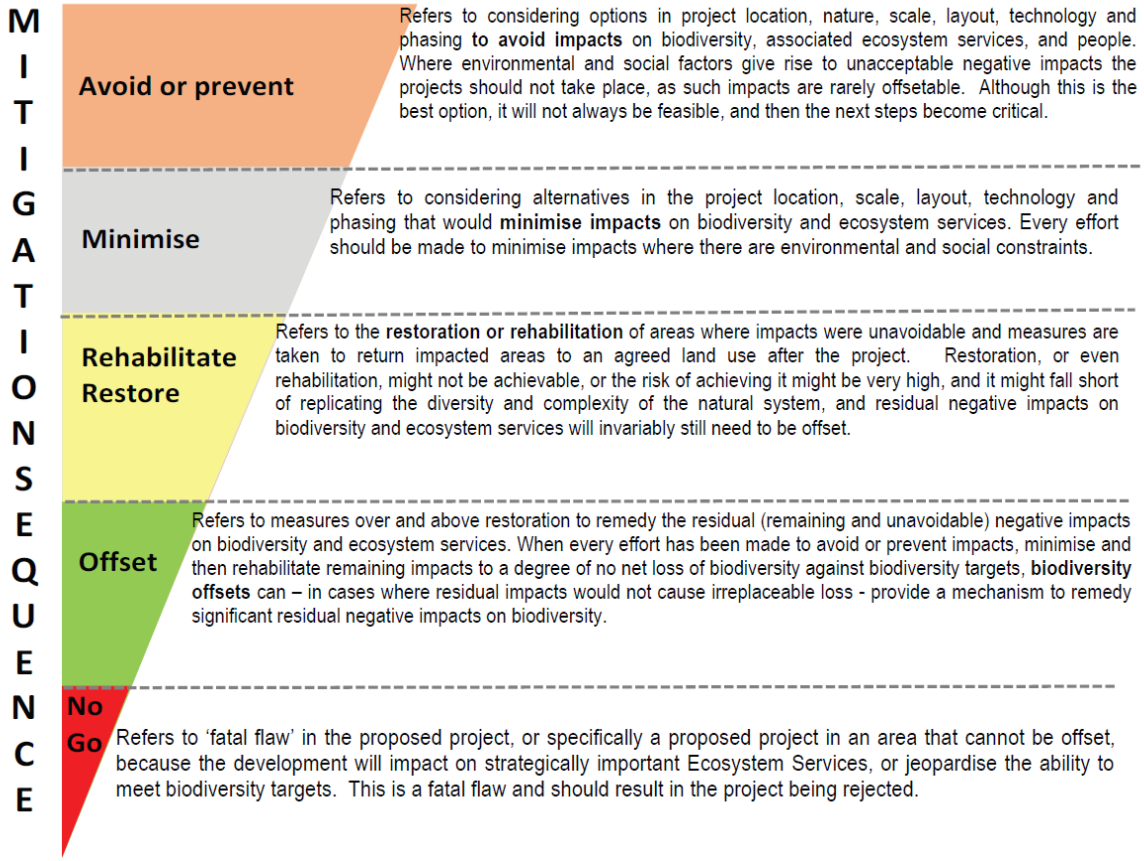


Figure 1. The mitigation hierarchy that is used to guide the study in terms of the priority of different mitigation and avoidance strategies.

Furthermore, in terms of best practice guidelines as outlined by Brownlie (2005) and De Villiers et al. (2005), a precautionary and risk-averse approach should be adopted for projects which may result in substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas: i.e. Critical Biodiversity Areas (CBAs) (as identified by systematic conservation plans, Biodiversity Sector Plans or Bioregional Plans) and Freshwater Ecosystem Priority Areas.

In order to adhere to the above principles and best-practice guidelines, the following approach forms the basis for the study approach and assessment philosophy:

- The study includes data searches, desktop studies, site walkovers / field survey of the property and baseline data collection, including:
    - A description of the broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of **pattern**, the following will be identified or described:

Community and ecosystem level

- The main vegetation type, its aerial extent and interaction with neighboring types, soils or topography;
- Threatened or vulnerable ecosystems (*cf. SA vegetation map/National Spatial Biodiversity Assessment, fine-scale systematic conservation plans, etc.*).

Species level

- Species of Conservation Concern (SCC) (giving location if possible using GPS)
- The viability of an estimated population size of the SCC that are present (including the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, low 0-40% confident)
- The likelihood of other RDB species, or SCC, occurring in the vicinity (include degree of confidence).

Fauna

- Describe and assess the terrestrial fauna present in the area that will be affected by the proposed development.
- Conduct a faunal assessment that can be integrated into the ecological study.
- Describe the existing impacts of current land use as they affect the fauna.
- Clarify SSC and that are known to be:
    - endemic to the region;
    - that are considered to be of conservational concern;
    - that are in commercial trade (CITES listed species); or
    - are of cultural significance.
- Provide monitoring requirements as input into the EMPr for faunal related issues.

Other pattern issues

- Any significant landscape features or rare or important vegetation associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
- The extent of alien plant cover of the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).
- The condition of the site in terms of current or previous land uses.

In terms of **process**, the following will be identified and/or described:

- The key ecological “drivers” of ecosystems on the site and in the vicinity, such as fire.
- Any mapped spatial component of an ecological process that may occur at the site or in its vicinity (i.e. *corridors* such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and *vegetation boundaries* such as edaphic interfaces, upland-lowland interfaces or biome boundaries).
- Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- Furthermore, any further studies that may be required during or after the EIA process will be outlined.
- All relevant legislation, permits and standards that would apply to the development will be identified.
- The opportunities and constraints for development will be described and shown graphically on an aerial photograph, satellite image or map delineated at an appropriate level of spatial accuracy.

1.1.4. Assumptions and Limitations

The current study is based on an intensive field campaign as well as a desktop study, which serves to reduce the limitations and assumptions required for the study. The site was visited numerous times across the flowering season from mid-winter through to spring and early summer when the vegetation was in a good condition for sampling. The entire development footprint was sampled with the result that no parts of the site have not been visited and sampled in the field. As a result, detailed on-site information regarding the location and distribution of plant SCC within the development footprint was obtained and there are no assumptions and limitations in this regard. The vegetation mapping and sampling conducted at the site is detailed in Section 1.1.6 of this report.

In terms of fauna, numerous sampling techniques were used to characterise the faunal community of the site. This includes camera trapping for larger mammals, Sherman trapping for small mammals and pitfall trapping for reptiles and amphibians. This provides a comprehensive characterization of the faunal community of the site. Although some fauna are rare or difficult to observe in the field, their potential presence at the site was evaluated based on the literature, their habitat preferences and distribution in the wider area according to the available databases. In order to ensure a conservative approach in this regard, the species lists derived for the site from the literature were obtained from an area significantly larger than the study site. The faunal sampling conducted at the site is further detailed in Section 1.1.6 of this report.

1.1.5. Source of Information

Data sources from the literature consulted and used where necessary in the study includes the following:

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006 and 2012 update) as well as the National List of Threatened Ecosystems (2011), where relevant.
- Information on plant and animal species recorded for the area was extracted from the new Plants of South Africa (POSA) database hosted by the South African National Biodiversity Institute (SANBI). Data was extracted for a significantly larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has not been well sampled in the past.
- The IUCN conservation status of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2018).

Habitats & Ecosystems:

- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011).
- Important protected areas expansion areas were extracted from the Northern Cape Protected Areas Expansion Strategy (NC-NPAES 2017).
- Critical Biodiversity Areas in the study area were obtained from the Northern Cape Conservation Plan (Oosthuysen & Holness 2016).

Fauna:

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and the ADU databases (ReptileMap, Frogmap and MammalMap) http://vmus.adu.org.za.
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, EWT & SANBI (2016) and Skinner and Chimimba (2005) for mammals.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as an assessment of the availability and quality of suitable habitat at the site.
- The conservation status of mammals is based on the IUCN Red List Categories (EWT/SANBI 2016), while reptiles are based on the South African Reptile Conservation Assessment (Bates et al. 2013) and amphibians on Minter et al. (2004) as well as the IUCN (2017).

1.1.6. Field Assessment

The site was visited numerous times between August 2017 and October 2017. As impacts on species and habitats of conservation concern are a primary concern associated with the development, specific and extensive measures were taken to identify and map the distribution of such features across the site. The entire proposed layout was walked in the field and all individuals and populations of plant SCC within or near the development footprint were mapped and recorded. Where rare or sensitive habitats such as quartz patches or mobile dune fields were present, these were recorded and mapped in the field. The vegetation of the site was characterised by sampling

the vegetation across the site within the development footprint and including at all proposed turbine locations. At every turbine location, the vegetation within an area of 50m radius (0.78ha) from the proposed turbine location was assessed and sampled in the field. A full plant species list for the sample area was drawn up and the cover abundance of each species present estimated on an ordinal scale. In addition, all additional species encountered on the walk-through of the development footprint were recorded as were all additional species observed while conducting general field work at the site. In addition to the specific vegetation sampling within the footprint areas, a detailed plant community and habitat map was derived for the site. The initial mapping was based on high resolution (sub 0.3m) that was flown of the site by the developer and made available to the consultant. The units mapped were later verified and characterised in the field, with adjustments made where necessary based on the site work and walk-through of the footprint areas. The final map which is the integrated result of the fine-scale desktop mapping and detailed field assessment information and GPS mapping forms the basis for the sensitivity map that was produced for the site.

A total of 13 camera traps were distributed across the site, placed along roads, fences, paths and other areas most likely to be frequented by mammals. These were put on the 15th of August 2017 and brought back in on the 20th of November 2017, thus giving a sampling period of just over 3 months. All images captured were reviewed and all animal images captured identified to species level. Small mammal trapping was conducted within different habitats at the site including the lowlands, uplands and rocky hills. A total of 60 Sherman live traps were left out for 5 days, giving a total of 300 trap nights. Although small mammal trap success can be low, success was over 30% and a total of 70 small mammals were caught over the sampling period. Eight pitfall traps consisting of a 25 liter bucket buried to ground level with two 4m diversion barriers were used to capture reptiles and amphibians. These were located in the same areas and sampled over the same period as the Sherman traps. Additional information on faunal presence at the site was collected through searching for reptiles within areas likely to harbor reptiles as well as through casual observation of fauna at the site while conducting the other field work at the site. This work contributed significantly to characterizing the faunal community of the site and while it is certain that additional species are present, the fieldwork certainly provides an adequate characterization of the typical and common species present at the site and significantly improves the baseline information available for the area.

1.1.7. Sensitivity Mapping and Assessment

An ecological sensitivity map of the site was produced by integrating the detailed desktop mapping that was conducted from the high resolution aerial photography with the GPS mapping and species information collected on-site> This was then further informed by the available biodiversity information available in the literature and various spatial databases. The final sensitivity map is based on a delineation of the habitat units which have been verified in the field and assigning sensitivity values to the units based on their vegetation composition, faunal habitat or conservation value and the known or potential presence of SCC. Specific attention was also paid the regional significance of the habitats present at the site and avoidance measures required to ensure that the overall ecological functioning of the site could be maintained even with development of the site. As such, certain areas were identified as No-Go areas based on their value as habitat for fauna or

flora, their sensitivity to disturbance or rarity in the landscape. The avoidance of these features is seen as a critical intervention with regards to the development of the site and reducing impacts associated with the development to acceptable levels.

The sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high impact may occur due to the high flora or faunal habitat value, sensitivity or important ecological role of the area. These areas may contain, or be important habitat for, SCC or provide important ecological services such as water flow regulation or forage provision. Development within these areas is generally undesirable and should proceed with caution as additional specific mitigation and avoidance is usually required to reduce impacts within these areas to acceptable levels. High sensitivity areas are also usually more sensitive to cumulative impact and the total developed footprint within these areas should be kept low.
- **No-Go/Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are considered to be no-go areas from a developmental perspective and should be avoided.

In some situations, areas were also classified between the above categories, such as Medium/High, where it was deemed that an area did not fit well into a certain category but rather fell most appropriately **between** two sensitivity categories. There are however no sensitivities that are identified as “Medium to High” or similar ranged categories because this adds uncertainty to the mapping as it is not clear if an area falls at the bottom or top of such a range.

1.2. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO ECOLOGICAL IMPACTS

The project is described in full in the main EIA report and this information is not repeated here, but rather a summary of the relevant components and footprint areas are described briefly below. It is anticipated that the Kap Vley WEF will have an output capacity of up to 300MW, which would be generated from a maximum of 45 turbines with a rotor diameter of up 160 m. The basic components of the development that would require vegetation clearing or generate potential impacts include the following:

- A total of up to 37 km of internal gravel surface access roads linking turbines, 5 - 15 m wide;
- Each turbine would have a reinforced foundation of 25 m x 25 m, with an associated Crane Platform of up to1 ha each;
- A concrete on-site batching plant of 50 m x 50 m (0.25ha);
- Operations and maintenance building occupying an area of approximately 1 ha;
- Temporary laydown and construction areas of 13 ha;
- On-site 22/33 kV to132 kV collector substation of approximately 2.3 ha);

A proposed 132 kV line to connect the facility to either the existing Gromis Substation or closer to the Eskom substation for which a location still needs to be determined, would also be required. A separate BA process is undertaken to assess a 200m wide corridor for the 132 kV overhead transmission line which is also dealt with in this report.

1.3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

1.3.1. Vegetation Types

According to the national vegetation map (Mucina & Rutherford 2006/2012), there are three vegetation types within the boundaries of the study area, Namaqualand Klipkoppe Shrubland, Namaqualand Strandveld and Namaqualand Sand Fynbos (Figure 2).

The majority of the site is mapped as Namaqualand Klipkoppe Shrubland. This vegetation unit occupies 10 936 km2 of central Namaqualand from Steinkopf to Nuwerus in the south. Namaqualand Klipkoppe Shrubland is associated with the rocky hills, granite and gneiss domes of the mountains of central Namaqualand. Due to its' steep and rocky nature, Namaqualand Klipkoppe Shrubland has not been impacted by intensive agriculture. Approximately 6% is currently conserved, mainly within Goegap and the Namaqua National Park. As Namaqualand Klipkoppe Shrubland is still largely intact, it has been classified as Least Threatened. Mucina & Rutherford list 15 endemic species for this vegetation type. At a coarse level, it is sensitive largely in terms of offering a diverse habitat for fauna such as reptiles but relatively speaking does not have a high abundance of listed plant species. The extent of this vegetation unit at the site is considerably over-mapped and only the actual rocky outcrops and not the surrounding areas within the site should be mapped as falling within this unit.

The majority of the lower-lying parts of the site are classified as Namaqualand Strandveld which occurs in the Northern and Western Cape Provinces from the southern Richtersveld as far south as Donkins Bay. Especially in the north of this unit it penetrates up to 40km inland and approaches the coast only near the river mouths of the Buffels, Swartlintjies, Spoeg, Bitter and Groen Rivers. In the south of the unit it is variably narrow and approaches the coast more closely. It consists of flat to undulating coastal peneplains with vegetation being a low species richness shrubland dominated by a plethora of erect and creeping succulent shrubs as well as woody shrubs and in wet years annuals are also abundant. It is associated with deep red or yellowish-red Aeolian dunes and deep sand overlying marine sediments and granite gneisses. Mucina and

Rutherford list eight endemic species for this vegetation type. About 10% of this vegetation type has been lost mainly to coastal mining for heavy metals and it is not currently listed.

There is a narrow strip of Namaqualand Sand Fynbos mapped along the eastern boundary of the study area. Namaqualand Sand Fynbos typically occurs on acid to neutral sands, often on windblown dunes and on the dune slacks. It is distributed in the Northern and Western Cape from the vicinity of the study area to Koekenaap in the south, along the coastal plain. It occurs on Aeolian deep, loose, red sands overlying marine or other sediments. It is usually a low to medium shrubland, often dominated by restios, with Proteaceae often present, usually in low numbers. Bulbs and annuals may be common, with succulents common only on dune slacks. It is not a fire driven system and often forms mosaics with various Strandveld types, and boundaries can be very diffuse. The extent of Sand Fynbos at the site is considerable under-mapped and the majority of the low-lying areas between the ridges of the site consist of Sand Fynbos and in many areas the ridges themselves have been covered in sand and consist of dunes or deep sands with typical Sand Fynbos vegetation present. The majority of the plant SCC that are associated with the site are to be found within the areas of Sand Fynbos.

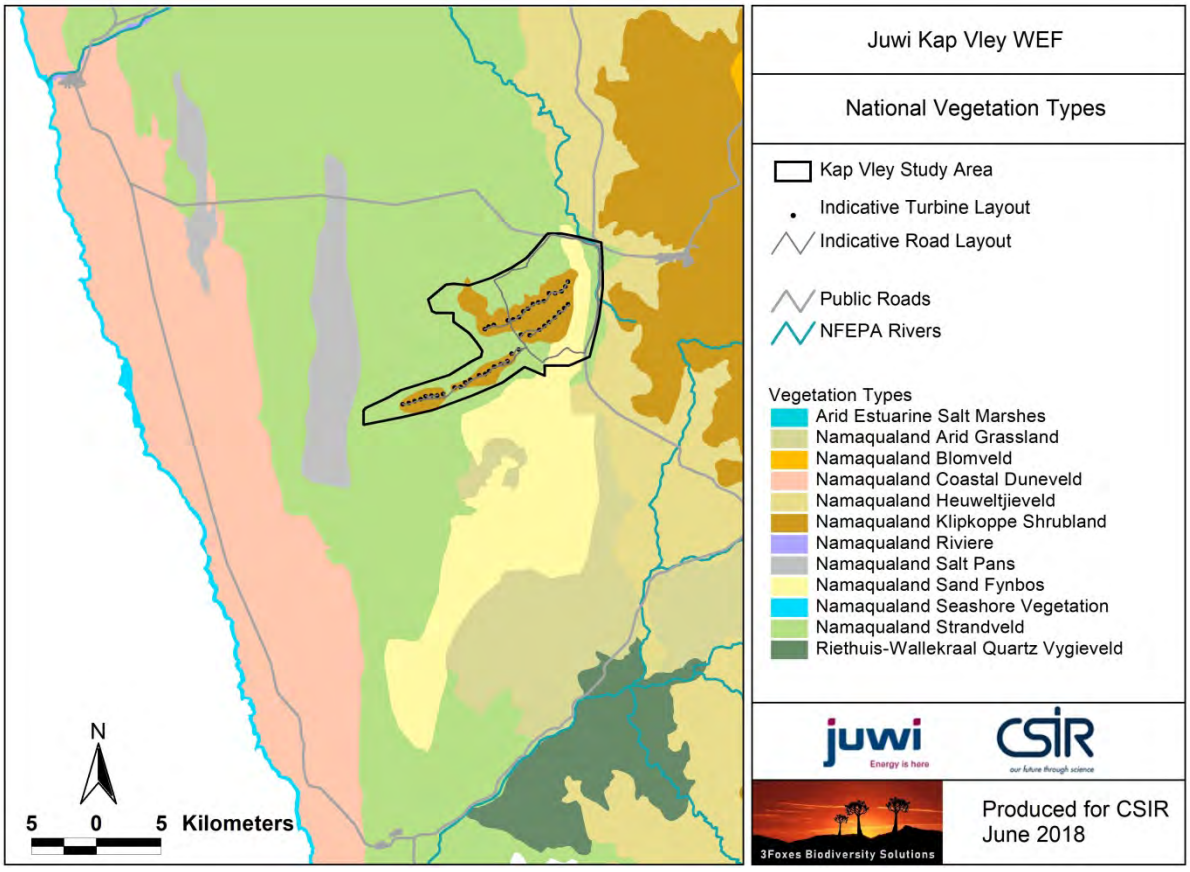


Figure 2. Vegetation map (Mucina and Rutherford 2006 and 2012 Powrie Update) of the Kap Vley study area and surrounding area.

As mentioned above, the national vegetation map does not provide a satisfactory reflection of the vegetation of the site. This relates firstly to the extensive tracts of Namaqualand Klipkoppe Shrubland which has been mapped at the site compared to the limited extent of this unit actually present. Although there are some rocky hills and outcrops present at the site which can be considered representative of this unit, the lower slopes of the hills on-site are generally covered in aeolian sand and consist of Namaqualand Sand Fynbos, which has been significantly under-mapped at the site. A notable feature of the Sand Fynbos of relevance to the current study, is that the site occurs at the northern extreme distribution point of Namaqualand Sand Fynbos and there do not appear to be any areas of this unit to the north of the current site. In addition, this unit has not been well investigated in the past and there are at least 30 endemic or red-listed species of conservation concern known from this vegetation unit. As such, the information contained in the VegMap is not considered reliable in this regard and alternative sources are relied upon to assess the significance and sensitivity of this vegetation at the site. The actual vegetation of the site as it occurs on the ground and which would be affected by the development is detailed below and is considered the primary source on which the assessment is based.

1.3.2. Fine-Scale Vegetation Description

A fine scale habitat map for the study area has been produced, based on high resolution aerial photography of the study area and information collected on-site (Figure 3) during the detailed ground-truthing and walk-through of the development footprint areas. The map illustrates the high diversity of habitats present at the site, as well as the high local variation in the number of habitats present. This map forms the basis for the sensitivity mapping at the site and each unit is ascribed a sensitivity rating according to the presence and abundance of species and features of conservation concern within each unit mapped. The different major habitat types and plant communities present are described in detail below along with their typical and characteristic associated species.

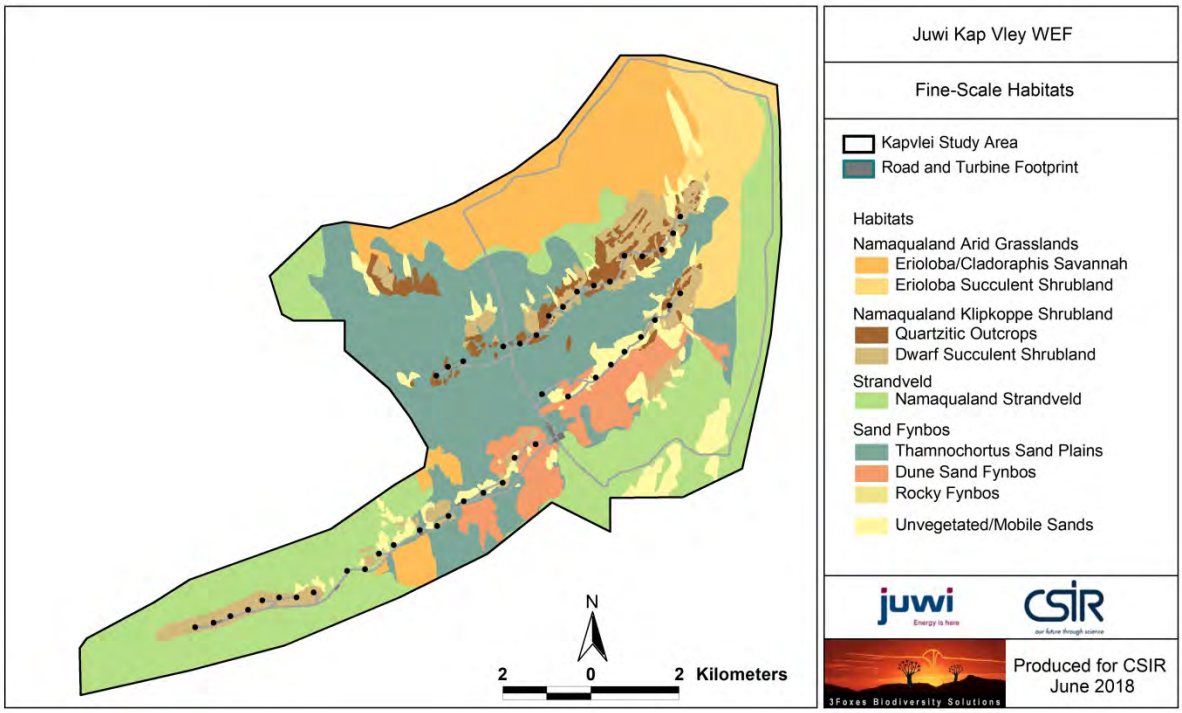


Figure 3. Fine-Scale habitat map for the Kap Vley study area, based on high resolution aerial photography and field-based GPS mapping and field verification.

Arid Strandveld

The ridge which extends west towards the coastline and which represents the western-most extension of the wind farm becomes increasingly arid as one moves westward. The vegetation becomes increasingly short and dominated by low succulent shrubs as restios and taller strandveld elements drop out. There are however some localised patches of Sand Fynbos on small dune fields along the northern slope of the ridge. The ridge areas affected by the development generally consist of low Strandveld dominated by species such as *Ruschia goodiae*, *Monsonia ciliata*, *Amphiglossa tomentosa*, *Crassothonna sedifolia*, *Anthospermum spathulatum*, *Euphorbia rhombifolia*, *Diospyros ramulosa*, *Roepera morgsana*, *Lycium cinereum*, *Willdenowia incurvata*, *Pelargonium praemorsum*, *Cephalophyllum pillansii*, *Jordaaniella spongiosa*, *Ehrharta barbinodis*, *Tetragonia fruticosa*, *Wiborgia monoptera*, *Asparagus capensis*, *Hermannia trifurca*, *Osteospermum oppositifolium*, *Hirpicium alienatum*, *Aspalathus pulicifolia*, *Chrysocoma longifolia* and *Searsia longispina*. The abundance of SCC in this habitat is low and it is not considered to be highly sensitive. There are also no faunal habitats of high significance in this habitat and due to the low stature of the vegetation, faunal diversity in this area appears to be fairly low although it is favoured by species that do not prefer the deep sands of the adjacent strandveld and sand fynbos areas.

Figure 4. Low Strandveld vegetation dominated by *Ruschia goodiae* and *Amphiglossa tomentosa* along the western ridge of the site, showing the position of Turbine 49.

Rocky Hills

Although the lower-lying ridges of the site are generally covered by sand, the higher ridges especially in the east of the site are generally exposed with rocky soils and numerous small emergent koppies. There are three habitats prevalent in this area, the rocky outcrops themselves, the intervening areas of shallow stony soils and localised quartz outcrops. The rocky outcrops are considered sensitive mainly from a faunal perspective as they offer habitat and refuge for a variety of reptiles and small mammals. The quartz outcrops are generally only a few square meters in extent and contain a specialised community of dwarf succulents that do not occur in other habitats. The quartz habitats have been mapped as No-Go areas as they are not common and of limited extent making them highly vulnerable to impact. As such, these areas would not be impacted by the development.

Figure 5. Example of rocky hills habitat from the western portion of the site, with
This was an initial proposed turbine position was considered sensitive and is no longer in the final layout.

Common and characteristic species found in the rocky hills include *Ficus ilicina*, *Crassothonna sedifolia*, *Euryops dregeanus*, *Eriocephalus microphyllus*, *Hirpicium alienatum*, *Tetragonia fruticosa*, *Ehrharta barbinodis*, *Searsia longispina*, *Stoeberia utilis*, *Pteronia undulata*, *Antimima watermeyeri*, *Amphiglossa tomentosa*, *Lycium cinereum*, *Conophytum bilobum*, *Antimima* sp. *Cassula hirtipes*, *Crassula deceptor*, *Crassula hirsuta*, *Adromischus marianiae*, *Teedia lucida*, *Berkheya fruticosa*, *Exomis microphylla*, *Tylecodon paniculatus*, *Athanasia flexuosa*, *Euphorbia hamata*, *Asparagus capensis*, *Hermannia cuneifolia*, *Euphorbia rhombifolia*, *Nenax cf microphylla*, *Monsonia ciliata*, *Ruschia goodiae*. The quartz outcrops are a rare feature of this habitat and while they share some species with the surrounding granite rocky areas, they also have specific associated species including *Conophytum bilobum*, *Euphorbia mauritanica*, *Blepharis macra*, *Crassula elegans*, *Crassula tetragonia* subsp. *rudis*, *Haworthia arachnoidea*, *Fockea sinuata*, *Lycium amoenum* and *Adromischus filicaulis* as well as some of the more widespread species as listed above.

Figure 6. One of the rocky outcrops which forms part of the large No-Go area in the high-lying central part of the site. This area is unique due to the juxtaposition of rocky areas and sand fynbos and the high flora and faunal diversity of the area.

Figure 7. Example of a quartz patch dominated by low dwarf succulents including various species of *Antimima*, *Conophytum* and *Crassula*.

Sand Fynbos

Large parts of the site are considered to be various habitat types of the Namaqualand Sand Fynbos vegetation type. These habitats are much more extensive than has been mapped under the VegMap. There are several different communities that can be identified within this unit with sand fynbos on dunes (Dune Fynbos) and sand fynbos on plains (Restio Fynbos) being particular prominent. The Dune Fynbos occurs along many of the target ridges where there are areas of loose sands that may be fairly well-vegetated or more exposed to the prevailing winds and largely devoid of vegetation or composed of a mix of vegetated and bare areas. These are considered one of the sensitive features of the site and have generally been classified as No-Go areas, based on their vulnerability to disturbance as well as the presence of numerous plant SCC. Typical and dominant species in the areas of loose and mobile sands habitat include *Willdenowia incurvata*, *Thamnochortus bachmannii*, *Leucospermum praemorsum (VU)*, *Passerina truncata*, *Anthospermum spathulatum*, *Agathosma elata (EN)*, *Ehrharta calycina*, *Ruschiella lunulata*, *Aspalathus pulicifolia*, *Metalasia adunca (NT)*, *Muraltia obovata (VU)*, *Muraltia spinosa*, *Stoebe nervigera*, *Metalasia densa*, *Searsia longispina*, *Arctotis auriculata*, *Aspalathus spinescens*, *Babiana hirsuta (NT)*, *Cladoraphis cyperoides*, *Gymnosporia buxifolia*, *Diospyros ramulosa* and *Polpoda capensis*. In some areas this habitat has been invaded by *Acacia cyclops*, leading to degradation of the habitat and loss of habitat for indigenous species.

Figure 8. Example of sand fynbos on loose dunes, in an area that has relatively high vegetation cover for the habitat, indicating that it is relatively stable. Common species include *Willdenowia incurvata*, *Leucospermum praemorsum*, *Metalasia adunca*, *Searsia longispina* and *Aspalathus spinescens*.

Figure 9. An area of Sand fynbos with a high degree of natural disturbance, resulting from large amounts of sand movement from a 'headland bypass' type system which usually develop at the western end of ridges. In some places the wind has removed all the sand resulting in exposure of the underlying substrate. Common species in these areas include *Cladoraphis cyperoides*, *Willdenowia incurvata*, *Leucospermum praemorsum*, *Metalasia adunca*, *Stoebe nervigera*, *Searsia longispina* and *Aspalathus spinescens*.

Outside of the dune areas described above, the Sand Fynbos is usually strongly dominated by *Willdenowia incurvata* and *Thamnochortus bachmannii* with various degrees of shrubs present depending on the nature of the substrate and depth of the sand. Over deep but stable sands as typically occur in the low-lying valleys between the ridges of the site, Restio Sand Fynbos develops and the vegetation tends to be homogenous with relatively few woody species present, while over rocky areas such as occur on the lower ridges and slopes, the diversity increases with an abundance of woody species present and occasional low succulents as well. The low-lying areas tend to be dominated by species such as *Thamnochortus bachmannii*, *Searsia longispina*, *Leucospermum praemorsum* (VU), *Leucadendron brunioides*, *Watsonia meriana*, *Argyrolobium velutinum* (EN), *Aspalathus albens*, *Aspalathus spinescens*, *Harveya squamosa*, *Lampranthus procumbens* (VU) and *Wiborgia obcordata*. There are also occasional *Acacia erioloba* trees present in this habitat. Although there are some listed species present in this habitat it is considered to be of moderate sensitivity based on the relatively low abundance of listed species, the relatively large extent of this habitat and the relative tolerance to disturbance.

Figure 10. Example of the low-lying sand fynbos habitat, dominated by *Willdenowia incurvata* and *Thamnochortus bachmannii* with occasional scattered individuals of *Leucospermum praemorsum* and various *Aspalathus* species.

***Cladoraphis* - *Acacia erioloba* Plains**

A unique feature of the coastal plains of the area is the Camelthorn "forest" that occurs at the foot of Sandberg to the east and north of the site and which extends as far north as the Buffels River. This community is associated with red sands and is characterised by the presence of numerous *Acacia erioloba* trees with an understorey dominated by the spiny grass *Cladoraphis spinescens*. Other species present in this area include *Stipagrostis ciliata*, *Zygophyllum morgsana*, *Lebeckia spinescens*, *Asparagus capensis*, *Euphorbia burmannii*, *Sarcocaulon ciliata, Othonna sedifolia* and *Lycium cinereum*. This is a unique habitat that is not found elsewhere in Namaqualand. Although this area is outside of the project development area, the access road to the site as well as the power line would pass through this area. There is however already a public access route through this area and this would be upgraded for the wind farm access. It is possible that a low number of *Acacia erioloba* would be affected by the road upgrade as there are several young trees immediately adjacent to the existing road, the local population is healthy and expanding with the result that the loss of a handful of trees would not be of consequence for the local population.

.

Figure 11. Looking south towards the northern ridge of the site, showing the *Acacia erioloba* population on the plains north of the site. This is outside of the development area, but the northern access road to the site passes through this area.

1.3.3. Listed and Protected Plant Species

Based on the fieldwork that has been conducted at the proposed Kap Vley WEF site there are a number of local endemics and SCC present at the site (Table 1) which would be affected by the development. These are summarised below, showing their distribution according to the SANBI Red List, as well as the potential significance of impacts on each species. As all populations of these species within or near the development footprint have been mapped, the extent of impact on these species is well characterised. Significant avoidance of important populations of these species has been implemented and no more than 2% of the on-site population of any of these species would be impacted by the development and in some cases no impact on species of higher conservation concern such as *Agathosma elata* would occur due to total avoidance. No local populations of these species would be compromised by the development or elevated to a higher level of conservation concern.

Although a full walk-through of the development footprint has been conducted, it is possible that additional species of concern are present in the area but were missed or were not active at the time of sampling. However, as the entire development footprint has been checked in the field, any additional species of concern that may be present, would occur at very low abundance. The list below however represents those species which are confirmed present at the site and which would potentially bear the brunt of the development impact. An second full walk-through of the development footprint would be required prior to construction and would be used to further reduce

the impact of the development on species of concern through translocation or seed banking of affected species and individuals.

Table 1. *Species of Conservation Concern (SCC) confirmed present at the Kap Vley site, with maps of their distribution taken from the Red List of South African Plants (see http://redlist.sanbi.org/redcat.php) and a short consideration of their likely significance for the development of the site.*

Species & Image	IUCN Status & Abundance on-site	Significance for Kap Vley development
Aspalathus albens 	Recently downgraded from VU to LC 	Populations are localised and total impact on this species at the site would be very low. Overall significance at site is low.
Metalasia adunca 	Near Threatened Widespread on dunes and sandy slopes. 	Common in many areas of the dune habitat and mobile sands. As it occurs as many scattered individuals, some impact on this species is unavoidable. However, the proportion of individuals affected is low and as this is fairly widespread species, the residual impact is not considered highly significant.
Muraltia obovata	Vulnerable Common and widespread across most habitats with sandy soils	Very common at the site and avoidance will not be possible, but impact on local population not likely to be highly significant as it is common within favourable habitat. Implications for the development are low.

Agathosma elata

Endangered
Locally abundant on sandy slopes

Scattered but healthy populations which have been avoided. Impact on this species would have high significance but avoidance has been effective at minimising impact.

Argyrolobium velutinum

Endangered
Occasional on sandy slopes

Occasional scattered plants that can't be easily avoided. Overall significance of the impact on this species is considered to be low.

Caesia sabulosa

Vulnerable

Not common at the site and significant impact is not likely.

Implications for the development is low.

Uncommon

Lampranthus procumbens

Vulnerable

Common on sandy slopes

Locally common at the site. Impact on this species would have high significance but the important populations have been avoided although some residual impact is likely. Translocation of affected plants may be able to partly mitigate any residual impact.

Phyllobolus tenuiflorus

Vulnerable

Uncommon on rocky soils

Not common at the site and it is not likely that a significant impact would be generated.

Low significance for the development.

Leucospermum praemorsum 	Vulnerable Localised but common along parts of the affected ridges		Common on sand dunes and while significant avoidance for this species has been implemented, this is a dominant species across large areas and some local residual impact on this species will occur. Moderate significance for the development as this is likely the northern-most population of this species.

1.3.4. Faunal Communities

1.3.4.1. Mammals

Mammals captured by the camera traps include African Wildcat, Bat-eared Fox, Cape Fox, Cape Grey Mongoose, Caracal, Common Duiker, Cape Hare, Honey Badger, Steenbok, Striped Polecat, Yellow Mongoose, Porcupine and Smith's Red Rock Rabbit (Figure 12, Figure 13, Table 2). Although all parts of the site were well-used by fauna, Caracal tended to be restricted to the rocky hills as were Smith's Rock Rabbit. The relative abundance of the various species present is indicated below in Figure 12 and more than half the observations are from Steenbok and Cape Hare, with Duiker, Porcupine, Striped Polecat and Caracal moderately abundant. This represents a fairly typical mammalian community and is similar to that obtained at other sites along the West Coast. A notable absence is the Black-backed Jackal which occurs in the area but is likely absent as a result of persecution. Small mammals caught in the Sherman traps include Hairy-footed Gerbil, Western Rock Elephant Shrew, Namaqua Rock Mouse and Four-striped Mouse (Figure 14). The rocky hills were dominated by Namaqua Rock Mouse and Western Rock Elephant Shrew, while the sandy substrates were dominated by Hairy-footed Gerbil with the occasional Four-striped Mouse. Not all species are easily captured in Sherman traps and apart from the above, Karoo Bush Rats and Brants' Whistling Rat were also observed at the site and some additional species are also likely present, especially in the rocky outcrops.

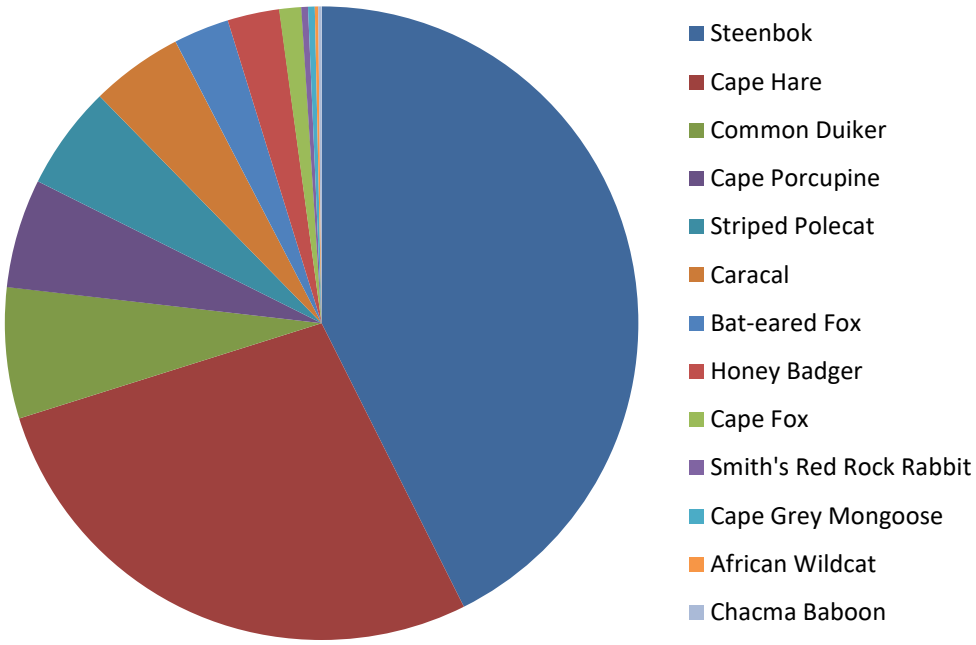


Figure 12. Relative composition of the medium sized mammalian fauna at the Kap Vley site based on over 1000 camera trap images captured over 3 months at the site. The legend key lists the species observed in decreasing order of abundance.

Apart from the species which were observed and can be confirmed present at the site, four red-listed SCC are known from the area. This includes the Leopard *Panthera pardus* (Vulnerable), Littledale's Whistling Rat *Parotomys littledalei* (Near Threatened), African Clawless Otter *Aonyx capensis* (Near Threatened) and Grants' Golden Mole *Eremitalpa granti granti* (Vulnerable). It is not likely that either the Leopard or Otter are present at the site on account of human disturbance or lack of suitable habitat. Golden Moles are confirmed present at the site, but it is not clear if these are the more common Cape Golden Mole or Grants' Golden Mole. These subterranean animals 'swim' through the soft sand and hardened surfaces such as roads would pose a significant obstacle for movement. In addition, they also use subtle vibrations in the soil to detect their prey and it is possible that noise and vibration transferred from the turbines to the soil would have a negative impact on the local populations of golden moles. There have however been no studies to date on the impacts of vibration and noise on golden moles and so this remains an unknown.

It is likely that the major impact of development on most mammals would be habitat loss equivalent to the footprint of the facility. Some species may however be wary of the turbines or negatively affected by the noise generated and may avoid them to the greater degree. It is however unlikely that the local or regional populations of any species would be compromised by the development and long-term impacts on mammals are likely to be low to moderate after mitigation.

Figure 13. Examples of camera trap images obtained from the site. Common and species of significance include from top left, Steenbok, Polecat, Honey Badger, Caracal, Cape Hare and Bat-eared Fox.

Figure 14. Small mammals trapped at the site include from top left Round-eared Elephant Shrew, Hairy-footed Gerbil, Striped Mouse and Namaqua Rock Mouse.

Table 2. List of mammals which can be confirmed present at Kap Vley based on observations at the site. The list is not considered exhaustive and additional species are likely present and listed in Appendix 2.

Family	Genus	Species	Common name	Red list category
Bathyergidae	*Cryptomys*	*hottentotus*	Southern African Mole-rat	Least Concern
Bovidae	*Raphicerus*	*campestris*	Steenbok	Least Concern
Bovidae	*Sylvicapra*	*grimmia*	Bush Duiker	Least Concern
Canidae	*Canis*	*mesomelas*	Black-backed Jackal	Least Concern
Canidae	*Otocyon*	*megalotis*	Bat-eared Fox	Least Concern
Canidae	*Vulpes*	*chama*	Cape Fox	Least Concern
Cercopithecidae	*Papio*	*ursinus*	Chacma Baboon	Least Concern
Felidae	*Caracal*	*caracal*	Caracal	Least Concern
Felidae	*Felis*	*silvestris*	African Wildcat	Least Concern
Herpestidae	*Cynictis*	*penicillata*	Yellow Mongoose	Least Concern
Herpestidae	*Herpestes*	*pulverulentus*	Cape Gray Mongoose	Least Concern
Herpestidae	*Suricata*	*suricatta*	Meerkat	Least Concern
Hystricidae	*Hystrix*	*africaeaustralis*	Cape Porcupine	Least Concern
Leporidae	*Lepus*	*capensis*	Cape Hare	Least Concern
Leporidae	*Lepus*	*saxatilis*	Scrub Hare	Least Concern

Leporidae	*Pronolagus*	*rupestris*	Smith's Red Rock Hare	Least Concern
Macroscelididae	*Elephantulus*	*rupestris*	Western Rock Elephant Shrew	Least Concern
Muridae	*Aethomys*	*namaquensis*	Namaqua Rock Mouse	Least Concern
Muridae	*Desmodillus*	*auricularis*	Cape Short-tailed Gerbil	Least Concern
Muridae	*Gerbilliscus*	*paeba*	Paeba Hairy-footed Gerbil	Least Concern
Muridae	*Otomys*	*unisulcatus*	Karoo Bush Rat	Least Concern
Muridae	*Rhabdomys*	*pumilio*	Xeric Four-striped Grass Rat	Least Concern
Mustelidae	*Ictonyx*	*striatus*	Striped Polecat	Least Concern
Mustelidae	*Mellivora*	*capensis*	Honey Badger	Least Concern
Orycteropodidae	*Orycteropus*	*afer*	Aardvark	Least Concern
Procaviidae	*Procavia*	*capensis*	Rock Hyrax	Least Concern
Sciuridae	*Xerus*	*inauris*	South African Ground Squirrel	Least Concern

1.3.4.2. Reptiles

A list of Reptiles known from the vicinity of the Kap Vley site, based on records from the ReptileMap database is provided in Appendix 3 of this report and indicates that as many as 40 species are known to occur in the wider area. No SCC have however been recorded from the area although it is possible that the Speckled Padloper *Chersobius signatus* (Vulnerable) is present at the site as it is widespread in Namaqualand and the rocky hills habitat at the site is suitable for this species. Namaqualand is however known as a centre of endemism and diversity for reptiles and the wider area has a high diversity and abundance of local endemics. This appears to be generated at least partly through the high habitat diversity of the area, which includes rocky hills, heuweltjie veld on fine-textured firm soils, loose sands and dunes, stable and vegetated dunes, well vegetated drainage lines etc.

The fieldwork supports the possibility that reptile diversity in the area is high and indicates that the site has a relatively diverse reptile assemblage, with significantly higher diversity in the rocky hills than on the surrounding plains due to the greater habitat diversity and refuge availability of this habitat compared to the plains. Species observed at the site include Armadillo Girdled Lizard, Karoo Girdled Lizard, Giant Desert Lizard, Southern Rock Agama, Common Giant Ground Gecko, Namaqua Day Gecko, Knox's Desert Lizard, Common Sand Lizard, Pink Blind Legless Skink and Many-horned Adder (Figure 15, Figure 16). The most important habitat for reptiles at the site are the rocky outcrops, which provide an array of microsites and suitable refuges for a variety of reptiles. Direct impact to this habitat would be relatively low as little of the footprint impinges on the outcrops themselves. The sandy substrates are home to local endemics such as the Pink Blind Legless Skink which may be vulnerable to habitat disruption due to the construction of roads which may fragment the continuity of the preferred sandy substrate. Overall, impacts of the development on reptiles are likely to be of local significance only as there are no species with a very narrow distribution range or of high conservation concern present at the site which may be compromised by the development.

Figure 15. Reptiles commonly observed at the site include from bottom left Armadillo Girdled Lizard, Cape Skink, Pink Blind Legless Skink, Knox's Desert Lizard, Giant Desert Lizard and Common Sand Lizard.

Figure 16. Many-horned Adder *Bitis cornuta* observed at the site, this species is a Namaqualand and southern Namibia endemic.

1.3.4.3. Amphibians

There is no natural permanent or even seasonal standing water at the site, which is due to the sandy substrate and consequent lack of drainage features where water can gather. As a result, the amphibian community at the site is restricted to species which are relatively independent of water and consequently of low diversity. The only species confirmed present at the site is the Namaqua Rain Frog (Figure 17) which appears to be relatively widespread at the site as it was captured in several different areas including in sandy areas between rocky outcrops, indicating that it is not restricted to low-lying areas. Other species which are possibly present include the Cape Sand Frog *Tomopterna delalandii* and the Desert Rain Frog *Breviceps macrops* which is classified as Vulnerable. The Desert Rain Frog is however restricted to the coastline and is not known to occur so far inland and as a result is unlikely to occur at the site, although this cannot be discounted as the area has not been well investigated. Given the paucity of important amphibian habitats at the site and the low diversity of amphibians, a significant impact on frogs is not likely.

Figure 17. The only frog observed at the site is the Namaqua Sand Frog, which is independent of water and a West-Coast endemic.

1.3.5. Critical Biodiversity Areas

The Kap Vley site lies within a Tier 1 and Tier 2 CBA, indicating that the site occurs within an area of recognised biodiversity significance. Development within such areas can have negative impacts on biodiversity pattern and process and is generally considered undesirable. Although the total footprint (128ha) of the development is not very large, it must be considered in context of the currently intact and relatively undisturbed receiving environment and the implications that the development may have for future land use options in the area. As development within CBAs is not desirable, the developer has taken a pro-active approach in this regard and measures to reduce the impacts of the development include detailed mapping of habitats and SCC on the site to inform the final development layout and ensure that avoidance of these features can be maximised, as well as the initiation of an offset study to examine the utility and feasibility of developing an offset to mitigate the residual impacts of the development on CBAs. A stand-alone offset study has been commissioned and forms part of the EIA documentation which accompanies this study.

As a primary purpose of CBAs is to try and secure the broad-scale ecological functioning and resilience of landscapes, it is pertinent to consider the impact that the development may have on ecological processes and not just the species resident within the site. In terms of connectivity in a north-south direction, the development is not likely to have a significant impact as there are extensive tracts of intact Strandveld vegetation to the west of the site as well as an intact corridor between Sandberg and the inland mountains of the escarpment towards Komaggas. Furthermore, in terms of the rocky hills and sand fynbos areas, these are isolated islands of habitat, with larger intact areas to the east in the former and to the south in the latter case. As such, there is likely little movement of fauna and flora closely associated these habitats in other directions. There is likely to be a fair amount of movement of fauna along the ridges of the site in an east-west direction and linking up to the main body of rocky habitats to the east of the site. This is likely most important for reptiles and while no studies have yet examined the impacts of wind farms on reptiles in general, some studies in other countries have found no impact of turbines on tortoises (Ennen et al. 2012, Lovich et al. 2011), suggesting that these impacts are likely to be low, especially since the development infrastructure is not likely to represent a significant impediment to movement in its own right. The primary value of the site and the Sandberg area is that it is likely to represent an upland-lowland gradient that can be used by fauna and flora on a local level. Fauna can move onto the adjacent plains habitats or northern slopes of the hills in the cooler winter months when these areas are warmer and then retreat to higher lying areas and south-facing slopes in the hotter summer months. This provides for resilience of local populations in the face of climate change as well as the generally unpredictable arid environment. This role of the site was recognised and provides one of the motivating factors for demarcating a significant proportion of the high-lying ground at the site as a no-go area. In addition, the total footprint of the development is relatively low and as this is generally restricted to the ridge-top environment, habitat connectivity along the slopes of the site and between many of the plains and slopes will generally not be disrupted. The layout of the development is very efficient in that it does not have an excess of roads that are not required and the turbines are restricted to a few aligned ridges. As such, there is significant space within the development area that is not impacted and most fauna should not have a problem moving through

this area. Consequently, the overall impact of the development on broader scale ecological processes is considered to be relatively low and no major impacts to dispersal ability or faunal movement patterns are likely to be generated by the development.

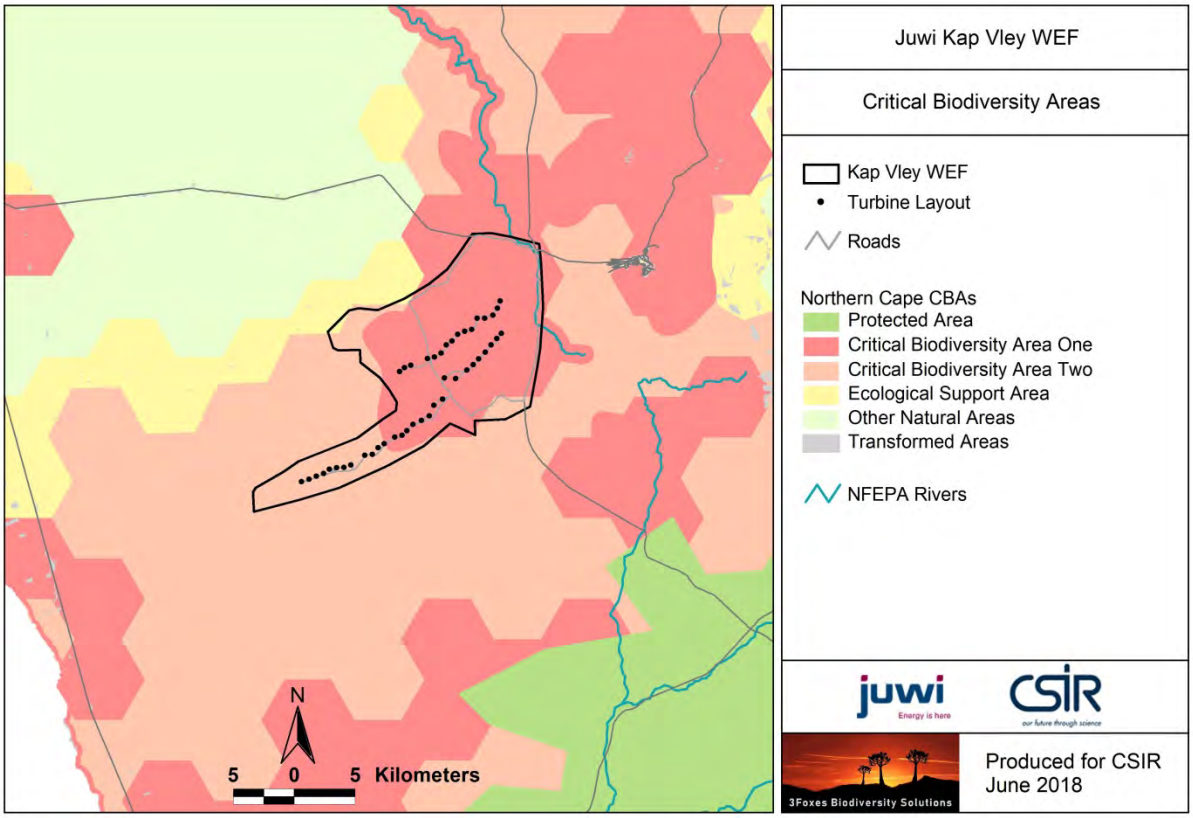


Figure 18. Critical Biodiversity Areas map for the study area, showing that the site lies within a Tier 1 and Tier 2 CBA.

The site also falls within a Northern Cape Protected Area Expansion Strategy (NCPAES) Focus Area (2017), which further highlights the significance of the area for conservation purposes (Figure 11). Development of the site would certainly place some limitations on the future expansion of traditional formalised conservation into the affected area. However, in principle, there would not be any hindrance on other forms of conservation expansion into this area, such as through stewardship. In addition, provided that the development can reduce impacts to an acceptable level, the site would retain significant biodiversity value and the development would not be likely to compromise the vast majority of biodiversity features and components. Currently, the major impact on biodiversity at the site is the current land use and especially overgrazing from livestock. Significant differences in vegetation composition and condition between land owners are visible in the area, with significant negative impact on some species and habitats. The wind farm would contribute to habitat loss in the area to some degree, but whether this significantly impacts on the conservation value of the area is debateable. While turbines certainly generate a visual impact for people in the close environment, most fauna appear to quickly become habituated to wind turbines and on existing wind farms it is not uncommon to see wildlife resting in the shade of the turbines.

Furthermore, a significant proportion of the wind farm is on communal land. It is not likely that these areas can be incorporated into traditional protectionist-style conservation areas and must be conserved as "working landscapes" with the people who rely on these areas for livelihoods still active in the landscape. It would be hard to argue that the wind farm is not compatible with the concept of a working landscape and as such, the development of the Kap Vley Wind Farm would not impact on future conservation options in the area to a large degree as many of these options would in fact remain open into the future and are not precluded by the presence of the wind farm..

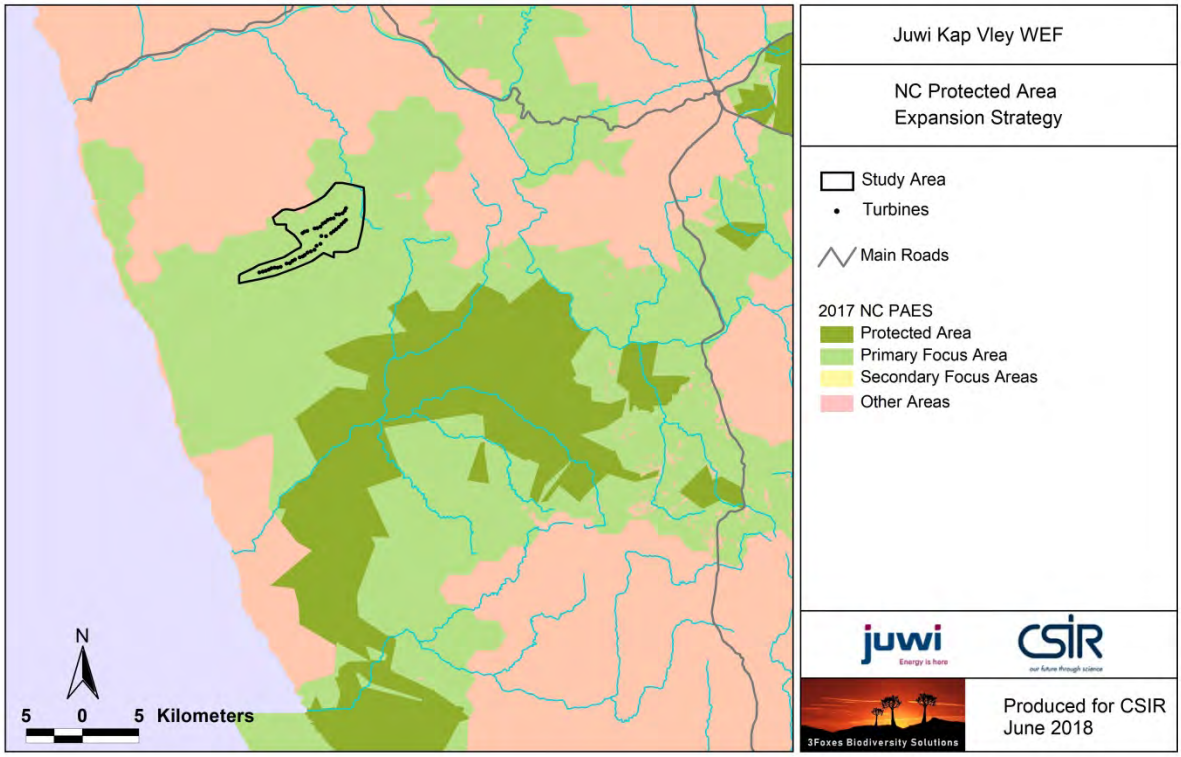


Figure 19. Northern Cape Protected Area Expansion Strategy map for the broader study area, showing the Kap Vley site falling within a Primary Focus Area.

1.3.6. Cumulative Impacts

Although there are a number of the different proposed renewable energy facilities in the broad area around the Kap Vley site (**Figure 12**), not all of these are within a similar environment and would not affect the same range of habitats as present at Kap Vley. Those developments to the east of Kap Vley above the escarpment are considered to be in a different environment and the proposed Kap Vley WEF would not significantly affect cumulative impacts in that area. As such, the consideration of cumulative impact in the area should be focused on other developments on the coastal plain. This includes the 300 MW Eskom wind energy facility west of the site as well as the 140 MW Project Blue wind energy facilities north west of the site. There is also the 7.2MW Koingnaas Wind Energy Facility to the south of the site. These projects are generally closer to the coastline and largely restricted to the Namaqualand Strandveld vegetation type. It is estimated that the total footprint of

these developments is approximately 500 ha. Within the context of the coastal plain and the affected vegetation types, this is a relatively low total extent. Existing impact in the area is largely restricted to the coastal forelands where diamond mining has had a significant impact on this environment. There are also a number of diamond mines along the Buffels River north of the site. Overall, existing impact on the coastal plain away from the actual coastline is relatively low and the contribution of the anticipated 128 ha footprint of the Kap Vley WEF is not considered highly significant. This does not however take the specific features present or the CBA status of Kap Vley site into account. As the nature and combination of features present at the Kap Vley site are relatively rare in the area, the impact on these features would be more significant and provides some of the motivation towards the development of an biodiversity offset to mitigate the residual on-site impacts of the development. An Ecological Biodiversity Offset study was prepared by this consultant is included as Appendix G2/Q of the Draft EIA Report.

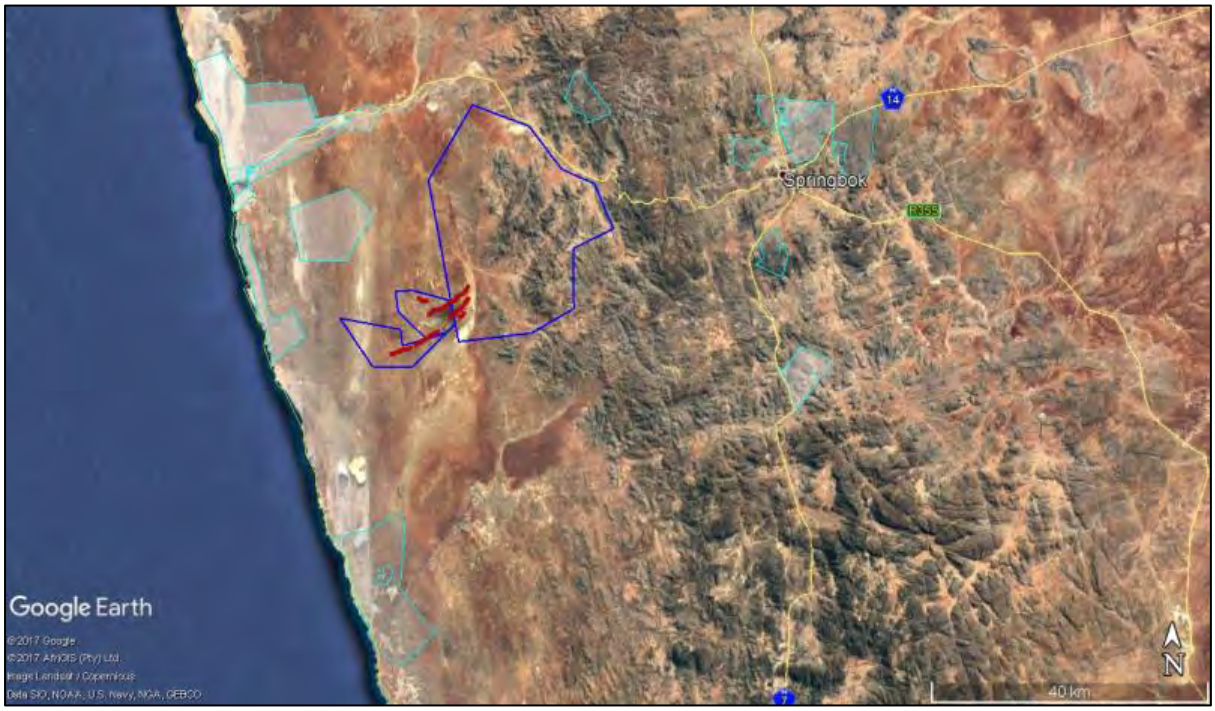


Figure 20. Map of other renewable energy developments in the wide area around the affected Kap Vley properties indicated in blue.

1.4. LEGISLATION AND PERMIT REQUIREMENTS

A summary of the environmental legislation and permitting requirements that would be triggered by the development of the site is outlined below.

Under the Environmental Impact Assessment Regulations Listing Notice 2 of 2014 the following activities are likely to be triggered:

Activity 1: The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more, excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs within an urban area.

Activity 15. The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-

(i) the undertaking of a linear activity; or
(ii) maintenance purposes undertaken in accordance with a maintenance management plan.

And, under Environmental Impact Assessment Regulations Listing Notice 3 of 2014:

Activity 4. The construction of a road wider than 4 metres with a reserve less than 13,5 metres.

ii. Outside urban areas, in:

(a) A protected area identified in terms of NEMPAA, excluding disturbed areas;
(b) National Protected Area Expansion Strategy Focus areas;
(c) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;
(d) Sites or areas identified in terms of an International Convention;
(e) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;
(f) Core areas in biosphere reserves;
(g) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas; or
(h) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined;

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

g. Northern Cape:

i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;
ii. Within critical biodiversity areas identified in bioregional plans;
iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuary, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas; or
iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.

Activity 18. The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.

g. Northern Cape

i. In an estuary;

ii. Outside urban areas:

(aa) A protected area identified in terms of NEMPAA, excluding conservancies;
(bb) National Protected Area Expansion Strategy Focus areas;
(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;
(dd) Sites or areas identified in terms of an international convention;
(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;
(ff) Core areas in biosphere reserves;
(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve;
(hh) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined; or
(ii) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland;

National Forest Act (No. 84 of 1998):

The National Forests Act provides for the protection of forests as well as specific tree species, quoting directly from the Act: “no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated”.

Two protected tree species have been observed at the site, *Aloe dichotoma* and *Acacia erioloba*. Although the numbers of affected individuals is low, a permit from DAFF would be required for any impacts to these species. Under the assessed layout, there are some individuals of *Acacia erioloba* present near the footprint which may be affected, but no individuals of *Aloe dichotoma* were observed within the footprint. The exact number of affected individuals that would need to be applied

for would be clarified at the preconstruction phase following a preconstruction walk-through of the final approved development footprint.

Conservation of Agricultural Resources Act (Act 43 of 1983):

The Conservation of Agricultural Resources Act provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species. The Conservation of Agricultural Resources Act defines different categories of alien plants and those listed under Category 1 are prohibited and must be controlled while those listed under Category 2 must be grown within a demarcated area under permit. Category 3 plants includes ornamental plants that may no longer be planted but existing plants may remain provided that all reasonable steps are taken to prevent the spreading thereof, except within the floodline of water courses and wetlands.

The predominant alien of concern at the site *Acacia cyclops*, which is listed as Category 1b.

1.5. IDENTIFICATION OF KEY ISSUES

1.5.1. Identification of Potential Impacts

The development would result in the loss of approximately 128ha of currently intact habitat. This would impact plant SCC as well as impact fauna directly though mortality and indirectly through habitat loss. The area is also falls within a Critical Biodiversity Area and Northern Cape Protected Area Expansion Strategy Focus Area. Based on the results of the Scoping study, the following impacts have been identified as being associated with the development of the Kap Vley site and which are assessed here:

1.5.1.1. Construction Phase

- Impacts on vegetation and plant SCC
- Direct and indirect faunal impacts

1.5.1.2. Operational Phase

- Increased soil erosion
- Increased alien plant invasion
- Impacts on Fauna due to Operation
- Impacts on Critical Biodiversity Areas

1.5.1.3. Decommissioning Phase

- Increased alien plant invasion
- Increased soil erosion
- Direct and indirect impacts on fauna

1.5.1.4. Cumulative impacts

- Cumulative impacts on habitat loss and broad-scale ecological processes

- Decreased ability to meet conservation targets

1.6. ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

1.6.1. Results of the Field Study

The ecological sensitivity map for the study area is illustrated below in Figure 13. There are several features of this map which warrant further discussion. In particular, a number of No-Go areas have been delineated, these were identified as being unique and sensitive areas where no development is considered appropriate. The delineation of these areas is an important action which is considered to be a key step in ensuring that the on-site impacts of the Kap Vley development remain acceptable. These areas are delineated with the specific purpose of avoiding high residual impacts at the site and maintaining the ecological functioning of the area. Avoidance of these areas therefore contributes significantly towards the goal of reducing residual impacts at the site to acceptable levels. A number of High sensitivity areas have also been identified which are largely areas with a high abundance of plant SCC or disturbance-sensitive habitats such as mobile dunes. No turbines have been located within the High sensitivity areas although there are some access roads which traverse these areas. The total footprint within these areas comprises 3.5 ha which is a very small proportion of the 220 ha total extent of the High sensitivity areas (**Table 2**) and is considered acceptable as this is not a significant proportion of these areas and cannot easily be further avoided. The majority of the development footprint is within areas considered to be of Medium sensitivity. These areas are areas of typical restio-dominated Sand Fynbos, Namaqualand Strandveld or Namaqualand Klipkoppe vegetation of moderate sensitivity with few SCC present. Development within these areas is considered to generate impacts of relatively low significance and it is only the CBA status of these areas that warrants the consideration of an offset to mitigate the residual impacts.

Table 3. Extent of the different sensitivity classes that occur within the overall site and within the development footprint. Note that sensitivity classes are Medium/High and not ranged categories such as Medium to High.

Sensitivity	Total Extent (ha)	Development Footprint (ha)
No Go Areas	191.47	0
High	220.23	3.5
Medium/High	922.21	17.93
Medium	3032.77	60.56
Medium/Low	5303.47	45.27

In terms of the mitigation hierarchy that should be implemented for development, the first three required measures are to avoid, minimize and rehabilitate/restore impacts. The potential of the current development to achieve these outcomes needs to be considered before considering the residual impact of the development and the overall acceptability of the development. With regards to on-site impacts on plant SCC, detailed mapping of the distribution of such species has been conducted and specific avoidance implemented, with the result that no high impacts on SCC is likely to occur. Similarly, sensitive habitats and areas of very high biodiversity value have been delineated as No-Go areas and will not be impacted by the development. The total development footprint is estimated at 128 ha and any disturbed areas that will not be required for the operation of the wind farm would be rehabilitated after construction to minimise the overall footprint and reduce erosion risk. Given the above, it is clear that the mitigation hierarchy has been well applied at the site and it is only the CBA status of the site that cannot be effectively mitigated and which drives the need for the consideration of an offset.

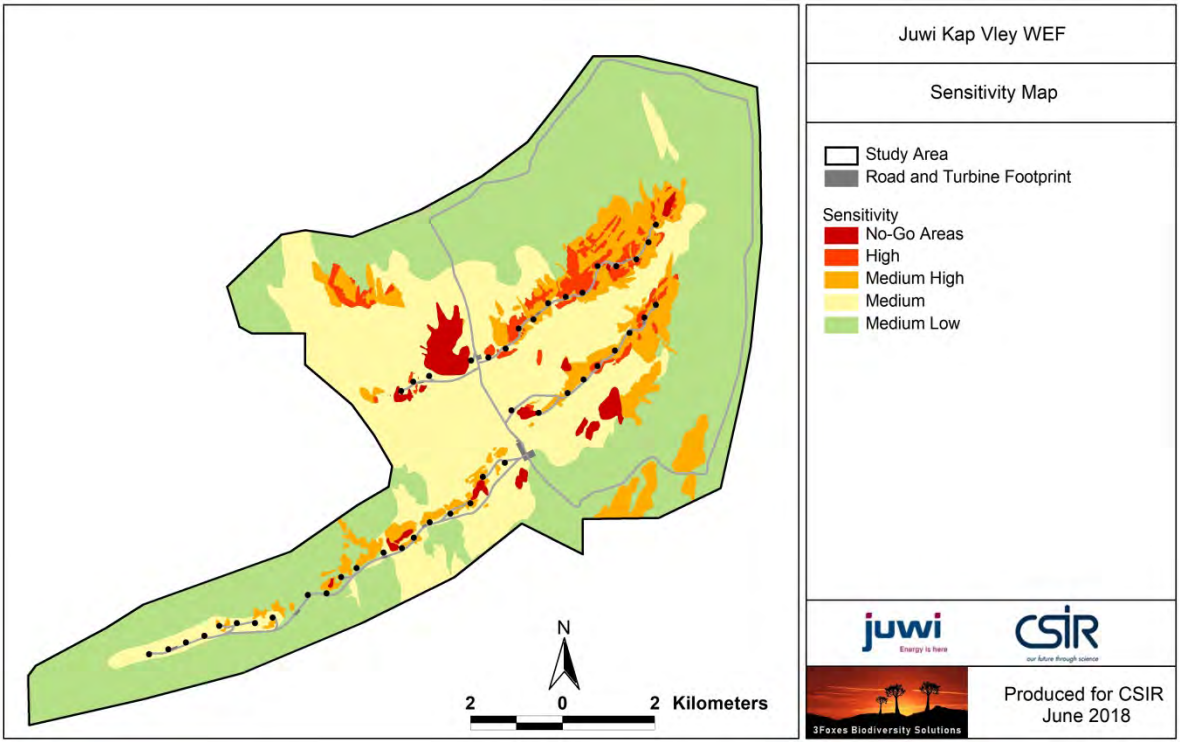


Figure 21. Ecological sensitivity map for the study area, showing that there is no footprint within the identified no-go areas and no turbines within the High sensitivity areas.

1.6.2. Construction Phase Impact 1. Impacts on vegetation and plant species of conservation concern

- The abundance of plant SCC at the site is high and as a result, there is a significant risk to the local populations of these species. However, significant avoidance has been implemented with regards to the layout of the facility, based on the results of the detailed field mapping of SCC on these results, no more than 2% of the local populations of any

SCC would be impacted by the development and as such it is not likely that any of these populations would be compromised by the development. Aside from the impact on SCC, there would be a more general loss of intact vegetation within the development footprint. For the more widespread vegetation types, this loss would not be of significant consequence, but for less widespread vegetation types such as the areas of Namaqualand Sand Fynbos, this would be of greater consequence. This impact would be generated by turbine foundations, turbine hard-stands as well as access roads and the on-site substation and lay-down areas. Fine-scale habitat and SCC population mapping has already been conducted to inform the final layout to ensure that impact on these features can be minimised through avoidance. As such, additional fine-scale mapping to inform the final layout would not further mitigate this impact. However, a preconstruction walk-through of the facility would still be required should the development reach preferred bidder status.

Without mitigation this impact would be of **High** potential significance.

Essential mitigation measures include:

- No development of turbines, roads of other infrastructure within identified no-go areas.
- All no-go areas should be demarcated at construction by a suitably qualified person able to identify the species of concern present at the site.
- Pre-construction walk-through of the development footprint to further refine the layout and further reduce impacts on SCC through micro-siting of the turbines and access roads. Where necessary impacts on SCC can be further reduced through translocation or seed banking.
- Loose sand will need to be managed at construction and the use of wind barriers, geotextiles and other mitigation measures to reduce sand movement due to wind erosion will need to be implemented.
- All cleared areas that are not under hard infrastructure will need to be rehabilitated with locally occurring species.
- No fires should be allowed at the site as the vegetation can sustain an uncontrolled fire and this is likely to have negative effects on the fauna and flora of the site.

With the implementation of the suggested mitigation the impact on vegetation and SCC can likely be reduced to a **Moderate** significance.

1.6.3. Construction Phase Impact 2. Direct and indirect faunal impacts

The construction of the development will result in significant habitat loss, noise and disturbance on site. This will lead to direct and indirect disturbance of resident fauna. Some slow-moving or retiring species such as many reptiles would likely not be able to escape the construction machinery and would be killed. There are also several species present at the site which are vulnerable to poaching and there is a risk that these species may be targeted. This impact would be caused by the

presence and operation of construction machinery and personnel on the site. This impact would however be transient and restricted to the construction phase, with significantly lower levels of disturbance during the operational phase.

Without mitigation this impact is likely to be of **Moderate** significance.

Essential mitigation measures would include:

- Avoidance of identified areas of high fauna importance and No-Go areas. All activity should be excluded from these areas.
- Search and rescue for reptiles and other vulnerable species during construction, before areas are cleared.
- Limiting access to the site and ensuring that construction staff and machinery remain within the demarcated construction areas during the construction phase.
- Environmental induction for all staff and contractors on-site.

With the implementation of the suggested mitigation the construction phase impact on fauna can likely be reduced to a **Moderate to Low Significance**.

1.6.4. Operational Phase Impact 1. Increased Soil Erosion

The site has sandy soils that are vulnerable to erosion, especially in the face of the strong winds that the area experiences. Once mobilised, the sands can be very difficult to arrest as the moving sand smothers new vegetation as it goes. There are already several areas of mobile dunes at the site that are severely affected by wind erosion. The natural movement of sand is clearly an important disturbance feature and ecological process operating in the area. The most vulnerable areas have generally been classified as High sensitivity and while no turbines are located in these areas, there are some roads through some of these areas that may generate erosion and where specific mitigation would be required.

Without mitigation, this impact would potentially be of **High significance**.

