ARCUS

VOLUME I:
BASIC ASSESSMENT REPORT

For

THE PROPOSED HIGHLANDS NORTH WIND ENERGY FACILITY, EASTERN CAPE PROVINCE

14/12/16/3/3/1/1955

On behalf of

HIGHLANDS NORTH WIND ENERGY FACILITY (RF) (PTY) LTD

January 2019

BASIC ASSESSMENT REPORT FOR THE PROPOSED HIGHLANDS NORTH WIND ENERGY FACILITY, EASTERN CAPE PROVINCE

On behalf of

Highlands North Wind Energy Facility (RF) (Pty) Ltd

January 2019

Prepared By:

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PROJECT DETAILS

DEA Reference Number:	14/12/16/3/3/1/1955
Arcus Reference No:	2780 North WEF
Title:	Basic Assessment Report for the Proposed Highlands North Wind Energy Facility, Eastern Cape Province
EAPs:	Ashlin Bodasing and Anja Albertyn - Arcus Consultancy Services South Africa (Pty) Ltd
Project Team:	Andrew Pearson - Arcus Consultancy Services South Africa (Pty) Ltd Jonathan Aronson - Arcus Consultancy Services South Africa (Pty) Ltd Michael Reid – Arcus Consultancy Services Ltd Simon Todd – 3 Foxes Consulting Brian Colloty / Patsy Scherman – Scherman Colloty and Associates Bernard Oberholzer Landscape Architect in association with Quinton Lawson Architect Jayson Orton and John Almond – ASHA Consulting Tony Barbour – Tony Barbour Environmental Consulting and Research Stephen Fautley - Techso
Project Applicant:	Highlands North Wind Energy Facility (RF) (Pty) Ltd
Report Status:	Final Basic Assessment Report

<table>
<tr><th>Changes made from Draft to Final BA Report</th><th>Section</th></tr>
<tr><td>Date changed to January 2019</td><td>Volume I: Section 1 to 20</td></tr>
<tr><td>Typographical and formatting corrections</td><td>Volume I: Section 1 to 20</td></tr>
<tr><td>Added Table D: DEA Information requirements: Regional map and GIS information as per DEA comments received</td><td>Volume I: Page vi</td></tr>
<tr><td>Added Table E: Development Area Geographic Coordinates</td><td>Volume I: Page vi</td></tr>
<tr><td>Table 1.4: Added Appendix C Water Use License Authorisation</td><td>Volume I: Section 1;:Table 1.4</td></tr>
<tr><td>The wording in Table 2.1 NEMA listed activities was changed from ‘may’ to ‘will’ where applicable</td><td>Volume I: Section 2: Table 2.1</td></tr>
<tr><td>Table 2.2: Legislative Requirements for Scope of Assessment and Content of Basic Assessment Reports has been updated as follows:
<table>
<tr><td>where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;</td><td><s>n/a</s> Commencement of construction will occur within 10 years of authorisation and conclude within 5 years of commencement. Post-construction monitoring requirements will be finalised within this period.</td></tr>
</table></td><td>Volume I: Section 2: Table 2:2</td></tr>
<tr><td>Section 4: Public Participation was updated to reflect process completed to date and summary of issues raised.</td><td>Volume I: Section 4</td></tr>
<tr><td>Table 6.1 Headings wording changed from “Site” to “Region”</td><td>Volume I: Section 6: Table 6.1</td></tr>
<tr><td>Geographic Coordinates of the Proposed Development Area were added to Figure 7.1</td><td>Volume I: Section 7: Figure 7.1</td></tr>
<tr><td>Repetition of paragraph Section 7.1 was corrected.</td><td>Volume I: Section 7.51</td></tr>
</table>

Ecology specialist figures 10.1-10.3 were converted to A3 Arcus figures	Volume I: Section 10 Figure 10.1, Figure 10.2 and Figure 10.3
The Avifaunal Sensitivity map legend wording as changed from "No Go for Turbines only" to "High Sensitivity (No turbines)" to be in line with DEA definition for No Go.	Volume I: Section 11: Figure 11.1: Combined Avifaunal Sensitivity
The Bat Sensitivity Map was updated to clearly display sensitivities. The buffers were not changed. The wording No Go was changed to No turbine as per the Departments definition	Volume I: Section 12; Figure 12.1 Bat Sensitivity Volume II: Bat Specialist report
Turbine numbers were added to Figure 15.5 Visual sensitivity	Volume I: Figure 15.5 Visual Sensitivity
The word 'should' has been changed to 'must' in the EMPr where applicable.	Volume I: Appendix B: EMPr
Pre-construction mitigation measure added: Should any telephone communication lines require moving this will have to be facilitated and approved by Telkom.	Volume I: Appendix B: EMPr Section 5
Added Figure 3: Environmental Sensitivity to EMPr	Volume I: Appendix B: EMPr
Bird collision mitigation measures were moved from Table 7.2 Operational Phase Mitigation measures to Table 6.2 Design & Construction Phase Mitigation Measures	Volume I: Appendix B: EMPr Section 6
Added clarification "A draft Open Space Management Plan is included in this EMPr and must be updated once the final site development plan is finalised and submitted to the DEA for approval." to first point	Volume I: Appendix B: EMPr Section , Table 7.2
Added clarification to 2nd point: "A draft Erosion Management Plan and Rehabilitation Plan is included in this EMPr and must be updated once the final site development plan is finalised and submitted to the DEA for approval."	Volume I: Appendix B: EMPr Section , Table 7.2
Develop an Invasive Alien Plant Management Plan was changed to: "Update and implement the Invasive Alien Plant Management Plan"	Volume I: Appendix B: EMPr Section , Table 7.2
An Avifauna Monitoring and Management Plan was collated from mitigation measures already listed in the avifaunal impact assessment and added to the EMPr	Volume I: Appendix B: EMPr, Section 19
The word draft was removed throughout the document where applicable.	Volume I: Appendix B: EMPr
Typographical and grammatical errors were corrected and minor clarifications were made throughout the document.	Volume I: Appendix B: EMPr
Added Appendix C: Evidence of Application for Water Use License Authorisation	Volume I: Appendix C: WULA
Turbine numbers were added to Figure 8, Soil Impact Assessment	Volume II: Soil impact Assessment
Turbine numbers were added to Figure 10, Avifaunal Sensitivity	Volume II: Avifauna Impact Assessment
Turbine numbers were added to Map 7 Highlands Visual Sensitivity	Volume II: Visual Impact Assessment
Table 19 Cumulative impacts was added to better demonstrate that the result of the cumulative assessment was reached using the assessment methodology.	Volume II: Visual impact Assessment Section 13

Added "The VIA addresses the preferred alternative for the three proposed wind farms. The preferred alternative is the result of numerous iterations taking into account engineering as well as the constraints identified by the various specialist studies, and therefore a number of alternatives have been tested and refined as part of the process." to clarify the assessment of alternatives conducted.	Volume II: Visual impact Assessment Section 13 Visual Assessment of Alternatives
Wording was changed to clarify that Hacking method was used for the intensity determination in the impact tables (categories low, medium and high only). "Based on the potential visual impacts outlined in Section 11 above it is expected that the intensity of the impacts would be **medium for the operational** phases of the proposed wind farms, and **medium for the operational phases** of the powerline and related infrastructure.	Volume II: Visual impact Assessment Section 12 Visual Impact Assessment proposed Wind Farms
Wording was changed to clarify impact significance rating versus visual intensity rating: "The potential visual impact significance of the proposed Highlands wind farms during construction would be **Moderate significance**. The North wind farms visual impact could be of **Moderate significance** during the operation phase, but being in close proximity to the R63 Route and *Bruintjieshoogte* Pass and a number of farmsteads in the area it's visual intensity would be higher than the Central and South wind farms, i.e. Moderate-high **visual intensity**.	Volume II: Visual impact Assessment Section 15 Findings and Recommendations
The Comments & Responses Report was updated to present the PPP conducted to date, as well as all comments received and responses given.	Volume III: Comments & Response report

EXECUTIVE SUMMARY OF THE BASIC ASSESSMENT REPORT FOR THE PROPOSED HGHLANDS NORTH WIND ENERGY FACILITY

Introduction

WKN Windcurrent South Africa (Ltd) Pty ('the Developer') is proposing the Highlands Wind Energy Facilities (WEFs), and associated infrastructure including grid connection infrastructure (the Proposed Development), located 20 km from the town of Somerset East in the Eastern Cape Province. The area of interest for development within the affected land parcels is approximately 9000 hectares (The Proposed Development Area), and falls entirely within the Cookhouse Renewable Energy Development Zone (REDZ). The Proposed Development aims to generate and produce electricity from renewable wind energy sources in order to supply electricity into the national grid by connecting to an existing Eskom transmission line within the Proposed Development Area.

Arcus Consultancy Services South Africa (Pty) Ltd ('Arcus') has been appointed to act as the independent environmental impact assessment practitioner (EAP) to undertake the environmental impact assessment (EIA) process for Environmental Authorisation under Chapter 5 of the National Environmental Management Act, 1998 (Act 107 of 1998 – NEMA) as amended, for the Proposed Development.

For the purpose of obtaining Environmental Authorisation (EA), and bidding requirements in the Department of Energy's Renewable Energy Independent Power Producers Procurement Programme (REIPPPP), the project has been split into three phases: North, Central and South. A Special Purpose Vehicle (SPV) has been set up for each of the three phases. Each phase will consist of two applications: one for the wind energy facility and one for the respective grid connection. The Proposed Development therefore consists of six components and six separate applications for EA:

- Highlands North Wind Energy Facility (RF) (Pty) Ltd:
  - **The Highlands North WEF (up to 85 MW) consisting of up to 17 turbines with a generating capacity of up to 5 MW each (The Proposed Project),**
  - Electrical Grid Connection and Associated Infrastructure for Highlands North WEF;
- Highlands Central Wind Energy Facility (RF) (Pty) Ltd:
  - The Highlands Central WEF (up to 70 MW): up to 14 turbines with a generating capacity of up to 5 MW each
  - Electrical Grid Connection and Associated Infrastructure for Highlands Central WEF;
- Highlands South Wind Energy Facility (RF) (Pty) Ltd:
  - The Highlands South WEF (up to 90 MW): up to 18 turbines with a generating capacity of up to 5 MW each;
  - Electrical Grid Connection and Associated Infrastructure for Highlands South WEF.

This report pertains to the **Highlands North WEF (up to 85 MW)** consisting of up to 17 turbines with a generating capacity of up to 5 MW each (The Proposed Project).

Should the Proposed Development be bid in the REIPPPP two submissions may potentially be made: The Highlands North WEF will be combined with the Highlands Central WEF **OR** be bid on its own, and the Highlands Central WEF will be combined with Highlands South WEF. Due to these uncertainties the specialist studies have described the baseline environment of the entire Proposed Development Site as the affected environment. The impact assessments however assess the six Proposed Projects individually, as well as cumulatively (as the six components together are likely to be seen as one wind farm).

Highlands North WEF Site Location and Proposed Project Description

The Proposed Highlands North WEF is located approximately 20 km west of the town of Somerset East, bordering the south of the R63 provincial route, approximately 23 km south-east of Pearston, in the Eastern Cape Province. It is located in the Blue Crane Route Local Municipality (BCRLM) in the Sarah Baartman District Municipality (SBDM), previously known as the Cacadu District Municipality. The main settlements in the municipality are Somerset East, which serves as the administrative and commercial centre, Cookhouse and Pearson. The most significant roads passing through the area are the N10, R61, R63, and the R390. The administrative seat of the SBDM is currently located in the Nelson Mandela Bay Metro area.

The Highlands North WEF (up to 85 MW) will consist of up to 17 three-bladed horizontal-axis turbines with a maximum hub height of 135 m and rotor diameter of up to 150 m, with a generating capacity of up to 5 MW each. A maximum height to blade tip of 200 m will be considered. Internal roads will connect the turbines to each other and the onsite substations. On-site cabling will largely follow the road infrastructure where possible, and will be either overhead, or underground, where technically and environmentally feasible. One on-site substation location forms part of this application. The final choice of turbine will be dependent on the technology available at the time of construction, project economics and the desired output from the development.

A Feasibility Assessment was conducted by the specialist team prior to the Basic Assessment process. The results of these preliminary assessments advised the development of the proposed project layout for assessment (embedded mitigation). This layout was improved further by the results of the detailed specialist studies conducted, resulting in the Final Mitigated Layout, as the best practicable environmental option submitted for authorisation.

Environmental Legislative Requirements

The EIA Regulations 2014 as amended by GNR 326 of 2017 provide for the control of certain Listed Activities. These activities are listed in Government Notice No. R327 (Listing Notice 1 – Basic Assessment), R325 (Listing Notice 2 – Scoping & EIA Process) and R324 (Listing Notice 3 – Basic Assessment) of 7 April 2017, and are prohibited to commence until environmental authorisation has been obtained from the competent authority, in this case, the Department of Environmental Affairs (DEA).

Listed Activities applicable to this proposed project are presented in the table below. All potential impacts associated with these Listed Activities are considered and assessed in this EIA.

On 16 February 2018, the Minister of Environmental Affairs promulgated new regulations in terms of Chapter 5 of the NEMA, Government Notices (GN) No. R. 114 in Government Gazette No. 41445 of 16 February 2018. These state that applications for environmental authorisation for large scale wind energy facilities, when such facilities trigger activity 1 of GN No.325 (Listing Notice 2), and where the entire proposed facility is to occur in a REDZ must follow the basic assessment procedure contemplated in Regulation 19 and 20 of the EIA Regulations 2014, as amended, in order to obtain environmental authorisations, as required, in terms of the Act. Further, the timeframe for decision-making as contained in the EIA Regulations, 2014, as amended, for the purposes of the applications for environmental authorisation is 57 days.

Therefore, a Basic Assessment (BA) process will be followed for the application for environmental authorisation for the Highlands North WEF.

Applicable Listed Activities in terms of the NEMA

LISTING NOTICE	ACTIVITIES
LN 1 GN R327[1]	11(i); 12 (ii)(a)(c); 19; 24 (ii); 27; 48 (i)(a)(c) 56 (ii)
LN 2 GN R325[2]	1; 6
LN 3 GN R324[3]	4(a)(i)(bb)(ee); 10(a)(i)(bb)(ee); 12(a)(ii); 14(ii)(a)(c)(a)(i)(bb)(ff); 18(a)(i)(bb)(ee) (a)(i)(bb); 23 (ii)(a)(c)(a)(bb)(ee)

Depending on the final design of the Highlands North WEF, there may be a requirement for the following additional permits/ authorisations:

- Waste Management License/s as required by the NEMA, Waste Act, 2008 (Act No. 59 of 2008);
- Mining Permits as required by the Minerals and Petroleum Resources Development Act, 2002 (MPRDA) (Act No. 28 of 2002)(MPRDA); and
- Water Use Licenses as required by the National Water Act, 1998 (Act No. 36 of 1998) (NWA). Proof of application is included in Appendix C.

Results of Specialist Assessments – Construction Phase Impacts

Construction Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Loss of Agricultural land	L	M	L	Negative	L	L	H
With Mitigation	*L*	*M*	*L*	*Negative*	***L***	*L*	*H*
Soil degradation	L	M	M	Negative	M	M	H
With Mitigation	*L*	*M*	*L*	*Negative*	***L***	*L*	*H*
Wetlands and freshwater							
Riparian systems & watercourses	L	M	L	Negative	M	H	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Increase in sedimentation & erosion	L	M	L	Negative	M	H	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Localized water quality	L	M	L	Negative	M	H	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Terrestrial Ecological Impacts							
On Vegetation	L	H	M	Negative	M	H	H

[1] "Listing Notice 1 of the EIA Regulations, promulgated under Government Notice R983 of 4 December 2014, as amended by Government Notice R327 of 7 April 2017."

[2] "Listing Notice 2 of the EIA Regulations, promulgated under Government Notice R984 of 4 December 2014, as amended by Government Notice R325 of 7 April 2017."

[3] "Listing Notice 3 of the EIA Regulations, promulgated under Government Notice R985 of 4 December 2014, as amended by Government Notice R324 of 7 April 2017."

Construction Phase	**Extent**	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
With Mitigation	*L*	*M*	*M*	*Negative*	***M***	*H*	*H*
On Fauna	L	L	H	Negative	M	H	H
With Mitigation	*L*	*L*	*M*	*Negative*	***L***	*L*	*M*
Avifauna							
Habitat destruction	L	M	M	Negative	M	H	H
With Mitigation	*L*	*M*	*L*	*Negative*	***L***	*L*	*M*
Disturbance and Displacement	L	L	M	Negative	M	M	M
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*M*
Bats							
Roost disturbance	L	M	L	Negative	L	L	M
With Mitigation	*L*	*M*	*L*	*Negative*	***L***	*L*	*M*
Roost destruction	L	H	L	Negative	M	M	M
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*M*
Habitat modification	L	M	L	Negative	L	L	M
With Mitigation	*L*	*M*	*L*	*Negative*	***L***	*L*	*M*
Noise							
Construction of Tracks and Hardstanding	L	L	H	Negative	M	M	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Excavation and Concreting of Foundations	L	L	H	Negative	M	M	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Turbine Erection	L	L	H	Negative	M	M	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Generator (Night-time Use)	L	L	M	Negative	L	L	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Heritage and Archaeology							
On Archaeological Resources	L	H	L	Negative	M	M	H
With Mitigation	*L*	*H*	*L*	*Negative*	***L***	*L*	*H*
On graves	L	H	H	Negative	M	L	H
With Mitigation	*L*	*H*	*L*	*Negative*	***L***	*L*	*H*
On cultural landscape	M	M	M	Negative	M	H	H
With Mitigation	*M*	*M*	*M*	*Negative*	***M***	*H*	*H*

Construction Phase	**Extent**	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Palaeontology							
On palaeontological resources	L	H	L	Negative	M	M	M
With Mitigation	*L*	*H*	*L*	*Negative*	***L***	*L*	*M*
Visual							
Visual effect on sense of place	L	L	M	Negative	M	H	H
With Mitigation	*L*	*L*	*M*	*Negative*	***M***	*M*	*M*
Social							
Employment and business creation opportunities	M	L	M	Positive	M	M	H
With Mitigation	*H*	*L*	*H*	*Positive*	***M***	*H*	*H*
Construction workers on local communities	M	L	M	Negative	M	M	H
With Mitigation	*M*	*L*	*L*	*Negative*	***L***	*L*	*H*
Impact of job seekers on local communities	M	L	L	Negative	L	L	M
With Mitigation	*M*	*L*	*L*	*Negative*	***L***	*L*	*M*
Risk to safety, livestock & farms	M	L	M	Negative	M	M	H
With Mitigation	*M*	*L*	*L*	*Negative*	***L***	*L*	*H*
Increased fire risk	M	L	M	Negative	M	M	H
With Mitigation	*M*	*L*	*L*	*Negative*	***L***	*L*	*H*
By construction vehicles	M	L	M	Negative	M	M	H
With Mitigation	*M*	*L*	*L*	*Negative*	***L***	*L*	*H*
On farmland	M	L	M	Negative	M	M	H
With Mitigation	*M*	*L*	*L*	*Negative*	*L*	*L*	*H*
Traffic							
Traffic Flow	M	L	M	Negative	M	M	M
With Mitigation	*M*	*L*	*M*	*Negative*	***L***	*L*	*M*
Route Constraints	M	L	H	Negative	M	H	H
With Mitigation	*M*	*L*	*L*	*Negative*	***L***	*L*	*H*
Minor Road Degradation	L	L	M	Negative	M	M	M
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*M*
Minor Road Dust	L	L	H	Negative	M	M	M

Construction Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*M*
Intersection Road Safety	L	L	H	Negative	M	M	M
With Mitigation	*L*	*L*	*H*	*Negative*	***L***	*L*	*M*

Results of Specialist Assessments – Operational Phase Impacts

Operational Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Agricultural land	L	M	L	Negative	L	L	H
With Mitigation	*L*	*M*	*L*	*Negative*	***L***	*L*	*H*
Soil degradation	L	M	M	Negative	M	M	H
With Mitigation	*L*	*M*	*L*	*Negative*	***L***	*L*	*H*
Additional land use income	L	M	L	Positive	M	H	H
With Mitigation	*L*	*M*	*L*	*Positive*	***M***	*H*	*H*
Wetlands and freshwater							
Impact on riparian systems	L	L	L	Negative	M	H	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Sedimentation and erosion	L	M	L	Negative	M	H	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Localized surface water quality	L	M	L	Negative	M	H	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Terrestrial Ecological Impacts							
Faunal impacts	L	M	M	Negative	M	H	H
With Mitigation	*L*	*M*	*L*	*Negative*	***L***	*L*	*H*
Soil erosion	L	H	M	Negative	M	H	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Alien plant invasion	L	H	M	Negative	M	H	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
CBAs & Ecological Processes	L	H	M	Negative	M	H	H
With Mitigation	*L*	*H*	*L*	*Negative*	***L***	*L*	*H*
Avifauna							
Collisions with wind turbines	M	M	H	Negative	M	H	M

Operational Phase	**Extent**	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
With Mitigation	*M*	*M*	*H*	*Negative*	***M***	*M*	*M*
Collisions with overhead powerlines	L	M	H	Negative	M	M	M
With Mitigation	*L*	*M*	*M*	*Negative*	***L***	*L*	*M*
Electrocution	L	M	M	Negative	M	M	M
With Mitigation	*L*	*M*	*M*	*Negative*	***L***	*L*	*H*
Disturbance and displacement	M	M	M	Negative	M	M	L
With Mitigation	*L*	*M*	*M*	*Negative*	***L***	*L*	*L*
Disruption of Local Bird Movements	M	M	M	Negative	L	L	L
With Mitigation	*M*	*M*	*M*	*Negative*	***L***	*L*	*L*
Bats							
Bat mortality during commuting / foraging	M	M	M	Negative	M	M	M
With Mitigation	*M*	*M*	*L*	*Negative*	***L***	*L*	*M*
Bat mortality during migration	H	M	M	Negative	M	L	M
With Mitigation	*M*	*M*	*M*	*Negative*	***L***	*L*	*M*
Habitat creation in high risk locations	L	M	L	Negative	L	L	M
With Mitigation	*L*	*M*	*L*	*Negative*	***L***	*L*	*H*
Light pollution	L	M	L	Negative	L	L	M
With Mitigation	*L*	*M*	*L*	*Negative*	***L***	*L*	*H*
Noise							
Noise (Day)	L	H	L	Negative	L	L	H
With Mitigation	*L*	*H*	*L*	*Negative*	***L***	*L*	*H*
Noise (Night)	L	H	H	Negative	M	M	H
With Mitigation	*L*	*H*	*M*	*Negative*	***M***	*M*	*H*
Heritage and Archaeology							
Cultural landscape	M	M	M	Negative	M	H	H
With Mitigation	*M*	*M*	*M*	*Negative*	*M*	*H*	*H*
Visual							
Intrusion on rural landscape	M	M	M	Negative	M	H	H
With Mitigation	*M*	*M*	*M*	*Negative*	***M***	*M*	*H*
Social							

Operational Phase	**Extent**	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Clean, renewable energy	M	M	M	Positive	M	M	H
With Mitigation	*M*	*H*	*M*	*Positive*	***H***	*H*	*H*
Employment and business opportunities	M	M	L	Positive	M	M	H
With Mitigation	*M*	*M*	*M*	*Positive*	***H***	*H*	*H*
Community Trust	M	H	M	Positive	M	L	H
With Mitigation	*M*	*H*	*H*	*Positive*	***H***	*H*	*H*
Income for affected farmers	M	M	L	Positive	L	L	H
With Mitigation	*M*	*M*	*M*	*Positive*	***M***	*H*	*H*
Sense of place (landscape)	M	M	M	Negative	M	M	M
With Mitigation	*M*	*M*	*M*	*Negative*	***M***	*M*	*M*
Sense of place (stakeholders)	M	M	L	Negative	L	M	M
With Mitigation	*M*	*M*	*L*	*Negative*	***L***	*M*	*M*
Property values	M	M	M	Negative	M	M	M
With Mitigation	*M*	*M*	*M*	*Negative*	***M***	*M*	*M*
Tourism in the region	M	M	L	Negative	L	L	H
With Mitigation	*M*	*M*	*L*	*Negative*	***L***	*L*	*H*
Adjacent tourism operations	M	M	M	Negative	M	M	M
With Mitigation	*M*	*M*	*M*	*Negative*	***M***	*M*	*M*
Traffic							
Route Constraints	M	L	H	Negative	M	M	H
With Mitigation	*M*	*L*	*L*	*Negative*	***L***	*L*	*H*

Results of Specialist Assessments – Decommissioning Phase Impacts

Decomm. Phase	**Extent**	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Geology, Soils and Agricultural Potential Impact							
Agricultural land loss	L	M	L	Negative	L	L	H
With Mitigation	*L*	*M*	*L*	*Negative*	***L***	*L*	*H*
Soil degradation	L	M	M	Negative	M	M	H
With Mitigation	*L*	*M*	*L*	*Negative*	***L***	*L*	*H*
Terrestrial Ecological Impacts							
Faunal impacts	M	L	H	Negative	M	H	H

Decomm. Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
With Mitigation	*L*	*L*	*M*	*Negative*	***L***	*L*	*H*
Soil erosion	M	H	M	Negative	H	H	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Alien plant invasion	L	H	M	Negative	M	H	H
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*H*
Birds							
Disturbance and Displacement	L	L	M	Negative	M	M	M
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*M*
Heritage and Archaeology							
Impacts to the cultural landscape	M	M	M	Negative	M	H	H
With Mitigation	*M*	*M*	*M*	*Negative*	***M***	*H*	*H*
Visual							
Potential visual intrusion	M	M	M	Negative	M	H	H
With Mitigation	*L*	*L*	*L*	*Neutral*	***L***	*M*	*M*
Social							
Loss of jobs and income	M	M	M	Negative	M	M	H
With Mitigation	*M*	*L*	*L*	*Negative*	***L***	*L*	*H*
Traffic							
Minor Road Degradation	L	L	M	Negative	M	M	M
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*M*
Minor Road Dust	L	L	H	Negative	M	M	M
With Mitigation	*L*	*L*	*L*	*Negative*	***L***	*L*	*M*

Conclusion

The proposed Highlands North WEF and its associated infrastructure, as part of the proposed Highlands Wind Energy Facilities, including grid connection infrastructure, has the potential to provide much needed renewable energy to the country's grid. The use of renewable energy to provide power to South Africa is supported at International, National, Provincial and Local Government Levels. Further, given South Africa's need for additional electricity generation and the need to decrease the country's dependency on coal-based power, renewable energy has been identified as a national priority, with wind energy identified as one of the most readily available, technically viable and commercially cost-effective sources of renewable energy.

The proposed development area has been identified by the Council of Scientific and Industrial Research (CSIR) as a Renewable Energy Development Zone (REDZ) Focus Area, which has been so earmarked by the Department of Environmental Affairs (DEA) under the developing wind energy Strategic Environmental Assessment (SEA) process. The latter aims to identify geographical areas best suited for the rollout of wind energy projects and the supporting electricity grid network. The Highlands North WEF is located within the Cookhouse REDZ, and is ideally placed to achieve the above.

The potential positive impacts associated with the proposed project are further recognised through the creation of jobs for the local community, and the positive contributions to the socio-economic development of the surrounding areas and local communities.

Should the Highlands North WEF be developed, the actual physical footprint of the wind turbines and associated on-site infrastructure will occupy an area of land equivalent to less than 1% of the total Proposed Development Site. Small livestock grazing and other agricultural activities can continue in parallel with the operation of the turbines. The project will have no significant impact in terms of loss of agricultural productivity. Should the mitigation measures identified by specialists and the recommendations of the EMPr be effectively implemented the negative impacts associated with the proposed project will be significantly reduced. The study has concluded that there are no negative high residual impacts, including potential cumulative impacts associated with the proposed development.

Taking into consideration the findings of the BA process for the proposed project and the fact that recommended mitigation measures have been used to inform the project layout design, it is the opinion of the Environmental Assessment Practitioner (EAP) that the majority of negative impacts associated with the implementation of the proposed project have been mitigated to acceptable levels. While the residual impacts of the project will have an impact on the local environment, and potentially on four to five existing game and hunting tourism operations, the extent of the benefits associated with the implementation of the projects will benefit a much larger group of people, in terms of renewable energy supply and positive local and regional economic impact. In addition, the area has been designated a Renewable Energy Development Zone for wind energy in particular, through a Strategic Environmental Impact Assessment by National Government.

ABBREVIATIONS, ACRONYMS AND UNITS

ATNS	Air Traffic and Navigation Services SOC Limited
BA	Basic Assessment
BAR	Basic Assessment Report
CARA	Conservation of Agricultural Resources, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CSP	Concentrated Solar Power
DAFF	Department of Agriculture, Forestry and Fisheries
dB	Decibel
DEA	Department of Environmental Affairs (National)
DEDEA	Eastern Cape Department: Economic Development Environmental Affairs, and Tourism
DMR	Department of Mineral Resources
DoE	Department Of Energy
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act, 1989 No. 73 of 1989)
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
ESA	Ecological Support Area
ESA	Early Stone Age
ESKOM	Eskom Holdings SOC Limited
EWT	Endangered Wildlife Trust
GNR	Government Notice Regulation
HIA	Heritage Impact Assessment
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IPP	Independent Power Producer
IRP	Integrated Resource Plan
kV	Kilovolt
kWh	Kilowatt Hours
LSA	Late Stone Age
MSA	Middle Stone Age
MW	Megawatt
NCR	Noise Control Regulations
NDP	National Development Plan
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NSD	Noise-sensitive Development
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PES	Present Ecological State
PGDS	Provincial Growth and Development Strategy
PPA	Power Purchase Agreement
PPP	Public Participation Process
PV	Solar photovoltaic
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SABAAP	South African Bat Assessment Advisory Panel
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SANS	South African National Standards
SAPS	South African Police Service
SAWS	South African Weather Service
SCADA	Supervisory Control and Data Acquisition
SDF	Spatial Development Framework
SEA Assessment	Strategic Environmental
SIA	Social Impact Assessment
SPV	Special Project Vehicle
WEF	Wind Energy Facility
WTG	Wind Turbine Generator
WULA	Water Use License Application

DEPARTMENT OF ENVIRONMENTAL AFFAIRS INFORMATION REQUIREMENTS FOR WIND FARM APPLICATIONS

The Department of Environmental Affairs' requirements for information for all applications for Wind Energy Facilities (WEFs) are included in this section of the report. Where this information is not provided in the tables below, the location of where it can be found in the report is indicated.

Table A: DEA Information Requirements – Wind Energy Facilities General Site Information

Description				
Descriptions of all affected farm portions (Farm Portions in grey do not have a turbine position)	**Property owner**	**Farm Portion**	**Size in hectare**	**21 digit Surveyor General codes**
	ZIRK JORDAAN FAMILY TRUST	Farm 102 Rietfontein Farm 102 – Portion 0 Remaining Extent	2443.50	C06600000000010200000
	SA Government (Tenant: Simphewe & Linda Fani)	Farm 104 Coetzees Fontein Farm 104 - Portion 0	25.54	C06600000000010400000
		Farm 104 Coetzees Fontein Farm 104 - Portion 1	389.41	C06600000000010400001
		Farm 104 Coetzees Fontein Farm 104 - Portion 2	618.43	C06600000000010400002
		Farm 105 Doorn Rivier Farm 105 - Portion 0 Remaining Extent	1284.80	C06600000000010500000
		Farm 105 Doorn Rivier Farm 105 - Portion 1	1027.83	C06600000000010500001
		Farm 143 Nels Kraal Farm 143 – Portion 0	689.13	C06600000000014300000
		Farm 146 Kiepersol Farm 146 – Portion 1	125.91	C06600000000014600001
	SA Government (Tenant: Tozi Nelani)	Farm 144 Nelskom Farm 144 - Portion 0 Remaining Extent	223.91	C06600000000014400000
		Farm 145 De Mullers Kraal Farm 145 – Portion 0	865.33	C06600000000014500000
		Farm 145 De Mullers Kraal Farm 145 – Portion 8	0.88	C06600000000014500008
	HIGHLANDS TRUST	Farm 361 Highlands Farm 361 – Portion 0 Remaining Extent	1828.82	C06600000000036100000
	G K W GEBOU TRUST	Farm 103 Spaarwater Farm 103 – Portion 0	854.39	C06600000000010300000
	Jakkie Nel Trust	Farm 101 Lekker water Farm 101 – Portion 2	53.96	C06600000000010100002
		Farm 104 Coetzees Fontein Farm 104 – Portion 5	650.37	C06600000000010400005
Copies of deeds of all affected farm portions	Submitted with application form			

Description	
Photos of areas that give a visual perspective of all parts of the site	Volume II: Visual Impact Assessment Figure 2-8
Photographs from sensitive visual receptors (tourism routes, tourism facilities, etc.)	Volume II: Visual Impact Assessment Figure 2-8
Type of technology	Onshore Wind Turbine electricity generators
Structure height (Tip Height)	Between 125 m and 200 m
Surface area to be covered (including associated infrastructure such as roads)	Typically in wind energy facilities, the amount of surface area covered by turbines and associated infrastructure such as roads is less than 1% of the total site. The footprint of the facility is estimated at 30.65 ha.
Structure orientation	Conventional three bladed horizontal axis wind turbine generator mounted on a single vertical tower structure.
Laydown area dimensions (Construction period and Operation)	Permanent laydown area and the temporary construction laydown area will both be approximately up to 1 hectare each.
Generation capacity of the facility as a whole at delivery points	17 Turbines (T1-T17) x Maximum of 5 MW per turbine = 85MW Maximum Generation Capacity

Table B: DEA Information Requirements – WEF Technical Details

Component	Description/Dimensions
Location of the site	20 km west of Somerset East, Eastern Cape
Facility Area	The Proposed Development Site is approximately 10 000 hectares. This is the total area covered, in which all six components will be located. The actual infrastructure footprint will be around 1% of this for the Highlands North WEF.
Number of Turbines	Up to 17
Site Access	Access A: 32°41'20.48"S; 25°21'31.00"E (Main Access) Access B: 32°41'23.39"S; 25°21'54.61"E Access C: 32°41'39.92"S; 25°23'16.19"E Figure 7.2: Highlands North WEF Development Plan
Hub Height from ground level	up to 135 m
Blade Length	up to 75 m

Component	Description/Dimensions
Rotor Diameter	up to 150 m
Area occupied by inverter transformer stations/substations	1.1 hectares
Capacity of on-site substation	66/132 kV
Area occupied by both permanent and construction laydown areas	1 hectare permanent laydown area 1 hectare construction laydown area
Operations and maintenance buildings (O&M building) with parking area	200 m x 200 m
Length of internal roads	approximately 50 km
Width of internal roads	12 m (6 m wide road surface plus 3 m on each side for road reserve and drainage)
Proximity to grid connection	On the northern part of the site, where existing 132 kV and 66 kV overhead powerlines are located. The WEF will connect into existing Eskom transmission lines located within the proposed development site.
Height of fencing	Up to 3 metres high
Type of fencing	Stock proof palisade / diamond mesh

Table C: DEA Information Requirements - Site Maps and GIS Information

Site Maps and GIS Information	Section of this Report
All maps/information layers are provided in ESRI Shapefile format.	
All affected farm portions must be indicated.	Figure 7.2 Highlands North WEF Development Plan
The exact site of the application must be indicated (the areas that will be occupied by the application).	Figure 1.1 Site Location Figure 7.1 Highlands WEFs Development Plan Figure 7.2 Highlands North WEF Development Plan
A *status quo* map/layer must be provided that includes the following: Current use of land on the site including:	
Buildings and other structures	Figure 8.3 Land Use
Agricultural fields	Figure 8.2 Land Types and Agricultural Sensitivity
Grazing areas	Figure 8.3 Land Use
Natural vegetation areas (natural veld not cultivated for the preceding 10 years) with an indication of the vegetation quality as well as fine scale mapping in respect of Critical Biodiversity Areas and Ecological Support Areas	Figure 8.3 Land Use Figure 10.1 Vegetation Types Figure 10.2 Critical Biodiversity Areas
Critically endangered and endangered vegetation areas that occur on the site	Figure 10.3 Ecological Sensitivity

Site Maps and GIS Information	Section of this Report
Bare areas which may be susceptible to soil erosion	No specific bare areas have been identified. During construction phase, vegetation removal will be confined to the smallest possible footprint, runoff will be controlled and site-specific measures will be devised for any potentially high risk areas.
Cultural historical sites and elements	Figure 20.1 Environmental Sensitivity
Rivers, streams and water courses	Figure 9.4 Watercourses
Ridgelines and 20 m continuous contours with height references in the GIS database	Figure 8.1 Slope Analysis Map
Fountains, boreholes, dams (in-stream as well as off-stream) and reservoirs	Figure 9.4 Watercourses within and adjacent to study area
High potential agricultural areas as defined by the Department of Agriculture, Forestry and Fisheries	Figure 8.2 Land types and agricultural sensitivity Figure 8.3 Land Use
Buffer zones (also where it is dictated by elements outside the site): **500 m from any irrigated agricultural land** **1 km from residential areas**	Figure 8.2 Land types and Agricultural Sensitivity Figure 8.3 Land Use Figure 20.1 Environmental Sensitivity
Indicate isolated residential, tourism facilities on or within 1 km of the site	Figure 8.3 Land Use Figure 13.1 Noise Sensitive Developments Figure 15.3 Protected Environments, Cultural Landscapes, Farmsteads with Buffers
A slope analysis map/layer that include the following slope ranges: **Less than 8% slope (preferred areas for turbines and infrastructure)** **Between 8% and 12% slope (potentially sensitive to turbines and infrastructure) Between 12%and 14% slope (highly sensitive to turbines and infrastructure)** **Steeper than 18% slope (unsuitable for turbines and infrastructure)**	Figure 8.1 Slope Analysis Map
A map/layer that indicate locations of birds and bats including roosting and foraging areas	Figure 11.1 Avifaunal Sensitivity Figure 12.1 Bat Sensitivity

Site Maps and GIS Information	Section of this Report
A site development proposal map(s)/layer(s) that indicate: **Turbine positions** **Foundation footprint** **Permanent laydown area footprint** **Construction period laydown footprint** **Internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible).**	Figure 7.2 Highlands North WEF Development Plan
River, stream and water crossing of roads and cables indicating the type of bridging structures that will be used.	Figure 7.2 Highlands North WEF Development Plan
Substation(s) and/or transformer(s) sites including their entire footprint.	Figure 7.2 Highlands North WEF Development Plan
Cable routes and trench dimensions (where they are not along internal roads) Connection routes to the distribution/transmission network (the connection must form part of the EIA even if the construction and maintenance thereof will be done by another entity such as ESKOM).	Figure 7.2 Highlands North WEF Development Plan
Cut and fill areas at turbine sites along roads and at substation/transformer sites indicating the expected volume of each cut and fill	Location of turbine foundations, substation, hardstanding and laydown areas have been chosen on flat positions as much as possible (Figure 7.2 Highlands North WEF Development Plan), to minimise cut and fill required. Volumes to be determined prior to construction.
Borrow pits	No borrow pits on site. Licenced borrow pits will be used to source material.
Spoil heaps (temporary for topsoil and subsoil and permanently for excess material) Buildings including accommodation	Temporary and permanent spoil heaps will be kept within demarcated construction areas, and monitored by the ECO during the construction phase.

Table D: DEA Information requirements: Regional Map and GIS information

Regional Map and GIS information	Section of this report
roads including their types (tarred or gravel) and category (national, provincial, local or private)	Volume III: Figure A: Regional Map
Railway lines and stations	Volume III: Figure A: Regional Map
Industrial areas	Volume III: Figure A: Regional Map
Harbours and airports	Volume III: Figure A: Regional Map

Electricity transmission and distribution lines and substations	Volume III: Figure A: Regional Map
Pipelines	Volume III: Figure A: Regional Map
Waters sources to be utilised during the construction and operational phases	Volume III: Figure A: Regional Map
A visibility assessment of the areas from where the facility will be visible	Volume III: Figure B: Highlands North Viewshed
Critical Biodiversity Areas and Ecological Support Areas	Volume III: Figure A: Regional Map Volume I: Figure 10.2: CBAs and NPAES
Critically Endangered and Endangered vegetation areas	Volume I: Figure 10.3: Ecological Sensitivity
Agricultural fields	Volume III: Figure A: Regional Map Volume I: Figure 8.3: Land Use
Irrigated areas	Volume III: Figure A: Regional Map Volume I: Figure 8.3: Land Use
An indication of new road or changes and upgrades that must be done to existing roads in order to get equipment onto the site including cut and fill areas and crossings of rivers and streams	This will only be determined, if the project is awarded preferred bidder status and a detailed transportation plan is produced.

Table E: Development Area Geographic Coordinates (Figure 7.1)

Reference Point	Latitude (Decimal Degrees)	Longitude (Decimal Degrees
1	25.39613	-32.69624
2	25.37343	-32.69093
3	25.34982	-32.68729
4	25.34892	-32.69057
5	25.34621	-32.69213
6	25.34408	-32.69862
7	25.34638	-32.70354
8	25.34055	-32.70321
9	25.33792	-32.70740
10	25.33324	-32.70855
11	25.32643	-32.70683
12	25.32084	-32.70748
13	25.31830	-32.71274
14	25.31575	-32.71397
15	25.31222	-32.71060
16	25.30763	-32.71044
17	25.30738	-32.71446
18	25.30410	-32.71298
19	25.30130	-32.71561
20	25.30122	-32.71857
21	25.30763	-32.72111

22	25.31140	-32.72768
23	25.31096	-32.73052
24	25.31415	-32.72959
25	25.32254	-32.73498
26	25.30687	-32.74448
27	25.32563	-32.75341
28	25.31789	-32.76456
29	25.30702	-32.78528
30	25.30836	-32.78599
31	25.30588	-32.79036
32	25.30936	-32.79328
33	25.30821	-32.79712
34	25.32270	-32.80643
35	25.32301	-32.80811
36	25.33561	-32.80347
37	25.34185	-32.80489
38	25.33491	-32.82131
39	25.34509	-32.82525
40	25.35119	-32.81378
41	25.38563	-32.82254
42	25.38810	-32.81792
43	25.38892	-32.78231
44	25.38418	-32.76744
45	25.38659	-32.76268
46	25.36601	-32.74624
47	25.36775	-32.74240
48	25.37047	-32.74411
49	25.38978	-32.74582
50	25.39380	-32.73799
51	25.39823	-32.73964
52	25.40114	-32.73396
53	25.38235	-32.72664

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1 INTRODUCTION

WKN Windcurrent South Africa (Ltd) Pty ('the Developer') is proposing the Highlands Wind Energy Facilities (WEFs), and associated infrastructure including grid connection infrastructure (the Proposed Development), located 20 km from the town of Somerset East in the Eastern Cape Province. The area of interest for development within the affected land parcels is approximately 9000 hectares (The Proposed Development Area), and falls entirely within the Cookhouse Renewable Energy Development Zone (REDZ) (Figure 1.1). The Proposed Development aims to generate and produce electricity from renewable wind energy sources in order to supply electricity into the national grid by connecting to an existing Eskom transmission line within the Proposed Development Area.

Arcus Consultancy Services South Africa (Ltd) Pty ('Arcus') has been appointed to act as the independent environmental impact assessment practitioner (EAP) to undertake the environmental impact assessment (EIA) process for Environmental Authorisation under Chapter 5 of the National Environmental Management Act, 1998 (Act 107 of 1998 – NEMA) as amended, for the Proposed Development.

For the purpose of obtaining Environmental Authorisation (EA), and bidding requirements in the Department of Energy's Renewable Energy Independent Power Producers Procurement Programme (REIPPPP), the project has been split into three phases: North, Central and South. A Special Purpose Vehicle (SPV) has been set up for each of the three phases. Each phase will consist of two applications: one for the wind energy facility and one for the respective grid connection. The proposed Development therefore consists of six components and six separate applications for EA:

- Highlands North Wind Energy Facility (RF) (PTY) Ltd:
  - **The Highlands North WEF (up to 85 MW) consisting of up to 17 turbines with a generating capacity of up to 5 MW each (The Proposed Project),**
  - Electrical Grid Connection and Associated Infrastructure for Highlands North WEF;
- Highlands Central Wind Energy Facility (RF) (PTY) Ltd:
  - The Highlands Central WEF (up to 70 MW) : up to 14 turbines with a generating capacity of up to 5 MW each
  - Electrical Grid Connection and Associated Infrastructure for Highlands Central WEF;
- Highlands South Wind Energy Facility (RF) (PTY) Ltd:
  - The Highlands South WEF (up to 90 MW): up to 18 turbines with a generating capacity of up to 5 MW each;
  - Electrical Grid Connection and Associated Infrastructure for Highlands South WEF.

This report pertains to the **Highlands North WEF (up to 85 MW)** consisting of up to 17 turbines with a generating capacity of up to 5 MW each (The Proposed Project).

Should the Proposed Development be bid in the REIPPPP two submissions will be made: The Highlands North WEF will be combined with the Highlands Central WEF or be bid on its own, with the Highlands Central WEF being combined with Highlands South WEF. Due to these uncertainties the specialist studies have described the baseline environment of the entire Proposed Development Site as the affected environment. The impact assessments however assess the Proposed Project individually, as well as cumulatively.

On 16 February 2018, the Minister of Environmental Affairs promulgated new regulations in terms of Chapter 5 of the NEMA, Government Notices (GN) No. R. 114 in Government Gazette No. 41445 of 16 February 2018. These state that applications for environmental authorisation for large scale wind energy facilities, when such facilities trigger activity 1 of

GN No.325 (Listing Notice 2), and where the entire proposed facility is to occur in a REDZ must follow the basic assessment procedure contemplated in Regulation 19 and 20 of the EIA Regulations 2014, as amended, in order to obtain environmental authorisations, as required, in terms of the Act. Further, the timeframe for decision-making as contained in the EIA Regulations, 2014, as amended, for the purposes of the applications for environmental authorisation is 57 days.

Therefore, a Basic Assessment (BA) process will be followed for the application for environmental authorisation for the Highlands North WEF.

1.1 Purpose and Structure of this Report

The purpose of this Basic Assessment (BA) Report is to present the environmental impact assessment process undertaken on the preferred alternative for the proposed development. The preferred site, layout, and technical specifications were assessed by the specialists and their findings and assessment are collated in this BA report. This BA report will provide sufficient information for the competent authority to make an informed decision on the proposed development. The report further addresses comments received during the public participation process.

The BA Report is set out in three volumes:

Volume I: BA Report

Volume II: Specialist Reports

Volume III: Comment & Response Report

Table 1.4: Structure of this Report

Section	Title	Containing
1	Introduction	Purpose and Structure of the BA Report; Overview of the BA Process; the Applicant; The EAP; The Specialists; Assumptions and Limitations
2	Environmental Legal Framework	National Environmental Legislation, Additional relevant legislation, International Conventions and Treaties, Policies and Guidelines.
3	Methodology	Feasibility Assessment; Specialist study assessments; Assessment technique for the BA; Cumulative Impact Assessment
4	Public Participation	Key Stakeholders; Initial Notifications; BA Process Public Participation; Summary of Issues Raised
5	Need and Desirability	Description of the Need and Desirability of the Proposed Development.
6	Assessment of Alternatives	A Comparative Analysis of Site, Technology, Location, Design and the No-Go Alternatives.
7	The Preferred Alternative	Description of the Proposed Project
8	Geology, Soils and Agriculture	Baseline Description of the affected Environment; Description and Assessment of Potential Impacts; Conclusion
9	Freshwater and Wetlands	Baseline Description of the affected Environment; Description and Assessment of Potential Impacts; Conclusion

Section	Title	Containing
10	Flora and Terrestrial Fauna	Baseline Description of the affected Environment; Description and Assessment of Potential Impacts; Conclusion
11	Avifauna	Baseline Description of the affected Environment; Description and Assessment of Potential Impacts; Conclusion
12	Bats	Baseline Description of the affected Environment; Description and Assessment of Potential Impacts; Conclusion
13	Noise	Baseline Description of the affected Environment; Description and Assessment of Potential Impacts; Conclusion
14	Heritage, Archaeology and Palaeontology	Baseline Description of the affected Environment; Description and Assessment of Potential Impacts; Conclusion
15	Visual	Baseline Description of the affected Environment; Description and Assessment of Potential Impacts; Conclusion
16	Social	Baseline Description of the affected Environment; Description and Assessment of Potential Impacts; Conclusion
17	Traffic and Transportation	Baseline Description of the affected Environment; Description and Assessment of Potential Impacts; Conclusion
18	Cumulative Impacts	Specialists assessments of cumulative impacts with a minimum of 35 km from the site
19	Summary of Findings	A summary of the Specialists Impact Assessments
20	Impact Statement	The EAPs Impact Statement and Conditions to be included in the EA
Appendix A	EAP Declaration of Independence and CV	Commissioner of Oaths and CV of the Lead EAP
Appendix B	Environmental Management Programme	The Environmental Management Programme, detailing the Proposed Mitigation Measures, and the Roles and Responsibility of Management during the Construction, Operation and Decommissioning of the Proposed Development.
Appendix C	Water Use License Authorisation	Evidence of application for Water Use License Authorisation

1.2 Overview of the Basic Assessment Process

A Basic Assessment (BA) process is ultimately a decision-making process with the specific aim of selecting a development option that will provide the most benefit, and cause the least environmental impact. The BA process assesses the potential impact of the identified activities which may have a detrimental effect on the environment, and which would therefore require Environmental Authorisation prior to commencement.