Essential mitigation measures would include:

- Avoiding areas of high wind erosion vulnerability as much as possible.
- Using net barriers, geotextiles, active rehabilitation and other measures during and after construction to minimise sand movement at the site. This should be monitored on a regular basis by the ECO and rectified by the developer as quickly as possible

With the effective implementation of the mitigation measures, it is likely that this impact can be reduced to an acceptable, **low significance**.

1.6.5. Operational Phase Impact 2. Increased Alien Plant Invasion

There are already several alien species present on the site such as *Acacia cyclops* and disturbance created during construction would leave the site vulnerable to further alien plant invasion, especially

along the access roads and other areas which receive additional run-off from the hardened surfaces of the development.

Without mitigation this impact would likely be of **Moderate Significance**.

Essential mitigation measures would include:

- Alien management plan to be implemented during the operational phase of the development, which makes provision for regular alien clearing and monitoring.
- Rehabilitation of disturbed areas that are not regularly used after construction.

With the effective implementation of the mitigation measures, it is likely that this impact can be reduced to a **Low Significance**.

1.6.6. Operational Phase Impact 3. Operational Impacts on Fauna

Operational activities as well as the presence of the turbines and the noise they generate may deter some sensitive fauna from the area. In addition, the access roads may function to fragment the habitat for some fauna, which are either unable to or unwilling to traverse open areas. For some species this relates to predation risk as slow-moving species such as tortoises are vulnerable to predation by crows and other predators. In terms of habitat disruption, subterranean species such as Golden Moles and burrowing snakes and skinks are particularly vulnerable to this type of impact as they are unable to traverse the hardened roads or become very exposed to predation when doing so. This is a low-level continuous impact which could have significant cumulative impact on sensitive species.

Without mitigation this impact would likely be of **Moderate to Low Significance**.

Essential mitigation measures would include:

- Open space management plan for the development, which makes provision for favourable management of the facility and the surrounding area for fauna.
- Limiting access to the site to staff and contractors only.
- Appropriate design of roads and other infrastructure where appropriate to minimise faunal impacts and allow fauna to pass through or underneath these features.
- No electrical fencing within 20cm of the ground as tortoises become stuck against such fences and are electrocuted to death.

With the effective implementation of the mitigation measures, it is likely that this impact can be reduced to a **Low Significance**.

1.6.7. Operational Phase Impact 4. Impacts on Critical Biodiversity Areas

The development is located within an area that is a recognised area of biodiversity significance and has been classified as a Tier 1 CBA. The development will result in direct habitat loss equivalent to

about 128 ha within the CBA as well as potentially affect broad-scale ecological processes operating in the area. There are also some localised specialised habitats present such as quartz patches, which have a high ecological value and which would potentially be affected by the development. The impact on the CBA would result from the transformation of currently intact habitat as well as the presence and operation of the facility.

Without mitigation this impact would likely be of **Moderate Significance**.

Essential mitigation measures would include:

- Minimise the development footprint as far as possible, which includes locating temporary-use areas such as construction camps and lay-down areas in previously disturbed areas.
- Avoid impact to restricted and specialised habitats such as quartz patches.

With the effective implementation of the mitigation measures, it is likely that this impact will remain at a **Moderate Significance**. Effective and full mitigation is not likely to be possible because the main impact results from the presence and operation of the facility itself, which cannot be avoided should the development go ahead.

1.6.8. Decommissioning Phase Impact 1. Increased Soil Erosion

As already described, the site has sandy soils that are vulnerable to erosion, especially in the face of the strong winds that the area experiences. Once mobilised, the sands can be very difficult to arrest as the moving sand smothers new vegetation as it goes. Decommissioning will remove the hard infrastructure from the site, generating disturbance and leaving areas that are unvegetated and vulnerable to erosion.

Without mitigation, this impact would potentially be of **High significance**.

Essential mitigation measures would include:

- Revegetation of cleared areas with monitoring and follow-up to ensure that rehabilitation is successful. Success must be measured against a predefined benchmark in terms of cover and species richness. Monitoring and rehabilitation must continue until such time as the benchmark has been attained. It is suggested that 40% of the natural vegetation for the affected habitat type represents a useful goal for rehabilitation. No goal for species richness is required, but the species used must be from the local environment and perennial in nature. These will have to be matched to their respective habitats.
- Using net barriers, geotextiles, active rehabilitation and other measures during and after decommissioning to minimise sand movement at the site.

With the effective implementation of the mitigation measures, it is likely that this impact can be reduced to an acceptable, **low significance**.

1.6.9. Decommissioning Phase Impact 2. Increased Alien Plant Invasion

There are already several alien species present on the site such as *Acacia cyclops* and disturbance created during decommissioning would leave the site vulnerable to further alien plant invasion.

Without mitigation this impact would likely be of **Moderate Significance**.

Essential mitigation measures would include:

- Alien management plan to be implemented during the decommissioning phase of the development, which makes provision for regular alien clearing and monitoring for up 5 years after decommissioning.
- Rehabilitation of disturbed areas that have been generated by decommsioning. Rehabilitation should restore ecological function to the affected areas, especially with regards to the return of vegetation cover to a predefined benchmark which is suggested as 40% of the natural of the vegetation cover for the habitat under consideration.

With the effective implementation of the mitigation measures, it is likely that this impact can be reduced to a **Low Significance**.

1.6.10. Cumulative Impact 1. Cumulative habitat loss and impact on broad-scale ecological processes

There are several other renewable energy developments in the wider area and along with the current development, these would potentially generate significant cumulative impacts on habitat loss and fragmentation and negative impact on broad-scale ecological processes such as dispersal and climate change resilience. However, not all of the developments in the area would impact on the same features and environment and overall, the current levels of cumulative development impact within the affected areas of the current development are relatively low. Currently, the major impact in the broad area is from diamond mining along the coastline, however areas further inland such as around Kap Vley have not been impacted to the same degree and are still largely intact.

Without mitigation, this impact is likely to be of **Moderate Significance.**

Essential mitigation measures would include:

- Avoid impact to restricted and specialised and high biodiversity-value habitats such as quartz patches.
- Minimise the current development footprint as much as possible and rehabilitate cleared areas after construction.
- Ensure that management of the facility occurs in a biodiversity-conscious manner in accordance with an open-space management plan for the facility.

With the effective implementation of the mitigation measures, it is likely that this impact will be reduced to a **Moderate to Low Significance**.

1.6.11. Cumulative Impact 2. Decreased ability to meet conservation targets

Although the affected vegetation types at the site are all classified as Least Threatened, this does not provide an adequate measure of the impact of the development on the ability to meet

conservation targets. The majority of the SCC that would be affected by the development are associated with the areas of Namaqualand Sand Fynbos, which has not been adequately mapped in the current revision of the National Vegetation Map. In addition, there are several different plant communities and habitat types present within the Namakwa Sand Fynbos vegetation unit. Currently, there are some areas of Sand Fynbos conserved within the Namakwa National Park, but the majority of this vegetation unit is still unprotected. In addition, some of the larger tracts such as inland of Hondeklipbay are under mining applications, with the result that the conservation status of this unit is likely to rise in the future as it becomes increasingly difficult to meet targets for this unit. Although the significance of the overall impact on sensitive habitats would be relatively low due to the avoidance that has been implemented, wind farm developments are not currently viewed as compatible with formal conservation and as a result, the development of the site would lower the desirability of the site for future conservation expansion.

Without mitigation, this impact is likely to be of **Moderate Significance**

Essential mitigation measures would include:

- An offset study to assess the suitability of an offset to mitigate the impacts of the development must be undertaken. (Such as study forms part of the EIA process and the outcomes of this offset study can be incorporated in the RoD should DEA feel that the offset is a warranted mitigation measure. This is recommended case from this study as well as the offset study)
- Identify other areas with a similar range of habitats and features to the current site, that might be used as target for the offset.
- Engage with the provincial and national conservation authorities on the implications of the current development for future conservation expansion in the area.

With the effective implementation of the mitigation measures, it is likely that this impact can be reduced to a **Low Significance**.

1.7. IMPACT ASSESSMENT SUMMARY

The assessment of impacts and recommendation of mitigation measures as discussed above are collated in Table 1-1 to 1-4 below. Impacts are assessed for the construction, operational and decommissioning phases of the development as well as for overall cumulative impacts.

Table 1-1 Impact assessment summary table for the Construction Phase

CONSTRUCTION PHASE													
Direct impacts													
Impact on vegetation and plant SCC													
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance o residual risk/impact (after mitigation)**	**Ranking o impact/ risk**	**Confidence level**
Habitat Loss	**-**	**Local**	**Long-term**	**Substantial**	**Very Likely**	**Low**	**Moderate**	**High Risk (2)**	**Partly**	**Partly**	**Moderate**	**3**	**High**
Suggested Mitigation: • No development of turbines, roads or other infrastructure within No-Go areas. • Preconstruction walk-through of the development footprint to further refine the layout and reduce impacts on SCC through micro-siting of the turbines and access roads. • Demarcate all areas to be cleared with construction tape or other appropriate and effective means. However caution should be exercised to avoid using material that might entangle fauna.													
Faunal Impacts due to construction													
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance o residual risk/impact (after mitigation)**	**Ranking o impact/ risk**	**Confidence level**
Habitat Loss	**-**	**Local**	**Long-term**	**Substantial**	**Very Likely**	**Moderate**	**Moderate**	**Moderate Risk (3)**	**Partly**	**Partly**	**Moderate**	**3**	**High**

Suggested Mitigation:

- Avoidance of identified areas of high faunal importance at the design stage.
- Ensure that lay-down and other temporary infrastructure is within medium- or low- sensitivity areas, preferably previously transformed areas if possible.
- Search and rescue for reptiles and other vulnerable species during construction, before areas are cleared.
- During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
- Limit access to the site and ensure that construction staff and machinery remain within the demarcated construction areas during the construction phase.
- Environmental induction for all staff and contractors on-site.
- All construction vehicles should adhere to a low speed limit (40km/h for cars and 30km/h for trucks) to avoid collisions with susceptible species such as snakes and tortoises and rabbits or hares. Speed limits should apply within the facility as well as on the public gravel access roads to the site.
- If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs) as far as practically possible, which do not attract insects and which should be directed downwards.

Table 1-2 Impact assessment summary table for the Operational Phase

OPERATIONAL PHASE													
Direct impacts													
Increased soil erosion													
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance o residual risk/impact (after mitigation)**	**Ranking o impact/ risk**	**Confidence level**
Disturbance	**-**	**Local**	**Long-term**	**Substantial**	**Very Likely**	**Moderate**	**Moderate**	**Moderate Risk (3)**	**Yes**	**Yes**	**Low**	**4**	**High**
Suggested Mitigation: • Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. • All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • All cleared areas should be revegetated with indigenous perennial species from the local area. • Avoid areas of high wind erosion vulnerability as much as possible. • Use net barriers, geotextiles, active rehabilitation and other measures during and after construction to minimise sand movement at the site.													
Increased alien plant invasion													
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance o residual risk/impact (after mitigation)**	**Ranking o impact/ risk**	**Confidence level**

Disturbance	**-**	**Local**	**Medium-term**	**Substantial**	**Very Likely**	**Moderate**	**Moderate**	**Moderate Risk (3)**	**Yes**	**Yes**	**Low**	**4**	**High**
Suggested Mitigation: • Alien management plan to be implemented during the operational phase of the development, which makes provision for regular alien clearing and monitoring. • Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. • Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem woody species such as *Acacia cyclops* are already present in the area and are likely to increase rapidly if not controlled. • Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems. • Regular alien clearing should be conducted, as needed, using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.													
Operational impacts on fauna													
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance o residual risk/impact (after mitigation)**	**Ranking o impact/ risk**	**Confidence level**
Noise & Disturbance	**-**	**Local**	**Long-term**	**Moderate**	**Likely**	**Moderate**	**Moderate**	**Moderate Risk (3)**	**Partly**	**Partly**	**Low**	**4**	**High**

Suggested Mitigation:

- Open space management plan for the development, which makes provision for favourable management of the facility and the surrounding area for fauna.
- Limiting access to the site to staff and contractors only.
- Appropriate design of roads and other infrastructure where appropriate to minimise faunal impacts and allow fauna to pass through or underneath these features.
- No electrical fencing within 20cm of the ground as tortoises become stuck against such fences and are electrocuted to death.
- If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs) as far as possible, which do not attract insects.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.

Impacts on Critical Biodiversity Areas

Impact pathway	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Significance o residual risk/impact (after mitigation)	Ranking o impact/ risk	Confidence level
Habitat loss and disturbance	-	Local	Long-term	Moderate	Likely	Moderate	Moderate	Moderate Risk (3)	Partly	Partly	Moderate	3	High

Suggested Mitigation:

- Minimise the development footprint as far as possible, which includes locating temporary-use areas such as construction camps and lay-down areas in previously disturbed areas.
- Avoid impact to restricted and specialised habitats such as quartz patches or active dune fields.
- Investigate the potential of implementing an offset to mitigate the residual impact on CBAs.

Table 1-3 Impact assessment summary table for the Decommissioning Phase

DECOMMISSIONING PHASE													
Direct impacts													
Increased soil erosion													
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance o residual risk/impact (after mitigation)**	**Ranking o impact/ risk**	**Confidence level**
Habitat loss and disturbance	**-**	**Local**	**Long-term**	**Severe**	**Very Likely**	**Low**	**Moderate**	**High Risk (2)**	**Yes**	**Yes**	**Low**	**4**	**High**
Suggested Mitigation: • All hard infrastructure should be removed and the footprint areas rehabilitated with locally-sourced perennial species. • The use of net barriers, geotextiles, active rehabilitation and other measures after decommissioning to minimise sand movement and enhance revegetation at the site. • Monitoring of rehabilitation success at the site for at least 5 years after decommissioning or until the rehabilitation benchmarks and criteria have been met. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.													
Increased alien plant invasion													
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance o residual risk/impact (after mitigation)**	**Ranking o impact/ risk**	**Confidence level**
Habitat loss and disturbance	**-**	**Local**	**Long-term**	**Severe**	**Very Likely**	**Low**	**Moderate**	**High Risk (2)**	**Yes**	**Yes**	**Low**	**4**	**High**

Suggested Mitigation:

- Alien management plan to be implemented during the decommissioning phase of the development, which makes provision for regular alien clearing and monitoring for at least 5 years after decommissioning.
- Active rehabilitation and revegetation of previously disturbed areas with indigenous species selected from the local environment.
- Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after decommissioning activities are complete to encourage natural regeneration of the local indigenous species.
- Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned.
- Regular monitoring for alien plants within the disturbed areas for at least five years after decommissioning or until alien invasives are no longer a problem at the site.
- Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

Table 1-4 Impact assessment summary table for Cumulative Impacts

Cumulative Impacts														
Cumulative habitat loss and impact on broad scale ecological processes														
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk = consequence x probability (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**		**Significance of residual risk/impact (after mitigation)**	**Ranking of impact/ risk**	**Confidence level**
Habitat loss and disturbance	**-**	**Regional**	**Long-term**	**Substantial**	**Very Likely**	**Low**	**Moderate**	**Moderate Risk (3)**	**Partly**	**Partly**		**Moderate**	**3**	**High**
Suggested Mitigation: • Minimise the development footprint as far as possible. • The facility should be managed in a biodiversity-conscious manner in accordance with an open-space management plan for the facility. • Ensure that on-site impacts on plant SCC are maintained at acceptable levels through avoidance of significant populations of these species. • Investigate the potential for an offset to mitigate the residual impacts of the development.														
Impaired ability to meet conservation targets														
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk = consequence x probability (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**		**Significance of residual risk/impact (after mitigation)**	**Ranking of impact/ risk**	**Confidence level**
Habitat loss and disturbance	**-**	**Regional**	**Long-term**	**Substantial**	**Very Likely**	**Low**	**Moderate**	**Moderate Risk (3)**	**Partly**	**Partly**		**Low**	**4**	**High**

Suggested Mitigation:

- Investigate the potential for the development of an offset to mitigate the residual impact of the current development.
- Identify other areas with a similar range of habitats and features to the current site, that might be used as target for the offset.
- Engage with the provincial and national conservation authorities on the implications of the current development for future conservation expansion in the area.

1.8. CONCLUSIONS AND RECOMMENDATIONS

The Kap Vley site is located within an area that is a recognised area of biodiversity significance. This is reflected in the inclusion of the area as a Tier 1 CBA as well as a Primary Focus Area for future conservation expansion. The fieldwork that has been conducted at the site confirms the presence of numerous plant species and habitats of conservation concern. Given these sensitivities, the prospect of development at the site raises the potential for significant ecological impact. A number of avoidance and mitigation measures have been implemented in the layout and planning phases of the development to reduce these impacts as far as possible. This includes a detailed walk-through of the entire development footprint to identify and map populations of species of conservation concern as well as map sensitive features and no-go areas. An important result of this detailed fieldwork is that a number of No-Go areas were delineated. These were identified as being unique and sensitive areas were no development is considered appropriate. These areas are delineated with the specific purpose of avoiding high residual impacts at the site and maintaining the ecological functioning of the area. The delineation of these areas is an important action which is considered to be a key step in ensuring that the on-site impacts of the Kap Vley development remain acceptable. A number of High Sensitivity areas were also identified which are largely areas with a high abundance of plant SCC or disturbance-sensitive habitats such as mobile dunes. No turbines have been located within these High Sensitivity areas.

The detailed mapping of the distribution of plant SCC has allowed for impact on these species to be minimised. As all populations of these species within or near the development footprint have been mapped, the extent of impact on these species can be well estimated. Significant avoidance of important populations of these species has been implemented and no more than 2% of the on-site population of any of these species would be impacted by the development. No local populations of these species would be compromised by the development or elevated to a higher level of conservation concern. Impacts on SCC is therefore considered to be acceptable.

Given the extensive on-site mitigation that has been implemented by the developer, it is clear that the mitigation hierarchy has been well-applied at the site and it is only the potential impact on the affected CBAs and the loss of future conservation options which are likely to result in impacts of moderate significance after on site-mitigation. As development within CBAs is not considered desirable and may generate significant impacts on biodiversity, this raises the potential need for off-site mitigation measures to mitigate this this impact to a low level. As such, a stand-alone offset study has been developed to inform the utility and feasibility of developing an offset to mitigate the residual impacts of the development on CBAs. This further explores the potential impact of the development on CBAs and future conservation options in the area, identifies the appropriate offset ratio to be used and lays out the required actions to implement the offset. In terms of this study, the relevant outcome is that suitable biodiversity offset areas are available in the broader area and if implemented, would contribute to meeting conservation targets for the affected habitats. An offset is therefore considered a viable possibility that can be used to offset the residual impact of the current development.

Ecological Impact Statement:

The Kap Vley site is considered to be a broadly sensitive environment due to the presence of numerous species and habitats of conservation concern. These have however been mapped in detail and effective avoidance implemented with regards to the layout of the proposed wind farm. As a result of this avoidance, on-site impacts on fauna and flora have been reduced to Low Significance after mitigation and are considered acceptable. However, impacts on CBAs and Protected Area Expansion Strategy Expansion focus areas cannot be effectively mitigated and impacts of Moderate significance after on-site mitigation on these features are expected. This fulfils the basic requirements for an offset and, with the implementation of an offset, residual impacts associated with the development can be reduced to an overall Low Significance. As such, the development, with the implementation of an offset is considered to have acceptable terrestrial ecological impacts and is therefore supported from a terrestrial ecological point of view.

1.9. REFERENCES

Alexander, G. & Marais, J. 2007. *A Guide to the Reptiles of Southern Africa*. Struik Nature, Cape Town.

Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J. & de Villiers, M. S. 2013. Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. Strelitzia 32. SANBI, Pretoria.

Branch W.R. 1998. *Field guide to snakes and other reptiles of southern Africa*. Struik, Cape Town.

Department of Environmental Affairs and Tourism, 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species. Government Gazette, Republic of South Africa.

Du Preez, L. & Carruthers, V. 2009. *A Complete Guide to the Frogs of Southern Africa*. Struik Nature., Cape Town.

EWT & SANBI, 2016. Red List of Mammals of South Africa, Lesotho and Swaziland. EWT, Johannesburg.

Ennen, J. R., Lovich, J. E., Meyer, K. P., Bjurlin, C., & Arundel, T. R. (2012). Nesting ecology of a population of Gopherus agassizii at a utility-scale wind energy facility in southern California. *Copeia*, *2012*(2), 222-228.

Lovich, J. E., Ennen, J. R., Madrak, S., Meyer, K., Loughran, C., Bjurlin, C. U. R. T. I. S., ... & Groenendaal, G. M. (2011). Effects of wind energy production on growth, demography and survivorship of a desert tortoise (Gopherus agassizii) population in southern California with comparisons to natural populations. *Herpetological Conservation and Biology*, *6*(2), 161-174.

Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ & Kloepfer D (eds). 2004. *Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland*. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.

Mucina L. & Rutherford M.C. (eds) 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Oosthuysen, E. & Holness, S. 2016. Northern Cape Critical Biodiversity Areas (CBA) Map. https://cirrus.nmmu.ac.za/index.php/s/20fe43905396fca0025948bc0d3b514d. Northern

Cape Department of Environment and Nature Conservation & Nelson Mandela Metropolitan University.

Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.

1.10. APPENDICES

1.10.1. Appendix 1. List of Plants

List of plant species observed present at Kap Vley based on fieldwork at the site.

Family	Genus	Species	Sub Species	IUCN Status
Acanthaceae	*Blepharis*	*macra*		LC
Acanthaceae	*Justicia*	*cuneata*	*latifolia*	LC
Acanthaceae	*Justicia*	*spartioides*		LC
Agavaceae	*Chlorophytum*	*undulatum*		LC
Aizoaceae	*Aizoon*	*canariense*		LC
Aizoaceae	*Antimima*	*koekenaapensis*		VU
Aizoaceae	*Antimima*	*watermeyeri*		LC
Aizoaceae	*Arenifera*	*stylosa*		LC
Aizoaceae	*Cephalophyllum*	*ebracteatum*		LC
Aizoaceae	*Cephalophyllum*	*pillansii*		LC
Aizoaceae	*Cleretum*	*rourkei*		LC
Aizoaceae	*Conicosia*	*elongata*		LC
Aizoaceae	*Conophytum*	*frutescens*		LC
Aizoaceae	*Drosanthemum*	*hispidum*		LC
Aizoaceae	*Galenia*	*africana*		LC
Aizoaceae	*Galenia*	*fruticosa*		LC
Aizoaceae	*Galenia*	*sarcophylla*		LC
Aizoaceae	*Galenia*	*secunda*		LC
Aizoaceae	*Hallianthus*	*planus*		LC
Aizoaceae	*Jordaaniella*	*spongiosa*		LC
Aizoaceae	*Lampranthus*	*otzenianus*		LC
Aizoaceae	*Leipoldtia*	*schultzei*		LC
Aizoaceae	*Mesembryanthemum*	*noctiflorum*	*stramineum*	LC
Aizoaceae	*Mesembryanthemum*	*spinuliferum*		LC
Aizoaceae	*Mesembryanthemum*	*subnodosum*		LC
Aizoaceae	*Ruschia*	*goodiae*		LC
Aizoaceae	*Ruschiella*	*lunulata*		LC
Aizoaceae	*Stoeberia*	*utilis*		LC
Aizoaceae	*Tetragonia*	*echinata*		LC
Aizoaceae	*Tetragonia*	*fruticosa*		LC
Aizoaceae	*Tetragonia*	*spicata*		LC
Amaranthaceae	*Chenopodium*	*murale*	*murale*	Alien
Amaranthaceae	*Hermbstaedtia*	*glauca*		LC
Amaranthaceae	*Manochlamys*	*albicans*		LC
Amaryllidaceae	*Brunsvigia*	*bosmaniae*		LC
Amaryllidaceae	*Gethyllis*	*britteniana*	*britteniana*	LC
Amaryllidaceae	*Gethyllis*	*grandiflora*		LC
Amaryllidaceae	*Haemanthus*	*coccineus*		LC
Anacampserotaceae	*Anacampseros*	*filamentosa*	*namaquensis*	LC
Anacampserotaceae	*Anacampseros*	*lanceolata*	*lanceolata*	LC
Anacampserotaceae	*Avonia*	*albissima*		LC
Anacardiaceae	*Ozoroa*	*dispar*		LC
Anacardiaceae	*Searsia*	*incisa*	*incisa*	LC
Anacardiaceae	*Searsia*	*laevigata*	*laevigata*	LC
Anacardiaceae	*Searsia*	*longispina*		LC
Anacardiaceae	*Searsia*	*populifolia*		LC
Anacardiaceae	*Searsia*	*undulata*		LC
Apiaceae	*Deverra*	*denudata*	*aphylla*	LC
Apocynaceae	*Fockea*	*sinuata*		LC
Apocynaceae	*Microloma*	*sagittatum*		LC

Apocynaceae	*Quaqua*	*mammillaris*		LC
Asparagaceae	*Asparagus*	*alopecurus*		LC
Asparagaceae	*Asparagus*	*asparagoides*		LC
Asparagaceae	*Asparagus*	*capensis*	*capensis*	LC
Asparagaceae	*Asparagus*	*exuvialis*	*exuvialis*	LC
Asparagaceae	*Asparagus*	*fasciculatus*		LC
Asparagaceae	*Asparagus*	*juniperoides*		LC
Asparagaceae	*Asparagus*	*lignosus*		LC
Asparagaceae	*Asparagus*	*multituberosus*		LC
Asphodelaceae	*Bulbine*	*frutescens*		LC
Asphodelaceae	*Bulbine*	*mesembryanthoides*	*mesembryanthoides*	LC
Asphodelaceae	*Trachyandra*	*ciliata*		LC
Asphodelaceae	*Trachyandra*	*revoluta*		LC
Asteraceae	*Amellus*	*microglossus*		LC
Asteraceae	*Amphiglossa*	*tomentosa*		LC
Asteraceae	*Arctotheca*	*calendula*		LC
Asteraceae	*Arctotis*	*fastuosa*		LC
Asteraceae	*Arctotis*	*revoluta*		LC
Asteraceae	*Athanasia*	*flexuosa*		LC
Asteraceae	*Berkheya*	*fruticosa*		LC
Asteraceae	*Chrysocoma*	*longifolia*		LC
Asteraceae	*Cotula*	*barbata*		LC
Asteraceae	*Cotula*	*tenella*		LC
Asteraceae	*Crassothonna*	*cylindrica*		LC
Asteraceae	*Crassothonna*	*sedifolia*		LC
Asteraceae	*Didelta*	*carnosa*	*carnosa*	LC
Asteraceae	*Dimorphotheca*	*pluvialis*		LC
Asteraceae	*Dimorphotheca*	*sinuata*		LC
Asteraceae	*Dimorphotheca*	*tragus*		LC
Asteraceae	*Eriocephalus*	*microphyllus*	*pubescens*	LC
Asteraceae	*Eriocephalus*	*racemosus*	*racemosus*	LC
Asteraceae	*Euryops*	*dregeanus*		LC
Asteraceae	*Felicia*	*dregei*		LC
Asteraceae	*Felicia*	*hyssopifolia*	*glabra*	LC
Asteraceae	*Felicia*	*merxmuelleri*		LC
Asteraceae	*Gazania*	*heterochaeta*		LC
Asteraceae	*Gorteria*	*diffusa*	*diffusa*	LC
Asteraceae	*Helichrysum*	*hebelepis*		LC
Asteraceae	*Helichrysum*	*leontonyx*		LC
Asteraceae	*Helichrysum*	*pumilio*	*pumilio*	LC
Asteraceae	*Hirpicium*	*alienatum*		LC
Asteraceae	*Kleinia*	*cephalophora*		LC
Asteraceae	*Lasiopogon*	*micropoides*		LC
Asteraceae	*Leysera*	*gnaphalodes*		LC
Asteraceae	*Leysera*	*tenella*		LC
Asteraceae	*Metalasia*	*adunca*		NT
Asteraceae	*Nestlera*	*biennis*		LC
Asteraceae	*Oncosiphon*	*suffruticosus*		LC
Asteraceae	*Osteospermum*	*hyoseroides*		LC
Asteraceae	*Osteospermum*	*monstrosum*		LC
Asteraceae	*Osteospermum*	*oppositifolium*		LC
Asteraceae	*Pentatrichia*	*petrosa*		LC
Asteraceae	*Pteronia*	*ciliata*		LC
Asteraceae	*Pteronia*	*divaricata*		LC
Asteraceae	*Pteronia*	*glauca*		LC
Asteraceae	*Pteronia*	*incana*		LC
Asteraceae	*Pteronia*	*undulata*		LC
Asteraceae	*Senecio*	*cinerascens*		LC
Asteraceae	*Stoebe*	*nervigera*		LC

Asteraceae	*Ursinia*	*chrysanthemoides*		LC
Boraginaceae	*Amsinckia*	*menziesii*		Alien
Boraginaceae	*Codon*	*royenii*		LC
Boraginaceae	*Lobostemon*	*glaucophyllus*		LC
Brassicaceae	*Raphanus*	*raphanistrum*		Alien
Campanulaceae	*Wahlenbergia*	*annularis*		LC
Campanulaceae	*Wahlenbergia*	*oxyphylla*		LC
Campanulaceae	*Wahlenbergia*	*psammophila*		LC
Caryophyllaceae	*Dianthus*	*namaensis*	*dinteri*	LC
Caryophyllaceae	*Pollichia*	*campestris*		LC
Caryophyllaceae	*Spergularia*	*media*		Alien
Celastraceae	*Gymnosporia*	*buxifolia*		LC
Crassulaceae	*Adromischus*	*alstonii*		LC
Crassulaceae	*Adromischus*	*filicaulis*	*filicaulis*	LC
Crassulaceae	*Adromischus*	*marianiae*	*immaculatus*	LC
Crassulaceae	*Cotyledon*	*orbiculata*	*oblonga*	LC
Crassulaceae	*Crassula*	*barklyi*		LC
Crassulaceae	*Crassula*	*cotyledonis*		LC
Crassulaceae	*Crassula*	*deceptor*		LC
Crassulaceae	*Crassula*	*elegans*	*elegans*	LC
Crassulaceae	*Crassula*	*hirsuta*		LC
Crassulaceae	*Crassula*	*hirtipes*		LC
Crassulaceae	*Crassula*	*macowaniana*		LC
Crassulaceae	*Crassula*	*namaquensis*		LC
Crassulaceae	*Crassula*	*pseudohemisphaerica*		LC
Crassulaceae	*Crassula*	*tetragona*	*rudis*	LC
Crassulaceae	*Tylecodon*	*grandiflorus*		LC
Crassulaceae	*Tylecodon*	*reticulatus*	*reticulatus*	LC
Crassulaceae	*Tylecodon*	*similis*		LC
Cucurbitaceae	*Kedrostis*	*psammophylla*		LC
Ebenaceae	*Diospyros*	*austro-africana*	*austro-africana*	LC
Ebenaceae	*Diospyros*	*ramulosa*		LC
Ebenaceae	*Euclea*	*racemosa*		LC
Euphorbiaceae	*Euphorbia*	*hamata*		LC
Euphorbiaceae	*Euphorbia*	*rhombifolia*		LC
Fabaceae	*Argyrolobium*	*velutinum*		VU
Fabaceae	*Aspalathus*	*albens*		LC
Fabaceae	*Aspalathus*	*pulicifolia*		LC
Fabaceae	*Aspalathus*	*spinescens*	*lepida*	LC
Fabaceae	*Calobota*	*lotononoides*		NT
Fabaceae	*Calobota*	*sericea*		LC
Fabaceae	*Indigofera*	*alternans*	*alternans*	LC
Fabaceae	*Indigofera*	*nigromontana*		LC
Fabaceae	*Lessertia*	*pauciflora*	*schlechteri*	DD
Fabaceae	*Melolobium*	*candicans*		LC
Fabaceae	*Vachellia*	*erioloba*		LC
Fabaceae	*Wiborgia*	*monoptera*		LC
Fabaceae	*Wiborgia*	*obcordata*		LC
Fabaceae	*Wiborgia*	*sericea*		LC
Fabaceae	*Wiborgia*	*tetraptera*		LC
Fabaceae	*Wiborgiella*	*humilis*		VU
Geraniaceae	*Erodium*	*cicutarium*		Alien
Geraniaceae	*Monsonia*	*ciliata*		LC
Geraniaceae	*Pelargonium*	*crithmifolium*		LC
Geraniaceae	*Pelargonium*	*echinatum*		LC
Geraniaceae	*Pelargonium*	*fulgidum*		LC
Geraniaceae	*Pelargonium*	*gibbosum*		LC
Geraniaceae	*Pelargonium*	*praemorsum*	*praemorsum*	LC
Hyacinthaceae	*Albuca*	*namaquensis*		LC

Hyacinthaceae	*Albuca*	*spiralis*		LC
Hyacinthaceae	*Lachenalia*	*mutabilis*		LC
Iridaceae	*Aristea*	*dichotoma*		LC
Iridaceae	*Babiana*	*hirsuta*		NT
Iridaceae	*Ferraria*	*divaricata*		LC
Iridaceae	*Ferraria*	*ferrariola*		LC
Iridaceae	*Lapeirousia*	*arenicola*		LC
Iridaceae	*Watsonia*	*meriana*	*meriana*	LC
Lamiaceae	*Ballota*	*africana*		LC
Lamiaceae	*Salvia*	*africana-lutea*		LC
Lamiaceae	*Salvia*	*dentata*		LC
Lamiaceae	*Stachys*	*rugosa*		LC
Limeaceae	*Limeum*	*africanum*	*canescens*	LC
Limeaceae	*Limeum*	*fenestratum*	*fenestratum*	LC
Malvaceae	*Hermannia*	*amoena*		LC
Malvaceae	*Hermannia*	*cuneifolia*	*cuneifolia*	LC
Malvaceae	*Hermannia*	*disermifolia*		LC
Malvaceae	*Hermannia*	*trifurca*		LC
Melianthaceae	*Melianthus*	*elongatus*		LC
Menispermaceae	*Cissampelos*	*capensis*		LC
Molluginaceae	*Adenogramma*	*glomerata*		LC
Molluginaceae	*Pharnaceum*	*croceum*		LC
Moraceae	*Ficus*	*ilicina*		LC
Neuradaceae	*Grielum*	*humifusum*	*humifusum*	LC
Orobanchaceae	*Harveya*	*squamosa*		LC
Orobanchaceae	*Hyobanche*	*sanguinea*		LC
Oxalidaceae	*Oxalis*	*flava*		LC
Oxalidaceae	*Oxalis*	*obtusa*		LC
Plumbaginaceae	*Dyerophytum*	*africanum*		LC
Poaceae	*Chaetobromus*	*involucratus*	*dregeanus*	LC
Poaceae	*Cladoraphis*	*cyperoides*		LC
Poaceae	*Cladoraphis*	*spinosa*		LC
Poaceae	*Ehrharta*	*barbinodis*		LC
Poaceae	*Ehrharta*	*calycina*		LC
Poaceae	*Fingerhuthia*	*africana*		LC
Poaceae	*Stipagrostis*	*ciliata*	*capensis*	LC
Poaceae	*Stipagrostis*	*namaquensis*		LC
Poaceae	*Stipagrostis*	*zeyheri*	*macropus*	LC
Polygalaceae	*Muraltia*	*obovata*		VU
Proteaceae	*Leucadendron*	*brunioides*	*brunioides*	LC
Proteaceae	*Leucospermum*	*praemorsum*		VU
Restionaceae	*Thamnochortus*	*bachmannii*		LC
Restionaceae	*Willdenowia*	*incurvata*		LC
Rubiaceae	*Anthospermum*	*spathulatum*	*spathulatum*	LC
Rubiaceae	*Nenax*	*arenicola*		LC
Rutaceae	*Diosma*	*acmaeophylla*		LC
Scrophulariaceae	*Dischisma*	*spicatum*		LC
Scrophulariaceae	*Hemimeris*	*racemosa*		LC
Scrophulariaceae	*Lyperia*	*tristis*		LC
Scrophulariaceae	*Teedia*	*lucida*		LC
Solanaceae	*Lycium*	*amoenum*		LC
Solanaceae	*Lycium*	*cinereum*		LC
Solanaceae	*Lycium*	*oxycarpum*		LC
Solanaceae	*Solanum*	*burchellii*		LC
Tecophilaeaceae	*Cyanella*	*hyacinthoides*		LC
Thymelaeaceae	*Passerina*	*truncata*	*truncata*	LC
Zygophyllaceae	*Roepera*	*cordifolia*		LC
Zygophyllaceae	*Roepera*	*morgsana*		LC

1.10.2. Appendix 2. List of Mammals

List of Mammals known from the broad area around the Kap Vley site, based on the MammalMap Database (http://vmus.adu.org.za)**,** with species confirmed present at the site indicated in **bold.**

Family	Genus	Species	Common name	Red list category
Bathyergidae	*Bathyergus*	*janetta*	Namaqua Dune Mole-rat	Least Concern
Bathyergidae	*Bathyergus*	*suillus*	Cape Dune Mole-rat	Least Concern
Bathyergidae	***Cryptomys***	***hottentotus***	**Southern African Mole-rat**	**Least Concern**
Bovidae	*Antidorcas*	*marsupialis*	Springbok	Least Concern
Bovidae	*Oreotragus*	*oreotragus*	Klipspringer	Least Concern
Bovidae	***Raphicerus***	***campestris***	**Steenbok**	**Least Concern**
Bovidae	***Sylvicapra***	***grimmia***	**Bush Duiker**	**Least Concern**
Canidae	***Canis***	***mesomelas***	**Black-backed Jackal**	**Least Concern**
Canidae	***Otocyon***	***megalotis***	**Bat-eared Fox**	**Least Concern**
Canidae	***Vulpes***	***chama***	**Cape Fox**	**Least Concern**
Cercopithecidae	***Papio***	***ursinus***	**Chacma Baboon**	**Least Concern**
Felidae	***Caracal***	***caracal***	**Caracal**	**Least Concern**
Felidae	***Felis***	***silvestris***	**African Wildcat**	**Least Concern**
Felidae	*Panthera*	*pardus*	Leopard	Vulnerable
Herpestidae	***Cynictis***	***penicillata***	**Yellow Mongoose**	**Least Concern**
Herpestidae	***Herpestes***	***pulverulentus***	**Cape Gray Mongoose**	**Least Concern**
Herpestidae	***Suricata***	***suricatta***	**Meerkat**	**Least Concern**
Hyaenidae	*Proteles*	*cristata*	Aardwolf	Least Concern
Hystricidae	***Hystrix***	***africaeaustralis***	**Cape Porcupine**	**Least Concern**
Leporidae	***Lepus***	***capensis***	**Cape Hare**	**Least Concern**
Leporidae	***Lepus***	***saxatilis***	**Scrub Hare**	**Least Concern**
Leporidae	***Pronolagus***	***rupestris***	**Smith's Red Rock Hare**	**Least Concern**
Macroscelididae	***Elephantulus***	***rupestris***	**Western Rock Elephant Shrew**	**Least Concern**
Macroscelididae	*Macroscelides*	*proboscideus*	Short-eared Elephant Shrew	Least Concern
Muridae	***Aethomys***	***namaquensis***	**Namaqua Rock Mouse**	**Least Concern**
Muridae	*Desmodillus*	*auricularis*	Cape Short-tailed Gerbil	Least Concern
Muridae	***Gerbilliscus***	***paeba***	**Paeba Hairy-footed Gerbil**	**Least Concern**
Muridae	*Otomys*	*auratus*	Southern African Vlei Rat	Least Concern
Muridae	*Otomys*	*unisulcatus*	Karoo Bush Rat	Least Concern
Muridae	*Parotomys*	*brantsii*	Brants's Whistling Rat	Least Concern
Muridae	*Parotomys*	*littledalei*	Littledale's Whistling Rat	Near Threatened
Muridae	***Rhabdomys***	***pumilio***	**Xeric Four-striped Grass Rat**	**Least Concern**
Mustelidae	*Aonyx*	*capensis*	African Clawless Otter	Near Threatened
Mustelidae	***Ictonyx***	***striatus***	**Striped Polecat**	**Least Concern**
Mustelidae	***Mellivora***	***capensis***	**Honey Badger**	**Least Concern**
Orycteropodidae	*Orycteropus*	*afer*	Aardvark	Least Concern
Petromuridae	*Petromus*	*typicus*	Dassie Rat	Least Concern

Procaviidae	***Procavia***	***capensis***	**Rock Hyrax**	**Least Concern**
Sciuridae	***Xerus***	***inauris***	**South African Ground Squirrel**	**Least Concern**
Soricidae	*Crocidura*	*cyanea*	Reddish-gray Musk Shrew	Least Concern
Soricidae	*Suncus*	*varilla*	Lesser Dwarf Shrew	Least Concern
Viverridae	*Genetta*	*genetta*	Common Genet	Least Concern

1.10.3. Appendix 3. List of Reptiles

List of Reptiles known from the vicinity of the Kap Vley site, based on records from the ReptileMap database. Conservation status is from Bates *et al*. 2013.

Family	Genus	Species	Subspecies	Common name	Red list category
Agamidae	*Agama*	*atra*		Southern Rock Agama	Least Concern
Agamidae	*Agama*	*hispida*		Spiny Ground Agama	Least Concern
Chamaeleonidae	*Bradypodion*	*occidentale*		Western Dwarf Chameleon	Least Concern
Chamaeleonidae	*Chamaeleo*	*namaquensis*		Namaqua Chameleon	Least Concern
Colubridae	*Dipsina*	*multimaculata*		Dwarf Beaked Snake	Least Concern
Colubridae	*Telescopus*	*beetzii*		Beetz's Tiger Snake	Least Concern
Cordylidae	*Karusasaurus*	*polyzonus*		Karoo Girdled Lizard	Least Concern
Elapidae	*Aspidelaps*	*lubricus*	*lubricus*	Coral Shield Cobra	Not listed
Elapidae	*Naja*	*nivea*		Cape Cobra	Least Concern
Gekkonidae	*Chondrodactylus*	*angulifer*	*angulifer*	Common Giant Ground Gecko	Least Concern
Gekkonidae	*Chondrodactylus*	*bibronii*		Bibron's Gecko	Least Concern
Gekkonidae	*Goggia*	*lineata*		Northern Striped Pygmy Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*austeni*		Austen's Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*barnardi*		Barnard's Rough Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*labialis*		Western Cape Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*weberi*		Weber's Gecko	Least Concern
Gekkonidae	*Phelsuma*	*ocellata*		Namaqua Day Gecko	Least Concern
Gekkonidae	*Ptenopus*	*garrulus*	*maculatus*	Spotted Barking Gecko	Least Concern
Gerrhosauridae	*Cordylosaurus*	*subtessellatus*		Dwarf Plated Lizard	Least Concern
Gerrhosauridae	*Gerrhosaurus*	*typicus*		Karoo Plated Lizard	Least Concern
Lacertidae	*Meroles*	*ctenodactylus*		Giant Desert Lizard	Least Concern
Lacertidae	*Meroles*	*knoxii*		Knox's Desert Lizard	Least Concern
Lacertidae	*Meroles*	*suborbitalis*		Spotted Desert Lizard	Least Concern
Lacertidae	*Nucras*	*tessellata*		Western Sandveld Lizard	Least Concern
Lamprophiidae	*Lamprophis*	*guttatus*		Spotted House Snake	Least Concern
Lamprophiidae	*Prosymna*	*frontalis*		Southwestern Shovel-snout	Least Concern
Lamprophiidae	*Psammophis*	*crucifer*		Cross-marked Grass Snake	Least Concern
Lamprophiidae	*Psammophis*	*namibensis*		Namib Sand Snake	Least Concern
Lamprophiidae	*Psammophis*	*notostictus*		Karoo Sand Snake	Least Concern
Lamprophiidae	*Psammophylax*	*rhombeatus*	*rhombeatus*	Spotted Grass Snake	Least Concern
Lamprophiidae	*Pseudaspis*	*cana*		Mole Snake	Least Concern
Scincidae	*Acontias*	*litoralis*		Coastal Dwarf Legless Skink	Least Concern
Scincidae	*Acontias*	*tristis*		Namaqua Dwarf Legless Skink	Least Concern
Scincidae	*Scelotes*	*caffer*		Cape Dwarf Burrowing Skink	Least Concern
Scincidae	*Scelotes*	*sexlineatus*		Striped Dwarf Burrowing Skink	Least Concern
Scincidae	*Trachylepis*	*capensis*		Cape Skink	Least Concern

Scincidae	*Trachylepis*	*variegata*		Variegated Skink	Least Concern
Scincidae	*Typhlosaurus*	*vermis*		Pink Blind Legless Skink	Least Concern
Testudinidae	*Chersina*	*angulata*		Angulate Tortoise	Least Concern
Testudinidae	*Psammobates*	*tentorius*	*trimeni*	Namaqua Tent Tortoise	Not listed
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern

1.10.4. Appendix 4. List of Amphibians

List of Amphibians known from the vicinity of the Kap Vley site, based on records from the FrogMap database. Conservation status is from Minter et al. 2004.

Family	Genus	Species	Subspecies	Common name	Red list category
Brevicepitidae	*Breviceps*	*macrops*		Desert Rain Frog	Vulnerable
Brevicepitidae	*Breviceps*	*namaquensis*		Namaqua Rain Frog	Least Concern
Bufonidae	*Vandijkophrynus*	*gariepensis*	*gariepensis*	Karoo Toad (subsp. gariepensis)	Not listed
Bufonidae	*Vandijkophrynus*	*robinsoni*		Paradise Toad	Least Concern
Pipidae	*Xenopus*	*laevis*		Common Platanna	Least Concern
Pyxicephalidae	*Amietia*	*fuscigula*		Cape River Frog	Least Concern
Pyxicephalidae	*Tomopterna*	*delalandii*		Cape Sand Frog	Least Concern

Scoping and Environmental Impact Assessment for the proposed Kap Vley Wind Energy Facility near Kleinzee in the Northern Cape

UPDATED DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

APPENDIX H:

Bird Impact Assessment Report

BIRD IMPACT ASSESSMENT FOR THE PROPOSED KAP VLEY WIND ENERGY FACILITY AND ASSOCIATED GRID CONNECTION, NORTHERN CAPE PROVINCE

IMPACT ASSESSMENT REPORT

On behalf of

juwi Renewable Energies (Pty) Ltd

26 January 2018

Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited

Office 220 Cube Workspace
Icon Building
Cnr Long Street and Hans Strijdom Avenue
Cape Town
8001

T +27 (0) 21 412 1529 l **E** AshlinB@arcusconsulting.co.za
W www.arcusconsulting.co.za

Registered in South Africa No. 2015/416206/07

TABLE OF CONTENTS

Figures:

LIST OF ABBREVIATIONS

ADU	Animal Demography Unit
AEWA	Agreement on the Conservation of African-Eurasian Migratory Waterbirds
BFDs	Bird Flight Diverters
BLSA	BirdLife South Africa
CAR	Co-ordinated Avifaunal Road-count
CEMP	Construction Environmental Management Plan
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CWAC	Co-ordinated Water-bird Count
DEA	Department of Environmental Affairs
DT	Driven Transect
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
ESMP	Environmental and Social Management Plan
EWT	Endangered Wildlife Trust
FSSS	Flight Section Sensitivity Score
FS	Focal Site
GCSS	Grid Cell Sensitivity Score
IBA	Important Bird Area
IKA	Index of Kilometric Abundance
NEMA	National Environmental Management Act, No 107 of 1998
NFEPA	National Freshwater Ecosystem Priority Areas
OEMP	Operational Environmental Management Plan
PSS	Priority Species Score
RASOD	Radar Assisted Shutdown on Demand
RSH	Rotor Swept Height
SABAP	Southern African Bird Atlas Project
TOPS	Threatened or Protected Species List
UCT	University of Cape Town
VP	Vantage Point
WEF	Wind Energy Facility
WT	Walked Transect

CONTENTS OF THE SPECIALIST REPORT – CHECKLIST

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	Appendix II
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix II
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1 Section 2
(cA) an indication of the quality and age of base data used for the specialist report;	Sections 3.1;3.2; and 3.3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 6
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3.4 Appendix III
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 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 6 Figure 1
(g) an identification of any areas to be avoided, including buffers;	Section 3.7 Figure 6 Figure 7
(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;	Figure 7
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3.3
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	Section 6
(k) any mitigation measures for inclusion in the EMPr;	Section 6
(l) any conditions for inclusion in the environmental authorisation;	Section 6
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 6 Section 7
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	Section 7
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	3.8
(p) any other information requested by the competent authority	Section 2 (included in the ToR)
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.	N/A

1 INTRODUCTION

juwi Renewable Energies (Pty) Ltd ('juwi') are proposing to develop the Kap Vley Wind Energy Facility (WEF) on a site approximately 35 km south east of Kleinzee, in the Northern Cape Province ('the WEF site') (Figure 1). juwi also propose to develop a grid connection power line to connect the proposed Kap Vley WEF to the national electricity grid, at the Gromis Substation or the new Eskom substation near Kleinzee.

juwi have appointed Arcus Consultancy Services South Africa (Pty) Limited ('Arcus') to provide avifaunal specialist input in the form of a specialist Impact Assessment Report for this Project. This study comprises the bird impact assessment that was conducted to assess the potential impacts to birds that might occur through the proposed development of the Kap Vley WEF and the associated power line in the 200m wide corridor to support the Kap Vley WEF.

Arcus have also been appointed to conduct the required pre-construction bird monitoring for the WEF site, the results of which have advised the Environmental Impact Assessment (EIA) process.

1.1 Purpose and Aims

The purpose and aims of this report are to provide:

- A confirmation of the terms of reference adopted for the avifaunal study;
- Description of the monitoring programme as part of the impact assessment;
- Findings of the completed 12 month bird monitoring programme;
- A description of the avifaunal status quo (i.e. the avifaunal baseline), including a description of avifaunal microhabitats available on site;
- A description of potential predicted impacts to avifauna;
- An impact assessment and significance rating for each impact and a cumulative impact assessment; and
- Recommendations and required mitigation measures.

1.2 Project Description

The proposed project consists of two components, the Kap Vley WEF and Kap Vley WEF Grid Connection (assessed separately in Section 6). The proposed Kap Vley WEF is located south east of Kleinzee in the Nama Khoi Local Municipality in the Northern Cape.. The proposed Kap Vley WEF will be constructed on the following farms: Kamaggas 200, Kap Vley 315, Gra'water 331, Platvley 314, and Kourootjie 316. While these land portions cover a large area, the total footprint of the Kap Vley WEF is estimated to be 128 ha. The Grid Connection route alternatives includes additional properties not listed here.

The proposed Kap Vley WEF will consist of between 20-45 turbines each with a hub height between 80 m and 150 m and a maximum rotor diameter between 100 m and 160 m. Each turbine will have a crane platform of approximately 1 ha and 25 x 25 m reinforced concrete foundation. The Kap Vley WEF will also include up to 37 km of internal access roads, a concrete batching plant, operations and maintenance buildings, fencing, an on-site substation, and temporary hard stand areas.

The proposed project will also include a new overhead power line to connect the WEF to the national grid ('the Grid Connection'). The grid infrastructure and its associated potential impacts are considered separately from the WEF site in a separate impact assessment section. The proposed Kap Vley WEF will connect to the Gromis Substation located on the remainder of the Farm Dikgat 195 or closer to the new Eskom substation near Klienzee, for which the location still needs to be determined, via a 132 kV overhead transmission line.

For the connection to the Gromis substation, three alternatives are being considered (Figure 1):

- Alternative 1 (western option): From the on-site substation to Gromis Substation. The transmission line is approximately 39 km long;
- Alternative 2 (central option): Directly to the Gromis substation from the on-site substation. The transmission line is approximately 34 km long; and
- Alternative 3 (eastern option): From the on-site substation to Gromis Substation. The transmission line is approximately 40.5 km long.

The predominant land use associated with the study area on and around the Kap Vley WEF and Grid Connection sites is agriculture, particularly grazing and subsistence farming

2 TERMS OF REFERENCE

The following terms of reference were utilised for the preparation of this report:

- Provide summarised results from the full 12 month bird pre-construction monitoring programme;
- Describe the project site baseline with regard to avifauna for the study area, focussing on the characteristics which may be impacted upon by the proposed project during construction, operation and decommissioning;
- Describe the sensitivity of the baseline environment with regard to avifauna specifically with regard to the conservation status of species;
- Identify the Regional Red Data and priority species[1] present and potentially present on the project site;
- Identify the nature of potential impacts (positive and negative, including cumulative impacts if relevant) of the proposed project on avifauna during construction and operation;
- Conduct a significance rating and impact assessment of identified impacts;
- Identify mitigation or enhancement measures to minimise impacts to avifauna or deliver enhancement from the proposed project; and
- Identify information gaps and limitations.

In addition to the above, the following ToR has been provided by the CSIR:

- Adhere to the requirements of specialist studies as outlined in Appendix 6 of the 2014 NEMA EIA Regulations, as amended;
- Assess the no-go alternative very explicitly in the impact assessment section. Please note that the DEA considers a 'no-go' area, as an area where no development of any infrastructure is allowed; therefore, no development of associated infrastructure including access roads and internal cables is allowed in the 'no-go' areas. Should your definition of the 'no-go' area differ from the DEA definition; this must be clearly indicated in your assessment. You are also requested to indicate the 'no-go' area's buffer.
- Assess cumulative impacts by identifying other wind and solar energy project proposals and other applicable projects, such as construction and upgrade of electricity generation, transmission or distribution facilities in the local area (i.e. within 50 km of the proposed Kap Vley WEF project) that have been approved (i.e. positive EA has been issued) or the EIA is currently underway. In addition, the cumulative impact assessment for all identified and assessed impacts must be refined to indicate the following:

[1] All species occurring on the Birdlife SA and EWT Avian Sensitivity map list of priority species (Retief *et al.*, 2011 updated 2014)

- Identified cumulative impacts must be clearly defined, and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land.
- The cumulative impacts significance rating must also inform the need and desirability of the proposed development.
- A cumulative impact environmental statement on whether the proposed development must proceed.
- Provide a detailed description of your methodology, as well as indicate the locations and descriptions of turbine positions, and all other associated infrastructures that you have assessed and are recommending for authorisations.
- Provide a detailed description of all limitations to your studies. Your specialist studies must be conducted in the appropriate season and providing that as a limitation, will not be accepted by DEA.
- Provide a description of the current environmental conditions, in sufficient detail so that there is a baseline description/status quo against which impacts can be identified and measured i.e. suitability of the project area with regards to bird habitat/foraging, important vegetation features etc;
- Provide a description of species composition and conservation status in terms of protected, endangered or vulnerable bird species. This description will include species which are likely to occur within, traverse across or forage within the proposed project area, as well as species which may not necessarily occur on site, but which are likely to be impacted upon as a result of the proposed development;
- Conduct field work to identify bird species presence at the proposed site;
- Compile a detailed list of bird species present on site, including SCC;
- Identification of issues and potential impacts related to birds, which are to be considered in combination with any additional relevant issues that may be raised through the PPP;
- Identify and assess potential direct and indirect impacts on birds within the site during the construction, operation and decommissioning phases of the project. Provide an assessment of the irreversibility of impacts, and the irreplaceability of lost resources. Use the CSIR methodology to determine the significance of potential impacts;
- The bird specialist assessments must assess and make recommendations for definite measurements for the preferred hub heights and rotor diameter (as requested by DEA), e.g: hub height: 80-150 m; rotor diameter: 100-160 m;
- Assess the cumulative impacts by identifying other REFs such as wind and solar and other applicable projects, such as construction and upgrade of electricity generation, and transmission or distribution facilities in the local area (i.e. within 50 km of the proposed WEF). These include projects that have been approved (i.e. positive EA has been issued), have been constructed or projects for which an Application for Environmental Authorisation has been lodged with the Competent Authority (see Table 6.1 in Chapter 6 of this report for a list of projects);
- Assess possible alternatives identified where relevant, including the no-go alternative;
- Compilation of a bird sensitivity map or identification of buffer zones and no-go areas to inform the project layout;
- Provide input to the EMPr, including mitigation and monitoring requirements to avoid or reduce negative impacts during construction, operation and decommissioning of the project.
- Provide additional management and monitoring requirements, as relevant;
- In addition to the specialist study, undertake a 12 month pre-construction bird monitoring programme (i.e. commissioned by juwi). The results and recommendations of this monitoring programme (including data of all four seasons) should be included in the specialist study and EMPr that will be included in the EIA Report;

- Provide a description of any assumptions, uncertainties, limitations and gaps in knowledge;
- Provide a description of the relevant legal context and requirements; and
- Incorporate and address issues and concerns raised during the Scoping Phase of the EIA where they are relevant to the specialist's area of expertise.

3 METHODOLOGY

The approach to the study followed the requirements of the Best Practice Guidelines applicable at the time of the surveys (Jenkins *et al.* 2015) ('the guidelines') and those of the National Environment Management Act, 1998 (Act No 107 of 1998), as amended and the EIA Regulations (GNR 326 of 4 December 2014, as amended 7 April 2017).

The following terminology is used:

- **Priority species** = all species occurring on the Birdlife South Africa (BLSA) and Endangered Wildlife Trust (EWT) Avian Sensitivity Map priority species list (Retief *et al.* 2011 updated 2014).This list consists of 107 species with a priority score of 170 or more, and most likely to be affected negatively by WEFs. The priority score was determined by BLSA and EWT after considering various factors including bird families most impacted upon by WEFs, physical size, species behaviour, endemism, range size and conservation status;
- **Red Data species** = species whose regional conservation status is listed as Near-Threatened, Vulnerable, Endangered or Critically Endangered in the Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015);
- **Endemic or Near-endemic** = Endemic or near endemic (i.e. ~70% or more of population in South Africa) to South Africa (not southern Africa as in field guides) or endemic to South Africa, Lesotho and Swaziland. Taken from BLSA Checklist of Birds in South Africa, 2014.

3.1 Defining the Baseline

The baseline avifauna environment for the WEF site and Grid Connection site was defined utilising a desk-based study and informed by four seasons of pre-construction bird monitoring on the WEF site (and its surrounds) and a specialist nest survey. This information was examined to determine the potential location and abundance of avifauna which may be sensitive to development, and to understand their conservation status and sensitivity.

3.2 Sources of Information

- Bird distribution data of the Southern African Bird Atlas Project (SABAP-1) (Harrison *et al.* 1997) and Southern African Bird Atlas Project 2 (SABAP-2) obtained from the Avian Demography Unit of the University of Cape Town (Brooks 2017);
- Co-ordinated Water-bird Count (CWAC) project (Taylor *et. al.* 1999);
- The Important Bird Areas of southern Africa (IBA) project (Marnewick *et al.* 2015);
- Publically available satellite imagery;
- The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015);
- Results of the four seasonal surveys (summer, autumn, winter and spring) and nest survey conducted for the pre-construction avifaunal monitoring programme for the Kap Vley WEF.
- Most recent publically available information regarding post-construction results from operational monitoring at wind farms in South Africa (Ralston Paton *et al.* 2017, BLSA 2017a);

- Proposed Kleinzee 300MW Wind Energy, South of Kleinsee Environmental Impact Assessment Process Final Environmental Impact Assessment Report (Savannah Environmental 2015);
- Proposed Koingnaas Wind Energy Facility Environmental Basic Assessment Process, Final Basic Assessment Report (Savannah Environmental 2011);
- Proposed Project Blue Wind Energy facility (Phase 1-3), North of Kleinsee Environmental Impact assessment Process Draft Impact Assessment Report (Savannah Environmental 2012);
- Springbok Wind Energy Facility Final Environmental Impact Assessment: Birds (Simmons 2010); and
- Publically available peer reviewed literature on the effects of wind energy developments on birds.

3.3 Limitations and Assumptions

- The SABAP-1 data covers the period 1986 – 1997. Bird distribution patterns fluctuate continuously according to availability of food and nesting substrate. (For a full discussion of potential inaccuracies in SABAP data, see Harrison *et al.* 1997);
- There is still limited information available on the environmental effects of wind energy facilities in South Africa. Only a summary of the results of post-construction monitoring from eight wind farms in South Africa is available (Ralston Paton *et al.* 2017), as well as information from BirdLife South Africa (BLSA) in the form of a presentation (2017a). Estimates of impacts are therefore also based on knowledge gained internationally, which should be applied with caution to local species and conditions;
- There is no guideline or standard scientifically reviewed method for extrapolating observed bird flight activity to a spatial set of sensitivity classes on a map. Flight sensitivity classes are also qualitatively assigned, and while for example a 'High Flight Sensitivity' area may represent an area where impacts are more likely, collisions are also possible any areas where there is little or no flights sensitivity. This is primarily due to the potential for inter-annual variation in bird activity, and the unpredictability of bird flight behaviour and inherent mobility of birds;
- While sampling effort was conducted as recommended in the guidelines, it represents only a small fraction of actual time, and to achieve statistically powerful results it would need to be increased beyond practical possibilities. The data was therefore interpreted using a precautionary approach.

3.4 Pre-Construction Bird Monitoring Survey Design

The monitoring programme was developed by Arcus to be in line with the latest best practice guidelines (Jenkins *et al.* 2015). Adherence to these guidelines is a requirement of the Department of Environmental Affairs (DEA) for assessment of proposed WEFs. Furthermore, BLSA recently released species specific Verreauxs' Eagle Guidelines (BLSA 2017b). These were considered in the design of the monitoring programme.

An arbitrary boundary was used to define the WEF site, within which all monitoring activities occurred, and species were recorded. To obtain data for accurate 'before-after' comparison, the monitoring programme included data collection in a control area, at least 3.5 km from the nearest proposed turbines, and where there are no future known plans for renewable energy development. An arbitrary boundary was also created to define the 'control site', around the locations of the control site monitoring methods (Figure 1).

Prior to the first survey, the avifaunal specialists visited the WEF site, control site, and surrounding areas between 20 and 23 February 2017 for the 'site set up' to confirm survey locations and effort. This visit confirmed that the locations and methods (as described below) were accessible and suitable.

The first seasonal survey was conducted between 22 February and 01 March 2017 (summer). It followed the sampling effort of the Verreaux's' Eagle guidelines (i.e. 18 hours were conducted at each vantage point), in order to establish if the site is an "important Verreaux's' Eagle habitat", as required by these guidelines.

A dedicated cliff nest survey was then conducted by an avifaunal specialist and assistant from 18 – 21 April 2017. All potential habitat was surveyed, and nineteen cliffs, ridges or cliff-lines (e.g. group of cliff faces) were surveyed (Figure 1). The survey methodology broadly followed the methods recommended in Malan (2009), and involved an initial desk-based screening using satellite imagery, to identify the location of possible cliffs. The specialist also utilised his knowledge of the site from the monitoring set up, prior to the summer survey, to identify cliffs that required surveying. The aim was to locate Verreaux's' Eagle nests (which are typically large), however the presence of any cliff nest (active or inactive) was noted if observed.

Due to low activity of Verreaux's' Eagle during the summer survey, and the results of the cliff nest survey, the vantage point (VP) sampling effort was reduced to the standard best practice guidelines (Jenkins *et al.* 2015) protocol for the autumn, winter and spring surveys. The sampling effort was reviewed after each seasonal survey, in case it needed to be adjusted if deemed necessary by the specialists. Bird monitoring comprised flight activity surveys from various Vantage Points (VPs), as well as walked transects, driven transects, and focal site surveys (Figure 1). Relevant species were also recorded incidentally in the course of travelling the length of the site en route to survey locations.

The following definitions were applied:

- Target species: those particular bird species that are to be recorded by a specific survey method. Target species per survey method:
    - Vantage Point (VP) Surveys: all raptors; all large (non-passerine) priority species; all waterfowl (e.g. ducks and geese);
    - Walked Transects (WT): all birds;
    - Driven Transects (DT): all raptors; all large (non-passerine) priority species;
    - Incidental Observations: all raptors; all large (non-passerine) priority species; and
    - Focal Sites (FS): all species associated, utilising or interacting at/with the focal site.

The target species per method were recorded using the following methods, as described in more detail below.

3.4.1 Vantage Points

Five vantage points were surveyed on the WEF site, and one in the control site (CVP) (Figure 1). The location of the VPs was designed to maximise coverage of the turbine layout, taking into account accessibility.

Observer pairs monitored a viewshed of 360 degrees with a radius of 2 km from each VP. These viewsheds were the focus of observation, however if target species were noted beyond these (or if a species being recorded flew out of the viewshed but was still visible), they would also be recorded. For each flight of a target species the flight path was recorded on a large scale map along with data on the number/species of bird(s) and type of flight, flight duration and flight height. Flight heights were recorded through five height bands: 1: 0-20 m; 2: 20-40 m; 3: 40-120 m; 4: 120 - 200 m and 5: >200 m.

Vantage Points in the WEF were surveyed for 18 hours each in summer, and for 12 hours in autumn, winter and spring. The control VP was surveyed for 12 hours in all four seasons. To maximise coverage over time, all VPs were surveyed in 3 hours sessions per

day if possible, or 6 hour sessions, at different times of day if possible. The locations and sampling times are presented in Appendix III.

3.4.2 Walk Transects

To sample abundances and species richness of small terrestrial species, four walked transects of 1 km each in length were established on the project site (Figure 1). WT2 was conducted once in summer, while WT3, WT4, and WT5 were each conducted twice. All walked transects were conducted twice in autumn, winter and spring. One transect was established the control site and conducted twice each during each seasonal survey.

Two observers walked between the start and end points of the transects whilst recording all birds seen or heard up to 150 m on either side of the transect. Beyond 150 m, only priority species were noted and were recorded as incidental sightings.

The coordinates and sampling dates of the walked transects are presented in Appendix III.

3.4.3 Drive Transects

To sample abundances of large terrestrial birds and raptors, three drive transect routes were established within the WEF site (DT1, DT2 and DT3) and one at the control site (CDT) (Figure 1). Each transect was sampled twice per seasonal survey. Target species were recorded by driving slowly (+- 25 km/h) with all windows open, and stopping occasionally to listen and scan the surrounding environment. When a target species was located, a GPS co-ordinate was recorded along with the distance and direction from the vehicle to the observed bird and additional information such as weather conditions and habitat type and biological information about the recorded individual. The coordinates and sampling dates of the driven transects are presented in Appendix III.

3.4.4 Focal Sites

Focal Sites (FS) may include cliff-lines, quarry faces, power lines, and stands of large trees, nest sites, dams, water points, marshes and wetlands. During the first seasonal survey only one focal site (FS1), a livestock water point, was identified (Figure 1) and was surveyed once (for 15 minutes) during the summer seasonal survey. FS1 was again visited once in autumn, and then sample on two occasions during each of winter and spring surveys.

Following the cliff nest survey in autumn an additional two focal sites (N1 and N4) were added and surveyed in autumn, winter and spring, as both were suspected Verreaux's' Eagle nest sites found during the cliff nest survey. A third nest site (N5) was surveyed as a focal site during the winter and spring surveys. The locations and sampling dates are presented in Appendix III.

3.4.5 Incidental Observations

All other incidental sightings of priority species on the WEF site, control site and within the broader area were recorded and geo-referenced, along with additional relevant information such as weather and habitat type.

3.5 Identification of Potential Impacts

After collation of the baseline data from the source of information listed above the potential impacts of the project were identified (separately for the WEF site and Grid Connection), for the construction, operational and decommissioning phases.

The key potential impact types on avifauna from WEFs and associated grid connection infrastructure are:

- Collision with turbines;
- Electrocution;
- Collision with power lines;
- Disturbance and displacement;
- Disruption of bird movements; and
- Habitat destruction.

3.6 Impact Assessment Methodology

Each of the potential impacts identified above, on the baseline environment presented in Section 5, is assessed in Section 6 using the methodology provided by the Environmental Assessment Practitioner (Appendix I). For each impact, the significance was determined by identifying the nature, status, spatial extent, duration, reversibility of the impact and irreplaceability of resource loss, it's severity and probability of occurrence, in the absence of any mitigation ('without mitigation'). Mitigation measures were identified and the significance was re-rated, assuming the effective implementation of the mitigation ('with mitigation'). The assessment 'without mitigation' assumes the worst case scenario in which the maximum proposed number of turbines (i.e. 45) is constructed. The assessment 'with mitigation' assumes that all turbines are constructed outside of avifaunal no-go areas identified, and all additional mitigations described in the Section 6 are also adequately implemented.

The assessment included determining the value of the avifaunal receptors. This was done primarily though the compilation of a list of focal species by considering factors such as abundance, behaviour on site, breeding and flight activity (i.e. by considering the survey results) as well as priority species status (as per Retief et al. 2014), Regional Red Data status (Taylor *et al.,* 2015) and whether the species is endemic or range-restricted or not.

The specialists' confidence in the accuracy of the rating is also given. Cumulative impacts were assessed as the incremental impact of the proposed activity on the baseline presented in Section 5, when added to the impacts of other past, present or reasonably foreseeable future relevant activities in a 50 km radius.

The following proposed or approved developments within 50 km were identified (and included five wind energy projects, eight solar PV projects and one power line project) for consideration in the cumulative assessments:

- 300 MW Eskom Kleinzee Wind Energy Facility (Brazil WEF).
- 55.5 MW Springbok Wind Power Generation Facility.
- 7.2 MW Koingnaas Wind Energy Facility.
- Project Blue Wind Energy Facility, North of Kleinzee.
- Project Blue Wind Energy Facility (Phase 2 and 3), near Kleinzee.
- Nigramoep Solar PV Energy Facility.
- Proposed Phase 2 Construction of a 75 MW solar PV on farm 134/17 Klipdam.
- 19 MW Solar PV Energy Facility on portion 1 and 3 Melkboschkuil 132.
- 20 MW Solar PV Energy Facility on farm 132/26 Melkbokskuil.
- O'Kiep 15 MW Solar PV Energy Facility.
- O'Kiep 2 Solar PV Energy Facility.
- Kokerboom Solar PV Power Facility.
- 10 MW Baobab Solar PV Energy Facility.
- Deviation of the Eskom Juno-Gromis 400kV transmission line.

Any publically available specialist, EIA or BA reports were obtained and reviewed in terms of avifaunal impacts, and included in the cumulative assessment.

3.7 Determination of Avian Sensitivity and No-Go Areas

Avifaunal Flight Sensitivity Zones were designated based on observed flight activity during 12 months of avifaunal monitoring sessions on the WEF site.

Observed flight sensitivity was determined by creating a Grid Cell Sensitivity Score (GCSS), falling within either a Low, Medium, Medium-High or High classification for a 200 m x 200 m grid covering the WEF site. The GCSS was derived by analysing the following characteristics of all mapped priority species and raptors flight lines passing through each grid cell:

- Priority species score and the number of individuals associated with each flight line;
- Risk height factor, which considered if the flight was within the Rotor Swept Height;
- The duration of the flight; and
- The length of the flight.

These factors were considered in the following equation to determine a Flight Section Sensitivity Score (FSSS), for each section of flight within a grid cell. The GCSS is the sum of these flight sections within the grid cell, giving a sensitivity score specific to the cell.

FSSS = PSS x N x (X/Y x D) x (P+1)

Where:

- PSS is the Priority Species Score (Retief *et al.* 2011, updated 2014).
- N is the number of birds that are associated with the flight line.
- X is the length of the flight line section that is within a particular Grid Square.
- Y is the length of the whole flight line.
- D is the duration of the whole flight.
- P is the proportion of the flight line at Risk Height.

Grid cells within the WEF site boundary without a GCSS did not have any recorded priority species flights passing through from the monitoring survey, either because no species were recorded, or they were beyond the viewsheds covered by VP watches.

The resultant GCSS scores were categorised into Flight Sensitivity Zones as follows: Low (<10,000); Low-Medium (10,000 - 45,000); Medium (45,000 - 100,000); and High (>100,000), and are displayed in Figure 6.

A combined Avifaunal Sensitivity Map (Figure 7) shows areas of varying sensitivity as well as Avifaunal No-Go Areas which were identified following the site work and monitoring surveys as follows:

3.7.1 High Sensitivity Areas

- Nest Site buffers (Various- See Table 6)
- High Flight Sensitivity Zones

These areas constitute a No-Go for turbine and overhead power-line placement. Other infrastructure (e.g. roads, underground cables, offices, substations etc.) is permitted except within 1 km of raptor nest sites (although none were located on the project site).

3.7.2 Medium Sensitivity Areas

- National Freshwater Ecosystem Priority Areas (NFEPA) rivers and wetlands buffers: 200 m
- Medium Flight Sensitivity Zones

Infrastructure (including overhead power lines and wind turbines) is permitted, but not recommended in these areas.

3.7.3 Low-Medium Sensitivity Areas

- Low-Medium Flight Sensitivity Zones
- 150 m Ridge Buffer

All infrastructure permitted

3.7.4 Low Sensitivity Areas

- Low Flight Sensitivity Zones

All infrastructure permitted

3.8 Stakeholder Consultation

Birdlife SA has been consulted and is aware of the preconstruction monitoring methodologies and results, and was consulted prior to the compilation of the final AIAR. Additional stakeholders will be consulted and engaged accordingly, as part of the public participation process of the EIA, as and when required.

4 POLICY AND LEGISLATIVE CONTEXT

The legislation relevant to this specialist field and the proposed project is as follows:

4.1 National Environmental Management Act, No 107 of 1998 (NEMA).

South Africa's framework environmental act was established to provide for co-operative, environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state; and to provide for matters connected therewith.

Through the Environmental Impact Assessment (EIA) Regulations (2014, as amended), the act requires certain activities and developments to undergo an EIA process. Certain specialist studies are required, depending on the development type, scale and location. In the case of a WEF development, and avifaunal specialist study is required.

4.2 The Convention on Biological Diversity (CBD), 1993

A multilateral treaty for the international conservation of biodiversity, the sustainable use of its components and fair and equitable sharing of benefits arising from natural resources. The convention prescribes that signatories identify components of biological diversity important or conservation and monitor these components in light of any activities that have been identified which are likely to have adverse impacts on biodiversity. The CBD is based on the precautionary principle which states that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat and that in the absence of scientific consensus the burden of proof that the action or policy is not harmful falls on those proposing or taking the action.

4.3 The Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention), 1983

An intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. The fundamental principles listed in Article II of this treaty state that signatories acknowledge the importance of migratory species being conserved and agree to take action to this end "whenever possible and appropriate", "paying special attention

to migratory species the conservation status of which is unfavourable and taking individually or in cooperation appropriate and necessary steps to conserve such species and their habitat".

4.4 The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 1999

An intergovernmental treaty developed under the framework of the Convention on Migratory Species (CMS), concerned the coordinated conservation and management of migratory waterbirds throughout their entire migratory range. Signatories of the Agreement have expressed their commitment to work towards the conservation and sustainable management of migratory waterbirds, paying special attention to endangered species as well as to those with an unfavourable conservation status.

4.5 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) – Threatened or Protected Species List (TOPS)

Amendments to the TOPS Regulations and species list were published on 31 March 2015 in Government Gazette No. 38600 and Notice 256 of 2015. The amended species list excluded all species threatened by habitat destruction and which are not affected by other restricted activities, but included the following potentially relevant target species for this study:

Endangered – Martial Eagle, Ludwig's Bustard; *Protected* – Kori Bustard

4.6 Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009)

Developed to protect both animal and plant species within the province which warrant protection. These may be species which are under threat or which are already considered to be endangered. The provincial environmental authorities are responsible for the issuing of permits in terms of this legislation.