An independent Environmental Assessment Practitioner (EAP) and specific specialists identify potential negative and positive impacts that could arise as a result of the proposed project and mitigation measures are recommended which would allow for the avoidance or reduction of negative impacts or which may enhance positive impacts.

The key phases of this BA process are described below:

- **Initial Notification and Call to Register as I&APs through the following:** Advertisements, site notices, posters, letters to landowners and pre-identified I&APs. The aim of this step is to inform people of the proposed activity and to encourage initial comment and feedback.
- **Basic Assessment Process: Collation of initial comments and specialist investigations into a concise report (this document) which provides feedback on the following:**
  - Nature of the activity;
  - Description of the receiving environment;
  - Identification of potential feasible alternatives;
  - Identification of potential positive and negative impacts; and
  - Identification of knowledge gaps.

This Basic Assessment process has involved an initial feasibility investigation by the specialists of the Proposed Development Site, which identified areas suitable for development as well as environmental constraints, which fed into the design of the proposed facility layout for assessment. The results of these assessments further informed the Final Mitigated Layout submitted for approval.

The identified impacts have been assessed and relevant management and mitigation measures have been included in an Environmental Management Programme (EMPr). The findings are included in this Report.

- **Ongoing Public Consultation:** Throughout the process, registered I&APs are consulted. This involvement was initiated through the dissemination of information by means of advertisements, notification letters, posters and site notices. Opportunities are provided for Interested and Affected Parties (I&APs) to review the Draft and Final Basic Assessment Reports.

Following the completion of the relevant processes described above and the submission of documentation to the competent authority (DEA), the DEA will review the application and issue a decision (Environmental Authorisation). I&APs will be informed of the decision and their rights to appeal.

1.3 The Developer

WKN-Windcurrent South Africa (Pty) Ltd (WKN-WC) is a South African registered company dedicated to the development of wind energy projects to supply energy to the national grid.

In accordance with the REIPPP bid requirements WKN-WC has established Highlands North Wind Energy Facility (RF) (PTY) Ltd as a Special Purpose Vehicle (SPV) that will be used to own all the authorisations, contracts, permits and licenses required to lawfully build and operate the proposed Highlands North Wind Energy Facility.

1.4 The Environmental Assessment Practitioner

The co-ordination and management of this EIA process is being conducted by Arcus Consultancy Services South Africa (Pty) Ltd ('Arcus') with the lead EAP being Ashlin Bodasing. Refer to Appendix A for the EAP's Declaration of Interest and *Curriculum Vita*.

Ashlin Bodasing

Qualifications	Bachelor of Social Science (Geography and Environmental Management)
Experience in Years	13 years
Experience	Ashlin Bodasing is the Technical Director at Arcus, located in Cape Town. Having obtained her Bachelor of Social Science Degree from the University of Kwa-Zulu Natal; she has over 13 years' experience in the environmental consulting industry in southern Africa. She has gained extensive experience in the field of Integrated Environmental Management, environmental impact assessments and public participation. She has also been actively involved in a number of industrial and infrastructural projects, including electricity power lines and substations; road and water infrastructure upgrades and the installation of telecommunication equipment and as well green field coal mines, as well as renewable energy facilities, both wind and solar. Ashlin has major project experience in the development of Environmental Impact Assessments, Environmental Management Plans and the monitoring of construction activities. Her areas of expertise include project management, environmental scoping and impact assessments, environmental management plans, environmental compliance monitoring and environmental feasibility studies. Experience also includes International Finance Corporation Performance Standards and World Bank Environmental Guidelines environmental reviews. She has worked in Mozambique, Botswana, Lesotho and Zimbabwe.

Anja Albertyn

Qualifications	Master of Science (Zoology)
Experience in Years	9 years
Experience	Anja Albertyn has worked at Arcus since November 2013. She is registered with SACNASP as a professional natural scientist in the field of ecological science. She has worked as a consultant since February 2009, when she oversaw a large-scale ballast water treatment testing project for an environmental consultancy in Cape Town for over two years. Since then she has worked on over 22 renewable energy development projects. Anja is involved in all aspects of environmental impact assessments, avifaunal specialist studies, and also functions as Arcus' GIS specialist in Cape Town. She holds a Master of Science in Zoology (Ornithology) from the Percy FitzPatrick Institute of African Ornithology at the University of Cape Town. She is currently in the position of Avifauna Specialist and Environmental Assessment Practitioner.

Arcus is a specialist environmental consultancy providing environmental services to the renewable energy market. Arcus has advised on over 150 renewable energy projects in the United Kingdom and South Africa, with environmental management and in-house specialist services.

1.5 The Specialists

The EAPs have assembled a team of technical specialists to undertake studies for the proposed Highlands Wind Energy Facilities.

The specialists' fields of investigation are listed in below. The areas of investigation have been identified as relevant to the proposed development as per the experience of the EAP, consultation with the listed specialists who are familiar with the locality and nature of development.

These specialists have been selected based on their experience in their specialist field, of renewable energy developments and the locality of the proposed development.

Name	Organisation	Role
Andrew Pearson	Arcus Consultancy Services	Bird Impact Assessment and Monitoring
Jon Smallie	Wildskies	External review of Bird IA

Name	Organisation	Role
Jonathan Aronson	Arcus Consultancy Services	Bat Impact Assessment and Monitoring
Stephanie Dippenaar	Bird & Bats Unlimited	External review of Bat IA
Michael Reid	Arcus Consultancy Services	Noise Impact Assessment
Morné de Jager	Enviro Acoustics Research	External reviewer of Noise IA
Simon Todd	3 Foxes Consulting	Terrestrial Ecological Impact Assessment (Flora and Fauna)
Dr Jayson Orton	ASHA Consulting	Cultural Heritage and Archaeology Impact Assessment
Dr John Almond	via ASHA Consulting	Palaeontology Impact Assessment
Dr Brian Colloty	Scherman Colloty and Associates	Freshwater and Wetlands Impact Assessment
Quinton Lawson & Bernard Oberholzer	Quinton Lawson & Bernard Oberholzer Architects	Landscape and Visual Impact Assessment
Johann Lanz	Johann Lanz Soil Scientist	Geology, Soils and Agriculture Impact Assessment
Tony Barbour	Tony Barbour Environmental Consulting and Research	Socio-Economic Impact Assessment
Stephen Fautley	TechSO	Traffic Impact Assessment

1.6 Assumptions and Limitations

The following assumptions and limitations are applicable to this study:

- It is assumed that the site investigated and assessed for the proposed WEF is technically suitable for such development.
- It is assumed that the connection to the national grid via the existing Eskom's Transmission Line is technically adequate, feasible and viable.
- Power generation alternatives were not investigated due to the fact that this application is project specific i.e. electricity generation from wind resources.
- The assumption is made that the information on which this report is based (specialist studies and project information, as well as existing information) is accurate and correct at the time of writing this report.
- It is assumed that the recommendations derived from this study would be included in all tender documentation and the EMP for implementation.
- This study does not analyse the impact of borrow pits. Contractors would be expected to provide services with all necessary approvals in place.

The assumptions and limitations of each specialist study presented in Volume II of this report, are noted for this BA Report.

2 ENVIRONMENTAL LEGAL FRAMEWORK

2.1 The National Environment Management Act, 1998 (Act No 107 of 1998)

Section 2 of the National Environment Management Act, 1998 (NEMA) as amended, lists environmental principles that are to be applied by all organs of state regarding proposals that may significantly affect the environment. Included amongst the key principles is the principle that all development must be socially, economically and environmentally sustainable, environmental management must place people and their needs at the forefront of its concern, to serve their physical, psychological, developmental, cultural and social interests equitably.

NEMA also provides for the participation of I&APs and it stipulates that decisions must take the interests, needs and values of all I&APs into account.

Chapter 5 of NEMA outlines the general objectives and implementation of Integrated Environmental Management (IEM), the latter providing a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals. Section 24 provides a framework for the granting of environmental authorisations.

In order to give effect to the general objectives of IEM, the potential impacts on the environment of listed activities must be considered, investigated, assessed and reported to the competent authority. Section 24(4) outlines the minimum requirements for procedures for the investigation, assessment and communication of the potential impact of activities.

On 7 April 2017 the Minister of Environmental Affairs published amendments to the NEMA: EIA Regulations of 2014 (GNR 326) and the three Listing Notices (GNR 324, 325 and 327) in Government Gazette No. 40772. This amendment was promulgated under the NEMA: EIA Regulations 2014 published by the Minister of Environmental Affairs in Government Gazette No. 38282 on 8 December 2014. The 2014 EIA Regulations in turn were promulgated under the requirements of Chapter 5 of the NEMA.

The DEA is the competent authority for all renewable energy proposals, as NEMA states that:

"24C. (2) The Minister must be identified as the competent authority in terms of subsection (1) if the activity- (a) has implications for international environmental commitments or Relations; ….(c) has a development footprint that falls within the boundaries of more than one province or traverses international boundaries."

This project has implications for international environmental commitments that South Africa has made in terms of climate change.

Environmental authorisation, which may be granted subject to conditions, will only be considered upon compliance with GNR982, as amended by GNR326 of 7 April 2017.

On 16 February 2018, the Minister of Environmental Affairs promulgated new regulations in terms of Chapter 5 of the NEMA, Government Notices (GN) No. R. 114 in Government Gazette No. 41445 of 16 February 2018. These state that applications for environmental authorisation for large scale wind energy facilities, when such facilities trigger activity 1 of GN No.325 (Listing Notice 2), and where the entire proposed facility is to occur in a REDZ must follow the basic assessment procedure contemplated in Regulation 19 and 20 of the EIA Regulations 2014, as amended, in order to obtain environmental authorisations, as required, in terms of the Act. Further, the timeframe for decision-making as contained in the EIA Regulations, 2014, as amended, for the purposes of the applications for environmental authorisation is 57 days.

As the proposed development occurs within a REDZs and triggers Activity 1 of GN R325 a Basic Assessment process is to be followed for this application.

Any Environmental Authorisation obtained from the DEA applies only to those specific listed activities for which the application was made. To ensure that all Listed Activities that could potentially be applicable to this proposal are covered by the Environmental Authorisation, a precautionary approach is followed when identifying listed activities, that is, if an activity could potentially be part of the proposed development, it is listed.

The Listed Activities applicable to this proposed development are presented in Table 2.1 below. All potential impacts associated with these Listed Activities have been considered and adequately assessed in this BA process.

Table 2.1: NEMA Listed Activities in Relation to the Proposed Development

Listing Notices 1 - 3 07 April 2017	Listed Activity	Description of project activity that triggers listed activity
Listing Notice 1 GN R 327 Activity 11	*The development of facilities or infrastructure for the transmission and distribution of electricity— (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.*	Medium voltage powerlines will be installed to transfer electricity from the turbines to an on-site substation. Cables will be installed underground where feasible.
Listing Notice 1 GN R 327 Activity 12	*The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs (a) within a watercourse (c) if no development setback exists within 32 m of a watercourse, measured from the edge of a watercourse*	Infrastructure will be required at 5 water-crossings and within 32 metres of a watercourse that covers an area of more than 100 m. Figure 7.2 shows the location of the water crossings applied for.
Listing Notice 1 GN R 327 Activity 19	*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;*	The construction of the WEF includes the excavation of soil in watercourses/drainage line areas, and infilling/deposition may exceed 5 cubic metres and in some instances may exceed 10 cubic metres. Figure 7.2 shows the location of water crossings. The construction of associated infrastructure, such as access tracks crossing watercourses will require excavation and/or infilling of watercourse areas.
Listing Notice 1 GN R 327 Activity 24	*The development of a road— (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;*	Access roads of 6 - 12 m will be required between turbines.
Listing Notice 1 GN R 327 Activity 27	*The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation*	The infrastructure and building area of the proposed WEF will require clearing of at least 1 hectare of indigenous vegetation in total.
Listing Notice 1 GN R 327 Activity 48	*The expansion of— (i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; where such expansion occurs— (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;*	Existing bridges over watercourses will need to be expanded or widened.
Listing Notice 1 GN R 327 Activity 56	*The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where*	Existing farm access roads need to be widened or lengthened. These roads currently have no road reserve and will be wider than 8 m in some areas.

Listing Notices 1 - 3 07 April 2017	Listed Activity	Description of project activity that triggers listed activity
	widening or lengthening occur inside urban areas.	
Listing Notice 2 GN R 325 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.*	The WEF will consist of up to 17 turbines for electricity generation with a combined capacity of more than 20 MW.
Listing Notice 2 GN R 325 Activity 6	*The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.*	The construction of the WEF will require a Water Use License in terms of the National Water Act, 1998 (Act No. 36 of 1998). Proof of application is being submitted with the Final BAR.
Listing Notice 3 GN R 324 Activity 4	*The development of a road wider than 4 metres with a reserve less than 13,5 metres a. Eastern Cape i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (ee) Critical Biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	Internal and external access roads will be constructed, which are wider than 4 m. The site falls outside of an urban area and parts of the site fall within a NPAESF and a Tier 2 CBA.
Listing Notice 3 GN R324 Activity 10	*The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. a. Eastern Cape i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (ee) Critical Biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	Fuel storage during construction will exceed 30 m^3. The proposed on-site substation will require the use of transformer oils/other hazardous substances during the operational phase.
Listing Notice 3 GN R324 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. a. Eastern Cape ii. Within critical biodiversity areas identified in bioregional plans;*	The proposed development will require the clearance of natural vegetation in excess of 300 m^2 in areas of natural vegetation. Parts of the site fall within a Tier 2 Critical Biodiversity Area.

Listing Notices 1 - 3 07 April 2017	Listed Activity	Description of project activity that triggers listed activity
Listing Notice 3 **GN R324** **Activity 14**	*The development of—* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(c) if no development setback has* *been adopted, within 32 metres of a* *watercourse, measured from the edge* *of a watercourse;* *a. Eastern Cape* *i. Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ff) Critical biodiversity areas or ecosystem service areas as identified in* *systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	Bridges and associated road infrastructure will be constructed within 32 m of watercourse(s) at the applied for water crossings. The site lies outside of an urban area and a portion of the site falls with an NPAESF area and a Tier 2 Critical Biodiversity Area.
Listing Notice 3 **GN R324** **Activity 18**	*The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *a. Eastern Cape* *i. Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ee) Critical biodiversity areas or ecosystem service areas as identified in* *systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	Existing farm roads will need to be widened or lengthened. The site lies outside urban areas, and a portion of the site falls with an NPAESF area and a Tier 2 Critical Biodiversity Area.
Listing Notice 3 **GN R324** **Activity 23**	*The expansion of—* *(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;* *where such expansion occurs—* *(a) within a watercourse;* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *a. Eastern Cape* *i. Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the*	The construction of the WEF will include the expansion of existing bridges by more than 10 m^2 over watercourses. The site lies outside of any urban area, and parts of the site fall within a Critical Biodiversity Area.

Listing Notices 1 - 3 07 April 2017	Listed Activity	Description of project activity that triggers listed activity
	competent authority or in bioregional plans;	

2.2 The National Heritage Resources Act, 1999 (Act No 25 of 1999)

Section 38 (1) of the National Heritage Resources Act, 1999 (NHRA) lists development activities that would require authorisation by the responsible heritage resources authority. Activities considered applicable to the proposed project include the following:

"*(a) The construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;*
(c) any development or other activity which will change the character of a site; and
(i) exceeding 5000 m² in extent."

The NHRA requires that a person intending to undertake such an activity must notify the relevant national and provincial heritage authorities at the earliest stages of initiating such a development.

The relevant heritage authority would then in turn, notify the person whether a Heritage Impact Assessment Report should be submitted. According to Section 38(8) of the NHRA, a separate report would not be necessary if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act, 1989 (No. 73 of 1989) (ECA) (now replaced by NEMA) or any other applicable legislation. The decision-making authority must ensure that the heritage evaluation fulfils the requirements of the NHRA and take into account any comments and recommendations made by the relevant heritage resources authority. As such, a Heritage Impact Assessment (HIA) will form part of this Basic Assessment process.

In South Africa, the law is directed towards the protection of human made heritage, although places and objects of scientific importance are covered. The NHRA also protects intangible heritage such as traditional activities, oral histories and places where significant events happened. Generally protected heritage, which must be considered in any heritage assessment, includes:

- *Any place of cultural significance (described below);*
- *Buildings and structures (greater than 60 years of age);*
- *Archaeological sites (greater than 100 years of age);*
- *Palaeontological sites and specimens;*
- *Shipwrecks and aircraft wrecks; and*
- *Graves and grave yards.*

Section 3(3) of the NHRA defines the cultural significance of a place or objects with regard to the following criteria:

a. *Its importance in the community or pattern of South Africa's history;*
b. *Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;*
c. *Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;*
d. *Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;*
e. *Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;*

f. Its importance in demonstrating a high degree of creative or technical achievement at a particular period;
g. Its strong or special association with a particular community or cultural group for social cultural or spiritual reasons;
h. Its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
i. sites of significance relating to the history of slavery in South Africa.

While not specifically mentioned in the NHRA, Scenic Routes are recognised as a category of heritage resources which requires grading as the Act protects area of aesthetic significance (clause "e" above).

The heritage impact assessment report are being submitted to the SAHRA for comment.

2.3 Subdivision of Agricultural Land Act, 1970 (Act No. 70 of 1970)

In terms of the Subdivision of Agricultural Land Act, 1970, any application for change of land use must be approved by the Minister of Agriculture.

2.4 Conservation of Agricultural Resources, 1983 (Act No. 43 of 1983)

The Conservation of Agricultural Resources Act (CARA), 1983 states that no degradation of natural land is permitted. The Act requires the protection of land against soil erosion and the prevention of water logging and salinization of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and watercourses are also addressed.

2.5 The Environment Conservation Act, 1989 (Act No.73 of 1989), the National Noise Control Regulations: GN R154 of 1992

The Environment Conservation Act, 1989 (ECA) allows the Minister of Environmental Affairs and Tourism ("now the Minister of Environmental Affairs") to make regulations regarding noise, amongst other concerns. The Minister has made noise control regulations under the ECA.

In terms of section 25 of the ECA, the national noise-control regulations (NCR) were promulgated (GN R154 in *Government Gazette* No. 13717 dated 10 January 1992). The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.

Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996 legislative responsibility for administering the NCR was devolved to provincial and local authorities.

These regulations define "**disturbing noise**" as:

"*Noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more*".

These Regulations prohibits anyone from causing a disturbing noise.

No provincial noise control regulations have been promulgated in the Eastern Cape Province and thus the National Noise Control Regulations are relevant here.

2.6 National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)

Section 34 of the Air Quality Act, 2004 (AQA) makes provision for:

(1) The Minister to prescribe essential national noise standards -

(a)For the control of noise, either in general or by specified machinery or activities or in specified places or areas; or

(b)For determining –

(i) a definition of noise; and

(ii) The maximum levels of noise.

(2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.

This section of the Act is in force, but no such standards have yet been promulgated.

An atmospheric emission license issued in terms of Section 22 may contain conditions in respect of noise. This however will not be relevant to the WEF.

2.6.1 National Dust Control Regulations, 2013

The National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004), makes provision for national dust control regulations. These regulations prescribe dust fall standards for residential and non-residential areas. These Regulations also provide for dust monitoring, control and reporting.

The acceptable dust fall out rates are:

Restriction Area	Dust Fall (D) (mg/m^2/day, 30 day average)	Permitted Frequency of exceedance
Residential	D<600	Two within a year, not sequential months
Non- Residential	600 <D< 1200	Two within a year, not sequential months

2.7 National Water Act, 1998 (Act No. 36 of 1998)

The National Water Act, 1998 (NWA) provides for constitutional requirements including pollution prevention, ecological and resource conservation and sustainable utilisation. In terms of this Act, all water resources are the property of the State.

A water resource includes any watercourse, surface water, estuary or aquifer, and, where relevant, its bed and banks. A watercourse is interpreted as 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 that the Minister may declare to be a watercourse.

Relevant water uses for the proposed construction of the Highlands North WEF, which will require access roads over watercourses and drainage channels, in terms of Section 21 of the Act include, but are not limited to, the following:

Section 21(c): Impeding or diverting the flow of water in a watercourse; and
Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

GN 1199 of 18 December 2009 grants general authorisation for the above water uses based on certain conditions. It is also stipulates that these water uses must be registered with the responsible authority.

Pollution of river water is a contravention of the NWA. Chapter 3, Part 4 of the NWA deals with pollution prevention and in particular the situation where pollution of a water resource occurs or might occur as a result of activities on land. The person who owns, controls, occupies or uses the land in question is responsible for taking measures to prevent pollution of water resources.

Chapter 3, Part 5 of the NWA deals with pollution of water resources following an emergency incident, such as an accident involving the spilling of a harmful substance that finds or may find its way into a water resource. The responsibility for remedying the situation rests with the person responsible for the incident or the substance involved.

The aquatic assessment has determined that there will be 5 water crossings. Highlands North WEF (RF) (Pty) Ltd is applying for a Water Use License, and proof of the application process will be provided with the Final Basic Assessment Report.

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

Amendments to the Threatened or Protected Species (TOPS) list were published on 31 March 2015 in Government Gazette No. 38600 and Notice 256 of 2015. Certain bird species that occur on the site may be threatened or protected.

2.8.1 Alien and Invasive Species Regulations, 2014

The Act and Regulations set out various degrees of Invasive species (Plants, Insects, Birds, Animals, Fish and Water Plants) and requires that certain of those invasive species are documented and, in some cases, removed from properties in South Africa. This must happen before a property may be sold.

The Regulations list 4 categories of invasive species that must be managed, controlled or eradicated from areas where they may cause harm to the environment, or that are prohibited to be brought into South Africa.

2.9 Cape Nature and Environmental Conservation Ordinance No. 19 of 1974; and Nature and Environmental Conservation Regulations (1975)

These were developed to protect both animal and plant species within the Western Cape and Eastern Cape Province (excluding the former Ciskei and Transkei) and parts of the North West province (excluding the former Boputhatswana) which warrant protection. These may be species which are under threat or which are already considered to be endangered and species are listed in the relevant documents. The provincial environmental authorities are responsible for the issuing of permits in terms of this legislation.

2.10 Additional Relevant Legislation

The applicant must also comply with the provisions of other relevant national legislation. Additional relevant legislation that has informed the scope and content of this BA Report includes the following:

- Constitution of the Republic of South Africa, 1996 (Act No. 108, 1996);
- Aviation Act, 1962 (Act No. 74, 1962);
- National Environmental Management: Waste Act, 2008 (Act No. 59, 2008);
- National Forest Act, 1998 (Act No. 84, 1998);
- National Environmental Management: Protected Areas Act, 2003(Act No. 57, 2003);
- National Roads Act, 1998 (Act No. 7, 1998)
- Occupational Health and Safety Act, 1993 (Act No. 85 of 1993);
- National Veld and Forest Fire Bill of 10 July 1998;
- Fertiliser, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947;
- Astronomy Geographic Advantage Act, 2007 (Act No. 21 of 2007);
- Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); and
- Independent Communications Authority of South Africa Act, 2000 (Act No. 13 of 2000; as amended).

2.11 Conventions and Treaties

2.11.1 The Convention on Biological Diversity (CBD) (1993)

This is 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. Signatories have the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

The convention prescribes that signatories identify components of biological diversity important for 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 minimise 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.

2.11.2 The Ramsar Convention (1971)

The Convention on Wetlands, called the Ramsar Convention, as it was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975, is an intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. Under the three pillars of the convention the Contracting Parties commit to work towards the wise use of all their wetlands through national plans, policies and legislation, management actions and public education; designate suitable wetlands for their list of Wetlands of International Importance (the "Ramsar List") and ensure their effective management; and Cooperate internationally on transboundary wetlands, shared wetland systems, shared species, and development projects that may affect wetlands.

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

An intergovernmental treaty, concluded under the sponsorship 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*".

2.11.4 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 with 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. The assessment of the ecology and identification of sites and habitats for migratory waterbirds is required to coordinate efforts that ensure that networks of suitable habitats are maintained and investigate problems likely posed by human activities.