4.7 The Civil Aviation Authority Regulations, 2011

These are relevant to the issue of lighting of wind energy facilities, and to painting turbine blades, both of which are relevant to bird collisions with turbine blades.

4.8 The Equator Principles (EPs) III, 2013

The principles applicable to the project are likely to include:

- Principle 2: Environmental and Social Assessment;
- Principle 3: Applicable Environmental and Social Standards;
- Principle 4: Environmental and Social Management System and Equator Principles Action Plan;
- Principle 8: Covenants.

These principles, among various requirements, include a requirement for an assessment process (e.g. EIA process), an Environmental and Social Management Plan (ESMP) to be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards, and the appointment of an independent environmental expert to verify monitoring information.

5 BASELINE AVIFAUNAL ENVIRONMENT

There are no Co-ordinated Avifaunal Road-count (CAR) routes on the WEF site or within 300 km of the proposed WEF site, and therefore data from this source is not considered relevant to this study. The proposed WEF site is not situated within an IBA and there are

no IBAs within 120 km of the proposed project site, and therefore data from this source is not considered relevant to this study.

5.1 Southern African Bird Atlas Project 1

The SABAP1 data (Harrison *et al.* 1997) was collected over an 11 year period between 1986 and 1997 and remains the best long term data set on bird distribution and abundance available in South Africa at present. This data was collected in quarter degree squares, with the WEF site situated in square 2917CD. The proposed grid connection alternatives also traverse squares 2917CC, 2917CA and 2917CB, and data from these have been considered as well (Figure 2). Table 1 indicates the reporting rate for all regional red data species, raptors and priority species recorded by the SABAP1 data within these squares, as well as giving a total number of species recorded in each square which varied from 64 to 128. The SABAP1 project recorded a total of 147 species. The two coastal squares (2917CC and 2917CA) had higher counting efforts (the latter having the town of Kleinzee within it), and it is likely that counts focussed on the marine environment, as is evident by the high numbers of marine species recorded. While some of these species may venture slightly inland, it is highly unlikely that species such as Cape Gannet, Damara Tern or the three cormorant species will be affected by the proposed developments. At its closest point the grid connection would be 15 km from the ocean, while the closest proposed turbine position is approximately 17 km from the ocean.

Important species within this data set that may occur within the WEF site or on the grid connection alternatives, and which have relatively high reporting rates are: Secretarybird, Martial Eagle, Black-chested Snake Eagle, Jackal Buzzard, Pale Chanting Goshawk, Lanner Falcon, Greater Kestrel, Rock Kestrel, Southern Black Korhaan and Ludwig's Bustard. The record of the latter species in each square, and its associated report rates, are probably the most significant information to come from this data set.

Table 1: Raptors and Priority Species Recorded by SABAP1 in the Quarter Degree Squares covering the Project Site (Harrison et al. 1997)

Species	Regional Red Data Status	Report rate (%) **			
		2917CD	2917CC	2917CA	2917CB
Total species		*65*	*90*	*128*	*64*
Number of cards submitted		*7*	*17*	*43*	*8*
African Penguin	EN	-	6	5	-
Great White Pelican	VU	-	-	23	-
Cape Gannet	VU	-	12	7	-
Cape Cormorant	EN	-	82	33	-
Bank Cormorant	EN	-	6	30	-
Crowned Cormorant	NT	-	71	65	--
Marabou Stork	NT	-	-	2	-
Greater Flamingo	NT	-	-	23	-
Lesser Flamingo	NT	-	6	53	-
Secretarybird	VU	-	12	37	-

Species	Regional Red Data Status	Report rate (%) **			
		2917CD	2917CC	2917CA	2917CB
Black-shouldered Kite	-	-	-	2	-
Booted Eagle	-	-	-	-	13
Martial Eagle	EN	-	6	51	13
Black-chested Snake Eagle	-	-	53	16	-
African Fish Eagle	-	-	6	-	-
Verreaux's' Eagle	V	14	-	2	-
Jackal Buzzard	-	29	-	5	38
Pale Chanting Goshawk	-	29	88	86	50
Black Harrier	EN	-	6	-	25
Lanner Falcon	VU	14	-	40	25
Greater Kestrel	-	14	53	9	63
Rock Kestrel	-	-	59	86	75
Western Barn Owl	-	-	-	23	-
Spotted Eagle Owl	-	-	-	49	-
Ludwig's Bustard	EN	29	35	30	25
Southern Black Korhaan	VU	-	35	53	-
Damara Tern	CR	-	6	2	-

** Priority species (Retief et al. 2014).*
*CR = Critically Endangered; EN = Endangered; V = Vulnerable; NT = Near-threatened. **Report rates are essentially percentages of the number of times a species was recorded in the square, divided by the number of times that square was counted. It is important to note that these species were recorded in the entire quarter degree square in each case and may not actually have been recorded on the proposed WEF site or along the grid connection alternatives.*

5.2 Southern African Bird Atlas Project 2

This project is part of an ongoing study by the Animal Demography Unit (ADU), a research unit based at the University of Cape Town (UCT), and data is collected per pentad. Pentads are roughly 8 km x 8 km squares, and are smaller than the squares used in SABAP1.

SABAP2 data was examined for the five out of six pentads covering the WEF site for which data exists. These were pentads 2945_1715, 2945_1720, 2945_1725, 2950_1715, and 2950_1720. The Grid Connection alternatives cover four of these pentads (2945_1715, 2950_1715, 2945_1720, 2950_1720), as well as an additional four pentads for which data was available (i.e. 2945_1710, 2940_1710, 2935_1710 and 2940_1725). Data from two additional pentads (2940_1705 and 2935_1705) were also considered due to their close proximity to the Grid Connection site and their high count effort (13 and 28 cards submitted respectively). The location of the pentads considered is shown in Figure 2.

Generally the counting effort is low in the area, with many pentads have less than 5 cards submitted, and the data should be interpreted with caution. Table 2 gives selected data for the pentads considered, and shows that 21 priority species have been historically recorded in the areas considered, including 10 Red Data species.

Table 2: Raptors, Priority Species and Selected Endemic Species Recorded in the SABAP2 Pentad Squares Covering the Project Site and Grid Connection

Species	Red Data Status	Endemic or Near Endemic	Priority score *	Report Rates- WEF Pentads					Report Rates-Grid Connection Pentads				Additional Pentads	
				2945_ 1715	2945_ 1720	2945_ 1725	2950_ 1715	2950_ 1720	2945_ 1710	2940_ 1710	2935_ 1710	2940_ 1725	2940_ 1705	2935_ 1705
			Total Species	30	41	54	18	58	35	20	15	26	65	109
			Number of cards (full protocol)	3	4	3	2	6	3	2	1	2	13	28
Cape Cormorant	EN		310											7.1
Black Harrier	EN	x	345	-	-	-	-	16.7	-	-	-	-	-	-
Ludwig's Bustard	EN		320	33.3	50	66.7	50	16.7	33.3	50	-	50	15.4	-
Verreaux's' Eagle	VU		360	-	Adh.	33.3	-	16.7	-	-	-	-	-	-
Lanner Falcon	VU		300	Adh.	-	33.3	-	-	33.3	-	-	50	-	7.1
Southern Black Korhaan	VU	x	270	-	25	-	50	83.3	Inc.	-	-	-	15.4	3.6
Secretarybird	VU		320	-	-	-	-	-	33.3	-	-	-	-	3.6
Black Stork	VU		330	-	-	-	-	-	-	-	-	-	-	3.6
Greater Flamingo	NT		290	-	-	-	-	-	-	-	-	-	-	3.6
Barlow's Lark	NT		210	-	-	-	-	-	-	-	-	-	7.7	-
Jackal Buzzard	-	x	250	-	25	100	-	33.3	Adhoc	-	-	-	7.7	92.9
Steppe Buzzard	-		210	-	-	-	-	-	-	-	-	-	-	7.1
Booted Eagle	-		230	66.7	-	-	-	33.3	66.7	-	-	-	-	-
Grey-winged Francolin	-	x	190	-	-	-	-	16.7	-	-	-	-	-	-
African Harrier Hawk	-		190	-	-	-	-	16.7	-	-	-	-	-	-
Greater Kestrel	-		174	66.7	25	-	-	16.7	100	-	-	50	7.7	25
Lesser Kestrel	-		214	-	-	-	-	16.7	-	-	-	-	-	-

Species	Red Data Status	Endemic or Near Endemic	Priority score *	Report Rates- WEF Pentads					Report Rates-Grid Connection Pentads				Additional Pentads	
				2945_ 1715	2945_ 1720	2945_ 1725	2950_ 1715	2950_ 1720	2945_ 1710	2940_ 1710	2935_ 1710	2940_ 1725	2940_ 1705	2935_ 1705
Rock Kestrel	-		-	-	25	33.3	-	16.7	33.3	-	Inc.	50	23.1	39.3
Black-shouldered Kite	-		174	-	-	-	-	-	-	-	-	-	-	3.6
Pale Chanting Goshawk	-		200	66.7	75	33.3	50	33.3	33.3	50	-	100	30.8	75
Black-chested Snake Eagle	-		230	33.3	-	-	-	-	33.3	Adh.	-	-	-	-
Spotted Eagle Owl	-		170	-	-	-	-	-	-	-	-	-	46.2	-
Cape Long-billed Lark	-	x	-	-	25	-	50	50	-	-	100	-	23.1	32.1
Yellow-billed Kite	-		-	-	-	-	-	16.7	-	-	-	-	-	-

*EN = Endangered; VU = Vulnerable; NT = Near-threatened (Taylor et al. 2015). * (Retief et al. 2011 updated 2014).*
Reporting rates are percentages of the number of times a species was recorded in the pentad, divided by the number of times that pentad was counted. It is important to note that these species were recorded in the entire pentad in each case and may not actually have been recorded on the proposed WEF site or Grid Connection site.

5.3 Coordinated Waterbird count (CWAC) data

There are two CWAC sites within 40 km of the proposed WEF site, both located near the town of Kleinzee (Figure 2).

5.3.1 Kleinzee AK3 Dam

A fairly large sludge dam situated on a mine property, this CWAC site was last counted in 2008 and has been discontinued. Species recorded in relatively high numbers in counts between 2007 and 2008 included Pied Avocet, Greater Flamingo, Lesser Flamingo, Black-necked Grebe, Hartlaub's Gull, White-fronted Plover, Curlew Sandpiper, Little Stint, Cape Teal and Swift Tern. Records of a single Bank Cormorant and two Caspian Tern are also noted.

5.3.2 Buffels River Mouth

A small lagoon is present at the mouth, which is seldom breached, and the count section of the river stretches from the back of the Kleinzee golf course down to the beach. This CWAC site is discontinued and was last counted in 2008. Species recorded in relatively high numbers in counts between 2007 and 2008 included Red-knobbed Coot, Black-necked Grebe, Egyptian Goose, Hartlaub's Gull, Kelp Gull and Common Tern. During 2017, the Arcus specialist recorded 3 Greater Flamingos at this site.

5.4 Bird Microhabitats

In order to determine which bird species are more likely to occur on the proposed project site, it is important to understand the habitats available to birds at a smaller spatial scale, i.e. micro habitats. Micro habitats are shaped by factors other than vegetation, such as topography, land use, food sources and man-made factors.

The WEF site is not overly diverse in terms of available bird habitats, with generally similar vegetation types found throughout. The dominant vegetation type around the proposed turbine ridges is Namaqualand Klipkoppe Shrubland. The lower lying areas consist of Namaqualand Strandveld and Namaqualand Sand Fynbos. There are no wetlands or rivers of any importance for birds on the site. The following bird micro-habitats have been identified to date: natural shrubland; natural thornveld/strandveld; rocky ridges and slopes; livestock water points; camel thorn forest; stands of alien trees and farmsteads.

The natural shrubland, sandveld and fynbos occurring in the area can host terrestrial priority species such as Southern Black Korhaan and Ludwig's Bustard, Black Harrier and Grey-winged Francolin as well as endemic passerine species such as Cape Long-billed Lark.

Rocky ridges and slopes are potentially important habitat for raptors such as Verreaux's' Eagle, African Harrier-hawk, Booted Eagle, Jackal Buzzard, Greater Kestrel and Rock Kestrel, which may use the slopes for soaring and to gain lift. Rocky outcrops may also provide nesting habitat for smaller cliff-nesting birds such as Lanner Falcon and Rock Kestrel, as well as prey animals such as dassies, the main prey item of Verreaux's' Eagle.

A camel thorn forest to the north of the site could provide important nesting and foraging habitat for a variety of passerines, corvids, doves and raptors.

Farmsteads and feeding kraals and watering points are mainly frequented by a large variety of small passerines but can also provide important habitat for smaller raptors and their rodent prey.

Alien trees such as blue gums, mostly found around farmsteads, can be utilised as roosting and nesting sites by raptors, corvids and passerines.

5.5 Kap Vley WEF Pre-construction Monitoring Results

5.5.1 Vantage Points

During VP watches on the WEF site in the final spring season survey, 66 flights of target species were recorded totalling 78 birds from 10 positively identified species. This equates to an average of 1.3 target birds per hour over the 60 hours of observation. This is a substantially higher passage rate than what was observed in the previous three seasons. In winter 25 flights were recorded (totalling 27 birds) during observations on the WEF site (an average of 0.45 target birds per hour), while in autumn 10 flights totalling 10 birds were recorded at an average 0.17 target birds per hour of observations. In summer 17 flights (totalling 17 birds) were recorded in 90 hours at an average of 0.18 target birds per hour.

Across all four seasonal surveys a total of 118 flight paths from 13 positively identified target species have been recorded, totalling 132 individual birds[2]. This equates to approximately 0.489 target species birds per hour of observation. These figures are moderate to low compared to other sites in the specialists' experience, with flight activity being especially very low in all seasons except spring. The 13 species recorded included four red data species, two of which are *Endangered* (Ludwig's Bustard and Black Harrier) and two are *Vulnerable* (Verreaux's Eagle and Southern Black Korhaan). Flight paths of all target species are shown in Figure 3. Table 3 shows a summary of the VP flights recorded for each target species to date, as well as an indication of the flights potentially at Rotor Swept Height (RSH).

One-hundred and seven (107), or 91% of the recorded flights were by raptors and the most frequently recorded species was Rock Kestrel with 33 flights (28% of all flights), followed by Jackal Buzzard with 18 flights (15%), Booted Eagle 17 flights (14%), and Verreaux's Eagle with 14 flights (12%). For these species, their overall relative activity is still low, when one considers the amount of observation time (270 hours), and the passage rates of all species (i.e. birds/hour of observation) was low (Table 3). Rock Kestrel activity was highest in spring, when 25 flights were recorded for this species.

Analyses of flight paths indicate that while target species utilised various height categories, 78% of target species flights included at least some time at RSH (height bands two (20-40 m), three (40-120 m) and four (120-200 m). This is a moderate to high amount of flights in the potential risk zone, and may be indicative of the species recorded, as raptors (the group of birds most recorded) do tend to fly at risk height while soaring, hovering, and gliding and change heights regularly. Total flight duration per species[3] shows that while some species may have been recorded more regularly (i.e. have more flights), others spent more time flying overall. For example, Black-chested Snake Eagle, with only two flights, had the fifth highest overall flight duration as both recorded flights were relatively long. In contrast, Southern Black Korhaan with 8 flights, all of which were short in duration, had a low overall flight duration. Caution must be taking when interpreting this information as larger species e.g. Eagles and Bustards are more easily seen and tracked, and less easily lost from site by an observer and by default may be recorded flying for longer.

[2] A flock of birds flying together is recorded as a single flight path. However, the majority of flight paths to date were of a single bird, with two flights (both by Southern black Korhaan) recording 2 birds each.

[3] Note these figures shows the total flight duration in seconds of all flight durations recorded for each species, regardless of the number of birds associated with a particular flight. For example, a single flight (recorded as one flight line on the map) of 30 seconds that consisted of three birds, constitutes 30 seconds to that species total duration, and not 90 seconds.

Table 3: Flight Path Target Species

Species	Species Priority Score	Red List Status (Taylor *et al.* 2015)	Total no. of Flight paths	Total no. of birds recorded*	Estimated minimum number individuals	Flights with a portion at RSH (% at RSH)	Total Flight Duration in Seconds	Birds per hour of observation
African Harrier Hawk	190	-	2	2	1	2 (100%)	756	0.007
Black-chested Snake Eagle	230	-	2	2	1	2 (100%)	1695	0.007
Black Harrier	345	EN	2	2	2	2 (100%)	376	0.007
Booted Eagle	230	-	17	17	5	16 (94%)	3919	0.063
Greater Kestrel	174	-	6	6	3	6 (100%)	673	0.022
Jackal Buzzard	250	-	18	19	4	15 (83%)	3452	0.070
Lesser Kestrel	214	-	2	2	1	1 (50%)	260	0.007
Ludwig's Bustard	320	EN	3	3	3	3 (100%)	420	0.011
Pale Chanting Goshawk	200	-	2	3	3	1 (50%)	70	0.011
Rock Kestrel	-	-	33	39	10	22 (67%)	4712	0.144
Southern Black Korhaan	270	VU	8	10	6	0 (0%)	295	0.037
Verreaux's' Eagle	360	VU	14	18	2	14 (100%)	5044	0.067
Unidentified kestrel	-	-	2	2	2	1 (50%)	207	0.007
Unidentified raptor	-	-	6	6	4	6 (100%)	1561	0.022
Yellow-billed Kite			1	1	1	1 (100%)	60	0.004
Total			**118**	**132**	**NA**	**92 (78%)**	**23500**	**0.489**

**Some flight paths (recorded as a single flight) may have included multiple birds i.e. a flock. As separate flights may have included the same individual bird/s, this figure should not be seen as an indication of abundance or population size, but rather an indication of activity of a particular species.*

5.5.2 Walk Transects

Across the four seasonal surveys on all four transects on the WEF site (n =31) 474 observations recorded 731 individual birds representing a total of 49 positively identified species. On the control site transect over the four seasons (n=8) a total of 153 observations of 271 individuals of 35 species were made.

Table 4 shows a summary of the total (i.e. across all four seasonal surveys) species and numbers of birds recorded on each walk transect. On the WEF site, WT2 had the most observations (136) and recorded the highest number of birds (257 individuals) but had the lowest number of species (25). WT4 had the highest number of species (30, along with WT5) but the lowest number of observations (94) and birds (137). The control site transect recorded relatively higher numbers of birds and species than transects on the WEF site.

The abundance of birds recorded on the WEF site walked transects was generally low. No small Red Data passerine species were recorded during walked transect surveys on the WEF site. Red Data species recorded were Ludwig's Bustard (WT2 and WT5), Verreaux's Eagle (WT2, WT4 and CWT) and Southern Black Korhaan (WT3 and WT5). The range-restricted Cape Long-billed Lark, while occasionally seen on an ad-hoc basis in various locations on the WEF site, was only recorded on WT5 during formal transect surveys.

Table 4: Small Terrestrial Species Walked Transect Results

Transect Name (n=replications)	Total Observations (Number of Individual Birds)	Total Species Recorded	Priority Species (P), Red Data Species (Status), Important (I)	Non-Priority, Frequently Recorded and/or Abundant.
WT2 (n=7)	136 (257)	25	Ludwig's Bustard (P, EN), Verreaux's Eagle (P, VU), Pale Chanting Goshawk (P).	Bokmakierie, Cape Bunting, Grey-backed Cisticola, Pied Crow, Cape Turtle Dove, Common Fiscal, Pale Chanting Goshawk, Chat Flycatcher, Karoo Lark, Karoo Prinia, Cape Sparrow.
WT3 (n=8)	127 (179)	26	Southern Black Korhaan (P, VU), Rock Kestrel (I).	Bokmakierie, Cape Bulbul, Grey-backed Cisticola, Common Fiscal, Karoo Lark, Karoo Prinia, African Stonechat, Malachite Sunbird, Southern Double-collared Sunbird.
WT4 (n=8)	94 (137)	30	Verreaux's Eagle (P, VU), Rock Kestrel (I), Cinnamon-breasted Warbler (I).	Bokmakierie, Cape Bulbul, Grey-backed Cisticola, Common Fiscal, Karoo Lark, Karoo Prinia, African Stonechat, Malachite Sunbird, Southern Double-collared Sunbird.
WT5 (n=8)	117 (158)	30	Ludwig's Bustard (P, EN), Southern Black Korhaan (P, VU), Cape Long-billed Lark (I).	Bokmakierie, White-throated Canary, Grey-backed Cisticola, Chat Flycatcher, Southern Black Korhaan, Cape Clapper Lark, Karoo Lark, Spike-heeled Lark, Karoo Prinia, Karoo Scrub Robin, Rufous-eared Warbler.
CWT	153 (271)	35	Verreaux's Eagle (P, VU), Jackal Buzzard (P), Rock	Acacia Pied Barbet, Bokmakierie, Cape Bunting, White-throated

Transect Name (n=replications)	Total Observations (Number of Individual Birds)	Total Species Recorded	Priority Species (P), Red Data Species (Status), Important (I)	Non-Priority, Frequently Recorded and/or Abundant.
(n=8)			Kestrel (I), Ground Woodpecker (I).	Canary, Karoo Chat, Grey-backed Cisticola, Yellow-bellied Eremomela, Karoo Lark, Karoo Prinia, Karoo Scrub Robin, Cape Sparrow, Southern Double-collared Sunbird, Alpine Swift, Grey Tit.

EN=Endangered; VU=Vulnerable; NT=Near-Threatened. I=Important, noteworthy, or uncommon species deemed relevant to highlight by the specialist.

5.5.3 Drive Transects

The driven transects resulted in a relatively low number of records of target species, with a total of 7 records on the control site transect and 39 records across the three WEF site transects after four seasonal surveys (n=32). A total of 240.8 km and 56.8 km of transects were driven on the WEF and control sites respectively across the four seasonal surveys.

On the WEF site, the most numerous and regularly encountered target species during driven transects was Pale Chanting Goshawk with 13 birds observed in 12 records (IKA ~0.053 individuals per km) followed by Ludwig's Bustard with 12 birds observed from 7 records (IKA ~0.049 individuals per km) and Southern Black Korhaan with 8 birds from 7 records (IKA ~0.033 individuals per km). The overall IKA for the WEF site of 0.2 target species birds recorded per kilometre was very low. The IKA of target species on the control site was 0.14.

Table 5: Summary of Driven Transect Results

Species	Total Individuals Recorded	Maximum Flock Count	No. Records				IKA (WEF Site)
			DT1	DT2	DT3	CDT	
Brown Snake Eagle	1	1	-	-	1	-	0.004
Greater Kestrel	4	1	-	1	2	1	0.012
Jackal Buzzard	4	2	1	1	-	1	0.012
Lanner Falcon	3	2	-	1	-	1	0.004
Ludwig's Bustard	12	3	1	3	3	-	0.049
Pale-chanting Goshawk	16	2	-	2	10	3	0.053
Rock Kestrel	3	1	1	-	1	1	0.008
Southern Black Korhaan	8	2	-	4	3	-	0.033
Spotted Eagle Owl	2	1	-	-	2	-	0.008
Verreaux's Eagle	2	1	1	1	-	-	0.008
Total	**55**	**NA**	**4**	**13**	**22**	**7**	**0.2**

5.5.4 Nest Survey

A dedicated search for cliff nests was conducted by the specialist at the end of April 2017. Selected nest sites (N1, N4 and N5) were subsequently revisited and surveyed in the autumn, winter and spring surveys (see below). Six cliff nest sites were found (Table 6; Figure 4) during the nest survey. It must be noted that no nests were found closer

than 6.8 km from the nearest proposed turbines. Therefore, the current recommended turbine exclusion buffers shown in Table 6, will have no impact on proposed layout of the Kap Vley WEF.

The exclusion buffers (Figure 4) were based upon current international and South African best practise, as well as the recommendations of Bird Life South Africa (BLSA 2017b).

Table 6: Cliff Nest Survey Results

Nest	Approx. nest location	Approx. distance from nearest turbine	Species	Description	Comment	Turbine exclusion buffer
N1	29.769719°S 17.467132°E	6.8 km	Unidentified Raptor	Large nest on cliff. No clear evidence of use. No white-wash seen.	Only long distance view possible. Initially suspected inactive Verreaux's' Eagle nest, but species not recorded in autumn, winter or spring. More Likely a Jackal Buzzard nest.	1.5 km
N2	29.800851°S 17.501511°E	8.5 km	Unidentified Raptor	Medium size nest on cliff. No white-wash seen.	Adult Jackal Buzzard observed in vicinity. Suspect active Jackal Buzzard nest.	1.5 km
N3	29.803182°S 17.502349°E	8.5 km	White-necked Raven	Goat/sheep fur and rope observed in messy stick nest.	Pair of ravens observed in vicinity.	NA
N4	29.817942°S; 17.496148°E	7.8 km	Verreaux's' Eagle	Large stick nest on cliff.	Adult Verreaux's' Eagle observed sitting on nest. Assumed adult is a separate bird to the pair at N5 (2.8 km away).	3 km
N5	29.836030°S; 17.516480°E	9.75 km	Verreaux's' Eagle	Very large stick nest on cliff in a deep Kloof. Lots of evidence of use including prey items, feathers and whitewash.	Active nest site with pair observed flying above in April 2017. In winter 2017 a chick was observed on the nest. In spring 2017 a fledged sub adult and two adult birds were seen flying above nest site, indicating successful breeding.	3 km
N6	29.901507°S; 17.464862°	8.2 km	Unidentified Raptor	Medium sized stick nest on cliff in Kloof. No clear evidence of recent use.	Adult Jackal Buzzard observed in vicinity on two occasions. Suspect Jackal Buzzard nest.	1.5 km

5.5.5 Focal Sites

Across all four seasons, observations from the visits to FS1 (the water trough point and reservoir) recorded the following species (total number of individual birds): African Stonechat (1); Bokmakierie (2); Cape Bulbul (2); Cape Bunting (3); Familiar Chat (1); Karoo Lark (1); Karoo Prinia (1); Karoo Scrub Robin (1); Malachite Sunbird (1); Namaqua Dove (9); Pied Crow (3); Southern Black Korhaan (2) and an unidentified lark (1).

The results were surprising, given the generally hot and dry conditions and lack of readily available natural water sources, as one would have expected more species to be visiting the water point to drink, especially in summer and autumn.

The remaining three focal site were selected nest sites (N1, N4 and N5), the statuses of which were confirmed by the focal site monitoring and are summarised in Table 6 above.

No other suitable or relevant focal sites (e.g. wetlands/dams/rivers/nets/power lines) were found on the WEF site or the control site during the one year monitoring programme.

5.5.6 Incidental Observations

A total of 97 incidental records were made of 14 target species (including 5 priority species), comprising 110 birds (Table 7). Of the 14 species recorded incidentally, four are Red Data species (Martial Eagle, Ludwig's Bustard, Lanner Falcon and Southern Black Korhaan) and 12 are priority species (Table 7). The geographical locations of the observers while recording the incidental observations (as well as priority species observed during transect surveys) are indicated in Figure 5, giving an indication of the general location of the various species on and around the WEF and control sites.

The species most regularly recorded incidentally was Southern Black Korhaan, accounting for 36% of all the incidental records, followed by Pale Chanting Goshawk (28% of incidental records). For both these species, it is likely that the same individual/s may have been recorded multiple times. Ludwig's Bustard was not recorded incidentally in either summer or autumn, with seven records coming from winter and three from spring following rains in the area. All eight records of Greater Kestrel were from the final spring seasonal survey. The single record of the endangered Martial Eagle was made just to the east of the WEF site (although the bird was flying towards the WEF site) in spring.

Table 7: Number of Incidental Records of Target Species

Species	Number of records	Total Birds**	Maximum flock count
African Harrier Hawk*	1	1	1
Booted Eagle*	3	3	1
Cape Eagle-Owl*	1	1	1
Greater Kestrel*	8	10	2
Grey-winged Francolin*	1	1	1
Jackal Buzzard*	5	5	1
Lanner Falcon*(VU)	1	1	1
Ludwig's Bustard*(EN)	10	12	2
Martial Eagle*(EN)	1	1	1
Spotted Eagle-Owl*	1	1	1
Pale Chanting Goshawk*	27	28	2

Species	Number of records	Total Birds**	Maximum flock count
Rock Kestrel	2	2	1
Yellow-billed Kite	1	1	1
Southern Black Korhaan*(VU)	35	43	3
TOTAL	**97**	**110**	**NA**

**Priority species. **Where more than one bird recorded, the same individual bird may have been recorded more than once. The figures in this column therefore do not necessarily indicate the number of individuals of this species present or the population size.*

5.5.7 Species Summary and Discussion

A total of 82 positively identified species (including 15 priority species) have been recorded across both the WEF site and the control site after four seasonal surveys (Table 8). Six regional Red Data species (Taylor *et al.* 2015) have been recorded including three classified as *Endangered* (Black Harrier, Ludwig's Bustard and Martial Eagle), and three as *Vulnerable* (Verreaux's' Eagle, Lanner Falcon and Southern Black Korhaan). Of these, only Southern Black Korhaan was frequently recorded.

A total of 82 species were observed in the WEF site, while 64 species were recorded at the control site. This lower number can be attributed to less time spent at the control site versus the WEF site, and is not necessarily a reflection of local diversity. All 64 species recorded at the control site were also recorded on the WEF site, while 18 species were recorded only in the WEF site including Black Harrier, Martial Eagle, Southern Black Korhaan, Spotted Eagle Owl, Cape Eagle Owl, Black-chested Snake Eagle and Grey-winged Francolin.

Table 8: Priority Species and Regional Red Data Species Recorded During the Surveys on the Control and WEF Sites

Full Name	Regional Red Data Status	Priority Species Score	summer		autumn		winter		spring	
			WEF	Control	WEF	Control	WEF	Control	WEF	Control
African Harrier-Hawk		190			x		x			
Black-chested Snake Eagle		230					x		x	
Black Harrier	EN	345					x		x	
Booted Eagle		230	x						x	x
Cape Eagle-Owl		250	x							
Greater Kestrel		174					x		x	x
Grey-winged Francolin		190					x			
Jackal Buzzard		250	x	x	x	x	x	x	x	x
Lanner Falcon	VU	300						x	x	
Ludwig's Bustard	EN	320					x	x	x	
Martial Eagle	EN	350							x	
Pale Chanting Goshawk		200	x	x	x	x	x	x	x	x
Southern Black Korhaan	VU	270	x		x		x		x	
Spotted Eagle-Owl		170	x						x	
Verreaux's' Eagle	VU	360	x		x	x			x	x

The full species list (of positively identified species) indicating their conservation status and endemism are provided in Appendix IV. This table shows that 21 endemic or near-endemic species[4] have been recorded on the WEF site, and one (Cape Long-billed Lark) is a restricted-range species. However, none of these species were overly abundant.

Generally the diversity and abundance of small passerine species was low to moderate, although a relatively high number (16) of these species were endemic or near-endemic, and may be at risk from displacement impacts. Possibly of most concern regarding these species is the range-restricted Cape Long-billed Lark. This recently recognised species is confined to a narrow strip on the west coast littoral, preferring short coastal scrub including Renosterveld and Strandveld (Taylor *et al*. 2015). The population has not been quantified, but is believed to be decreasing, possibly due to disturbance and degradation of coastal habitats.

Two large terrestrial species have been recorded, the *Vulnerable* Southern Black Korhaan and the *Endangered* Ludwig's Bustard. Southern Black Korhaan males are territorial, and many of the records of this species may have been of the same individual bird. It was generally more abundant in the valleys and lower lying areas below the ridges. Southern Black Korhaan is generally known to fly mostly at low heights, yet may be susceptible to collision impacts with both turbines (particularly at the lower blade tip point) and over-head powerlines. However, it is more likely to be at threat from disturbance and/or displacement impacts.

Ludwig's Bustard was not recorded during the first two seasonal surveys and was only recorded in winter, following good rains in the area, and again in spring. This was predicted after the first and second survey, as generally very hot and dry conditions had only been experienced up until that point. Ludwig's Bustard is known to be nomadic and to have seasonal movements in line with rainfall patterns, and considering historical records from the area and the habitats available, it presence in winter and spring was expected. The WEF site falls within the potential range of Kori Bustard and Secretarybird, although neither of these two species was recorded on the site.

Verreaux's' Eagle was occasionally recorded on the WEF site in summer, autumn and spring, but not in winter. It is strongly suspected that all records of this species on the WEF in summer were of the same individual bird, and this may also be the case with the autumn sightings (which included only one flight). The sightings in spring were of at least 2 different birds (flights of a pair was seen on the WEF site on three separate occasions), and the species was most active in spring when a total of 7 flights were recorded from VPs.

Verreaux's' Eagles are territorial and their territories surround their nest sites, but their nests are not necessarily in the centre of their territory (Gargett 1990). Single birds recorded on the WEF, may be a young adult/s without an established territory (territorial adults are usually observed in pairs), termed a 'floater' that is searching for a territory. The WEF site does not hold any suitable nesting habitat (i.e. cliffs). Nests are usually built on cliffs and ledges (Gargett 1990), although they have been recorded nesting on power lines and occasionally in trees or on telephone poles (pers. obs.). Verreaux's' Eagle are predominantly found in mountainous, rocky habitat (Davies & Allan 1997), and the regional population (i.e. for South Africa, Lesotho and Swaziland) has been estimated to be between 3 500 and 3 750 mature individuals, but confidence in these figures is low (Taylor *et al.* 2015). Verreaux's' Eagle is an apex predator which plays an important ecological role. While no suitable cliff-nest habitat is on or near the WEF site, some suitable foraging habitat is present on the WEF site, and prey species such as Rock Hyrax ('Dassie') and Red Rock Rabbit have been observed.

[4] Endemic or near-endemic (i.e. ~70% or more of population in RSA) to South Africa (not southern Africa as in field guides) or endemic to South Africa, Lesotho and Swaziland. Taken from BirdLife South Africa Checklist of Birds in South Africa, 2014.

Martial Eagle was only recorded once on the WEF site, however it is generally uncommon outside of major game reserves and protected areas in South Africa. It is *Endangered* and is scarce outside of protected areas with the population in the Eastern, Western and Northern Cape approximately 100-150 birds (<1 bird / 5000 km^2) (Hockey *et al.* 2005). Its average breeding territory in north-east South Africa is 130-150 km^2 and at least 280 km^2 in the Nama Karoo and Namibia (Hockey *et al.* 2005) while inter-nest distances in the central Karoo average about 15 km (Boshoff 1993; Machange *et al*. 2005). These large territories show that this is a wide ranging species. It is also important to note that this species is monogamous and the pair bond is often maintained over several years, regularly re-using and breeding at the same nest site. Construction of pylons in the remote and arid areas on and around the Kap Vley project site may provide nesting substrate for this species.

6 IDENTIFICATION OF IMPACTS, IMPACT ASSESSMENT AND MITIGATION MEASURES

The possible impacts arising from the construction, operation and decommissioning of the WEF site and the grid connection have been identified and rated separately and are described in the following sections. A significance rating and impact assessment was done for each impact and mitigation measures for each of the identified impacts are also provided.

6.1 Background to Interactions between Wind Energy Facilities, Power Lines and Birds

South Africa has experienced an increase in the number of wind energy developments (both in terms of applications and those that have been built) in the past six years, but still lacks some information about the effects that these developments have on certain aspects of the environment. In South Africa, while post-construction monitoring is being conducted on the majority of operational sites, publically available data and information of operational results is limited and restricted to information supplied to BirdLife SA and made available by them to the public in the form of a report (Ralston Paton *et al*. 2017), and a public presentation (BLSA 2017a).

International experience, and results from South Africa have shown that birds can be impacted negatively by wind farms, and that the severity of these impacts can differ drastically from site to site. Overall, it appears that severe impacts, such as the high mortality numbers of Golden Eagle observed at Altamont Pass in California (Orloff & Flannery 1992; Hunt *et al.* 1998) seem to be the exception rather than the rule, with the majority of facilities recording relatively low mortalities (Erickson *et al.* 2001; de Lucas *et al.* 2008; Strickland *et al.* 2011). The effects of one poorly placed facility, or some poorly sited turbines within a facility, can however affect the population of certain species at a regional, national or even global level (Bellebaum *et al*. 2013; Carrete 2009; Dahl *et al.* 2012). Hence, it is important to assess the impacts of wind energy facilities, and to base this assessment on a thorough investigation of the local avifauna prior to construction, which is being done for the proposed development.

The main impacts of wind energy facilities and their associated infrastructure have been identified as (a) displacement through disturbance and habitat destruction and (b) mortality through collisions with turbines and/or powerlines and (c) electrocution on live power infrastructure (Rydell *et al.*, 2017; Drewitt & Langston 2006; Hotker *et al.* 2006; Percival 2005; van Rooyen 2004).

6.2 Kap Vley WEF Impacts

6.2.1 Construction Phase Impacts

6.2.1.1 Habitat Destruction

During the construction of the WEF, some habitat destruction and alteration will take place. This happens with the construction of access roads, the clearing of servitudes and areas for turbine placements, and the levelling of substation yards, development of laydown areas and turbine bases. The removal of vegetation which provides habitat for avifauna and food sources may have an impact on birds breeding, foraging and roosting.

This habitat destruction is a direct impact that is restricted to the site. If no mitigation (rehabilitation) occurs the impact can be permanent.

The scale of direct habitat loss resulting from the construction of a wind farm and associated infrastructure depends on the size of the project but, generally speaking, is likely to be small per turbine base. Typically, actual habitat loss amounts to 2 – 5 % of the total development area (Drewitt & Langston 2006) of a WEF although it is likely less in the case of the Kap Vley WEF. At Kap Vley, approximately 128 Ha of vegetation is expected to be cleared and lost. Therefore the consequence of the impact is considered as moderate as there is extensive suitable and similar habitat that will remain in the area and the environment will continue to function in a modified manner. This impact is unavoidable if development takes place, as some habitat destruction will have to occur in order to construct roads and turbines, and is therefore determined as very likely. The impact is partially reversible through rehabilitation.

The significance of the impact is rated as **Low (4)** prior to the application of mitigation measures, and as **Low (4)** following mitigation.

6.2.1.1.1 Mitigation Measures

- High traffic areas and buildings such as offices, batching plants, storage areas etc. should where possible be situated in areas that are already disturbed;
- Existing roads and farm tracks should be used where possible;
- The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths;
- Sensitive zones and no-go areas (e.g. nesting areas) are to be avoided;
- No off-road driving;
- Environmental Control Officer (ECO) to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced;
- Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes as well as the final turbine positions, to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded;
- The construction Phase ECO, the onsite Environmental Manager, and the client's representative on site (e.g. the resident engineer) are to be trained to identify Red Data and priority bird species, as well as their nests. If any nests or breeding locations for this species are located, the avifaunal specialist is to be contacted for further instruction; and
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the CEMP.

6.2.1.2 Disturbance and Displacement

Disturbances and noise from staff and construction activities can impact on certain sensitive species particularly whilst feeding and breeding, resulting in effective habitat loss through a perceived increase in predation risk (Frid & Dill 2002; Percival 2005). There are various potentially sensitive species occurring on the WEF site including Cape Long-billed Lark, Southern Black Korhaan, Black Harrier, Ludwig's Bustard and Verreaux's' Eagle. Disturbance can cause these species to be displaced, either temporarily (i.e. for some period during the construction activity) or permanently (i.e. they do not return), into less suitable habitat which may reduce their ability to survive and reproduce.

This is a negative impact restricted to the WEF construction site and duration (~2 years). The impact will cease as soon as construction is completed (highly reversible), and irreplaceability of the receiving environment is low. The severity of the impact can be mitigated partially, but some disturbance is likely to occur. The consequence of this impact is moderate as the environment will continue to function in a modified manner.

The significance of the impact is rated as **Low (4)** prior to the application of mitigation measures, and as **Low (4)** following mitigation.

6.2.1.2.1 Mitigation Measures

- A CEMP must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMP and should apply good environmental practice during construction;
- Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final infrastructure (e.g. road, substation, offices, turbine positions etc.) to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise;
- Sensitive zones and no-go areas are to be designated by the specialist (e.g. nesting sites) and must be avoided;
- The construction Phase ECO, the onsite Environmental Manager, and the client's representative on site (e.g. the resident engineer) are to be trained to identify Red Data and priority bird species, as well as their nests. The ECO and Environmental Manager must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any nests or breeding locations for these species are located, the avifaunal specialist is to be contacted for further instruction; and
- ECOs to oversee activities and ensure that the CEMP is implemented and enforced.

6.2.2 Operational Phase

6.2.2.1 Collisions with Wind Turbines

WEFs can cause bird mortalities through the collision of birds with moving turbine blades. A number of factors influence the number of birds impacted by collision, including:

- Number of birds in the vicinity of the WEF;
- The species of birds present and their flying patterns and behaviour; and
- The design of the development including the turbine layout, height and size of the rotor swept area.

It is important to understand that not all birds that fly through the WEF at heights swept by rotors automatically collide with blades. In fact avoidance rates for certain species have proven to be extremely high internationally, while avoidance rates have not been determined for South African species. In a radar study of the movement of ducks and geese in the vicinity of an off-shore wind facility in Denmark, less than 1% of bird flights were close enough to the turbines to be at risk, and it was clear that the birds avoided the turbines effectively (Desholm and Kahlert 2005). Whilst avoidance rates for SA species are currently unknown due to the lack of data, comparisons can be drawn between functionally similar species, for example Verreaux's' Eagle with Golden Eagle, in order to inform an assessment. Whitfield (2009) reviewed the avoidance rates for Golden Eagle and reported estimates varying between 98.64 % and 99.89 %.

The majority of studies on collisions caused by wind turbines have recorded relatively low mortality levels (Madders & Whitfield 2006). This is perhaps largely a reflection of the fact that many of the studied wind farms are located away from large concentrations of birds. It is also important to note that many records are based only on finding carcasses, with no correction for carcasses that were overlooked or removed by scavengers (Drewitt & Langston 2006). Relatively high collision mortality rates have been recorded at several large, poorly-sited wind farms in areas where large concentrations of birds are present (including IBAs), especially among migrating birds, large raptors or other large soaring species, e.g. in the Altamont Pass in California, USA (Thelander *et. al* 2003), and in Tarifa and Navarra in Spain (Barrios and Rodrigues 2004).

In northern Germany one study estimated an annual mortality of 8,500 common Buzzards, 11300 Wood Pigeons and 13000 Mallards from wind turbine collisions (Grunkorn *et al.* 2017). They also concluded that for the majority of wind farms studied, the numbers of collision victims predicted by collision risk modelling (CRM) using the BAND model, were clearly below the number of collision victims estimated from carcass searches and that the suitability of the BAND-Model for the evaluation of an anticipated collision risk at an 'average' onshore site is limited. Although large birds with poor manoeuvrability (such as cranes, korhaans, and bustards) are generally at greater risk of collision with structures (Jenkins *et al*. 2015), it is noted that these classes of birds (unlike raptors) do not feature prominently in literature as wind turbine collision victims. It may be that they avoid wind farms, resulting in lower collision risks, or that they are not distracted and focussed on hunting and searching the ground while flying, as is the case for raptors.

A minimum of 636 birds have been killed by turbines in South Africa to date (BLSA, 2017a). Ralston Paton *et al.* (2017) found that mortality estimates for eight studied wind farms in South Africa ranged from 2.1 to 8.6 birds per turbine per year, which is within range of average estimates from Europe (6.5) and North America (1.6) (Rydell *et al.* 2012). Raptors and passerines are the groups most affected by collisions in South Africa to date.

Eleven Red Data species (Taylor *et al.* 2015) have been affected, including fatalities of six Blue Crane (Near Threatened), six Verreaux's' Eagle (Vulnerable), six Cape Vulture (Endangered), five Black Harrier (Endangered), four Lanner Falcon (Vulnerable), three Southern Black Korhaan (Vulnerable) and two Martial Eagle (Endangered). Notably, a large number of the not red listed but endemic Jackal Buzzard (63) have been killed (Ralston Paton *et al.* 2017), as well as a number of Rock Kestrel (33) and passerines such as Bokmakkierie (21), White-rumped Swift (21) and Red-capped Lark (24).

Verreaux's Eagle is ranked third on the South African Birds and Renewable Energy Specialist Group's priority list and concerns that this species is vulnerable to collisions have been confirmed. During the first year of monitoring at operational wind farms in South Africa, one wind farm recorded four Verreaux's Eagle fatalities in the first year of

operation (Ralston-Paton *et al.* 2017). The fatalities occurred a considerable distance (at least 3.5 km) from suitable Verreaux's Eagle breeding habitat and on relatively flat ground (Smallie 2015). A single adult fatality occurred at another wind farm in August, again some distance from a nest 3.8 km away (Ralston-Paton *et al.* 2017).

As of 28 September 2017, 6 mortalities of Verreaux's Eagle had been recorded at wind farms in South Africa (BLSA 2017a). Some of these fatalities were unexpected as they occurred in areas not identified as sensitive during pre-construction monitoring. Therefore it is important to consider that collisions may not necessarily occur where predicted, and that they can occur away from areas perceived to be preferred use areas. On the other hand, no fatalities have been reported to date for several species predicted to be susceptible to collisions. Due to these uncertainties a pre-cautionary approach was adapted in the assessment of the impact of collisions with turbines.

Eagle mortalities at wind farms are not unexpected. Fatalities at wind farms have been reported for Golden Eagle (e.g. Smallwood 2013), White-tailed Sea Eagle (e.g. Hötker *et al.* 2006), Bald Eagle (Pagel *et al.* 2013) and White-bellied Sea Eagle (Smales & Muir, 2005). Verreaux's Eagle has recently been up-listed to Vulnerable and rough estimates of the population size are between 3 500 and 3 750 mature individuals (Taylor *et al.,* 2015).

Bird mortality is a direct, negative effect that can occur for the duration of the project's lifespan (long-term). It can affect regional populations if for example dispersing eagles continue to collide with turbines as they attempt to populate an available territory (sinkhole effect). The consequence of this impact is potentially severe and recent data from wind farms in South Africa (Ralston Paton *et al.* 2017; BLSA, 2017a) demonstrates that mortalities are very likely to occur, and irreversible in terms of the deceased individual and possibly also irreversible at a population level.

The significance of the impact is rated as **High (2)** prior to the application of mitigation measures, and as **Moderate (3)** following mitigation.

The most effective mitigation for collision impacts currently available is wind farm placement, as well as specific turbine placement within a WEF to avoid high use areas. Such recommendations have been made. While not yet tested in South Africa, deterrent devices and shut-down on demand strategies have been implemented internationally. Foss *et al.* (2017) found monochromatic LEDs that specifically target avian photoreceptors could provide a useful tool to divert raptors from hazardous situations, while in Scotland trials are underway by Scottish Natural Heritage (SNH) using laser beams to deter Sea Eagles from feeding on lambs[5]. Tome *et al.* (2017) found that a Radar Assisted Shutdown on Demand (RASOD) system at the Barão de São João wind farm in Portugal's Sagres region resulted in zero mortality of soaring birds over five consecutive autumn migratory seasons. While such strategy should not be relied upon completely (also considering that they are use internationally during migration events), they should not be discounted and may well hold valuable application in South Africa.

6.2.2.1.1 Mitigation Measures

- Turbines must not be constructed within any High Sensitivity Zones. The turbine blade should not protrude into these areas, and therefore the bases should be constructed suitably far from these areas to prevent this. Based on the outcomes of the sensitivity mapping, turbine number WEA 14 is within such an area and should be relocated approximately 120 m to the south or 125 m to the south east so that the turbine base is no less than 80 m from the boundary of the high sensitivity area. Turbine WEA 25 should also be set back approximately 65 m north or 75 m north east so that its blade tip does not encroach the high sensitivity area (Figure 6);

[5] http://www.bbc.com/news/uk-scotland-highlands-islands-42578354

- The hierarchy of sensitivity zones to be identified should be considered where possible;
- Develop and implement a carcass search programme for birds during the first two years of operation, in line with the applicable (i.e. at the start of operations at the wind farm) South African monitoring guidelines;
- Develop and implement a 24 month post-construction bird activity monitoring program that mirrors the pre-construction monitoring surveys completed by Arcus and is in line with the applicable South African post-construction monitoring guidelines. This program must include thorough and ongoing nest searches and nest monitoring;
- Conduct frequent and regular review of operational phase monitoring data (activity and carcass) and results by an avifaunal specialist. This review should also establish the requirement for continued monitoring studies (activity and carcass) throughout the operational and decommissioning phases of the development;
- The above reviews should strive to identify sensitive locations at the development including turbines and areas of increased collisions with power lines that may require additional mitigation. If unacceptable impacts are observed (in the opinion of the bird specialist after consultation with BLSA and an independent review), the specialist should conduct a literature review specific to the impact (e.g. collision and/or electrocution) and provide updated and relevant mitigation options to be implemented. Mitigations that may need to be implemented (and should be considered in the project's financial planning) include:
    - Onsite and off-site habitat management. A habitat management plan which aims to prevent an influx/increase in preferred prey items (e.g. Dassies) in the turbine area due to the construction and operation activities, while improving raptor habitat and promoting prey availability away from the site.
    - Using deterrent devices (e.g. visual and noise deterrents)
    - Deterrent and/or shutdown systems e.g. DT Bird and Radar Assisted Shutdown on Demand (RASOD) e.g. BIRDTRACK to reduce collision risk.
    - Identify options to modify turbine operation (e.g. temporary curtailment or shut-down on demand) to reduce collision risk if absolutely necessary and other methods have not had the desired results.

6.2.2.2 Collisions with Power Lines

Collisions with power lines are a well-documented threat to birds in southern Africa (van Rooyen 2004), and smaller lines pose a higher threat of electrocution but can still be responsible for collisions. Wind energy facilities may have overhead lines between turbine strings and substations that pose a collision threat, although this is not often the case as internal power is usually transferred between turbines and the onsite substation via underground cabling. Collisions with overhead power lines occur when a flying bird does not see the cables, or is unable to take effective evasive action, and is killed by the impact or impact with the ground. Especially heavy-bodied birds such as bustards, cranes and waterbirds, with limited manoeuvrability are susceptible to this impact (van Rooyen 2004). Many of the collision and electrocution sensitive species are also considered threatened in southern Africa. The Red Data (Taylor *et al.* 2015) species vulnerable to power line collisions are generally long living, slow reproducing species. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Species that may be affected on the WEF site include Ludwig's Bustard and Southern Black Korhaan. Ludwig's Bustard is known to be

particularly prone to collision (pers. Com R. Simmons, J. Smallie, M. Martins and BARESG) (Shaw *et al.* 2010).

Mortality through collisions with powerlines on the WEF is a direct, negative impact that can affect local populations over the course of the projects lifespan. The consequence of this impact is considered substantial, likely to occur and the effects are irreversible in terms of mortality. It can be mitigated to reduce the probability of the impact, but is unlikely to be avoided completely.

The significance of the impact is rated as **Moderate (3)** prior to the application of mitigation measures, and as **Low (4)** following mitigation.

6.2.2.2.1 Mitigation Measures

- Electrical infrastructure should not be constructed in 'no-go areas' and construction of infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
- Place new power lines on the WEF site underground where possible;
- Place new overhead power lines adjacent to existing power lines or linear infrastructure (e.g. roads and fence lines);
- Attach appropriate marking devices [Bird Flight Diverters (BFDs)] on all spans of all new overhead power lines to increase visibility; and
- Develop and implement a carcass search programme for birds during the first two years of operation, in line with the South African monitoring guidelines (Jenkins *et al*. 2015). This program must include monitoring of overhead power lines, including the new grid connection line.

6.2.2.3 Electrocution

Electrocution of birds from electrical infrastructure including overhead lines and substation components is an important and well documented cause of bird mortality, especially for raptors and storks (APLIC 1994; van Rooyen and Ledger 1999). Electrocution may also occur within newly constructed substations. Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Electrocutions are generally more likely for larger species whose wingspan is able to bridge the gap such as eagles or storks. A few large birds (such as Verreaux's' Eagle and Martial Eagle), susceptible to electrocution (particularly in the absence of safe and mitigated structures) occur in the area. Electrocution is also possible on electrical infrastructure within the substation particularly for species such as crows and owls.

Mortality through electrocution is a direct, negative impact that can affect populations at a regional level and can occur throughout the existence of the powerlines (long-term). The consequence of this impact is considered to be potentially substantial, but the probability is unlikely due to the development of bird friendly power line structures in recent years which are now constructed as a standard.

The significance of the impact is rated as **Moderate (3)** prior to the application of mitigation measures, and as **Very low (5)** following mitigation.

6.2.2.3.1 Mitigation Measures

- Electrical infrastructure should not be constructed in 'no-go areas' and construction of infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
- Place new power lines on the WEF underground where possible;

- Any new overhead power lines must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' structures, with clearances between live components of 1.8 m or greater and which provides a safe bird perch.

6.2.2.4 Disturbance and Displacement

Disturbance and displacement by operational activities such as power line and turbine maintenance, fencing, and noise can lead to birds avoiding the area for feeding or breeding, and effectively leading to habitat loss and a potential reduction in breeding success (Larsen & Madsen 2000; Percival 2005). Turbines can also be disruptive to bird flight paths, with some species altering their routes to avoid them (Dirksen *et al.* 1998, Tulp *et al.* 1999, Pettersson & Stalin 2003). While this reduces the chance of collisions it can also create a displacement or barrier effect, for example between roosting and feeding grounds and result in an increased energy expenditure and lower breeding success (Percival 2005). Small songbirds have been known to have been displaced from operational turbines which cause disturbance through noise, vibrations and shodow-flicker (Rydell *et al.* 2017). Disturbance distances (the distance from wind farms up to which birds are absent or less abundant than expected) can vary between species and also within species with alternative habitat availability (Drewitt & Langston 2006). Some international studies of various species have recorded disturbance distances of 80 m, 100 m, 200 m and 300 m (Larsen & Madsen 2000, Shaffer & Buhl 2015) from turbine positions, but distances of 600 m (Kruckenberg & Jaehne 2006) and up to 800 m have been recorded (Drewitt & Langston 2006).

Leddy *et al.* (1999) found increased densities of breeding grassland passerines with increased distance from wind turbines, and higher densities in the reference area than within 80 m of the turbines, indicating that displacement did occur, at least in this case. A comparative study of nine wind farms in Scotland (Pearce-Higgens *et al.* 2009) found seven of the 12 species studied exhibited significantly lower frequencies of occurrence close to the turbines, after accounting for habitat variation, with evidence of turbine avoidance in a further two. No species were more likely to occur close to the turbines. Raptors are generally fairly tolerant of wind farms, and continue to use the area for foraging (Thelander *et al.* 2003, Madders & Whitfield 2006, Ralston Paton *et al.* 2017), and may not be affected by displacement, however this increases their collision risk.

In South Africa the results available thus far have shown little evidence that displacement and disturbance of priority species has occurred. However, due to the limited number of operational wind farms in South Africa and short monitoring efforts, the precautionary principle should be applied, and disturbance and displacement must still be regarded as a potential impact.

It is expected that some species potentially occurring on the WEF site will be susceptible to disturbance and displacement, for example smaller passerines such as larks, warblers, flycatchers and chats, as well as large terrestrial Red Data species such as Southern Black Korhaan and Ludwig's Bustard. Priority species nesting on the project site (including on new infrastructure e.g. powerline pylons) may be disturbed during routine maintenance.

This negative impact is of potentially moderate consequence and will continue throughout the operational phase of the project. Disturbance is likely to occur and but is restricted to local populations and is moderately reversible once the activity ceases.

The significance of the impact is rated as **Low (4)** prior to the application of mitigation measures, and as **Low (4)** following mitigation.

6.2.2.4.1 Mitigation Measures

- A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations.
- The on-site WEF manager (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational Wind Farm, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction;
- Operational phase bird monitoring, in line with applicable guidelines, must be implemented and must include monitoring of all raptor nest sites for breeding success;
- No turbines should be placed in no-go areas to be identified through pre-construction monitoring, while associated infrastructure should be avoided where possible in these areas.

6.2.2.5 Disruption of Local Bird Movement Patterns

Wind energy facilities may form a physical barrier to movement of birds across the landscape, this may alter migration routes and increase distances travelled and energy expenditure or block movement to important areas such as ephemeral wetlands or prey sources altogether. This potential impact is not yet well understood, is likely to be more significant as a cumulative impact with surrounding developments, is difficult to measure and assess, and therefore mitigation measures are difficult to identify. Some mitigation may be possible by avoiding turbine placement in obvious flyways and making turbines more visible through lighting, but this will not change the significance of this impact.

This impact is a direct potentially negative regional effect which continues throughout the lifespan of the facility. It will cease as soon as the turbines are removed (highly reversible) and is unlikely to occur. The consequence of this impact is considered moderate.

The significance of the impact is rated as **Low (4)** prior to the application of mitigation measures, and as **Low (4)** following mitigation.

6.2.2.5.1 Mitigation Measures

- Turbines must not be constructed within any high sensitivity zones identified through pre-construction monitoring and impact assessment;
- The lowest feasible number of turbines should be constructed for the required MW output. Therefore, fewer larger (i.e with a higher MW output) turbine models should be favoured where possible.
- Preferred turbine placement in areas of low sensitivity, and decreasing preference through to high sensitivity zones identified through pre-construction monitoring; and
- Lighting on turbines to be of an intermittent and coloured nature rather than constant white light to reduce the possible impact on the movement patterns of nocturnal migratory species.

6.2.3 Decommissioning Phase

6.2.3.1 Disturbance and Displacement

Activities such as, noise and traffic associated with the decommissioning of the facility can impact species in the same way as construction activities. In addition, any nesting birds utilising the electrical infrastructure are vulnerable to disturbance impacts, especially if nests are disturbed or removed during the removal/take down of structures (e.g. pylons). This direct impact is restricted to the site to be decommissioned and will last for the length of the decommissioning phase (medium-term). It is likely to occur and mitigation is possible. The consequence of this impact is considered to be medium.

The significance of the impact is rated as **Low (4)** prior to the application of mitigation measures, and as **Low (4)** following mitigation.

6.2.3.1.1 Potential Mitigation Measures

- An EMP for decommissioning must be implemented, which gives appropriate and detailed description of how decommissioning activities must be conducted. All contractors are to adhere to the EMP and should apply good environmental practice during decommissioning;
- ECOs to oversee activities and ensure that the EMP is implemented and enforced;
- The appointed ECO must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), decommissioning activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed;
- Prior to decommissioning, an avifaunal specialist should conduct a site walkthrough, to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final decommissioning schedule in close proximity to that specific area, including abbreviating activity times, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.

6.3 Grid Connection Impacts

6.3.1 Construction Phase Impacts

6.3.1.1 Habitat Destruction

During the construction of the grid connection infrastructure, some habitat destruction and alteration will take place. This happens with the construction of access roads, the clearing of servitudes and areas for pylon placements, and the development of laydown areas. The removal of vegetation which provides habitat for avifauna and food sources may have an impact on birds breeding, foraging and roosting. This habitat destruction is a direct impact that is restricted to the grid connection site. If no mitigation (rehabilitation) occurs the impact can be permanent.

The consequence of the impact is considered as moderate as the environment will continue to function in a modified manner. This impact is unavoidable if development

takes place, as some habitat destruction will have to occur, and is therefore determined as very likely. The impact is partially reversible through rehabilitation.

The significance of the impact is rated as **Low (4)** prior to the application of mitigation measures, and as **Low (4)** following mitigation.

6.3.1.1.1 Mitigation Measures

- Existing roads and farm tracks should be used where possible;
- The minimum footprint areas of infrastructure should be used wherever possible, including access road widths and lengths;
- Sensitive zones and no-go areas (e.g. nesting areas) are to be avoided;
- No off-road driving;
- ECOs to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced;
- Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line routes to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded; and
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the CEMP.

6.3.1.2 Disturbance and Displacement

Disturbances and noise from staff and construction activities can impact on certain sensitive species particularly whilst feeding and breeding, resulting in effective habitat loss through a perceived increase in predation risk (Frid & Dill 2002; Percival 2005). There are various potentially sensitive species occurring on the Grid Connection route alternatives including Cape Long-billed Lark, Southern Black Korhaan, Black Harrier and Ludwig's Bustard. Disturbance can cause these species to be displaced, either temporarily (i.e. for some period during the construction activity) or permanently (i.e. they do not return), into less suitable habitat which may reduce their ability to survive and reproduce.

This is a negative impact restricted to the construction site and duration (~2 years). The impact will cease as soon as construction is completed (highly reversible), and irreplaceability of the receiving environment is low. The severity of the impact can be mitigated partially, but some disturbance is likely to occur. The consequence of this impact is moderate as the environment will continue to function in a modified manner.

The significance of the impact is rated as **Low (4)** prior to the application of mitigation measures, and as **Low (4)** following mitigation.

6.3.1.2.1 Mitigation Measures

- A CEMP must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMP and should apply good environmental practice during construction;
- Prior to construction, the avifaunal specialist should conduct a site walkthrough, covering the final power line route to identify any nests/breeding/roosting activity of sensitive species as well as any additional sensitive habitats. The results of which may inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise;
- Sensitive zones and no-go areas are to be designated by the specialist (e.g. nesting sites) and must be avoided; and

- ECOs to oversee activities and ensure that the site specific CEMP is implemented and enforced.

6.3.2 Operational Phase

6.3.2.1 Collisions with Power Lines

Collisions with large (132 kV or above) power lines is a well-documented threat to birds in southern Africa (van Rooyen 2004). Collisions with overhead power lines occur when a flying bird does not see the cables, or is unable to take effective evasive action, and is killed by the impact or impact with the ground. Especially heavy-bodied birds such as bustards, cranes and waterbirds, with limited manoeuvrability are susceptible to this impact (van Rooyen 2004). Many of the collision sensitive species are also considered threatened in southern Africa. The Red Data (Taylor *et al.* 2015) species vulnerable to power line collisions are generally long living, slow reproducing species. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Species that may be affected on the Grid Connection route alternatives include Ludwig's Bustard, Secretarybird, Greater Flamingo and Southern Black Korhaan. Ludwig's Bustard is known to be particularly prone to collision (pers. Com R. Simmons, J. Smallie, M. Martins and BARESG) (Shaw *et al.* 2010).

Mortality through collisions with powerlines is a direct, negative impact that can affect regional populations over the course of the projects lifespan. The consequence of this impact is considered severe, very likely to occur and the effects are irreversible in terms of mortality. It can be partially mitigated (especially by installing BFD's on all overhead lines), thus reducing the probability to likely, but is unlikely to be avoided completely as BFD's are not always 100% effective. However, using the supplied assessment criteria a reduction in the probability to likely, does not change the significance rating which remains high.

The significance of the impact is rated as **High (2)** prior to the application of mitigation measures, and as **High (2)** following mitigation.

6.3.2.1.1 Mitigation Measures

- Place new overhead power lines adjacent to existing power lines or linear infrastructure (e.g. roads and fence lines);
- Attach appropriate marking devices [Bird Flight Diverters (BFDs)] on all spans of all new overhead power lines to increase visibility;
- Conduct a pre-construction walkthrough by an avifaunal specialist of the approved grid-connection route, to microsite the tower positions and to advice on the number and type of BFD needed for each span. In some instances, BFDs fitted with solar lights may be needed to mitigate for nocturnal/diurnal flying species e.g. flamingos; and
- Develop and implement a carcass search programme for birds during the first two years of operation, in line with the South African monitoring guidelines (Jenkins *et al.* 2015). This program must include monitoring of overhead power lines, including the new grid connection line.

6.3.2.2 Electrocution

Electrocution of birds from electrical infrastructure including overhead lines is an important and well documented cause of bird mortality, especially for raptors and storks

(APLIC 1994; van Rooyen and Ledger 1999). With regard to the grid connection infrastructure, overhead power line infrastructure with a capacity of 132 kV or more does not generally pose a risk of electrocution due to the large size of the clearances between the electrical infrastructure components. Electrocutions are therefore more likely for larger species whose wingspan is able to bridge the gap such as eagles or storks. A few large birds (such as Verreaux's' Eagle and Martial Eagle), susceptible to electrocution (particularly in the absence of safe and mitigated structures) occur in the area.

Mortality through electrocution on power lines is a direct, negative impact that can affect populations at a regional level and can occur throughout the existence of the powerlines (long-term). The consequence of this impact is considered to be potentially substantial, but the probability is unlikely.

The significance of the impact is rated as **Moderate (3)** prior to the application of mitigation measures, and as **Very low (5)** following mitigation.

6.3.2.2.1 Mitigation Measures

- Electrical infrastructure should not be constructed in 'no-go areas' and construction of infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
- Any new overhead power lines must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' structures (in line with standard Eskom guidelines), with clearances between live components of 1.8 m or greater and which provides a safe bird perch.

6.3.2.3 Disturbance and Displacement

Disturbance and displacement by operational activities such as power line maintenance, can lead to birds avoiding the area for feeding or breeding, and effectively leading to habitat loss and a potential reduction in breeding success (Larsen & Madsen 2000; Percival 2005). During operation of the grid connection, servitudes for the power line will have to be cleared of excess vegetation at regular intervals. This is done to allow access to the power line for maintenance, to prevent vegetation from intruding into the prescribed clearance gap between the ground and the conductors, and to minimize the risk of fire under the line which can result in electrical flashovers. These and other maintenance activities can disturb sensitive species occurring on site.

It is expected that some species potentially occurring on the Grid Connection route alternatives will be susceptible to disturbance and displacement, for example smaller passerines such as larks, warblers, flycatchers and chats, as well as large terrestrial Red Data species such as Southern Black Korhaan and Ludwig's Bustard. Priority species nesting on the project site (including on new infrastructure e.g. powerline pylons) may be disturbed during routine maintenance. Potential species at risk of this are Lanner Falcon, Martial Eagle, Verreaux's Eagle and Greater Kestrel.

This negative impact is of potentially substantial consequence and will continue throughout the operational phase of the project. Disturbance is likely to occur and but is restricted to local populations and is moderately reversible once the activity ceases.

The significance of the impact is rated as **Moderate (3)** prior to the application of mitigation measures, and as **Low (4)** following mitigation.

6.3.2.3.1 Mitigation Measures

- A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All

contractors are to adhere to the OEMP and should apply good environmental practice during all operations.
- No bird nests must be disturbed or removed from any pylon infrastructure prior to consultation with and approval from the avifaunal specialist;
- The Manager and field staff responsible for maintenance and repairs on the grid connection line (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational Grid Connection site, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction; and
- Operational phase bird monitoring, in line with applicable guidelines, must be implemented to include monitoring of the Grid Connection route and must include monitoring of all raptor nest sites for breeding success.

6.3.3 Decommissioning Phase

6.3.3.1 Disturbance and Displacement

Activities such as, noise and traffic associated with the decommissioning of the Grid Connection can impact species in the same way as construction activities. In addition, any nesting birds utilising the electrical infrastructure are vulnerable to disturbance impacts, especially if nests are disturbed or removed during the removal/take down of structures (e.g. pylons). Particularly Martial Eagle (Endangered) is known to utilise pylons for nesting and could be susceptible to disturbance, and experience a resulting reduced breeding success. Martial Eagle has been recorded by monitoring at the WEF site and by SABAP2 in the Kleinzee area, not far from the proposed grid connection routes, and could be attracted to nest on the new pylons in the area. Lanner Falcon and Verreaux's Eagle as well as Greater Kestrel are three other priority species that may nest on pylons.

This direct impact is restricted to the site to be decommissioned and will last for the length of the decommissioning phase (medium-term). It is likely to occur but mitigation is possible. The consequence of this impact is considered to be substantial.

The significance of the impact is rated as **Moderate (3)** prior to the application of mitigation measures, and as **Low (4)** following mitigation.

6.3.3.1.1 Mitigation Measures

- An EMP must be implemented, which gives appropriate and detailed description of how decommissioning activities must be conducted. All contractors are to adhere to the EMP and should apply good environmental practice during decommissioning;
- ECOs to oversee activities and ensure that the CEMP for decommissioning is implemented and enforced;
- The appointed ECO must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), decommissioning activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed;

- Prior to decommissioning, an avifaunal specialist should conduct a site walkthrough, covering the entire power line route to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final decommissioning schedule in close proximity to that specific area, including abbreviating activity times, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.

6.4 Assessment of no-go alternative

Should the proposed project not be constructed (i.e. the no-go alternative is realised), the status quo with regards to the current land use is likely to persist in the medium to long term. The bird baseline as described in the report is unlikely to change significantly, apart from changes caused by natural environmental fluctuations (e.g. dry vs wet years). There will be no negative impact on the avifauna of the WEF site or the Grid Connection site if the no-go alternative is realised.

6.5 Cumulative Impacts

Five wind energy-and eight solar PV energy developments are proposed or approved within a 50 km radius of the proposed site, which could lead to cumulative impacts on birds. All of the above mentioned impacts, and particularly those associated with the operational phase of the proposed project, could be intensified due to potential cumulative effects.

The Kleinzee WEF avifaunal specialist concludes in the Final EIA report (Savannah Environmental 2015) that the species to be most likely impacted on are flamingos, cormorants, pelicans, bustards, korhaans, eagles and ducks. Of these groups only bustards, korhaans and eagles occur on the Kap Vley WEF site and could potentially be impacted on cumulatively, as the others are birds associated with the shoreline habitat and are unlikely to be influenced by the Kap Vley WEF. Flamingos may occur along the Kap Vley Grid connection route alternatives, and are at risk of cumulative impacts of power line collisions. In addition Verreaux's' Eagle, which occurs at Kap Vley WEF site was not recorded or identified as a target species at the Kleinzee WEF site.

Similarly, the Koingnaas WEF avifaunal specialist assessment identified flamingos, raptors, shelduck and Ludwig's Bustard as species likely to be impacted on, with particular emphasis on Ludwig's Bustard. Of these only Ludwig Bustard and some smaller raptors are likely to be impacted on by the proposed Kap Vley WEF, while flamingos may be impacted upon by the proposed Kap Vley grid connection.

At Springbok WEF Verreaux's' Eagle, which also occurs at Kap Vley WEF site, was identified as the species that will potentially be impacted on. However, Verreaux's' Eagle was only recorded sporadically at Kap Vley WEF site, and is not considered a species of high concern there. Therefore the cumulative impact of the proposed Kap Vley WEF on Verreaux's' Eagle is expected to be moderate.

The Project Blue Wind Energy Facility avifaunal specialist report mentions Black Harrier, Secretarybird, Jackal Buzzard and two kestrels (Greater and Rock Kestrel) as species of concern. Of these, Jackal Buzzard, Black Harrier and the kestrels were recorded at a low frequency at the Kap Vley WEF site with no record of Secretarybird.

Eight solar PV projects are planned within a 50 km radius. The main impact of solar PV facilities on birds is habitat destruction and collision impacts associated with the grid connection lines. Due to the relatively small footprint and resulting low significance of the habitat destruction impact at the Kap Vley WEF and Grid Connection, the cumulative habitat destruction impact for these developments is concluded to be of low significance. Details regarding the routes and lengths of the grid connection power lines for all eight

solar PV facilities were not all available, and therefore a precautionary approach has been adopted and the cumulative impact of power line collisions (particularly involving Ludwig's Bustard) is rated as moderate-high.

In summary the cumulative effect of Kap Vley WEF and Grid Connection along with the impacts of the proposed five wind farms and eight solar PV facilities has the potential to affect various bird species at a higher significance than the impacts of the Kap Vley WEF and Grid Connection alone. Key species most likely to impacted upon cumulatively include Ludwig's Bustard, Southern Black Korhaan, Jackal Buzzard, Verreaux's' Eagle, Cape Long-billed Lark and Black Harrier. Ludwig's Bustard and Southern Black Korhaan are most prone to impacts from collisions with power lines, while Jackal Buzzard and Verreaux's' Eagle are prone to impacts from collisions with wind turbines. There may be some moderate effects on other small raptors and passerines, but this is not considered to be of high concern.