2.12 Policies and Guidelines

2.12.1 Environmental Impact Assessment Guidelines

Relevant guidelines and policies as applicable to the management of the EIA process and to this application have also been taken into account, as indicated below:

- IEM Guideline Series (Series 3): Stakeholder engagement (2002);
- IEM Guideline Series (Series 4): Specialist studies (2002);
- IEM Guideline Series (Series 5): Impact Significance (2002);
- IEM Guideline Series (Guideline 5): Companion to the EIA Regulations 2010 (October 2012);
- IEM Guideline Series (Series 7): Cumulative Effects Assessment (2002);
- IEM Guideline Series (Guideline 7): Public Participation in the EIA process (October 2012);
- IEM Guideline Series (Series 7): Alternatives in the EIA process (2002);
- IEM Guideline Series (Guideline 9): Draft guideline on need and desirability in terms of the EIA Regulations 2010 (October 2012);
- DEA (2017) Guideline on Need and Desirability, Department of Environmental Affairs (DEA) Pretoria, South Africa;
- IEM Guideline Series (Series 12): Environmental Management Plans (EMP) (2002); and
- IEM Guideline Series (Series 15): Environmental impact reporting (2002).

2.12.2 Noise Standards

2.12.2.1 SANS 10328

SANS 10328 defines procedures for environmental noise impact investigations and assessments at the various stages of an Environmental Impact Assessment.

According to the standard, there could be acoustical implications where a wind generator farm is to be established within 2 km of a noise-sensitive development.

2.12.2.2 SANS 10103

SANS 10103 provides guidance on assessing working and living environments with respect to acoustic comfort, excellence and possible annoyance by noise. It provides information on typical indoor and outdoor noise levels in various districts, of which the outdoor levels in rural districts are of relevance to this report

2.12.2.3 ETSU-R-97

In the UK, Guidance on the assessment of noise from wind turbines is provided by ETSU-R-97 *The Assessment and Rating of Noise from Wind Turbines*.

Both ambient noise and noise from wind turbines typically vary with wind speed. According to ETSU-R-97, wind farm noise assessments should therefore consider the site-specific relationship between wind speed and background noise, along with the particular noise emission characteristics of the proposed wind turbines.

2.12.2.4 The IOA Good Practice Guide

The Good Practice Guide (GPG) was published by the UK Institute of Acoustics (IOA) in May 2013 and has been endorsed by the UK Government as current industry good practice. The guide presents current good practice in the assessment of wind turbine developments at the various stages of the assessment process.

During the development of the GPG, a detailed study was undertaken of wind farm noise propagation and prediction methods used in a number of countries.

2.12.3 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 5: Stakeholder Engagement;
- Principle 6: Grievance Mechanism;
- Principle 7: Independent Review;
- Principle 8: Covenants;
- Principle 9: Independent Monitoring and Reporting; and
- Principle 10: Reporting and Transparency.

These principles, among various requirements, include a requirement for an assessment process and 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.

2.12.4 South African Wind Energy Facility Guidelines

The following guidelines are relevant to the proposed WEF and the potential impacts they may have on bats/avifauna and habitat that support bats/avifauna:

- South African Good Practise Guidelines for Surveying Bats in Wind Energy Facility Developments – Pre-Construction. Fourth Edition: 2016;
- South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (2014);
- Birds 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, 2015 (previous versions 2011 and 2012); and
- Verreaux's Eagle and Wind Farms: Guidelines for impact assessment, monitoring, and mitigation (March 2017)

2.13 Impact Assessment and Reporting

The primary objective of the basic assessment process is to present sufficient information to the competent authority (CA) and interested and affected parties (I&APs) on predicted impacts and associated mitigation measures required to avoid or mitigate negative impacts, as well as to improve or maximise the benefits of the project.

In terms of legal requirements, NEMA EIA Regulations regulate and prescribe the content of the BA Report and specify the type of supporting information that must accompany the submission of the report to the authorities. Table 2.2 shows how and where the legal requirements are addressed in this BA Report. Volume III of this BA Report contains the PPP undertaken to date. As the comments are received on the Draft BA Report these will be collated and included in the comments and response report.

The BA Report presents a summary of the findings and recommendations of all specialists.

As per the EIA Regulations 2014, as amended, "*the objective of the basic assessment process is to, through a consultative process-*

a) determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;

b) *identify the alternatives considered, including the activity, location and technology alternatives;*

c) *describe the need and desirability of the proposed alternatives;*

d) *through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine-*

   i. *the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and*

   ii. *the degree to which these impacts-*

      (aa) can be reversed;

      (bb) may cause irreplaceable loss of resources; and

      (cc) can be avoided, managed or mitigated; and

e) *Through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to-*

   i. *identify and motivate a preferred site, activity and technology alternative;*

   ii. *identify suitable measures to avoid, manage or mitigate identified impacts; and*

   iii. *identify residual risk that need to be managed or monitored.*

The above activities are completed through consultation with:

- The lead authorities involved in the decision-making for the BA application (in this case, the DEA);
- The public, I&APs and other relevant organisations to ensure that local issues are well understood; and
- The specialist team to ensure that technical issues are identified.

The existing environment within which a proposed development is to be located is investigated, through a review of relevant background literature and ground-truthing.

A primary objective is to present key stakeholders with the findings of the assessments, obtain and document feedback and address all issues raised.

Table 2.2: Legislative Requirements for Scope of Assessment and Content of Basic Assessment Reports

Appendix 1 Requirements NEMA, 1998 (Act No. 107 of 1998)	Location in BAR
details of- *(i) the EAP who prepared the report; and* *(ii) the expertise of the EAP, including a curriculum vitae;*	Section 1.4 Appendix A
the location of the activity, including- *(i) the 21 digit Surveyor General code of each cadastral land parcel;* *(ii) where available, the physical address and farm name;* *(iii) where the required information in items (i) and (ii) is not available, the co-ordinates of the boundary of the property or properties;*	Table A Figure 1.1 Figure 7.1 Figure 7.2 Table 7.1

Appendix 1 Requirements NEMA, 1998 (Act No. 107 of 1998)	Location in BAR
a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is- *(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or* *(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;*	Figure 7.1 Figure 7.2 Table 7.1
a description of the scope of the proposed activity, including- *(i) all listed and specified activities triggered and being applied for; and* *(ii) a description of the activities to be undertaken including associated structures and infrastructure;*	Table 2.1 Section 7
a description of the policy and legislative context within which the development is proposed including- *(i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and* *(ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools framework, and instruments;*	Section 2 Section 5
a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Section 5
a motivation for the preferred site, activity and technology alternative;	Section 6
a full description of the process followed to reach the proposed preferred alternative within the site, including- *(i) details of the alternatives considered;*	Section 6
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 4 Volume III
(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Section 4
(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 8-17
(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- *(aa) can be reversed;* *(bb) may cause irreplaceable loss of resources; and* *(cc) can be avoided, managed or mitigated;*	Section 8-18
(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	Section 3.3 Volume II: Specialist Reports
(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 8-18
(viii) the possible mitigation measures that could be applied and level of residual risk;	Section 8-18
(ix) the outcome of the site selection matrix;	Section 6

Appendix 1 Requirements NEMA, 1998 (Act No. 107 of 1998)	**Location in BAR**
(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and	Section 6
(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity;	Section 6 Section 7
a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including - *(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and* *(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;*	Section 8-18
an assessment of each identified potentially significant impact and risk, including- *(i) cumulative impacts;* *(ii) the nature, significance and consequences of the impact and risk;* *(iii) the extent and duration of the impact and risk;* *(iv) the probability of the impact and risk occurring;* *(v) the degree to which the impact and risk can be reversed;* *(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and* *(vii) the degree to which the impact and risk can be avoided, managed or mitigated;*	Section 8-18
where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report;	Section 19
an environmental impact statement which contains- *(i) a summary of the key findings of the environmental impact assessment;* *(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and* *(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;*	Section 19 Section 20 Figure 20.1
based on the assessment, and where applicable, impact management measures from specialist reports, the recording of proposed impact management outcomes, and the impact management outcomes for the development for inclusion in the EMPr;	Section 8-19 Appendix B: EMPr
any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section 20.1
a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 1.6 Volume II: Specialist Reports
a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Section 20
where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	Commencement of construction will occur within 10 years of authorisation and

Appendix 1 Requirements NEMA, 1998 (Act No. 107 of 1998)	Location in BAR
	conclude within 5 years of commencement. Post-construction monitoring requirements will be finalised within this period.
an undertaking under oath or affirmation by the EAP in relation to- *(i) the correctness of the information provided in the reports;* *(ii) the inclusion of comments and inputs from stakeholders and I&APs;* *(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and* *(iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties; and*	Appendix A
where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	n/a
any specific information that may be required by the competent authority; and	n/a
any other matters required in terms of section 24(4)(a) and (b) of the Act.	n/a

3 METHODOLOGY

3.1 Feasibility Assessment

WKN Windcurrent South Africa (Pty) Ltd appointed Arcus to conduct a Feasibility Study for the Highlands Wind Energy Facilities in 2017.

This feasibility assessment involved:

- Conducting site visits to confirm desktop reviews, where necessary;
- Adding environmental and planning designations (e.g., landscape, nature conservation, archaeology);
- Identifying other designations of relevance; e.g.; regional renewable targets;
- Identifying nearby windfarm proposals and status;
- Identifying key biophysical constraints and / opportunities and potential red flags;
- Identifying key socio-economic constraints and / opportunities and potential red flags;
- Production of a preliminary overall environmental sensitivity map;
- Production of a preliminary biophysical sensitivity map;
- Comment on the feasibility of the proposed development given the potential environmental impact and constraints and buffers applied;
- Identifying the potentially developable area within the available land; and
- Providing a list of key issues and conclusions.

The results of the feasibility assessment were used to develop the proposed turbine layout for assessment by the specialists, which represents the first step of 'embedded mitigation'.

3.2 Assessment Techniques for the BA

Each of the specialist assessments follows a systematic approach to the assessment of impacts, with the principal steps being:

- Description of existing environment/baseline conditions;
- Prediction of likely potential impacts, including cumulative impacts (both positive and negative);
- Assessment of likely potential impacts (positive and negative);
- Identification of appropriate mitigation measures; and
- Assessment of residual (potential) environmental impacts.

3.2.1 Baseline Description

In order to evaluate the potential environmental impacts, information relating to the existing environmental conditions were collected through field and desktop research; this is known as the baseline. Specialists collected data from public records and other archive sources and where appropriate field surveys were carried out. Specific methodologies for each specialist's baseline description and impact assessments are presented in Volume II: Specialist Reports.

Climate change is expected to affect the proposed development site over the lifetime of the proposed development; however, the nature, scale and severity of climate change effects are uncertain. Given this uncertainty, the existing environment is assumed to remain constant throughout the lifetime of the proposed development, and forms the current and future baseline for the impact assessments.

The baseline was used to determine the sensitivity of receptors on and near the proposed development site and what changes may take place during the construction, operation and decommissioning of the proposed development and the impacts, if any, that these changes may have on these receptors.

3.2.2 Identification of Potential Impacts

The identification of potential impacts covers the three phases of the proposed development: construction, operation and decommissioning. During each phase, the potential environmental impacts may be different.

The project team have experience from environmental studies for other projects in the locality of the proposed development as well as other WEFs. The team are therefore able to identify potential impacts addressed in the BA based on their experience and knowledge of the type of development proposed and the local area. Their inputs informed the scope for the BA.

Each specialist assessment considered:

- The extent of the impact (local, regional or (inter) national);
- The intensity of the impact (low, medium or high);
- The duration of the impact and its reversibility;
- The probability of the impact occurring (improbable, possible, probable or definite);
- The confidence in the assessment; and
- Cumulative impacts.

Following identification of potential environmental impacts, the baseline information was used to predict changes to existing conditions, and undertake an assessment of the impacts associated with these changes.

3.2.3 Assessment of Potential Effects

The potential impact that the proposed Highlands North WEF may have on each environmental receptor could be influenced by a combination of the sensitivity and importance of the receptor and the predicted degree of alteration from the baseline state (either beneficial or adverse).

Environmental sensitivity (and importance) may be categorised by a multitude of factors, such as the rarity of the species; transformation of natural landscapes or changes to soil quality and land use.

The overall significance of a potential environmental impact is determined by the interaction of the above two factors (i.e., sensitivity/importance and predicted degree of alteration from the baseline).

Specialists, in their terms of references were supplied with a standard method with which to determine the significance of impacts to ensure objective assessment and evaluation, while enabling easier multidisciplinary decision-making. The methodology[4] is outlined below.

The table below, taken from the above guideline, indicates the categories for the rating of impact magnitude and significance.

The assessment methodology that was used is in accordance with the revised 2014 EIA Regulations (as amended). The significance of environmental impacts is a function of the environmental aspects that are present and to be impacted on, the probability of an impact occurring and the consequence of such an impact occurring before and after implementation of proposed mitigation measures.

3.2.3.1 Extent (spatial scale)

L	**M**	**H**
Impact is localised within site boundary	Widespread impact beyond site boundary; Local	Impact widespread far beyond site boundary; Regional/national

3.2.3.2 Duration

L	**M**	**H**
Quickly reversible, less than project life, short term	Reversible over time; medium term to life of project	Long term; beyond closure; permanent; irreplaceable or irretrievable commitment of resources

3.2.3.3 Intensity (severity)

Type of Criteria	**Negative**			**Positive**		
	H-	**M-**	**L-**	**L+**	**M+**	**H+**
Qualitative	Substantial deterioration death, illness or injury, loss of habitat /diversity or resource, severe alteration or disturbance of important processes.	Moderate deterioration, discomfort, Partial loss of habitat /biodiversity /resource or slight or alteration	Minor deterioration, nuisance or irritation, minor change in species/habitat/diversity or resource, no or very little quality deterioration.	Minor improvement, restoration, improved management	Moderate improvement, restoration, improved management, substitution	Substantial improvement, substitution
Quantitative	Measurable deterioration Recommended level will often be	Measurable deterioration Recommended level will	No measurable change; Recommended level will never be violated	No measurable change; Within or better than	Measurable improvement	Measurable improvement

[4] Adapted from T Hacking, AATS – Envirolink, 1998: An innovative approach to structuring environmental impact assessment reports. In: IAIA SA 1998 Conference Papers and Notes.

	violated (e.g. pollution)	occasionally be violated		recommended level.		

3.2.3.4 Probability of Occurrence

L	M	H
Unlikely; low likelihood; Seldom No known risk or vulnerability to natural or induced hazards.	Possible, distinct possibility, frequent Low to medium risk or vulnerability to natural or induced hazards.	Definite (regardless of prevention measures), highly likely, continuous High risk or vulnerability to natural or induced hazards.

3.2.3.5 Status of the Impact

The specialist should describe whether the impact is positive, negative or neutral for each parameter. The ranking criteria are described in negative terms. Where positive impacts are identified, use the opposite, positive descriptions for criteria.

3.2.3.6 Degree of Confidence in Predictions:

The degree of confidence in the predictions, based on the availability of information and specialist knowledge, is to be stated.

3.2.3.7 Consequence: (Duration x Extent x Intensity)

Having ranked the severity, duration and spatial extent, the overall consequence of impacts is determined using the following qualitative guidelines:

Intensity = L				
Duration	**H**			
	M			Medium
	L	Low		
Intensity = M				
Duration	**H**			High
	M		Medium	
	L	Low		
Intensity = H				
Duration	**H**			
	M			High
	L	Medium		
		L	M	H
		Extent		

Positive impacts are ranked in the same way as negative impacts, but result in high, medium or low positive consequence.

3.2.3.8 Overall Significance of Impacts

Combining the consequence of the impact and the probability of occurrence provides the overall significance (risk) of impacts.

PROBABILITY	**Definite Continuous**	H	MEDIUM		HIGH
	Possible Frequent	M		MEDIUM	
	Unlikely Seldom	L	LOW		MEDIUM
			L	M	H
			CONSEQUENCE		

3.2.3.9 Mitigation

Measures to avoid, reduce or remedy significant adverse impacts were identified; these are termed mitigation measures. Where the assessment process identified any significant adverse impacts, mitigation measures were proposed to reduce those impacts where practicable. Such measures include the physical design evolutions such as movement of turbines and management and operational measures. Design alterations such as the route of the servitude to avoid certain sensitive receptors are mitigation embedded into the design of the proposed development, i.e., embedded mitigation.

This strategy of avoidance, reduction and remediation is a hierarchical one which seeks:

- First to avoid potential impacts;
- Then to reduce those which remain; and
- Lastly, where no other measures are possible, to propose compensatory measures.

Each specialist consultant identified appropriate mitigation measures (where relevant).

3.3 Cumulative Impact Assessment

In accordance with the EIA Regulations, consideration is also given to 'cumulative impacts'.

By definition, cumulative impacts are those that result from incremental changes caused by past, present or reasonably foreseeable future actions together with the proposed development. Cumulative impacts are the combined impacts of several developments that are different to the impacts from the developments on an individual basis. For example the landscape impact of one WEF may be insignificant, but when combined with another it may become significant.

For the purpose of this assessment cumulative impacts is defined and has been assessed in the future baseline scenario, i.e. cumulative impact of the proposed development = change caused by proposed development when added to the cumulative baseline (The cumulative baseline includes all other identified developments. In the cumulative assessment the effect of adding the proposed development to the cumulative baseline is assessed.)

In line with best practice, the scope of this assessment will include all operational, approved or current and planned renewable energy applications (including those sites under appeal), within a 35 km radius of the site (as a minimum) (Figure 1.1).

The WEF sites included in the assessment of cumulative impacts has been based on the knowledge and status of the surrounding areas at the time of writing the BA Report.

Each of the specialists used existing publicly available information for the developments that occur within 35 km of the proposed Highlands North WEF, in order to assess the cumulative impacts. Cumulative impacts that have been considered are those residual impacts that remain medium to high post mitigation. It should be noted that this assessment is highly qualitative and based on specialists' knowledge.

4 PUBLIC PARTICIPATION

This Public Participation Process follows the requirements of Regulation 41, 42, 43 and 44 of GN R. 326 Amendments to the Environmental Impact Assessment Regulations, 2014 (7 April 2017), promulgated under Section 24 (5) of the National Environmental Management Act (Act 107 of 1998 – NEMA), as amended.

The primary aims of the public participation process are:

- To inform Interested and Affected Parties (I&APs) of the proposed development;
- To identify issues, comments and concerns as raised by I&APs;
- To promote transparency and an understanding of the project and its potential consequences;
- To facilitate open dialogue and liaise with all I&APs;
- To assist in identifying potential environmental (biophysical and socio-economic) impacts associated with the proposed development; and
- To ensure that all I&AP issues and comments are accurately recorded, addressed and documented in a Comments & Response Report.

Volume III of this report contains the Comments & Response Report which includes copies and proof of all correspondence.

A combined public participation process was followed for the six applications, due to their interlinked nature. Any comments related specifically to an individual component was only included in that application's issues trail.

4.1 Initial Notification

An I&AP database (Volume III - Appendix 1) was compiled consisting of project landowners, surrounding landowners within 5 km, and relevant stakeholders of the Proposed Development Site boundary, identified organs of state and organisations. This database has been updated throughout the duration of the basic assessment process and anyone with an interest in the proposed development was encouraged to register.

On 14 June 2018 initial notification letters (email and registered mail in English and Afrikaans) were sent to I&APs on the database, informing them of the intention of the applicant to apply for Environmental Authorisations for the proposed development (Volume III - Appendix 2). This included a locality map, proposed development plan and project descriptions. Details of how to submit comments and queries were included.

Site notice boards in English and Afrikaans were placed where the site boundary meets the R63 at 32°41'23.8"S 25°21'54.7"E and 32°41'23.8"S 25°21'54.7"E on 15 June 2018 (Volume III - Appendix 3).

Notification posters in English and Afrikaans, encouraging I&APs to register on the database were placed on notice boards in Pearston at the post office, municipality, library, SAPS and a local supermarket on 15 June 2018 (Volume III - Appendix 3).

In Somerset East notification posters were placed on notice boards at the SAPS, Langenhoven library, municipality, Spar supermarket, a hardware shop and a café. Photographs and coordinates are presented in Volume III - Appendix 3.

Newspaper advertisements in English and Afrikaans were placed in *The Daily Sun* Eastern Cape and *The Mid Karoo Express* on 21 June 2018 (Volume III - Appendix 4).

4.2 BA Process Public Participation

The following tasks were undertaken during the Basic Assessment process:

- Notification letters were sent out to registered I&APs, key stakeholders, and organs of state to inform them of the availability of the Basic Assessment Report (BAR) for review and comment (30 days) (Volume III - Appendix 5);
- Notification letters were sent to all registered I&APs, key stakeholders, and organs of state to inform them of the extension of the commenting period on the Basic Assessment Report (BAR) by five working days (seven calendar days) (Volume III - Appendix 6);
- E-mails were sent to landowners and adjacent landowners requesting contact details of their properties occupiers in order to arrange focus group meetings (Volume III - Appendix 8);
- Where no response to the e-mail was received phone calls were made to surrounding landowners requesting occupier details and assistance in arranging focus group meetings (Volume III - Appendix 8);
- Focus Group Meetings were held with occupiers of project landowners and adjacent properties (Volume III - see Section 4 & Appendix 8)
- A Comments and Reponses Report was compiled and updated, recording comments and/or queries received and the responses provided (Volume III - Section 5). Copies of all original comments received and responses sent are included in Volume III - Appendix 7-10.

4.3 Decision & Appeal

- Notification letters will be sent to all registered I&APs, key stakeholders, and organs of state to inform them of the decision by the DEA and the appeal procedure; and
- Placement of advertisements in the by the DEA.

4.4 Summary of Issues Raised

Copies of all comments received from the public during the process, the review of the Draft Basic Assessment Report, and focus group meetings held have been collated in Volume III (Comments and Responses Report), which documents the issues raised and project team original responses to the comments received. The original comments are also included in Volume III.

4.4.1 Social Impact Interviews

The social specialist has conducted interviews with several adjacent landowners as detailed in the Social Impact Assessment (Volume II).

In as far as could be established by the social specialist, commercial game farming is carried out on surrounding farms Buffelsfontein, Kamala Game Reserve, Kaalplaas (East Cape Safaris) and Klipplaat (Side by Side Safaris). Only the owners of Buffelsfontein, Kamala and East Cape Safaris could be contacted for comment. The owners of Klipplaat (Side by Side) declined to comment (Mr. Fleming Jensen, communicated via Mr. Grant Abrahamson, pers. comm). A number of other properties in the vicinity of the site (e.g. Mistkraal and Driefontein) also appear to support commercial game hunting operations. The owners of these properties could not be reached for comment. However, the concerns identified by the owners of Kamala and East Cape Safaris are likely to be relevant and apply to the other game-based operations in the study area.

Proposed turbines of the Highlands North WEF would be mainly visible to adjacent and near-adjacent properties located to the north and east of the site. One adjacent farm, Lekkerwater, located to the north of the site falls within 2.5 km of the nearest turbine.

Lekkerwater is owned by Mr Zirk Jordaan, a project landowner who would benefit from the proposed development. A number of other farmsteads to the north and east are located within 5 km of the site. These include those on (clockwise from north) Bergvliet, Onder-Oranje (Kamala), Tevrede, Stroh's Fontein and Bosfontein. With the exception of Stroh's Fontein and Bosfontein (largely within view shadow), large portions of these properties are also within the 2.5 – 5 km range, and less screened by topography.

Approximately half of Kamala Game Reserve located to the north and east of the site would be located within 2.5-5 km (High Visibility) range, with the remainder within 5-10 km range (Moderate). Kamala Lodge is located ~ 5km from the nearest proposed turbine. The Kamala Game Reserve is exposed to sections of the proposed Development due to its higher elevation.

A sizeable portion of Buffelsfontein Guest Farm located to the east of the site is also located within 5-10 km. The owner of Buffelsfontein has indicated that he has no issues with the proposed turbines, as the key portions of his property would either be in the view shadow or too distant to experience significant impacts (Tollie Jordaan, pers. comm).

A small portion of Kaalplaas (East Cape Safaris) falls within 5-10 km, but the bulk of the property is located beyond 10 km of the proposed Highlands North WEF. The East Cape Safaris Lodge is located ~ 12 km from the nearest proposed turbine and the lodge is located in a view shadow area. The owner of East Cape Safaris expressed concerns with regard to potential visual and sense of place impacts associated with the proposed Highlands Wind Energy Facilities. The concerns were related to potential visual impacts both during the daytime (turbines) and night-time (flickering lights) which would impact on the current 'African veld' experience offered to guests.

It must be noted that the closest proposed turbine of the Highlands North WEF lies more than 12 km from the lodge in question. The visual specialist assessed the visibility of turbines as moderate within 10 km of the turbines, with navigation lights visible over longer distances. Mitigation measures to minimise the negative effects of lighting have been recommended and included in the EMPr.

4.4.2 Issues raised by I&APs during and after commenting period

AVDS Environmental Consultants representing 11 parties submitted a letter of objection to the proposed Highlands Wind Energy Facilities. The list of objecting parties includes the owners of Kamala Game Reserve, East Cape Safaris, Side by Side Safaris and Driefontein, mentioned above and in the Social Impact Assessment. The main concern of these 11 landowners appears to be to the potential of them to be negatively impacted by the proposed development's visual impact. The main points raised in the letter of objection do not however pertain to the visual impact, but rather question compliance with the EIA Regulations. The points raised are:

- "Inadequate and non-compliant public participation process;"
- "Misrepresentation of the true facts through selective use and manipulation of critical information"
- "Advanced stage of BA process and DBAR reached in the absence of required and genuine 'consultative process' with I&APs";
- "The terms of reference and assessments of the specialist studies devoid of I&AP input";
- "Wholesale failure to provide 'a reasonable opportunity to comment' per EIA Regulation 41(6)(b).";
- "No proper and legally constituted EAP and Applicant-favoured bias of those involved in management of the applications";
- "Failure to properly assess Alternatives, including the "No go" Option";
- "Cumulative impacts of the proposed HWEF not properly assessed.";

- "Lack of "consultative process" against which to assess proclaimed need & desirability;
- "Social impact assessment inadequate (Economic impacts not properly assessed";
- "Findings of the Visual impact Assessment are disputed";
- "Findings of the Avifaunal Impact Assessment are disputed";
- "Flora and Fauna Impact Assessment inadequate and findings disputed";
- "All potential impacts of the HWEF not assessed including "off site" impacts"

All points raised have been responded to in detail and these responses are provided in Volume III: Comments & Response Report: Table 5.1 Comments & Responses. Details or evidence regarding how the visual impact would potentially negatively affect the objectors businesses were not provided in the objection letter. It is therefore also not known how and if the existing wind farms in the region (Amakhala Emoyeni WEF, Nojoli WEF and Cookhouse WEF, which are already visible from these properties, especially at night, have impacted upon the objecting parties.

The Director of Kuzuko Lodge, a hospitality business approximately 45 km from the development site has expressed concerns that the wind farm will spoil the views from his property during the day and even more at night and will have a "disastrous effect" on his tourism business which employs 65 permanent staff. The visual specialist therefore modelled the visibility of the turbines from Kuzuko Lodge and found that they will not be visible from the lodge due to intervening terrain. Turbines may be slightly visible, but hardly discernible due to the distance, from a higher location on the Kuzuko property. They would potentially be more visible at night, but distance and climatic conditions would be mitigating factors. Three existing wind farms flashing red lights at night are closer to Kuzuko Lodge than the proposed Highlands WEF. Kuzuko employed their own specialist to model a viewshed, which corresponds to the findings of the visual specialist study. He found that during the day, unless it is a clear day, a viewer will not be able to see the turbines due to the distance unless looking specifically for them. He states that they will be far more visible at night with the red flashing aviation lights contrasting significantly against an un-lit night landscape, as is already experienced by Kamala, Side by Side Safaris, Eastern Cape Safaris and Boskam with the existing Cookhouse WEF. All individuals that attended Focus Group meetings expressed their support for the proposed development, in particular with regards to job creation, clean energy and social upliftment for the local population.

Birdlife SA commented that the site is arguably less sensitive than the more easterly parts of the REDZ where Birdlife has serious concerns regarding Cape Vulture, but that the area is not without its environmental challenges, particularly as it is within a NPAES Focus Area. Birdlife acknowledges that their guidelines were used, effort was sufficient and the Applicant has adopted the recommended buffers. It is however likely that there will still be residual negative impacts and Birdlife made a number of recommendations for mitigations in this regard.

For a complete list of all comments received and responses, please see Volume III. The above is just a summary of the comments received.

5 NEED AND DESIRABILITY

WEFs can play a role in mitigating or reducing climate change, addressing South Africa's energy resource constraints and producing low-cost energy. In addition, operating WEFs in South Africa contribute significantly to the economic development of the areas in which they are located through the requirements of the REIPPPP adjudication process. This section of the report highlights the national, provincial and local plans and policies that are in support of renewable energy facilities. Throughout this section, it is demonstrated that at all levels of governance, policy supports the development of renewable energy in order to address energy supply issues and to promote economic growth in South Africa.

Reference is made to the Department of Environmental Affairs (DEA) 2017 Guideline on Need and Desirability[5] which states that while the "concept of need and desirability relates to the type of development being proposed, essentially, the concept of need and desirability can be explained in terms of the general meaning of its two components in which need refers to time and desirability to place – i.e. is this the right time and is it the right place for locating the type of land-use/activity being proposed? Need and desirability can be equated to wise use of land – i.e. the question of what is the most sustainable use of land."

The need and desirability assessment answers the question of whether the activity or development is being proposed at the right time in the right place. The guidelines pose questions that should be considered in this investigation, which are addressed in Table 5.1 and Table 5.2 below.

[5] DEA (2017) Guideline on Need and Desirability. Department of Environmental Affairs (DEA), Pretoria, South Africa, ISBN: 978-0-9802694-4-4.

Table 5.1: Ecological Considerations of Need and Desirability for Highlands WEFs

"securing ecological sustainable development and use of natural resources"[6]			
Question		**Answer**	**Reference**
How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?		The ecological specialist study states: Although there are extensive areas of sensitive habitat within the wider Highlands site, the development footprint is restricted to the medium and low sensitivity parts of the site. These areas are considered suitable for development and there are no impacts associated with the Highlands WEF that cannot be mitigated to a low level. As such there are no fatal flaws or high post-mitigation impacts that should prevent the development from proceeding. Based on the layouts provided for the assessment, the Highlands North, Central and South WEFs can be supported from a terrestrial ecology point of view.	Volume II: Fauna & Flora Specialist Basic Assessment
How were the following ecological integrity considerations taken into account?	*Threatened Ecosystems*	The National List of Threatened Ecosystems (2011) was used to identify and map listed ecosystems in need of protection. No threatened ecosystem falls within the site boundary.	Volume II: Fauna & Flora Specialist Basic Assessment
	Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure	An ecological sensitivity map of the site was produced by integrating information collected on-site with available ecological and biodiversity information. Sensitive features such as wetlands, drainage lines, water bodies, steep slopes and rocky outcrops were mapped and appropriately buffered. The proposed layout avoids all areas of high and very high ecological sensitivity.	Volume II: Fauna & Flora Specialist Basic Assessment
	Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs")	Critical Biodiversity Areas (CBAs) were extracted from the Eastern Cape Conservation Plan. The majority of the Highlands North WEF falls within a Tier 2 CBA aimed at maintaining the broad-scale connectivity of the landscape. Even though the development would result in some habitat loss within the CBA this is not likely to compromise the overall functioning of the CBA as it is very large and the development occupies a very small portion of the CBA.	Volume II: Fauna & Flora Specialist Basic Assessment
	Conservation targets	The majority of the development footprint falls within the Camdeboo Escarpment NPAES Focus Area, indicating that the area has been identified as a potential target for the protected area expansion.	Volume II: Fauna & Flora Specialist Basic Assessment

[6]Section 24 of The Constitution of South Africa refers.

"securing ecological sustainable development and use of natural resources"[6]			
Question		**Answer**	**Reference**
		The Camdeboo Escarpment Focus area is over 421 000 ha in extent and the loss of less than 10 000 ha from this focus area is not considered highly significant.	
	Ecological drivers of the ecosystem	The specialist concludes that the potential for disruption of broad-scale ecological processes and their drivers is low with recommended mitigation measures	Volume II: Fauna & Flora Specialist Basic Assessment
	Environmental Management Framework	No area-specific Environmental Management Framework exists for the site. The Sarah Baartman District Municipality IDP and the Cacadu District Municipality SDF provide environmental management goals and strategies. The proposed Highlands North WEF complies with all policies and planning tools.	Volume II: Social Impact Assessment
	Spatial Development Framework	The Cacadu District Municipality SDF highlights the following points relevant to the development: • The districts economy is dependent on the natural resources of the area; • The SDF should identify areas for renewable energy production; • Spatial planning must recognise that game reserves and farming are playing a bigger role in the economy; • Inappropriate land use change can have a negative impact on district resources and the economy; • The introduction of alternative energy generation infrastructure and the associated land use change will provide both economic opportunities but may also have a negative impact on the ecotourism of the district. (Potential changes to the visual and cultural landscapes); • The protected area network together with the intended expansion areas (Nature reserves and parks) provide significant and expanding ecotourism opportunities within the District; • Both the tourism and productive components of the economy are dependent on effective access. (Transportation infrastructure). The location of the proposed WEF does not appear to conflict with the land use planning objectives contained in the SDF. The site does not appear to be located within a Tourism Focus Area or a Protected and Critical Biodiversity Area (Tier 1). In terms of land use, the site is located in an area designated as grazing potential. The area to the north of the site is however identified as a Tourism Focus area.	Volume II: Social Impact Assessment page 19-21
	Global and international responsibilities relating to the	All global responsibilities to which South Africa is signatory or party to were assessed within this report. Applicable international treaties and conventions are:	Volume II: Social Impact

“securing ecological sustainable development and use of natural resources”[6]			
Question		**Answer**	**Reference**
	environment (e.g. RAMSAR sites, Climate Change, etc.)	• UNFCCC Paris Agreement (2016) • The Convention on Biological Diversity (CBD) (1993) • The Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention) (1983) • The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) (1999) The proposed development complies with all international responsibilities.	Assessment; Bird Impact Assessment; Bat Impact Assessment
How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?		The proposed development can disturb listed plant species and vegetation from clearing of the development footprint, soil erosion and alien plant invasion. Increased levels of pollution, noise, disturbance and human presence can impact negatively on faunal communities. Biodiversity value and ecological functioning of the proposed development area are potentially affected by the development. Before the start of the Basic Assessment process detailed specialist feasibility studies were conducted to identify areas most environmentally suitable for development within the proposed development site boundary. As a result of these studies a development layout was produced that avoids sensitive areas and identified constraints. This layout was then assessed by the specialists in their Basic Assessment specialist reports presented here. The specialists proposed mitigation measures to further reduce residual risks or enhance opportunities during construction, operation and decommissioning phases of the development. With implementation of these mitigation measures, all identified negative impacts are expected to be reduced to acceptable levels of medium or low negative significance. All mitigation measures proposed by the specialists are included in the EMPr for each phase of the project.	Volume I App B: EMPr Volume II Specialist reports
How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?		On a national level the development will lessen the country’s dependency on coal, and contribute to lowering water consumption, pollution and environmental degradation per kW of electricity produced. The EMPr provides measures for avoidance and minimisation of pollution, as well as enhancing any potential positive impacts.	Volume I App B: EMPr
What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been		The generation of waste will largely be restricted to the construction phase of the project and consist of normal construction phase solid waste streams. The EMPr details specific mitigation measures that must be implemented for the appropriate management and minimisation of waste, during all phases of the project. Registered service providers will be utilised to transport solid waste to registered landfills.	Volume I App B: EMPr

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Question	**Answer**	**Reference**
explored to safely treat and/or dispose of unavoidable waste?		
How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	A visual feasibility study was conducted to identify no go areas and areas most visually suitable for development. Visual buffers were applied to prominent topographic features, steep slopes, water features, roads, nature reserves and protected areas, private nature reserves, game farms, guest farms and resorts, farmsteads, towns, settlements and cultural landscapes / heritage sites. The development layout was produced by avoiding turbine placement within these visual buffers. A Heritage Impact Assessment and a Visual Impact Assessment were conducted to assess the developed layout. Comment from the relevant heritage authorities is being sought. Mitigation measures have been identified by the heritage specialists to minimise and remedy residual impacts, and enhance positive impacts, including: • Monitoring of all substantial excavations for fossil material on an on-going basis during construction; • Application of Chance Fossil Finds Procedure; • A 30 m buffer around all graves, ruins and buildings to be maintained and if not possible features to be cordoned off for their protection • Final walkdown survey of the authorised footprints to be carried out at least 6 months prior to start of construction in order for any archaeological mitigation to be carried out if required; • If any archaeological material or human burials are uncovered then work in the immediate area is to be halted. The fund is to be reported to the heritage authorities and may require inspection, excavation and curation in an approved institution; • Substation & O&M buildings to be located in visually unobtrusive positions or screened with earth berms and planting; • Location of the construction camp, batching plant and related storage/stockpile areas in unobtrusive positions in the landscape, away from arterial or district roads, or alternatively screening measures utilized. • Clear demarcation of construction camps, limited in size to only that which is essential. • Employment of dust suppression and litter control measures. Formulation and adherence to an Environmental Management Programme (EMPr), monitored by an Environmental Control Officer (ECO). • Areas disturbed during construction to be rehabilitated to original state.	Volume II: Heritage Impact Assessment & Visual Impact Assessment

<table>
<tr><th colspan="4">“securing ecological sustainable development and use of natural resources”[6]</th></tr>
<tr><th colspan="2">Question</th><th>Answer</th><th>Reference</th></tr>
<tr><td colspan="2">How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?</td><td>Wind is a renewable resource and will be the ‘fuel’ for the WEF to generate electricity. Therefore the development will have a minimal impact on non-renewable resources.</td><td>n/a</td></tr>
<tr><td rowspan="2">How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of</td><td></td><td>The WEF will use the renewable energy resource of wind to generate power.
Construction of the WEF will require use of water, a renewable natural resource.
Operation of the WEF will consume relatively small quantities of water when compared to alternative energy technologies such as coal.
Impacts on the ecosystem caused by use of these renewable energy resources has been evaluated.</td><td>n/a</td></tr>
<tr><td>Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life)</td><td>The proposed WEF will reduce South Africa’s dependency on non-renewable resources, particularly coal, as an energy source.
Wind as an energy source is not dependant on water, as compared to the massive water requirements of conventional power stations, has a limited footprint and does not impact on large tracts of land, and poses limited pollution and health risks, specifically when compared to coal and nuclear energy plants.
The proposed WEF lies within a Renewable Energy Development Zone for wind energy.</td><td>n/a</td></tr>
</table>

"securing ecological sustainable development and use of natural resources"[6]			
Question		**Answer**	**Reference**
resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?	*Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources this the proposed development alternative?)*	The current land use is low-intensity grazing and the land is not suitable for other agricultural uses. The proposed development will increase yield as the landowners will be paid for the use of their land. This will improve cash flow and financial sustainability of farming enterprises on site. The proposed development itself will not cause a significant change in land use, as the development site is primarily low intensity agriculture (grazing), which can still proceed once the development is constructed. The opportunity cost of not proceeding with the proposed development is therefore likely to be high.	Volume II: Agricultural Impact Assessment; Social Impact Assessment
	Do the proposed location, type and scale of development promote a reduced dependency on resources?	The proposed WEF is predicted to reduce dependency on coal as an energy source. Wind as an energy source is not dependant on water, as compared to the massive water requirements of conventional coal fired power stations, has a limited footprint and does not impact on large tracts of land, and poses limited pollution and health risks, specifically when compared to coal and nuclear energy plants. The proposed WEF lies within a Renewable Energy Development Zone for wind energy, and a comprehensive cumulative impact assessment has been conducted.	n/a
How were a risk-averse and cautious approach applied in terms of ecological impacts?	*What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?*	The faunal component of the study is based on field observations of species and habitats as well as the results the camera trapping. This is supplemented with species records obtained from the various spatial databases and coverages. In many cases, these databases are not intended for fine-scale use and the reliability and adequacy of these data sources relies heavily on the extent to which the area has been sampled in the past. Many remote areas have not been well sampled with the result that the species lists for an area do not always adequately reflect the actual fauna and flora present at the site	Volume II: Fauna & Flora Specialist Basic Assessment
	What is the level of risk associated with the limits of current knowledge?	The risk associated with assumptions and limits of current knowledge is the potential for information being assessed to be incorrect. This would translate to erroneous impact identification and mitigation measures. However, due to the amount of site work conducted the risk associated with this is considered to be low.	Volume II: Fauna & Flora Specialist Basic Assessment
	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious	In order to counter the likelihood that the area has not been well sampled in the past and in order to ensure a conservative approach, the species lists derived for the site from the literature were obtained from an area significantly larger than the study area and are likely to include a much wider array of species than actually occur at the site. This is a cautious and conservative approach which takes the study limitations into account.	Volume II: Fauna & Flora Specialist Basic Assessment

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Question		**Answer**	**Reference**
	approach applied to the development?	Adopting a risk-averse and cautious approach in all stages of the impact assessment allows one to minimise the chance of assessing incorrect information and identifying erroneous impacts. This precautionary approach was utilised throughout the process by all specialists. The precautionary approach has been adopted for this study, i.e. assuming the worst-case scenario will occur and then identifying ways to mitigate or manage these impacts. Current gaps in knowledge include confirmation on the preferred turbine generating capacity and turbine technology to be used at this site. Ways in which these gaps are addressed are to consider the worst-case scenarios as noted above in terms of turbine size and generation capacity. Mitigation measures to manage these impacts have been identified.	
How will the ecological impacts resulting from this development impact on people's environmental right in terms following:	*Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?*	Impacts on people's rights have been identified and assessed by the social specialist, visual specialist and noise specialist. A visual feasibility study was conducted to identify no go areas and areas most visually suitable for development. Visual buffers were applied to prominent topographic features, steep slopes, water features, roads, nature reserves and protected areas, private nature reserves, game farms, guest farms and resorts, farmsteads, towns, settlements and cultural landscapes / heritage sites. The proposed development layout was produced by avoiding turbine placement within these visual buffers. The significance of the potential negative health risks posed by the development (noise, shadow flicker, electromagnetic radiation) is low. The noise impact assessment found the level of noise impacts for the Highlands North WEF to be of low to medium significance without mitigation and of low significance with mitigation. Mitigation measures proposed are the installation of turbines with lower noise emission than those assumed (worst case scenario), shutdown of selected turbines at night under relevant wind directions; removal of selected turbines; and /or relocation of farm workers from properties with the greatest noise impact. The impact on the sense of place is difficult to predict and would potentially be ambiguous. This is due to the subjective nature of perceptions regarding the relative attraction or disturbance of the WEF in a rural landscape. The visual impact has been assessed as part of the Visual Impact Assessment	Volume II: Visual Impact Assessment; Social Impact Assessment; Noise Impact Assessment
	Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures	The social impact assessment concluded that wind energy has fewer negative health effects than other forms of traditional energy generation and will have overall positive health benefits.	Volume II: Social Impact Assessment

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Question		**Answer**	**Reference**
	were taken to enhance positive impacts?		
Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?		The findings of the Social Impact Assessment (SIA) indicate that the development of the proposed Highlands WEF will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also benefit the local community. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated with a coal based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The findings of the SIA also indicate that the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives. The Highlands WEF site is also located within the Cookhouse Wind REDZ. The area has therefore been identified as suitable for the establishment of renewable energy facilities. However, a key concern identified during the SIA relates to the visual impacts associated with the wind turbines and the potential impact on existing, well established game farming and hunting operations in the area, specifically the area to the north, east and south of the site.	Volume II: Social Impact Assessment
Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?		The ecology, avifauna, bat and aquatic specialists have all concluded that the development can proceed without having any unacceptable negative impacts that cannot be mitigated to a low or medium level of significance. The majority of the Highlands North lies within a tier 2 CBA aimed at maintaining the broad-scale connectivity of the landscape. Although the development would result in some habitat loss within the CBA, this is not likely to compromise the overall functioning of the CBA as it is very large and the development occupies a very small proportion of the CBA.	Volume II: Fauna & Flora Specialist Basic Assessment
Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?		The initial specialist site feasibility studies identified the most suitable areas for development for which a development layout was then produced for assessment. The results of the specialist's studies and assessments of this layout further refined and improved the proposed development layout resulting in the Final Mitigated Layout, as the best practicable environmental option.	Volume II: Specialist Reports

"securing ecological sustainable development and use of natural resources"[6]		
Question	**Answer**	**Reference**
Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Given that the renewable energy projects in the area are not within viewing distance of each other and that they form part of a REDZ, the cumulative visual impact significance is considered to be Low (Negative) in the local context. The habitat loss resulting from the development is not likely to be significant, given the low total footprint of wind farm development in relation to the large extent of the affected NPAES focus area. With mitigation, the impact of habitat loss and future ability to meet conservation targets is likely to be of Low Significance. The cumulative effect of all impacts on bats and avifauna can be mitigated to levels of medium significance. All of the projects have indicated that aquatic impact avoidance as part of their layouts design process coupled mitigation, i.e. selecting the best possible routes to minimise the local and regional impacts while improving the drainage or hydrological conditions within these rivers has been included to result in a cumulative impact that would be negligible. In the worst case scenario the significance of cumulative impacts during construction and operation is expected to be medium without mitigation, and low with mitigation.	Volume II: Visual Impact Assessment

Table 5.2: Socio-economic Considerations of Need and Desirability

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Question		**Answer**	**Reference**
What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?:	*The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area,*	A Strategic Environmental Assessment (SEA) for wind and solar PV energy in South Africa identified eight ***Renewable Development Zones*** (REDZs). The REDZs identified areas where large scale wind energy facilities can be developed in a manner that limits significant negative impacts on the environment while yielding the highest possible socio-economic benefits to the country. The proposed Highlands WF falls within the Cookhouse Wind REDZ. The **Eastern Cape Provincial Growth and Development Plan (PGDP)** states that development of infrastructure is a necessary condition to eradicate poverty. Energy demands and electricity infrastructure rollout forms part of the Strategic Infrastructure Programme of the PGDP. The PGDP states that the, "…economic and logistics infrastructure – energy, roads, rail, ports, and air transport among others – is a necessary condition for economic growth and development." Infrastructure	Volume II: Social Impact Assessment

[7]Section 24 of The Constitution of South Africa refers.