6.6 Impact Assessment Summary Table- WEF

Table 9: Impact Assessment Table- WEF

Impact pathway	Nature of potential impact/risk	Status[6]	Extent[7]	Duration[8]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/impact (after mitigation)	Ranking of impact / risk	Confidence level
CONSTRUCTION PHASE															
Clearing of vegetation	Habitat destruction	Negative	Site	Long-term	Moderate	Very Likely	Moderate	Moderate	**Low (4)**	No	Yes	Where feasible, construct minimum number of turbines required to meet project MW output. Implement CEMP	**Low (4)**	4	Medium
Noise and disturbance from construction activities	Habitat loss through perceived increased predation risk (Displacement). Reduced breeding success.	Negative	Site	Medium-term	Moderate	Likely	High	Moderate	**Low (4)**	No	Yes	Buffer nest sites. Amend construction schedule. No turbines in No-go areas. Implement CEMP	**Low (4)**	4	Medium
OPERATIONAL PHASE															
Collisions with operational wind turbines	Bird mortality	Negative	Regional	Long-term	Severe	Very Likely	Non-reversible	Moderate	**High (2)**	No	Yes	Where feasible, construct minimum number of turbines required to meet project MW output. Adherence to no-go area buffers for turbine placement. Operational monitoring in line with applicable guidelines. Further operational mitigation measures to be researched, by appointed bird specialist, and the appropriate selected mitigation implemented, if post construction monitoring reveal high levels of impacts.	**Moderate (3)**	3	Medium
Collisions with overhead powerlines	Bird mortality	Negative	Local	Long-term	Substantial	Likely	Non-reversible	Moderate	**Moderate (3)**	No	Yes	Where possible route new line along existing roads and/or power line servitudes. BFD's must be installed on new overhead power line spans identified during a pre-construction walkthrough.	**Low (4)**	3	Medium
Electrocution from overhead powerlines	Bird mortality	Negative	Regional	Long-term	Severe	Unlikely	Non-reversible	Moderate	**Moderate (3)**	Yes	Yes	New powerline to be buried where possible. Use only a bird-friendly pylon structure. Ensure all clearance between live components are 1.8 m or greater.	**Very Low (5)**	5	High

[6] Status: Positive (+) ; Negative (-)
[7] Site; Local (<10 km); Regional (<100); National; International
[8] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 yrs); Long-term (project duration); Permanent (beyond project decommissioning)

Disturbance and noise from maintenance activities	Habitat loss through perceived increased predation risk (Displacement)	Negative	Site	Long-term	Moderate	Likely	Moderate	Moderate	**Low (4)**	No	Yes	Reduce disturbance by adhering to OEMP; on-site manager / ECO to be trained to ID priority species and signs of breeding; monitor raptor nest breeding success and conduct post-construction monitoring; No turbines in No-go areas.	**Low (4)**	4	Medium
Avoidance of turbines	Disruption of local bird movement patterns	Negative	Regional	Long-term	Moderate	Unlikely	High	Moderate	**Low (4)**	No	No	Intermittent coloured lighting on turbines; No turbines in high sensitivity areas; Where feasible, construct minimum number of turbines required to meet project MW output.	**Low (4)**	4	Low
DECOMMISSIONING PHASE															
Noise and disturbance from decommissioning activities	Habitat loss through perceived increased predation risk (Displacement). Reduced breeding success.	Negative	Site	Medium-term	Moderate	Likely	High	Moderate	**Low (4)**	No	Yes	Adhere to Decommissioning Phase EMP. Amendments to decommissioning schedule required if any of the Red Data species are confirmed to be breeding decommissioning activities within 500 m of the breeding site must cease, and an avifaunal specialist may advise changes to the schedule.	**Low (4)**	4	Medium

Table 10: Impact Assessment Table- Grid Connection

Impact pathway	**Nature of potential impact / risk**	**Status[9]**	**Extent [10]**	**Duration [11]**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment / resource**	**Significance of impact / risk = consequence x probability (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated ?**	**Potential mitigation measures**	**Significance of residual risk / impact (after mitigation)**	**Ranking of impact / risk**	**Confidence level**
CONSTRUCTION PHASE															
Clearing of vegetation	Habitat destruction	Negative	Site	Long-term	Moderate	Very Likely	Moderate	Moderate	**Low (4)**	No	Yes	Where feasible, construct minimum number of turbines required to meet project MW output. Implement CEMP	**Low (4)**	4	Medium
Noise and disturbance from construction activities	Habitat loss through perceived increased predation risk (Displacement). Reduced breeding success.	Negative	Site	Medium-term	Moderate	Likely	High	Moderate	**Low (4)**	No	Yes	Buffer nest sites. Amend construction schedule. No turbines in No-go areas. Implement CEMP	**Low (4)**	4	Medium
OPERATIONAL PHASE															
Collisions with overhead powerlines	Bird mortality	Negative	Local	Long-term	Severe	Very Likely	Non-reversible	Moderate	**High (2)**	No	Yes	Where possible route new line along existing roads and/or power line servitudes. BFD's must be installed on new overhead power line spans identified during a pre-construction walkthrough.	**High (2)**	3	Medium

[9] Status: Positive (+) ; Negative (-)
[10] Site; Local (<10 km); Regional (<100); National; International
[11] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 yrs); Long-term (project duration); Permanent (beyond project decommissioning)

Electrocution from overhead powerlines	Bird mortality	Negative	Regional	Long-term	Severe	Unlikely	Non-reversible	Moderate	**Moderate (3)**	Yes	Yes	New powerline to be buried where possible. Use only a bird-friendly pylon structure. Ensure all clearance between live components are 1.8 m or greater.	**Very Low (5)**	5	High
Disturbance and noise from maintenance activities	Habitat loss through perceived increased predation risk (Displacement)	Negative	Site	Long-term	Substantial	Likely	Moderate	Moderate	**Moderate (3)**	No	Yes	Reduce disturbance by adhering to OEMP; on-site manager / ECO to be trained to ID priority species and signs of breeding; monitor raptor nest breeding success and conduct post-construction monitoring; No turbines in No-go areas.	**Low (4)**	4	Medium
DECOMMISSIONING PHASE															
Noise and disturbance from decommissioning activities	Habitat loss through perceived increased predation risk (Displacement). Reduced breeding success.	Negative	Site	Medium-term	Substantial	Likely	High	Moderate	**Moderate (3)**	No	Yes	Adhere to Decommissioning Phase EMP. Amendments to decommissioning schedule required if any of the Red Data species are confirmed to be breeding decommissioning activities within 500 m of the breeding site must cease, and an avifaunal specialist may advise changes to the schedule.	**Low (4)**	4	Medium

Table 11: Impact Assessment Table- Cumulative Impacts

Impact pathway	**Nature of potential impact / risk**	**Status** [12]	**Extent** [13]	**Duration** [14]	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment / resource**	**Significance of impact / risk = consequence x probability (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated ?**	**Potential mitigation measures**	**Significance of residual risk / impact (after mitigation)**	**Ranking of impact / risk**	**Confidence level**
CUMULATIVE IMPACTS															
Collisions with overhead powerlines	Bird mortality	Negative	Regional	permanent	Extreme	Very Likely	Non-reversible	Moderate	**Very High (1)**	No	Yes	Where possible route new lines along existing roads and/or power line servitudes. BFD's must be installed on new overhead power line spans identified during a pre-construction walkthrough	**High (2)**	2	Medium
Collisions with operational wind turbines	Bird mortality	Negative	Regional	Permanent	Severe	Very Likely	Non-reversible	Moderate	**High (2)**	No	Yes	Where feasible, construct minimum number of turbines required to meet project MW output .Adherence to no-go area buffers for turbine placement. Operational monitoring in line with applicable guidelines. Further operational mitigation measures to be researched, by the appointed bird specialist and the appropriate selected mitigation implemented, if post construction monitoring reveal high levels of impacts.	**Moderate (3)**	3	Medium
Clearing of vegetation	Habitat destruction	Negative	Site	Long-term	Substantial	Very Likely	Moderate	Moderate	**Moderate (3)**	No	Yes	Implement CEMP. Where feasible, construct minimum number of turbines required to meet project MW output	**Low (4)**	4	Medium

[12] Status: Positive (+) ; Negative (-)
[13] Site; Local (<10 km); Regional (<100); National; International
[14] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 yrs); Long-term (project duration); Permanent (beyond project decommissioning)

7 CONCLUSION AND IMPACT STATEMENT

Activity and abundance of priority species and red data species were generally found to be low on the Kap Vley WEF site after one year of pre-construction monitoring. Thorough fieldwork and monitoring did not reveal any key or important avifaunal landscape features or sensitivities (e.g. nest sites) on or within 5 km of the WEF site. Abundances of small passerines were also found to be low. While the drought conditions experienced during the first two surveys (summer and autumn 2017), may have influenced the results, the third and fourth surveys (winter and spring) were conducted after rainfall in the area. It is unlikely that inter annual variation in bird occurrence would be so substantial so as to significantly alter the findings of this study. This can be said, as historical data sets from the area (as well as other studies done on surrounding proposed projects), did not reveal substantially different findings/conclusions. The Kap Vley WEF site has some of the lowest activity and occurrence of priority species experienced by the specialists, relative to other project sites worked on in South Africa. Passage rates were very low. The level of Verreaux's' Eagle activity is regarded as low, and it is unlikely that the development would pose a highly significant risk to this or any other species, except for a potentially moderate to high risk to Ludwig's Bustard posed by the Grid Connection line. A sensitivity mapping exercise found that one turbine (WEA 14) is currently within a high sensitivity area and should be relocated approximately 120 m to the south or 125 m to the south east while turbine WEA 25 may protrude into a high sensitivity area and should be set back approximately 65 m north or 75 m north east to avoid this. These requirements have been included as mitigation measures, and if implemented should reduce the potential collision impacts. The different ranges as proposed by juwi are accepted (i.e. Hub Height of 80-150 m and Rotor Diameter of 100-160 m). Overall, the potential impacts on avifauna as a group are not viewed as being of a significance so as to preclude development and it is the specialists' opinion that the project may proceed, subject to the implementation of all recommendations and mitigations referred to in this report.

The following conditions applicable to avifauna should be included in the Environmental Authorisation (EA) (if granted):

- All recommendations in the avifaunal specialist report are to be implemented;
- Prior to construction, the avifaunal specialist should conduct a site walkthrough covering the final road and power line routes as well as the final turbine positions, to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats within which construction activities may need to be excluded. The walkthrough must also cover the Grid Connection route;
- Attach appropriate marking devices [Bird Flight Diverters (BFDs)] on all spans of all new overhead power lines to increase visibility;
- Develop and implement a carcass search programme for birds during the first two years of operation, in line with the applicable (i.e. at the start of operations at the wind farm) South African monitoring guidelines; and
- Develop and implement a 24 month post-construction bird activity monitoring program that mirrors the pre-construction monitoring surveys completed by Arcus and is in line with the applicable South African post-construction monitoring guidelines. This program must include thorough and ongoing nest searches and nest monitoring

All proposed grid connection alternatives are acceptable, but Alternative 2 (the central route) is the more preferred route from an avifaunal perspective as it is the shortest route.

8 REFERENCES

Avian Power Line Interaction Committee (APLIC). 1994. *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994*. Edison Electric Institute. Washington D.C.

Barrios, L. & Rodriguez, A. 2004. Behavioural and environmental correlates of soaring-bird mortality at on-shore wind turbines. *Journal of Applied Ecology* 41: 72–81

Bellebaum, J., Korner-Nievergelt, F., Dürr, T. & Mammen, U. 2013. Wind turbine fatalities approach a level of concern in a raptor population. *Journal for Nature Conservation* 21: 394–400.

BLSA 2017a. *Wind energy and birds in South Africa: Turbine collision fatalities during the first two years of operational monitoring*. Presentation to the Birds and Renewable Energy Forum, 28 September 2017. BirdLife South Africa, 2017.

BLSA 2017b. BirdLife South Africa. 2017. Verreauxs' Eagle and Wind Farms. Guidelines for impact assessment, monitoring, and mitigation. *Birdlife South Africa Occasional Report Series.* BirdLife South Africa, Johannesburg, South Africa.

Boshoff, A.F. 1993. Density, active performance and stability of Martial Eagles *Polemaetus bellicosus* active on electricity pylons in the Nama-Karoo, South Africa. In: Wilson, R.T. (Ed.). Proceedings of the Eighth Pan-African Ornithological Congress. Musee Royal de 1'Afrique Centrale, Tervuren. pp 95-104.

Brooks, M. 2017. Southern African Bird Atlas Project 2: Full protocol records. Version 1.12. Animal Demography Unit, Department of Zoology, University of Cape Town. Occurrence Dataset https://doi.org/10.15468/8x5b7h accessed via GBIF.org on 2017-09-11.

Carrete, M., Sanchez-Zapata, J.A, Benitez, J.R., Lobon, M., Donazar, J.A. 2009. Large scale risk-assessment of wind-farms on population viability of a globally endangered long-lived raptor. *Biological Conservation* 142: 2954-2961.

Dahl, E.L., Bevanger, K., Nyg_ard, T., Røskaft, E. & Stokke, B.G. 2012. Reduced breeding success in white-tailed eagles at Smøla windfarm, western Norway, is caused by mortality and displacement. *Biological Conservation* 145: 79–85.

Davies, R. A. G., and D. G. Allan. 1997. "Black eagle Aquila verreauxii." *The atlas of southern African birds* 1 175-177.

de Lucas, M., Janss, G.F.E., Whitfield, D.P., Ferrer, M., 2008. Collision fatality of raptors in wind farms does not depend on raptor abundance. *Journal of Applied Ecology* 45: 1695–1703.

Desholm, M. and Kahlert, J. 2005. *Avian collision risk at an offshore wind farm*. Available online: http://rsbl.royalsocietypublishing.org/content/1/3/296.full

Dirksen, S., Spaans, A. L., & van den Winden, J. 1998. Nocturnal collision risks with wind turbines in tidal and semi-offshore areas. In: Ratto, C. F., & Solari, G. (eds.), *Wind Energy and Landscape*: 99-108. Proc. 2nd European and African Conference on Wind Engineering, Balkema, Rotterdam.

Drewitt, A.L. & Langston, R.H.W. 2006. Assessing the impacts of wind farms on birds. *Ibis* 148: 29-42.

Erickson, W.P., Johnson, G.D., Strickland, M.D., Young, D.P.Jr., Sernka, K.J. & Good, R.E. 2001. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States. *National Wind Coordinating Committee Resource Document*. 62 pp.

Foss, C.R., Ronning, D.J., and Merker, D.A. 2017. Intense short-wavelength light triggers avoidance response by Red-tailed Hawks: A new tool for raptor diversion?. The Condor: Ornithological Applications 119:431–438, Q2017 American Ornithological Society.

Frid, A. & Dill, L.M. 2002. Human-caused disturbance stimuli as a form of predation risk. *Conservation Ecology* 6(1): 11

Gargett, Valerie, and Peter J. Mundy. 1990. *The black eagle: a study*. Acorn Books.

Grunkorn, T., Blew, J., Kruger, O., Potiek, A., Reichenbach,M., von Ronn, J., Timmermann, H., Weitekamp, S. and Nehls, G. 2017. A Large Scle, Multispecies Assessment of Avian Mortality Rates at Land-Based Wind Turbines in Northern Germany. Wind Energy and Wildlife Interactions- J. Koppel (ed).

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. and Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1: Non-passerines. BirdLife South Africa, Johannesburg.

Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. (eds) 2005. Roberts Birds of Southern Africa, VII edition. The trustees of the John Voelcker Bird Book Fund, Cape Town.

Hötker, H., Thomsen, K.M. and Jeromin., H. 2006. Impacts on biodiversity of explotation of renewable energy resources: the example of birds and bats- facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation. Bergenhusen.

Hunt, W.G., Jackman, R.E., Hunt, T.L., Driscoll, D.E. & Culp, L. 1998. A population study of golden eagles in the Altamont Pass Wind Resource Area: population trend analysis 1994–1997*. Report to National Renewable Energy Laboratory, Subcontract XAT-6-16459-01*. Predatory Bird Research Group, University of California, Santa Cruz, USA

Jenkins, A.R., van Rooyen, C.S., Smallie, J.J., Harrison, J.A., Diamond, M., Smit-Robinson, H.A. Ralston, S. 2015. Bird and Wind-Energy Best-Practice Guidelines. Best-Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa. Third Edition (previous versions 2011 and 2012). BirdLife South Africa and Endangered Wildlife Trust, Johannesburg, South Africa.

Kruckenberg, H. & Jahene, J. 1999. Zum Einfluss eines Windparks auf die Verteilung weidender Bläßgänse im Rheiderland (Landkreis Leer, Niedersachsen). *Natur Landschaft* 74: 420–427

Larsen, J.K. & Madsen, J. 2000. Effects of wind turbines and other physical elements on field utilization by pink-footed geese (*Anser brachyrhynchus*): A landscape perspective. *Landscape Ecology* 15: 755–764

Leddy, K.L., Higgins, K., & Naugle, D. 1999. Effects of Wind Turbines on Upland Nesting Birds in Conservation Reserve Program Grasslands. The Wilson Bulletin, 111(1), 100-104. Retrieved from http://www.jstor.org/stable/4164034

Machange, R.W., Jenkins, A.R. & Navarro, R.A. 2005. Eagles as indicators of ecosystem health: Is the distribution of Martial Eagle nests in the Karoo, South Africa, influenced by variations in land-use and rangeland quality? *Journal of Arid Environments* 63: 223-243.

Madders, M. & Whitfield, D.P. 2006. Upland raptors and the assessment of wind farm impacts. *Ibis* 148: 43-56.

Malan, G. 2009. Raptor survey and monitoring – a field guide for African birds of prey. Briza, Pretoria.

Marnewick MD, Retief EF, Theron NT, Wright DR, Anderson TA. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa

Orloff, S. and A. Flannery. 1992. Wind turbine effects on avian activity, habitat use and mortality in Altamont Pass and Solano County Wind Resource Areas. *Report to the Planning Departments of Alameda, Contra Costa and Solano Counties and the California Energy Commission, Grant No. 990-89-003 to BioSystems Analysis, Inc., Tiburon, CA.*

Pagel, J.E., Kritz, K.J., Millsap, B., Murphy, R.K., Kershner, E., and Covington, S. 2013. Bald Eagle and Golden Eagle Mortalities at Wind Energy Facilities in the Contiguous United States. *Journal of Raptor Research*.

Percival, S. 2005. Birds and windfarms: what are the real issues? British Birds 98: 194-204.

Pettersson, J., & Stalin, T. 2003. Influence of offshore windmills on migration of birds on southeast coast of Sweden. *Report to GE Wind Energy.*

Pearce-Higgins, J. W., Stephen, L., Langston, R. H. W., Bainbridge, I. P. and Bullman, R. 2009. The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology* 46: 1323–1331. doi:10.1111/j.1365-2664.2009.01715.

Ralston Paton, S., Smallie J., Pearson A., and Ramalho R. 2017. Wind energy's impacts on birds in South Africa: A preliminary review of the results of operational monitoring at the first wind farms of the Renewable Energy Independent Power Producer Procurement Programme in South Africa. *BirdLife South Africa Occasional Report Series No. 2.* BirdLife South Africa, Johannesburg, South Africa

Retief, E.F., Diamond, M., Anderson, M.D., Smit, Dr. H.A., Jenkins Dr. A. & Brooks, M. 2011, updated 2014. Avian Wind Farm Sensitivity Map for South Africa: Criteria and Procedures Used.

Rydell, J., Engstrom, H., Hedenstrom, A., Larson, J.K., Petterrson, J. & Green, M. 2012. *The effect of wind power on birds and bats – a synthesis.* Unpublished report by the Swedish Environmental Protection Agency.

Rydell, J., Ottvall, R., Petterrson, J. & Green, M. 2017. *The effects of wind power on birds and bats – an updated synthesis report.* Report by the Swedish Environmental Protection Agency.

Savannah Environmental 2015. Proposed Kleinzee 300MW Wind Energy, South of Kleinsee Environmental Impact Assessment Process Final Environmental Impact Assessment Report.

Savannah Environmental 2012. Proposed Project Blue Wind Energy facility (Phase 1-3), North of Kleinsee Environmental Impact assessment Process Draft Impact Assessment Report.

Savannah Environmental 2011. Proposed Koingnaas Wind Energy Facility Environmental Basic Assessment Process, Final Basic Assessment Report.

Shaffer, J.A. and Buhl, D.A. 2015. Effects of wind-energy facilities on breeding grassland bird distributions. *Conservation Biology* 00 1-13 DOI: 10.111/cobi.12569

Shaw, J.M, Jenkins, A.R., Smallie, J.J & Ryan, P.G. 2010. Modelling power-line collision rosk for the Blue Crane *anthropoids paradiseus* in South Africa. *Ibis* 152: 590-599.

Smales, I. & Muir, S. 2005. Modelled cumulative impacts on the Tasmanian Wedge-tailed Eagle of wind farms across the species range. Biosis Research Pty. Ltd (for Australian Department of the Environment and Heritage.

Smallie, J. 2015. Verreaux's' Eagle *Aquila verreauxii* wind turbine collision fatalities. Wildskie Ecological Services Short Note.

Smallwood, K.S. 2013. Comparing bird and bat fatality rate estimates among North American Wind Energy Projects. Wildlife Society Bulletin. 37 (1): 19-22. DOI: 10.1002/wsb.260

Simmons, Dr. R. 2010. Springbok Wind Energy Facility. Final Environmental Impact Assessment: Birds.

Strickland, M.D., Arnett, E.B., Erickson, W.P., Johnson, D.H., Johnson, G.D., Morrison, M.L., Shaffer, J.A. and Warren-Hicks, W. 2011. *Comprehensive Guide to Studying Wind Energy/Wildlife Interactions.* Prepared for the National Wind Coordinating Collaborative, Washington, D.C., USA.

Taylor, M.R. (ed.) 2015. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Birdlife South Africa, Johannesburg.

Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A. & Kieswetter, S.L. 1999. *Coordinated waterbird Counts in South Africa, 1992-1997*. Avian Demography Unit, Cape Town.

Thelander, C. G., Smallwood, K. S., & Rugge, L. 2003. Bird risk behaviors and fatalities at the Altamont Pass Wind Resource Area. National Renewable Energy Laboratory, Golden, Colorado, USA.

Tome, R., Canario, F., Leitao, H., Pires, N., and Repas, M. 2017. Radar Assisted Shutdown on Demand Ensures Zero Soaring Bird Mortality at a Wind Farm Located in a Migratory Flyway. In Wind Energy and Wildlife Interactions (J. Koppel (ed)).

Tulp, I., Schekkerman, H., Larsen, J. K., van der Winden, J., van de Haterd, R. J.W., van Horssen, P., Dirksen, S., & Spaans, A. L. 1999. Nocturnal flight activity of sea ducks near the windfarm Tunø Knob in the Kattegat. IBN-DLO Report No. 99.30.

van Rooyen, C.S. 2004. The Management of Wildlife Interactions with over-headlines. In The fundamentals and practice of Over-head Line Maintenance (132 kV and above), pp 217-245. Eskom Technology, Services International, Johannesburg.

van Rooyen, C.S. and Ledger, J.A. 1999. Birds and utility structures: Developments in southern Africa. *Ferrer, M. & G.. FM Janns. (eds.) Birds and Power lines. Quercus: Madrid, Spain*, pp.205-230.

Whitfield, D.P. (2009) Collision Avoidance of Golden Eagles at Wind Farms under the 'Band' Collision Risk Model. Report to Scottish Natural Heritage. Natural Research Ltd, Banchory, UK.

APPENDIX I: SPECIALIST IMPACT ASSESSMENT CRITERIA

The identification of potential impacts and risks includes impacts that may occur during the construction, operational and decommissioning phases of the activity. The assessment of impacts includes direct, indirect, as well as cumulative impacts.

In order to identify potential impacts (both positive and negative) it is important that the nature of the proposed activity is well understood so that the impacts associated with the activity can be understood. The process of identification and assessment of impacts includes:

- Determination of the current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Determination of future changes to the environment that will occur if the activity does not proceed;
- An understanding of the activity in sufficient detail to understand its consequences; and
- The identification of significant impacts which are likely to occur if the activity is undertaken.

As per DEA *Guideline 5: Assessment of Alternatives and Impacts* the following methodology is applied to the prediction and assessment of impacts. Potential impacts are rated in terms of the direct, indirect and cumulative:

- **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
- **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.
- **Nature of impact** - this reviews the type of effect that a proposed activity will have on the environment and should include "what will be affected and how?"
- **Status** - Whether the impact on the overall environment (social, biophysical and economic) will be:
  - Positive - environment overall will benefit from the impact;
  - Negative - environment overall will be adversely affected by the impact; or
  - Neutral - environment overall will not be affected.
- **Spatial extent** – The size of the area that will be affected by the risk/impact:
  - Site;
  - Local (<10 km from site);
  - Regional (<100 km of site);
  - National; or
  - International (e.g. Greenhouse Gas emissions or migrant birds).
- **Duration** – The timeframe during which the risk/impact will be experienced:
  - Very short term (instantaneous);
  - Short term (less than 1 year);

- Medium term (1 to 10 years);
- Long term (the impact will occur for the project duration); or
- Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (*i.e.* the impact will occur beyond the project decommissioning).

- **Reversibility** of impacts -
  - High reversibility of impacts (impact is highly reversible at end of project life, i.e. this is the most favourable assessment for the environment. For example, the nuisance factor caused by noise impacts associated with the operational phase of an exporting terminal can be considered to be highly reversible at the end of the project life);
  - Moderate reversibility of impacts;
  - Low reversibility of impacts; or
  - Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment. The impact is permanent. For example, the loss of a palaeontological resource on the site caused by building foundations could be non-reversible).
- **Irreplaceability** of resource loss caused by impacts –
  - High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment. For example, if the project will destroy unique wetland systems, these may be irreplaceable);
  - Moderate irreplaceability of resources;
  - Low irreplaceability of resources; or
  - Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

Using the criteria above, the impacts will further be assessed in terms of the following:

- **Probability** – The probability of the impact occurring:
  - Extremely unlikely (little to no chance of occurring);
  - Very unlikely (<30% chance of occurring);
  - Unlikely (30 – 50% chance of occurring)
  - Likely (51 – 90% chance of occurring); or
  - Very likely (>90% chance of occurring regardless of prevention measures).
- **Consequence**–The anticipated severity of the impact:
  - Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);
  - Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or
  - Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).

- **Significance** – To determine the significance of an identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure A below). The approach incorporates internationally recognised methods from the Intergovernmental Panel on Climate Change (IPCC) (2014) assessment of the effects of climate change and is based on an interpretation of existing information in relation to the proposed activity, to generate an integrated picture of the risks related to a specified activity in a given location, with and without mitigation. Risk is assessed for each significant stressor (e.g. physical disturbance), on each different type of receiving entity (e.g. the municipal capacity, a sensitive wetland), qualitatively (very low, low, moderate, high, very high) against a predefined set of criteria (as shown in Figure A below).

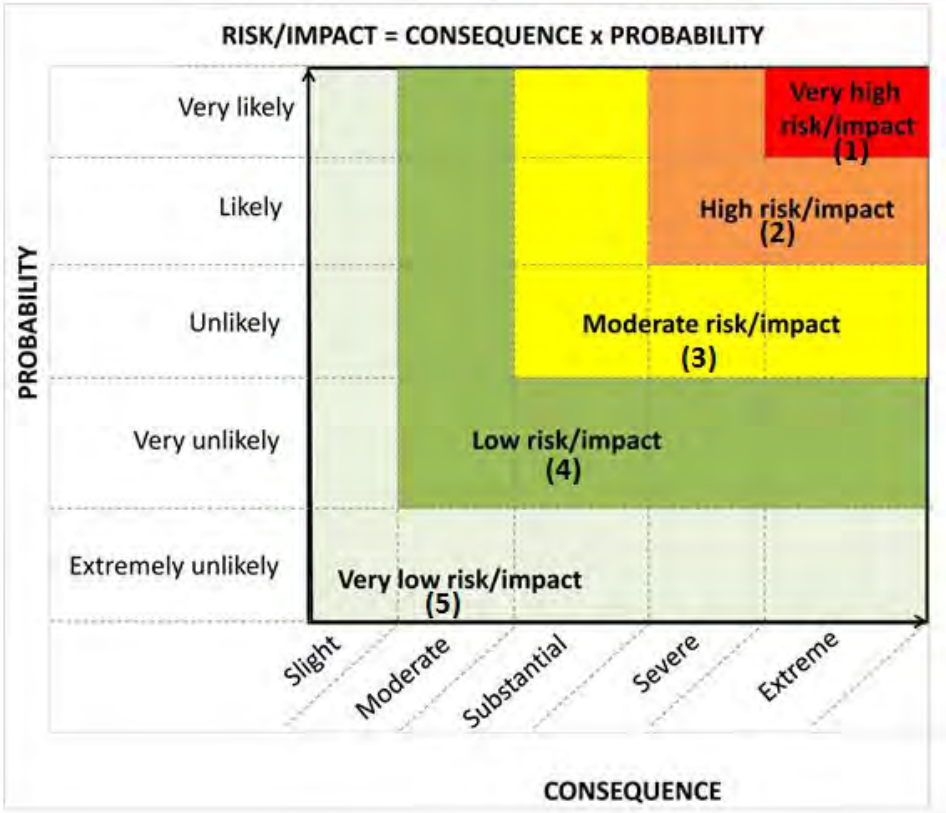


Figure A: Guide to assessing risk/impact significance as a result of consequence and probability.

- **Significance** – Will the impact cause a notable alteration of the environment?
  - Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
  - Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
  - Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated); or

- High (the risk/impacts will result in a considerable alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making).
- Very high (the risk/impacts will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).

The above assessment must be described in the text (with clear explanation provided on the rationale for the allocation of significance ratings) and summarised in an impact assessment Table in a similar manner as shown in the example below (Table 1).

With the implementation of mitigation measures, the residual impacts/risks must be ranked as follows in terms of significance:

- Very low = 5;
- Low = 4;
- Moderate = 3;
- High = 2; and
- Very high = 1.

- **Confidence** – The degree of confidence in predictions based on available information and specialist knowledge:
  - Low;
  - Medium; or
  - High.

Impacts will then be collated into an EMPr and these will include the following:

- Management actions and monitoring of the impacts;
- Identifying negative impacts and prescribing mitigation measures to avoid or reduce negative impacts; and
- Positive impacts will be identified and enhanced where possible.

Other aspects to be taken into consideration in the assessment of impact significance are:

- Impacts will be evaluated for the construction, operational and decommissioning phases of the development. The assessment of impacts for the decommissioning phase will be brief, as there is limited understanding at this stage of what this might entail. The relevant rehabilitation guidelines and legal requirements applicable at the time will need to be applied;
- The impact evaluation will, where possible, take into consideration the cumulative effects associated with this and other facilities/projects which are either developed or in the process of being developed in the local area; and
- The impact assessment will attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact;
- Impacts should be assessed for all layouts and project components;
- IMPORTANT NOTE FROM THE CSIR: IMPACTS SHOULD BE DESCRIBED BOTH BEFORE AND AFTER THE PROPOSED MITIGATION AND MANAGEMENT MEASURES HAVE BEEN IMPLEMENTED. THE ASSESSMENT OF THE POTENTIAL IMPACT "BEFORE MITIGATION" SHOULD TAKE INTO CONSIDERATION ALL MANAGEMENT ACTIONS THAT ARE ALREADY PART OF THE PROJECT DESIGN (WHICH ARE A GIVEN). THE ASSESSMENT OF THE POTENTIAL IMPACT "AFTER MITIGATION" SHOULD TAKE INTO CONSIDERATION ANY ADDITIONAL MANAGEMENT ACTIONS PROPOSED BY THE SPECIALIST, TO MINIMISE NEGATIVE OR ENHANCE POSITIVE IMPACTS.

APPENDIX II: AVIFAUNAL SPECIALISTS CVS AND DECLARATION OF INDEPENDANCE

CURRICULUM VITAE

Andrew Pearson
Ecology Specialist (Avifauna)
Email: andrewp@arcusconsulting.co.za Tel: +27 (0) 21 412 1529

Specialisms

- Avifauna Impact Assessment
- Pre-construction Avifauna Monitoring
- Construction Phase and Operational Phase Avifauna Monitoring
- Survey Design and Management
- Environmental Management Process

Summary of Experience

Andrew is an Avifauna Specialist with nine years of environmental management experience. He has worked as an avifaunal specialist for six years. Andrew has gained a strong level of experience in avifauna assessments across a multitude of sectors, including various powerline assessments and walk-downs. To date, Andrew has provided avifaunal specialist services on over 27 solar, power line and wind farm projects in Southern Africa. Andrew provides specialist input into the design of projects and environmental management plans, assesses environmental due diligence and compliance with international environmental policies (World Bank, IFC, Equator Principles) and peer reviews avifaunal specialist reports. Andrew is a professional natural scientist registered with SACNASP, and is a selected member of the Birds and Renewable Energy Specialist Group (BARESG). Andrew has been bird watching for 25 years, has worked as a birding field guide in 2006 and 2007, and attended bird identification training at the Lawson's Birding Academy in 2007.

Professional History

January 2014 to Present - Avifauna Specialist, Arcus Consultancy Services Ltd:

- Specialist Bird Impact Assessment Studies for energy infrastructure;
- Design of high quality bird surveys in line with applicable guidance and legal requirements;
- Design and implementation of operational carcass search programme including the training and management of locally based observers; and
- Specialist raptor nest surveys.

March 2011 to December 2013 - Environmental Impact Assessment & Avifaunal Specialist, Endangered Wildlife Trust

- Specialist Bird Impact Assessment Studies for energy infrastructure;
- Extensive work in the Wind Energy Sector to reduce possible impacts on birds and bats;
- 12 month Bird Monitoring on WEF sites - compilation of monitoring protocol, recruitment, management and co-ordination of observers, on-site bird observation and compilation of final monitoring reports; and
- Presentations and Environmental Training.

January 2008 to March 2011 - Group Environmental Manager, Basil Read (Pty) Ltd

- Environmental management of roads and civil construction projects;
- Implementation and certification of an ISO 14001:2004 Environmental Management System;
- Group Internal Environmental Audits;
- Compilation of EMPs and Environmental site inspections;
- Assistance in ENV authorisations and applications;
- Environmental Awareness Training; and
- Compilation of Group Carbon Footprint.

February 2006 to January 2008 - Game Ranger and Walking Guide, CC Africa (now *&BEYOND*), Phinda Private Game Reserve

- Game drives and walks in a Big 5 reserve;
- Hosting guests and sharing environmental and wildlife knowledge; and
- Environmental management, waste management.

Arcus Consultancy Services South Africa (Pty) Limited
Registered in South Africa No. 2015/416206/07

CURRICULUM VITAE

Qualifications and Professional Interests

- **University of Stellenbosch, 2005.**
  Bachelor of Science (Hons.): Conservation Ecology.
- August 2010 - Hazard Identification and Risk Assessment (HIRA) Course, IRCA Global.
- April 2010 - SAMTRAC, NOSA, East Rand Office.
- April 2009 - Green Star Accredited Professional Exam, (GBCSA), PROMETRIC.
- May 2008 - Environmental Auditing: ISO 14001:2004, Lead Auditors' Course (SAACTA approved), Centre for Environmental Management at North West University (NWU), Potchestroom.
- February 2008 - Environmental Law for Managers, Centre for Environmental Management at NWU.
- February 2008 - Implementing Environmental Management Systems - ISO 14001:2004, Centre for Environmental Management at NWU.
- August 2007 – Bird Identification Course, Lawson's Birding Academy, Intensive training in Makuleke, Kruger National Park.

Professional Membership

- South African Council for Natural Scientific Professions (SACNASP), "Ecological Science". Professional Natural Scientist (Pr. Sci. Nat.), Reg. no 400423/11.

Recent Conferences and Seminars

- Windaba 2013, 2014, 2015 and 2016; Solar Indaba 2013; Africa Utility Week 2014, 2015 and 2016.
- IAIA SA National Conference 2011, 2013 and 2016.
- March 2011 Endangered Wildlife Trust (EWT) Wildlife and Energy Symposium.

Additional Skills

- ArcGIS, Google GEO Tools and Google Earth.
- Computer Skills: Office 2013 including Microsoft Word, Excel, Outlook and PowerPoint.
- Field work skills involving various sampling methods, data capturing & analysis.
- Excellent knowledge of fauna (especially birds) and flora.
- 4x4 driving skills.

Project Experience

- **Due Diligence**
  Due Diligence of bird work conducted at the Kangnas WEF (ERM); Due Diligence of Bird Work conducted at the Excelsior WEF (ERM); Due Diligence of Bird Work conducted at the Golden Valley WEF (ERM); Due Diligence of Bird Work at the Roggeveld Wind Farm (IBIS Consulting).

- **Peer Review**
  Peer Review of Operational Monitoring at the Jeffreys Bay Wind Farm (Globeleq South Africa Management Services (Pty) Ltd); Review and design mitigation strategies for birds at the Kinangop Wind Park, Kenya (African Infrastructure Investment Managers).

- **Feasibility Studies**
  Assessment of the Feasibility of a Wind Farm in the Eastern Cape near Somerset East (WKN Windcurrent SA (Pty) Ltd).

- **Pre-Construction Monitoring and/or Impact Assessment - Wind Energy Facility (WEF) Projects:**
  Kouga WEF; Aberdeen WEF; Hidden Valley WEF; Middleton WEF; Springfontein WEF, Moorreesburg WEF; Grassridge WEF; Ukomeleza WEF; Chaba WEF; Waainek WEF; Vryheid WEF; Kouga Western Cluster WEF; Hopefield WEF; DNA Elliot WEF; Confidential WEF near Elliot; Umsinde Emoyeni WEF; Grassridge II WEF; Komsberg East WEF; Komsberg West WEF; Gouda WEF; Confidential WEF near Touws River; Confidential WEF near Kleinsee.

- **Operational Monitoring - WEF Projects:**
  Hopefield WEF; Gouda WEF.

Arcus Consultancy Services South Africa (Pty) Limited
Registered in South Africa No. 2015/416206/07

CURRICULUM VITAE

- **Impact Assessment - Powerline Projects:**
  St Francis Bay Kouga 66kV; Ncwane Okuku 88kV; Vulcan Ekangala 132kV; Merapi Everest 400kV; Mathibestad Majaneng 132kV; Majaneng Themba Main-Babelegi 132kV; Ngoma Pandamatenga 400kV (ZIZABONA Phase 2); Estancia Thuli 132kV; Estancia Zamokuhle 132kV; Gumeni Bosloop 132kV; Mbumbu Tsakani 132kV; Normandie Heyshope 132kV; Mookodi Integration Project; Wildebees Bethal 132kV; Zaaifontein Mathondwane 88kV; Hlabisa Nongoma 88kV; Mandeni Gingindlovu 132kV; Tabor Nzhelele 400kV; Leksand St James 88kV; Emondlo St James 88kV; Randfontein Mine 132kV; Droogfontein CSP 132kV; Mtubatuba St Lucia 132kV; Ndumo Gezisa 132kV; Ermelo Uitkoms 88kV; TCTA Spring Grove 88kV; Springfontein 132kV.
- **Pre-construction Monitoring and/or Impact Assessment - Concentrated Solar Power (CSP) Plants and Solar Photovoltaic (PV) Plants:**
  Humansrus 100MW CSP; Arriesfontein 100MW CSP; Arriesfontein 225MW PV; Eenzaamheid PV; Vaal Dam PV; Mokopole PV; Kalkaar CSP and PV; Droogfontein PV; Bokpoort II CSP; Metsimatala CSP.
- **Other:**
  Expansion of Hendrina Power Station Ash Disposal Facilities; Expansion of Majuba Power Station Ash Disposal Facilities; Expansion of Tutuka Power Station Ash Disposal Facilities; Eskom Distribution Cedarville Upgrade; Eskom Limpopo Operating Unit (LOU) Head Office, Polokwane.

Arcus Consultancy Services South Africa (Pty) Limited
Registered in South Africa No. 2015/416206/07

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

Proposed Kap Vley Wind Energy Facility

Specialist:	Arcus Consulting		
Contact person:	Andrew Pearson		
Postal address:	Office 220 Cube Workspace, Crn Long Street and Hans Strydom Street 8001		
Postal code:			
Telephone:	021 412 1533	Cell:	076 265 8933
E-mail:	andrewp@arcusconsulting.co.za	Fax:	n/a
Professional affiliation(s) (if any)	South African Council for Natural Scientific Professions		

Project Consultant:	Minnelise Levendal		
Contact person:	MInnelise Levendal		
Postal address:	CSIR		
Postal code:			
Telephone:		Cell:	
E-mail:	Mlevendal@csir.co.za	Fax:	n/a

4.2 The specialist appointed in terms of the Regulations_

I, Andrew Pearson, declare

that –General declaration:

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

Signature of the specialist:

Arcus Consultancy Services South Africa (Pty) Ltd
Name of company (if applicable):

18/09/2017
Date:

CURRICULUM VITAE

Anja Albertyn (neé Terörde), Pr.Sci.Nat.
Avifauna Specialist & Environmental Practitioner
Email: anjaa@arcusconsulting.co.za Tel: +27 (0) 21 412 1533

Specialisms

- Ornithology, Avifaunal Monitoring and Assessments
- Environmental Impact Assessments
- Avian Collision Risk Modelling
- GIS Mapping and Analysis (ArcGIS Pro, ArcMap)

Summary of Experience

Anja is a SACNASP registered Avifauna Specialist with close to 6 years of experience as an environmental consultant, and over 12 years of avifaunal monitoring experience. She has worked on over 22 renewable energy facility projects in South Africa. Anja is also involved in all aspects of environmental impact assessments and functions as Arcus' GIS specialist in Cape Town. She has been trained in Avian Collision Risk Modelling using the Band model.

Anja started her professional career as an environmental consultant in 2009 after graduating with a Master of Science in Zoology (Ornithology) from the Percy FitzPatrick Institute of African Ornithology at the University of Cape Town. She oversaw a large-scale ballast water treatment testing project for over 2 years before continuing to pursue her career in ornithology. To date she has published eight scientific papers on avian and estuarine ecology.

Professional History

2017 to present – Avifauna Specialist and Environmental Assessment Practitioner
2013 to 2017 – Ecology Consultant (Avifauna), Arcus, Cape Town
2011 to 2013 – Avifaunal Monitoring Services (self-employed)
2009 to 2011 – Consultant, Anchor Environmental Consultants, Cape Town
2005 to 2008 – Director & Co-founder, Fishriver Horse Safaris, Port Alfred
2002 to 2003 – Assistant Camp Manager. Mashatu Game Reserve, Botswana
1999 to 2000 – Wildlife Research Assistant, Centre for Wildlife Management, Pretoria

Qualifications and Professional Interests

- **Department of Environmental Science, Rhodes University, 2015**
  Introduction to Environmental Impact Assessment Procedure Short Course, *Highly competent*
- **Percy FitzPatrick Institute, University of Cape Town, 2006-2009**
  Zoology (Ornithology), Master of Science
- **Rhodes University, 2005-2006**
  Zoology, Bachelor of Science (Honours)
- **University of South Africa, 2002 – 2004**
  Zoology & Botany, Bachelor of Science *(cum laude)*
- **Heinrich-Heine Universität, 1999 – 2002**
  Biology, Vordiplom

Professional Membership

- South African Council for Natural Scientific Professions (Registration: 400037/16)
- Birdlife SA
- International Association for Impact Assessment South Africa

Project Experience

- **Pre-construction Avifaunal Monitoring and Avifaunal Impact Assessments for Wind Energy Facilities**
  Confidential WEF, Eastern Cape (WKN-Windcurrent);
  Confidential WEF, Eastern Cape (WKN- Windcurrent);
  Confidential WEF, Northern Cape (juwi);
  Kolkies WEF, Western Cape (Mainstream);
  Karee WEF, Western Cape (Mainstream);
  Komsberg East WEF, Western Cape (ACED);
  Komsberg West WEF, Western Cape (ACED);
  Grassridge II WEF (Innowind);
  Confidential WEF, Eastern Cape (Rainmaker);

CURRICULUM VITAE

Confidental WEF, Eastern Cape (Ventusa);
Koingnaas WEF, Northern Cape (Savannah),
Richtersveld WE, Northern Cape (G7);
Namakwaland WEF Northern Cape (G7);
Springbok WEF, Northern Cape (DJ Consultants).

- **Post-construction Avifaunal Monitoring for Wind Energy Facilities**
  Hopfield WEF, Western Cape (Umoya);
  Gouda WEF, Western Cape (Blue Falcon).

- **Pre-construction Avifaunal monitoring at Solar Energy Facilities**
  Bokpoort Solar Farm, Northern Cape (Golder);
  Metsimatala CSP Facility, Northern Cape (EnviroWorks).

- **Environmental Impact Assessment Practitioner**
  Confidential WEF, Eastern Cape (WKN-Windcurrent);
  Confidential WEF, Eastern Cape (WKN- Windcurrent).
  Phezukomoya WEF, Northern and Eastern Cape (Innowind);
  San Kraal WEF, Northern and Eastern Cape (Innowind);
  Kolkies WEF, Western Cape (Mainstream);
  Karee WEF, Western Cape (Mainstream);
  Komsberg East WEF, Western Cape (ACED);
  Komsberg West WEF, Western Cape (ACED);
  Umsinde Emoyeni Phase 1 WEF, Western Cape (Windlab);
  Umsinde Emoyeni Phase 2 WEF, Western Cape (Windlab);
  Umsinde Emoyeni Phase 1 Grid, Western Cape (Windlab);
  Umsinde Emoyeni Phase 2 Grid, Western Cape (Windlab);

- **Other Avifaunal Studies**
  Avifaunal Walkthrough, Robben Island PV, Western Cape (Sola Future Energy);
  Avifaunal Feasibility Assessment, Confidential WEF, Western Cape (ACED);
  Canal Walk Wetlands Avifauna Study, Cape Town (Sun International);
  Review and mitigation strategy design for birds at the Kinangob Wind Park, Kenya (African Infrastructure Investment Managers)

Scientific Publications

- Cowley, PD, Terörde, AI & Whitfield, AK. **2018**. Birds as major predators of fishes in a small estuary: does this influence the nursery area concept for estuary-associated fish species? African Zoology – ACCEPTED – *in press*
- Maree, BA, Cowley, PD, Naesje, TF Childs, A-R, Terörde, AI & Thorstad, EB. **2016**. Influence of prey abundance and abiotic factors on the long-term home-range and movement dynamics of spotted grunter *Pomadasys commersonnii* in an intermittently open estuary. African Journal of Marine Science 2016: 1-10
- Terörde, AI & Turpie, JK. **2013**. Influence of habitat structure and mouth dynamics on avifauna of intermittently-open estuaries: A study of four small South African estuaries. *Estuarine, Coastal and Shelf Science* 125: 10-19
- Terörde, AI & Turpie, JK. **2012**. Use of a small, intermittently-open estuary by waterbirds: a case study of the East Kleinemonde Estuary, Eastern Cape, South Africa. African Journal of Aquatic Science 37: 183-190
- Terörde, AI, Clark, B. Hutchings, K. Orr, K. **2011**. Ballast water management technology testing. South African Marine Science Symposium 2011.
- Turpie, JK. Clark, B.M., Bornman, T, Cowley, PD & Terörde, AI. **2009.** Integrated Ecological-Economic Modeling as an Estuarine Management Tool: A Case Study of the East Kleinemonde Estuary. Volume II: Model Construction, Evaluation and User Manual. WRC Report No. 1679/2/08

CURRICULUM VITAE

- Terörde, AI & Turpie, JK. **2008.** Appendix K. Specialist Report: Birds. In: van Niekerk, L., Bate, G.C. & Whitfield, A.K. (eds). East Kleinemonde Estuary Reserve determination study: Technical report. Department of Water Affairs & Forestry, Pretoria.
- Whitfield, AK, Adams, JB, Bate, GC, Bezuidenhout, K, Bornman, TG, Cowley, PD, Froneman, PW, Gama, PT, James, NC, Mackenzie, B, Riddin, T, Snow, GC, Strydom, NA, Taljaard, S, Terörde, AI, Theron, AK, Turpie, JK, van Niekerk, L, Vorwerk, PD & Wooldridge, T.H. **2008.** A multidisciplinary study of a small, intermittently open South African estuary, with particular emphasis on the influence of mouth state on the ecology of the system. African Journal of Marine Science 30: 453-474
- Terörde, AI & Turpie, JK. **2008.** Use of a small, intermittently-open estuary by waterbirds: a case study of the East Kleinemonde estuary, Eastern Cape, South Africa. South African Marine Science Symposium 2008. (Awarded **best student** oral presentation)
- Terörde, AI & Turpie, JK. **2007.** Birds. In: Whitfield AK, Bate GC (eds). A Review of Information on Temporarily Open/closed Estuaries in the Warm and Cool Temperate Biogeographic Regions of South Africa, with Particular Emphasis on the Influence of River Flow on these Systems. WRC Report No. 1581/1/07.

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

Proposed Kap Vley Wind Energy Facility

Specialist:	Anja Albertyn		
Contact person:	Anja Albertyn		
Postal address:	Office 220 Cube Workspace, Crn Long Street and Hans Strydom Street 8001		
Postal code:			
Telephone:	021 412 1533	Cell:	076 265 8933
E-mail:	anjaa@arcusconsulting.co.za	Fax:	n/a
Professional affiliation(s) (if any)	South African Council for Natural Scientific Professions		

Project Consultant:	Minnelise Levendal		
Contact person:	MInnelise Levendal		
Postal address:	CSIR		
Postal code:			
Telephone:		Cell:	
E-mail:	Mlevendal@csir.co.za	Fax:	n/a

4.2 The specialist appointed in terms of the Regulations_

I, Anja Albertyn, declare that –

General declaration:

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

Signature of the specialist:

Arcus Consultancy Services South Africa (Pty) Ltd
Name of company (if applicable):

18/09/2017
Date:

APPENDIX III: PRE-CONSTRUCTION BIRD MONITORING SURVEY DETAILS

Table A: Vantage Point Locations and Survey Dates with Hours Surveyed

VP	Co-ordinates		Dates surveyed (Session length)				Total Hours
	South	East	Summer	Autumn	Winter	Spring	
1	-29.822514°	17.401152°	24/02/2017 (3 h) 25/02/2017 (3 h) 27/02/2017 (6 h) 28/02/2017 (6 h)	17/05/2017 (3 h) 19/05/2017 (3 h) 20/05/2017 (3 h) 19/05/2017 (3 h)	01/08/2017 (3 h) 03/08/2017 (3 h) 04/08/2017 (3 h) 06/08/2017 (3 h)	10/10/2017 (3h) 12/10/2017 (3h) 13/10/2017 (3h) 15/10/2017 (3h)	54
2	-29.841478°	17.361940°	24/02/2017 (6 h) 25/02/2017 (6 h) 26/02/2017 (6 h)	17/05/2017 (3 h) 18/05/2017 (3 h) 20/05/2017 (3 h) 21/05/2017 (3 h)	02/08/2017 (3 h) 03/08/2017 (3 h) 05/08/2017 (3 h) 07/08/2017 (3 h)	10/10/2017 (3h) 11/10/2017 (3h) 13/10/2017 (3h) 14/10/2017 (3h)	54
3	-29.844505°	17.393906°	24/02/2017 (3 h) 25/02/2017 (3 h) 27/02/2017 (6 h) 28/02/2017 (3 h) 01/03/2017 (3 h)	17/05/2017 (3 h) 19/05/2017 (3 h) 20/05/2017 (3 h) 22/05/2017 (3 h)	01/08/2017 (3 h) 03/08/2017 (3 h) 04/08/2017 (3 h) 06/08/2017 (3 h)	10/10/2017 (3h) 12/10/2017 (3h) 13/10/2017 (3h) 15/10/2017 (3h)	54
4	-29.875842°	17.353799°	24/02/2017 (6 h) 25/02/2017 (6 h) 26/02/2017 (6 h)	17/05/2017 (3 h) 18/05/2017 (3 h) 20/05/2017 (3 h) 21/05/2017 (3 h)	01/08/2017 (3 h) 02/08/2017 (3 h) 04/08/2017 (3 h) 05/08/2017 (3 h)	10/10/2017 (3h) 11/10/2017 (3h) 13/10/2017 (3h) 14/10/2017 (3h)	54
5	-29.893285°	17.312513°	26/02/2017 (6 h) 27/02/2017 (6 h) 01/03/2017 (6 h)	18/05/2017 (3 h) 19/05/2017 (3 h) 19/05/2017 (3 h) 22/05/2017 (3 h)	01/08/2017 (3 h) 02/08/2017 (3 h) 04/08/2017 (3 h) 05/08/2017 (3 h)	11/10/2017 (3h) 12/10/2017 (3h) 14/10/2017 (3h) 15/10/2017 (3h)	54
CVP	-29.763502°	17.442609°	28/02/2017 (6 h) 01/03/2017 (6 h)	18/05/2017 (3 h) 19/05/2017 (3 h) 21/05/2017 (3 h) 23/05/2017 (3 h)	02/08/2017 (3 h) 03/08/2017 (3 h) 05/08/2017 (3 h) 07/08/2017 (3 h)	11/10/2017 (3h) 12/10/2017 (3h) 14/10/2017 (3h) 15/10/2017 (3h)	48

Table B: Walked Transect Locations and Survey Dates

Ref	Transect Co-ordinates (Start)		Transect Co-ordinates (Finish)		Dates Surveyed			
	South	East		East	Summer	Autumn	Winter	Spring
WT2	-29.804304°	17.382200°	-29.801195°	17.391889°	28/02/2017	20/05/2017 23/05/2017	04/08/2017 05/08/2017	13/10/2017 15/10/2017
WT3	-29.834881°	17.395963°	-29.840944°	17.388608°	24/02/2017 25/02/2017	19/05/2017 23/05/2017	03/08/2017 06/08/2017	12/10/2017 15/10/2017
WT4	-29.878162°	17.349255°	-29.873356°	17.357927°	25/02/2017 26/02/2017	18/05/2017 21/05/2017	01/08/2017 05/08/2017	11/10/2017 14/10/2017
WT5	-29.898949°	17.295032°	-29.896796°	17.305128°	26/02/2017 01/03/2017	18/05/2017 21/05/2017	02/08/2017 05/08/2017	12/10/2017 14/10/2017
CWT	-29.764588°	17.441543°	-29.762218°	17.450770°	28/02/2017 01/03/2017	19/05/2017 23/05/2017	03/08/2017 05/08/2017	11/10/2017 14/10/2017

Table C: Driven Transect Locations and Survey Dates

Ref	Length	Co-ordinates (Start)		Co-ordinates (Finish)		Survey Date			
		South	East	South	East	Summer	Autumn	Winter	Spring
DT1	6.7 km	-29.834820°	17.395940°	-29.790450°	17.430000°	24/02/2017 25/02/2017	17/05/2017 20/05/2017	01/08/2017 03/08/2017	10/10/2017 12/10/2017
DT2	9.7 km	-29.783020°	17.397370°	-29.843280°	17.360040°	23/02/2017 24/02/2017	17/05/2017 20/05/2017	03/08/2017 07/08/2017	11/10/2017 13/10/2017
DT3	13.7 km	-29.824780°	17.297370°	-29.898740°	17.294830°	23/02/2017 26/02/2017	18/05/2017 20/05/2017	01/08/2017 06/08/2017	11/10/2017 12/10/2017
CDT	7.1 km	-29.757700°	17.427410°	-29.696790°	17.423810°	23/02/2017 28/02/2017	19/05/2017 23/05/2017	02/08/2017 05/08/2017	11/10/2017 14/10/2017

Table D: Focal Site Locations, Descriptions and Survey Dates

Focal Site	Co-ordinates		Description	Survey Date			
	South	East		Summer	Autumn	Winter	Spring
FS1	-29.870674°	17.379208°	Artificial water point for live-stock and reservoir.	24/02/2017	17/05/2017	04/08/2017 06/08/2017	13/10/2017 14/10/2017
N1	-29.769719°	17.467132°	Verreaux's' Eagle Nest (N1)	-	23/05/2017	04/08/2017 07/08/2017	13/10/2017 15/10/2017
N4	-29.817942°	17.496148°	Verreaux's' Eagle Nest (N4)	-	23/05/2017	07/08/2017 08/08/2017	12/10/2017
N5	-29.836030°	17.516480°	Verreaux's' Eagle Nest (N5)	-	-	07/08/2017	12/10/2017

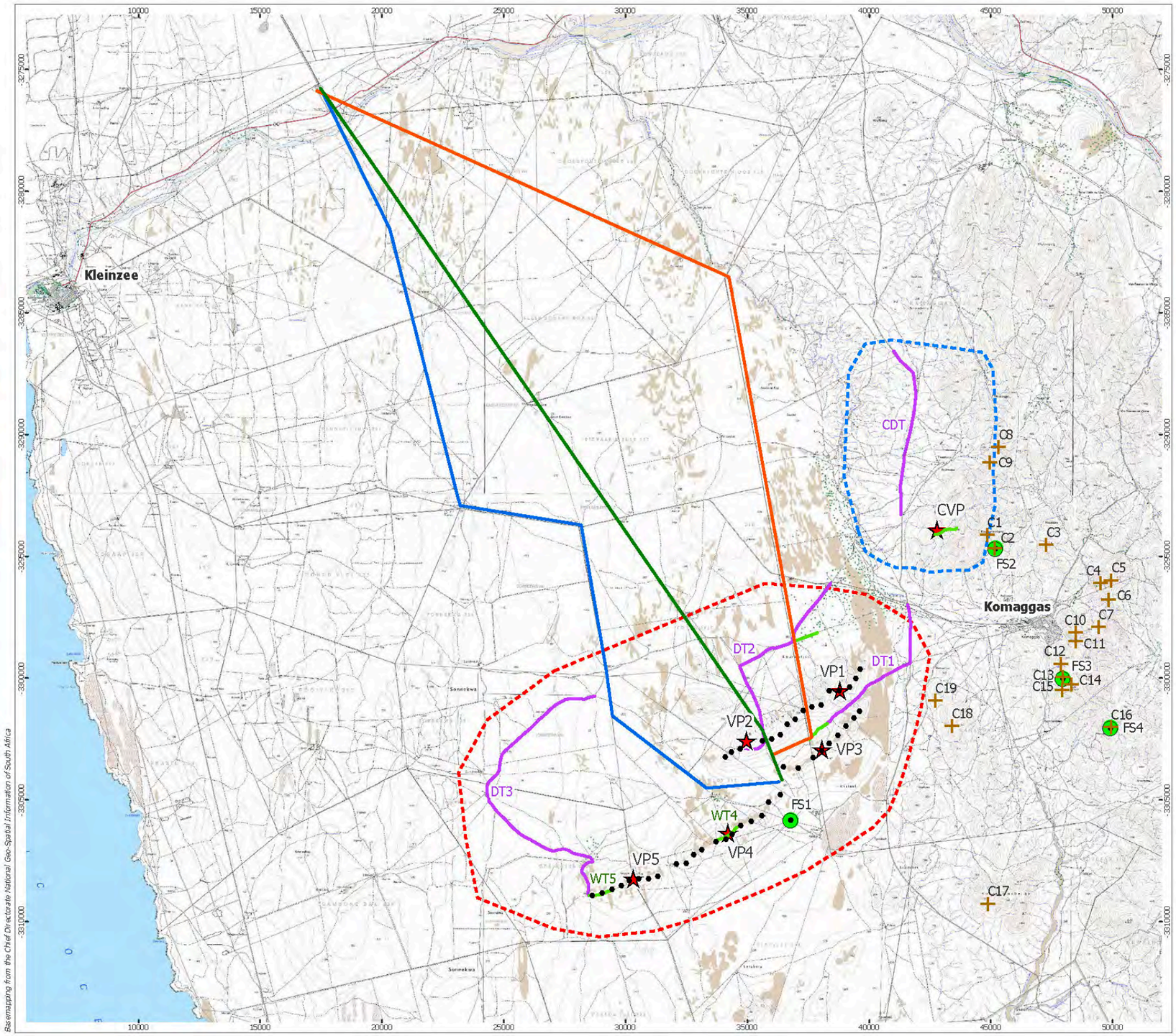
APPENDIX IV: PRE-CONSTRUCTION BIRD MONITORING SPECIES LIST

Full Name	Scientific Name	Red Data Status	Endemic / Near-Endemic	Restricted-range	Priority Species Score	Summer		Autumn		Winter		Spring	
						WEF Site	Control	WEF Site	Control	WEF Site	Control	WEF Site	Control
Acacia Pied Barbet	*Tricholaema leucomelas*					x	x	x	x	x	x	x	x
African Harrier-Hawk	*Polyboroides typus*				190			x		x	x		
African Sacred Ibis	*Threskiornis aethiopicus*							x	x	x	x	x	x
African Stonechat	*Saxicola torquatus*					x		x	x	x	x	x	x
Alpine Swift	*Tachymarptis melba*					x		x	x	x	x	x	x
Ant-eating Chat	*Myrmecocichla formicivora*					x		x	x			x	
Barn Swallow	*Hirundo rustica*					x							
Black Harrier	*Circus maurus*	EN	X		345					x		x	
Black-chested Snake Eagle	*Circaetus pectoralis*				230					x		x	
Bokmakierie	*Telophorus zeylonus*					x	x	x	x	x	x	x	x
Booted Eagle	*Hieraaetus pennatus*				230	x						x	x
Bradfield's Swift	*Apus bradfieldi*					x	x	x					
Brown-throated Martin	*Riparia paludicola*					x	x	x	x	x	x	x	x
Cape Bulbul	*Pycnonotus capensis*		X			x	x	x	x	x	x	x	x
Cape Bunting	*Emberiza capensis*					x	x	x	x	x	x	x	x
Cape Canary	*Serinus canicollis*					x		x	x	x	x	x	
Cape Clapper Lark	*Mirafra apiata*		X			x		x		x	x	x	
Cape Crow	*Corvus capensis*					x	x	x	x	x	x	x	x
Cape Eagle-Owl	*Bubo capensis*				250	x							
Cape Long-billed Lark	*Certhilauda curvirostris*		X	X		x		x	x	x	x	x	x
Cape Sparrow	*Passer melanurus*					x	x	x	x	x	x	x	x
Cape Turtle Dove	*Streptopelia capicola*					x	x	x	x	x	x	x	x

Full Name	Scientific Name	Red Data Status	Endemic /Near-Endemic	Restricted-range	Priority Species Score	Summer		Autumn		Winter		Spring	
						WEF Site	Control	WEF Site	Control	WEF Site	Control	WEF Site	Control
Cape Wagtail	*Motacilla capensis*							x	x		x	x	
Cape Weaver	*Ploceus capensis*		X					x	x	x	x	x	
Capped Wheatear	*Oenanthe pileata*										x	x	
Chat Flycatcher	*Bradornis infuscatus*					x	x	x	x	x	x	x	x
Chestnut-vented Tit-Babbler	*Sylvia subcaerulea*					x		x				x	
Cinnamon-breasted Warbler	*Euryptila subcinnamomea*		X			x		x					
Common Fiscal	*Lanius collaris*					x		x	x	x	x	x	x
Dusky Sunbird	*Cinnyris fuscus*					x		x		x			
European Bee-eater	*Merops apiaster*											x	
Fairy Flycatcher	*Stenostira scita*		X					x					
Familiar Chat	*Cercomela familiaris*					x		x	x	x	x	x	x
Greater Kestrel	*Falco rupicoloides*				174					x		x	x
Greater Striped Swallow	*Cecropis cucullata*					x	x					x	x
Grey Tit	*Parus afer*		X				x	x		x	x	x	x
Grey-backed Cisticola	*Cisticola subruficapilla*					x	x	x	x	x	x	x	x
Grey-winged Francolin	*Scleroptila africana*		X		190					x			
Ground Woodpecker	*Geocolaptes olivaceus*		X			x	x	x	x	x	x	x	
Hadeda Ibis	*Bostrychia hagedash*											x	x
Jackal Buzzard	*Buteo rufofuscus*		X		250	x	x	x	x	x	x	x	x
Karoo Chat	*Cercomela schlegelii*					x	x	x	x	x	x	x	x
Karoo Lark	*Calendulauda albescens*		X			x	x	x	x	x	x	x	x
Karoo Prinia	*Prinia maculosa*		X			x	x	x	x	x	x	x	x
Karoo Scrub Robin	*Erythropygia coryphoeus*					x	x	x	x	x	x	x	x
Karoo Thrush	*Turdus smithi*		X							x			

Full Name	Scientific Name	Red Data Status	Endemic /Near-Endemic	Restricted-range	Priority Species Score	Summer		Autumn		Winter		Spring	
						WEF Site	Control	WEF Site	Control	WEF Site	Control	WEF Site	Control
Lanner Falcon	*Falco biarmicus*	VU			300						x	x	
Large-billed Lark	*Galerida magnirostris*		X			x		x		x	x	x	
Laughing Dove	*Streptopelia senegalensis*							x	x	x	x	x	x
Layard's Tit-Babbler	*Sylvia layardi*		X			x	x	x	x	x	x	x	
Little Swift	*Apus affinis*					x		x	x	x	x	x	x
Long-billed crombec	*Sylvietta rufescens*					x		x	x	x	x	x	x
Ludwig's Bustard	*Neotis ludwigii*	EN			320					x	x	x	
Malachite Sunbird	*Nectarinia famosa*							x	x	x	x	x	x
Martial Eagle	*Polemaetus bellicosus*	EN			350							x	
Mountain Wheatear	*Oenanthe monticola*					x	x	x	x	x	x	x	x
Namaqua Dove	*Oena capensis*					x		x				x	
Namaqua Sandgrouse	*Pterocles namaqua*						x	x	x			x	x
Namaqua Warbler	*Phragmacia substriata*		X			x		x		x		x	
Pale Chanting Goshawk	*Melierax canorus*				200	x	x	x	x	x	x	x	x
Pied crow	*Corvus albus*					x		x	x	x	x	x	x
Pied Starling	*Lamprotornis bicolor*		X					x		x	x	x	x
Red-eyed Dove	*Streptopelia semitorquata*						x	x	x			x	x
Red-faced Mousebird	*Urocolius indicus*									x		x	x
Red-winged Starling	*Onychognathus morio*							x	x	x	x	x	x
Rock Kestrel	*Falco rupicolus*					x	x	x		x		x	
Rock Martin	*Hirundo fuligula*					x	x	x	x	x	x	x	x
Rufous-eared Warbler	*Malcorus pectoralis*							x	x	x	x	x	x
Sickle-winged Chat	*Cercomela sinuata*		X			x						x	x
Southern Black	*Afrotis afra*	VU	X		270	x		x		x		x	

Full Name	Scientific Name	Red Data Status	Endemic /Near-Endemic	Restricted-range	Priority Species Score	Summer		Autumn		Winter		Spring	
						WEF Site	Control	WEF Site	Control	WEF Site	Control	WEF Site	Control
Korhaan													
Southern Double-collared Sunbird	*Cinnyris chalybeus*		X			x		x	x	x	x	x	x
Speckled Pigeon	*Columba guinea*					x		x	x		x	x	x
Spike-heeled Lark	*Chersomanes albofasciata*					x	x	x	x	x	x	x	x
Spotted Eagle-Owl	*Bubo africanus*				170	x						x	
Tractrac Chat	*Cercomela tractrac*							x				x	x
Verreauxs' Eagle	*Aquila verreauxii*	VU			360	x		x	x			x	x
White-backed Mousebird	*Colius colius*					x		x		x	x	x	x
White-necked Raven	*Corvus albicollis*											x	
White-throated Canary	*Crithagra albogularis*					x		x	x	x	x	x	x
Yellow Canary	*Crithagra flaviventris*					x		x	x	x	x	x	x
Yellow-bellied Eremomela	*Eremomela icteropygialis*						x	x		x			
Yellow-billed Kite	*Milvus aegyptius*					x						x	



ARCUS

- WEF Site Study Area
- Control Site Study Area
- Proposed Turbine Location
- Grid Connection Alternative 1
- Grid Connection Alternative 3
- Grid Connection Alternative 2

Survey Locations

- Vantage Point
- Walked Transect
- Driven Transect
- Focal Site
- Surveyed Cliffs and Ridges

1:150,000 Scale @ A3

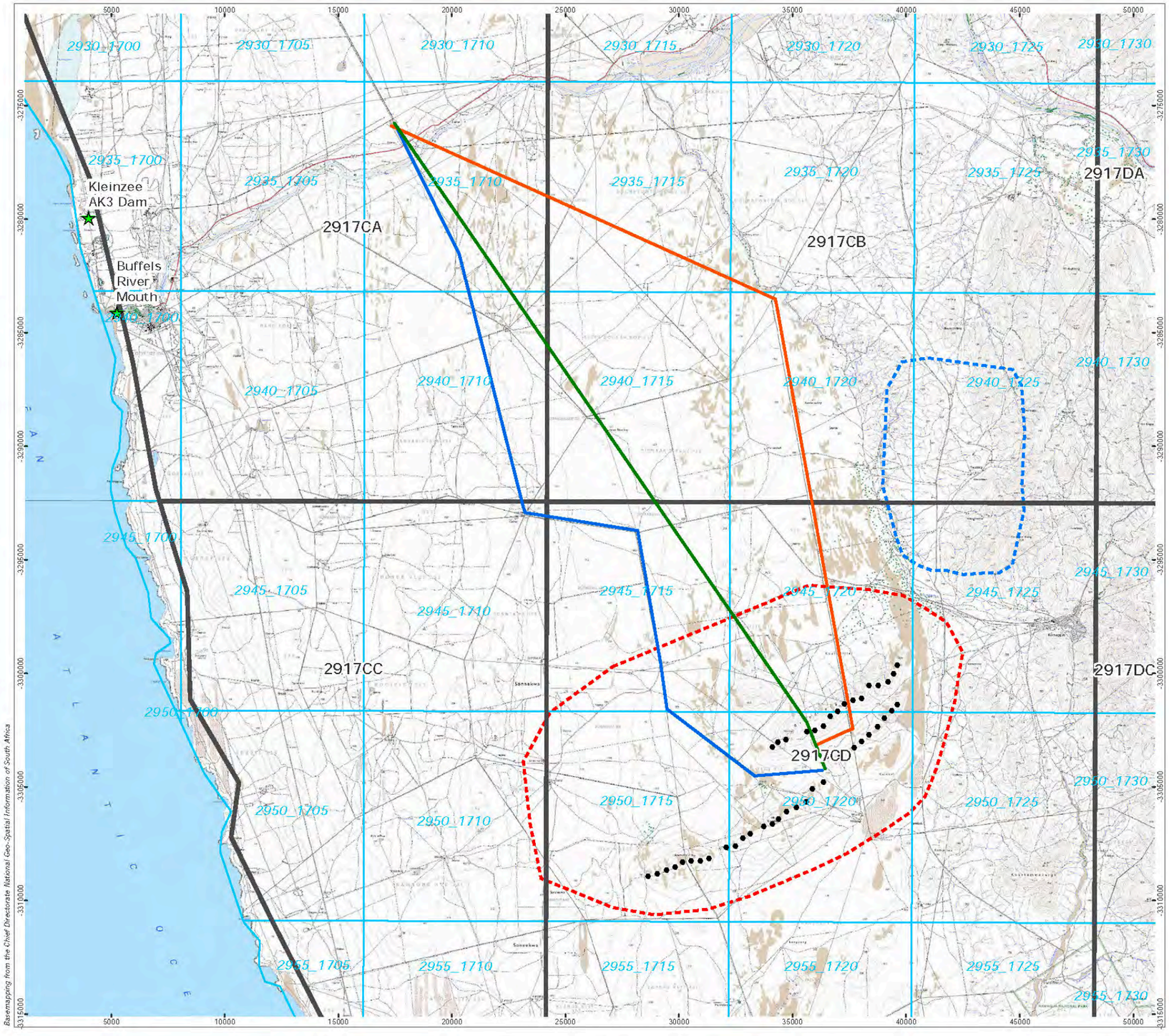
0 2.5 5 km

N

Produced: AP Reviewed: SC Approved: AB	Ref: 2622/REP/011 Date: 30/01/2018

Project Site and Bird Survey Locations
Figure 1

Kap Vley WEF Avifaunal Impact Assessment Report



Basemapping from the Chief Directorate National Geo-Spatial Information of South Africa

ARCUS

- WEF Site Study Area
- Control Site Study Area
- Proposed Turbine Location
- Grid Connection Alternative 1
- Grid Connection Alternative 3
- Grid Connection Alternative 2
- CWAC Site
- SABAP1 QDS
- SABAP2 Pentad

1:160,000 Scale @ A3

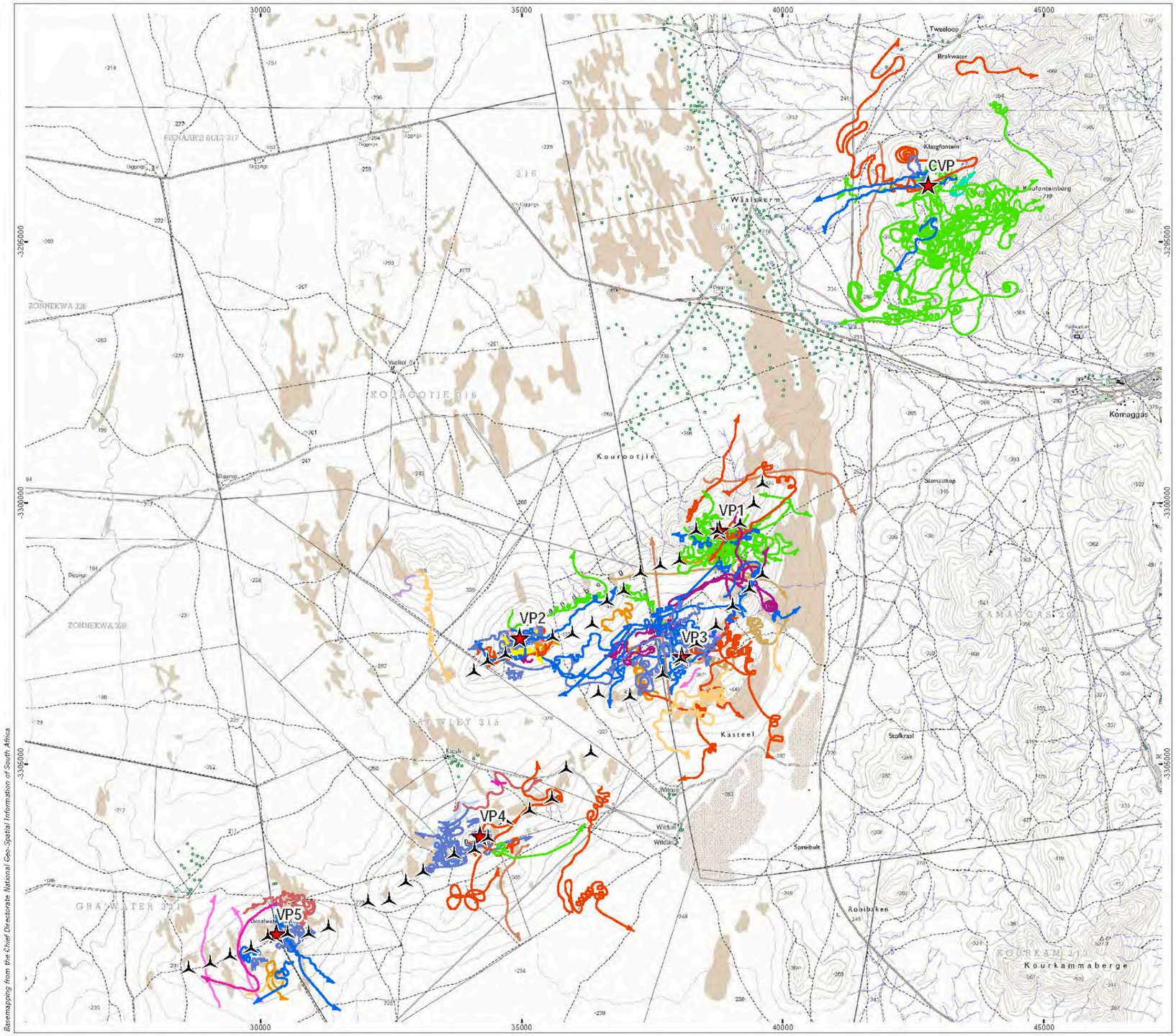
0 2.5 5 km

N

Produced: AP Reviewed: SC Approved: AB	Ref: 2622/REP/012 Date: 25/01/2018

SABAP Grid Squares and CWAC Sites
Figure 2

Kap Vley WEF Avifaunal Impact Assessment Report



Basemapping from the Chief Directorate National Geo-Spatial Information of South Africa

ARCUS

- Vantage Point
- African Harrier Hawk Flight
- Black-chested Snake Eagle Flight
- Black Harrier Flight
- Booted Eagle Flight
- Greater Kestrel Flight
- Jackal Buzzard Flight
- Unidentified Kestrel Flight
- Lanner Falcon Flight
- Lesser Kestrel Flight
- Ludwig's Bustard Flight
- Pale Chanting Goshawk Flight
- Rock Kestrel Flight
- Southern Black Korhaan Flight
- Undientified Raptor Flight
- Verreauxs' Eagle Flight
- Yellow-billed Kite Flight