"promoting justifiable economic and social development"[7]			
Question		Answer	Reference
		development, in turn, will have strong growth promotion effects on the agriculture, manufacturing and tourism sectors by improving market access and by "crowding in" private investment. Poverty alleviation should also be promoted through labour-intensive and community based construction methods. The high-level objectives of the Strategic Infrastructure Programme include consolidating and building upon the strengths of the Province's globally-competitive industrial sector through the development of world-class infrastructure and logistics capability in the East London and Coega IDZs. A reliable energy supply will be critical to achieving these objectives. The proposed WEF will assist to contribute to the future energy requirements of the Eastern Cape, and its proximity to the Coega IDZs will also benefit these key initiatives. The **Sarah Baartman District Municipality IDP** states that opportunities exist in the renewable energy sector with the area having been identified as one of three preferred locations in the country. It highlights the importance of investing in natural capital, including "creating new generation green jobs and local income streams rooted in renewable energy", developing the skills base, improving connectivity and utility infrastructure, and economic development in the green economy, tourism and skills development and education; The **Blue Crane Route IDP** notes that "wind generation initiatives in the Sarah Baartman District are fast growing with a large number of generation facilities under investigation" and the "the importance of wind energy generation in the district has been confirmed by the announcement by the Department of Energy in terms of successful wind farm developments, as three of the eight approved wind farm developments are to be developed in the district, with an additional wind farm to be developed in Nelson Mandela Bay Municipality." As part of the strategy to address challenges facing the rural areas the Development Bank of Southern Africa initiated the Rural Economic Development Initiative (REDI). The Sarah Baartman REDI, one of three pilot sites in South Africa, is a partnership between SBDM, the Development Bank of Southern Africa (DBSA) and other major stakeholders in the region aimed at identifying and unlocking economic potential to realize the latent economic growth potential of the district. Areas of intervention include (a) agri-innovation primarily in the areas of agro-processing, aquaculture, natural fibre beneficiation; *renewable energy* and agri-tourism and (b) strategy and institutional development. The REDI process has identified a number of catalytic factors that could accelerate economic growth in the District including *renewable energy,* fibre innovation, the potential for agro-processing in key niches, tourism development and growing the education sector. The BCRLM IDP identifies a number of deliverables emanating from REDI. Of relevance to the proposed development are:	

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Question		Answer	Reference
		• Renewable Energy Rapid Assessment and Audit; • Provincial Renewable Energy Coordinating Forum; • Land Use and Location Policy for Renewable Energy Projects; • Preparation of a Project Plan for the Establishment of a Wind Research and Training Centre in BCRM; • Investigation into the Social Economy and Identification of Interventions to Address Poverty and Unemployment. The primary sector focus of REDI in BCRLM will be on improving the performance of agriculture-related sectors (including priority sectors from phase one research, *renewable energy*, land restoration, agro-tourism and aquaculture). The IDP notes that the BCRLM has identified Local Economic Development (LED) as a key factor in the development of the BCRLM economy and all of its communities The LED strategy identifies six main pillars aimed at stimulating local economic development in Blue Crane Route Municipality. The following are of relevance to the proposed development: • Alternative sources of energy; • Enterprise Development; • Agricultural Development; • Tourism Development; • Investment in Human Capital.	
	Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	The Sarah Baartman Spatial Development Framework highlights the following: • The districts economy is dependent on the natural resources of the area;; • The SDF should identify areas for renewable energy production; • Spatial planning must recognise that game reserves and farming are playing a bigger role in the economy; • Inappropriate land use change can have a negative impact on district resources and the economy; • The introduction of alternative energy generation infrastructure and the associated land use change will provide both economic opportunities but may also have a negative impact on the ecotourism of the district. (Potential changes to the visual and cultural landscapes);	Volume II: Social Impact Assessment

"promoting justifiable economic and social development"[7]			
Question		Answer	Reference
		• The protected area network together with the intended expansion areas (Nature reserves and parks) provide significant and expanding ecotourism opportunities within the District; • Both the tourism and productive components of the economy are dependent on effective access. (Transportation infrastructure).	
	Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	The location of the proposed WEF does not appear to conflict with the land use planning objectives contained in the SDF. In this regard the site does not appear to be located within a Tourism Focus Area or a Protected and Critical Biodiversity Area (Tier 1). In terms of land use, the site is located in an area designated as grazing potential. The area to the north of the site is however identified as a Tourism Focus area. Impacts to the cultural landscape are visual/contextual in nature and, if development goes ahead, would definitely occur. The significance of this impact calculates to medium. Although mitigation measures can be suggested to reduce the overall intensity of the impacts, these will have no real effect on the impact significance which remains medium after mitigation. There are no fatal flaws in terms of the cultural landscape, especially since the area is a REDZ which encourages an accumulation of impacts in one area (admittedly far larger than the area considered for this assessment) and discourages a widespread proliferation of impacts across the wider landscape. The impacts to heritage resources are not significant enough to outweigh the social and economic impacts to be realised by the proposed project.	Volume II: Social Impact Assessment; Heritage Impact Assessment
	Municipal Economic Development Strategy ("LED Strategy").	The BCRLM has identified Local Economic Development (LED) as a key factor in the development of the BCRLM economy and all of its communities. The objectives for the Blue Crane Route LED Strategy that are relevant to the proposed development include: • Promote investor confidence in BCRLM through the provision of sound infrastructure and reliable services; • Promote SMMEs to increase employment opportunities; • Promote the development of the tourism sector. The LED strategy identifies six main pillars aimed at stimulating local economic development in Blue Crane Route Municipality. The following are of relevance to the proposed development: • Alternative sources of energy;	Volume II: Social Impact Assessment;

"promoting justifiable economic and social development"[7]			
Question		Answer	Reference
		• Enterprise Development; • Agricultural Development; • Tourism Development; • Investment in Human Capital.	
Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?		The impact of creation of employment and opportunities during the construction phase is rated as of medium positive significance. The negative impacts associated with construction (impacts on family structures and social networks, influx of job seekers, risks to safety, livestock and farming operations, risk of fires, impacts from construction vehicles and impacts on farmland) can all be mitigated to levels of low negative significance. Positive impacts of the operation of the proposed facility are rated as high positive (clean renewable energy, creation of a community trust) and medium positive (creation of employment and business opportunities, support for local economic development, income generated for affected farmers) significance with enhancements. Negative impacts associated with the operation of the proposed facility are rated as medium with mitigation (impact on rural sense of place for adjacent game farm operations; impact on adjacent property values and operations; impact on adjacent game farming and hunting tourism) to low (impact on sense of place for others, impact on tourism in the region) The Socio-Economic Development and Enterprise Development commitments of the REIPPPP require a percentage of gross revenue from the operating wind farm to be invested in education, health, small business development etc. Projects are required to commit at least 1% of gross revenue towards socio-economic development. As an indication, 1% of gross revenue of a hypothetical 140 MW wind farm, with a capacity factor of 35% and a tariff of 80 c/kWh would equal approximately R3.5 m/year (and R68 million over the 20 year operation period of a project).	Volume II: Social Impact Assessment;
	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	The proposed development will contribute towards the BCRLM LED strategy and skills development programs through the creation of employment and business opportunities, and the opportunity for skills development and on-site training during both construction and operation phases.	Volume II: Social Impact Assessment;
How will this development address the specific physical,		The Sarah Baartman DM IDP identifies a number of key challenges including water supply, housing and services and maintenance of the road network.	Volume II: Social Impact Assessment;

"promoting justifiable economic and social development"[7]			
Question		**Answer**	**Reference**
psychological, developmental, cultural and social needs and interests of the relevant communities?		The initiatives for identified in the IDP that could benefit from the Community Trust include: Increasing agricultural income: • Facilitating investments in local and regional agro-processing operations; • Investing in research and knowledge sharing to improve the quality and resilience of crops and livestock; • Supporting local and regional food systems that keep wealth in rural communities. Investing in Natural Capital: • Promoting and incentivising natural resource restoration and conservation including alien vegetation clearing; • Creating new generation green jobs and local income streams rooted in ***renewable energy***; • Growing the rural tourism economy based on natural capital through agri-, adventure- and eco-tourism initiatives. Broadening economic participation • Promoting BBBEE, SMME and cooperative development; • Linking up with and maximising the opportunities for Extended Public Works Programme (EPWP) and Community Work programme opportunities; • Establishing community-based beneficiation projects; • Facilitating community and worker participation in share ownership; • Promoting social development investments. Developing the skills base • Improving the quality and quantity of school education and early childhood development (ECD) through partnerships; • Creating further education opportunities linked to work opportunities in the region; • Developing skills transfer partnerships between established and emerging farmers and between established and emerging businesses. Improving connectivity and utility infrastructure • Assisting with the development of rural broadband and mobile phone connectivity.	

"promoting justifiable economic and social development"[7]			
Question		**Answer**	**Reference**
Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?		The Green Jobs Study found that wind energy facilities are socially and economically sustainable in the short and long term. IPP projects require a minimum ownership of 2.5% by local communities which represents a significant injection of capital into mainly rural areas of South Africa for the lifespan of the facility. In addition local content minimum thresholds result in a substantial stimulus for establishing local manufacturing capacity. A target requirement for BBBEE of 60% of procurement spend has raised employment opportunities for black South African citizens and local communities. Social economic development contributions are concentrated in the immediate vicinity of the IPPs and as such there is a lack of equity across geographical areas with some communities benefitting more than others.	Volume II: Social Impact Assessment;
In terms of location, describe how the placement of the proposed development will:	*result in the creation of residential and employment opportunities in close proximity to or integrated with each other,*	During the construction phase of the Highlands Wind Energy Facilities approximately 200-250 employment opportunities will be created, of which 55% will be for low-skilled workers, 30% for semi-skilled and 15% for skilled personnel. Members from the local communities (Pearston, Somerset East, and Cookhouse) are likely to be in a position to qualify for the majority of the low skilled and a proportion of the semi-skilled positions.	Volume II: Social Impact Assessment;
	reduce the need for transport of people and goods,	The need for transport of people and goods will be increased during the construction phase. Lower per capita carbon footprints are predicted due to the commercial forms of transport that will be employed to move the workforce (e.g. public transport, contractor buses).	Volume II: Traffic Impact Assessment;
	result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms public transport),	not applicable	n/a
	compliment other uses in the area,	Local communities and their service providers will benefit from the socio-economic development provided by the WEF and current land use will be able to continue.	Volume II Social Impact Assessment;
	be in line with the planning for the area,	The proposed WEF is in line with applicable international, national, provincial and local planning strategies.	Volume II Social Impact Assessment

"promoting justifiable economic and social development"[7]			
Question		**Answer**	**Reference**
	for urban related development, make use of underutilised land available with the urban edge,	The proposed development occurs approximately 20 km beyond the urban edge of the nearest town, Somerset East	Volume II Social Impact Assessment
	optimise the use of existing resources and infrastructure,	Wind energy is a renewable, clean resource and reduces pollution and the reliance on non-renewable fossil fuels and water for electricity generation. Existing access roads will be utilised wherever possible. The existing Eskom transmission lines have the capacity to support this development. It is expected that any construction water required will be delivered by tankers. Waste removal will be in accordance with best practice as per the EMPr by qualified waste removal contractors to the nearest registered landfill. Portable sanitation facilities will be utilised during construction, so that no connection to the local sewerage system will be required. Any additional infrastructure required will be constructed by the developer.	Appendix B: EMPr Vol II: Social Impact Assessment
	opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),	No opportunity costs in terms of bulk infrastructure expansions in non-priority areas are predicted due to the proposed development. The proposed WEF is not located within a bulk infrastructure expansion area.	Vol II: Social Impact Assessment
	discourage "urban sprawl" and contribute to compaction/densification,	Not applicable as the proposed development site lies outside of urban areas.	Vol II: Social Impact Assessment
	contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,	The existing Eskom transmission bordering the proposed development site grid has capacity for additional energy generation. The proposed development will utilise this existing capacity. The project will contribute to economic and infrastructure development in the Eastern Cape Province, in line with the Eastern Cape Provincial Growth and Development Plan	Vol II: Social Impact Assessment
	encourage environmentally sustainable land development practices and processes,	Construction of the renewable energy Highlands WEF project will assist South Africa in transitioning from a carbon-intensive resource use economy to a sustainable low carbon footprint economy. Sustainable land development is an overarching aspect of the proposed project development.	Vol II: Social Impact Assessment

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Question		**Answer**	**Reference**
	take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),	Feasibility of access for wind turbine delivery, the site is easily accessible from the national road; Close proximity to the Eskom grid with available evacuation capacity; Viable wind resource, therefore suited to wind farm development; The proposed site is transformed agricultural land and current land use is gazing; Willingness of landowners to host a wind farm on their properties; and Position within a Renewable Energy Development Zone for wind energy.	Section 6.2: Site Selection
	the investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential),	The proposed development will create jobs and contribute towards socio-economic development in an area that does not have high economic potential. The WEF is likely to result in significant positive socio-economic opportunities. Please refer to the SIA for further information in this regard.	Vol II: Social Impact Assessment
	impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	Impacts to the cultural landscape are unavoidable but only of a medium significance and no other aspects of heritage are expected to be impacted significantly.	Vol II: Social Impact Assessment; Visual Impact Assessment; Heritage Impact Assessment
	in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	The proposed development aligns with the Sarah Baartman DM IDP. One of the strategies of the IDP is implementing an integrated human settlement plan. Thus the proposed development is predicted to support the creation of a more integrated settlement.	Vol II: Social Impact Assessment
How were a risk-averse and cautious approach applied in terms of socio-economic impacts?:	*What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?*	The information contained in some key policy and land use planning documents, such as Integrated Development Plans etc., is based on the 2011 Census. Where relevant, information from the 2016 Community Survey has been added. The strategic importance of promoting wind energy is supported by the national and provincial energy policies. However, this does not mean that site related issues can be ignored or overlooked.	Vol II: Social Impact Assessment
	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources,	The risk due to limits of current knowledge is considered to be low due to the positive socioeconomic impact expected from the proposed WEF.	Vol II: Social Impact Assessment

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Question		**Answer**	**Reference**
	economic vulnerability and sustainability) associated with the limits of current knowledge?		
	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	The approach to the SIA study is based on the Western Cape Department of Environmental Affairs and Development Planning Guidelines for Social Impact Assessment (DEADP, 2007).	Vol II: Social Impact Assessment
How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:	*Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?*	Negative impacts were identified by the Social Specialist. These are: • Impacts associated with the presence of construction workers on local communities; • Impacts related to the potential influx of job-seekers; • Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site; • Increased risk of grass fires associated with construction related activities; • Noise, dust, waste and safety impacts of construction related activities and vehicles. • Visual impacts and associated impact on sense of place; The SIA details mitigation measures including locals first policy, establishment of a Monitoring fund, code of conduct, HIV/AIDS awareness programme; compensation policy with landowners, waste and fire management procedures part of EMPr,	Vol II: Social Impact Assessment
	Positive impacts. What measures were taken to enhance positive impacts?	Creation of employment and business opportunities, and the opportunity for skills development and on-site training: • Locals first policy, use local BBBEE contractors, establish a local skills database; • Inform local authorities and community representatives of final decision and potential job opportunities • Implement a skills development and training programme aimed at maximizing the number of employment opportunities for local community members; • Maximise opportunities for local content, procurement and community shareholding;	Vol II: Social Impact Assessment

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Question		**Answer**	**Reference**
		• Establish a visitor centre. As indicated in the literature review, visitor centres in Scotland have attracted large numbers of visitors to wind farms. • Establish database of local service providers, specifically BBEEE companies, and notify of tender process and assist local BBBEEE companies to complete and submit required tender forms • SBDM and BCRLM in conjunction with local business sector and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project.	
Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socio-economic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?		It is not expected that the development's socio-economic impacts will result in significant ecological impacts. The creation of jobs will cause some disturbance to the local fauna, particularly in the construction phase. This impact has been assessed as of low significance with mitigation measures applied.	Vol II: Social Impact Assessment; Fauna & Flora Specialist Basic Assessment
What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?		A suitable site within a REDZ was selected. A feasibility assessment was conducted. The layout was adjusted according to the results of the visual specialist investigation. Enhancements and mitigations recommended by the social specialist are being implemented.	Volume II Social Impact Assessment; Visual Impact Assessment
What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)?	*Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?*	The proposed development aligns with a variety of planning policies that consider environmental and spatial justice. It falls within a REDZ.	Volume II: Social Impact Assessment
What measures were taken to pursue equitable access to environmental resources, benefits and services to meet		The proposed development will contribute to equitable access by supplying electricity to the national grid, and by providing local and regional socioeconomic benefits in	Volume II:

<table>
<tr><th colspan="4">“promoting justifiable economic and social development”[7]</th></tr>
<tr><th colspan="2">Question</th><th>Answer</th><th>Reference</th></tr>
<tr><td colspan="2">basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?</td><td>terms of the REIPPPP Economic Development requirements, which includes BBBEE scorecard on which wind projects are evaluated.</td><td>Social Impact Assessment</td></tr>
<tr><td colspan="2">What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development’s life cycle?</td><td>Construction, operation and decommissioning of the proposed development will be done according to environmental health and safety legislative requirements and applicable guidelines.</td><td>Appendix B: EMPr</td></tr>
<tr><td rowspan="6">What measures were taken to:</td><td>ensure the participation of all interested and affected parties,</td><td>Public participation is being undertaken according to NEMA: EIA Regulations (2014) as amended and DEA (2017) Public Participation Guidelines.</td><td>Volume III; Comments & Response Report</td></tr>
<tr><td>provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,</td><td>The PPP is being undertaken in terms of legislative requirements and best practise guidelines.
A Public Meeting will be held to present the findings of the Basic Assessment Report.
All notifications have been provided in English and Afrikaans. Further languages are made available upon request.</td><td>Section 4; Volume III</td></tr>
<tr><td>ensure participation by vulnerable and disadvantaged persons,</td><td>The PPP is being undertaken according to best practise guidelines;
Notification of initiation of the PPP was provided in all required channels, i.e. newspaper adverts, site notices, local posters and written notifications.</td><td>Section 4; Volume III</td></tr>
<tr><td>promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,</td><td>The proposed development fits into the various planning policies including Contribution to the SBDM IDP and the implementation of a Community trust will assist the local strategies, including improving education facilities and youth development.</td><td>Vol II: Social Impact Assessment</td></tr>
<tr><td>ensure openness and transparency, and access to information in terms of the process,</td><td>Legislative requirements and best practise guidelines are followed throughout the process.
The PPP is being undertaken in terms of legislative requirements and best practise guidelines.</td><td>Section 4</td></tr>
<tr><td>ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all</td><td>A PPP is being undertaken in terms of legislative requirements and best practise guidelines.</td><td>Section 4; Volume II: Social Impact Assessment; Volume III</td></tr>
</table>

"promoting justifiable economic and social development"[7]			
Question		**Answer**	**Reference**
	forms of knowledge, including traditional and ordinary knowledge, and	A Social Impact Assessment forms part of the BA process. The independent Social Specialist ensures that all needs and values are taken into account.	
	ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein were be promoted?	The Social Impact Assessment and PPP that are conducted according to legislation and guidelines will ensure that women and youth are recognised and involved in the process. REIPPPP requirements place specific responsibilities on IPPs in terms of women and youth development.	Volume II: Social Impact Assessment
Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g.. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?		The proposed WEF has a good planning fit with all applicable policies and will result in substantial local socio-economic opportunities. The key challenges facing the BCRLM are poverty and inequality in the rural areas and a shortage of skills. As such the proposed development will be of benefit to the local area by creating job and business opportunities, particularly for unskilled and semi-skilled local workers. To date the only negative impact for I&APs of the proposed development is a potential reduction in revenue for the adjacent local hunting industry (middle and high income community) through a change in sense of place for tourists, which is rated as of medium significance in the local context and of low significance in the regional context. Landowners of the proposed development site itself will benefit from an increase of revenue from low grazing potential land.	Volume II: Social Impact Assessment
What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse		Future workers on the proposed development will be educated on their rights to refuse work.	

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Question		**Answer**	**Reference**
such work will be respected and protected?			
Describe how the development will impact on job creation in terms of, amongst other aspects:	*the number of temporary versus permanent jobs that will be created,*	200-250 (full-time equivalent) employment opportunities will be created for 20-24 months during the construction phase. 20 full time employment opportunities will be created for the operational phase of the proposed development (minimum of 20 years).	Volume II: Social Impact Assessment
	whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),	Members from the local community in the area are likely to be in a position to qualify for the majority of the low skilled and a proportion of the semi-skilled jobs. 55% of construction phase jobs will be for low-skilled workers, and 30% for semi-skilled.	Volume II: Social Impact Assessment
	the distance from where labourers will have to travel,	It is expected that most workers will reside in the nearby towns Pearston, Somerset East and Cookhouse.	Volume II: Social Impact Assessment
	the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and	The majority of employment opportunities associated with the operational phase is likely to benefit HD members of the community. It will also be possible to increase the number of local employment opportunities through the implementation of a skills development and training programme linked to the operational phase. A percentage of permanent employees who are not locally based may purchase houses in one of the local towns in the area, such as Somerset East or Cookhouse, others may decide to rent. Both options would represent a positive economic benefit for the region. In addition, a percentage of the monthly wage bill earned by permanent staff would be spent in the regional and local economy. This will benefit local businesses in the relevant towns. The benefits to the local economy will extend over the anticipated 20 year operational lifespan of the project. The local hospitality industry is also likely to benefit from the operational phase. These benefits are associated with site visits by company staff members and other professionals (engineers, technicians etc.) who are involved in the company and the project but who are not linked to the day-to-day operations. Procurement during the operational phase will also create opportunities for the local economy and businesses. The potential negative visual impact on the areas sense of place and rural character were identified as key concerns by surrounding hunting and game farm owners, whereas surrounding livestock farmers were less concerned about the visual impacts.	Volume II: Social Impact Assessment
	the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but	Potential opportunity costs of the proposed development will be restricted to the 4 or 5 surrounding game farm and hunting operations. All of the operations cater for up-	Volume II: Social Impact Assessment

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Question		**Answer**	**Reference**
	impact on 1000 agricultural jobs, etc.).	market overseas visitors and the existing "African veld" sense of place represents a key component of their marketing strategy for overseas hunters and visitors. The establishment of a wind farm on their western boundary would impact on the areas sense of place, which in turn, may impact on the ability to attract overseas visitors. This would in turn have a potential impact on their operations. The impact on their operations would in turn impact on other local sectors of the economy in the area that benefit from the game farming sector. As indicated in the SBDM IDP, the game farming sector has become an increasingly important sector in the area. However, a WEF in the area (Amakhala Emoyeni WEF) did not impact negatively on visitor numbers at Ezulu Private Nature Reserve whose boundary is 8 km from the closest turbine. The significance of this impact was rated as of medium negative significance. The creation of 200-250 temporary (20-24 month) jobs and 20 permanent jobs associated with the proposed development proceeding was rated as of high and medium positive significance.	
What measures were taken to ensure:	*that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and*	All applicable planning policies and legislation were considered. The proposed development fits with all planning policies. Organs of State were pre-identified and registered on the I&AP database.	Volume II: Social Impact Assessment
	that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	As registered I&APs all public correspondence including notifications of reports availability are provided.	Volume III
What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?		The proposed development aims to uphold the principles of sustainable development. The project team consists of suitably qualified individuals that comply with all legal requirements.	Section 1; Volume II: Specialist reports
Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?		Specialist input provides realistic mitigation measures. Rehabilitation to be undertaken after decommissioning of the proposed development will significantly reduce any potential legacy effects. Specific mitigation and rehabilitation measures are provided in the EMPr.	Appendix B: EMPr
What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental		The EMPr is a legally binding document, which when enforced during construction, operational or decommissioning phases, hold the applicant or their representative liable for any remedial actions as a result of negligence.	Appendix B: EMPr

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Question	**Answer**	**Reference**
damage or adverse health effects will be paid for by those responsible for harming the environment?		
Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	The alternative selection process included the assessment of the No Development alternative, site alternatives, design layout alternatives and technology alternatives.	Section 6
Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	<u>Cumulative Impact on Sense of Place:</u> Given that the renewable energy projects mentioned above are not within viewing distance of each other and that they form part of REDZ, the cumulative visual impact is considered to be of **low negative significance** in the local context. While certain stakeholders are opposed to the proposed development, others either support the development and or do not have an objection to the establishment of a WEF on the proposed site. This will also have implications for the perceptions of different people towards to the nature and significance of the cumulative impacts associated with wind farms on sense of place. However, the potential impact of wind energy facilities on the landscape is an issue that does need to be considered, specifically given South African's strong attachment to the land and the growing number of wind facility applications. The Environmental Authorities should therefore be aware of the potential cumulative impacts when evaluating applications and the potential implications for other land uses, specifically game farming and associated tourist activities. <u>Cumulative impact on local services and accommodation</u> The establishment of the proposed 150 MW Highlands WF and the other renewable energy facilities in the SBDM and BCRLM may place pressure on local services, specifically medical, education and accommodation. This pressure will be associated with the influx of workers to the area associated with the construction and operational phases of renewable energy projects proposed in the area, including the proposed WF. The potential impact on local services can be mitigated by employing local community members. The presence of non-local workers during both the construction and operation phase will also place pressure on property prices and rentals. As a result, local residents, such as government officials, municipal workers, school teachers, and the police, may no longer be able to buy or afford to rent accommodation in towns such as Somerset East, Bedford and Cookhouse. The LED Manager for the BCRLM interviewed as part of the Spitskop West WF SIA indicated	Volume II: Visual Impact Assessment; Social Impact Assessment

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Question	**Answer**	**Reference**
	that rental prices in Somerset East and Cookhouse had been driven up during the construction phase of the Amakhala Emoyeni Wind Farm. This impact is rated as of **low negative significance.** However, the potential impacts should also be viewed within the context of the potential positive cumulative impacts for the local economy associated with the establishment of renewable energy as an economic driver in the area. These benefits will create opportunities for investment in local towns, such as Somerset East and Cookhouse, including the opportunity to up-grade and expand existing services and the construction of new houses. In this regard the establishment of a renewable energy will create an opportunity for economic development in the area. The Community Trusts associated with each project will also generate revenue that can be used by the SBDM and BCRLM in consultation with the Eastern Cape Provincial Government, to invest in up-grading local services where required. In should also be noted that it is the function of national, provincial and local government to address the needs created by development and provide the required services. The additional demand for services and accommodation created by the establishment of development renewable energy projects should therefore be addressed in the Integrated Development Planning process undertaken by the SBDM and BCRLM. Cumulative impact on local economy In addition to the potential negative impacts, the establishment of the proposed 150 MW WF and other renewable energy facilities in the area has the potential to result in significant positive cumulative socio-economic opportunities for the region, which, in turn, will result in a positive social benefit. There are a large number of renewable energy projects proposed in the study area. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. The Community Trusts associated with each project will also create significant socio-economic benefits. The Overview of the IPPP (2017) confirms the benefits associated with renewable energy projects for local and regional economies. The total projected procurement spend for BW1 to BW4, 1S2 and 1S2 during the construction phase was R75 billion, while the operational procurement over 20 years is estimated to be in the region of R72 billion. The reports note that the construction spend of R75 billion has resulted in a substantial stimulus for establishing local manufacturing capacity. Actual local content spend reported for IPPs that have started construction amounts to R38.1 billion against a corresponding project value (as realised to date) of R75.8 billion. This means 50% of the project value has been locally procured, exceeding the 45% commitment from IPPs and the thresholds for BW1 – BW4 (25%-45%). The report	

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Question	**Answer**	**Reference**
	also notes that the REIPPPP has prompted several technology and component manufacturers to establish local manufacturing facilities. The potential cumulative benefits for the local and regional economy are therefore associated with both the construction and operational phase of renewable energy projects and extend over a period of 20-25 years. This impact is rated as of **high positive significance** with enhancements.	

5.1 Wind Energy Facilities' Contribution to Climate Change

The scientific consensus is that climate is changing and that these changes are in large part caused by human activities[8]. Of these human activities, increase in carbon dioxide (CO_2) levels due to emissions from fossil fuel combustion is regarded as a significant contributor to anthropogenic climate change.

South Africa is one of the world's largest emitters of CO_2 in absolute and per capita terms.

The following climate change impacts have been predicted in relation specifically to South Africa[9]:

- South Africa's coastal regions will warm by around 1 - 2°C by about 2050 and around 3 - 4°C by about 2100;
- South Africa's interior regions will warm by around 3 - 4°C by about 2050 and around 6 - 7°C by about 2100;
- There will be significant changes in rainfall patterns and this, coupled with increased evaporation, will result in significant changes in respect of water availability;
- Our biodiversity will be severely impacted, especially the grasslands, fynbos and succulent Karoo where a high level of extinction is predicted;
- Small scale and homestead farmers in dry lands are most vulnerable to climate change and although intensive irrigated agriculture is better off than these farmers, irrigated lands remain vulnerable to reductions in available water;
- Some predictions suggest that maize production in summer rainfall areas and fruit and cereal production in winter rainfall areas may be badly affected;
- Commercial forestry is vulnerable to an increased frequency of wildfires and changes in available water in south-western regions;
- Rangelands are vulnerable to bush encroachment which reduces grazing lands;
- Alien invasive plant species are likely to spread more and have an ever-increasing negative impact on water resources;
- Although strong trends have already been detected in our seas, including rising sea levels and the warming of the Agulhas current and parts of the Benguella current, we are not yet sure what impacts these could have on our seas, the creatures living in the seas or on the communities dependant on the sea;
- Because of our already poor health profile, South Africans are specifically vulnerable to new or exacerbated health threats resulting from climate change. For example, some effects of climate change may already be occurring due to changes in rainfall (droughts and floods) and temperature extremes and cholera outbreaks have been associated with extreme weather events, especially in poor, high density settlements; and
- There will be an increase in the frequency and severity of extreme weather events. Damage costs due to extreme weather-related events (flooding, fire, storms and drought) have already been conservatively estimated at being roughly 1 billion rand per year.

As explained in National Treasury's Carbon Tax Policy Paper (May 2013)[10], addressing the challenges of climate change through facilitating a viable and fair transition to a low-carbon economy is essential to ensure an environmentally sustainable economic development and growth path for South Africa. Further the Policy Paper states that the South African government is of the view that South Africa needs to reduce its greenhouse gas emissions while working to ensure economic growth, increase employment, and reduce poverty and

[8] http://adsabs.harvard.edu/abs/2013ERL.....8b4024C.

[9] http://www.cop17-cmp7durban.com/en/south-africa-on-climate-change/effects-of-climate-change-on-south-africa.html.

[10] National Treasury Carbon Tax Policy Paper. Available online http://www.treasury.gov.za/public%20comments/Carbon%20Tax%20Policy%20Paper%202013.pdf

inequality[11]. Renewable energy projects will play a significant role in meeting South Africa's targets in accordance with the Paris Agreement and assisting the transition to a low-carbon economy.

Renewable energy is valuable to the environment because these projects displace energy produced by fossil fuel (dirty coal, dirty gas, diesel etc.) and nuclear energy (risky and costly with almost perpetual and dangerous by-products) sources. A renewable energy project injects electrical energy into the grid and this energy becomes mixed with the energy produced by all the sources feeding into the grid. The effect is that less fossil and nuclear fuel is required to keep the grid balanced if you increase the fraction of renewable energy entering the grid.

For every kilowatt hour (kWh) that Eskom produces from fossil fuels, Eskom also creates about 1.1 kg of carbon dioxide (a gas strongly associated with global warming). In other words, if you use 450 kWh electrical energy at your home per month you are adding approximately half a ton (500 kg) to the concentration of carbon dioxide in the atmosphere.

5.2 Economic Development and Job Creation

The REIPPPP requires Economic Development ("ED") commitments from onshore wind energy projects and projects are adjudicated according to their ED commitments. The main ED beneficiaries of approved projects are currently communities living within a 50 km radius of renewable energy facilities. Projects are bid and thereafter adjudicated according to tariff (70%) and Economic Development (30%). There is therefore an incentive for projects to focus on Economic Development of the Local Community and to assign as much revenue, jobs, procurement etc. to local people as well as South African companies and people as possible in order to stand a chance of having a successful project.

Projects are adjudicated according to the following points:

Economic Development Elements	**Weighting**
Job Creation	25%
Local Content	25%
Ownership	15%
Management Control	5%
Preferential Procurement	10%
Enterprise Development	5%
Socio-Economic Development	15%
Total	**100%**
Total points	**30 points**

A number of these elements will have a significant and positive impact on the Local Community.

In terms of job creation, bidders are required to indicate the actual number of jobs that will be created for South African citizens, Skilled People, Black People, Skilled Black People and Citizens from the Local Communities. Significant skilled and unskilled job opportunities will be created in the Local Communities, particularly during the construction period.

For Ownership, bidders are required to indicate the total shareholding of the Project Company in the hands of Black People and Local Communities. The minimum ownership percentage for Local Community is 2.5% but projects have committed up to 40% Local

[11] http://www.treasury.gov.za/public%20comments/Carbon%20Tax%20Policy%20Paper%202013.pdf

Community Ownership in order to have a competitive project. Broad-based community trusts are established as a vehicle for Local Community Ownership to received dividend revenue from an operating project that will be invested in socio-economic development imperatives as determined by trustees. The ownership stake is funded either through debt or through equity partners ("a free-carry").

The Socio-Economic Development and Enterprise Development commitments require a percentage of gross revenue from the operating wind farm to be invested in education, health, small business development etc. Projects are required to commit at least 1% of gross revenue towards socio-economic development. As an indication, 1% of gross revenue of a hypothetical 140 MW wind farm, with a capacity factor of 35% and a tariff of 80 c/kWh would equal approximately R3.5 m/year (and R68 million over the 20 year operation period of a project). Projects in the REIPPPP receive additional points if the socio-economic and enterprise development investments are committed to be invested in the Local Community.

WEFs in South Africa will create skilled and unskilled jobs, particularly during the construction period. Under the REIPPPP, projects are incentivised to maximise the direct job creation opportunities, particularly for people in the communities surrounding the project.

WEFs tend to be constructed in rural areas with small communities and limited infrastructure and social amenities. A wind farm would create indirect jobs in accommodation, catering and other services that would support a wind farm and cater for the material and social needs of wind farm workers.

Localisation is considered one of the major contributors to job creation and general improvement of the economy of South Africa. Localisation through the construction of new manufacturing facilities to build wind turbine towers and other turbine components in South Africa is currently progressing.

Wind energy can provide technical skills to South Africans and thus improve the technical skills profile of the country and the regions where wind energy facilities are located. Through the REIPPPP, developers' own initiatives and through support from international donor agencies, a number of young South Africans are being trained on various aspects of wind farm construction and operation.

These projects, if successfully implemented, have the potential to transform for the better key development areas of South Africa and would assist South Africa in meeting its development goals, while meeting its carbon emission reduction targets as per international protocols.

5.3 Need and Desirability Conclusion

The need for the proposed development is supported in terms of meeting the country's climate change goals, and in terms of reducing the country's dependence on fossil fuels as the main source of meeting the country's electricity requirements. Both national and provincial policies and planning documents support the development of renewable energy facilities. The need and desirability for these types of developments play a role in meeting energy and climate change targets and also provide a socio-economic boost at the local level in areas that are in need of it. Based on the review of key planning documents that pertain to the study area it is clear that the development of renewable energy (including wind farms) in the SBDM and BCRLM is supported. However, there is a need to ensure that the siting of renewable energy facilities (including wind farms) does not impact on the areas tourism potential. In this regard the area to the north of the site and the R63 is identified as Tourist Focus Area in the SBDM SDF.

The Proposed Development lies within a REDZ for wind energy, and represents the desired technology to be developed in this specific area. The Proposed Development Site is currently used for low intensity grazing and has little potential for other types of land use. Grazing could continue on the site during the construction and operation of the development. Therefore the change to a mixed land use of grazing and renewable energy would be an improvement to the area. As discussed in detail above, as well as in Chapter 6: Assessment of Alternatives, the proposed development represents the best practicable environmental option, identified through specialists' assessments.

A requirement of the REIPPPP is that in the development of any WEF, the local economy must benefit through employment opportunities, skills development, and the development or enhancement of community infrastructure. The cumulative effect of the proposed development and other developments in the area has the potential to result in highly significant positive socio-economic opportunities for the region.

6 ASSESSMENT OF ALTERNATIVES

Alternatives are different means of meeting the general purpose and need of a proposed development and may include alternative sites, alternative layouts or designs, alternative technologies and the "no development" or "no go" alternative. One of the objectives of the Basic Assessment process is to 2(b) *Identify the alternatives considered, including the activity, location, and technology alternatives.* This section describes alternatives in relation to the proposed development. Table 6.4 provides a summary of this assessment.

The EIA Regulations indicate that alternatives that are considered in an assessment process should be reasonable and feasible, and that I&APs should be provided with an opportunity to provide inputs into the process of formulating alternatives.

The assessment of alternatives should, as a minimum, include the following:

- The consideration of the no-development or "no-go option" alternative as a baseline scenario;
- A comparison of reasonable and feasible selected alternatives; and
- The provision of reasons for the elimination of an alternative.

6.1 The No Development Scenario / "No-Go" Option

This scenario assumes that the proposed development does not proceed. It is equivalent to the future baseline scenario in the absence of the proposed development.

Relative to the proposed development, the negative implications of this scenario include:

- The land-use remains agricultural, with no further benefits derived from the implementation of a complementary land use;
- There is no change to the current landscape or environmental baseline and biodiversity;
- No additional electricity will be generated on-site or supplied through means of renewable energy resources. This would have negative implications for the South African government in achieving its proposed renewable energy target, given the need for increased generation;
- No impact on the local game hunting tourism operations and property values of properties in the immediate vicinity of the proposed development;
- No opportunity for additional employment (permanent and temporary) and business opportunities in the local area where job creation is identified as a key priority;
- No benefit to the local communities and local economic development from a Community Trust over a 20 year period;
- The national and local economic benefits associated with the proposed project's REIPPPP commitments and broader benefits would not be realised.

The purpose of the proposed development is to generate renewable electricity and export this to the national grid. Other socio-economic and environmental benefits will result from the proposed development such as:

- Reduced air pollution emissions - burning fossil fuels generates CO_2 emissions which contributes to global warming. Emissions of sulphurous and nitrous oxides are produced which are hazardous to human health and impact on ecosystem stability;
- Water resource saving – conventional coal-fired power stations use large quantities of water during their cooling processes. WEFs require limited amounts of water during construction and a minimal amount of water during operation. As a water stressed country, South Africa needs to be conserving such resources wherever possible;
- Improved energy security – renewables can be deployed in a decentralised way close to consumers, improving grid strength while reducing expensive transmission and distribution losses. Renewable energy projects contribute to a diverse energy portfolio;
- Take advantage of significant natural renewable energy resources – solar and wind resources remain largely unexploited;
- Sustainable energy solutions – the uptake of renewable energy technology addresses the country's energy needs, generation of electricity to meet growing demands in a manner which is sustainable for future generations;
- Addressing climate change - Climate change is widely considered by environmental professionals as one of the single largest threats to the environment on a local, national and global scale; and
- Employment creation and other local economic benefits associated with support for a new industry in the South African economy.

The 'No Development' alternative would not assist the government in addressing climate change, energy security and economic development. Implementing this option would also not allow for any beneficial socio-economic and environmental impacts as outlined above.

Some surrounding landowners are objecting to the development of a wind energy facility in the area on the grounds that it could negatively impact their hunting tourism operations. However, proceeding with the development will create a substantial amount of jobs and opportunities for the local community which could offset any potential negative effects. In addition, the area has been designated a Renewable Energy Development Zone suitable for wind farm development in particular by the Department of Environmental Affairs, following a Strategic Environmental Impact Assessment (SEA). This SEA identified areas where large scale wind energy facilities can be developed in a manner that limits significant negative impacts on the environment while yielding the highest possible socio-economic benefits to the country.

Based on the above, the 'No Development' alternative is not a preferred alternative.

6.2 Site Selection

Once a site has been identified as a possibility, the Developer models a 'Virtual Wind Farm' to understand the potential for a wind farm project at the site. If the site shows potential, the landowner is approached and the land secured by means of a long-term lease. Once this has occurred the next step is for Monitoring and Pre-feasibility.

The Pre-feasibility part of this stage includes a range of preliminarily considerations which are investigated to evaluate the project sites:

1. Grid connection options and capacity availability on the existing national grid;
2. The feasibility of site access;
3. Technical construction issues such as geological conditions and topography;

4. Preliminary high level environmental considerations regarding the presence of internationally, nationally, provincial and local protected areas, identified heritage sites, hydrology (including perennial and no-perennial waterways, dams and wetlands, etc.), location of houses, roads etc. based on publicly available data or preliminary on-site investigations. Publicly available data is obtained from sources such as the Endangered Wildlife Trust (EWT), Cape Nature, Birdlife SA, SANBI, local wildlife groups and other publicly available georeferenced environmental data of South Africa. At this stage of a development initial consultation with key statutory and non-statutory organisations such as Birdlife SA, EWT, SANBI and Provincial/National Department of Environmental Affairs may be completed.

Only if no initial, high level issues are identified, a monitoring mast is erected on preferred project sites to measure on site wind. A minimum of 12-months data collection is required in order for the wind data to be considered bankable.

The next stage is Full Feasibility, which includes the Basic Assessment or Scoping and EIA process. The aim of this phase is to address the project at a more detailed level, so as to advance the decision on if the project should proceed, and if so, what are the limitation and constraints to development. This includes consideration of key commercial, environmental, technical and legal issues. The aim for this stage is to inform the decision that the site can be financed and constructed. Since the developer makes a firm commitment towards the project at this point, this is a very important step in the selection process of project sites and the moment when the project is introduced into the public domain. The EIA is one of the key actions identifying site specific environmental feasibility and constraints at the Full Feasibility stage. The EIA therefore forms an important stage in informing the progression of the project, its design, and facilitates the introduction to the public.

In brief, the selection process is a detailed process of identification and elimination of sites and starts with identifying a potentially viable site through the presence of suitable wind resource. This is done at a macro scale using wind modelling techniques. Areas with favourable wind regimes at this scale can then be scaled down using more refined modelling techniques, and the process of ruling out sites through considering applicable constraints. Sites which are found to be suitable in terms of both wind resource and constraints, including environment considerations, are taken forward to the application for Environmental Authorisation.

WKN-Windcurrent has and continues to develop a portfolio of sites across South Africa including sites in the Eastern Cape. The proposed Highlands WEF was selected out of WKN-Windcurrent's portfolio based on anticipated wind resource (high wind speeds), proximity to existing grid infrastructure, land availability, minimum technical constraints from a construction perspective and absence of high level environmental issues at the Monitoring and Pre-feasibility stage.

Further on-site wind monitoring is currently underway from anemometer masts and SODAR devices in order to confirm the wind resource on site and improve the accuracy of existing wind data as well as to inform the most efficient turbine layout.

The tables below provide further detail on the site selection process in relation to the proposed development, which was selected based on consideration of a range of potential sites at the time. This does not present the full WKN-Windcurrent portfolio of projects as this changes with time. It reflects the projects being considered at the time of selection of the proposed Highlands WEF to be taken forward to the Full Feasibility stage, including the EIA process.

Based upon the analysis as summarised above and in the Alternatives Tables below, the proposed Highlands WEF site is the Preferred Site.

Table 6.1: Alternatives Table for the Proposed WEF – Investigated Regions

Factor	Region A – Preferred Region	Region B	Region C	Region D
Location Descriptor	Inland Eastern Cape	Inland Eastern Cape	Inland Eastern Cape	Inland Eastern Cape
Wind Resource	Good based on installed wind measurement masts	Below Average based on installed wind measurement mast	Good based on desktop data	Good based on desktop data
Grid Connection	Available on site	Available close to site	Available close to site	Limited connection capacity available on site
Land Use and Land Availability	Suitable land use and able to secure	Suitable land use and able to secure	Suitable land use and able to secure	Suitable land use and able to secure
Site Access	Good	Moderate - difficult	Good	Good
Environmental Sensitivity	Low-medium sensitivity	Low-medium sensitivity	High sensitivity – avifaunal concerns (Rudd's Lark, Cape Vulture)	High sensitivity – avifaunal concerns (Cape Vulture)
Status of Development / Decision	Advanced to Feasibility Stage	Not advanced	Not advanced	Not advanced

Table 6.2: Alternatives Table for the Proposed WEF – Specific Site Selection within Preferred Region

Factor	**Suitability of the Preferred Site**	**Suitability of Area North of Preferred Site**	**Suitability of Area East of Preferred Site**	**Suitability of Area South of Preferred Site**	**Suitability of Area West of Preferred Site**
Land Availability	The site is located on rolling hills that offers suitable buildable area for a full 150MW facility. The landowner has signed consents for the undertaking of the EIA process.	Not pursued due to several factors: Area not located in REDZ Inaccessible mountainous terrain	Not pursued due to several factors: Low-lying land to East of Preferred site has poor wind resource	Not pursued due to several factors: Area not located in REDZ	Not pursued due to several factors: Area not located in REDZ Low-lying land beyond escarpment has poor wind resource
Land Use	Transformed land currently used for low density livestock farming.	Commercial game hunting - unsuitable	Commercial game hunting - unsuitable.	Commercial game hunting - unsuitable.	Combination of livestock farming, hunting and protected area.
Environmental Sensitivity	Although the site does contain environmental features that have to be avoided due to high environmental sensitivity, suitable area is still available, following these exclusions, to develop a 140 MW facility.	High sensitivity – mountainous terrain with confirmed Verreaux's Eagle nest	Moderate sensitivity - closer to the town of Somerset East and confirmed Cape Vulture colony. Also more risk of cumulative impacts due to proximity to existing wind energy facilities.	Likely to be similar to Preferred Site, but confirmed Verreauxs Eagle nest, slightly more mountainous terrain, and less accessible.	Moderate-high sensitivity – due to cave used for bat roost
Wind speed levels	Feasible wind speed confirmed through over one year of onsite wind monitoring.	Likely to be feasible wind speed based on elevated terrain and satellite data, however the area is inaccessible.	Likely to be below that of preferred site, based on lower altitude and according to satellite data.	Likely to be below that of preferred site, based on lower altitude and according to satellite data.	Likely to be below that of preferred site, based on lower altitude and according to satellite data.
Distance to grid	Two Eskom overhead powerlines with available capacity traverse the Northern portion of the site.	Two Eskom overhead powerlines with available capacity in close vicinity	Two Eskom overhead powerlines with available capacity in close vicinity	Much greater distance to the two Eskom overhead powerlines with available capacity	Two Eskom overhead powerlines with available capacity in close vicinity
Status of Development / Decision	Advanced to Feasibility Stage	Not advanced	Not advanced	Not advanced	Not advanced

6.3 Design Evolution Alternatives

Following the selection of a suitable site, consideration is given to the design of the development layout within that site. It is important that wind turbines are sited in the optimum position to maximise the wind energy yield whilst minimising environmental impacts as far as possible.

The Developer therefore commissioned Arcus to conduct a multi-disciplinary high level site feasibility assessment to identify any areas known to be unsuitable for development and determine the sensitivity of the remaining site. The output of this assessment was a preliminary site sensitivity map used to ascertain if development within this area was feasible. Based on the results the Applicant then developed a preliminary development layout that avoids all no-go areas and areas of high sensitivity, and prioritised areas of low sensitivity where possible. This layout was given to the specialist team to assess in their specialist impact assessment reports (The Proposed Layout). Based on the results of their assessments the layout was revised further in order to give consideration to all the specialist mitigation requirements. This is referred to within this report as the Final Mitigated Layout.

Table 6.3 indicates the location of the turbines, pre and post specialist assessment and indicates the final preferred locations to be considered for authorisation.

Table 6.3: Turbine Layout Design Evolution[12]

	The Proposed Layout		**The Final Mitigated Layout**	
WTG No.	**Latitude**	**Longitude**	**Latitude**	**Longitude**
WTG1	-32.69347	25.3575	-32.6935	25.3575
WTG2	-32.6972	25.34996	-32.6972	25.34996
WTG3	-32.69687	25.36668	-32.6969	25.36668
WTG4	-32.69902	25.37581	-32.699	25.37581
WTG5	***-32.70314***	***25.388***	***-32.7031***	***25.38799***
WTG6	***-32.71499***	***25.38244***	***-32.716***	***25.38022***
WTG7	-32.70973	25.37525	-32.7097	25.37525
WTG8	-32.70985	25.36681	-32.7099	25.36681
WTG9	***-32.7161***	***25.36987***	***-32.7161***	***25.36988***
WTG10	-32.72232	25.37377	-32.7223	25.37377
WTG11	-32.70648	25.35246	-32.7065	25.35246
WTG12	-32.71384	25.35514	-32.7138	25.35514
WTG13	-32.71458	25.34684	-32.7146	25.34684
WTG14	-32.70726	25.34311	-32.7073	25.34311
WTG15	-32.71101	25.33664	-32.711	25.33664
WTG16	-32.71268	25.32701	-32.7127	25.32701
WTG17	***-32.72362***	***25.3188***	***-32.7235***	***25.31863***

[12] Coordinates in bold italics indicate turbines that have been relocated in response to the findings of the specialist studies.

6.4 Technology Alternatives

Additional renewable energy technologies include hydro-electric power, photovoltaic solar or concentrated solar power. The site itself has no resource for hydro-electricity. The site topography is less suited to the construction of large scale ground mounted solar facilities. Solar electricity generation would also require a much greater infrastructure footprint and water consumption (for cleaning panels) to generate the equivalent energy of the proposed WEFs. Wind farms are less land intensive and water intensive than solar projects.

Wind energy is likely to present less of an impact on the continued use of the land for grazing, as it does not result in the shading that occurs from solar facilities which may affect vegetation and consequently farming practices. Whilst there are potential impacts associated with wind energy which are not associated with solar, such as collision risk with avifauna, there are different potential impacts for solar facilities such as loss of habitat and foraging areas for avifauna and other ecological receptors.

Based on the site's physical characteristics and existing land uses, the renewable energy technology best suited to the site, taking into account the potential environmental impacts, is a WEF.

Various wind turbine designs and layouts will be considered for the site in order to maximise the electricity generation capacity and efficiency, whilst taking into account environmental constraints. The turbine manufacturer and turbine model has not yet been determined and will not be decided upon until the completion of further wind analysis and competitive tendering.

6.5 Alternative Assessment Summary

Table 6.4 provides a summary of the alternatives considered in the selection of the preferred alternative. Based on this assessment, it was decided that the proposed location of the WEF will be the Highlands site, located in the Eastern Cape Province. Through the feasibility process the design of the WEF was developed taking into consideration environmental constraints. These constraints were provided by the specialists, and included no-go areas based on avifaunal and bat constraints, as well as floral and faunal constraints, aquatic buffers, and visual constraints. A provisional layout for the proposed development was designed based on these constraints, and provided to the specialists to use as part of the impact assessment phase (The Proposed Layout). The specialist's detailed assessments resulted in constraints being refined or added so that this provisional layout has continued to evolve throughout the process. The Final Mitigated Layout takes into account all final specialist findings and recommendations, as well as geo-technical aspects of the site. The Final Mitigated Layout is submitted to the DEA for authorisation, and if approved and awarded preferred bidder status, this layout will further be developed, through micro siting of turbines and roads, with the assistance from the relevant specialists.