1: 70,000 Scale @ A3

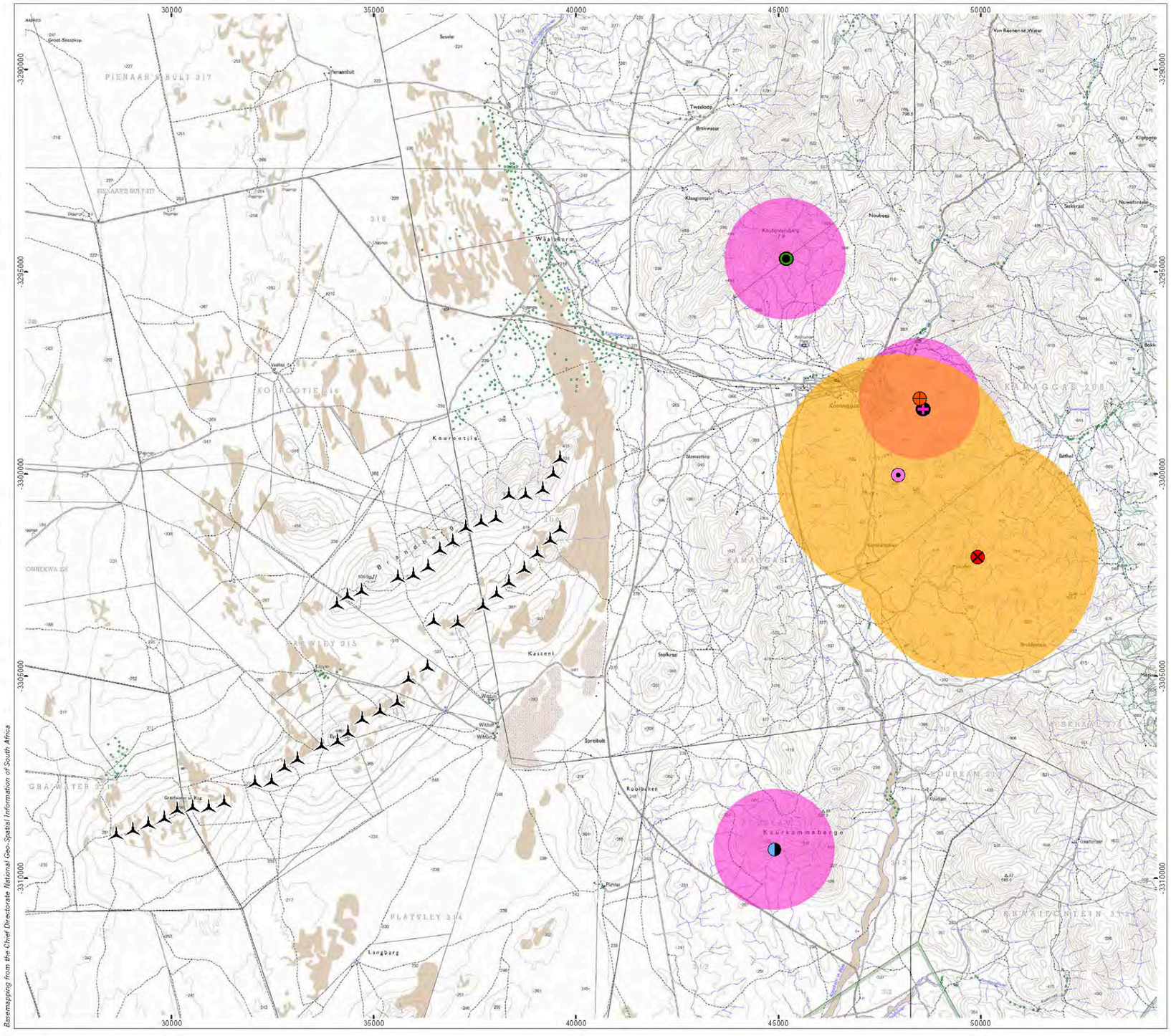
0 1 2 km

N

Produced: AP Reviewed: SC Approved: AB	Ref: 2622/REP/013 Date: 25/01/2018

All Target Species Flights
Figure 3

Kap Vley WEF Avifaunal
Impact Assessment Report



ARCUS

- Proposed Turbine Location
- N1 Unidentified Raptor Nest
- N2 Unidentified Raptor Nest
- N3 White-necked Raven Nest
- N4 Verreaux's Eagle Nest
- N5 Verreaux's Eagle Nest
- N6 Unidentified Raptor Nest
- 3 km Verreaux's Eagle Nest Buffer
- 1.5 km Unidentified Raptor Nest Buffer

1:90,000 Scale @ A3

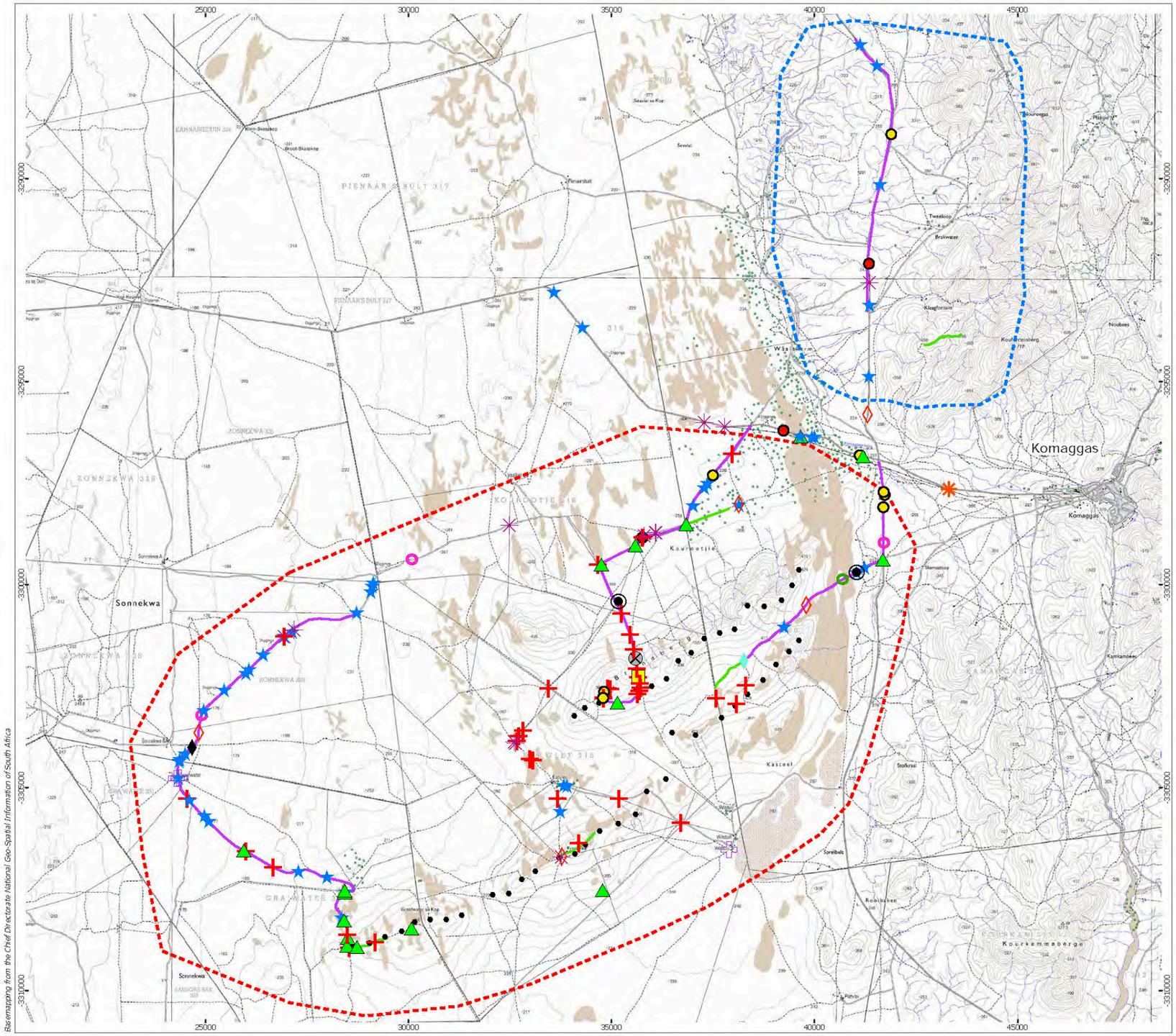
0 2 4 km

N

Produced: AP Reviewed: SC Approved: AB	Ref: 2622/REP/014 Date: 26/01/2018

Nest Sites and Exclusion Buffers
Figure 4

Kap Vley WEF Avifaunal
Impact Assessment Report



ARCUS

- WEF Site Study Area
- Control Site Study Area
- Proposed Turbine Location
- Walked Transect
- Driven Transect
- African Harrier Hawk
- Booted Eagle
- Brown Snake Eagle
- Cape Eagle-owl
- Greater Kestrel
- Grey-winged Francolin
- Jackal Buzzard
- Lanner Falcon
- Ludwig's Bustard
- Martial Eagle
- Pale Chanting Goshawk
- Rock Kestrel
- Southern Black Korhaan
- Spotted Eagle-owl
- Verreaux's Eagle
- Yellow-billed Kite

1:90,000 Scale @ A3

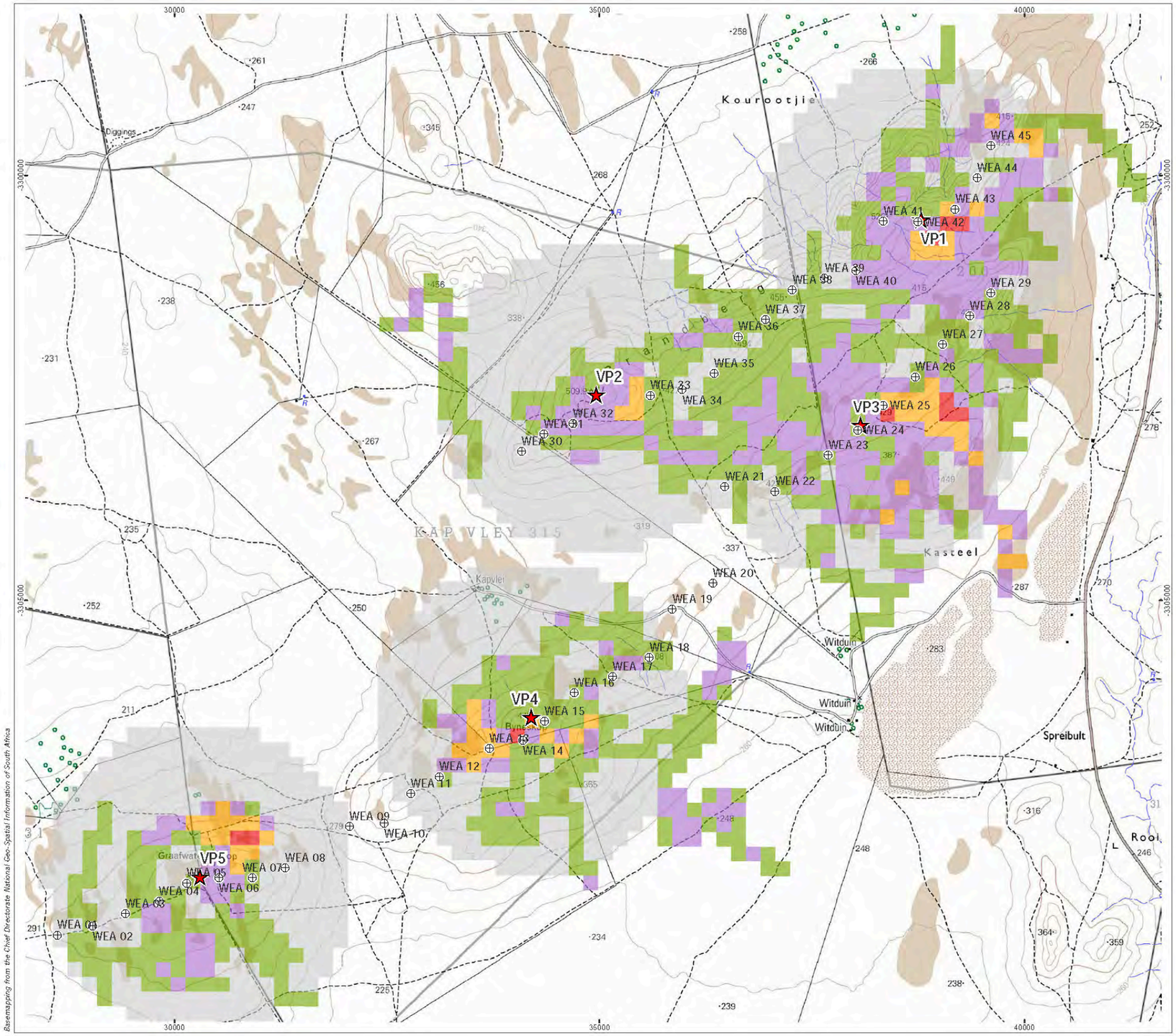
0 2 4 km

N

Produced: AP Reviewed: SC Approved: AB	Ref: 2622/REP/015 Date: 26/01/2018

Incidental and Driven Transect Records
Figure 5

Kap Vley WEF Avifaunal Impact Assessment Report



ARCUS

Vantage Point

Proposed Turbine Location

Grid Cell Sensitivity Score

- No Score (Cell within 2 km of VP)
- <10,000 (Low)
- 10,000 - 45,000 (Low-Medium)
- 45,000 - 100,000 (Medium)
- >100,000 (High)

1:43,000 Scale @ A3

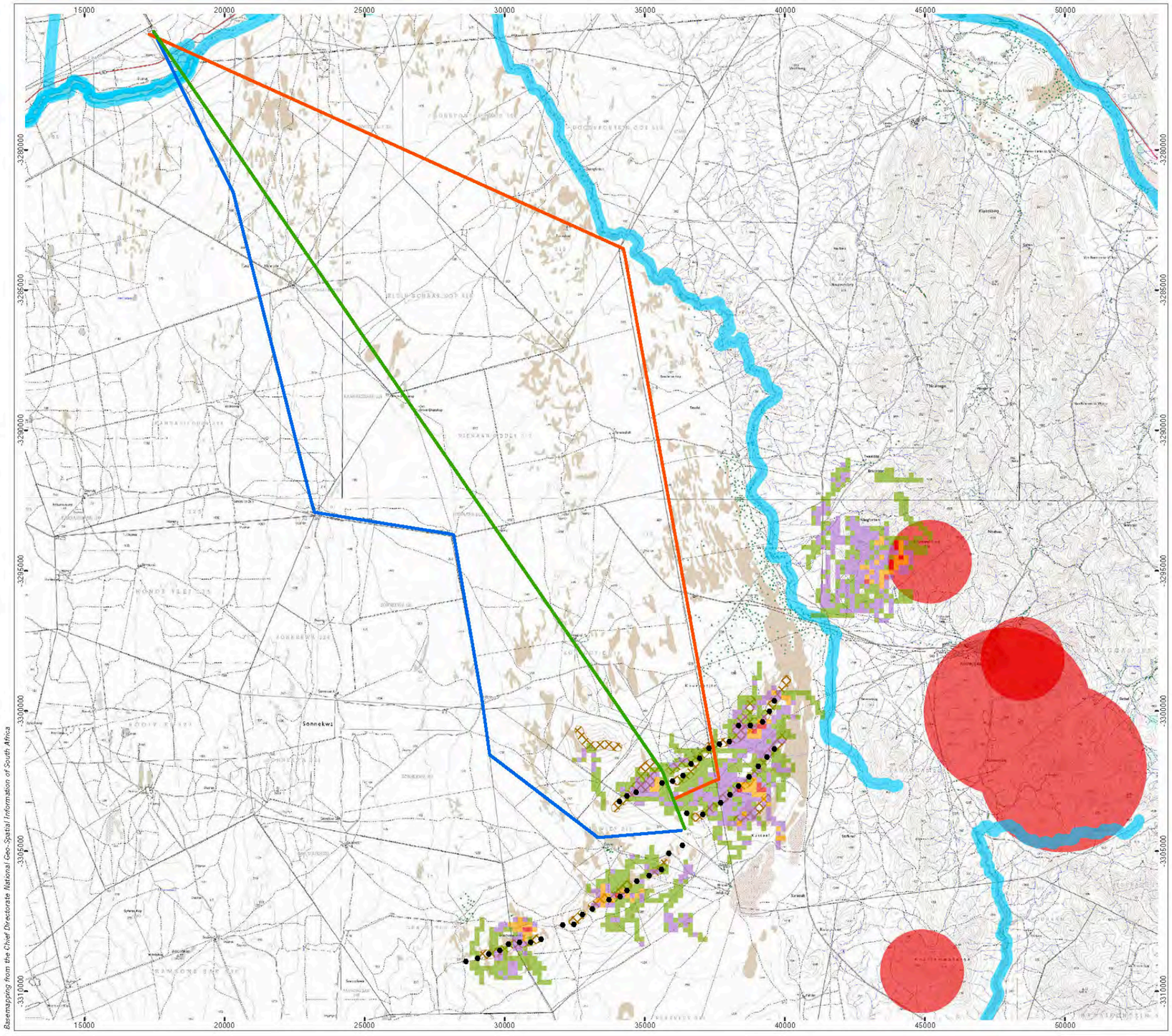
N

0 0.95 1.9 km

Produced: AP Reviewed: SC Approved: AB	Ref: 2622/REP/016 Date: 26/01/2018

Flight Sensitivity Zones
Figure 6

Kap Vley WEF Avifaunal
Impact Assessment Report



ARCUS

- Proposed Turbine Location
- Grid Connection Alternative 1
- Grid Connection ALternative 3
- Grid Connection Alternative 2

Flight Sensitivity-GCSS

- <10,000 (Low)
- 10,000 - 45,000 (Low-Medium)
- 45,000 - 100,000 (Medium)
- >100,000 (High)

Additional Sensitivities

- Ridge Buffer 150m (Low-Medium)
- Wetlands & Rivers Buffer 200m (Medium)
- Raptor Nest Buffers (High)

1:130,000 Scale @ A3

0 2.5 5 km

N

Produced: AP Reviewed: SC Approved: AB	Ref: 2622/REP/017 Date: 30/01/2018

Combined Avifaunal Sensitivity Map
Figure 7

Kap Vley WEF Avifaunal Impact Assessment Report

Scoping and Environmental Impact Assessment for the proposed Kap Vley Wind Energy Facility near Kleinzee in the Northern Cape

UPDATED DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

APPENDIX I:

Bat Impact Assessment Report

KAP VLEY WIND ENERGY FACILITY AND ASSOCIATED POWERLINE, NORTHERN CAPE PROVINCE

BAT IMPACT ASSESSMENT REPORT

On behalf of

juwi Renewable Energies (Pty) Ltd

March 2018

Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited

Office 220 Cube Workspace
Icon Building
Cnr Long Street and Hans Strijdom Avenue
Cape Town
8001

T +27 (0) 21 412 1529 l **E** AshlinB@arcusconsulting.co.za
W www.arcusconsulting.co.za

Registered in South Africa No. 2015/416206/07

TABLE OF CONTENTS

CONTENTS OF THE SPECIALIST REPORT – CHECKLIST

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	Section of Report
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	Appendix 4; Appendix 5
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix 4
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 4.1; Section 5
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 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
(g) an identification of any areas to be avoided, including buffers;	Section 5; Figure 1
(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;	Figure 1
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.2
(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 4
(k) any mitigation measures for inclusion in the EMPr;	Section 5
(l) any conditions for inclusion in the environmental authorisation;	Section 5
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 5
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	Section 4.4, Section 6
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	None received as yet
(p) any other information requested by the competent authority	Section 2.1 (included in the ToR)
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.	N/A

1 INTRODUCTION

juwi Renewable Energies (Pty) Ltd ('juwi') are proposing to develop the Kap Vley Wind Energy Facility (WEF) and an associated powerline on a site approximately 35 km south east of Kleinzee, in the Northern Cape Province ('the WEF site'). Although the individual turbine generation capacity has not yet been determined, the proposed WEF will consist of between 20 and 45 turbines each with a hub height between 80 m and 150 m and a maximum rotor diameter between 100 m and 160 m. The estimated total footprint[1] of the WEF is approximately 128 Hectares.

2 SCOPE OF STUDY

2.1 Terms of Reference

This report forms part of the Environmental Impact Assessment (EIA) for the proposed development. The aim of this report is to present the baseline environment with respect to bats that may be influenced by the development of the WEF and associated infrastructure. Based on this baseline, a description and evaluation of the potential impacts the project may pose to bats is provided. The following terms of reference were utilised for the preparation of this report:

- Describe the baseline environment of the project and its sensitivity with regard to bats;
- Identify the nature of potential impacts (positive and negative, including cumulative impacts) of the proposed project on bats during construction, operation and decommissioning;
- Conduct a significance rating and impact assessment of identified impacts;
- Conduct an assessment of any alternatives where relevant (including the no-go alternative);
- Identify information gaps and limitations; and
- Identify potential mitigation or enhancement measures to minimise impacts to bats.

In addition to the above, the following ToR has been provided by the CSIR:

- Adhere to the requirements of specialist studies as outlined in Appendix 6 of the 2014 NEMA EIA Regulations, as amended;
- Assess the no-go alternative very explicitly in the impact assessment section. Please note that the DEA considers a 'no-go' area, as an area where no development of any infrastructure is allowed; therefore, no development of associated infrastructure including access roads and internal cables is allowed in the 'no-go' areas. Should your definition of the 'no-go' area differ from the DEA definition; this must be clearly indicated in your assessment. You are also requested to indicate the 'no-go' area's buffer.
- Assess cumulative impacts by identifying other wind and solar energy project proposals and other applicable projects, such as construction and upgrade of electricity generation, transmission or distribution facilities in the local area (i.e. within 50 km of the proposed Kap Vley WEF project) that have been approved (i.e. positive EA has been issued) or the EIA is currently underway. In addition, the cumulative impact assessment for all identified and assessed impacts must be refined to indicate the following:
  - Identified cumulative impacts must be clearly defined, and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land.

[1] Including internal access roads, turbines/hardstands, turnaround areas, laydown areas, the collector station, a batching plant and Operation and Maintenance buildings.

    - The cumulative impacts significance rating must also inform the need and desirability of the proposed development.
    - A cumulative impact environmental statement on whether the proposed development must proceed.
- Provide a detailed description of your methodology, as well as indicate the locations and descriptions of turbine positions, and all other associated infrastructures that you have assessed and are recommending for authorisations.
- Provide a detailed description of all limitations to your studies. Your specialist studies must be conducted in the appropriate season and providing that as a limitation, will not be accepted by DEA.
- Provide a description of the current environmental conditions, in sufficient detail so that there is a baseline description/status quo against which impacts can be identified and measured i.e. suitability of the project area with regard to bat habitat/foraging, important vegetation features etc;
- Provide a description of species composition and conservation status in terms of protected, endangered or vulnerable bird species. This description will include species which are likely to occur within, traverse across or forage within the proposed project area, as well as species which may not necessarily occur on site, but which are likely to be impacted upon as a result of the proposed development;
- Conduct field work to identify bat species presence at the proposed site;
- Compile a detailed list of bat species present on site, including SCC;
- Identification of issues and potential impacts related to bats, which are to be considered in combination with any additional relevant issues that may be raised through the PPP;
- Identify and assess potential direct and indirect impacts on bats within the site during the construction, operation and decommissioning phases of the project. Provide an assessment of the irreversibility of impacts, and the irreplaceability of lost resources. Use the CSIR methodology to determine the significance of potential impacts;
- The bat specialist assessments must assess and make recommendations for definite measurements for the preferred hub heights and rotor diameter (as required by DEA), e.g: hub height: 80-150 m; rotor diameter: 100-160 m;
- Assess the cumulative impacts by identifying other REFs such as wind and solar and other applicable projects, such as construction and upgrade of electricity generation, and transmission or distribution facilities in the local area (i.e. within 50 km of the proposed WEF). These include projects that have been approved (i.e. positive EA has been issued), have been constructed or projects for which an Application for Environmental Authorisation has been lodged with the Competent Authority (see Table 6.1 in Chapter 6 of this report for a list of projects);
- Assess possible alternatives identified where relevant, including the no-go alternative.
- Compilation of a bat sensitivity map or identification of buffer zones and no-go areas to inform the project layout;
- Provide input to the EMPr, including mitigation and monitoring requirements to avoid or reduce negative impacts during construction, operation and decommissioning of the project. Provide additional management and monitoring requirements, as relevant.
- In addition to the specialist study, undertake a 12 month pre-construction bat monitoring programme (i.e. commissioned by juiw). The results and recommendations of this monitoring programme (including data of all four seasons) should be included in the specialist study and EMPr that will be included in the EIA Report;
- Provide a description of any assumptions, uncertainties, limitations and gaps in knowledge;
- Provide a description of the relevant legal context and requirements; and
- Incorporate and address issues and concerns raised during the Scoping and EIA phases of the EIA where they are relevant to the specialist's area of expertise.

2.2 Assumptions and Limitations

The following assumptions and limitations relevant to this study are noted:

- The knowledge of certain aspects of South African bats including natural history, population sizes, local and regional distribution patterns, spatial and temporal movement patterns (including migration and flying heights) and how bats may be impacted by wind energy is very limited for many species.
- Bat echolocation calls (i.e. ultrasound) operate over ranges of metres therefore acoustic monitoring samples only a small amount of space (Adams et al. 2012). Recording a bat using sound is influenced by the type and intensity of the echolocation call produced, the species of bat, the bat detector system used, the orientation of the signal relative to the microphone and environmental conditions such as humidity. One must therefore be cautious when extrapolating data from echolocation surveys over large areas because only small areas are actually sampled.
- There can be considerable variation in bat calls between different species and within species. The accuracy of the species identification is also very dependent on the quality of the calls used for identification. Species call parameters can often overlap, making species identification difficult.
- Bat activity recorded by bat detectors cannot be used to directly estimate abundance or population sizes because detectors cannot distinguish between a single bat flying past a detector multiple times or between multiple bats of the same species passing a detector once each (Kunz et al. 2007a). This is interpreted using the specialists' knowledge and presented as relative abundance.
- There is no standard scale to rate bat activity as low, medium or high. A qualitative assessment is given based on the specialists experience and on data collected from other locations. Data from this study were compared to data from other similar locations to rate the levels of bat activity recorded.
- The potential impacts of wind energy on bats presented in this report represent the current knowledge in this field. New evidence from research and consultancy projects may become available in future, meaning that impacts presented and discussed in this report may be adjusted.

2.3 Legislative Context

The following legalisation, policies, regulations and guidelines are all relevant to the project and the potential impact it may have on bats and habitats that support bats:

- Convention on the Conservation of Migratory Species of Wild Animals (1979)
- Convention on Biological Diversity (1993)
- Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)
- National Environmental Management Act, 1998 (NEMA, Act No. 107 of 1998)
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
- Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009)
- The Equator Principles (2013)
- The Red List of Mammals of South Africa, Swaziland and Lesotho (2016)
- National Biodiversity Strategy and Action Plan (2005)
- South African Good Practise Guidelines for Surveying Bats in Wind Energy Facility Developments – Pre-Construction (2016)
- South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (2014)

3 METHODOLOGY

The baseline environment for bats was investigated by using acoustic monitoring to document bat activity on the WEF site. Bats emit ultrasonic echolocation calls for

orientation, navigation and foraging. These calls can be recorded by bat detectors enabling bat species to be identified and their activity patterns quantified.

The monitoring was undertaken in accordance best practise[2]. The survey approach focused on the use of passive acoustic monitoring to record bats at seven locations at the WEF site (Figure 1). Six bat detectors were installed on temporary aluminium masts with ultrasonic microphones mounted at 12 m. At the seventh bat detector, microphones were mounted at 12 m and 80 m above ground level on a lattice meteorological mast. The detectors were installed and commissioned on 1 and 2 March 2017 and sampled bat activity until 19 February 2018. The sampling period therefore spanned autumn (92 nights), winter (92 nights), spring (91 nights) and summer (81 nights) allowing for a characterisation of baseline bat activity appropriate to the aims of this impact assessment report.

Potential structures that bats could use as roosts were investigated during the day for the presence or evidence of roosting bats (e.g. guano and culled insect remains, etc.) whenever the Arcus team was on site. These included buildings, rocky outcrops and trees.

Acoustic data from each bat detector were analysed using Kaleidoscope (Version 4.3.2, Wildlife Acoustics). Bat species were automatically identified from their echolocation calls using the embedded echolocation call library in the software. The results were vetted by manually identifying and checking several recordings. Most files contained only a single bat pass[3] and therefore the total number of files was used as a proxy for bat passes. This would underestimate bat activity if any files contained more than one bat pass.

4 BASELINE ENVIRONMENT

4.1 Habitats

The topography at the site consists of a series of low ridges running across a generally flat terrain. The dominant vegetation type around the proposed turbine ridges is Namaqualand Klipkoppe Shrubland. The lower lying areas consist of Namaqualand Strandveld and Namaqualand Sand Fynbos. There are no major wetlands or rivers of any importance for bats on the site but there are non-perennial drainage systems and farm dams which will be attractive to bats. Micro-habitats available to bats for foraging include natural shrubland, natural thornveld/Duneveld, livestock water points, camel thorn woodland, stands of alien trees and farmsteads. Roosting micro-habitats include rocky outcrops, trees and buildings. Grazing is the only current land use on the site and there are no other existing impacts to bats.

4.2 Bat Species

The project falls within the actual or predicted distribution range of approximately eleven species of bat (African Chiroptera Report 2013; Monadjem et al. 2010). However, the distributions of some bat species in South Africa, particularly rarer species, are poorly known so it is possible that more (or fewer) species may be present. Analysis of the acoustic monitoring data suggests that at least five species of bat are present (Table 1).

[2] Sowler, S., Stoffberg, S., MacEwan, K., Aronson, J., Ramalho, R., Potgieter, K., Lötter, C. 2016. South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: 4th Edition. South African Bat Assessment Association.

[3] A sequence of calls is called a bat pass defined as two or more echolocation calls separated from other calls by more than 500 milliseconds Hayes, J.P., 1997. Temporal Variation in Activity of Bats and the Design of Echolocation-Monitoring Studies. Journal of Mammalogy 78, 514-524, Thomas, D.W., 1988. The distribution of bats in different ages of Douglas-Fir forests. The Journal of Wildlife Management 52, 619-626.

Table 1: Bat Species Recorded at the Project and their Sensitivity to WEFs

Species	Species Code	# of Bat Passes	Conservation Status[4]		Likelihood of Risk[5]
			National	International	
Egyptian free-tailed bat *Tadarida aegyptiaca*	EFB	7,290	Least Concern	Least Concern	**High**
Roberts's flat-headed bat *Sauromys petrophilus*	RFB	235	Least Concern	Least Concern	**High**
Natal long-fingered bat *Miniopterus natalensis*	NLB	3,737	Least Concern	Least Concern	**High**
Cape serotine *Neoromicia capensis*	CS	6,009	Least Concern	Least Concern	**Medium-High**
Long-tailed serotine *Eptesicus hottentotus*	LTS	641	Least Concern	Least Concern	**Medium**

4.3 Spatio-Temporal Bat Activity Patterns

A total of 17,912 bat passes were recorded from 356 sample nights across the five species and across all bat detectors. Overall, the levels of bat activity were low to moderate compared to other sites within a similar biome. The percentage of nights with bat activity ranged from 92.2 % at KAP5 to 14.5 % at KAPHIGH (Table 2). Across the site, bats were detected on all but eleven sampling nights and total nightly activity varied between 0 and 462 bat passes (Graph 1). Mean and median bat activity per night across the site was 50.3 and 30.5 bat passes respectively.

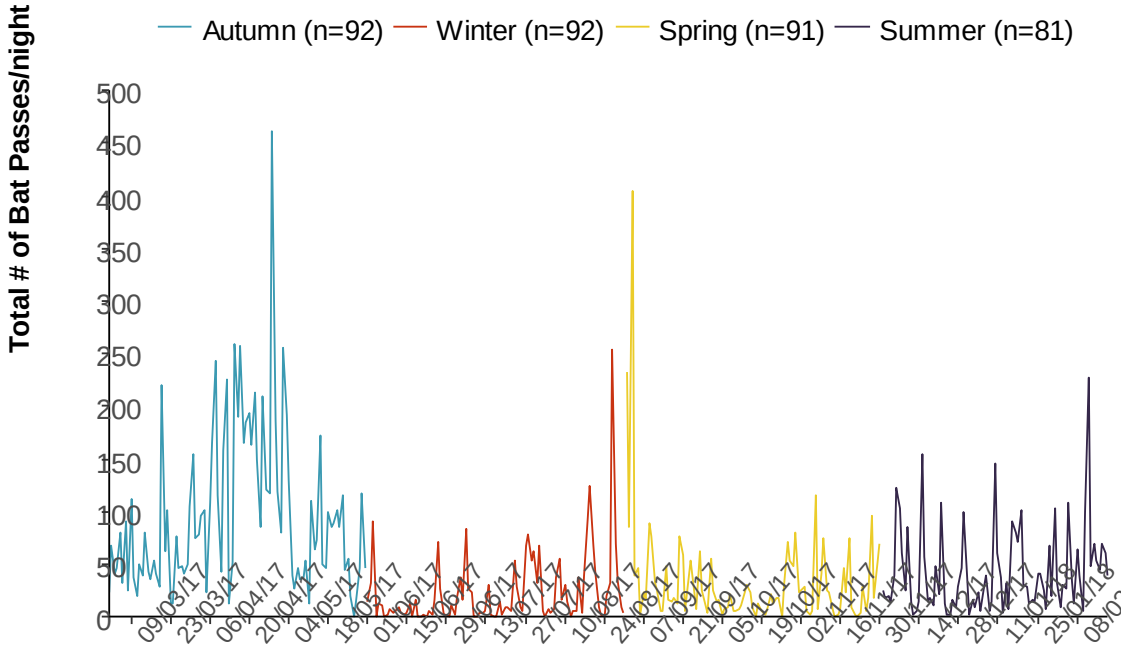
Table 2: Acoustic Monitoring Summary

Monitoring Location (Figure 1)	Altitude (masl)	# of Sample Nights	% of Sample Nights with Bat Activity	Total number of Bat Passes
KAP1	254	280	66.1	1,318
KAP2	302	356	73.3	4,422
KAP3	360	356	62.4	2,047
KAP4	431	321	34.6	428
KAP5	281	335	92.2	8,518
KAP6	388	355	31.8	391
KAPLOW	463	346	40.7	680
KAPHIGH	543	341	14.5	108

Bat activity varied seasonally (Graph 1). Median activity was lowest in winter (10 bat passes/night) but then increased in spring (22 bat passes/night) and again in summer (30 bat passes/night) and was highest in autumn (77.5 bat passes/night). Peaks in activity were recorded in autumn, spring and summer.

[4] Child, M.F., Roxburgh, L., Do Linh San, E., Raimondo, D., Davies-Mostert, H.T. eds., 2016. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

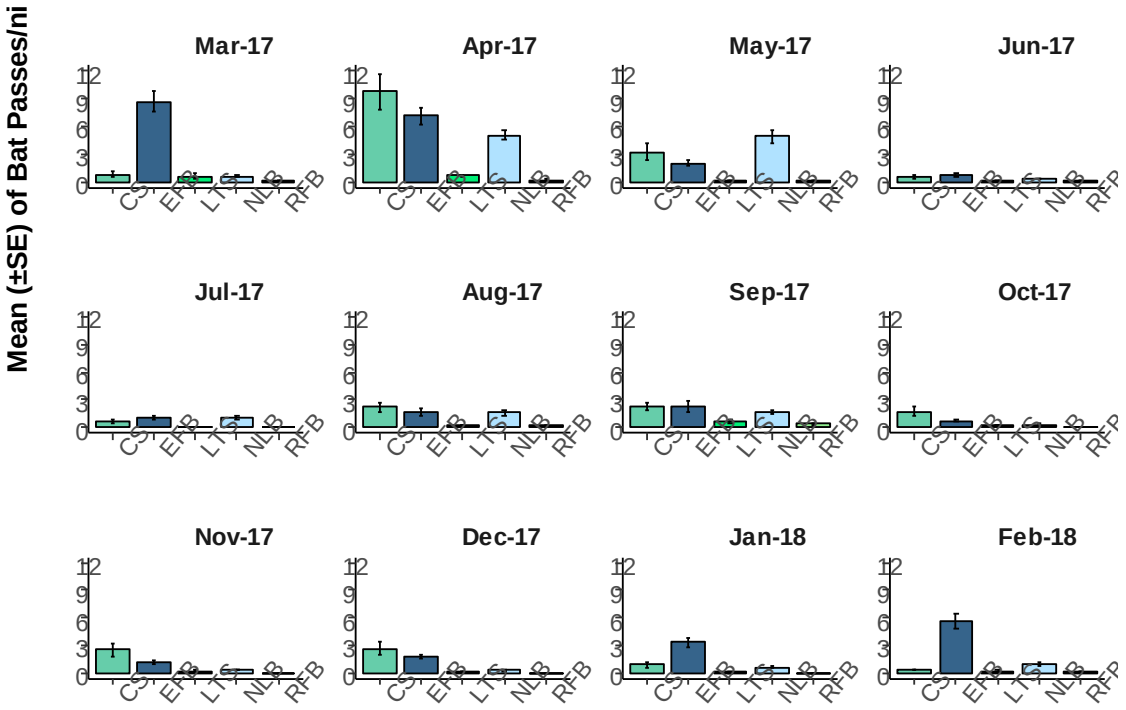
[5] The likelihood of risk to impacts of wind energy was determined from the guidelines and is based on the foraging and flight ecology of bats and migratory behaviour.



Graph 1: The total number of bat passes/night across all detectors during the sampling period.

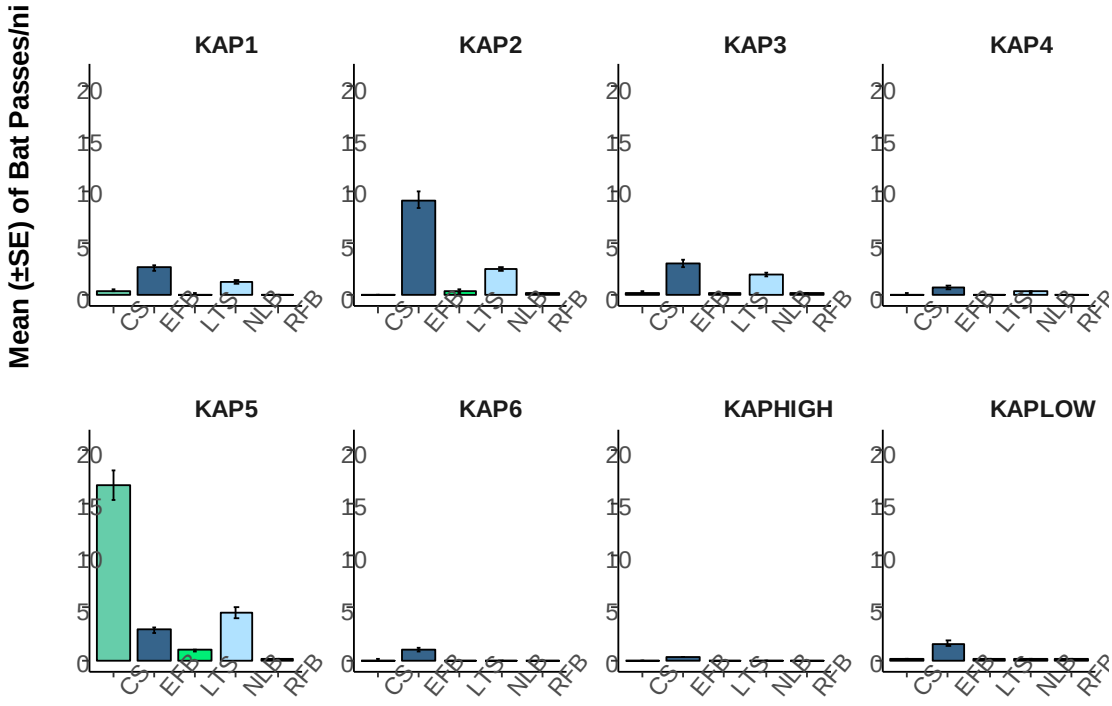
All five species were recorded in each month and at each location. The only exception was that only three species, the Egyptian free-tailed bat, Roberts' flat-headed bat, and the Natal long-fingered bat, were recorded at 80 m on the met mast (KAPHIGH). Overall, the Egyptian free-tailed bat was the most frequently recorded species, accounting for approximately 40 % of total activity recorded. The Cape serotine and the Natal long-fingered bat accounted for approximately 34 % and 21 % of total activity respectively. Combined, activity of Roberts' flat-headed bat and the Long-tailed serotine accounted only for 5 % of total activity (Table 1).

The activity of each species peaked in different months (Graph 2) and varied across the site (Graph 3). For the majority of species average activity was highest in March 2017 and April 2017 but the mean number of passes per night was low in these months. The highest average number of passes per night in any one month, 9.7 in March 2017, was attributed to the Cape serotine (Graph 2).



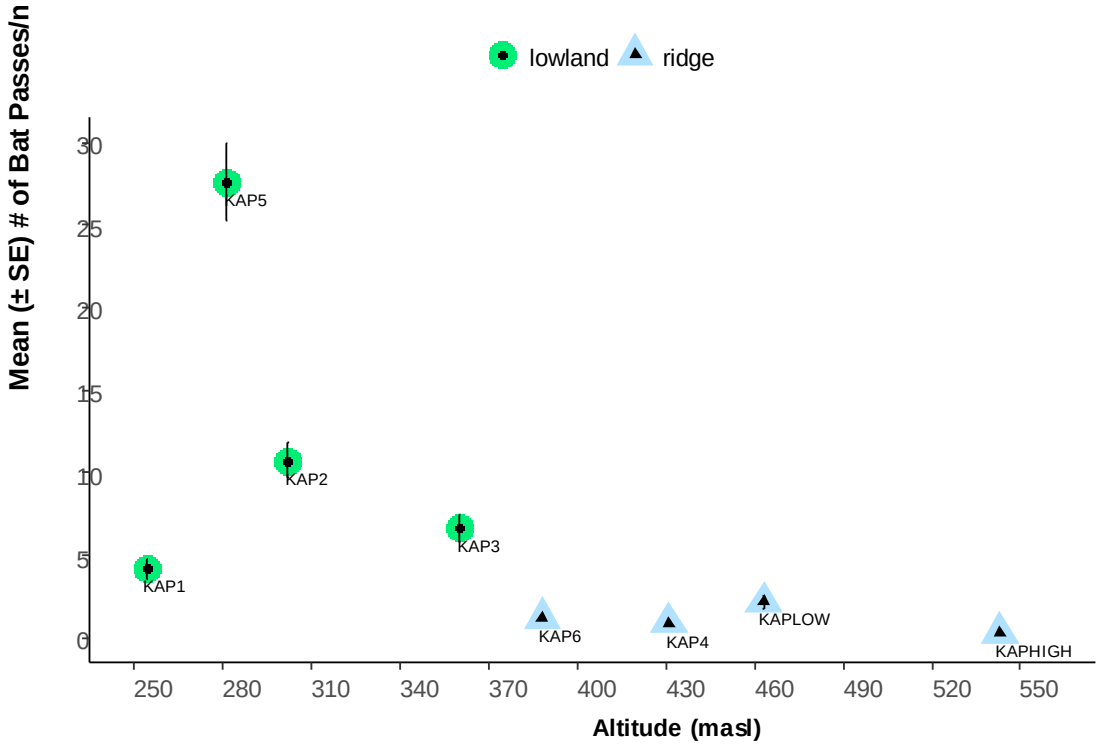
Graph 2: The mean (±SE) number of bat passes/night per species for each month sampled.

Highest activity occurred at KAP5, driven by the activity of the Cape serotine and the Natal long-fingered bat, followed by KAP2, due to dominant activity of the Egyptian free-tailed bat (Graph 3). The range in bat activity was also notably higher at KAP5 compared to the other locations (Graph 4) which saw between 0 and 198 passes per night, the highest total number of passes for any night during the study period.



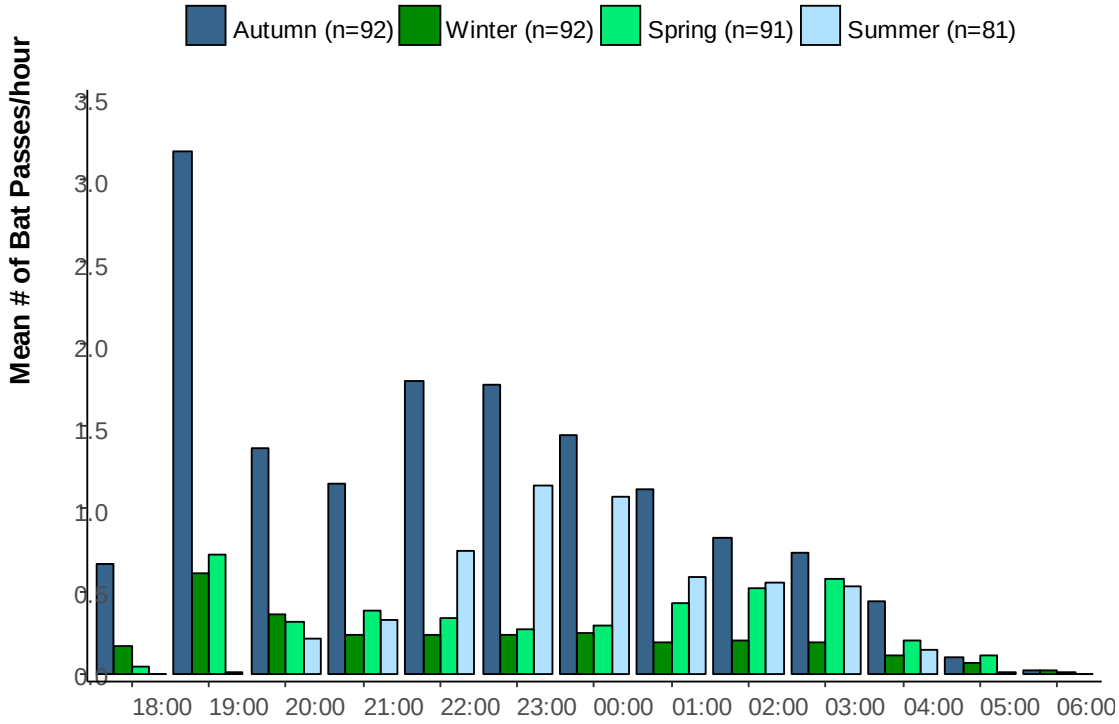
Graph 3: The mean (±SE) number of bat passes/night per species at each monitoring location.

There was a clear decrease in bat activity with altitude resulting in higher bat activity in lowland areas compared to on ridges (Graph 4). In addition, at the meteorological mast, bat activity was higher at the lower microphone (KAPLOW) compared to the microphone at 80 m (KAPHIGH).



Graph 4: The mean (±SE) number of bat passes/night at different altitudes.

Bats were active at the WEF site between 18:00 and 07:00 (Graph 5). Peak activity levels occurred between 19:00 and 20:00 in autumn, winter and spring but in summer activity peaked between 23:00 and 00:00 (Graph 5).



Graph 5: The mean number of bat passes/hour across all species and locations during the study period.

4.4 Discussion

A key finding of the bat monitoring is that the vast majority of the bat activity, approximately 90 %, was recorded in low lying areas of the site, away from proposed turbine positions. Further, at the meteorological mast bat activity was higher at the lower monitoring height. These findings suggest lower risk to bats in the potential rotor swept zone.

Bats were much more active in the lower altitude areas of the site. In particular, activity was highest at KAP5 which is situated at a farmstead where moderate numbers of bat passes were recorded each night. This site was deliberately chosen for monitoring because the presence of trees, buildings and water are favourable for bats and monitoring here could give a good indication of bat activity in the area. At KAP2 and KAP3, although also situated in lowland areas, activity was much lower possibly because there are no trees, buildings or water at these locations – although there are some scattered trees near KAP2. This suggests that a combination of altitude and habitat might explain some spatial patterns in bat activity at the site.

The Cape serotine was principally responsible for the high activity at KAP5. This species is known to roost in buildings and a survey at the farmstead on the evening of 5 December 2017 confirmed the presence of roosting bats. A total of 58 bats were counted emerging from three different entrances in the main building at the farmstead. Acoustic data confirmed that the bats emerging from the building were Cape serotine. This species is classified as being at medium-high risk of impacts of wind turbines and fatalities at operational wind energy facilities in South Africa have been reported across a wide geographic range (Aronson et al. 2013; Doty and Martin 2012). Based on best practise guidelines[6] this building will need to be buffered by 1 km to protect bats using the roost (Figure 1). The building is located approximately 1600 m from the nearest turbine to the north so this should not impact the current proposed turbine layout.

Among the high risk species recorded were two free-tailed bats; the Egyptian free-tailed bat and Roberts's flat-headed bat, which is endemic to South Africa. Free-tailed bats are high-flying species whose morphology and echolocation enable fast flight in open areas and these bats are therefore at risk of encountering wind turbine blades across most of the rotor-swept zone. Monitoring of operational WEFs in South Africa has confirmed that Egyptian free-tailed bats have suffered mortality by wind turbines (Aronson et al. 2013; Doty and Martin 2012). However, based on the monitoring data from the met mast, these two species appear to be more active at lower altitudes. Both species had their highest activity at KAP2 which is situated in the Namaqualand sand vegetation type approximately 1 km to the nearest turbine. Both are known to roost in, among other types of roosts, rock crevices (Monadjem et al. 2010) and additionally Roberts's flat-headed bat appears to be adapted for roosting under slabs of exfoliated rock or narrow crevices and cracks (Jacobs and Fenton 2001). These geological features are present near KAP2. In addition, Egyptian free-tailed bats also roost under tree bark and the scattered trees and open woodland near KAP2 might be attracting these bats to this area of the site.

The third high risk species, the Natal long-fingered bat, was mainly recorded in lower risk areas of the proposed site and away from proposed turbine positions. This is a migratory species (Monadjem et al. 2010) and is protected under the Convention on the Conservation of Migratory Species of Wild Animals (1979). The majority of bat mortalities at Wind Energy Facilities (WEFs) in North America and Europe are migratory species (Baerwald and Barclay 2011; Cryan 2011; Kunz et al. 2007b) therefore it may be assumed that the Natal long-fingered bat is at risk from wind turbines in South Africa.

[6] Sowler, S., Stoffberg, S., MacEwan, K., Aronson, J., Ramalho, R., Potgieter, K., Lötter, C. 2016. South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: 4th Edition. South African Bat Assessment Association.

This species migrates during autumn (April and May) and spring (September and October) between summer maternity roosts and winter hibernating sites generally located at higher latitudes, and is reported to migrate distances from approximately 150 km to 560 km (Miller-Butterworth et al. 2003; Monadjem et al. 2010). Although this species had higher activity during these periods, based on the magnitude of their activity it is unlikely that they are migrating through the site. It is more likely that there is a resident population of the Natal long-fingered bat at the project and surrounding region. While this may decrease the risk to this species, resident populations of bats are also impacted by wind energy facilities (Rydell 2010).

Activity was generally restricted to low levels for most of the study period with isolated peaks in each season moderate levels (Graph 1). Apart from some increased activity in the early evening between 19:00 and 20:00 (although this was several hours later in summer), which is typical for many insectivorous bats (Hayes 1997; Kunz 1973; Taylor et al. 2013), less than two bat passes per hour were recorded on average during the night at each monitoring location. Therefore, the impact of the proposed development to bats is low and no major mitigation measures are required.

5 IMPACT ASSESSMENT

WEFs have the potential to impact bats directly through collisions and barotrauma resulting in mortality (Horn et al. 2008; Rollins et al. 2012), and indirectly through the modification of habitats (Kunz et al. 2007b). Direct impacts pose the greatest risk to bats and, in the context of the project, habitat loss and displacement should not pose a significant risk because the project footprint (i.e. turbines, roads and powerline foundations) is small.

Direct impacts to bats will be limited to species that make use of the airspace in the rotor-swept zone of the wind turbines. Of the five species of bat that were recorded on site, at least four exhibit behaviour that may bring them into contact with wind turbine blades and they are potentially at risk of negative impacts if not properly mitigated, although the magnitude of these impacts are unknown at this stage. The impact assessment methodology is given in Appendix 1 and a summary of the impact assessment is given in Appendix 2.

5.1 Construction Phase Impacts

5.1.1 Roost Disturbance

WEFs have the potential to impact bats directly through the disturbance of roosts during construction. Relevant activities include the construction of roads, Operation and Maintenance (O&M) buildings, sub-station(s), grid connection transmission line and installation of wind turbines. Excessive noise and dust during the construction phase could result in bats abandoning their roosts, depending on the proximity of construction activities to roosts. This impact will vary depending on the number of roosts at the site and the species involved; species that roost in trees are likely to be impacted more (e.g. Cape serotine and Egyptian free-tailed bats; Monadjem et al. 2010) because tree roosts are less buffered against noise and dust compared to roosts in buildings and rocky crevices.

Reducing roosting opportunities for bats will have negative impacts. Before mitigation this impact is likely to have a moderate consequence because roosts are limiting factors in the distribution of bats and their availability is a major determinant in whether bats would be present in a particular location. However, it is unlikely that this impact will occur as there are low numbers of roosting spaces at the site. Therefore, the significance of this impact would be low. After mitigation, both the consequence and probability could decrease resulting in an impact of very low significance.

Mitigation measures:

- Avoid construction activities near roosts which include buildings, trees and rocky crevices. It is recommended that a bat specialist surveys the confirmed turbine and pylon locations and the locations of all other proposed site infrastructure for the presence of confirmed roosts before any construction activities commence.

5.1.2 Roost Destruction

WEFs have the potential to impact bats directly through the physical destruction of roosts during construction. Relevant activities include the construction of roads, O&M buildings, sub-station(s), grid connection transmission lines and installation of wind turbines. Potential roosts that may be impacted by construction activities include trees, crevices in rocky outcrops and buildings. Roost destruction can impact bats either by removing potential roosting spaces which reduces available roosting sites or, if a roost is destroyed while bats are occupying the roost, this could result in bat mortality.

Reducing roosting opportunities for bats or killing bats during the process of destroying roosts will have negative impacts. Before mitigation this impact is likely to have a moderate consequence because roosts are limiting factors in the distribution of bats and their availability is a major determinant in whether bats would be present in a particular location. It is likely that roost destruction will occur if construction activities require the removal of trees, buildings and blasting rocky outcrops, though such activity is unlikely to be required for this development. If bats are occupying such roosts at the time they are destroyed it is likely this could result in mortality. In such cases the duration of the impact will be permanent. Despite this, the consequence should be moderate as low numbers of roosts will likely need to be destroyed resulting in the significance of this impact being low. After mitigation, this could decrease to very low because the consequence would reduce to slight.

Mitigation measures:

- The WEF and grid connection infrastructure must be designed and constructed in such a way as to avoid the destruction of potential roosts, particularly trees, rocky crevices (if blasting is required) and buildings.
- No construction activities with the potential to physically affect any bat roosts will be permitted without the express permission of a suitably qualified bat specialist following appropriate investigation and mitigation.
- It is recommended that a bat specialist surveys the confirmed turbine locations and the locations of all other site infrastructure, such as pylons, for the presence of occupied roosts among the potential roosts before any construction activities commence and once the preliminary design and layout of the site is complete.
- If occupied roosts are confirmed these should be buffered based on best practise guidance[7], which includes a minimum buffer of 200 m (Figure 1).
- A site-specific Construction Phase Environmental Management Plan (CEMP) must be created, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of bat habitat. All contractors are to adhere to the CEMP and should apply good environmental practice during construction.
- The power line alternative 1 is the preferred route as the other two routes could require the removal of more important habitat features (Figure 1).

[7] Sowler, S., Stoffberg, S., MacEwan, K., Aronson, J., Ramalho, R., Potgieter, K., Lötter, C. 2016. South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: 4th Edition. South African Bat Assessment Association.

- During construction, laydown areas and temporary access roads should be kept to a minimum in order to limit direct vegetation loss and habitat fragmentation, while designated no-go areas must be enforced i.e. no off road driving.
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and a habitat restoration plan must be developed by a specialist and included within the CEMP.

5.1.3 Habitat Modification

Bats can be impacted indirectly through the modification or removal of habitats (Kunz et al. 2007b). The removal of vegetation during the construction phase will impact bats by removing vegetation cover and linear features that some bats use for foraging and commuting (Verboom and Huitema 1997). The modification of habitat could create linear edges which some bats to commute or forage along. This modification could also create favourable conditions for insects upon which bats feed which would in turn attract bats. The footprint of the facility is small relative to the remaining habitat available in the surrounding area and as such the removal of vegetation is not likely to result in a significant impact. This impact can be reduced even further by limiting the removal of vegetation as far as possible.

The consequence of this impact is moderate as it could result in altered foraging and commuting patterns for bats which would persist for the duration of the project. It is likely to occur and before mitigation would result in low significance. Implementing mitigation measures would reduce the significance of residual impacts to very low.

Mitigation measures:

- This impact must be reduced by limiting the removal of vegetation as far as possible. A site-specific CEMP must be created, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of bat habitat. All contractors are to adhere to the CEMP and should apply good environmental practice during construction.
- Before construction commences, a bat specialist should conduct a site walkthrough, covering the final road and power line routes as well as the final turbine positions, to identify any roosts/activity of sensitive species, as well as any additional sensitive habitats.
- During construction laydown areas and temporary access roads should be kept to a minimum in order to limit direct vegetation loss and habitat fragmentation, while designated no-go areas must be enforced i.e. no off-road driving.
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and a habitat restoration plan must be developed by a specialist and included within the CEMP.
- The power line alternative 1 is the preferred route as the other two routes could require the removal of more important habitat features (Figure 1).

5.2 Operational Phase Impacts

5.2.1 Bat Mortality During Commuting and/or Foraging

The major potential impact of wind turbines on bats is direct mortality resulting from collisions with turbine blades and/or barotrauma. These impacts will be limited to species that make use of the airspace in the rotor-swept zone of the wind turbines. At least four species of bat that were recorded at the project thus far exhibit behaviour that may bring them into contact with wind turbine blades and so they are potentially at risk of negative impacts.

Bat fatalities have occurred at all wind farms where it has been investigated and it is therefore very likely that mortality will occur at the Kap Vley WEF. The consequence of bat mortality would be severe and result in an impact of high significance before mitigation. Given the low bat activity on the site, the likelihood of bat mortality is low. If mortality occurs, mitigation would decrease the consequence of any bat mortality to moderate with an unlikely probability of occurring resulting in a low risk.

Insectivorous bats are unlikely to collide with transmission lines due to their ability to echolocate. They are therefore able to detect and avoid obstacles in their path, such as electrical cabling. Fruit bats do not echolocate in the same manner and can collide and become electrocuted by transmission lines. There is no published evidence of this in South Africa but these events to occur globally. However, there are no fruit bats that occur in the areas under assessment. As such, this impact is not considered further.

Mitigation measures:

- There are several mitigation options available to reduce the potential for bat mortality to occur or to reduce bat mortality. Designing the layout of the project to avoid areas that are more frequently used by bats may reduce the likelihood of mortality and should be the primary mitigation measure. For the Kap Vley WEF, low lying areas should be avoided. This has been adhered to as all turbines are situated on the low ridges at the site, away from areas of higher bat activity and outside of no-go areas (Figure 1).
- Operational acoustic monitoring and carcass searches for bats must be performed, based on best practice[8], to monitor mortality and bat activity levels. Acoustic monitoring should include monitoring at height (from more than one location) and at ground level.
- If mortality does occur, the level of mortality should be considered by a bat specialist to determine if this is at a level where further mitigation needs to be considered. Mitigation options may include using ultrasonic deterrents, raising the cut-in speeds of turbines and turbine blade feathering. Any operational minimization strategy (i.e. curtailment) should be targeted during specific seasons and time periods for specific turbines coincident with periods of increased bat activity.
- It is advised that both pre-construction and operational monitoring data are used to confirm the need for above mentioned mitigation measures such as curtailment and to determine at what stage of the development such mitigation needs to be implemented, if at all.

5.2.2 Bat Mortality During Migration

It has been suggested that some bats may not echolocate when they migrate (Baerwald et al. 2009) which could explain the higher numbers of migratory species suffering mortality in WEF studies in North America and Europe. Therefore, the direct impact of bat mortality may be higher when they migrate compared to when they are commuting or foraging. This has therefore been considered as a separate impact of the WEF on the Natal long-fingered bat, which is the only current species of the five recorded during pre-construction monitoring thus far known to exhibit long-distance migratory behaviour.

The majority of bat mortalities at WEFs in North America and Europe are migratory species. However, evidence from the pre-construction monitoring does not suggest migratory behaviour through the Kap Vley WEF. It is therefore unlikely that mortality will occur during migration periods. The consequence of any bat mortality would be severe which will result in a moderate impact before mitigation. Mitigation would decrease the consequence of bat mortality to moderate with an unlikely probability of occurring resulting in a low risk.

[8] Aronson, J., Richardson, E., MacEwan, K., Jacobs, D., Marais, W., Aiken, S., Taylor, P., Sowler, S., Hein, C., 2014. South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities. 1st edition: July 2014.

Mitigation measures:

- There are several mitigation options available to reduce the potential for bat mortality to occur or to reduce bat mortality. Designing the layout of the project to avoid areas that are more frequently used by bats may reduce the likelihood of mortality and should be the primary mitigation measure. For the Kap Vley WEF, low lying areas should be avoided. This has been adhered to as all turbines are situated on the low ridges at the site, away from areas of higher bat activity and outside of no-go areas (Figure 1).
- Operational acoustic monitoring and carcass searches for bats should be performed to monitor mortality and bat activity levels. Acoustic monitoring should include monitoring at height (from more than one location) and at ground level.
- If mortality does occur, the level of mortality should be considered by a bat specialist to determine if this is at a level where further mitigation needs to be considered. Mitigation options may include using ultrasonic deterrents, raising the cut-in speeds of turbines and turbine blade feathering. Any operational minimization strategy (i.e. curtailment) should be targeted during specific seasons and time periods for specific turbines coincident with periods of increased bat activity.
- It is advised that both pre-construction and operational monitoring data are used to confirm the need for above mentioned mitigation measures such as curtailment and to determine at what stage of the development such mitigation needs to be implemented, if at all.

5.2.3 Habitat Creation in High Risk Locations

The construction of a WEF and associated building infrastructure may inadvertently provide new roosts for bats, attracting them to the area and indirectly increasing the risk of negative mortality impacts. It has been suggested that some bats may investigate wind turbines for their potential roosting spaces (Cryan et al. 2014; Horn et al. 2008; Kunz et al. 2007b) and bats could therefore be attracted to WEFs, increasing the chance of wind turbine-induced mortality. Bats may also be attracted to roosting opportunities in new buildings and other infrastructure such as road culverts at WEFs (J. Aronson, personal observation).

The probability of large numbers of bats roosting in infrastructure at the project is very unlikely. However, if any bats do manage to do so, they would be at greater risk of mortality due to the proximity to wind turbines. Therefore the consequence of this impact is severe but the significance is low. After mitigation, the consequence would reduce to moderate and the overall significance would be very low.

Mitigation measures:

- Bats must be prevented from entering any possible artificial roost structures (e.g. roofs of buildings, road culverts and wind turbines) by ensuring that they are sealed in such a way as to prevent bats from entering. If bats colonise WEF infrastructure, a suitably qualified bat specialist should be consulted before any work is undertaken on that infrastructure and before attempting to remove any bats. Ongoing maintenance and inspections of buildings must be carried out to ensure no access to bats.

5.2.4 Light Pollution

Currently the local region experiences very little light pollution from anthropogenic sources and the construction of a WEF will marginally increase light pollution. This excludes turbine aviation lights which do not appear to impact bats (Baerwald and Barclay 2011; Horn et al. 2008; Jain et al. 2011; Johnson et al. 2003). During the operation of the WEF, it is assumed that the only light sources would be motion sensor security lighting for short periods and lighting associated with the substation.

This artificial lighting would impact bats indirectly via the mortality of their insect prey thereby reducing foraging opportunities for certain bat species. Lighting attracts (Blake et al. 1994; Rydell 1992; Stone 2012) and can cause direct mortality of insects. These local reductions in insect prey may reduce foraging opportunities for bats, particularly for species that avoid illuminated areas. This impact is likely to be low before mitigation because, relative to the large area in the region that would not be developed that likely supports large numbers of insects, the prey resource for bats is likely to be sufficient. The consequence of this impact will be moderate before and after mitigation but the probability of the impact would reduce to unlikely.

Other bat species actively forage around artificial lights due to the higher numbers of insects which are attracted to these lights (Blake et al. 1994; Rydell 1992; Stone 2012). This may bring these species into the vicinity of the project and indirectly increase the risk of collision/barotrauma particularly for species that are known to forage around lights. These include the Cape serotine and the Egyptian free-tailed bat (Fenton et al. 2004; J. Aronson, personal observation). This impact is likely to be very low with mitigation but must be carefully considered because the consequence could be severe without mitigation. Lighting at the project should be kept to a minimum and appropriate types of lighting should be used to avoid attracting insects, and hence, bats.

Mitigation measures:

- This impact can be mitigated by using as little lighting as possible. Where lights need to be used, these should have low attractiveness for insects such as low pressure sodium and warm white LED lights (Rydell 1992; Stone 2012). High pressure sodium and white mercury lighting is attractive to insects (Blake et al. 1994; Rydell 1992; Svensson and Rydell 1998) and should not be used as far as possible. Variable lighting regimes, reducing light spillage and using lower intensity lighting will be favourable. Additional considerations and mitigation options are provided in Stone (2012).

5.3 Decommissioning Phase Impacts

5.3.1 Roost Disturbance

Decommissioning activities of WEF and grid connection infrastructure could result in excessive noise and dust which could result in bats abandoning their roosts, depending on the proximity of these activities to roosts. This impact will vary depending on the species involved; species that roost in trees are likely to be impacted more (e.g. Cape serotine and Egyptian free-tailed bats; Monadjem et al. 2010) because tree roosts are less buffered against noise and dust compared to roosts in buildings and rocky crevices.

Reducing roosting opportunities for bats will have negative impacts. Before mitigation this impact is likely to have a moderate consequence because roosts are limiting factors in the distribution of bats and their availability is a major determinant in whether bats would be present in a particular location. However, it is unlikely that this impact will occur as there are low numbers of roosting spaces at the site. Therefore, the significance of this impact would be low. After mitigation, both the consequence and probability could decrease resulting in a very low impact.

Mitigation measures:

- Avoid decommissioning activities near roosts which include buildings, trees and rocky crevices.
- Limit decommissioning activities to daylight hours.

5.4 Cumulative Impacts

It is important to consider cumulative impacts of the WEF and grid connection infrastructure across the entire scale that potentially affected animals which are likely to move, especially mobile animals like bats. Impacts at a local scale could have negative consequences at larger scales if the movement between distant populations is impacted (Lehnert et al. 2014; Voigt et al. 2012). For example, Lehnert et al. (2014) demonstrated that among Noctule bats collected beneath wind turbines in eastern Germany, 28% originated from distant populations in the Northern and North-eastern parts of Europe. The cumulative impacts could be lower for species that do not migrate over such large distances or resident species that are not known to migrate. The sphere of the cumulative impact would then likely be restricted to the home ranges and foraging distances of different species, which can range from 1 km to at least 15 km for some insectivorous bats (Jacobs and Barclay 2009; Serra-Cobo and Sanz-Trullen 1998).

The cumulative impact for each issue was considered by searching for current and future development of WEFs within a 50 km radius of the project. Five onshore wind facilities are approved within this radius. However, for migratory bats such as the Natal long-fingered bat (Miller-Butterworth et al. 2003) the cumulative impacts region might be significantly higher. This species is known to migrate over hundreds of kilometres between winter and summer roosts (Miller-Butterworth et al. 2003). This was taken into consideration when undertaking the cumulative impact assessment (Appendix 3).

Cumulative impacts on bats could increase as new facilities are constructed but are difficult to accurately predict or assess without baseline data on bat population size and demographics (Arnett et al. 2011; Kunz et al. 2007b) and these data are lacking for many South African bat species. It is possible that cumulative impacts could be mitigated with the appropriate measures applied to wind farm design and operation. The significance of impacts in the cumulative impact assessment assumes that the mitigation measures in Appendix 3 are applied to all wind farms in the cumulative impact area. Cumulative impacts could result in declines in populations of even those species of bats currently listed as Least Concern, if they happen to be more susceptible to mortality from wind turbines (e.g. high-flying open air foragers such as free-tailed) even if the appropriate mitigation measures are applied.

6 CONCLUSION

The bat monitoring data presented suggest that the development of the proposed Kap Vley WEF and associated powerline can be achieved without unacceptable risks to bats. The majority of the proposed turbines are situated in areas where low levels of bat activity were recorded, on the ridges, and as such they are less sensitive to development with regards to impacts to bats. A confirmed roost was located at a farmstead approximately 1,600 m to the nearest turbine. This roost has been buffered with a no go buffer of 1 km in which no turbines, or parts of a turbine, should enter. Other infrastructure, such as roads and powerlines, is permitted in this buffer. This buffer does not impact the current turbine layout and no adjustments to the proposed layout are required to accommodate the buffer.

The significance ratings for the majority of the impacts to bats posed by the development are predicted to be low before mitigation and very low after mitigation, including for cumulative impacts. Impacts related to bat mortality are predicted to be of high significance before mitigation but low after mitigation. However, cumulative impacts are predicted to be of moderate significance after mitigation.

At this stage, the mitigation measures are related to the design of the proposed Kap Vley WEF and associated powerline and avoiding the placement of turbines in areas that bats are most active based on the pre-construction monitoring data. This has been adhered to in the proposed layout (Figure 1). The different turbine ranges have been considered (i.e

Hub Height of 80 – 150 m and Rotor Diameter of 100-160 m) and it would be preferential to use a higher hub height and shorter rotor diameter. Bats were most often recorded in the lower lying areas of the site and were recorded less on ridges, where all turbines are proposed. Monitoring of bat activity and bat fatality during the operational phase of the WEF is needed to determine if any additional mitigation measures are needed. Mitigation options at this stage may include using an operational minimization strategy (i.e. curtailment) during specific seasons and time periods for specific turbines coincident with periods of increased bat activity and fatality.

7 REFERENCES

ACR, 2013. African Chiroptera Report 2013. AfricanBats, African Chiroptera Project, Pretoria. i-xix + 6330 pp.

Adams, A.M., Jantzen, M.K., Hamilton, R.M., Fenton, M.B., 2012. Do you hear what I hear? Implications of detector selection for acoustic monitoring of bats. Methods in Ecology and Evolution 3, 992-998.

Arnett, E.B., Hein, C.D., Schirmacher, M.R., Baker, M., Huso, M.M.P., Szewczak., J.M., 2011. Evaluating the effectiveness of an ultrasonic acoustic deterrent for reducing bat fatalities at wind turbines. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

Aronson, J.B., Thomas, A.J., Jordaan, S.L., 2013. Bat fatality at a wind energy facility in the Western Cape, South Africa. African Bat Conservation News 31, 9-12.

Baerwald, E.F., Barclay, R.M.R., 2011. Patterns of activity and fatality of migratory bats at a wind energy facility in Alberta, Canada. The Journal of Wildlife Management 75, 1103-1114.

Baerwald, E.F., Edworthy, J., Holder, M., Barclay, R.M.R., 2009. A Large-Scale Mitigation Experiment to Reduce Bat Fatalities at Wind Energy Facilities. The Journal of Wildlife Management 73, 1077-1081.

Blake, D., Hutson, A.M., Racey, P.A., Rydell, J., Speakman, J.R., 1994. Use of lamplit roads by foraging bats in southern England. Journal of Zoology 234, 453-462.

Cryan, P.M., 2011. Wind turbines as landscape impediments to the migratory connectivity of bats. Environmental Law 41, 355-370.

Cryan, P.M., Gorresen, P.M., Hein, C.D., Schirmacher, M.R., Diehl, R.H., Huso, M.M., Hayman, D.T.S., Fricker, P.D., Bonaccorso, F.J., Johnson, D.H., Heist, K., Dalton, D.C., 2014. Behavior of bats at wind turbines. Proceedings of the National Academy of Sciences 111, 15126-15131.

Doty, A.C., Martin, A.P., 2012. Assessment of bat and avian mortality at a pilot wind turbine at Coega, Port Elizabeth, Eastern Cape, South Africa. New Zealand Journal of Zoology, 1-6.

Fenton, M.B., Jacobs, D.S., Richardson, E.J., Taylor, P.J., White, W., 2004. Individual signatures in the frequency-modulated sweep calls of African large-eared, free-tailed bats Otomops martiensseni (Chiroptera: Molossidae). Journal of Zoology 262, 11-19.

Hayes, J.P., 1997. Temporal Variation in Activity of Bats and the Design of Echolocation-Monitoring Studies. Journal of Mammalogy 78, 514-524.

Horn, J.W., Arnett, E.B., Kunz, T.H., 2008. Behavioral responses of bats to operating wind turbines. The Journal of Wildlife Management 72, 123-132.

Jacobs, D.S., Barclay, R.M.R., 2009. Niche Differentiation in Two Sympatric Sibling Bat Species, Scotophilus dinganii and Scotophilus mhlanganii. Journal of Mammalogy 90, 879-887.

Jacobs, D.S., Fenton, B.M., 2001. The status of Sauromys petrophilus and Chaerephon pumilus (Chiroptera: Molossidae) in the Western Cape Province of South Africa. 2011 36.

Jain, A.A., Koford, R.R., Hancock, A.W., Zenner, G.G., 2011. Bat mortality and activity at a Northern Iowa wind resource area. American Midland Naturalist 165, 185-200.

Johnson, G.D., Erickson, W.P., Strickland, M.D., Shepherd, M.F., Shepherd, D.A., Sarappo, S.A., 2003. Mortality of bats at a large-scale wind power development at Buffalo Ridge, Minnesota. The American Midland Naturalist 150, 332-342.

Kunz, T.H., 1973. Resource Utilization: Temporal and Spatial Components of Bat Activity in Central Iowa. Journal of Mammalogy 54, 14-32.

Kunz, T.H., Arnett, E.B., Cooper, B.M., Erickson, W.P., Larkin, R.P., Mabee, T., Morrison, M.L., Strickland, M.D., Szewczak, J.M., 2007a. Assessing impacts of wind-energy development on nocturnally active birds and bats: A guidance document. The Journal of Wildlife Management 71, 2449-2486.

Kunz, T.H., Arnett, E.B., Erickson, W.P., Hoar, A.R., Johnson, G.D., Larkin, R.P., Strickland, M.D., Thresher, R.W., Tuttle, M.D., 2007b. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. Frontiers in Ecology and the Environment 5, 315-324.

Lehnert, L.S., Kramer-Schadt, S., Schönborn, S., Lindecke, O., Niermann, I., Voigt, C.C., 2014. Wind farm facilities in Germany kill noctule bats from near and far. PloS one 9, e103106.

Miller-Butterworth, C.M., Jacobs, D.S., Harley, E.H., 2003. Strong population substructure is correlated with morphology and ecology in a migratory bat. Nature 424, 187-191.

Monadjem, A., Taylor, P.J., Cotterill, F.P.D., Schoeman, M.C., 2010. Bats of Southern and Central Africa: A Biogeographic and Taxonomic Synthesis. Wits University Press, Johannesburg.

Rollins, K.E., Meyerholz, D.K., Johnson, G.D., Capparella, A.P., Loew, S.S., 2012. A forensic investigation into the etiology of bat mortality at a wind farm: barotrauma or traumatic injury? Veterinary Pathology Online 49, 362-371.

Rydell, J., 1992. Exploitation of insects around streetlamps by bats in Sweden. Functional Ecology 6, 744-750.

Serra-Cobo, J., Sanz-Trullen, J.P., 1998. Migratory movements of Miniopterus schreibersii in the north-east of Spain. Acta Theriologica 43, 271-283.

Stone, E.L., 2012. Bats and Lighting: Overview of current evidence and mitigation.

Svensson, A.M., Rydell, J., 1998. Mercury vapour lamps interfere with the bat defence of tympanate moths (Operophtera spp.; Geometridae). Animal Behaviour 55, 223-226.

Taylor, P., Bohmann, K., Steyn, J., Schoeman, M., Matamba, E., Zepeda-Mendoza, M., Nangammbi, T., Gilbert, M., 2013. Bats eat pest green vegetable stink bugs (Nezara viridula): Diet analyses of seven insectivorous species of bats roosting and foraging in macadamia orchards. South African Avocado Growers Association Yearbook 21.

Thomas, D.W., 1988. The distribution of bats in different ages of Douglas-Fir forests. The Journal of Wildlife Management 52, 619-626.

Verboom, B., Huitema, H., 1997. The importance of linear landscape elements for the pipistrelle Pipistrellus pipistrellus and the serotine bat Eptesicus serotinus. Landscape Ecology 12, 117-125.

Voigt, C.C., Popa-Lisseanu, A.G., Niermann, I., Kramer-Schadt, S., 2012. The catchment area of wind farms for European bats: A plea for international regulations. Biological Conservation 153, 80-86.

Appendix 1: Impact Assessment Criteria

The identification of potential impacts and risks includes impacts that may occur during the construction, operational and decommissioning phases of the activity. The assessment of impacts includes direct, indirect, as well as cumulative impacts.

In order to identify potential impacts (both positive and negative) it is important that the nature of the proposed activity is well understood so that the impacts associated with the activity can be understood. The process of identification and assessment of impacts includes:

- Determination of the current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Determination of future changes to the environment that will occur if the activity does not proceed;
- An understanding of the activity in sufficient detail to understand its consequences; and
- The identification of significant impacts which are likely to occur if the activity is undertaken.

As per DEA Guideline 5: Assessment of Alternatives and Impacts the following methodology is applied to the prediction and assessment of impacts. Potential impacts are rated in terms of the direct, indirect and cumulative:

- **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
- **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

- **Nature of impact** - this reviews the type of effect that a proposed activity will have on the environment and should include “what will be affected and how?”

- **Status** - Whether the impact on the overall environment (social, biophysical and economic) will be:
  - Positive - environment overall will benefit from the impact;
  - Negative - environment overall will be adversely affected by the impact; or
  - Neutral - environment overall will not be affected.
- **Spatial extent** – The size of the area that will be affected by the risk/impact:
  - Site;
  - Local (<10 km from site);
  - Regional (<100 km of site);
  - National; or
  - International (e.g. Greenhouse Gas emissions or migrant birds).
- **Duration** – The timeframe during which the risk/impact will be experienced:
  - Very short term (instantaneous);
  - Short term (less than 1 year);

- Medium term (1 to 10 years);
- Long term (the impact will occur for the project duration); or
- Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning).

- **Reversibility of impacts** –
  - High reversibility of impacts (impact is highly reversible at end of project life, i.e. this is the most favourable assessment for the environment. For example, the nuisance factor caused by noise impacts associated with the operational phase of an exporting terminal can be considered to be highly reversible at the end of the project life);
  - Moderate reversibility of impacts;
  - Low reversibility of impacts; or
  - Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment. The impact is permanent. For example, the loss of a palaeontological resource on the site caused by building foundations could be non-reversible).
  - Irreplaceability of resource loss caused by impacts –
  - High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment. For example, if the project will destroy unique wetland systems, these may be irreplaceable);
  - Moderate irreplaceability of resources;
  - Low irreplaceability of resources; or
  - Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

Using the criteria above, the impacts are assessed in terms of the following:

- **Probability** – The probability of the impact occurring:
  - Extremely unlikely (little to no chance of occurring);
  - Very unlikely (<30% chance of occurring);
  - Unlikely (30 – 50% chance of occurring)
  - Likely (51 – 90% chance of occurring); or
  - Very likely (>90% chance of occurring regardless of prevention measures).

- **Consequence** –The anticipated severity of the impact:
  - Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);
  - Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or
  - Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).

- **Significance** – To determine the significance of an identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure A below). The approach incorporates internationally recognised methods from the Intergovernmental Panel on Climate Change (IPCC) (2014) assessment of the effects

of climate change and is based on an interpretation of existing information in relation to the proposed activity, to generate an integrated picture of the risks related to a specified activity in a given location, with and without mitigation. Risk is assessed for each significant stressor (e.g. physical disturbance), on each different type of receiving entity (e.g. the municipal capacity, a sensitive wetland), qualitatively (very low, low, moderate, high, very high) against a predefined set of criteria (as shown in Figure A below).

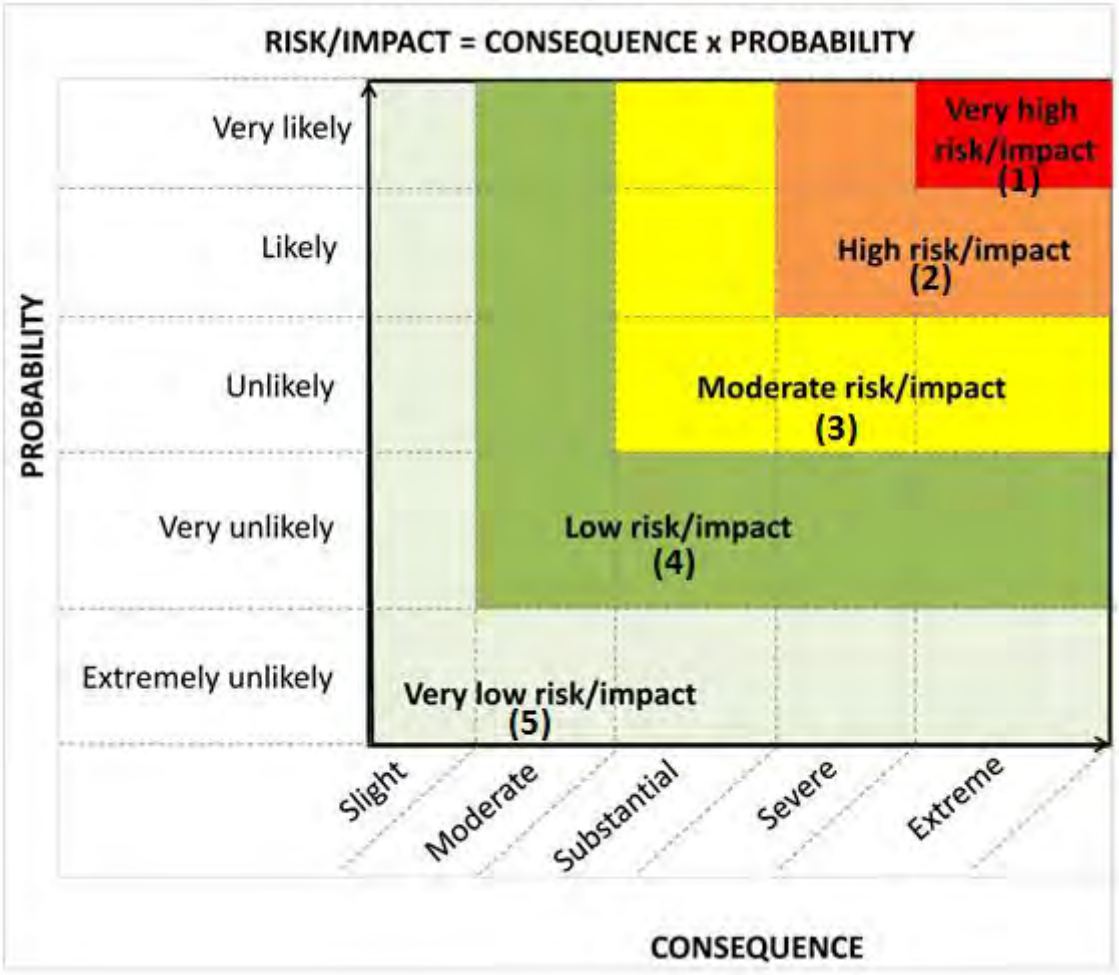


Figure A: Guide to assessing risk/impact significance as a result of consequence and probability.

- **Significance** – Will the impact cause a notable alteration of the environment?
  - Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
  - Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
  - Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated); or

- High (the risk/impacts will result in a considerable alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making).
- Very high (the risk/impacts will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating).

The above assessment must be described in the text (with clear explanation provided on the rationale for the allocation of significance ratings) and summarised in an impact assessment table.

- **Ranking** – With the implementation of mitigation measures, the residual impacts/risks must be ranked as follows in terms of significance:
  - Very low = 5;
  - Low = 4;
  - Moderate = 3;
  - High = 2; and
  - Very high = 1.
- **Confidence** – The degree of confidence in predictions based on available information and specialist knowledge:
  - Low;
  - Medium; or
  - High.

Other aspects to be taken into consideration in the assessment of impact significance are:

- Impacts will be evaluated for the construction, operational and decommissioning phases of the development. The assessment of impacts for the decommissioning phase will be brief, as there is limited understanding at this stage of what this might entail. The relevant rehabilitation guidelines and legal requirements applicable at the time will need to be applied;
- The impact evaluation will, where possible, take into consideration the cumulative effects associated with this and other facilities/projects which are either developed or in the process of being developed in the local area; and
- The impact assessment will attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact;
- Impacts should be assessed for all layouts and project components;

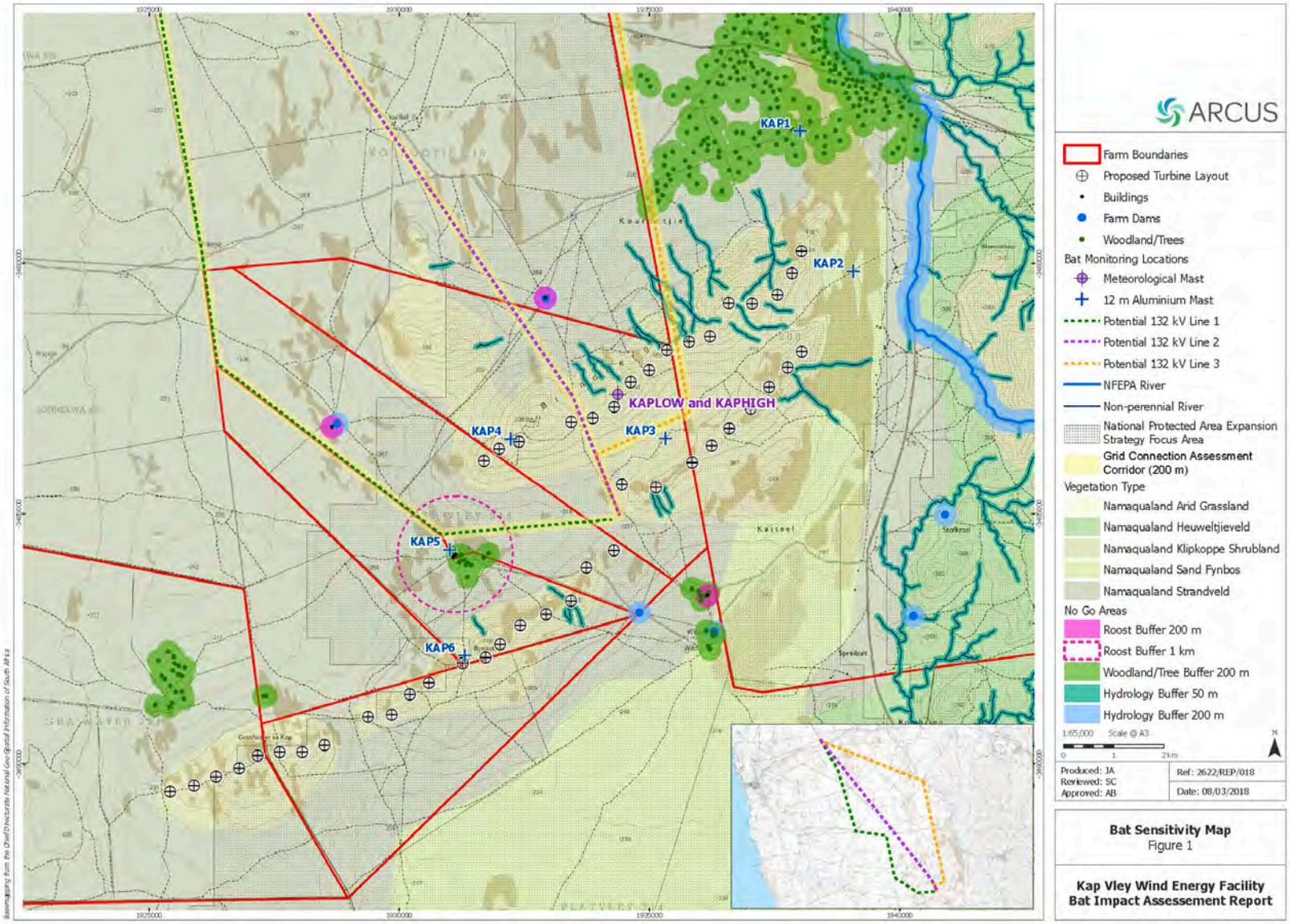
- IMPORTANT NOTE FROM THE CSIR: IMPACTS SHOULD BE DESCRIBED BOTH BEFORE AND AFTER THE PROPOSED MITIGATION AND MANAGEMENT MEASURES HAVE BEEN IMPLEMENTED. THE ASSESSMENT OF THE POTENTIAL IMPACT "BEFORE MITIGATION" SHOULD TAKE INTO CONSIDERATION ALL MANAGEMENT ACTIONS THAT ARE ALREADY PART OF THE PROJECT DESIGN (WHICH ARE A GIVEN). THE ASSESSMENT OF THE POTENTIAL IMPACT "AFTER MITIGATION" SHOULD TAKE INTO CONSIDERATION ANY ADDITIONAL MANAGEMENT ACTIONS PROPOSED BY THE SPECIALIST, TO MINIMISE NEGATIVE OR ENHANCE POSITIVE IMPACTS.

Appendix 2: Impact Assessment Summary for WEF and Grid Connection

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/impact (after mitigation)	Ranking of impact/ risk	Confidence level
CONSTRUCTION PHASE															
Excessive noise, dust and blasting	Roost Disturbance	Negative	Site	Medium	Moderate	Unlikely	Moderate	Low	Low	Yes	Yes	Avoid construction near roosts. Adhere to sensitivity map (Figure 1). Survey turbine locations and infrastructure for presence of roosts.	Very low	5	Medium
Removal of buildings, trees or rocky outcrops (bat roosts)	Roost Destruction	Negative	Site	Permanent	Moderate	Likely	Moderate	Low	Low	Yes	Yes	Avoid destroying roosts. Survey turbine locations and infrastructure for presence of roosts. Construction Phase EMP.	Very low	5	Medium
	Bat Mortality	Negative	Site	Permanent	Moderate	Likely	Non-reversible	Low	Low	Yes	Yes		Very low	5	Medium
Removal of foraging and commuting habitat	Habitat Modification	Negative	Site	Long Term	Moderate	Likely	High	Low	Low	No	Yes	Limiting the removal of vegetation. Construction Phase EMP. Rehabilitate disturbed areas.	Very low	5	Medium
OPERATIONAL PHASE															
Collisions with Operational Wind Turbines	Bat Mortality during commuting and/or foraging	Negative	Regional	Long term	Severe	Very Likely	Non-reversible	moderate	High	No	Yes	Avoid areas more frequently used by bats. Operational acoustic monitoring and carcass searches to advise operational minimization strategies.	Low	4	Medium
	Bat Mortality during migration	Negative	National	Permanent	Severe	Unlikely	Non-reversible	Moderate	Moderate	No	Yes		Low	4	Medium
Habitat creation in high risk locations	Bat Mortality	Negative	Regional	Long term	Severe	Very Unlikely	Non-reversible	Moderate	Low	Yes	Yes	Artificial roost (e.g. roofs of buildings, road culverts and wind turbines) must be sealed. Ongoing maintenance and inspections of buildings to ensure no access to bats.	Very low	5	Medium
Light Pollution	Displacement and reduced foraging opportunities for bats	Negative	Local	Long term	Moderate	Likely	High	Low	Low	Yes	Yes	Using as little lighting as possible. Low pressure sodium and warm white LED lights are favourable. High pressure sodium and white mercury lighting to be avoided.	Low	4	Medium
	Bat Mortality	Negative	Regional	Long term	Severe	Very Unlikely	Non-reversible	Low	Low	Yes	Yes		Very low	5	Medium
DECOMMISSIONING PHASE															
Excessive noise and dust could result in bats abandoning their roosts	Roost Disturbance	Negative	Site	Medium	Moderate	Unlikely	Moderate	Low	Low	Yes	Yes	Avoid decommissioning activities near roosts. Limit decommissioning activities to daylight hours.	Very low	5	Medium

Appendix 3: Cumulative Impact Assessment Summary for WEF and Grid Connection

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/impact (after mitigation)	Ranking of impact/ risk	Confidence level
CONSTRUCTION PHASE															
Excessive noise, dust and blasting could result in bats abandoning their roosts	Roost Disturbance	Negative	Regional	Medium	Moderate	Likely	Moderate	Low	Low	Yes	Yes	Avoid construction near roosts. Survey turbine locations and infrastructure for presence of roosts.	Very low	5	Medium
Physically destroying or removing buildings, trees or rocky outcrops	Roost Destruction	Negative	Regional	Permanent	Moderate	Likely	Moderate	Low	Low	No	Yes	Avoid destroying roosts. Survey turbine locations and infrastructure for presence of roosts. Construction Phase EMP.	Very low	5	Medium
	Bat Mortality	Negative	Site	Permanent	Moderate	Likely	Non-reversible	Low	Low	Yes	Yes		Very low	5	Medium
Removal of foraging and commuting habitat	Habitat Modification	Negative	Regional	Long Term	Moderate	Likely	High	Low	Low	No	Yes	Limiting the removal of vegetation. Construction Phase EMP. Rehabilitate disturbed areas.	Very low	5	Medium
OPERATIONAL PHASE															
Collisions with Operational Wind Turbines	Bat Mortality during commuting and/or foraging	Negative	Regional	Long term	Severe	Very Likely	Non-reversible	Low	High	No	Yes	Avoid areas more frequently used by bats. Operational acoustic monitoring and carcass searches to advise operational minimization strategies.	Moderate	3	Low
	Bat Mortality during migration	Negative	National	Long term	Severe	Very Likely	Non-reversible	Low	High	No	Yes		Moderate	3	Low
Habitat creation in high risk locations – inadvertent provision of new roosts for bats attracting to the WEF	Bat Mortality	Negative	Regional	Long term	Severe	Very Unlikely	Non-reversible	Low	Low	Yes	Yes	Artificial roost (e.g. roofs of buildings, road culverts and wind turbines) must be sealed. Ongoing maintenance and inspections of buildings to ensure no access to bats.	Very low	5	Medium
Light Pollution	Displacement and reduced foraging opportunities for bats	Negative	Regional	Long term	Moderate	Likely	High	Low	Low	Yes	Yes	Using as little lighting as possible. Low pressure sodium and warm white LED lights are favourable. High pressure sodium and white mercury lighting to be avoided.	Low	4	Medium
	Bat Mortality	Negative	Regional	Long term	Severe	Very Unlikely	Non-reversible	Low	Low	Yes	Yes		Very low	5	Medium
DECOMMISSIONING PHASE															
Excessive noise and dust could result in bats abandoning their roosts	Roost Disturbance	Negative	Regional	Medium	Moderate	Unlikely	Moderate	Low	Low	Yes	Yes	Avoid decommissioning activities near roosts. Limit decommissioning activities to daylight hours.	Very low	5	Medium


KAP1
KAP2
KAP3
KAP4
KAP5
KAP6
KAPLOW and KAPHIGH
ARCUS
Farm Boundaries
Proposed Turbine Layout
Buildings
Farm Dams
Woodland/Trees
Bat Monitoring Locations
Meteorological Mast
12 m Aluminium Mast
Potential 132 kV Line 1
Potential 132 kV Line 2
Potential 132 kV Line 3
NFEPA River
Non-perennial River
National Protected Area Expansion Strategy Focus Area
Grid Connection Assessment Corridor (200 m)
Vegetation Type
Namaqualand Arid Grassland
Namaqualand Heuweltjieveld
Namaqualand Klipkoppe Shrubland
Namaqualand Sand Fynbos
Namaqualand Strandveld
No Go Areas
Roost Buffer 200 m
Roost Buffer 1 km
Woodland/Tree Buffer 200 m
Hydrology Buffer 50 m
Hydrology Buffer 200 m
1:65,000 Scale @ A3
Produced: JA
Reviewed: SC
Approved: AB
Ref: 2622/REP/018
Date: 08/03/2018
Bat Sensitivity Map
Figure 1
Kap Vley Wind Energy Facility
Bat Impact Assessement Report

Appendix 4 – Details of Specialist and Declaration of Interest

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

Proposed Kap Vley Wind Energy Facility

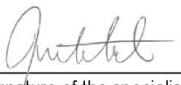
Specialist:	Jonathan Aronson		
Contact person:	Jonathan Aronson		
Postal address:	Office 220 Cube Workspace, Crn Long Street and Hans Strydom Street 8001		
Postal code:			
Telephone:	021 412 1535	Cell:	079 0988 595
E-mail:	jonathana@arcusconsulting.co.za	Fax:	n/a
Professional affiliation(s) (if any)	South African Council for Natural Scientific Professions South African Bat Assessment Association		
Project Consultant:	Minnelise Levendal		
Contact person:	Minnelise Levendal		
Postal address:	CSIR, Implementation Unit (Environmental Management Services), PO Box 320, Stellenbosch 7599		
Postal code:			
Telephone:	021 888 2494	Cell:	083 309 8159
E-mail:	mlevendal@csir.co.za	Fax:	021 888 2693

4.2 The specialist appointed in terms of the Regulations_

I, Jonathan Aronson, declare that –

General declaration:

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



Signature of the specialist:

Arcus Consultancy Services South Africa Pty (Ltd)
Name of company (if applicable):

08/03/2018
Date:

Appendix 5 – Bat Specialist CV

CURRICULUM VITAE

Jonathan Aronson MSc Pr.Sci.Nat
Ecologist Specialist
Email:JonathanA@arcusconsulting.co.za

Specialisms

- Ecological Impact Assessments
- Pre-construction and Operational monitoring at wind energy developments
- Data analysis and statistical assessment of ecological data
- GIS mapping and Analysis

Summary of Experience

Jonathan has 12 years of experience studying and researching bats and has presented at the International Bat Research Conference and local bat workshops. He has been at the forefront of bats and wind energy research in South Africa. He has contributed to the Good Practise Guidelines for Surveying Bats at Wind Energy Facilities in South Africa, is the lead author on the operational monitoring guidelines for bats and is a founding member of the South African Bat Assessment Advisory Panel (SABAAP). He has experience managing wind energy facility projects including developing survey strategies, implementing field surveys, data analysis and report writing. He can conduct reviews and assessments of Environmental Due Diligence and compliance with international environmental standards. He has provided extensive input to Environmental Impact Assessments (EIA) and post-construction Environmental Management Plans (EMP) for bats.

Professional History

2013 to present - Ecology Specialist, Arcus Consultancy Services Ltd, Cape Town
2011 to 2013 - Director, Gaia Environmental Services Pty (Ltd), Cape Town
2008 to 2008 - Research Assistant, Percy Fitzpatrick Inst. of African Ornithology, Cape Town

Qualifications and Professional Interests

- **University of Cape Town, 2009-2010**
  Msc Zoology
- **University of Cape Town, 2007**
  BSc (Hons) Freshwater Biology
- **University of Cape Town, 2003-2006**
  BSc Zoology
- Member of Society for Conservation Biology (2011 to present)
- South African Bat Assessment Advisory Panel (2013 to present)
- Professional Natural Scientist (Ecological Science) – SACNASP Registration #400238/14

Project Experience

Bat Monitoring and Environmental Impact Assessments

- Highlands Wind Energy Facility. 12 months pre-construction bat monitoring study (WKN Windcurrent SA (Pty) Ltd).
- Kap Vley Wind Energy Facility. 12 months pre-construction bat monitoring study (juwi Renewable Energies (Pty) Ltd).
- Universal and Sonop Wind Energy Faculties. Pre-construction bat monitoring (JG Afrika).
- Kolkies and Karee Wind Energy Facility. 12 months pre-construction bat monitoring study (Mainstream Renewable Power South Africa).
- Komsberg East and West Wind Energy Facility. 12 months pre-construction bat monitoring study (African Clean Energy Developments Pty Ltd).
- Gouda Wind Energy Facility. 12 months of operational monitoring for bats including activity and fatality surveys. (Blue Falcon 140 (Rf) Pty Ltd).
- Hopefield Wind Farm. 12 months of operational monitoring for bats including activity and fatality surveys. (Umoya Energy)
- Elliot Wind Energy Facility. Pre-construction bat monitoring study. (Rainmaker).
- Pofadder Wind Energy Facility. 12 months pre-construction bat monitoring study (Mainstream Renewable Power South Africa).
- Spitskop West Wind Energy Facility. 12 months pre-construction bat monitoring study (RES Southern Africa/Gestamp).

CURRICULUM VITAE

Jonathan Aronson MSc Pr.Sci.Nat
Ecology Specialist
Email:JonathanA@arcusconsulting.co.uk Tel: +27 (0) 790 988 595

- Spitskop East Wind Energy Facility. Analysis of 12 months of pre-construction bat monitoring data (RES Southern Africa).
- Patryshoogte Wind Energy Facility. Pre-construction bat monitoring study (RES Southern Africa).
- Swartberg Wind Energy Facility. 12 months pre-construction monitoring and surveys for the presence of bats roosting in farm buildings (CSIR).
- Clover Valley and Groene Kloof Wing Energy Facility. Arcus staff undertook 12 months of pre-construction bat monitoring which included acoustic surveys and mist-netting to catch bats. (Western Wind Energy).
- Spitskopvlakte Wind Energy Project. Arcus staff assisted with the implementation of a survey of bat activity on this site located near Laingsburg in the Western Cape. This work included acoustic monitoring at several locations including monitoring at height.

Ecological Surveys

- Killean Wind Farm. Bat acoustic surveys including a driven transect and commissioning of bat detectors for this proposed site in Scotland, UK. (Renewable Energy Systems Ltd).
- Maple Road, Tankersely. Bat acoustic surveys including a walked transect for this proposed site near Barnsley, UK (Rula Developments).

Due Diligence

- Due Diligence of Bat Monitoring at the Kangas, Excelsior and Golden Valley Wind Farms (ERM).
- Due Diligence of Bat Monitoring at the Roggeveld Wind Farm (IBIS Consulting).

Amendment Applications

- Review and impact assessment for amendment to turbine dimensions for the Soetwater Wind Energy Facility (Savannah Environmental (Pty) Ltd).
- Review and impact assessment for amendment to turbine dimensions for the Karusa Wind Energy Facility (Savannah Environmental (Pty) Ltd).
- Review and impact assessment for amendment to turbine dimensions for the Zen Wind Energy Facility (Savannah Environmental (Pty) Ltd).

Peer Review

- Peer Review for Three Bat Monitoring Reports for the Bokpoort II Solar Developments (Golder Associates)
- Peer Review of Operational Monitoring at the Jeffreys Bay Wind Farm, including updating the operational mitigation strategy for bats (Globeleq South Africa Management Services (Pty) Ltd).
- Oyster Bay Wind Energy Facility. Reviewing a pre-construction bat monitoring study and providing input into a stand-alone study (RES Southern Africa).
- Review and design mitigation strategies for bats at the Kinangop Wind Park, Kenya (African Infrastructure Investment Managers).

Feasibility Studies

- Feasibility assessment for four potential wind farms in Mozambique (Ibis Consulting (Pty) Ltd).
- Assessment of the Feasibility of a Wind Farm in the Northern Cape (juwi Renewable Energies (Pty) Ltd).
- Assessment of the Feasibility of a Wind Farm in the Eastern Cape (WKN Windcurrent SA (Pty) Ltd).

Research Projects

- Darling National Demonstration Wind Farm Project. Designed and implemented a research project investigating bat fatality in the Western Cape.

CURRICULUM VITAE

Jonathan Aronson MSc Pr.Sci.Nat

Ecology Specialist

Email:JonathanA@arcusconsulting.co.uk Tel: +27 (0) 790 988 595

Publications

- MacEwan, K., **Aronson, J.**, Richardson, E., Taylor, P., Coverdale, B., Jacobs, D., Leeuwner, L., Marais, W., Richards, L. South African Bat Fatality Threshold Guidelines for Operational Wind Energy Facilities – South African Bat Assessment Association (1st Edition).
- **Aronson, J.B.** and Sowler, S. (2016). Mitigation Guidance for Bats at Wind Energy Faculties in South Africa.
- **Aronson, J.B.**, Richardson, E.K., MacEwan, K., Jacobs, D., Marais, W., Aiken, S., Taylor, P., Sowler, S. and Hein, C (2014). South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (1st Edition).
- Sowler, S. and S. Stoffberg (2014). South African Good Practise Guidelines for Surveying Bats in Wind Energy Facility Developments - Pre-Construction (3rd Edition). Kath Potgieter, K., MacEwan, K., Lötter, C., Marais, M., **Aronson, J.B.**, Jordaan, S., Jacobs, D.S, Richardson, K., Taylor, P., Avni, J., Diamond, M., Cohen, L., Dippenaar, S., Pierce, M., Power, J. and Ramalho, R (eds).
- **Aronson, J.B.**, Thomas, A. and Jordaan, S. 2013. Bat fatality at a Wind Energy Facility in the Western Cape, South Africa. *African Bat Conservation News* 31: 9-12.

Workshops, Seminars and Courses

- The Ecosystem Approach and Systems Thinking Course, United Nationals Environment Programme, Currently undertaking.
- Why Carbon Footprinting Makes Business Sense, African Climate and Development Initiative Seminar, September 2016.
- The Age of Sustainable Development Course, The SDG Academy, 2016.
- Planetary Boundaries and Human Opportunities Course, The SDG Academy, 2015.
- Endangered Wildlife Trust (EWT) Bats and Wind Energy Training Course, October 2013.
- Ecological Networks Course, Kirstenbosch Botanical Gardens, July 2013.
- Social and Economic Network Analysis Course, online via Stanford University, 2013.
- Social Network Analysis Course, online via University of Michigan, 2013
- Introduction to Complexity Science Course, online via Santa Fe Institute, 2013.
- Introduction to Spatial Analysis using R, Kirstenbosch Botanical Gardens, May 2013.
- Google Geo Tools for Conservation, University of Cape Town, February 2013.
- Endangered Wildlife Trust (EWT) Bats and Wind Energy Training Course, January 2012
- Statistical Modelling Workshop for Biologists, University of Cape Town, September 2010.
- ESRI Virtual Campus Online GIS Courses, 2010.
- WAYS/ScholarShip IT Workshop: Remote Sensing and GIS Course, March 2009.

Scoping and Environmental Impact Assessment for the proposed Kap Vley Wind Energy Facility near Kleinzee in the Northern Cape

UPDATED DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

APPENDIX J:

Dry and Ephemeral Watercourses Impact Assessment

DRY AND EPHEMERAL WATERCOURSES IMPACT ASSESSMENT

Scoping and Environmental Impact Assessment for the Proposed Kap Vley Wind Energy Facility near Kleinzee, in the Northern Cape

and

Basic Assessment for the Transmission Line

Prepared by:
Council for Scientific and Industrial Research
Stellenbosch, South Africa

Contact person:
Luanita Snyman-van der Walt

Tel: +27 21 888 2490
Email: LvdWalt1@csir.co.za

March 2018

SPECIALIST EXPERTISE

CV OF LUANITA SNYMAN-VAN DER WALT

Qualifications
MSc Environmental Science (NWU)
Pr. Sci. Nat. Environmental Science

Specialisation: Environmental Assessment and Management; Geographic Information Systems; Landscape & Urban Ecology

Luanita commenced work at CSIR in January 2014, after completing a BSc. Botany-Zoology-Tourism, a BSc. Hons. in Environmental Science, as well as a MSc. in Environmental Science with a focus on landscape ecology at the North West University, Potchefstroom Campus. She is pursuing a MSc. In Geographical Information Science at Vrije Universiteit Amsterdam, and is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (Reg. no. 400128/16).

Her work at the CSIR involves strategic environmental assessment and management, with a focus on Geographic Information System (GIS) analyses for environmental assessment and decision-making.

QUALIFICATIONS

2017 - current	MSc. Geographic Information Science	Vrije Universiteit, Amsterdam, Netherlands
2013	MSc. Environmental Science *(Cum Laude)*	North West University, Potchefstroom, South Africa
2010	BSc. Hons. Environmental Science	North West University, Potchefstroom, South Africa
2009	BSc. Botany- Zoology-Tourism	North West University, Potchefstroom, South Africa

PROJECT TRACK RECORD

Completion	Description	Role	Client
In progress	GEF funded biodiversity and land use projects	Project management, technical/specialist support, and mentoring	SANBI
In progress	Scoping and Environmental Impact Assessment for the proposed development of a 100 MW Solar Photovoltaic Facility near Kenhardt in the Northern Cape Province	Specialist study: Visual Impact Assessment	juwi Renewable Energies
In progress	Sustainable Development Goal Lab on "Mainstreaming resilience into climate change adaptation and disaster risk planning."	Project leader	Future Earth; Stockholm Resilience Centre; University of Tokyo (funders)
In progress	Strategic Environmental Assessment Aquaculture Development in South Africa	Project member – Technical GIS and mapping	Department of Environmental Affairs
June 2017	Strategic Environmental Assessment for the development of Shale Gas in South Africa	Project officer	Department of Environmental Affairs
December 2017	Guidance for Resilience in the Anthropocene: Investments for development (GRAID) – African Cities.	Project member: Sustainability assessment guideline	Stockholm Resilience Centre (funder)
January 2017	Environmental and Social Impact Assessment for the Floating Liquid Natural Gas project near Kribi, Cameroon.	Project member – Technical GIS and mapping, ecology inputs	Golar

Completion	Description	Role	Client
October 2016	Environmental Screening Study for the Giyani Waste Oil Boiler, Limpopo: Environmental management plan for the Hi-Hanyile essential oil distillery	Project manager	CSIR Enterprise Creation for Development
September 2016	Scoping and Environmental Impact Assessment for 5 x 100 MW Solar PV facilities near Dealesville, Free State.	Project manager	29 Solar
June 2016	Environmental and Social Impact Assessment for the Bomono Early Field Development Project, Cameroon.	Project member - Technical GIS and mapping, ecology inputs	EurOil
May 2016	Scoping and Environmental Impact Assessment for the proposed Development of a 7 x 75 MW Solar Photovoltaic Facilities near Kenhardt, Northern Cape	Project member - Technical GIS and mapping	Mulilo
April 2016	Scoping and Environmental Impact Assessment for the Proposed Development 3 x 75 MW Solar Photovoltaic Facilities near Kenhardt, Northern Cape	Project member - Technical GIS and mapping	Scatec
April 2016	Strategic Environmental Assessment for identification of electricity grid infrastructure development corridors in South Africa	Project member - Technical GIS and mapping	Department of Environmental Affairs
February 2016	Environmental Impact Assessment for the development of 12 Solar PV projects near Dealesville, Free State.	Project member - Technical GIS and mapping, ecology inputs, stakeholder engagement	Mainstream Renewable Energy
September 2015	Environmental Screening Study for the Proposed Vaayu Energy SA Wind Energy Facility near Wesley, Eastern Cape	Project leader	Vaayu Energy
February 2015	Environmental Screening Study for Biochar- and Composting facilities in the Umzimvubu Catchment	Project member - Technical GIS and mapping & ecology inputs	Department of Environmental Affairs
March 2015	Strategic Environmental Assessment for identification of renewable energy zones for wind and solar PV projects in South Africa	Project member - Technical GIS and mapping	Department of Environmental Affairs
November 2014	Rapid environmental screening study for WASA wind monitoring masts (11-15) in the Eastern Cape, Kwazulu-Natal and Free State provinces, South Africa	Project member - Technical GIS and mapping	CSIR Built Environment
August 2014	Environmental Screening Study for the importation of Liquid Natural Gas into the Western Cape	Project member - Technical GIS and mapping, ecology inputs	Western Cape Government
March 2014	Environmental Screening Study for a Proposed LNG Terminal at Saldanha and associated pipeline infrastructures to Atlantis and Mossel Bay, Western Cape	Project member - Technical GIS and mapping, ecology inputs	PetroSA

SPECIALIST DECLARATION

I, **LUANITA SNYMAN-VAN DER WALT,** as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- ~~I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;~~ *Responsibility of the EAP.*
- ~~I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;~~ *Responsibility of the EAP.*
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: 

Name of Specialist: LUANITA SNYMAN-VAN DER WALT

Date: 26 January 2018

EXECUTIVE SUMMARY

This document constitutes the Ephemeral and Dry Watercourses Impact Assessment for the Kap Vley Wind Energy Facility (WEF) and 132 kilovolt (kV) overhead powerline, near Kleinzee in the Northern Cape province.

The aspect associated with the juwi Kap Vley WEF and 132 kV powerline that is most likely to drive impacts to dry and ephemeral watercourses is the clearance of land (surface disturbance) and vegetation clearance for the establishment of physical footprints of infrastructure and roads. The clearance of land and vegetation could impact dry and ephemeral watercourses through increasing runoff and sedimentation in the surrounding ecosystems. However, this is not expected to be a significant concern given the limited rainfall of the arid region (< 100 mm Mean Annual Precipitation) to stimulate damaging overland flow.

Due to the arid climate and very limited rainfall, not many permanent watercourses exist within the landscape. Dry and ephemeral rivers, salt pans (depressions) and drainage lines were identified. The proposed WEF layout and 132 kV powerline avoids these as far as possible in its initial design, or follows existing linear and disturbance corridors. The mapped Namaqualand Salt Pan crossed by the powerlines was confirmed by the terrestrial ecology specialist (Todd, 2018a & b), through ground-truthing, to not exist as a hydrological feature.

The impacts of physical disturbance to dry and ephemeral watercourses, altered drainage patterns, increased runoff, erosion and sedimentation due to clearance of land and vegetation for the WEF and the 132 kV overhead powerline are expected to be 'Low' to 'Very Low', with the effective implementation of the mitigation and management actions outlined in this report.

Summary of sensitive dry and ephemeral watercourses in the study area that may be impacted, and recommended actions required.

Sensitive dry and ephemeral watercourses	WEF	132 kV overhead powerline
Drainage lines	**Avoided** ACTION: None required. Implement recommended mitigation measures	**Avoided** ACTION: None Required Implement recommended mitigation measures
Drainage lines proposed buffer	**Some roads coincide with the proposed drainage line buffers.** ACTION: None required. Implement recommended mitigation measures	**Avoided** ACTION: None required. Implement recommended mitigation measures
Potential Namaqualand Salt Pan	**Not impacted**	**Verified to not be a hydrological feature**
Buffels River, associates NFEPA wetland and proposed buffers	**Not impacted**	**Avoided** ACTION: Implement recommended mitigation measures
Kommagas River	**Not impacted**	**Not impacted**

Based on the findings in this assessment it has been concluded that the juwi Kap Vley WEF and 132 kV overhead powerline, from a dry and ephemeral watercourses perspective, may receive Environmental Authorisation with adherence to the mitigation and management measures set out in this report.

LIST OF ABBREVIATIONS

EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GIS	Geographic Information System
I&AP	Interested and Affected Party
kV	Kilovolt
MW	Megawatt
NFEPA	National Freshwater Ecosystem Priority Areas
PES	Present Ecological State
WEF	Wind Energy Facility

GLOSSARY

Definitions	
Drainage line	A geomorphological feature in which water may flow during periods of rainfall (also refer to the definition for "Watercourse" as "natural channel in which water flows regularly or intermittently".)
Watercourse	"A river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake or dam into which, or from which, water flows; and 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: (South Africa, 1998:9).
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 land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil (South Africa, 1998:9).

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 of NEMA EIA Regulations as amended (7 April 2017)	Where addressed in the Specialist 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;	Pg 1-2
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Pg 3
c) an indication of the scope of, and the purpose for which, the report was prepared; (ca) an indication of the quality and age of base data used for the specialist report; (cb) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 1.1 Section 1.6 Section 5 & 6
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.4
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 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. 3
g) an identification of any areas to be avoided, including buffers;	Section 5. 3
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 5.3
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.5
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6
k) any mitigation measures for inclusion in the EMPr;	Section 6
l) any conditions for inclusion in the environmental authorisation;	None
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8 (in reference to Section 6)
n) a reasoned opinion- i. 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 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;	Section 5.1. (public commenting as part of EIA process)
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 5.1. (no comments received to date)
q) any other information requested by the competent authority.	External review - Appendix 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.	None

TABLE OF CONTENTS

TABLES

FIGURES

DRY AND EPHEMERAL WATERCOURSES IMPACT ASSESSMENT

1 INTRODUCTION AND METHODOLOGY

1.1 Scope and Objectives

juwi Renewable Energies is proposing the development of a 300 megawatt (MW) Wind Energy Facility (WEF) and associated electrical infrastructure (132 kilovolt (kV) overhead powerline[1]) on the farms Remainder (RE) Kammagas Farm 200 Portion 5, RE Kap Vley Farm 315, Portion 1 of Kap Vley Farm 315, Portion 2 of Kap Vley Farm 315, Portion 3 of Kap Vley Farm 315, Portion 3 of Platvley Farm 314, RE Kourootjie Farm 316 and RE Gra'water Farm 331 between Kleinzee and Kommagas, Northern Cape. The affected farm portions will be referred to hereafter as the "project area". Study areas for the WEF and 132 kV powerline was defined as the infrastructure layout, buffered by 250 m (Figure 1).

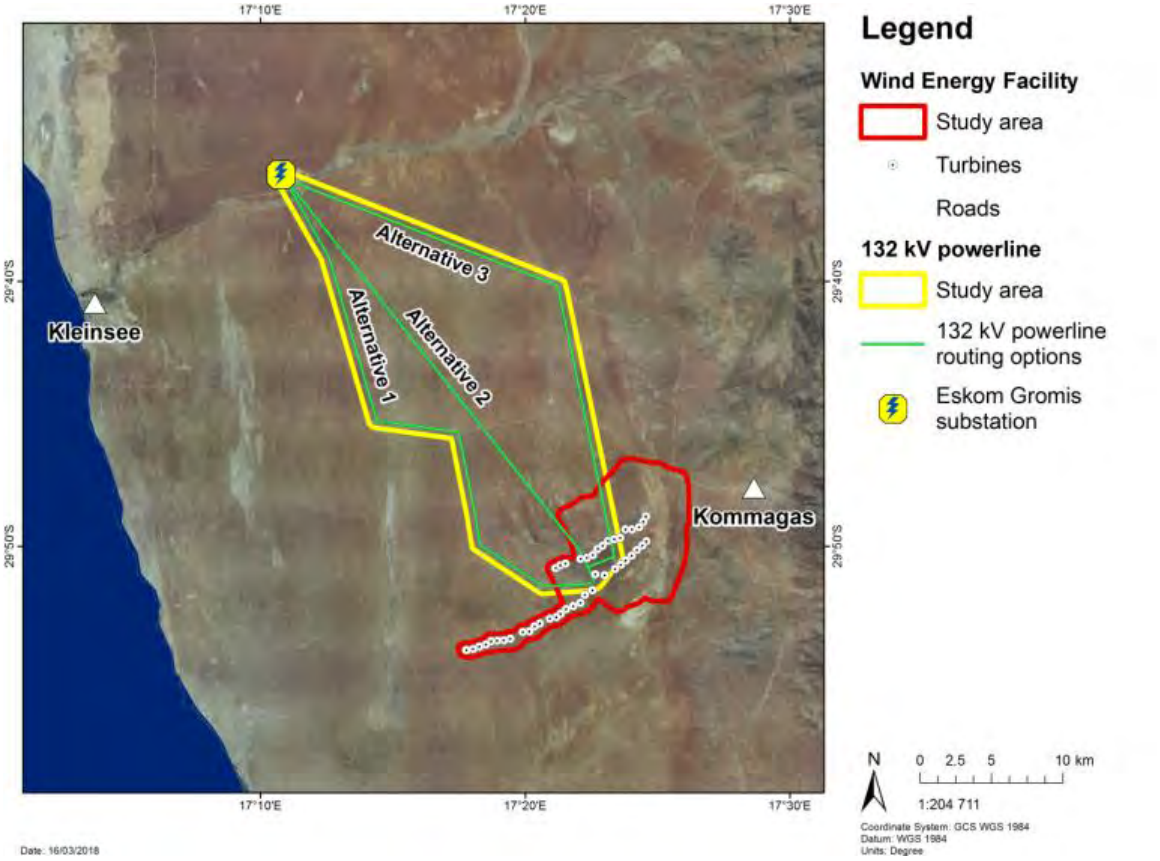


Figure 1: Study areas for the juwi Kap Vley WEF and 132 kV powerline proposed near Kleinzee and Kommagas in the Western Cape Province of South Africa.

[1] Separate Environmental Impact Assessment processes are being undertaken for the Wind Energy Facility (Full Scoping and Environmental Impact Assessment) and the 132 kV powerline (Basic Assessment). This dry and ephemeral watercourses EIA Report input considers and reports on both these project components in an integrated manner, but provides separate impact assessments for each as separate sections.

1.2 Terms of Reference

The Terms of Reference for this assessment include:

- Desktop review of existing literature;
- Consider and address concerns raised and comments made on the content of this document (Scoping Phase) by Interested and Affected Parties (I&APs);
- Impact assessment and cumulative impact assessment; and
- Recommendations for mitigation, management and monitoring actions.

In addition to the above, the following ToR has been provided by the CSIR:

- Adhere to the requirements of specialist studies as outlined in Appendix 6 of the 2014 NEMA EIA Regulations, as amended;
- Assess the no-go alternative very explicitly in the impact assessment section. Please note that the DEA considers a 'no-go' area, as an area where no development of any infrastructure is allowed; therefore, no development of associated infrastructure including access roads and internal cables is allowed in the 'no-go' areas. Should your definition of the 'no-go' area differ from the DEA definition; this must be clearly indicated in your assessment. You are also requested to indicate the 'no-go' area's buffer.
- Assess cumulative impacts by identifying other wind and solar energy project proposals and other applicable projects, such as construction and upgrade of electricity generation, transmission or distribution facilities in the local area (i.e. within 50 km of the proposed Kap Vley WEF project) that have been approved (i.e. positive EA has been issued) or the EIA is currently underway. In addition, the cumulative impact assessment for all identified and assessed impacts must be refined to indicate the following:
    - Identified cumulative impacts must be clearly defined, and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land.
    - The cumulative impacts significance rating must also inform the need and desirability of the proposed development.
    - A cumulative impact environmental statement on whether the proposed development must proceed.
- Provide a detailed description of your methodology, as well as indicate the locations and descriptions of turbine positions, and all other associated infrastructures that you have assessed and are recommending for authorisations.
- Provide a detailed description of all limitations to your studies. Your specialist studies must be conducted in the appropriate season and providing that as a limitation, will not be accepted by DEA.
- a description of the environment (aquatic resources) that may be affected by a specific activity and the manner in which the environment may be affected by the proposed project;
- a description and evaluation of environmental issues and potential impacts (including assessment of direct, indirect and cumulative impacts) that have been identified;

- a statement regarding the potential significance of the identified issues based on the evaluation of the aspects/impacts;
- an indication of the methodology used in determining the significance of potential environmental impacts ; (the CSIR methodology to determine the significance of potential impacts;
- an assessment of the significance of direct and indirect impacts of the development. Use the CSIR methodology to determine the significance of potential impacts as outlined in Section 4.6 of this Chapter);
- a description and assessment of all alternatives including the no-go alternative;
- an assessment of cumulative impacts of other solar and wind energy projects as well as other relevant projects (i.e. powerlines) within an area of 50 km from the proposed site (please refer to the projects listed in Table 6.1 of Chapter 6 of this report);
- identify no-go areas or buffers to inform the project layout;
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the EMPr;
- an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;
- a description of any assumptions uncertainties and gaps in knowledge;
- an environmental impact statement which contains:
- a summary of the key findings of the environmental impact assessment;
- an assessment of the positive and negative implications of the proposed activity;
- a comparative assessment of the positive and negative implications of identified alternatives; and
- the specialist study must address all relevant comments raised during the Scoping and EIA phases.

1.3 Approach and Methodology

This assessment has been conducted in accordance with the requirements of Appendix 6 of the 2014 NEMA EIA Regulations, as amended 2017.

1.3.1 Environmental description

A desktop study was conducted to establish and describe the receiving environment. A combination of data analysis using Geographic Information Systems (GIS), existing spatial data, and a review of existing literature was used to identify and describe aquatic ecological features and conditions in the project area.

1.3.2 Drainage line delineation

Drainage lines were delineated using existing spatial data. These include imagery on Google Earth Pro (Google Inc. 2014), the South African 50 cm imagery (CD:NGI, 2012), and 20 m contours (CS:SM, 2006). Drainage lines were digitised using ArcMap 10.4 software (ESRI Inc., 2014).

1.4 Site visit

A site visit was conducted 14 – 15 August 2017. The purpose of the site visit was to identify potential watercourses/aquatic features that may be present on site. However, due to the limited rainfall the arid area receives, the site visit was mainly aimed towards verifying the absence of permanent watercourses/aquatic features.

1.5 Assumptions and Limitations

1.5.1 Fauna

The presence and potential impacts to fauna associated with dry and ephemeral watercourses are considered in the Ecological Study: Fauna and Flora (Todd, 2018a; 2018b).

1.5.2 Mitigation measures

Mitigation measures in this report assume that construction activities are managed and performed in such a way as to minimise its impact on the receiving environment.

1.5.3 Accuracy of spatial data

The most recent available and obtainable spatial data was utilised for this assessment. It must be noted that the spatial data originate from different sources and have been created at various scales and resolutions. Discrepancies and scale incompatibilities may exist.

1.5.4 Cumulative impacts

The following proposed developments within 50 km of the proposed juwi Kap Vley WEF and 132 kV powerline were considered for the cumulative impact assessment:

- WEFs:
    - 12/12/20/2331/1: Project Blue Wind Energy Facility Near Kleinsee Within The Nama Khoi Local Municipality, Northern Cape Province (Savannah Environmental, 2012);
    - 12/12/20/2331/3: Project Blue Wind Energy Facility (Phase 2 and 3) Near Kleinsee Within The Nama Khoi Local Municipality, Northern Cape Province (in process) (Savannah Environmental, 2012);
    - 12/12/20/2212: Proposed 300MW Kleinzee WEF in the Northern Cape Province (Savannah Environmental, 2015);
    - 12/12/20/2154: Proposed Construction Of The 7.2MW Koingnaas Wind Energy Facility Within The De Beers Mining Area On The Farm Koingnaas 745 Near Koingnaas, Northern Cape Province (Savannah Environmental, 2011);
    - 12/12/20/1721/AM3: Proposed 55.5MW Springbok wind power generation facility, Northern Cape (Holland & Associates, 2015).
- Solar PV developments:
    - 14/12/16/3/3/1/416:Nigramoep PV Solar Energy Facility on a site near Nababeep, Northern Cape (in process);
    - 14/12/16/3/3/2/562: Proposed Phase 2 - Construction of a 75MW solar PV on Farm 134/17 Klipdam, Springbok, within Nama Khoi Municipality, Northern Cape (Footprint Environmental Services, 2014a);
    - 14/12/16/3/3/1/511: The Construction Of 19 Mw Photovoltaic Solar Energy Facility On Portion 1 And 3 Of The Farm Melkboschkuil 132 In Carolusberg, Northern Cape Province (Footprint Environmental Services, 2014b);
    - 14/12/16/3/3/1/974: Proposed 20MW solar PV on Farm 132/26 Melboskuil within Nama Local Municipality, Northern Cape*;

  - 14/12/16/3/3/1/510: Proposed Construction of the O'Kiep (15MW) Photovoltaic solar energy facility on the remainder of the farm Brakfontein NO. 133, O'Kiep Copper mine near Springbok, Northern Cape Province (Savannah Environmental, 2012);
  - 12/12/20/2656: O'Kiep 2 PV Solar Energy Facility on a site in O'Kiep 2 near Springbok, Northern Cape Province*;
  - 14/12/16/3/3/1/557: The Kokerboom Photovoltaic Solar Power Facility on a site south of Springbok within the Nama Khoi Local Municipality, Northern Cape Province*;
  - 14/12/16/3/3/1/558: The Establishment of the 10mw Baobab Photovoltaic Solar Energy Facility on the Farms Mesklip 14/259 and 23/259 near Kamieskroon Northern Cape Province*.
- Powerlines:
  - 12/12/20/720: Proposed deviation of the Eskom Juno-Gromis 400kV transmission line in the Northern and Western Cape (Nsovo Environmental Consulting,2016a).

** Unable to locate report / documentation.*

Note: whilst most of the (obtainable) EIA reports for the above projects mention the presence of ephemeral watercourses and drainage lines, not many of these studies include aquatic ecology specialist studies or highlight impacts to watercourses, wetlands or aquatic ecology as being a key concern.

Renewable Energy EIA Applications within 50 km of the proposed juwi Kap Vley WEF are presented in Figure 2.

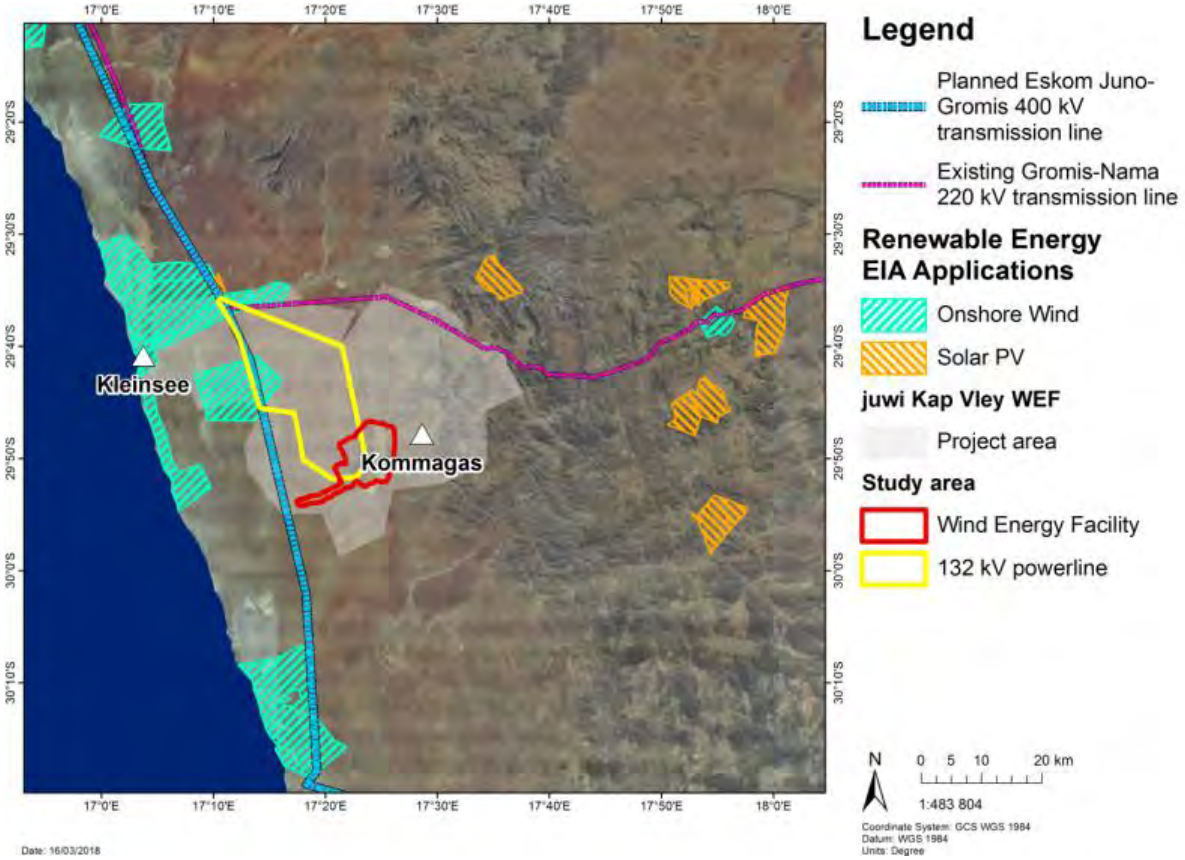


Figure 2: Renewable Energy EIA Applications in the direct vicinity of the proposed juwi Kap Vley WEF (DEA, 2017).

1.5.5 No-Go Scenario

The no-go scenario (i.e. the project does not go ahead and is not constructed) is considered in the EIA report compiled by the Environmental Assessment Practitioner (EAP), and assumes no impacts to dry and ephemeral watercourses due to the juwi Kap Vley WEF development.

1.6 Information sources

1.6.1 Literature

The following literary information was used for conducting this assessment:

- Documentation supplied by the developer and the CSIR Environmental Assessment Practitioner; and
- EIA reports for surrounding renewable energy and powerline developments (where available and obtainable).

1.6.2 Spatial data

The spatial data sets used for the landscape description, drainage line delineation, and cumulative impact assessment include:

- South African Renewable Energy EIA Application Database (DEA, 2017);
- Roadlines (DRDLR, 2006);
- NFEPA wetlands and rivers (Nel *et al*., 2011);
- South African 50 cm imagery (CD:NGI, 2012);
- 20 m Digital Terrain Model (ComputaMaps, 2002)
- 20 m contours(CS:SM, 2006); and
- Google Earth Pro satellite imagery (Google Inc. 2014).

1.7 Software

Software used for mapping and drainage line delineation include:

- Esri ArcMap software (Esri Inc., 2017); and
- Google Earth (Google Inc., 2015).

2 DESCRIPTION OF THE AFFECTED ENVIRONMENT

2.1 Climate

The Kleinzee area is characterized by an arid climate (Mucina *et al*., 2006), receiving very limited rainfall – mainly during the winter months (Figure 3).

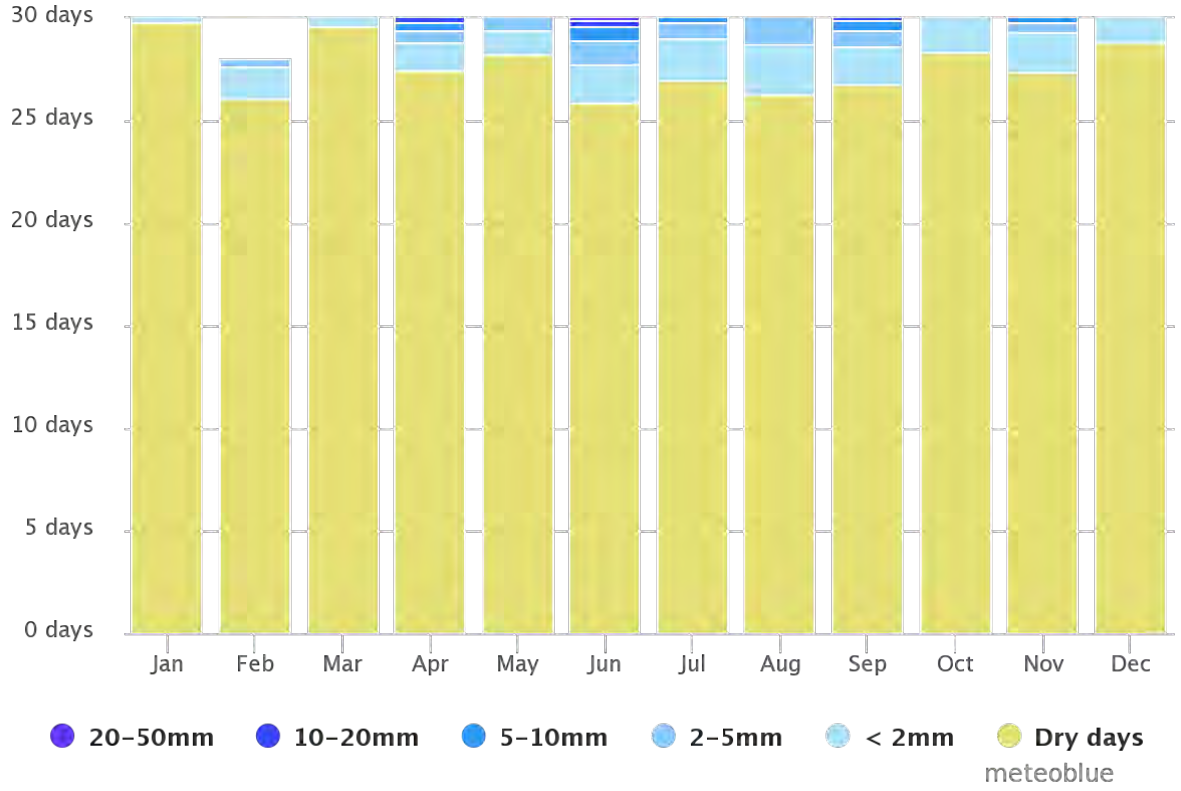


Figure 3: Average annual rainfall (mm) and rainfall days for Kleinzee based on 30 years of historical data (1985 – 2015) (Meteoblue, 2018).

2.2 Regional vegetation

The project area is situated in vegetation types of the Succulent Karoo and Fynbos biomes. However, some azonal inland vegetation (Mucina *et al*., 2006) associated with salt pans and riparian vegetation exists and is of specific concern to this study as they are indicative of ephemeral waterbodies.

2.2.1 Namaqualand Salt Pans

Namaqualand Salt Pans are bare depressions, sometimes sparsely covered with salt-tolerant succulent shrubs. The pans are almost permanently dry, but can become intermittently moist or pools. In the Kleinzee area the depressions are often covered by a layer of sand transferred by the wind (Mucina *et al*., 2006).

The Namaqualand Salt Pans are Least Threatened from a conservation perspective and have undergone minimal transformation (Mucina *et al*., 2006), but are unique features of the landscape.

Important plant taxa associated with the Namaqualand Salt Pans are presented in Table 1. These salt pans are also potentially of importance in terms of aquatic invertebrates, that rely on the pans for some or all of their life cycles. A high level of endemism may be associated with these taxa, which are poorly studied in this area.

Table 1: Important plant taxa associated with the Namaqualand Salt Pans ((d) - dominant).

Growth form	Species
Succulent shrubs	*Salsola aphylla* (d)
	Sarcocornia mossiana agg. (d)
	Atriplex cinerea subsp *bolusii*
	***Lycium tetrandrum* - Biographically important taxon, West Coast endemic**
Herbs	***Malephora purpurea-crocea* (d) - Biographically important taxon, Namaqualand endemic**
	***Limonium equisetum* - Biographically important taxon, Namaqualand endemic**
Succulent herbs	*Mesembryanthenun gueruchianum*
	Salicornia meyeriana
	***Psilocaulon dinteri* - Biographically important taxon, West Coast endemic**
Graminoids	*Juncus rigidus* (d)
	Sporobolus viginicus
	***Schoenoplectus scirpoides* - Biographically important taxon**

2.2.2 Namaqualand Riviere

The Namaqualand Riviere vegetation type is associated with dry riverbeds throughout Namaqualand, especially the Buffels River. The riverbed may sometimes carry torrential flood water, and is characterised by alluvial shrubland, patches of grass, and low woody thickets (Mucina *et al*., 2006).

The Namaqualand Riviere are Least Threatened from a conservation perspective, but are under pressure exotic invasive shrubs (Mucina *et al*., 2006), but are unique features of the landscape.

Important plant taxa associated with the Namaqualand Salt Pans are presented in Table 2.

Table 2: Important plant taxa associated with the Namaqualand Riviere ((d) - dominant).

Habitat	Growth form	Species
Riparian thicket	Small trees	*Acacia karroo* (d)
	Tall shrubs	*Melianthus pectinatus*
		Searsia burchelli
		Tamarix usneoides
	Low shrubs	*Ballota africana* (d)
	Semiparasitic epiphytic shrubs	*Viscum capense*
Dry river bottoms	Tall shrubs	*Lebeckia sericea*
	Low shrubs	*Galenia africana* (d)

Habitat	Growth form	Species
		Gomphocarpus fruticosus (d)
		Hermannia disermifolia
		Jamesbrittenia fruticosa
		Salvia dentata
	Succulent shrubs	*Suaeda fruticose* (d)
		Zygophyllym morgsana (d)
		Atriplex cinerea subsp. *bolusii*
		Didelta carnosa var. *carnosa*
		Lycium horridum
		Salsola tuberculata
		Tetragonia fruticosa
		T. pilansii
		Zygophyllum retrofractum
		***Sarcocornia terminalus* (d) – Endemic Taxon**
	Herbaceous climbers	*Didymodoxa capensis*
	Graminoids	*Cynodon dactylon* (d)
		Odyssea paucinervis (d)
		Cyperus marginatus
		Diplachne fusca
		Ehrharta longiflora
		Isolepsis antarctica
		Scirpus nodosus
	Herbs	*Limonium dregeanum* (d)
		Arcotheca calendula
		Cotula coronopifolia
		Galium tomentosum
	Geophytic herbs	*Crinum varuabile*
	Succulent herbs	*Conicosia elongate*
		Mesembryanthemum guerichianum

Figure 4 below illustrates the arid conditions that characterise the project area.

Figure 4: Photograph illustrating the arid environmental conditions of the area in which the juwi Kap Vley WEF is proposed (taken during site visit, 14 August 2017).

2.3 Quaternary catchments

The water resources of South Africa have been divided into quaternary catchments, which serve as water management units for the country (DWA, 2015). A Quaternary Catchment is a fourth order catchment in a hierarchical classification system in which the primary catchment is the major unit. The project area spans several quaternary catchments: F30D, F30F, F30G, F40A, F40B, F40D. The proposed layout entails that physical infrastructure would only be constructed in quaternary catchments F30G, F40A, F40B, F40D (Figure 5).

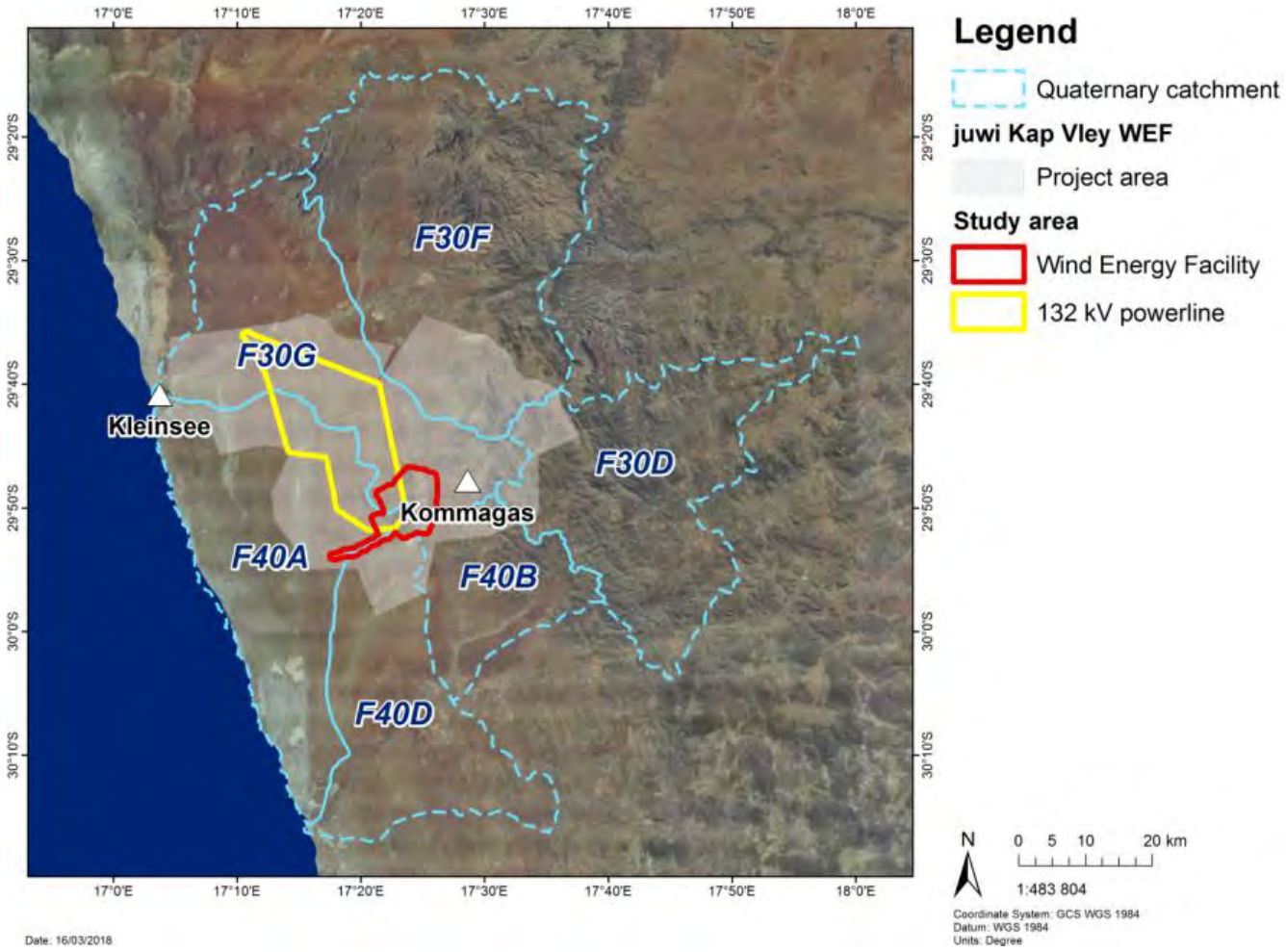


Figure 5: Quaternary catchments in the juwi Kap Vley WEF project area.

2.4 Dry and ephemeral watercourses

Based on existing spatial data, watercourses in the project area consist of ephemeral rivers, wetlands and salt pans (Figure 6).

During the site visit, carried out in August 2017, no pans, drainage lines or other watercourses were observed to be wet or inundated.

2.4.1 Non-perennial rivers

Two ephemeral rivers are within the project area, namely the Buffels River (non-perennial, primary river) and the Kommagas River (non-perennial, secondary river) (Table 3, Figure 6). Both these rivers were modelled by Kleynhans (2000) as being in a Category C, or Moderately Modified, Present Ecological State (PES).

Table 3: Present Ecological State, Ecological Importance & Ecological Sensitivity of the Buffels and Kommagas Rivers.

	Buffels	Kommagas
Present Ecological State (Kleinhans, 2000)	C Moderately Modified	C Moderately Modified
Ecological Importance (DWS, 2014)	Moderate	Moderate
Ecological Sensitivity (DWS, 2014)	Low	Low

Rivers in semi-arid to arid regions generally show decreased volume downstream mainly due to evaporation and infiltration into the alluvium and channel boundaries (Tooth, 2000). In the Buffels River most of the water flows along the base of the alluvial aquifer and is stored in the channel banks during drier months (Adams *et al*., 2004).

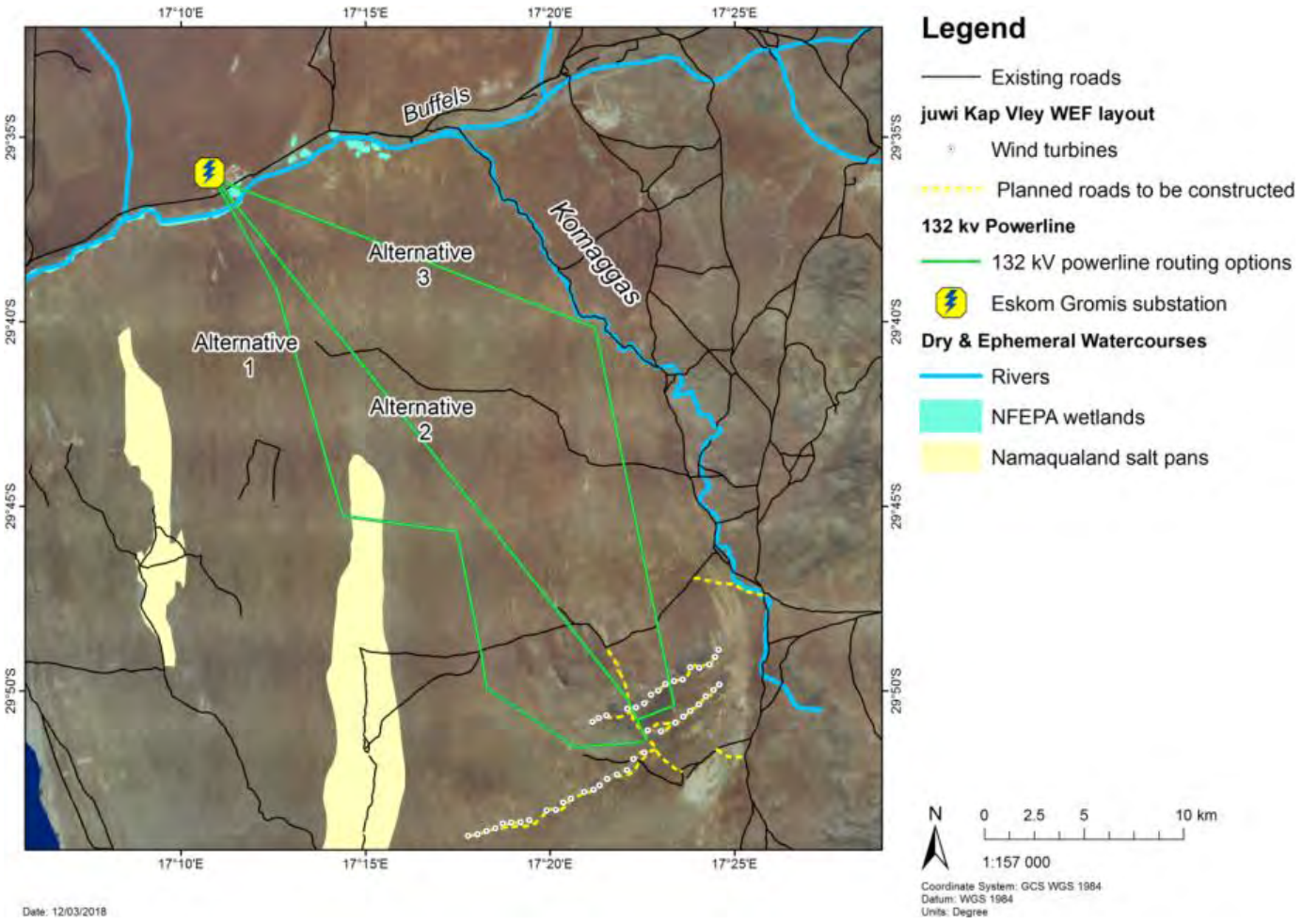


Figure 6: Dry and ephemeral watercourses in the project area consist of ephemeral rivers and wetlands (incl. Namaqualand Salt Pans) (based on existing spatial data). Importantly, the Namaqualand Salt Pans were verified in-field to not be hydrological features.

The Buffels River is likely to be sensitive to physical disturbance of its bed and banks, with long disturbance recovery times being required, as a result of the low frequency of river "re-setting" flows. Species present within the river include *Acacia karoo*, *Suaeda fruticosa, Salsola aphylla*, *Tamarix useneoides*, *Hermannia trifurca*, *Stipagrostis namaquensis*, *Galenia africana*, *Codon royenii*, *Argemone ochroleuca*, *Scirpoides dioecus* and *Forsskaolea candida* (Todd, 2018b).

The Kommagas River is situated approximately 2 km east of the proposed juwi WEF infrastructure (wind turbines and roads). A section of the 132 kV powerline (Alternative 3) is proposed within 500 m of the Kommagas River, but does not cross it (Figure 6). As such, the Kommagas River will not be impacted and was not described and assessed in this report.

All three proposed alternative routings for the 132 kV powerline must cross the Buffels River to reach the Eskom Gromis substation. However, the river would be easily spanned by the proposed powerline (Figure 7).

Figure 7. Photo of a view to the north over the Buffels River, just south of the power line crossing point (Photo credit: Simon Todd).

2.4.2 Wetlands

Natural wetlands associated with the Buffels River as delineated by the National Freshwater Ecosystem Priority Area (NFEPA) project (Nel et al., 2011) are presented in Figure 8.

All three proposed alternative routings for the 132 kV powerline must cross the Buffels River to reach the Eskom Gromis substation. Based on the NFEPA database, the wetlands at the proposed Buffels River crossing are channelled valley-bottom and flat wetlands. Most of the wetlands here have been assessed as in a Natural or Good condition (equivalent to PES A), whilst the wetland closest to the existing road is Moderately Modified (equivalent to PES C) (Nel et al., 2011). However, from the satellite imagery (Figure 8) it is clear that the wetlands recorded in the NFEPA database are mainly associated with the riverbed of the Buffels River and may have been incorrectly derived for the NFEPA database. The entire Buffels River can be regarded as a wetland and the extent is greater than the extent indicated on the NFEPA spatial data. The river does not currently hold water and may go for several years without water, but in wet years it may flow for several months at a time. The Buffels River is not classified as NFEPA Priority River as it is ephemeral and does not have any priority species. However, the associated wetlands are classified as priority wetlands, indicating that they are in a largely natural state and considered to be good examples of the valley bottom wetlands within the Namaqualand Sandveld region. The Buffels River may be considered to be in a reasonable condition in most parts and the NFEPA classification is considered a reasonable reflection of the situation on the ground. (S. Todd, Pers. Comm, 19 Mar. 2018).

2.4.3 Salt pans

According to the South African Vegetation map Namaqualand salt pans are present in the project area (Mucina *et al*., 2006; SANBI, 2012). Namaqualand salt pans are nearly permanently dry. Occasionally the lowest depressions of these pans may contain pools of standing water. In the Kleinzee area these pans are often covered under wind-borne sand (Mucina *et al*., 2006).

However, within the study area, the classification of these areas as this vegetation type as a salt pan is debatable as these areas do not appear to be salt pans in their origin and do not correspond with the general description of these areas as provided. Furthermore, their description as a pan is considered a misnomer as these areas are dry and do not fill with water even in exceptional circumstances. These appear to rather be areas where the wind has removed the sand overburden exposing the older underlying calcrete basement, leading to their 'white' appearance and assumption that these are salt pans.

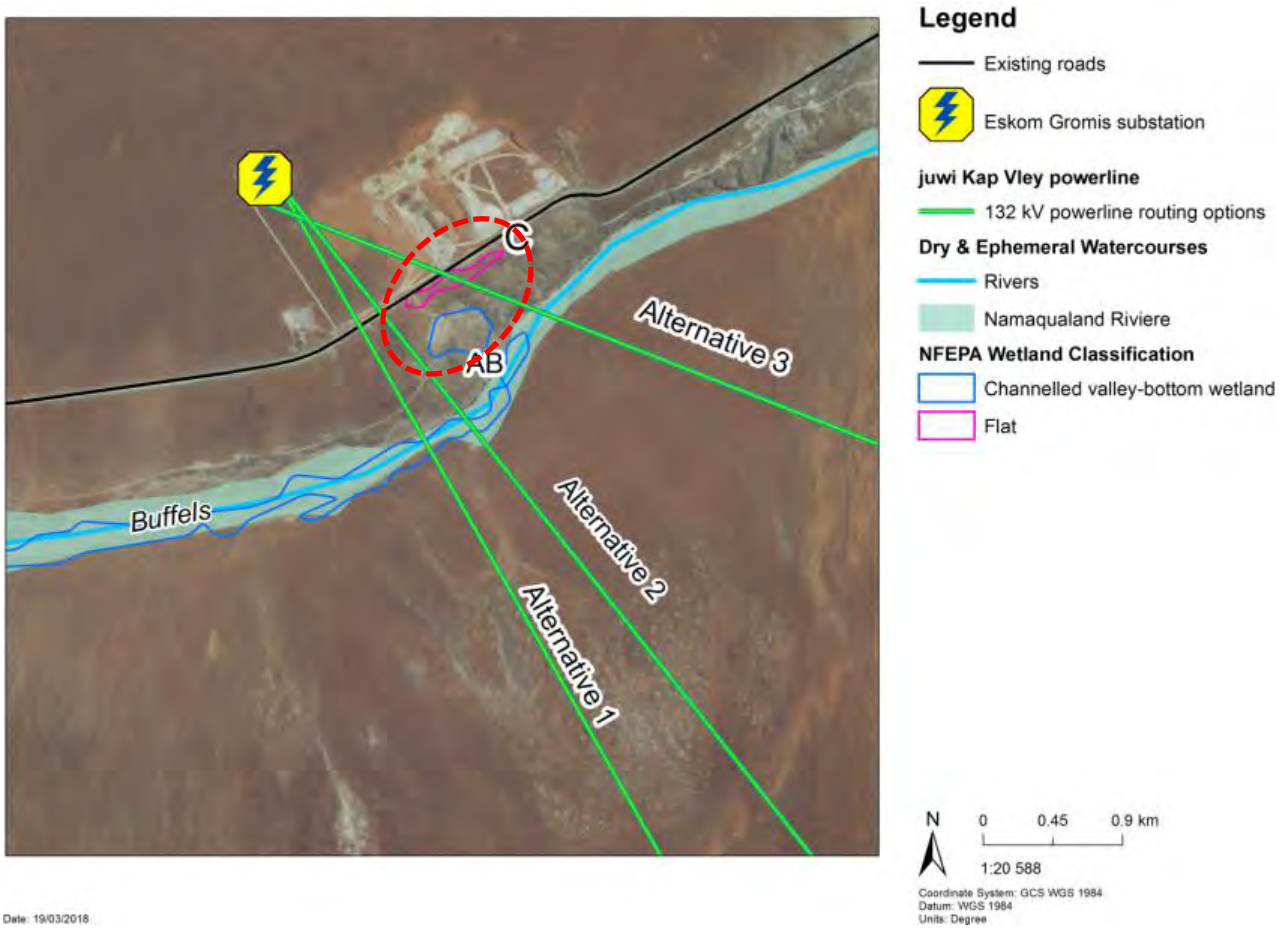


Figure 8: Classification and Present Ecological State of wetlands associated with the non-perennial Buffels River (Nel *et al*., 2011). The two wetlands indicated by the red dashed line do not exit and are related to the mining operation that can be seen adjacently.

Figure 9: Photo of the area indicated by the Vegetation Map of South Africa (Mucina & Rutherford 2006; SANBI, 2012). The sandy overburden has been removed by the wind. The area is generally fairly well vegetated with shorter succulent and woody shrubs. These are not hydrological features and occur on marine sediments (Photo credit: Simon Todd).

2.5 Drainage line delineation

Drainage lines were delineated using existing spatial data, namely imagery on Google Earth Pro (Google Inc. 2014), the South African 50 cm imagery (CD:NGI, 2012), and 20 m contours (CS:SM, 2006). Drainage lines were digitised using ArcMap 10.4 software (ESRI Inc., 2014).

Slope was derived from the 20 m Digital Terrain Model of South Africa (ComputaMaps, 2002).The slope of the project area is generally flat, ranging from 0 – 2.5 degrees. However, to maximise wind exposure the WEF is proposed on an elevated ridgeline characterised by slopes of up to 30 degrees (Figure 11 and Figure 12).

The drainage lines are situated on the slopes of a ridgeline on which the WEF is proposed and is probably the most likely route of overland flow to lower lying areas during rainfall events. The drainage lines channel runoff to the lower lying plains, and not into a specific watercourse.

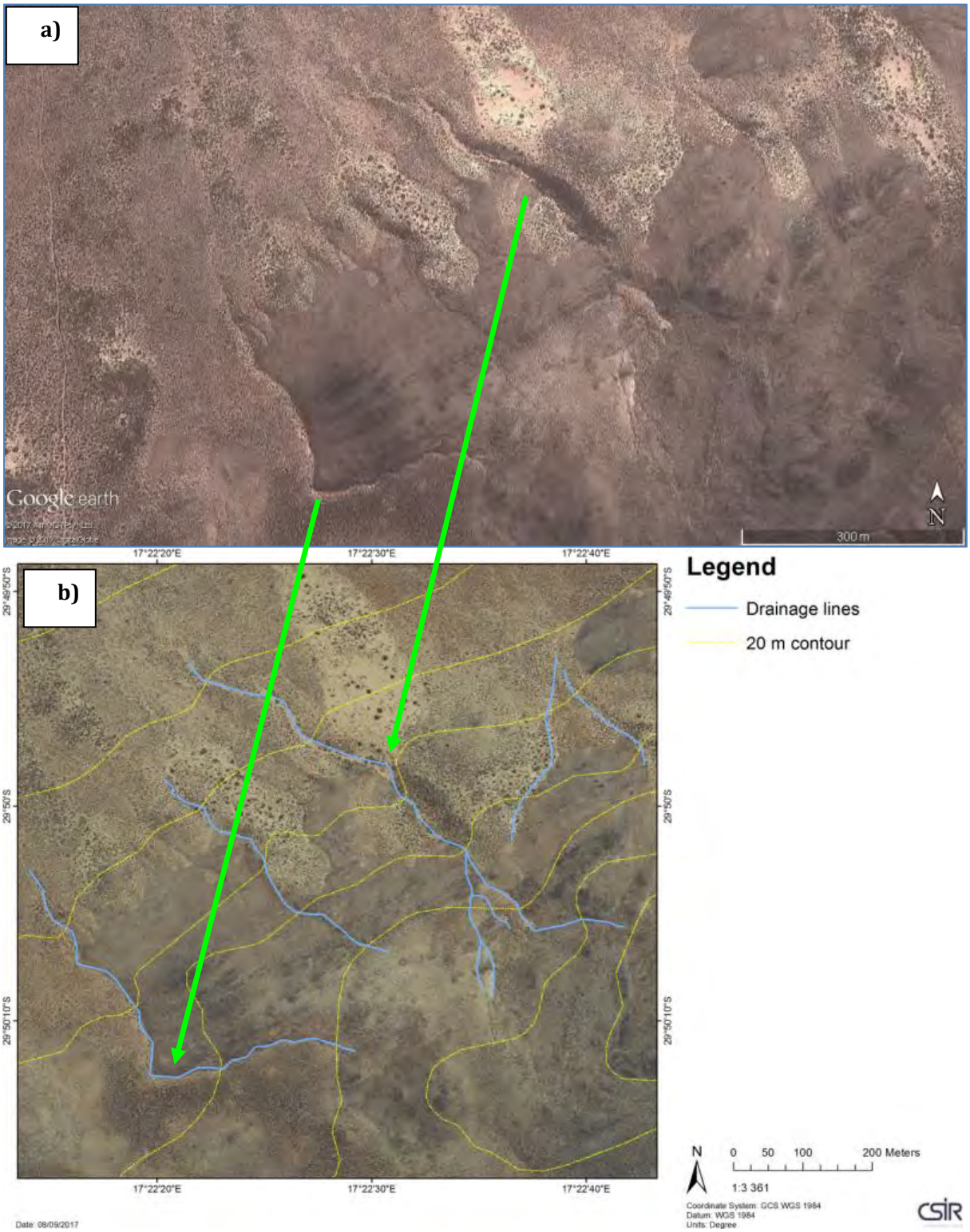


Figure 10: a) Imagery on Google Earth, as well as b) South African 50 cm imagery and 20 m contours were used to identify and delineate potential drainage lines.

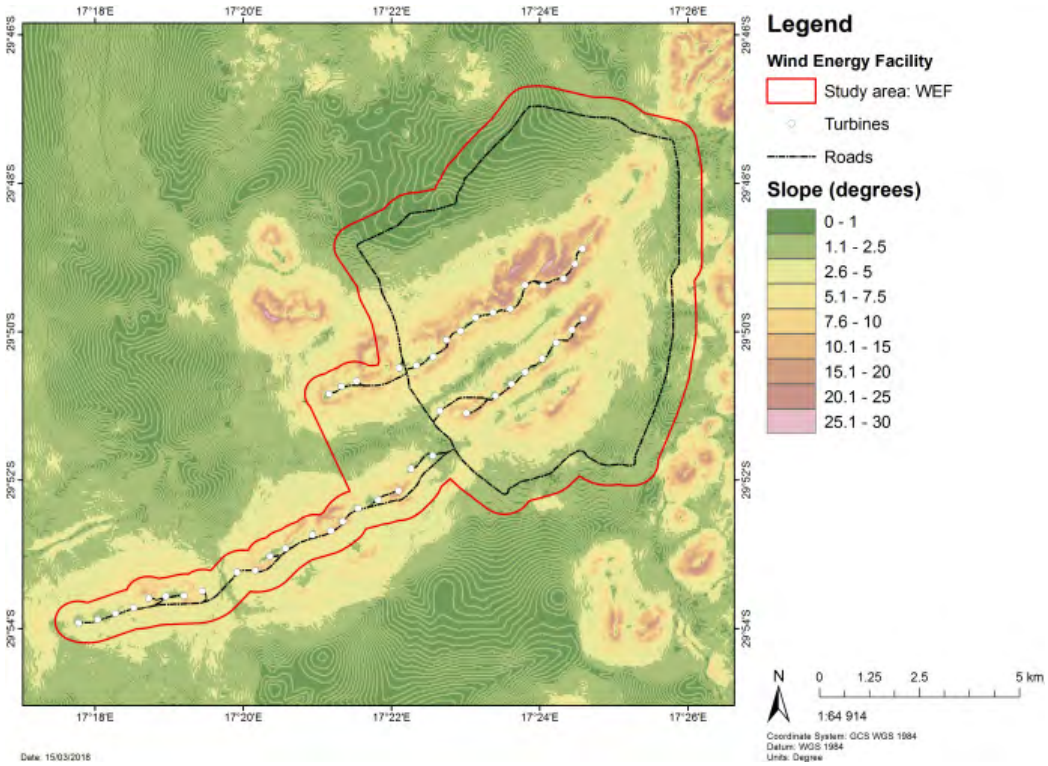


Figure 11: Slope of the WEF study area. The WEF is proposed to run on a ridgeline to maximise wind exposure - as such the slopes mainly range between 2.5 – 25 degrees.

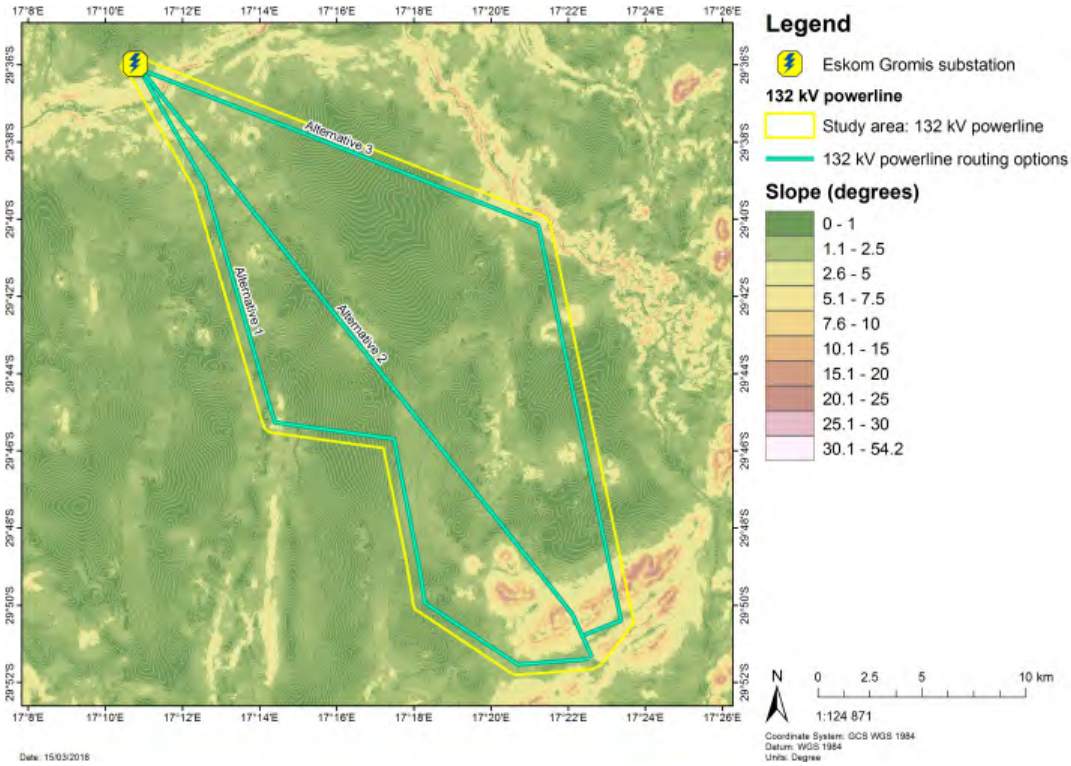


Figure 12: Slope of the 132 kV powerline study area, exceeding 20 degrees at the connection point with the WEF, but very slight (0 – 2.5 degrees) towards to Eskom Gromis substation.

Figure 13: Photograph illustrating an example of the drainage lines on site (taken during site visit, 14 August 2017). The blue arrow indicates the most likely direction of overland flow during a rainfall event.

3 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO IMPACTS TO DRY & EPHEMERAL WATERCOURSES

The aspect associated with the juwi Kap Vley WEF and 132 kV powerline that is most likely to drive impacts to dry and ephemeral watercourses is the clearance of land (surface disturbance) and vegetation clearance for the establishment of physical footprints of infrastructure and roads (Table 4).

Table 4: Project aspects of the juwi Kap Vley WEF and 132 kV overhead powerline most likely to drive impacts to dry and ephemeral watercourses.

Wind Energy Facility	Specification
Turbine foundations	- 25 m^2 per turbine - Total 45 turbines = 1 125 m^2
Crane platforms	- 1 ha per turbine - Total 45 turbines = 45 ha
On-site substation	- 150 m^2
Operations and maintenance buildings	- 1 ha
Construction and laydown areas	- 13 ha
Roads (access and service) & Turn Around Areas	- 37 km in length. - Gravel. - 5 m (alternated with 15 m section for passing, curvature and the physical footprint due to cut and fill requirements) – *5 m vs 15 m section locations not currently known.* - Turning areas.
Excavation depths	- 1.5 m
Underground cabling	
Stormwater channels and culverts	
132 kV overhead powerline	**Specification**
Pylon foundations	- < 1 m^2
Powerline span between pylons	- 150 m
Access and service roads	- Jeep track along the length of a powerline
Servitude	- 40 m wide - No clearance needed due to low growing, sparse vegetation

4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

The following permits may be required:

- Water Use License from the Department of Water Affairs under Section 21 c and i under the National Water Act.

5 IDENTIFICATION OF KEY ISSUES

5.1 Key Issues Identified During the Scoping Phase

The key potential impacts identified during the Scoping Phase are driven by the clearance of vegetation and surface disturbance, and include:

- Physical disturbance and destruction of dry and ephemeral watercourses (incl. drainage lines); and
- Altered drainage patterns, increased runoff, erosion and sedimentation of related ecosystems.

The Scoping Report including the dry and ephemeral watercourses impact assessment input was released for a 30-day comment period. To date, no specific comments or additional issues have been raised by I&APs specifically relating to potential impacts to dry and ephemeral watercourses.

5.2 Identification of Potential Impacts

The potential impacts of the proposed project are most likely associated with surface and vegetation clearing during site preparation and construction. The proposed Kap Vley WEF and 132 kV powerline may impact on dry and ephemeral watercourses, but it is anticipated that these can be mitigated through placement and routing of infrastructure that poses least environmental risk and planning pylon placement to follow existing linear features and avoid sensitive dry and ephemeral watercourses.

The clearance of land and vegetation could impact dry and ephemeral watercourses through increasing runoff and sedimentation in the surrounding ecosystems. However, this is not expected to be a significant concern given the limited rainfall of the arid region (< 100 mm Mean Annual Precipitation).

Key impact drivers that may impact dry and ephemeral watercourses and their functioning are presented in Table 5.

Decommissioning of the WEF and electricity infrastructure at the end of the operational phase is unlikely. The facility would rather be updated and repowered. However, potential impacts relating to decommissioning activities (e.g. removal of permanent infrastructure) have also been considered.

Table 5: Key project aspects may result in impacts to the dry and ephemeral watercourses and the associated project phase.

Impact	Impact pathway/driver		Project phase		
			Construction	Operation	Decommissioning
Physical disturbance and destruction of dry and ephemeral watercourses (incl. drainage lines).	Clearance of land and vegetation	WEF and ancillary infrastructure	X		X
		132 kV powerline	X	X	X
Altered drainage patterns, increased runoff, erosion and sedimentation of surrounding ecosystems.		WEF and ancillary infrastructure	X	X	X
		132 kV powerline	X	X	X
Cumulative impacts of all proposed WEF developments in the proposed project area.			X	X	X

5.3 Sensitivity: dry and ephemeral watercourses

The dry and ephemeral watercourses features in the juwi Kap Vley WEF project area were assigned sensitivities (Table 6). The features were also assigned buffer distances to ensure that they are not impeded and to secure ecological functioning.

Table 6: Dry and ephemeral watercourses sensitivity.

Feature	Distance	Sensitivity
Rivers	Actual feature	High
River buffer	100 m	Moderate
NFEPA Wetland	Actual feature	High
NFEPA Wetland buffer	100 m	Moderate
Drainage lines	Actual feature	High
Drainage line buffer	50 m	Moderate

The current layout of the WEF and roads do not directly coincide with drainage lines (Figure 14), but may impinge the proposed buffers.

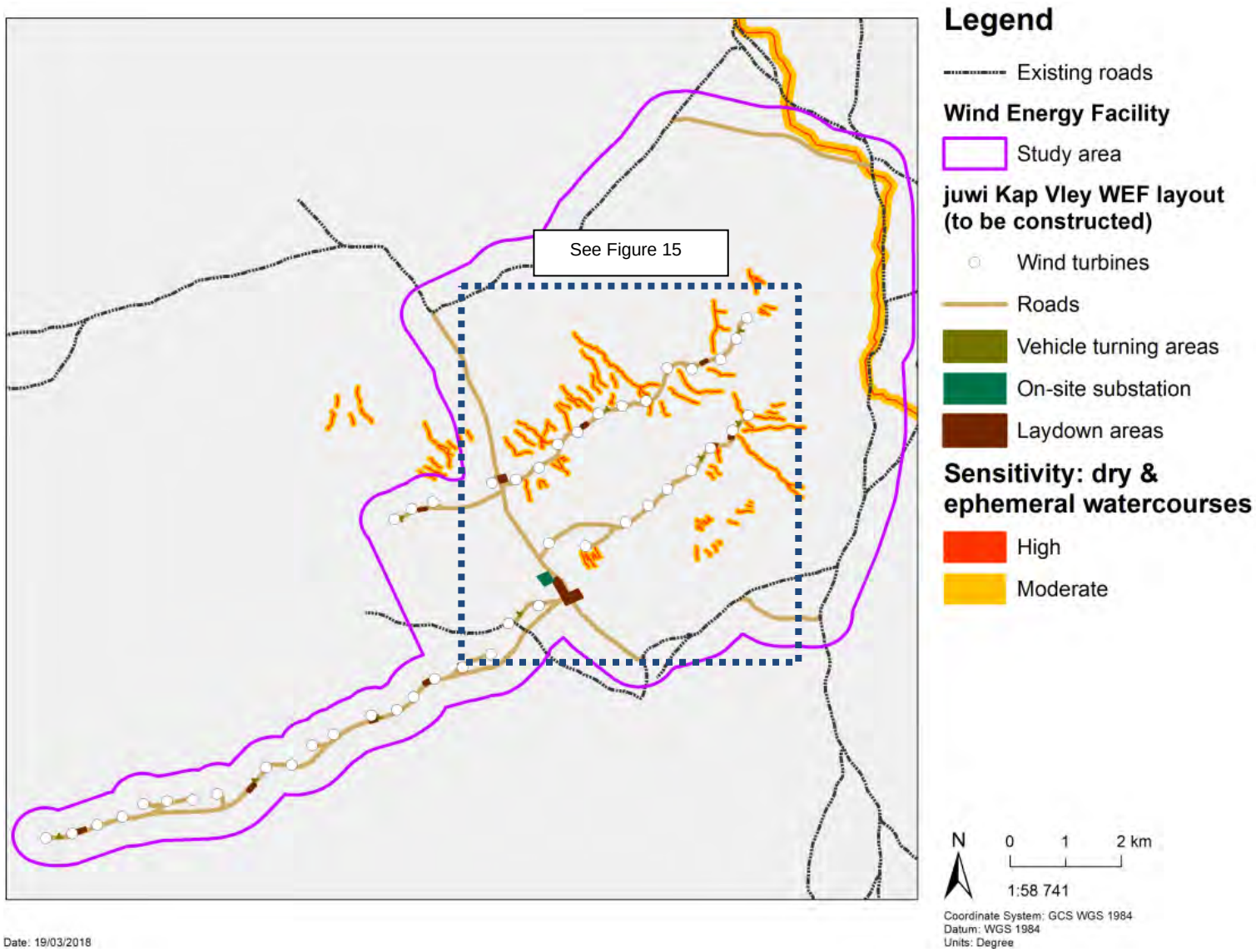


Figure 14: Dry and ephemeral watercourse (incl. drainage lines) sensitivity for the area proposed for the juwi Kap Vley WEF.

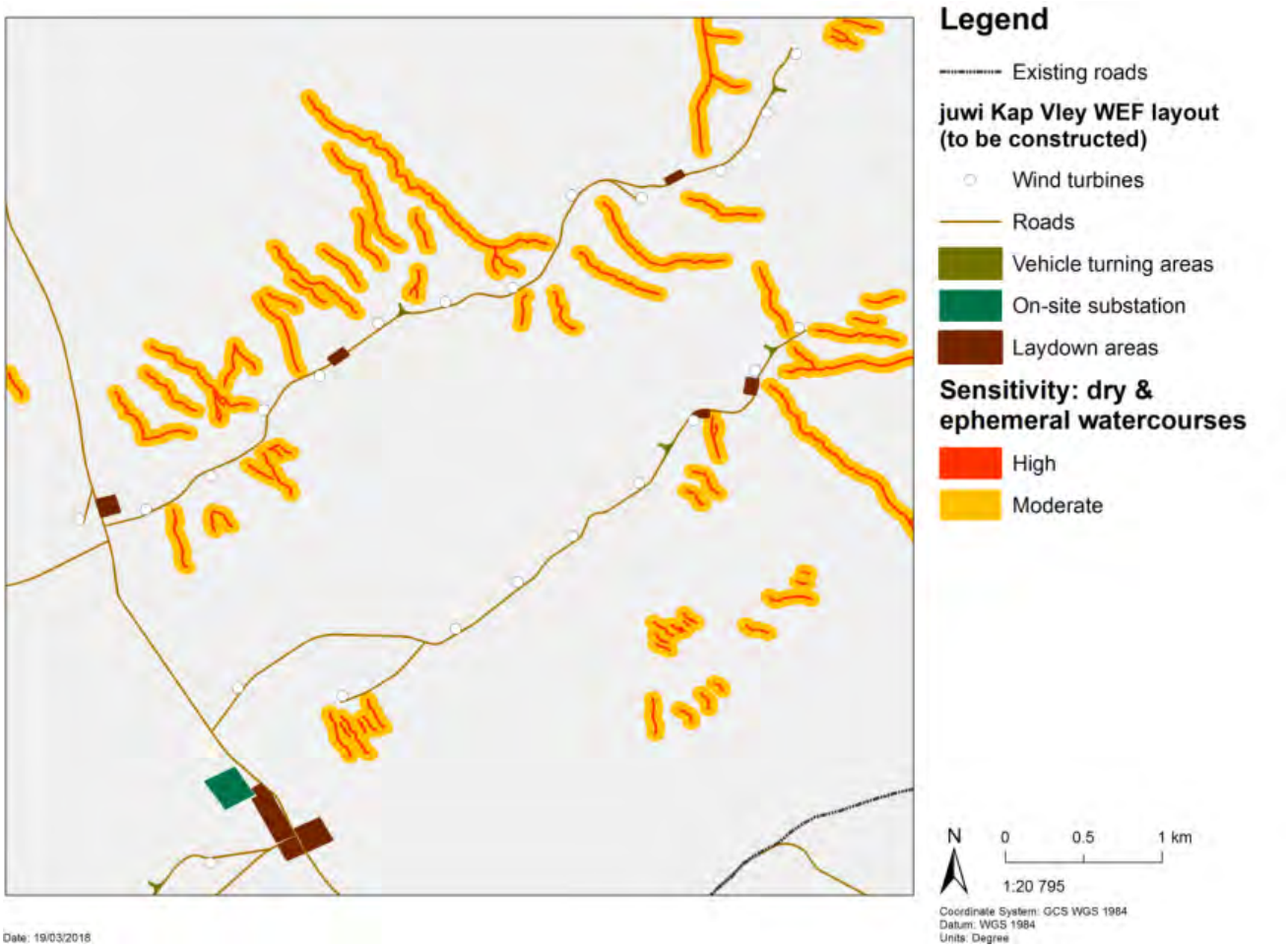


Figure 15: The infrastructure associated with the proposed WEF is mainly just adjacent to identified drainage lines, and may impinge on their proposed buffers.

In order to connect to the Eskom Gromis substation, the proposed 132 kV powerline will have to cross the Buffels River and NFEPA wetlands associated with the river (Figure 16). It is recommended that the powerline routing should cross the river in the least intrusive manner, avoiding the dry and ephemeral watercourses and buffer areas. Furthermore, the 132 kV powerline routing options may cross identified drainage lines. It is recommended that the powerline routings follow existing and proposed linear features (e.g. roads) as far as possible and that pylon foundations avoid identified drainage lines as far as possible. Proposed 132 kV powerline routing Alternative 1 follows the routing of the 400 kV Eskom Juno-Gromis transmission line (DEA ref: 12/12/20/720) (Nsovo Environmental Consulting, 2016b), as well as smaller dirt roads along a farm boundary. As Alternative 1 follows existing linear disturbance corridors, it is likely to have the least impact through land and vegetation clearance and is thus preferred (Table 7).

Table 7: Comparative summary of the three alternative 132 kV powerline routings.

	Alternative		
	1 (Preferred)	**2**	**3**
Buffels River crossing (at the connection with Eskom Gromis substation) *Powerline span 150 m, able to avoid Buffels River*	Yes	Yes	Yes
Namaqualand Salt Pan *Verified to not be a hydrological feature*	*Verified to not be a hydrological feature*		
Possibility for pylon placement in identified drainage lines (at connection with the WEF) *Powerline span 150 m, able to avoid placing pylons (< 1 m^2) in drainage lines.*	No	Yes	Yes
Comments	Follows existing linear disturbance corridors, it is likely to have the least impact through land and vegetation clearance	Most direct route, assume fewer pylons, however, does not follow existing linear infrastructure or disturbance corridors. As such, undisturbed land will be cleared.	Longer route than Alternative 1 and 2, follows farm boundaries.

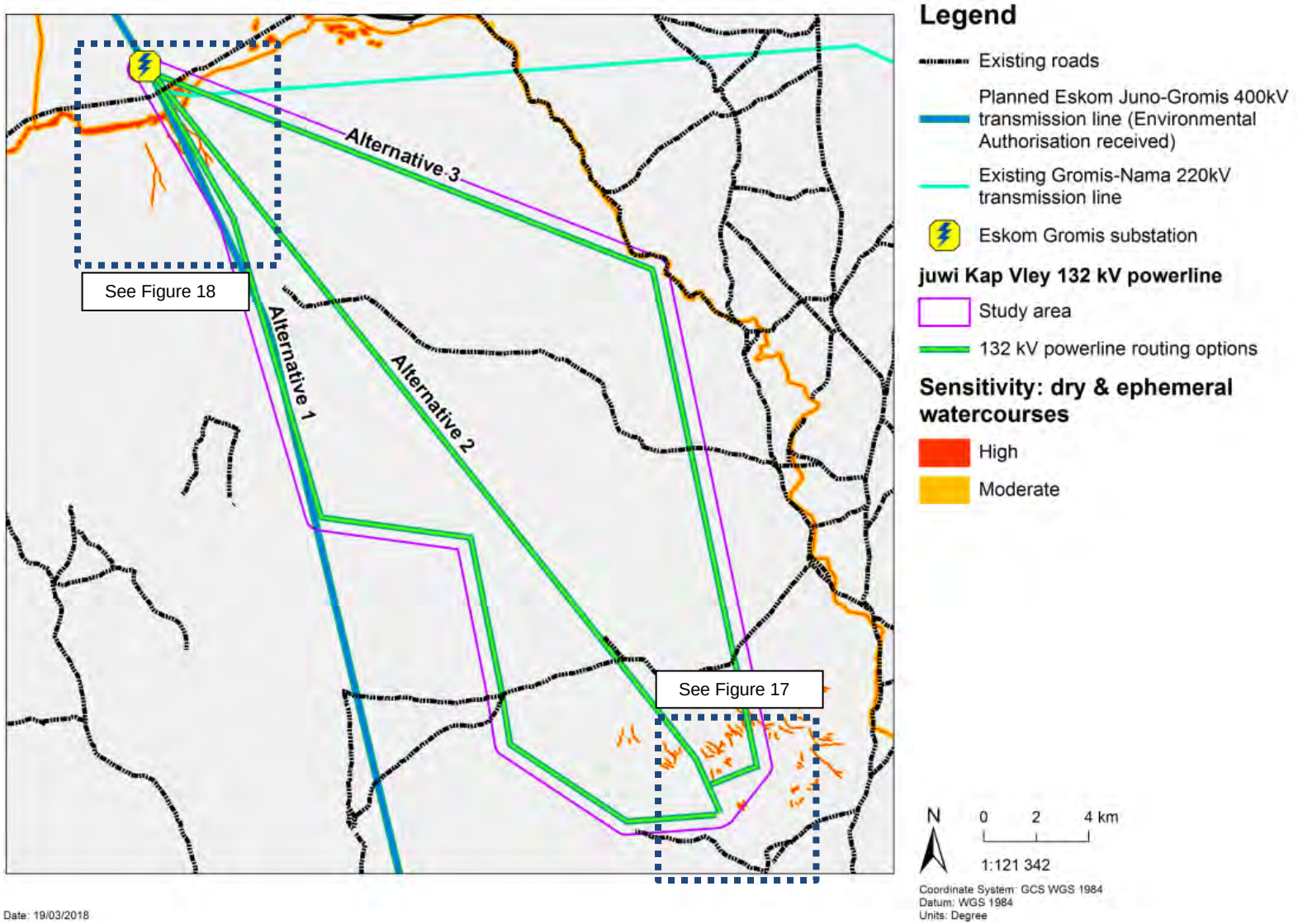


Figure 16: Dry and ephemeral watercourses (incl. drainage lines) sensitivity for the routings proposed for the 132 kV powerline connecting the juwi Kap Vley WEF to the Eskom Gromis substation.

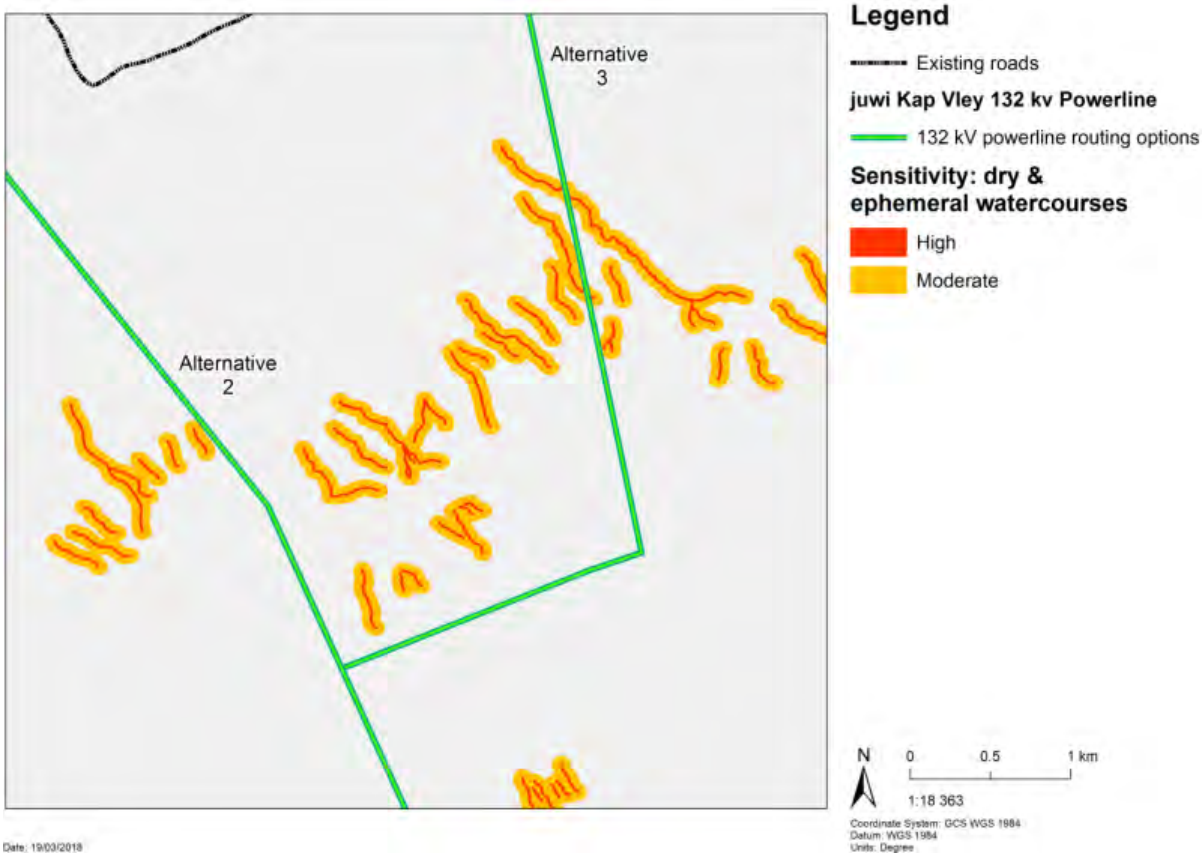


Figure 17: The 132 kV powerline routings (Alternatives 1) crosses identified drainage lines.

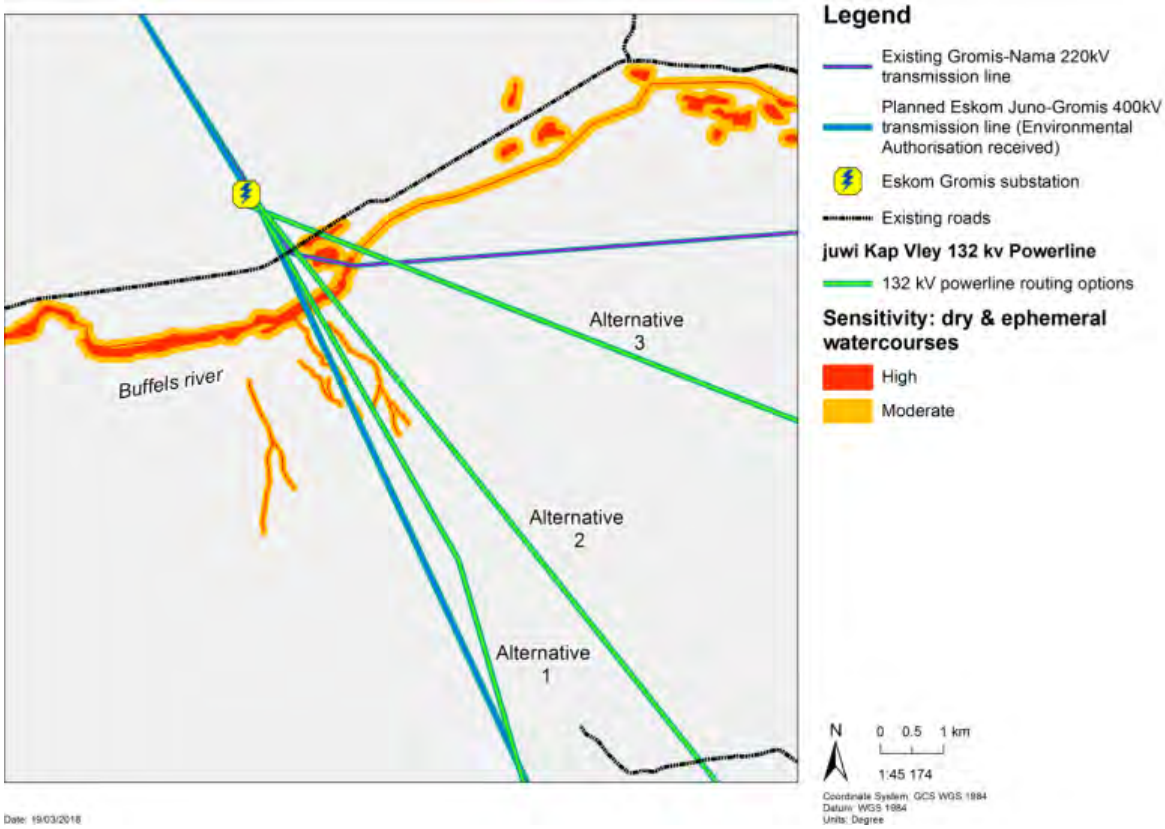


Figure 18: The 132 kV powerline routings will need to cross the Buffels River to connect to the Eskom Gromis Substation.

6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

6.1 Wind Energy Facility

6.1.1 Potential Impact: Physical disturbance and destruction of dry and ephemeral watercourses (incl. drainage lines)

PHYSICAL DISTURBANCE AND DESTRUCTION OF DRY AND EPHEMERAL WATERCOURSES (INCL. DRAINAGE LINES).

Project phases

- Construction.
- Decommissioning.

Nature of the impact

Physical disturbance and destruction of dry and ephemeral watercourses (incl. drainage lines) due to *land and vegetation clearance* may have a local negative impact. The consequence of such an impact would be substantial; however, the probability of vegetation clearance impacting dry and ephemeral watercourses is unlikely as the present development layout does not display any direct coincidence with dry and ephemeral watercourses. Any disturbance would be expected to be of long term duration, and is most pronounced during construction and decommissioning. The wind turbines and roads connecting them will be constructed on the top of a ridgeline to maximise wind exposure. The physical infrastructure placement as considered in this report may impact drainage line buffers (not a fatal flaw) and avoids identified drainage lines; as such the layout presented here does not need to be changed.

Proposed mitigation measures

Design

- As far as possible, avoid identified sensitive dry and ephemeral watercourses (incl drainage lines) and associated buffers. *(The current layout already avoids the identified drainage lines).*

Construction

- Ecology specialist/Environmental Control Officer (ECO) to confirm adequate avoidance of sensitive features.
- Minimise the footprint of cleared vegetation.
- Phased clearance of the area in order to reduce the amount and duration of bare soil exposure.
- Establish an effective record keeping system of all areas where soil is disturbed, to serve as basis for effective monitoring of rehabilitation process and success.
- Commence with restoration of disturbed, cleared land as soon as possible (e.g. non-permanent features such as the crane platforms and laydown and construction areas).

Decommissioning

- During decommissioning activities, avoid identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers as far as possible.
- Commence with restoration of disturbed, cleared land as soon as permanent structures have been removed.
- Ecology specialist/ECO to monitor progress and success of rehabilitation.

Significance of impact

Before mitigation	With mitigation
Low	Very low

6.1.2 Potential Impact: Altered drainage patterns, increased runoff, erosion and sedimentation.

ALTERED DRAINAGE PATTERNS, INCREASED RUNOFF, EROSION AND SEDIMENTATION OF SURROUNDING ECOSYSTEMS

Project phases

- Construction.
- Operation.
- Decommissioning.

Nature of the impact

Altered drainage patterns, increased runoff, erosion and sedimentation of surrounding ecosystems due to *land and vegetation clearance* may have a regional negative impact. The consequence of such an impact would be substantial and likely, especially during and following high rainfall events (albeit rare or infrequent for the area). Any disturbance that does occur however is expected to be of long term duration, and may persist during construction, operation and decommissioning. The wind turbines and roads connecting them will be constructed on the top of a ridgeline to maximise wind exposure. The physical infrastructure placement as considered in this report avoids identified drainage lines, but may be present adjacently in the proposed buffer. However, the present layout does not display any direct coincidence with dry and ephemeral watercourses; as such the layout presented here does not need to be changed.

Proposed mitigation measures

Design

- As far as possible, avoid identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers. *(The current layout already avoids the identified drainage lines).*

Construction

- Keep the footprint of the disturbed area to the minimum and designated areas only.
- Limit hard surfaces on site to reduce runoff.
- Clear site only before a section is due to be constructed.
- Phased clearance of the area in order to reduce the amount and duration of bare soil exposure.
- Commence with restoration of disturbed, cleared land as soon as possible (e.g. non-permanent features such as the crane platforms and laydown and construction areas).
- Implement net barriers, active rehabilitation and other erosion control measures.
- Implement an effective system of storm water runoff control using bunds and ditches, where it is required (at points where water accumulation might occur).

Operation

- The storm water runoff system must effectively collect and safely disseminate any runoff water from all hardened surfaces and it must prevent any potential down slope erosion.
- Undertake periodic site inspections, especially after rainfall events, to verify and inspect the effectiveness and integrity of the storm water runoff control system and to specifically record the occurrence of any erosion on site or downstream. Correct or improve the runoff control system in the event of any erosion occurring.

Decommissioning

- During decommissioning activities, avoid identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers as far as possible.
- Commence with restoration of disturbed, cleared land as soon as permanent structures have been removed - a rehabilitation plan to be drawn up with terrestrial ecology (fauna & flora) input
- Ecology specialist/ECO to monitor progress and success of rehabilitation.

Significance of impact

Before mitigation	With mitigation
Moderate	Low

6.1.3 Cumulative impacts

CUMULATIVE IMPACTS

Project phases

- Construction.
- Operation.
- Decommissioning.

Nature of the impact

Impacts of WEF projects in the area may cumulatively lead to the degradation and loss of dry and ephemeral watercourses (incl. drainage lines), although most impacts are expected to have local, or limited regional, consequences per facility. Due to climatic conditions, there are limited permanent watercourses or aquatic features present within the landscape.

Proposed mitigation measures

- Adequate implementation of proposed mitigation measures and best practice to reduce potential impacts to dry and ephemeral watercourses by all renewable energy projects in the area.

Significance of impact

Before mitigation	With mitigation
Moderate	Low

6.1.4 Impact Assessment Summary

The assessment of impacts and recommended mitigation measures, as discussed in Section 6.1, are collated in Table 8 - Table 11.

Table 8: Impact assessment summary table for the construction phase of the WEF.

DESIGN & CONSTRUCTION Nature of Potential Impact	Aspect/ Impact Pathway	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact		Ranking of Residual Impact	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact)		
Physical disturbance and destruction of dry and ephemeral watercourses (incl. drainage lines).	**Clearance of land and vegetation for the WEF**	Negative	Local	Short-term	Substantial	Unlikely	Low	Moderate	Design - As far as possible, avoid identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers. (The current design already avoids the identified drainage lines) Construction - Ecology specialist/Environmental Control Officer (ECO) to confirm adequate avoidance of sensitive features - Minimise the footprint of cleared vegetation. - Phased clearance of the area in order to reduce the amount and duration of bare soil exposure. - Establish an effective record keeping system of all areas where soil is disturbed, to serve as basis for effective monitoring of rehabilitation process and success. - Commence with restoration of disturbed, cleared land as soon as possible (e.g. non-permanent features such as the crane platforms and laydown and construction areas).	**Low**	**Very low**	5	High

DESIGN & CONSTRUCTION Nature of Potential Impact	Aspect/ Impact Pathway	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact		Ranking of Residual Impact	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact)		
Altered drainage patterns, increased runoff, erosion and sedimentation of surrounding ecosystems.		Negative	Regional	Long-term	Substantial	Likely	Low	Moderate	Design - As far as possible, avoid identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers. (The current layout already avoids the identified drainage lines). Construction - Keep the footprint of the disturbed area to the minimum and designated areas only. - Limit hard surfaces on site to reduce runoff. - Clear site only before a section is due to be constructed. - Phased clearance of the area in order to reduce the amount and duration of bare soil exposure. - Commence with restoration of disturbed, cleared land as soon as possible (e.g. non-permanent features such as the crane platforms and laydown and construction areas). - Implement net barriers, active rehabilitation and other erosion control measures. - Implement an effective system of storm water runoff control using bunds and ditches, where it is required (at points where water accumulation might occur).	**Moderate**	**Low**	4	High

Table 9: Impact assessment summary table for the operation phase of the WEF.

OPERATION Nature of Potential Impact	Aspect/ Impact Pathway	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact		Ranking of Residual Impact	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact)		
Altered drainage patterns, increased runoff, erosion and sedimentation of surrounding ecosystems.		Negative	Regional	Long-term	Substantial	Likely	Low	Moderate	- The storm water runoff system must effectively collect and safely disseminate any runoff water from all hardened surfaces and it must prevent any potential down slope erosion. - Undertake periodic site inspections, especially after rainfall events, to verify and inspect the effectiveness and integrity of the storm water runoff control system and to specifically record the occurrence of any erosion on site or downstream. Correct or improve the runoff control system in the event of any erosion occurring.	**Moderate**	**Low**	4	High

Table 10: Impact assessment summary table for the decommissioning phase of the WEF.

Nature of Potential Impact	Aspect/ Impact Pathway	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact		Ranking of Residual Impact	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact)		
Physical disturbance and destruction of dry and ephemeral watercourses (incl. drainage lines).	**Clearance of land and vegetation for the WEF**	Negative	Local	Short-term	Substantial	Unlikely	Low	Moderate	- During decommissioning activities, avoid identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers as far as possible. - Commence with restoration of disturbed, cleared land as soon as permanent structures have been removed. - Ecology specialist to monitor progress and success of rehabilitation.	**Low**	**Very low**	5	High
Altered drainage patterns, increased runoff, erosion and sedimentation of surrounding ecosystems.		Negative	Regional	Long-term	Substantial	Unlikely	Low	Moderate	- During decommissioning activities, avoid identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers as far as possible. - Commence with restoration of disturbed, cleared land as soon as permanent structures have been removed. - Ecology specialist to monitor progress and success of rehabilitation.	**Moderate**	**Low**	4	High

Table 11: Impact assessment summary table for cumulative impacts of renewable energy projects within 50 km.

Nature of Potential Impact	Aspect/ Impact Pathway	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact		Ranking of Residual Impact	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact)		
Cumulative Impacts of renewable energy projects	**Degradation of dry and ephemeral watercourses (incl. drainage lines).**	Negative	Regional	Long-term	Moderate	Unlikely	Low	Moderate	- Adequate implementation of proposed mitigation measures and best practice to impacts to dry and ephemeral watercourses (incl. drainage lines) by all renewable energy projects in the area.	**Moderate**	**Low**	4	High

6.2 132 kV POWELINE

6.2.1 Potential Impact: Physical disturbance and destruction of dry and ephemeral watercourses (incl. drainage lines)

PHYSICAL DISTURBANCE AND DESTRUCTION OF DRY AND EPHEMERAL WATERCOURSES (INCL. DRAINAGE LINES).

Project phases

- Construction.
- Operation.
- Decommissioning.

Nature of the impact

Physical disturbance and destruction of dry and ephemeral watercourses (incl. drainage lines) due to *land and vegetation clearance* may have a local negative impact. The consequence of such an impact would be moderate; the probability of vegetation clearance impacting dry and ephemeral watercourses is very likely since the powerline has to cross the Buffels River to connect to the Eskom Gromis substation. Any disturbance is expected to be of long term duration, and is most pronounced during construction and decommissioning, whilst vehicle access for maintenance may cause disturbance during the operation phase.As Alternative 1 follows existing linear disturbance corridors, it is likely to have the least impact though land and vegetation clearance and is thus preferred.

Proposed mitigation measures

Design

- Avoid placing pylons in identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers. *(The powerline pylons have a span distance of 150 m, and must be placed to avoid the non-perennial Buffels River and its associated ephemeral wetlands).*
- Routing should follow existing linear infrastructure and disturbance corridors (e.g. roads) where possible. *(Alternative 1 follows existing linear infrastructure and disturbance corridors, and is preferred from a dry and ephemeral watercourses perspective).*

Construction

- Use existing Buffels River crossing for all vehicles, including powerline stringing vehicles.
- Avoid clearance of vegetation for the powerline servitude, minimise clearance of vegetation to the pylon foundations.
- Phased clearance of the area in order to reduce the amount and duration of bare soil exposure.
- Commence with restoration of disturbed, cleared land as soon as possible (e.g. as soon as non-permanent construction gear and infrastructure are removed).

Operation

- Use existing Buffels River crossing for all vehicles
- Avoid clearance of vegetation for the powerline servitude for maintenance.
- Service vehicles should keep to the servitude and follow existing roads and tracks where possible.

Decommissioning

- Use existing Buffels River crossing for all vehicles
- During decommissioning activities, avoid identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers as far as possible.
- Commence with restoration of disturbed, cleared land as soon as permanent structures have been removed.
- Ecology specialist/ECO to monitor progress and success of rehabilitation.

Significance of impact

Before mitigation	With mitigation
Moderate	Low

6.2.2 Potential Impact: Altered drainage patterns, increased runoff, erosion and sedimentation.

ALTERED DRAINAGE PATTERNS, INCREASED RUNOFF, EROSION AND SEDIMENTATION OF SURROUNDING ECOSYSTEMS

Project phases

- Construction.
- Operation.
- Decommissioning.

Nature of the impact

Altered drainage patterns, increased runoff, erosion and sedimentation of surrounding ecosystems due to *land and vegetation clearance* may have a regional negative impact. The consequence of such an impact would be moderate and likely, especially during and following high rainfall events (albeit rare or infrequent for the area).. Any disturbance is expected to be of long term duration, and may persist during construction, operation and decommissioning. This impact is expected to be more pronounced at the connection to the WEF where the slopes are steeper. As Alternative 1 follows existing linear disturbance corridors, it is likely to have the least impact though land and vegetation clearance and is thus preferred.

Proposed mitigation measures

Design

- Avoid placing pylons in identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers. *(The powerline pylons have a span distance of 150 m, and must be placed to avoid the non-perennial Buffels River and its associated ephemeral wetlands).*
- Routing should follow existing linear infrastructure and disturbance corridors (e.g. roads) where possible. *(Alternative 1 follows existing linear infrastructure and disturbance corridors, and is preferred from a dry and ephemeral watercourses perspective).*

Construction

- Use existing Buffels River crossing for all vehicles, including powerline stringing vehicles.
- Keep the footprint of the disturbed area to the minimum and designated areas only.
- Limit hard surfaces to reduce runoff.
- Clear site only before a section is due to be constructed.
- Phased clearance of the area in order to reduce the amount and duration of bare soil exposure.
- Commence with restoration of disturbed, cleared land as soon as possible (e.g. as soon as non-permanent construction gear and infrastructure are removed).
- Implement net barriers, active rehabilitation and other erosion control measures as needed, especially for pylons placed on steeper slopes.

Operation

- Use existing Buffels River crossing for all vehicles.
- Avoid clearance of vegetation for the powerline servitude, minimise clearance of vegetation to the pylon foundations.
- Service vehicles should keep to the servitude and follow existing roads and tracks where possible.
- Undertake periodic site inspections, especially after rainfall events, to verify and inspect the effectiveness and integrity of the storm water runoff control system and to specifically record the occurrence of any erosion on site or downstream. Correct or improve the runoff control system in the event of any erosion occurring.

Decommissioning

- Use existing Buffels River crossing for all vehicles.
- During decommissioning activities, avoid identified sensitive dry and ephemeral watercourses drainage lines and associated buffers as far as possible.
- Commence with restoration of disturbed, cleared land as soon as permanent structures have been removed – a rehabilitation plan to be drawn up with terrestrial ecology (fauna & flora) input.
- Ecology specialist/ECO to monitor progress and success of rehabilitation.

Significance of impact

Before mitigation	With mitigation
Moderate	Low

6.2.3 Cumulative impacts

CUMULATIVE IMPACTS

Project phases

- Construction.
- Operation.
- Decommissioning.

Nature of the impact

Impacts of WEF projects in the area may cumulatively lead to the degradation and loss of dry and ephemeral watercourses (incl. drainage lines) – although most impacts are expected to have local, or limited regional, consequences per facility. Due to climatic conditions, there are limited watercourses/aquatic features present within the landscape.

Proposed mitigation measures

- Adequate implementation of proposed mitigation measures and best practice to reduce potential impacts to dry and ephemeral watercourses (incl. drainage lines) by all renewable energy projects in the area.

Significance of impact

Before mitigation	With mitigation
Moderate	Low

6.2.4 Impact Assessment Summary

The assessment of impacts and recommended mitigation measures, as discussed in Section 6.1 and 6.2, are collated in Table 12 - Table 15.

Table 12: Impact assessment summary table for the construction phase of the 132 kV powerline.

DESIGN & CONSTRUCTION Nature of Potential Impact	Aspect/ Impact Pathway	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact		Ranking of Residual Impact	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact)		
Physical disturbance and destruction of dry and ephemeral watercourses (incl. drainage lines).	**Clearance of land and vegetation for the 132 kV powerline**	Negative	Local	Short-term	Moderate	Likely	Low	Moderate	Design - Avoid placing pylons in identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers. (The powerline pylons have a span distance of 150 m, and must be placed to avoid the non-perennial Buffels River and its associated ephemeral wetlands). - Routing should follow existing linear infrastructure and disturbance corridors (e.g. roads) where possible. (Alternative 1 follows existing linear infrastructure and disturbance corridors, and is preferred). Construction - Use existing Buffels River crossing for vehicles, including stringing vehicles. - Avoid clearance of vegetation for the powerline servitude, minimise clearance of vegetation to the pylon foundations. - Phased clearance of the area in order to reduce the amount and duration of bare soil exposure. - Commence with restoration of disturbed, cleared land as soon as possible.	**Moderate**	**Low**	4	High

DESIGN & CONSTRUCTION Nature of Potential Impact	Aspect/ Impact Pathway	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact		Ranking of Residual Impact	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact)		
Altered drainage patterns, increased runoff, erosion and sedimentation of surrounding ecosystems.		Negative	Regional	Long-term	Moderate	Unlikely	Low	Moderate	<u>Design</u> - Avoid placing pylons in identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers. (The powerline pylons have a span distance of 150 m, and must be placed to avoid the non-perennial Buffels River and its associated ephemeral wetlands). - Routing should follow existing linear infrastructure and disturbance corridors (e.g. roads) where possible. (Alternative 1 follows existing linear infrastructure and disturbance corridors, and is preferred). <u>Construction</u> - Use existing Buffels River crossing for all vehicles, including stringing vehicles. - Keep the footprint of the disturbed area to the minimum and designated areas only. - Limit hard surfaces to reduce runoff. - Clear site only before a section is due to be constructed. - Phased clearance of the area in order to reduce the amount and duration of bare soil exposure. - Commence with restoration of disturbed, cleared land as soon as possible (e.g. as soon as non-permanent construction gear and infrastructure are removed). - Implement net barriers, active rehabilitation and other erosion control measures as needed, especially for pylons placed on steeper slopes.	**Moderate**	**Low**	5	High

Table 13: Impact assessment summary table for the operation phase of the 132 kV powerline.

OPERATION Nature of Potential Impact	Aspect/ Impact Pathway	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact		Ranking of Residual Impact	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact)		
Physical disturbance and destruction of dry and ephemeral watercourses (incl. drainage lines).	**Clearance of land and vegetation for the 132 kV powerline**	Negative	Local	Short-term	Moderate	Likely	Low	Moderate	- Use existing Buffels River crossing for all vehicles. - Avoid clearance of vegetation for the powerline servitude for maintenance. - Service vehicles should keep to the servitude and follow existing roads and tracks where possible.	**Moderate**	**Low**	4	High
Altered drainage patterns, increased runoff, erosion and sedimentation of surrounding ecosystems.		Negative	Regional	Long-term	Moderate	Unlikely	Low	Moderate	- Use existing Buffels River crossing for all vehicles. - Avoid clearance of vegetation for the powerline servitude for maintenance. - Service vehicles should keep to the servitude and follow existing roads and tracks where possible. - Undertake periodic site inspections, especially after rainfall events, to verify and inspect the effectiveness and integrity of the storm water runoff control system and to specifically record the occurrence of any erosion on site or downstream. Correct or improve the runoff control system in the event of any erosion occurring.	**Moderate**	**Low**	5	High

Table 14: Impact assessment summary table for the decommissioning phase of the 132 kV powerline.

DECOMMISSIONING Nature of Potential Impact	Aspect/ Impact Pathway	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact		Ranking of Residual Impact	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact)		
Physical disturbance and destruction of dry and ephemeral watercourses (incl. drainage lines).	**Clearance of land and vegetation for the 132 kV powerline**	Negative	Local	Short-term	Moderate	Likely	Low	Moderate	- Use existing Buffels River crossing for all vehicles. - During decommissioning activities, avoid identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers as far as possible. - Commence with restoration of disturbed, cleared land as soon as permanent structures have been removed. - Ecology specialist/ECO to monitor progress and success of rehabilitation.	**Moderate**	**Very low**	5	High
Altered drainage patterns, increased runoff, erosion and sedimentation of surrounding ecosystems.		Negative	Regional	Long-term	Moderate	Unlikely	Low	Moderate	- Use existing Buffels River crossing for all vehicles. - During decommissioning activities, avoid identified sensitive dry and ephemeral watercourses, drainage lines and associated buffers as far as possible. - Commence with restoration of disturbed, cleared land as soon as permanent structures have been removed. - Ecology specialist/ECO to monitor progress and success of rehabilitation.	**Moderate**	**Low**	4	High

Table 15: Impact assessment summary table for cumulative impacts of powerline projects within 50 km.

Nature of Potential Impact	Aspect/ Impact Pathway	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact		Ranking of Residual Impact	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact)		
Cumulative Impacts of powerline projects	**Degradation of dry and ephemeral watercourses (incl. drainage lines).**	Negative	Regional	Long-term	Moderate	Unlikely	Low	Moderate	- Adequate implementation of proposed mitigation measures and best practice to impacts to dry and ephemeral watercourses (incl. drainage lines) by all renewable energy projects in the area.	**Moderate**	**Low**	4	High

7 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

The mitigation and management recommendations outlined in Section 6 should be included in the EMPr. Implementation of the recommended mitigation and management actions, for all development phases, should be monitored and reported on by the ECO.

8 CONCLUSION AND RECOMMENDATIONS

This document constitutes the Dry and Ephemeral Watercourses Impact Assessment for the Kap Vley WEF and 132 kV overhead powerline.

The impacts of physical disturbance to sensitive dry and ephemeral watercourses, altered drainage patterns, increased runoff, erosion and sedimentation due to clearance of land and vegetation for the WEF and the 132 kV overhead powerline are expected to be 'Low' to 'Very Low' with the effective implementation of the mitigation and management actions outlined in this report.

The area has an arid climate and receives very limited rainfall. As such, not many watercourses or aquatic features exist within the landscape. Dry and ephemeral rivers, salt pans (depressions) and drainage lines were identified. The proposed WEF layout and 132 kV powerline avoids these as far as possible in its initial design, or follows existing linear and disturbance corridors. The Namaqualand Salt Pan was confirmed by the terrestrial ecology specialist (Todd, 2018a & b) through ground-truthing that the mapped pans (Mucina & Rutherford, 2006; SANBI, 2012) crossed by the powerlines did not exist as hydrological features (Table 16).

Table 16: Summary of sensitive dry and ephemeral watercourses in the study area that may be impacted, and recommended actions required.

Sensitive dry and ephemeral watercourses	WEF	132 kV overhead powerline
Drainage lines	**Avoided** ACTION: None required. Implement recommended mitigation measures	**Avoided** ACTION: None Required Implement recommended mitigation measures
Drainage lines proposed buffer	**Some roads coincide with the proposed drainage line buffers.** ACTION: None required. Implement recommended mitigation measures	**Avoided** ACTION: None required. Implement recommended mitigation measures
Potential Namaqualand Salt Pan	**Not impacted**	**Verified to not be a hydrological feature**
Buffels River, associates NFEPA wetland and proposed buffers	**Not impacted**	**Avoided** ACTION: None required. Implement recommended mitigation measures
Kommagas River	**Not impacted**	**Not impacted**

Based on the findings in this assessment it has been concluded that the juwi Kap Vley WEF and 132 kV overhead powerline, from a dry and ephemeral watercourses perspective, may receive EA with adherence to the mitigation and management measures set out in this report.

9 REFERENCES

Adams, S., Titus, R., and Xu, Y., 2004. Groundwater recharge assessment of the basement aquifers of central Namaqualand. WRC Report No. 1093/1/04.

Chief Directorate: National Geo-spatial Information (CD:NGI). 2012. South Africa 50 cm colour imagery. [Url] https://www.arcgis.com/home/item.html?id=9d01fa9041264cb283c35 3a5a613c81e. Date accessed: 12 August 2011.

Chief Directorate: Surveys and Mapping (CD:SM). 2006. South Africa 20 m contours.

ComputaMaps. 2002. 20m Digital Terrain Model of South Africa.

DEA (Department of Environmental Affairs). 2017. Renewable Energy EIA Application Database for SA. 2017 Thirs Quarter Data Release. https://egis.environment.gov.za/renewable_energy.

Department of Environmental Affairs (DEA). 2017. South African Renewable Energy EIA Application Data for SA, 2017, THIRD QUARTER data release. [Url] https://egis.environment.gov.za/renewable_energy.

Department of Rural Development and Land Reform (DRDLR). 2006. Roadlines.

Department of Water Affairs (DWA). 2015. The groundwater dictionary. 2nd ed. http://www.dwa.gov.za/Groundwater/Groundwater_Dictionary/.

DWS. 2014. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: [F3]. Compiled by RQIS-RDM: https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx accessed on 07 Mar. 2017.

Environmental Systems Research Institute (Esri) Inc. 2017. ArcGIS 10.5.1 for Desktop. [Url] http://www.esri.com/

Footprint Environmental Services. 2014. Draft Basic Assessment Report: proposed construction of a <20 MW Solar PV on Melkboskuil, Farm 132/26, Carolusberg. Prepared for NK Energie.

Footprint Environmental Services. 2014. Draft Scoping Report : Proposed 75 MW Photovoltaic (PV) Solar Energy Facilities on Klipdam, Farm 134/17, Springbok, Northern Cape. Prepared for NK Energie.

Google Inc. 2015. Google Earth Pro 7.1.4.1529. https://www.google.com/earth/download/ gep/agree.html.

Holland & Associates. 2015. Proposed Springbok Wind Energy Facility near Springbok, Northern Cape Province. Application for amendment of Environmental Authorisation: Environmental Assessment Report. Prepared for Longyuan Mulilo Springbok Wind Power.

Kleynhans, C.J., 2000. Desktop Estimates of the Ecological Importance and Sensitivity Categories (EISC), Default Ecological Management Classes (DEMC), Present Ecological Status Categories (PESC), Present Attainable Ecological Management Classes (Present AEMC), and Best Attainable Ecological Management Class (Best AEMC) for Quaternary Catchments in South Africa. DWAF report. Pretoria: Institute for Water Quality Studies, Department of Water Affairs and Forestry.

Meteoblue. 2018. Climate Kleinzee. [Url] https://www.meteoblue.com/en/weather/forecast/modelclimate/kleinzee_south-africa_3365707. Date accessed: 23 Jan 2018.

Mucina, L., Rutherford, M.C., Powrie, L.W., Gerber, J., Bezuidenhout, H., Sieben, E.J.J., Cilliers, S.S., Du Preez, P.J., Manning, J.C., Hoare, D.B. and Boucher, C., 2006. Inland azonal vegetation. In: Mucina, L. & Rutherford, M.C. (eds.). The vegetation of South Africa, Lesotho and Swaziland, 19, pp.630-631.

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R. and Smith-Adao, L.B., 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project (No. K5). WRC Report No. 1801/2/11. ISBN 978-1-4312-0149-5.

Nsovo Environmental Consulting. 2016b. Draft Construction and Operation Environmental Management Programme for the proposed Eskom Juno - Gromis 400 kV Transmission Line in The Northern and Western Cape Provinces, Ref: 12/12/20/720. [Url] http://www.nsovo.co.za/Juno-Gromis Operation & Construction.html.

Nsovo Environmental Consulting. 2016a. Draft Baisc Assessment Report for the Proposed deviation of the Eskom Juno-Gromis 400kv Transmission Line, In The Northern And Western Cape Provinces. Prepared for Eskom Holding SOC Limited.

SANBI (South African National Biodievsrity Institute). 2012. Update of vegm2009.shp based on decisions made by the National Vegetation map Committee and contributions by various partners.

Savannah Environmental. 2012. Environmental Impact Assessment Process. Draft Basic Assessmetn Report. Proposed O'Kiep 3 PV Solar Energy Facility on a site on O'Kiep copper mine in O'Kiep near Springbok, Norhtern Cape. Prepared for Ilio Energy.

Savannah Environmental. 2015. Environmental Impact Assessment Process. Final Environmental Impact Assessment Report. Proposed Kleinzee 300 MW Wind Energy Farm , South of Kleinsee. Prepared for Eskom Holding SOC Limited.

Savannah Environmental. 2011. Basic Assessment Report: The proposed Koningaas Wind Energy Facility, Northern Cape Province. Prepared for Just Palm Tree Power.

Savannah Environmental. 2012. Draft EIA Report: Proposed Project Blue Wind Energy Facility (Phases 1 – 3) North of Kleinsee in the Northern Cape Province. Prepared for WWK Development.

South Africa, 1998. National Water Act No 36 of 1998. Pretoria.

Todd, S. 2018a. Terrestrial Ecological (Fauna and Flora) Specialist Study: Scoping and Environmental Impact Assessment for the Proposed Development of the 300 MW Kap Vley Wind Energy Facility and associated powerline near Kleinzee, Northern Cape Province. Impact Assessment Report.

Todd, S. 2018b. Ecological (Fauna and Flora) Specialist Study: Basic Assessment for the Proposed Development of the 132 kV Kap Vley powerline near Kleinzee, Northern Cape Province. Basic Assessment Report.

Tooth, S., 2000. Process, form and change in dryland rivers: a review of recent research. *Earth-Science Reviews*, 51(1-4), pp.67-107.

APPENDIX A: EXTERNAL REVIEW LETTER

(EXTERNAL REVIEWER: DR LIZ DAY)

FreshwaterCONSULTING$_{CC}$

Unit F6, Prime Park
Mocke Road,
Diep River
7800
Cell: 083 454 2309
E-mail: Liz@freshwaterconsulting.co.za

19 March 2018
VAT registration No: 444 024 7122

Ms Minnelise Levendal
CSIR
Stellenbosch

Dear Ms Levendal

External specialist review of the Dry and Ephemeral Watercourses Impact Assessment: Environmental Impact Assessment for the proposed development of the 300 MW Kap Vley Wind Energy Facility and Basic Assessment for the proposed development of the 132 kV Kap Vley overhead powerline near Kleinzee in the Northern Cape Province

This document comprises specialist review of the above report, compiled by Ms Luanita Snyman-van der Walt and dated 19 March 2018. It is my understanding that external review of this report is required by the National Department of Environmental Affairs (DEA), based on input provided at project Scoping Phase, where "specialist studies are conducted in-house or by a specialist other than a suitably qualified specialist in the relevant field, such specialist reports must be peer reviewed by a suitably qualified external specialist in the relevant field".

This review has been structured to meet the terms of reference for peer review as outlined by the DEA. My Curriculum Vitae are appended to this document, as required. The review follows initial engagement with the specialist regarding the approach to the study, following which the original report underwent some revision to address the issues raised during preliminary inputs. This review provides a formal consideration of the specialist report.

Background

The specialist Aquatic Ecology Impact Assessment ("the report") focuses on the proposed development of a 300 megawatt Wind Energy Facility and associated electrical infrastructure (i.e. the installation of a 132 kV overhead power line) near Kleinzee in the Northern Cape Province (on the farms Remainder (RE) Kammagas Farm 200 Portion 5, RE Kap Vley Farm 315, Portion 1 of Kap Vley Farm 315, Portion 2 of Kap Vley Farm 315, Portion 3 of Kap Vley Farm 315, Portion 3 of Platvley Farm 314, RE Kourootjie Farm 316 and RE Gra'water Farm 331 – referred to hereafter as "the site").

Freshwater Consulting cc trading as "**The Freshwater Consulting Group**" **(FCG)**
Members: E Day, JL Ewart-Smith, CD Snaddon, DJ Ollis
Reg. No. 2007/064216/23

Review Limitations and assumptions

This review is based only on the above report, which was read and interpreted by this reviewer with reference to GOOGLE Map imagery, overlays of the National Freshwater Ecosystems Priority Area (NFEPA) project outputs and some knowledge of the broader study area, but no past access to the actual project area or to the Buffels and /or Kommagas Rivers that pass through and in close proximity to the site.

No site visit informed this review.

Review findings

- **Overview**

The report is neatly and well presented, and there are no issues of clarity as a result of poor grammar or spelling. It is well illustrated with clear and detailed maps of the study area and close-ups of points of interest to the report. The specialist appears to have accessed all available spatial data, as well as reports pertaining to wind and solar energy development in the broader area (a 50km radius from the site), for consideration in cumulative impact assessments. The specialist has also engaged with the findings of the terrestrial biodiversity specialist included on the overall project team, and used this in consideration of overall biodiversity linkages and importance of aquatic ecosystems in the study area.

- **Terms of reference**

The specialist's Terms of Reference allowed for specialist input on the basis of a desktop study only. Such an approach in the arid areas of the Northern Cape would potentially be flawed, in that existing spatial data (e.g. National Freshwater Ecosystem Priority Area (NFEPA) wetland and drainage line data) are relatively inaccurate in these areas and ground-truthing ought to have been part of the terms of reference. That said, however, the specialist did in fact visit the sites for the proposed wind turbines and their access roads, and liaised with the biodiversity specialist who visited other areas on the broader site, where the powerlines would potentially cross. This approach thus addressed the concern over the actual terms of reference, and allowed the specialist to identify inaccuracies in the available spatial data.

- **Methodology**

The methodology and approach as described in Sections 1.1.3 (Approach and Methodology) and 1.1.4 (Site Visit) are sound.

Delineation of watercourses was based on spatial data at a desktop level with limited ground-truthing and was not carried out on site, using the DWAF (2005) delineation method. The latter method would not however have been useful or appropriate for the highly ephemeral watercourses / wetlands identified in the study area.

Specialist assumptions and limitations include the assumption that fauna and flora associated with the affected watercourses on the site would be assessed by the Ecological Study: Fauna and Flora. This is important as ephemeral pans in particular can support populations of invertebrates that may have high conservation importance.

- **Watercourse and pan identification**

The aquatic specialist recognised that the aquatic ecosystems in and associated with the study area comprise ephemeral watercourses and pans, which have particular sensitivities to physical disturbance, but are not major drivers of biodiversity, flowing rarely and for periods of time that are in many cases too short-lived to result in the establishment of specific riverine or wetland plant communities. While ephemeral pans can be associated with important invertebrate fauna, the large salt pans shown in

2

NFEPA datasets were found by the biodiversity specialist not to exist as such, and were merely blown-out terrestrial areas with exposed calcrete. While such impermeable surfaces can result in pan formation, both the wetland specialist and the Fauna and Flora specialist considered that those mapped on the site were not in fact hydrological features.

- **Specialist's Evaluation of findings**
    - **Identification of impacts and proposed mitigation measures**

The identification of impacts seem reasonable, given my knowledge of the study area, and the differentiation of impacts and impact pathways / drivers in Table 5 is a clear way of presenting such impacts. Only two impacts were identified, namely – (1) physical disturbance of watercourses and (2) degradation and altered drainage patterns, increased runoff, erosion and sedimentation of surrounding ecosystems.

Recommended mitigation measures revolve around avoidance of sensitive features where possible and rehabilitation of disturbed areas, noting that disturbance impacts are difficult to address in these arid areas.

Where some level of impact is considered inevitable (e.g. crossing the Buffels River), crossing of vehicles via existing crossings is recommended. Avoidance mitigation is recommended to protect all pans and watercourses from the footprints of all powerline support structures, roads and wind turbine structures.

The powerline alternatives are adequately compared and assessed.

- **Assessment ratings**

The rating method used by the specialist is a robust one and in line with legal requirements for EIAs.

The ratings for different impacts in different development phases appear reasonable, and reflect activities that lie largely outside of any watercourses and on the top of ridges of high ground. They are thus largely mitigable by avoidance.

- **Recommendations for the project to proceed**

The specialist recommends the project should receive authorization subject to mitigation and management measures being implemented. This appears to be a reasonable recommendation, on the basis of the relatively few impacts identified and the high level to which they can be mitigated by avoidance, despite the high sensitivity of much of the environment.

Appropriateness of references

The report includes appropriate references.

Conclusion

Based on the above comments I am happy that the specialist aquatic ecosystem report considers ephemeral aquatic ecosystems in adequate detail to make informed and reasonable recommendations about the kind of mitigation measures required in development planning, construction, operation and decommissioning phases, and to draw reasonable conclusions as to the acceptability of development authorisation.

3

Thank you for approaching me to undertake this review.

Yours sincerely

Liz Day
PhD; Pr Nat Sci

4

REVIEWER CURRICULUM VITAE

5

Liz Day

CURRICULUM VITAE
SUMMARY DOCUMENT (2017)

Name	Elizabeth Day (née Reynolds)
Address	6 Flamingo Crescent, Zeekoevlei 7941, Cape Town
Telephone/Fax number	021-705 8672
Cell number	083 4542309
Email	liz@freshwaterconsulting.co.za
Date of birth	3 May 1968
Place of birth	Zimbabwe
Nationality	South African
Position in company	Partner

KEY QUALIFICATIONS

- Bachelor of Arts (English), University of Cape Town, 1989
- Bachelor of Science (Zoology (with distinction) and Environmental and Geographical Science); University of Cape Town; 1992
- Bachelor of Science (honours- Zoology, first class); University of Cape Town, 1993
- PhD (Zoology / Marine Biology); University of Cape Town, 1998

KEY WORK EXPERIENCE

1999- present	Specialist consultant on freshwater ecosystems; co-founder of the Freshwater Consulting Group
1997 - 1999	Senior Consultant for Southern Waters Ecological Research and Consulting cc
1994 - 1996	Scientific Officer on Water Research Commission Project, Freshwater Research Unit, UCT.

SUMMARY OF RELEVANT EXPERIENCE

More than 22 years' experience in aspects of aquatic ecology, specialising in:

- urban river and wetland management and rehabilitation
- urban stormwater design with respect to freshwater ecosystems
- water quality, specialising in urban stormwater quality assessments, wetland, river, wetland and vlei water quality monitoring, analysis and assessment;
- specialist input into environmental impact assessments; baseline and situation assessments
- DWS Risk Assessments and Wetland Offset plans;
- catchment and River Management Plans;
- river and wetland Maintenance and Management Plans;
- river and wetland mapping and biodiversity planning;
- wetland delineation.

Compiled over 600 specialist riverine ecology technical reports, 8 scientific papers (6 in international literature), 20 popular biological articles published in local environmental magazines, scripts for eight environmental documentaries. *Ad hoc* lecturer in freshwater ecology at UCT and University of Stellenbosch; co-author on 4 Water Research Commission reports; lead author on chapter in UNESCO Sustainable Management of Urban Aquatic Ecosystems handbook; lead author on chapter in Fynbos Ecosystem Management book; project leader and author of WRC Technical Manual for River Rehabilitation in South Africa.

PROFESSIONAL AFFILIATIONS

- Member of IAIASA
- Member of SAIEES
- Registered Professional Natural Scientist by SACNASP (Reg No 400270/08) for fields of Biological Science, Ecological Science and Zoological Science
- Member of Western Cape Wetlands Forum

6

Scoping and Environmental Impact Assessment for the proposed Kap Vley Wind Energy Facility near Kleinzee in the Northern Cape

UPDATED DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

APPENDIX K:

Visual Impact Assessment Report

VISUAL IMPACT ASSESSMENT

Scoping and Environmental Impact Assessment for the Proposed Kap Vley Wind Energy Facility near Kleinzee, in the Northern Cape

and

Basic Assessment for the Transmission Line

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services P O Box 320 Stellenbosch 7600	Bernard Oberholzer Landscape Architect / Environmental Planner *in association with* Quinton Lawson MLB Architects / Urban designers PO Box 471 Stanford 7210

March 2018

SPECIALIST EXPERTISE

The visual impact assessment and basic assessment were prepared by the following:

- Bernard Oberholzer, Landscape Architect, and Principal at BOLA
- Quinton Lawson, Architect, and Partner at MLB Architects.

Expertise

Bernard Oberholzer has a Bachelor of Architecture (UCT) and Master of Landscape Architecture (University of Pennsylvania), and has more than 20 years experience in undertaking visual impact assessments. He has presented papers on *Visual and Aesthetic Assessment Techniques*, and is the author of *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes,* prepared for the Dept. of Environmental Affairs and Development Planning, Provincial Government of the Western Cape, 2005.

Quinton Lawson has a Bachelor of Architecture Degree (Natal) and has more than 10 years experience in visual assessments, specializing in visual mapping, 3D modeling and photomontage visual simulations. He has previously lectured on visual simulation techniques in the Master of Landscape Architecture Programme at UCT.

The authors have been involved in visual assessments for a wide range of residential, industrial and renewable energy projects, including a number in the Namaqualand area. They prepared the 'Landscape Assessment' report for the *National Wind and Solar PV Strategic Environmental Assessment (SEA)*, in association with the CSIR, for the Department of Environmental Affairs (DEA) in 2014, as well as the 'Visual Specialist Report' for the *National Electricity Grid Infrastructure SEA* in 2015.

SPECIALIST DECLARATION

We, Bernard Oberholzer and Quinton Lawson, as the appointed independent specialists, in terms of the 2014 EIA Regulations, hereby declare that we:

- We act as the independent specialist in this application;
- we perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- we declare that there are no circumstances that may compromise my objectivity in performing such work;
- we have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- we will comply with the Act, Regulations and all other applicable legislation;
- we have no, and will not engage in, conflicting interests in the undertaking of the activity;
- we have no vested interest in the proposed activity proceeding;
- we undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- we have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- we have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- we realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist

Name of Specialists: Bernard Oberholzer, Quinton Lawson
Date: 07 March 2018

EXECUTIVE SUMMARY

This report includes a Visual Impact Assessment (VIA) of the proposed Kap Vley wind energy facility (WEF), and a basic visual assessment of the connecting transmission line between the WEF and the Gromis Substation. The VIA Report provides a visual assessment for the project, including the preferred layout of all the facilities, including the wind turbines, substation, operation / maintenance building, and powerlines, finalised through the earlier scoping process.

A maximum of 45 wind turbines would be located on the ridgeline of a low mountain range to the west of Komaggas. The range, which has an altitude of about 500m can be seen as a local feature within the larger landscape context. Although the visually exposed coastal peneplain is well-suited to wind farm development, due to the laminar flow inherent with flat coastal areas, the turbines would be visible for some distance.

The site is a low-lying ridge extension of the much higher mountains 6km further inland. The general area has been previously disturbed in places by diamond-mining, and is currently used for grazing. Potential sensitive receptors in the area are the Komaggas settlement 7 km to the north-east, the Namaqualand National Park 14 km to the south, and the Houthoop guest farm 21 km to the north-west. Distance is, however, a mitigating factor. There are also a number of farmsteads in the sparsely populated surrounding area.

The potential visual impact of the proposed wind energy facility (WEF) during the operational phase ranges from **moderate to high** before mitigation for the wind turbines, because of their scale and the exposed nature of the surrounding landscape. The related building infrastructure and transmission line are expected to be of **moderate** visual significance before mitigation.

It is difficult and considered unfeasibile to reduce the visual effect of the large wind turbines, but a number of visual mitigation measures have been recommended for related infrastructure. The visual risk significance after mitigation is expected to be **unchanged** for the turbines and **moderate to low** for the building infrastructure, taking into account that the potential visual impacts would be local in scale, and largely reversible after decommissioning.

The visual impact significance during the construction phase of the above facilities is expected to be slightly lower because it is of short-term duration, i.e. **moderate** for the wind turbines. At the decommissioning phase, most of the infrastructure could be removed, except possibly for some of the access roads, platforms and concrete slabs, and the expected residual impact significance is therefore expected to be **low**.

The potential visual impact of the transmission line would be similar for the three alternatives proposed. The visual impact significance would be **moderate** before mitigation, and **moderate-low** after mitigation, including avoidance of the Toringkop peak.

The potential cumulative visual impacts are difficult to determine without information on the actual number and layout of wind turbines for the other proposed wind energy facilities in the area. The proposed solar energy facilities, mainly located near Springbok, are not expected to have any cumulative visual significance. Given that Kleinsee could be seen as a renewable energy node in the future, the cumulative visual impacts would be **moderate**.

LIST OF ABBREVIATIONS

DEA	Department of Environmental Affairs
DEM	Digital elevation model
ECO	Environmental control officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
O&M	Operations and Maintenance
REDZ	Renewable Energy Development Zone
SEA	Strategic Environmental Assessment
SRTM	Shuttle Radar Topography Mission
VIA	Visual Impact Assessment
WEF	Wind energy facility

GLOSSARY

Definitions	
Cultural landscapes	Human-modified landscapes, particularly those of aesthetic, historical or archaeological significance.
Cumulative impacts	The combined or incremental effects resulting from changes caused by a proposed development in conjunction with other existing or proposed activities.
Receptors	Viewers who would be affected by a proposed development, the viewers usually being residents, commuters, visitors or tourists.
Sense of place	The unique or special qualities found in a particular location, including the combined natural, cultural, aesthetic, symbolic and spiritual qualities.
View corridor	A linear geographic zone, usually along movement routes such as trails, roads and railways, visible to users of the routes.
View shadow	A zone within the view catchment area that is visually obscured from the proposed development by the topography, trees or structures.
Viewshed	A geographic zone encompassing a view catchment area, usually defined by ridgelines, similar to a watershed.
Visual buffer	A geographic zone of varying distance, indicating visual sensitivity or visual constraints for proposed development or activities.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 (7 April 2017)	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- 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;	Page 1 Page 42
a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 2
an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1; Page 8
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.5 Page 10
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 2, 5, 6 and 7
the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.3, Page 9
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, Page 9
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 alternatives;	Section 3, Page 13-14 Section 6, 7
an identification of any areas to be avoided, including buffers;	Section 6.5 Table 4-Page 18
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;	Figure 6 & 7
a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.4, Page 10
a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6.1, Page 15
any mitigation measures for inclusion in the EMPr;	Section 6, 7 & 8
any conditions for inclusion in the environmental authorisation;	Section 6.2-6.5 Pages 18 & 19
any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8, Page 24
a reasoned opinion- whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity and activities; and 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 9, Page 23-24
a description of any consultation process that was undertaken during the course of preparing the specialist report;	n/a
a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	n/a
any other information requested by the competent authority.	n/a
2. Where a government notice gazetted by the Minister provides for any protocol of minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply	n/a

TABLE OF CONTENTS

TABLES

FIGURES and PLATES

1. INTRODUCTION AND METHODOLOGY

1.1 Scope and Objectives

The current VIA takes into account the Visual Baseline Study, carried out during the Environmental Scoping Phase, resulting in adjustments to the layout of the proposed Kap Vley Wind Energy Facility (WEF).

The VIA includes an updated assessment of potential visual impacts and risks associated with the project and provides recommended mitigations to minimise potential visual impacts.

1.2 Terms of Reference

The following form part of the Terms of Reference for the visual specialist study:

- A description of the regional and local landscape features;
- A field survey to identify landscape features and visually sensitive receptors;
- Mapping of the sensitive landscape features / sensitive receptors;
- Assessing (identifying and rating) potential visual impacts on the environment / receptors;
- Identification of relevant legislation and legal requirements; and
- Recommendations on possible mitigation measures and rehabilitation procedures /management guidelines.

In addition to the above, the following ToR has been provided by the CSIR:

- Adhere to the requirements of specialist studies as outlined in Appendix 6 of the 2014 NEMA EIA Regulations, as amended;
- Assess the no-go alternative very explicitly in the impact assessment section. Please note that the DEA considers a ‘no-go’ area, as an area where no development of any infrastructure is allowed; therefore, no development of associated infrastructure including access roads and internal cables is allowed in the ‘no-go' areas. Should your definition of the ‘no-go’ area differ from the DEA definition; this must be clearly indicated in your assessment. You are also requested to indicate the ‘no-go’ area’s buffer.
- Assess cumulative impacts by identifying other wind and solar energy project proposals and other applicable projects, such as construction and upgrade of electricity generation, transmission or distribution facilities in the local area (i.e. within 50 km of the proposed Kap Vley WEF project) that have been approved (i.e. positive EA has been issued) or the EIA is currently underway. In addition, the cumulative impact assessment for all identified and assessed impacts must be refined to indicate the following:
  - Identified cumulative impacts must be clearly defined, and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land.
  - The cumulative impacts significance rating must also inform the need and desirability of the proposed development.
  - A cumulative impact environmental statement on whether the proposed development must proceed.
- Provide a detailed description of your methodology, as well as indicate the locations and descriptions of turbine positions, and all other associated infrastructures that you have assessed and are recommending for authorisations.

- Provide a detailed description of all limitations to your studies. Your specialist studies must be conducted in the appropriate season and providing that as a limitation, will not be accepted by DEA.
- Describe, in sufficient detail, the existing landscape and visual conditions of the surrounding region to form a baseline against which impacts can be measured and compared;
- Describe the regional and local landscape features;
- Identify visually sensitive receptors;
- Identify and assess potential visual impacts (direct and indirect) that may occur during construction, operational and decommissioning phases of the development. Use the CSIR methodology to determine the significance of potential impacts;
- Assess a max tip height of 230 m to ensure that the worst-case scenario is assessed;
- Assess all alternatives, including the no-go alternative;
- Assessment cumulative visual impacts by identifying other REFs such as wind and solar and other applicable projects, such as construction and upgrade of electricity generation, and transmission or distribution facilities in the local area (i.e. within 50 km of the proposed WEF). These include projects that have been approved (i.e. positive EA has been issued), have been constructed or projects for which an Application for Environmental Authorisation has been lodged with the Competent Authority (see Table 6.1 in Chapter 6 of this report for a list of projects);
- Determine mitigation and/or management measures to be included in the EMPr which could be implemented to reduce the effect of negative impacts, or enhance the effect of positive impacts, as far as possible;
- Provide a description of any assumptions, uncertainties, limitations and gaps in knowledge;
- Provide a description of the relevant legal context and requirements; and
- Incorporate and address issues and concerns raised during the Scoping and EIA Phases of the project where they are relevant to the specialist's area of expertise.

1.3 Approach and Methodology

The VIA builds on the visual baseline study and includes the following:

- Mapping of the study area in its landscape context, including surrounding land uses;
- Mapping of the projected viewsheds and distance radii of the proposed WEF to determine the possible zone of visual influence;
- Identification of important viewpoints and view corridors, together with a photographic survey from selected viewpoints, taking into account possible sensitive receptors;
- Identification of landscape characteristics, including topographical and geological features, vegetation cover, land use, cultural landscapes, protected areas and farmsteads;
- Identification and mapping of visual / landscape constraints, including no-go areas and visual buffers for the proposed project based on a range of criteria.
- Use of the above mapping and photographic survey to assess the visual effect of the proposed project.

A visit to the proposed Kap Vley project site and surroundings was carried out on 14 and 15 August 2017. The route taken on the field trip is indicated on Figure 2. The season was not a major consideration for carrying out a visual assessment.

1.4 Assumptions and Limitations

Some assumptions had to be made regarding the nature of the proposed substation and O&M buildings, as well as lighting and fencing relating to the proposed WEF.

1.5 Sources of Information

The main sources of information for the visual assessment included the following:

- Project description of the proposed Kap Vley WEF provided by Juwi (January 2018).
- 1:1 000 000 Geological map of South Africa, Council for Geoscience, 2011.
- 1:500 000 and 1:250 000 topographical maps of South Africa, Surveys and Mapping.
- Google Earth satellite imagery, 2017.
- SRTM DEM data.

2. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO VISUAL IMPACTS

The proposed WEF site is located on a number of land portions about 30 km south-east of Kleinzee and about 7 km south-west of Komaggas within Namaqualand, in the Northern Cape.

The WEF project is planned to consist of up to 45 wind turbines with a maximum hub height of 150 m and maximum rotor diameter of 160 m. It is envisaged that the WEF will connect to the Gromis Substation via a 132 kV powerline over a distance of approximately 40 km. A list of components for the proposed WEF, that have a potential visual impact, is given in Table 1 below. A preferred layout of the turbine positions, provided by the Developer, is indicated on the attached maps.

Table 1: Description of Proposed Wind Energy Facilities at the Kap Vley Site

Facility	Extent/Footprint	Height	Comments
Kap Vley WEF area	±128 hectares	n/a	50-300 MW
No. of wind turbines:	20 to 45 turbines. Turbine capacity to be confirmed.	Hub ht. 80-150m Rotor diam. 100-160m	Colour: off-white / grey - TBC
Turbine pads	1.0 ha crane platform per turbine	n/a	Foundation 25 x 25m.
Internal access roads	37 km of internal road linking a maximum of 45 turbine locations.	n/a	8m width, and 15m in parts to accommodate crawler crane.
Electrical substation on-site	2.3 ha, 132kV	Single storey building	33 kV /132 kV capacity. Location to be determined.
Transmission line 132 kV	40 km from on-site substation to Gromis substation.	Height to be determined	3 alternative routes. Pylon type to be determined.
Operations and maintenance structures	1 ha Workshop/office buildings, maintenance, storage, visitor facilities.	max. 32m incl. comm. tower	Location to be determined. Includes parking, water tanks, storage yard, waste collection.
Security fencing	Around substation and O&M building.	Max. 5m	Around substation and O&M buildings.
Security Lighting **Navigation lights**	To be confirmed. To be confirmed.	To be confirmed. At hub height.	At substation and O&M building. Flashing red light on selected turbines (to CAA requirements).
Construction Phase:			
Lay down area, construction camp	13 ha. Temporary site camp, laydown areas incl. access road, site offices.	Single storey structures	Temporary gravel hard standing and prefab structures.
On-site concrete batching plant	0.25 ha	n/a	Temporary plant.
Borrow pits	To be confirmed.	n/a	Possibly from existing sources.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

Relevant landscape features of the receiving environment are described below, and the general character of the study area is illustrated in Plates 1 to 7.

Location (Figure 1)

The project site is located in the Namakhoi Local Municipality within Namaqualand, in the Northern Cape. The nearest settlements are Komaggas, about 7km away, and Kleinzee on the coast, about 30 km away. The site can be accessed via the R355 Route and Spektakel Pass from Springbok, about 50 km to the east, or via the newly tarred coastal route from Hondeklipbaai, about 70 km to the south. The Namaqua National Park lies about 14 km to the south of the project site.

Physical Landscape (Figures 2 and 4)

The project is located on a low mountain range separated from the Komaggas Mountains further inland. The highest portion of this low range, the 'Brandberg', is 512 m above mean sea level. The other highpoints are known as 'Byneskop' and 'Graafwater se Kop'. The range is surrounded by a vast, flat to gently undulating coastal peneplain, which, being visually exposed, tends to make the mountain ridge visible over long distances. Steep slopes are indicated on Figure 4.

Geology (Figure 3)

The low mountain range is composed of quartzite and schist of the Khurisberg Formation (Okiep Group of rocks), the resistant quartzite being responsible for the parallel ridges trending in a SW-NE direction. The surrounding coastal peneplain is mostly sand and calcrete with alluvium along the dry riverbeds. Augen gneiss occurs to the east around Komaggas. (Geological Survey, 1984, 1:1 000 000 Map).

Vegetation

The vegetation type of the rocky ridges is classified as Namaqualand Klipkoppe Shrubland (SKn1), being part of the Succulent Karoo Biome, and consisting of open shrubland and succulents. The surrounding coastal peneplain comprises Namaqualand Strandveld (SKs7), with low species-rich shrubland, both succulent and non-succulent, (Mucina and Rutherford, 2006).

Land Use

The predominant land use associated with the study area is agriculture, mainly extensive grazing, including dorper sheep, and subsistence farming where irrigation is available, particularly in the Komaggas settlement. Grazing farms tend to be large and farmsteads far apart in the semi-arid landscape. Diamond mining took place in the past and many excavated trenches still remain. The land-based mining in the immediate area appears to have largely ceased.

A tar road serves the Komaggas settlement, the other access roads around the site being gravel. The Namaqua National Park gate is 13.2 km to the south of the site, with access by gravel road. The 'Houthoop' guest farm is about 20 km to the north-west of the site.

Visual Informants Map (Figure 6)

The main scenic resources and sensitive receptors are indicated on the Visual Informants Map. The buffers generally conform to those developed in previous studies (Lawson and Oberholzer, 2014).

The Visual Informants Map includes the following:

- *Steep slopes* with gradients steeper than 1:5 have high visual sensitivity.

- *Topographic features,* mainly prominent landforms, especially peaks. The skylines are visually sensitive and require careful siting of facilities.
- *Drainage courses,* although dry, are scarce scenic features and therefore visually sensitive.
- *Arterial / district roads* are sensitive visual corridors used by local residents, visitors and tourists.

Visual Sensitivity

The extensive open plain is bordered by high mountains to the interior through which the road to Kommagas runs. The majority of visual receptors in the mountainous interior will not see the wind farm. The relatively low-populated plain is visually exposed, with only gentle undulations that would screen the proposed WEF from roads and farms in the district. Although not as prominent as the much higher mountains to the interior, the ridgelines of the low mountain range tend to be visually sensitive in the exposed landscape.

The site is located in a remote area with sparsely scattered farmsteads, and therefore low population. Affected receptors would include the farmsteads, guest accommodation and the Namaqualand National Park, most of which are a considerable distance from the proposed WEF.

4. APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

The National Environmental Management Act (Act No. 107 of 1998). (NEMA) and the (NEMA EIA Regulations (2014, as amended) apply as the proposed wind energy facility is a listed activity requiring a Scoping study and EIA. The need for a visual assessment has been identified.

The National Heritage Resources Act (Act No. 25 of 1999) (NHRA), and associated provincial regulations, provide legislative protection for natural, cultural and scenic resources, as well as for archaeological and paleontological sites within the study area. This report deals with visual considerations, including scenic resources. Archaeological, paleontological and historical sites are covered by the heritage specialists.

5. IDENTIFICATION OF KEY ISSUES

5.1 Key Issues Identified During the Scoping Phase

The potential visual issues identified by the specialists during the scoping phase of this EIA process include the following:

- Potential scarring in the landscape caused by earthworks for access roads and assembly platforms, particularly on the steeper slopes;
- Visual effect of wind turbines on the ridge skylines;
- Potential visual clutter in the landscape of on-site substation, O&M structures and connecting powerlines.
- Dust and noise during construction from heavy machinery and truck traffic.

Additional issues may be added during the public participation process.

5.2 Identification of Potential Impact

The potential impacts identified during the scoping phase of the visual assessment are outlined below:

5.2.1 Construction Phase

- Potential visual intrusion, dust and noise caused by heavy construction vehicles and cranes.
- Potential visual effect of construction camp and material stockpiles.
- Potential visual scarring caused by earthworks for roads and platforms, as well as borrow-pits.
- Potential visual pollution caused by littering and wind-blown packaging materials.

5.2.2 Operational Phase

- Potential visual intrusion caused by large-scale wind turbines on the skyline of the rural landscape.
- Potential visual clutter caused by substation and operations / maintenance structures and overhead powerlines.
- Potential visual intrusion of lights at the WEF, including navigation lights on the traditionally dark skies of the area at night.
- Potential visual effect on the Namaqualand National Park to the south.
- Potential visual effect on surrounding farmsteads and the Houthoop guest farm.

5.2.3 Decommissioning Phase

- Potential visual effect of remaining roads, platforms and concrete slabs on the landscape after decommissioning of the WEF.

5.2.4 Cumulative impacts

- Cumulative visual effect of the WEF caused by powerlines crossing the landscape, as well as by other proposed energy facilities in the area, the nearest being the proposed 300 MW Eskom WEF near Kleinzee, the Project Blue WEF Phases 2 and 3 at Kleinzee, and the proposed 7.2 MW Koingnaas WEF 60 km south of Kleinzee. A 20 MW solar energy facility is proposed to the north-east of the site near Nababeep. A number of other solar energy facilities are proposed near Springbok, but these are not expected to have cumulative visual implications in relation to the proposed Kap Vley WEF. The various proposed WEFs are indicated on Figure1.

6. ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

6.1 Results of the Field Study

The field survey and study of the photographic panoramas indicated that the proposed WEF would be prominently visible on the skyline of the mountain ridgelines. However, the mountain range is fairly low (<500m above the surrounding plain), and only of local visual significance in the broader landscape context. A summary of the visual criteria and findings from the survey are given below.

Visibility (Figure 2):

The proposed WEF would be visible from a number of farmsteads and a guest farm, most of which are some distance away. The WEF would be only marginally visible in the far distance from the Namaqualand National Park. Visibility from the Komaggas settlement is partly obscured by the topography, (see Table 2 below). Estimated degrees of visibility are indicated below:

High visibility:	Prominent feature within the observer's viewframe 0-2.5 km
Mod-high visibility:	Relatively prominent within observer's viewframe 2.5-5 km
Moderate visibility:	Only prominent with clear visibility as part of the wider landscape 5-10 km
Marginal visibility:	Seen in very clear visibility as a minor element in the landscape 10-20 km

Visual Exposure (Figures 5 and 8):

The viewshed extends fairly far in all directions over the open plain, but is partly restricted by the higher mountainous terrain to the east, which is in a view shadow.

Scenic Resources / sensitive receptors (Figure 2):

There are few topographic or scenic features in the surrounding area. The general area is sparsely populated, the farmsteads being far apart, mostly some distance from the WEF. Potential sensitive receptors include the Komaggas settlement and the Namaqualand National Park, but distance is a mitigating factor.

Landscape Integrity:

The surrounding area has a combination of wilderness and rural qualities, the intactness of which has been partly altered by previous diamond mining activities.

Visual Absorption Capacity:

The area around the project site is generally flat, with low scrub vegetation and therefore visually exposed.

The above visual criteria are assessed and summarised in Table 3 below in order to determine overall visual sensitivity for the wind turbines, related infrastructure and connecting powerlines.

Table 2: Viewpoints, Sensitive Receptors and Potential Visibility

View-point	Location	Coordinates	Distance to WEF	Visibility of WEF
VP1	Tar road to Komaggas	29.747S, 17.527E	13.6km	Marginal visibility. Partly obscured by foreground topography.
VP2	Centre of Komaggas	29.795S, 17.486E	7.6km	Moderate visibility in the distance.
VP3	Western edge of Komaggas	29.797S, 17.466E	5.7km	Moderate visibility in the distance.
VP4	Gate near Witduin farmhouse	29.868S, 17.394E	1.9km	High visibility on the skyline.
VP5	Gate to Namaqualand National Park	29.931S, 17.487E	13.2km	Marginal visibility in far distance.
VP6	Namaqualand National Park boundary	29.956S, 17.473E	14.0km	Not visible.
VP7	Vaalkol farmstead	29.799S, 17.341E	5.3km	Moderate visibility on the skyline.
VP8	Sonnekwa farmstead	29.854S, 17.251E	6.6km	Moderate visibility in middle distance.
VP9	Rooivlei farmstead in valley	29.845S, 17.184E	12.4km	Marginal visibility in far distance.
VP11	Rooivlei farmstead on hill	29.824S, 17.148E	16.5km	Marginal visibility in far distance.
VP12	Gromis substation on R355	29.603S, 17.180E	32.2km	Not visible
VP13	Gravel road near Steenvlei* and Hondevlei farmsteads	29.762S, 17.144E	21.1km	Practically not visible.
VP14	Gravel road near Lewies se Duin	29.758S, 17.210E	17.0km	Marginal visibility in far distance.
VP15	Gravel road near proposed powerline	29.756S, 17.239E	14.8km	Marginal visibility in far distance.

* Houthoop guest farm

Table 3: Visual Impact Intensity

Visual Criteria	Comments	Wind Turbines	Related Infra-structure	Connecting powerlines
Visibility of facilities	Visible from a number of farmsteads, Komaggas and Houthoop guest farm.	Med-High	Low-med	Medium
Visibility of lights at night	Navigation lights on turbines, security lighting at substation and O&M buildings.	Medium	Medium	n/a
Visual exposure	Viewshed extends across the plain, restricted by landforms to the east.	High	Low-med	Medium
Scenic resources and receptors	Low mountain ridgelines, dry river courses, farmsteads, guest farm.	Med-high	Low-med	Medium
Landscape integrity	wilderness / rural character, previous disturbance by diamond-mining.	Med-high	Low-med	Medium
Visual absorption capacity	Visually exposed plain, partly undulating. Low scrub vegetation, low visual absorption capacity.	Med-high	Low-med	Medium
Impact intensity	Summary	Med-high	Low-med	Medium

6.2 Potential Visual Impact 1 (Construction Phase)

Nature of the impact:

Potential visual intrusion, dust and noise affecting the rural sense of place.

Significance of impact without mitigation measures:

Potential visual impact intensity is moderate-high, but over the short term of the construction period.

Proposed mitigation measures:

- Location of the construction camp, batching plant and related storage/stockpile areas in unobtrusive positions in the landscape.
- Employment of dust suppression measures. Implementation of litter control measures. Formulation and adherence to an Environmental Management Programme (EMPr), monitored by an Environmental Control Officer (ECO).

Significance of impact with mitigation measures:

Visual impact intensity could potentially be reduced to moderate.

6.3 Potential Visual Impact 2 (Operational Phase)

Nature of the impact:

Potential visual intrusion of proposed wind turbines on the skyline, visible to surrounding receptors, and visual clutter of related infrastructure and lights at night.

Significance of impact without mitigation measures:

Potential visual impact intensity for turbines is moderate-high over the long term.

Proposed mitigation measures:

- Avoidance of steep slopes (>1:5 gradient).
- Location of internal powerlines underground.
- Location of substation and O&M buildings in unobtrusive, low-lying positions, avoiding ridgelines.
- Access roads kept as narrow as possible and existing roads used as far as possible.

Significance of impact with mitigation measures:

Visual impact intensity could potentially remain unchanged for wind turbines.

6.4 Assessment of No-go alternative

Nature of the impact:

Landforms and skyline would remain visually intact.

Significance of impact without mitigation measures:

The potential visual impact would be neutral.

6.5 Cumulative Visual Impacts

Nature of the impact:

Combined potential visual impact of several renewable energy projects in the area.

Significance of impact without mitigation measures:

Subject to layout of other WEF proposals. Could be moderate visual impact.

Proposed mitigation measures:

None. Kleinsee possibly seen as a renewable energy node within a gazetted REDZ.

Significance of impact with mitigation measures:

Visual impact intensity would remain unchanged.

Recommended buffers for wind energy farms have been determined in recent studies, which in turn were based on international guidelines. Buffers are indicated in Table 4 below together with comments relating to the Kap Vley WEF. The buffers are also indicated on Figures 6 and 7.

Table 4: Recommended buffers for Wind Turbines

Landscape features/criteria	PGWC 2006 Guidelines [1]	Visual Guidelines (2014) [2]	Comments relating to proposed Kap Vley WEF
Project area boundary	-	270 m (subject to turbine specification)	This provides a visual buffer for neighbours, but is also a safety issue.
Ephemeral streams/ tributaries	-	-	Subject to freshwater assessment. 50 m buffers indicated in the interim.
Prominent ridgelines, peaks and rock outcrops	500 m	250 m	Brandberg and Byneskop are minor peaks. These and the ridgelines are local rather than regional topographic features.
Arterial / district gravel roads	500 m	500 m	District roads are used by local residents and tourists to the region.
Scenic routes, passes	2.5 km	1 km very sensitive 3 km sensitive	Spektakel Pass is 25 km from the proposed WEF and outside the viewshed.
National Parks, nature reserves / protected areas	2 km	5 km very sensitive 10 km sensitive	The Namaqualand National Park is about 14 km to the south of the proposed WEF.
Private nature reserves/ game farms/ guest farms.	500 m	2 km very sensitive 5 km sensitive	The Houthoop guest farm is about 21 km from the proposed WEF.
Farmsteads	400 m (noise)	500 m – 1 km [3]	Affected farmsteads are indicated on Figure 2.
Towns / settlements	800 m	2 km very sensitive 4 km sensitive	Komaggas is about 7 km from the proposed WEF.

[1] Provincial Government of the Western Cape, (2006).
[2] Lawson Q. and Oberholzer B. (2014).
[3] The general literature recommends a 500m to 2km buffer between wind turbines and residential buildings.

The consequence of a visual impact is determined by combining the nature (and intensity) of the visual impact with the spatial extent (site, local, regional or national scale), and the duration of the impact (short-term, medium-term, long-term or permanent). Reversibility of the visual impact as well as the irreplaceability of the scenic resource or amenity are further considerations, (CSIR, undated).

The calibration of consequence and probability are given in Tables 5 and 6 below. Significance (or risk) is then determined by combining consequence with probability as indicated in Figure 6.1 below. Finally, a summary of the visual impact assessment is given in Table 7 indicating potential residual risk.

Table 5: Calibration of Consequence

Slight	Moderate	Substantial	Severe	Extreme
Negligible alteration of scenic resources and where no sensitive receptors are affected.	Notable alteration of scenic resources, and where sensitive receptors are slightly affected.	Substantial alteration of scenic resources and where sensitive receptors are considerably affected.	Severe alteration of scenic resources, and where sensitive receptors are visibly compromised.	Extreme alteration of scenic resources, and where sensitive receptors are drastically affected.

Table 6: Calibration of Probability

Extremely unlikely	Very unlikely	Unlikely	Likely	Very likely
Little to no chance of scenic resources or visual receptors being affected.	Less than 25% chance of scenic resources or visual receptors being affected.	25 to 50% chance of scenic resources or visual receptors being affected.	50 to 75% chance of scenic resources or visual receptors being affected.	More than 75% chance of scenic resources or visual receptors being affected.

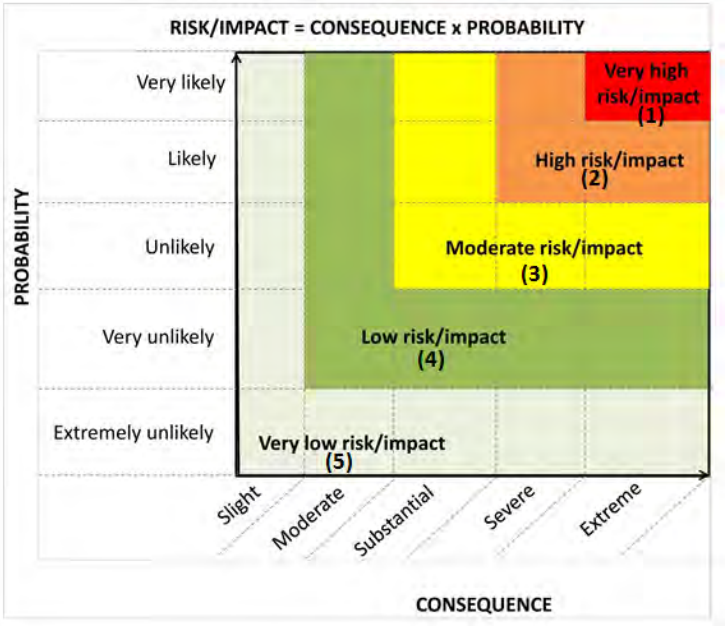


Figure 6.1: Assessment of Visual Risk Significance as a result of Consequence and Probability (Intergovernmental Panel on Climate Change, (2014).

7. IMPACT ASSESSMENT SUMMARY

Table 7: Visual impact assessment summary table for wind turbines and related infrastructure

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of scenic resources	Significance = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated ?	Potential mitigation measures	Significance after mitigation	Ranking of impact/ risk	Confidence level
CONSTRUCTION PHASE															
Effect of construction activities	Visual intrusion, dust and noise.	-ve	local	short-term	severe	very likely	high	low	moderate	No	Yes	Careful siting of construction camp. Implementation of EMPr.	moderate	3	Medium
OPERATIONAL PHASE															
Visual effect of wind turbines on ridgeline	Visual intrusion turbines on skyline.	-ve	local	long-term	severe	very likely	mod-high	low after decommission-ing	mod-high	No	No	Avoidance of steep slopes (>1:5 gradient).	mod-high	3	High
Visual effect of related infrastructure.	Visual clutter of infrastructure on the open landscape.	-ve	local	long-term	substantial	very likely	mod-high	low after decommission-ing	moderate	No	Yes	Careful siting of substation and O&M buildings.	mod -low	4	High
Introduction of lighting at the WEF	Effect of lighting at night on dark skies.	-ve	local	long-term	substantial	very likely	high	replaceable	moderate	Yes	Yes	Low-level lighting and use of reflectors.	mod-low	4	Medium
DECOMMISSIONING PHASE															
Removal of WEF structures	Visual impacts of remaining roads, platforms and concrete slabs.	neutral	local	permanent	Slight	very likely	mod-high	low after decommission-ing	low	Yes	Yes	Regrading, ripping and revegetation.	low	4	Medium

Note: For ranking see Figure 1.
Extent: Site; Local (<10 km); Regional (<100 km); National; International
Duration: Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 yrs); Long-term (project duration); Permanent (beyond project decommissioning)

Table 8: Visual impact assessment summary table for transmission lines

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of scenic resources	Significance before mitigation	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance after mitigation	Ranking of impact/ risk	Confidence level
CONSTRUCTION PHASE															
Effect of construction activities	Visual intrusion, dust and noise.	-ve	local	short-term	moderate	very likely	high	low	moderate	No	Yes	Control of construction activities. Implementation of EMPr.	mod-low	4	Medium
OPERATIONAL PHASE															
Effect of Transmission line on ridgelines	Visual intrusion turbines on skyline.	-ve	local	long-term	substantial	very likely	mod-high	low after decommission-ing	moderate	Yes	Yes	Avoidance of ridgelines where possible.	mod-low	4	High
Effect of access roads.	Visual clutter of infrastructure on the open landscape.	-ve	local	long-term	moderate	very likely	mod-high	low after decommission-ing	mod-low	No	Yes	Use of existing roads where possible.	low	4	High
DECOMMISSIONING PHASE															
Removal of transmission line	Remaining Roads..	neutral	local	permanent	Slight	very likely	mod-high	low after decommission-ing	low	Yes	Yes	Regrading, ripping and revegetation.	low	4	Medium

Note: For ranking see Figure 1.
Extent: Site; Local (<10 km); Regional (<100 km); National; International
Duration: Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 yrs); Long-term (project duration); Permanent (beyond project decommissioning)

Table 9: Cumulative visual impact assessment summary table

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of scenic resources	Significance before mitigation	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance after mitigation	Ranking of impact/ risk	Confidence level
Combined visual effect of WEF, related infrastructure and adjacent renewable energy projects.	Visual intrusion, on character of the area.	-ve	regional	long-term	substantial	very likely	high	low	moderate	No	No	Minimal potential for mitigation.	moderate	3	Medium

Note: For ranking see Figure 1.
Extent: Site; Local (<10 km); Regional (<100 km); National; International
Duration: Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 yrs); Long-term (project duration); Permanent (beyond project decommissioning)

8. INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

Construction Phase Monitoring:

Ensure that visual management measures are included as part of the EMPr, monitored by an ECO, including siting of construction camp and stockpiles, dust suppression and litter control measures, as well as rehabilitation of borrow pits and haul roads, with regular reporting to an environmental management team.

Operation Phase Monitoring:

Ensure that visual mitigation measures are monitored by management on an on-going basis, including the control of signage, lighting and wastes on the site, with interim inspections by a delegated ECO.

Decommissioning Phase Monitoring:

Ensure that procedures for the removal of structures and stockpiles during decommissioning are implemented, including recycling of materials and rehabilitation of the site to a visually acceptable standard, and signed off by the delegated authority.

9. CONCLUSION AND RECOMMENDATIONS

The proposed site for the Kap Vley WEF consists of a low mountain range set in a broad, semi-arid coastal peneplain. The range, being less than 500 m above the surroundings, is considered to be a local rather than a regional landscape feature when seen in the context of the rugged mountains to the east.

The most important receptors are the Komaggas settlement about 7 km to the north-east, the Houthoop guest farm about 21 km to the north-west and the Namaqualand National Park, about 14 km to the south of the proposed WEF. There are also a number of small farmsteads in the otherwise sparsely populated area. It was found that the potential visibility of the proposed WEF would be moderate to marginal for most of the receptors, and in some cases practically not visible.

Wind Turbines

The proposed wind turbines would be highly visible on the skyline of the low mountain range and seen over a long distance of the surrounding plain. However, the mountain range is a local feature within the district and the receptors are mostly at a considerable distance from the proposed WEF, resulting in a visual significance rating of **moderate-high** based on the current preferred layout.

Related infrastructure, such as the substation and O&M buildings, are smaller in scale and therefore expected to have less visual effect. Recommended mitigations have been provided for the siting of these structures. The potential visual significance is expected to be **moderate** before mitigation and **moderate to low** after mitigation.

Transmission Line

Three alternative routes for the connecting 132kV powerlines between the proposed WEF and the Gromis substation, about 32 km to the north, have been provided. The type and height of the pylons are not known at this stage, but would presumably be similar to the monopoles on the Komaggas road. The alignments should ideally follow farm boundaries and existing or approved powerline routes, as well as avoid the 'Toringkop'. The expected visual significance of the powerline alternatives would be **moderate** before mitigation and **moderate-low** after mitigation.

Cumulative Impacts

The site lies within a gazetted REDZ and is therefore within an identified wind development area for which cumulative visual impacts would be expected.

Cumulative visual impacts could arise from the proximity of the proposed Eskom 300 MW wind energy facility, about 12 km to the north-west of the site, because of its proximity. The other proposed wind energy and solar energy facilities in the region would, however, have a limited visual influence on the proposed Kap Vley WEF because of their distance from the site, which suggests that a major overall cumulative visual effect is not expected, and significance rated as **moderate**. Kleinzee could also potentially be seen as a renewable energy node in the future.

Given the remoteness of the proposed WEF site, the sparsely populated area, the previous disturbance by diamond-mining, and the local scale of the project, no potential fatal flaws from a visual perspective are expected. However, the visual mitigations outlined in this Report should be included in the authorisation and EMPr to minimise potential adverse visual impacts.

10. REFERENCES

CSIR, undated. Specialist Impact Assessment Criteria.

Geological Survey, Dept. Mineral and Energy Affairs, 1984. Geological Map of South Africa, 1:1 000 000 scale.

Juwi, undated. Request for proposal: EIA for Kap Vley Wind Farm.

Juwi, 2018. Project description for the Proposed Kap Vley Wind Energy Facility near Kleinzee in the Northern Cape. 3pp.

Juwi, 2017. KMZ files of project area, farm boundaries and alternative grid connections.

Lawson Q. and Oberholzer B. 2014. National Wind and Solar PV SEA Specialist Report: Landscape Assessment. CSIR Report for Dept. Environmental Affairs.

Mucina L. and Rutherford MC, (eds), 2006. The Vegetation of South Africa, Lesotho and Swaziland. *Strelitzia 19*. South African National Biodiversity Institute, Pretoria.

Oberholzer, B. 2005. Guideline for Involving Visual and Aesthetic Specialists in EIA Processes. Edition 1. CSIR Report No. ENV-S-C 2005 053 F. Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning, Cape Town.

Provincial Government of the Western Cape / CNdV Africa, May 2006. Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape.

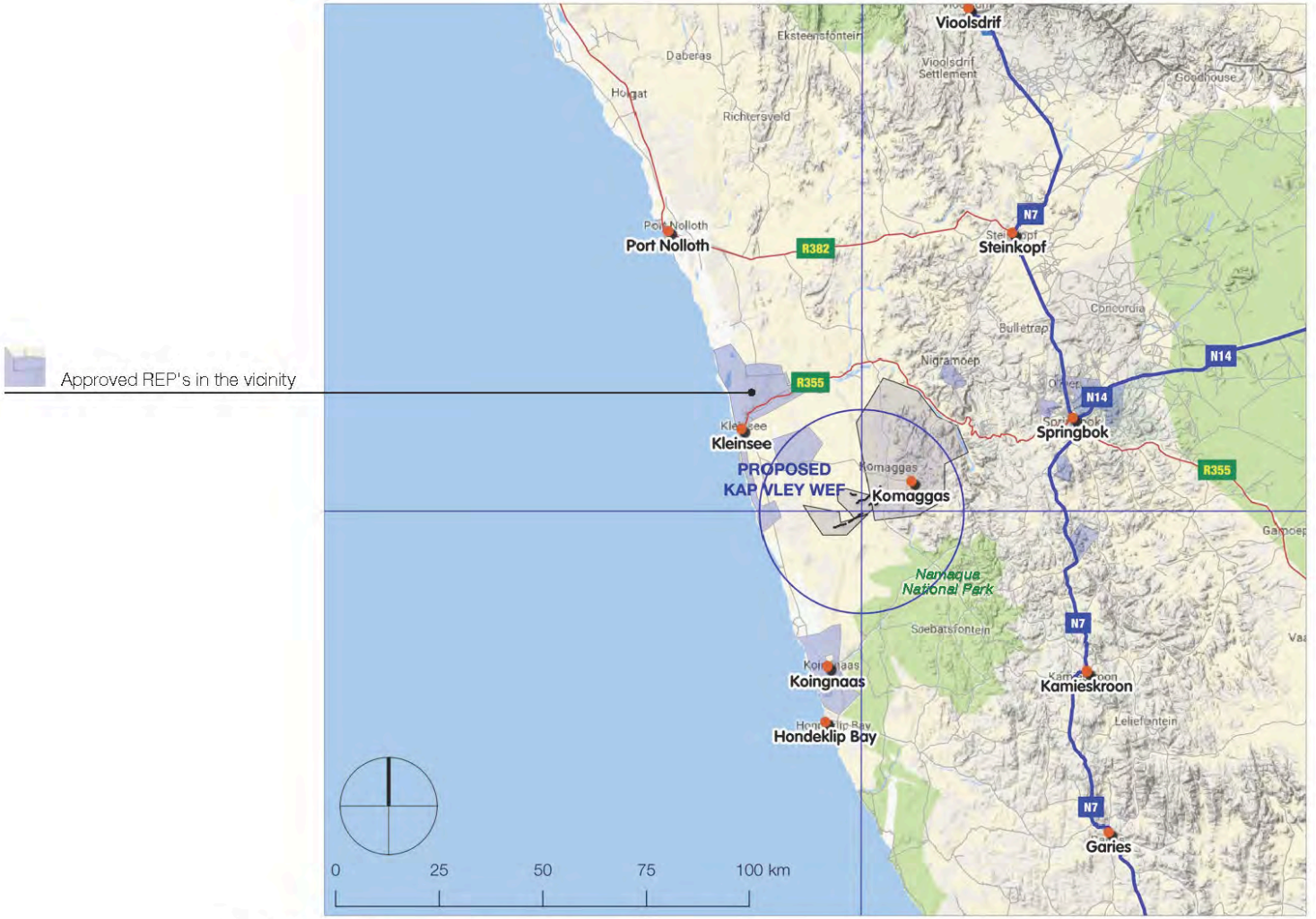


Figure 1 · Locality Map

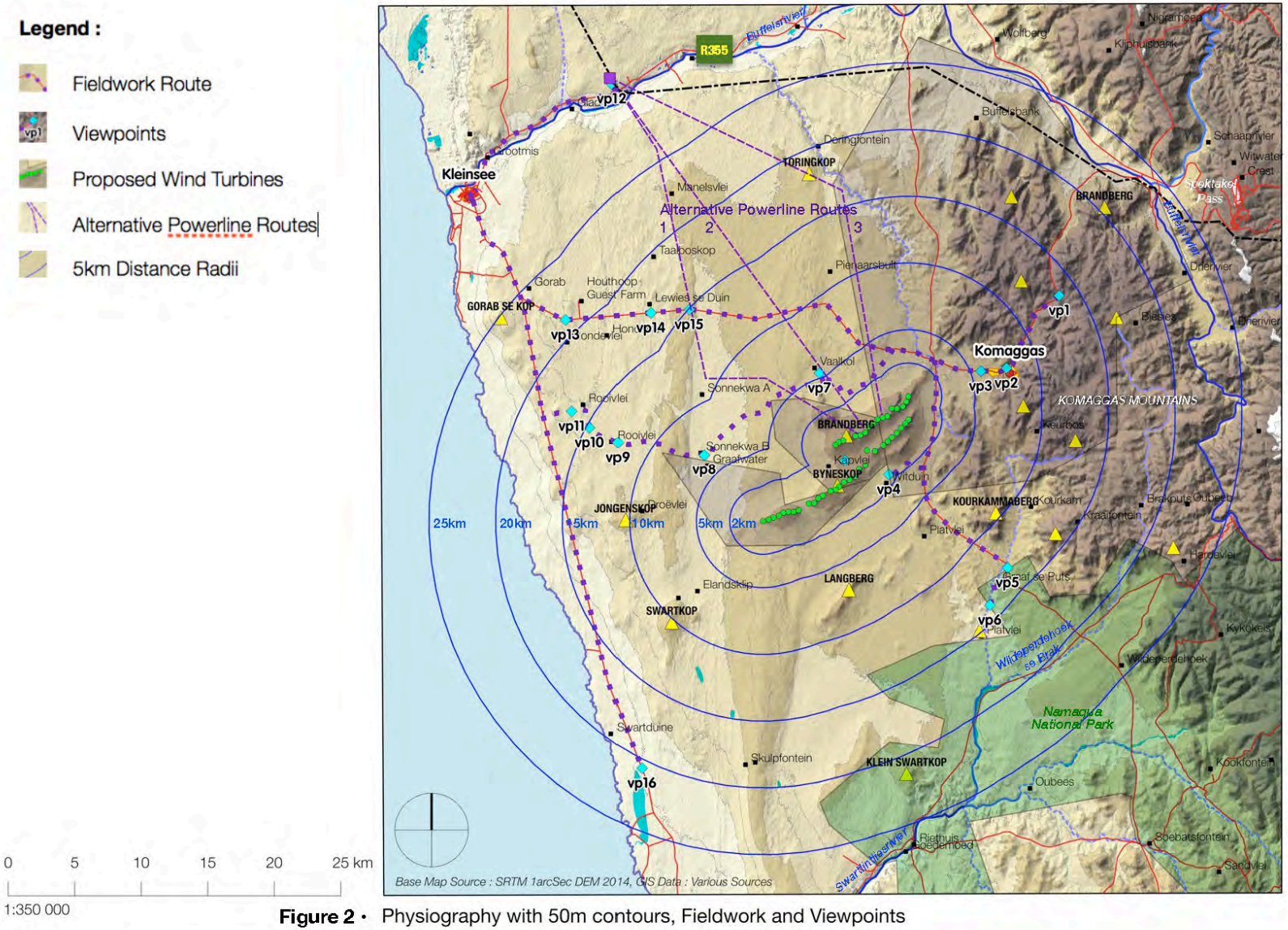


Figure 2 · Physiography with 50m contours, Fieldwork and Viewpoints

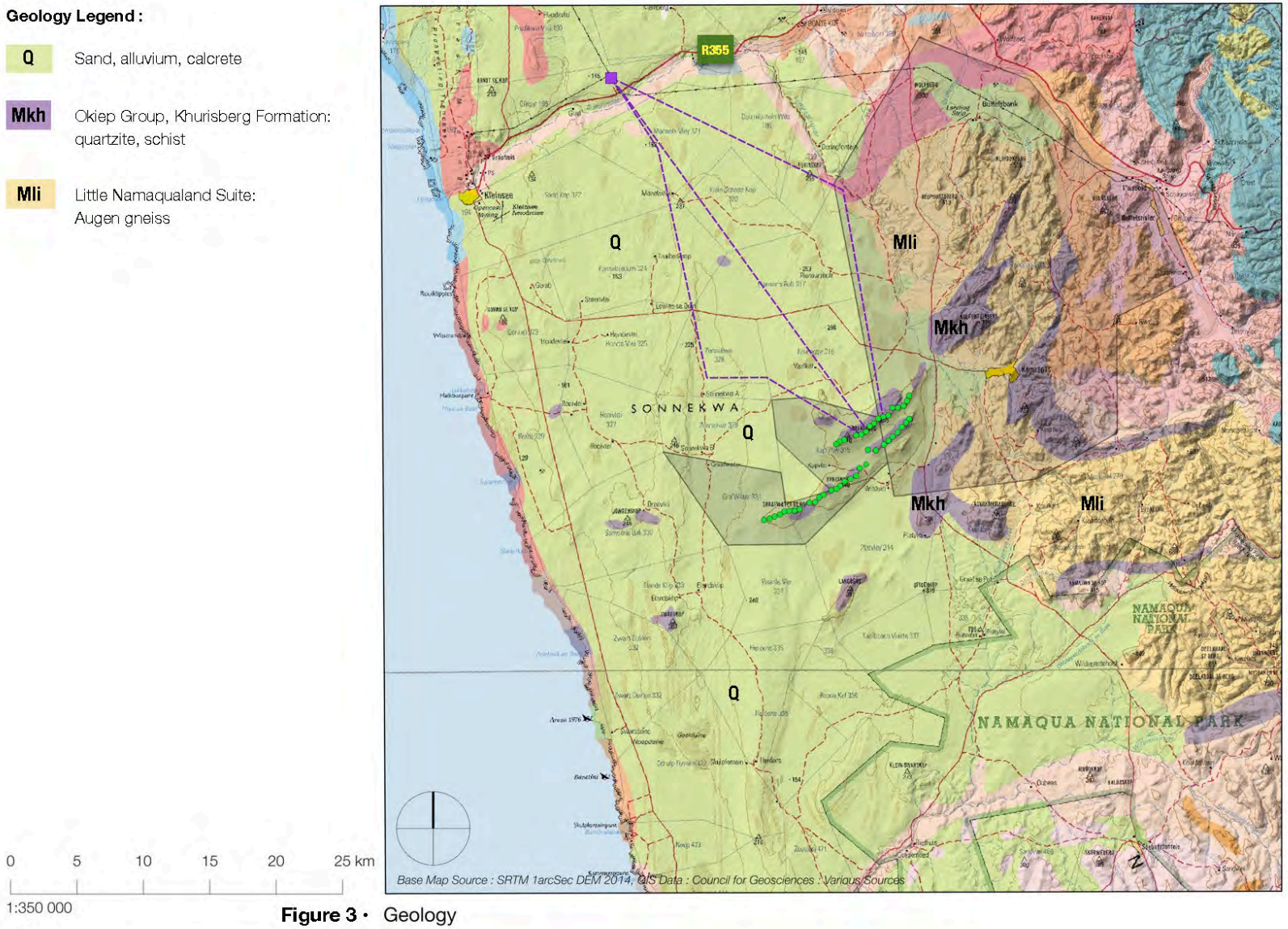


Figure 3 · Geology

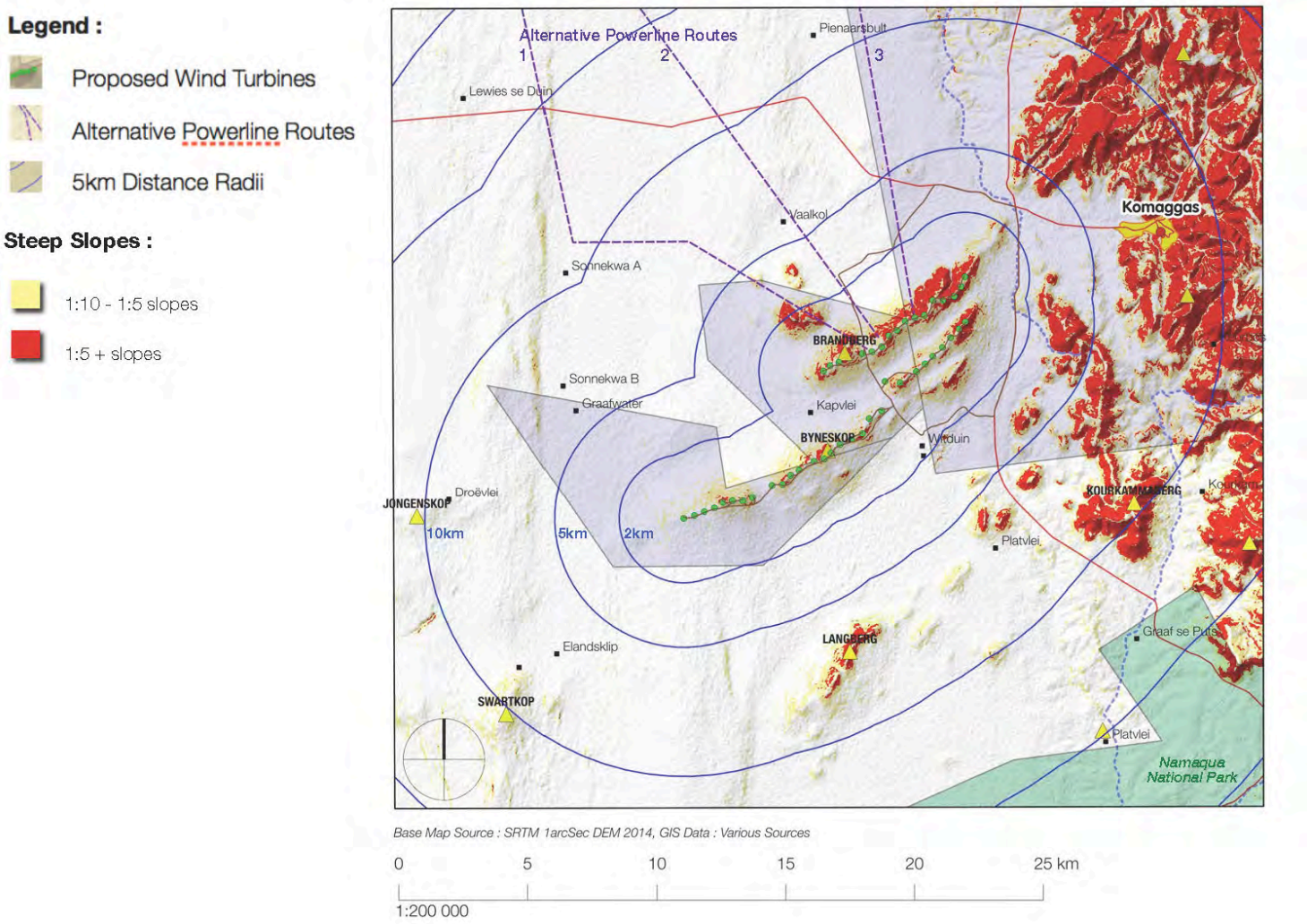


Figure 4 · Steep Slopes, Peaks

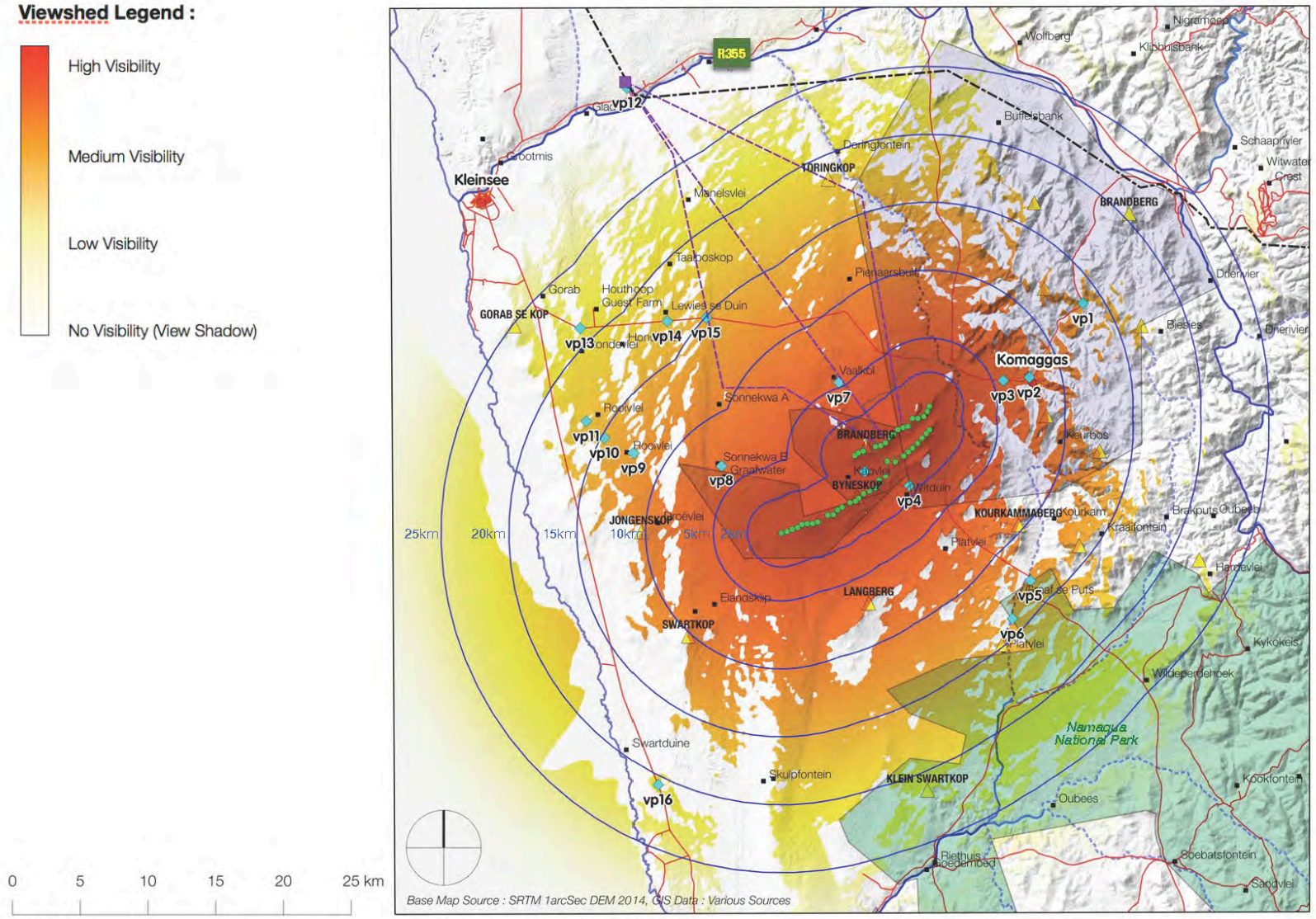


Figure 5 · WEF Viewshed, Distance Radii

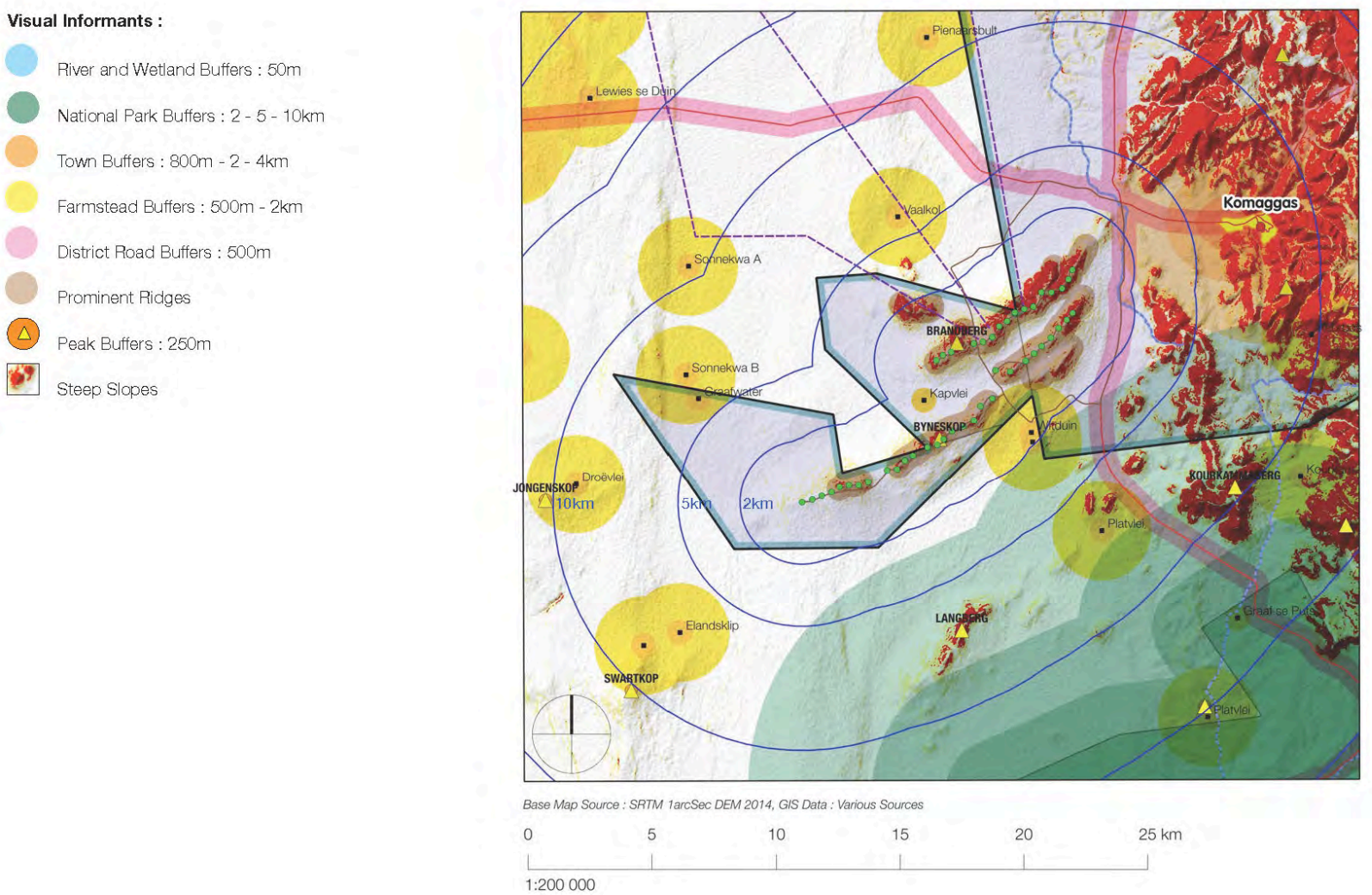


Figure 6 · Visual Informants

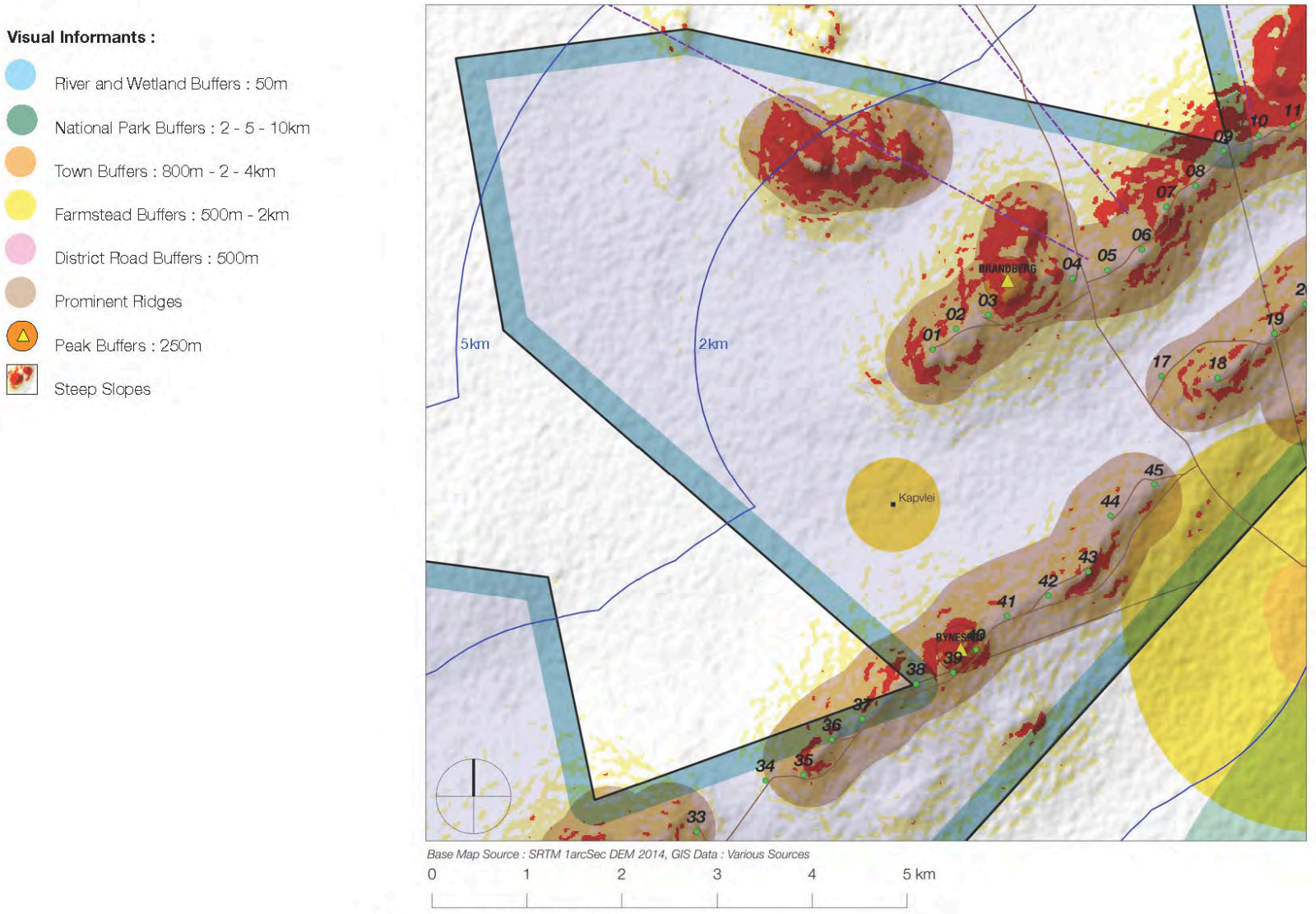


Figure 7 • WTG's Central Area

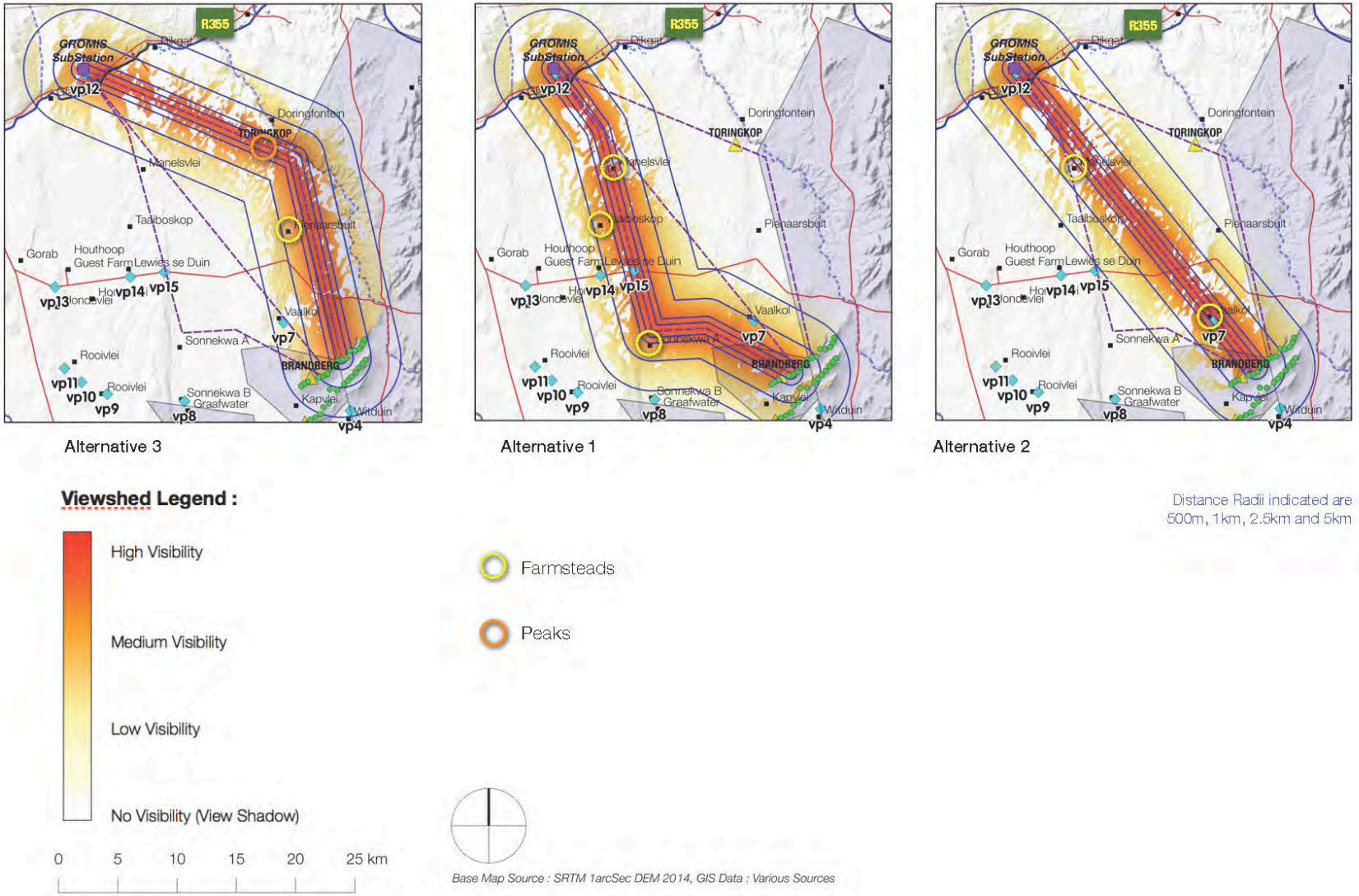


Figure 8 • Alternative Powerline Viewsheds

viewpoint 1 • looking west from tar road to Komaggas • distance 13.6km

viewpoint 2 • looking west from the centre of Komaggas • distance 7.7km

Plate 1: Viewpoint Panoramas

viewpoint 3 • looking west from the western edge of Komaggas • distance 5.7km

viewpoint 4a • looking north from the gate near Witduin farmhouse • distance 1.9km

Plate 2: Viewpoint Panoramas