Table 6.4: Assessed Alternatives Summary

Alternative Type	Alternative description	Advantages	Disadvantages	Result
No Development	The proposed development does not proceed	• No change in current landscape or environmental baseline • No risk of negative environmental and social impacts • No impacts on local hunting tourism industry	• Land use remains low agricultural, without benefits from complimentary land use • No additional electricity will be generated through renewable resources • No opportunity for additional employment (permanent or temporary) in an area where job creation is identified as a key priority • No socio-economic benefits for the community associated with the establishment of a Community Trust • The government will not be assisted in addressing climate change, energy security and economic development • No development in an area earmarked and suitable for such specific development (REDZ)	Not reasonable
Preferred Location	The Proposed Development Site	• Good wind • Accessible for wind turbine delivery • Proximity to Eskom grid • Surrounding area not densely populated • Site is transformed agricultural land with current land use grazing • Within the Cookhouse REDZ	• Potential visual sensitive receptors • Potential loss of sense of place • Potential ecological sensitivities • Potential negative impact on surrounding hunting and game farm operations	Reasonable and feasible
Location	Different location in the area	• None identified	• No landowner consent; • Longer grid connection and access roads possibly required; • No wind data.	Reasonable not feasible
Technology	Wind Energy Facility	• Emits no CO_2 and has no fuel costs • Low water consumption compared to conventional power stations • Can share land use with other activities	• WEFs pose collision risk to birds and bats • Potential visual impact and impact on sense of place; • Potential impact on surrounding game farm operations	Feasible and reasonable

Alternative Type	Alternative description	Advantages	Disadvantages	Result
		• Small footprint (little habitat loss) compared to other means of equivalent electricity generation • Low water consumption and pollution compared to conventional power plants • Contributes to government renewable energy goals. • Stable, consistent and reliable resource for the long term. • Less amount of maintenance required and therefore higher availability of machines compared with nuclear, coal and gas (around 97% compared with around 50% for conventional power stations).	• Dependent on availability of wind in any given time in one place, but if located at different wind spots widely over the country, this is not an issue. • New skills and training required in workforce (this could also be seen as an advantage).	
Technology	Photo-voltaic	• Solar PV poses less risk to birds and bats; • Lower visual impact on surrounding game farms.	• Site topography not suitable for large scale ground mounted solar facilities with equivalent output • Solar power has much larger footprint (habitat loss) • Dependent on cloud cover • Water use for cleaning panels.	Not reasonable
Technology	Concentrated Solar Power	• No collision risk to bats	• Site topography less suitable for large scale ground mounted solar facilities • CSP poses collision risk to birds and loss of foraging habitat • Visual impact on surrounding game farm operations	Not reasonable
Technology	Hydro-electric	• Almost no emissions and no fuel costs • Large-scale and stable electricity generation • No risk of collision for birds & bats	• No hydro-electric resources in area • Significant impact on the landscape and river systems	Not feasible
Technology	Biomass	• Carbon neutral over time	• More expensive than other forms of energy • Biomass supply difficult to secure at present	Not feasible

Alternative Type	Alternative description	Advantages	Disadvantages	Result
Technology	Coal-fired power plant	Established skills sector. “Business-as-usual” means immediate job stability for coal miners.	• Abundant but expensive to extract. • emits high levels of CO2, major pollutant and contributes to climate change • coal mining impacts significantly on the environment • Non-renewable resource • Took over 1 million years to form under the earth’s surface and is irreplaceable once extracted. • Price volatility. • More expensive than wind energy • High water consumption to produce electricity. • Procurement at expense of wind/solar means loss of jobs in younger clean technology industries	Not reasonable
Technology	Nuclear power	• Low carbon footprint	• Most expensive form of energy; requires major investments • Safety concerns (highly radioactive raw and waste material) • Radioactive toxic waste product • Very long timelines until energy generation can start. • Low job creation potential. • Proposed location not suitable for Nuclear power.	Not reasonable or feasible
Design	Final Mitigated Layout (Preferred Alternative)	• Maximises wind • Minimises negative impacts • Enhances positive impacts	• Potential residual negative impacts of low to medium significance	Reasonable and feasible

7 THE PREFERRED ALTERNATIVE

Based on the alternatives analysis, the 150 MW Highlands Wind Energy Facilities, and associated infrastructure, including grid connection infrastructure was chosen as the preferred alternative as the best practicable environmental option (Figure 7.1).

There are two existing Eskom Transmission lines located within the Proposed Development Site boundary, one a 66 kV and the other a 132 kV. Both have a limited available capacity, and both will be required to connect the Highlands WEFs to the national grid. It is unknown at this stage how many turbines can connect to which each line, based on uncertainty surrounding the available capacities on each line and the downstream constraints (for example the Eskom main transmission system (MTS) substations). The technical and financial feasibility for the optimum split will be determined on finalising the ongoing analysis of meteorological data – this will ultimately determine whether the larger of the two projects connecting to the 132 kV line will be located to the north or the south of the smaller project connecting to the 66 kV line.

Therefore, for the purpose of obtaining Environmental Authorisation (EA), and bidding requirements in the Department of Energy's Renewable Energy Independent Power Producers Procurement Programme (REIPPPP), the project has been split into six components:

- **Highlands North Wind Energy Facility (WEF);**
- Electrical Grid Connection and Associated Infrastructure for Highlands North WEF;
- Highlands Central WEF;
- Electrical Grid Connection and Associated Infrastructure for Highlands Central WEF;
- Highlands South WEF; and
- Electrical Grid Connection and Associated Infrastructure for Highlands South WEF.

This report and application pertains to the **Highlands North WEF (The Proposed Project)**.

7.1 Description of the Highlands North WEF (The Proposed Project)

The Highlands North WEF (Figure 7.2) will consist of up to 17 three-bladed horizontal-axis turbines with a maximum hub height of 135 m and rotor diameter of up to 150 m (Figure 7.2), with a generating capacity of up to 5 MW each. A maximum height to blade tip of 200 m will be considered. Internal roads will connect the turbines. On-site cabling will largely follow the road infrastructure where possible, and will be either overhead, or underground. One on-site substation location (Substation A) forms part of this application.

The final choice of turbine will be dependent on the technology available at the time of construction, project economics and the desired output from the development.

Should a positive Environmental Authorisation (EA) be obtained for this WEF, and in the event that no change in evacuation capacity has occurred, the applicant will implement the approved layout to suit evacuation capacity, current policy and turbine type at the time of development.

7.2 Site Description and Location of the Proposed Project

The Proposed Highlands North WEF is located approximately 20 km west of the town of Somerset East, bordering the south of the R63 route, approximately 23 km south-east of Pearston, in the Eastern Cape Province. The Proposed Development site is located in the Blue Crane Route Local Municipality (BCRLM) in the Sarah Baartman District Municipality (SBDM), previously known as the Cacadu District Municipality.

The main settlements in the municipality are Somerset East, which serves as the administrative and commercial centre, Cookhouse and Pearson. The most significant roads passing through the area are the N10, R61, R63, and the R390. The administrative seat of the SBDM is currently located in the Nelson Mandela Bay Metro area, with disaster centres located throughout the district.

Access to the site is via the R63, which effectively forms the site's northern boundary, which is a tarred road linking Pearston, in the west, to Somerset East, in the east (Photograph 7.1). The R63 continues west of Pearston to link up with the R75 (Jansenville-Graaff-Reinet). To the east of Somerset East the R63 links up with the N10 at Cookhouse.

Photograph 7.1: View along R63 looking towards Somerset East near turnoff to Rietfontein

Alternative access from the R63 is provided by the Klipplaatberg Road which links up with the R63 on the eastern outskirts of Pearston. A servitude farm road via Klipplaat, Mulderskraal and Kaalplaas, linking the Klipplaatberg and Waterford Roads, is the only road which actually traverses the site. The Cradock gravel road links up with the R63 approximately 5 km east of the site and provides access to the Kamala Game Reserve and Buffelsfontein Guest Farm located to the north of the R63.

An Eskom corridor (66 kV and 132 kV line) runs parallel to the R63 in the vicinity of the proposed development site and traverses the northernmost portion of the site approximately 200 m south of the R63 over a distance of approximately 3 km from east to west. The proposed development intends to connect to this grid infrastructure on site. Apart from the road network, Eskom corridor and telecommunications infrastructure on

Groot Bruintjieshoogte Mountain, there are no other significant service related infrastructure located in the study area.

The R63 would be most directly affected, with the nearest proposed turbine ~500 m from the road and another 8 within 2.5 km of the road. The relevant portion of the R63 is already affected by the Eskom line corridor and is not visible from Bruintjieshoogte Pass to the east. The nearest turbine would be located approximately 5 km from the Cradock Road which provides access to Buffelsfontein Guest Farm and Kamala. Due the Cradock Road's higher elevation, the proposed development would be clearly visible from the road. Turbines would be located >10 km of the Waterford Road and would be less visible due the increased distance.

The Proposed Development site lies at the eastern end of the Camdeboo Region and at the foot of the Bruitjieshoogte Mountain. Its land parcels cover an area of approximately 11 180 hectares. The area of interest for development within these land parcels is approximately 9000 hectares (The Proposed Development Area), but the development footprint of the Highlands North WEF will only occupy approximately 1% of this area. The Proposed Project is situated entirely within the Cookhouse REDZ (Figure 1.1).

The Proposed Development site is comprised of properties owned by five different land owners (Table 7.1, Figure 7.2). Four of the owners are commercial farmers farming while the fifth is National Government who leases the land to two sets of farmers with long lease (30-year) contracts.

Table 7.1: Property Details of the Proposed Development Site (greyed out land parcels do not contain turbine positions for the Highlands North WEF)

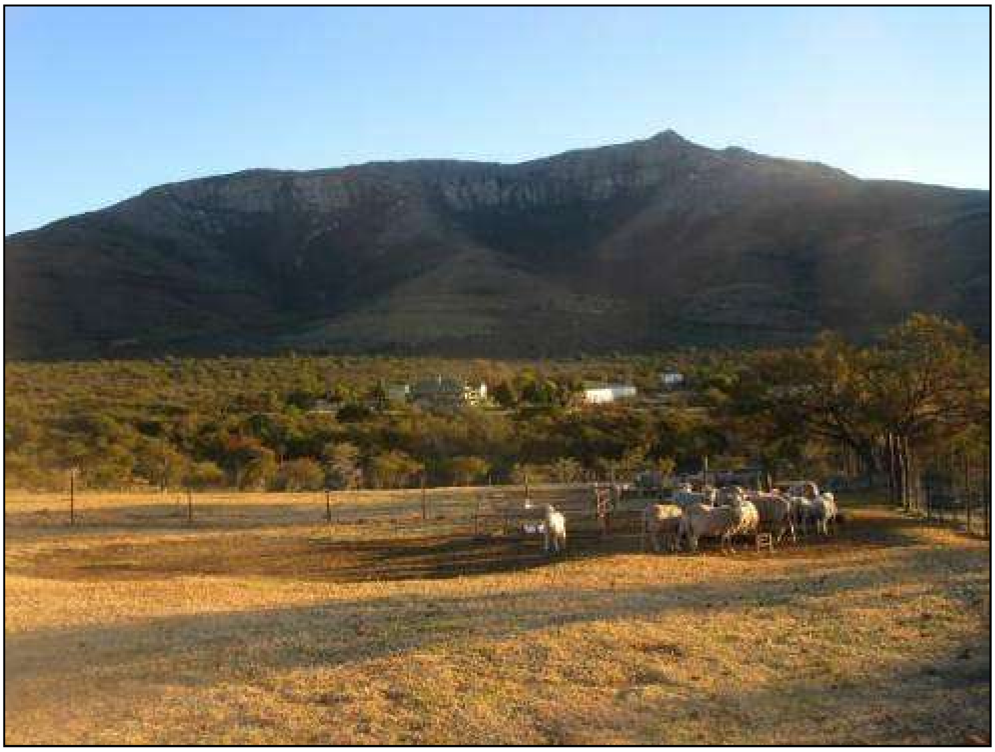
Property Owner	Farm Portion	Size	SG Number
ZIRK JORDAAN FAMILY TRUST	Farm 102 Rietfontein Farm 102 – Portion 0 Remaining Extent	2443.50	C06600000000010200000
SA Government (Tenant: Simphewe & Linda Fani)	Farm 104 Coetzees Fontein Farm 104 - Portion 0	25.54	C06600000000010400000
	Farm 104 Coetzees Fontein Farm 104 - Portion 1	389.41	C06600000000010400001
	Farm 104 Coetzees Fontein Farm 104 - Portion 2	618.43	C06600000000010400002
	Farm 105 Doorn Rivier Farm 105 - Portion 0 Remaining Extent	1284.80	C06600000000010500000
	Farm 105 Doorn Rivier Farm 105 - Portion 1	1027.83	C06600000000010500001
	Farm 143 Nels Kraal Farm 143 – Portion 0	689.13	C06600000000014300000
	Farm 146 Kiepersol Farm 146 – Portion 1	125.91	C06600000000014600001
SA Government (Tenant: Tozi Nelani)	Farm 144 Nelskom Farm 144 - Portion 0 Remaining Extent	223.91	C06600000000014400000
	Farm 145 De Mullers Kraal Farm 145 – Portion 0	865.33	C06600000000014500000
	Farm 145 De Mullers Kraal Farm 145 – Portion 8	0.88	C06600000000014500008
HIGHLANDS TRUST	Farm 361 Highlands Farm 361 – Portion 0 Remaining Extent	1828.82	C06600000000036100000
G K W GEBOU TRUST	Farm 103 Spaarwater Farm 103 – Portion 0	854.39	C06600000000010300000
Jakkie Nel Trust	Farm 101 Lekker water	53.96	C06600000000010100002

	Farm 101 – Portion 2		
	Farm 104 Coetzees Fontein Farm 104 – Portion 5	650.37	C06600000000010400005

The farm portions affected by turbines are discussed in more detail below.

7.2.1 Farm Rietfontein

Farm 102 Rietfontein is owned by Mr Zirk Jordaan. The inhabited portion of the farm (Photograph 7.2) lies north of the R63 and is excluded from the Proposed Development Area. There are no farmsteads on the farm that form part of the proposed development. The Rietfontein farmstead lies 1.4 km from the closest proposed turbine position.



Photograph 7.2: Sheep and farmstead on portion of Rietfontein located north of the R63

Rietfontein currently employs 10 tenured households and is used for extensive livestock farming of beef cattle, sheep and angora goats. Labour is based elsewhere and transported in by the owner when required for farming operations. No commercial hunting or tourism activities are taking place on the property. The property would be affected by a maximum of 13 turbine positions. Turbine positions are proposed on higher-lying less easily accessible portions of the property and would not impact areas of high quality grazing (Photograph 7.3 & 7.4). A substation is proposed on Rietfontein in an area not considered to be of agriculture value to the owner (Z. Jordaan, pers. comm.). Rietfontein is accessed directly off the R63.

Photograph 7.3 and 7.4: Portions of Rietfontein affected by turbines

7.2.2 Farm Spaarwater

The farm 103 Spaarwater is owned by GKW Gebou Trust (Mr Renier Kemp) who resides in Graaf Reinet. The western portion of Spaarwater does not form part of the proposed development site as it consists of steep terrain associated with the western escarpment. The farmstead is located on the excluded portion of the site and no staff reside on the property. The farm is used for extensive beef, sheep and goat farming with labour only brought in when required (Photograph 7.5 and 7.6). No commercial hunting or tourism is conducted on the farm. Two proposed turbine positions are located on Spaarwater, with the closest turbine being located 1.8 km from the farmstead.

Photograph 7.5 (left) and 7.6 (right): Spaarwater farm yard (middle distance) located to the west of the site viewed from Bruintjieshoogte Pass; Stock pens on Spaarwater

7.2.3 Farm Coetzeesfontein

The farm 104 Coetzeesfontein is owned by the Jakkie Nel Trust (Mr Jakkie Nel). The western and southern section of the farm do not form part of the proposed development area and consist of largely steep terrain associated with the western escarpment. The farmstead is located on the proposed development site approximately 650 m from the closest proposed turbine location. Two proposed turbine positions are located on Coetzeesfontein. Only skeleton supervisory staff reside on the property.

7.3 Adjacent Properties

More recently, game farming has become an increasingly important activity in the area and is either combined with livestock farming or has in some cases replaced commercial livestock farming. Based on the findings of the sites visit the existing game farming operations are located within a continuous band within 5-10 km along the eastern boundary of the proposed development site. The game farming includes operations based on Buffelsfontein, Kamala Game Reserve, Kaalplaas (East Cape Safaris), Klipplaat (Side by Side Safaris), and possibly more (e.g. Driefontein). These operations focus primarily on the overseas trophy-hunting market and attract high-end visitors to the area (Nolte, pers. comm). The game farms also provide benefit to other sectors of the local economy in Somerset-East, including local suppliers (groceries, etc.), taxidermists and other operations.

Due to the broken topography and the extensive nature of farming activities, the settlement pattern in the study area is sparse and largely concentrated along major roads. Farms located in close proximity to the R63, Waterford Road or Klipplaat Road tend to be inhabited. Labourer's housing is typically located in the immediate periphery of farm yards. Large operations (such as Rietfontein) may have up to 10 resident farm worker households. More isolated farms (which make up the majority of farms on the WF site) are typically farmed as stock-posts inhabited by a small number of supervising staff. Most of the relevant owners own farming operations in other parts of the broader region, such as Graaff-Reinet, Cookhouse and Middleton, and deploy staff to the study area farms on an as-needed base. The study area is located sufficiently close to Somerset-East to enable owners to transport permanent and casual labour in and out on a daily basis.

Based on field interviews, permanent direct employment associated with site farms and those in the immediate vicinity, ranges from none or only supervisory staff, to 10 for a large commercial farming operation such as Rietfontein, and 24 for Kaalplaas (East Cape Safaris).

7.4 Wind Energy Facility (WEF) Components

The WEF will comprise components described below. It should be noted that as the design of the proposed development is not yet finalised, all dimensions are maximums as is required by the precautionary principle. The final design may include infrastructure which is of equal or less than dimensions to those stated below, but not greater or bigger than these dimensions.

7.4.1 Turbines

The proposed WEF will comprise of up 17 turbines.

At this stage, it is envisaged that the turbines will each have a capacity to generate between 3 and 5 MW of power. Each turbine will have a maximum height to blade tip of 200 m. The turbines will be three-bladed horizontal-axis design with a hub height of up to 135 m and a rotor diameter of up to 150 m and a blade length of up to 75 m. The exact turbine model has not yet been selected and will be subject to competitive tendering after further wind analysis has been completed. The turbine model will depend upon the technical, commercial and site specific requirements.

The turbine rotor speed will vary according to the energy available in the wind, the wind speed. The turbines will generate power in wind speeds between approximately 3 metres per second (m/s) and 28 m/s (depending on the model of turbine) with maximum power output usually achieved at wind speeds of around 10 - 12 m/s. On average, wind speeds greater than approximately 28 m/s the turbines will automatically turn the angle of the blade to reduce energy capture (this is known as 'pitching') and stop turning to prevent damage.

The turbines would be placed on steel and concrete foundations, each foundation area occupying an area of up to 25 m by 25 m in total (which includes the maximum total area that may need to be disturbed during construction of the foundation). The foundation areas are typically up to 5 m deep and will include concrete and steel plinths depending upon local ground conditions.

Figure 7.2 indicates the preferred positions of the turbines for approval (The Final Mitigated Layout).

7.4.1.1 Turbine Power Output and Transformers

When operating, the rotational speed of the rotor is multiplied through the gearbox, which drives the generator. This produces a three-phase power output which is transferred from the generator to a transformer located either within the turbine or externally at ground level adjacent to each tower.

The turbine transformer converts the electrical output from the turbine to a higher voltage, 33 kilo volts (kV), for grid connection purposes. Stepping up the voltage helps to reduce electrical losses and in this case match the electrical system voltage for transmission to the grid. Power generated from the turbines is transmitted back to the site switching station via the underground site cables.

7.4.2 Electric Cabling and On-site Substation

Underground cabling will link the turbines to each other and to the on-site substation. The electricity from the turbines will be transferred via a 33 kV electrical network to an on-site substation of 110 m by 100 m. Where possible this will be underground but the feasibility of this will be confirmed as the design progresses and geotechnical studies are conducted. Detailed construction and trenching specifications will depend on the ground conditions encountered. Typically cables would be laid in a trench approximately 1 m deep and 0.5 m wide. To minimise ground disturbance, cables will be routed along the side of the access tracks where practicable. The proposed cabling routing is presented in Figure 7.2.

The on-site substation will house electrical infrastructure such as transformers and switch gear to enable the energy to be transferred into the existing national grid. The operations and maintenance (O&M) building adjacent to the on-site substation will be 50 m by 100 m including parking. A fence of up to 3 m height will surround the substation and O&M building.

7.4.2.1 Hard Stand Areas

Each turbine requires an area of hard-standing to be built adjacent to the turbine foundation. This provides a flat, stable base on which to lay down the turbine components ready for assembly and erection and to site the two cranes necessary to lift the tower sections, nacelle and rotor into place.

A hardstanding area of up to 100 m by 50 m will be established adjacent to each turbine location. This will be used to provide a platform for cranes to operate during construction (and unscheduled maintenance), as well as a clear area to lay out turbine components prior to erection.

The crane hard-standing will be reduced to 100 m x 30 m following construction in order to allow for maintenance should major components need replacing during the operational phase of the proposed development.

7.4.3 Ancillary Equipment

In addition to the key components outlined above, the WEF will also require:

- Meteorological masts;
- Security fencing; and
- CCTV monitoring equipment.

7.4.3.1 Access

The turbine locations will be accessed through a network of unsealed roads which will be established across the WEF Site. The proposed road layout is presented in Figure 7.2. These access roads will be between 6 m and 12 m wide. A width of 12 m is required during the construction phase for curves in order to allow trucks to turn. Such roads are required to facilitate access for the cranes and abnormal load deliveries of turbine components.

Existing farm access roads will be upgraded and utilised where possible, as will existing watercourse crossings.

7.5 Description of the Construction Phase of the WEF

It is estimated that construction will take approximately 18 - 24 months subject to the final design of the WEF, weather and ground conditions, including time for testing and commissioning. The construction process will consist of the following principal activities:

- Site survey and preparation;
- Construction of site entrance, access roads and passing places;
- Enabling works to sections of the public roads to the WEF site (if required) to facilitate turbine delivery;
- Construction of the contractors' compound;
- Construction of crane pads;
- Construction of turbine foundations;
- Construction of substation building;
- Excavation of the cable trenches and cable laying;
- Delivery and erection of wind turbines;
- Erection of electricity overhead powerlines;
- Testing and commissioning of the wind turbines; and
- Rehabilitation.

It is possible for certain operations to be carried out concurrently, although predominantly in the order mentioned above. This would minimise the overall length of the construction programme. Construction would be phased such that the civil engineering works would be continuing on some parts of the site, whilst wind turbines are being erected elsewhere. Site rehabilitation will be programmed and carried out in order to allow the rehabilitation of disturbed areas as early as possible and in a progressive manner.

Based on the social specialists' assessment, the construction phase is likely to create approximately up to 200 to 250 employment opportunities, at its peak. Of this total, approximately 15% will be available to skilled personnel (engineers, technicians, management and supervisory), 30% to semi-skilled personnel (drivers, equipment operators) and 55% to low skilled personnel (construction labourers, security staff). The number and nature of employment opportunities will be refined as the development process progresses. These figures are based on other WEF developments, the exact number and nature of the employment opportunities will be defined during the bidding process, should the project be selected as a preferred bidder. These are requirements of the bidding process as defined by the DoE.

Water for construction purposes (e.g. mass earthworks and roads) will be transferred from the source to the point of use on the site via tanker. All storage of water will be below Water Use License Application (WULA) authorisation limits, i.e. 10 000 m^3. If this goes beyond this limit, a WULA will be submitted to the Department of Water Affairs.

7.5.1 Temporary Infrastructure

Laydown Areas

Additional temporary laydown areas will be required for equipment and component storage during construction across the site. These areas will be levelled and compacted and used for component storage. Temporary infrastructure would include a site camp, laydown areas and a batching plant with a total size of 1 hectare (Figure 7.2)

Cement Batching Plant

A cement batching plant is proposed as part of the construction camp area. The total volume of cement that is required for the project is expected to be at least 25,300 m³ and would require on-site bulk storage of aggregate, cement and sand, all of which would be imported to the site from commercial sources, i.e. no mining or crushing of materials is proposed. It is anticipated that the water demand for concrete production would be approximately 5,060 kL (14.4 kL /day) over a 16 month period and would be supplied by new borehole(s) in vicinity of the batching plant.

Details of the batching plant are not known at this stage, but will all be contained within the footprint area allocated for the construction camp site (approximately 4 ha).

Some of the aggregate required for the construction of the on-site tracks may be sourced from cut and fill operations during construction from within the proposed development site with additional material imported from permitted quarries as required.

If required, a separate application will be lodged with the Department of Mineral Resources in regard to this activity.

Storage of Hazardous Chemicals

It is anticipated that temporary storage facilities for various hydrocarbons would be required during construction including Liquid Petroleum gas, petrol, diesel, and transformer oils.

All construction camps, lay down areas, batching plants or areas with any fuel stores should be more than 50 m from any demarcated water courses. No permanent hydrocarbon storage facilities are proposed and temporary facilities will be completely be removed on completion of construction and the area rehabilitated.

The Environmental Management Programme must be adhered to by the appointed contractors, and mitigation measures for the storage and handling of hazardous chemicals are included in the EMPr.

7.5.2 Water Supply for Construction

The estimated total water demand for construction is approximately 200 kL/day, not exceeding 40,000 kl total per annum. It is anticipated that this will either be will be supplied via 15 kL water trucks to the various construction areas, or be abstracted from boreholes, in which case an application for authorisation will be made. All storage of water will be below Water Use License Application (WULA) authorisation limits, i.e. 10 000 m^3. If this goes beyond this limit, a WULA will be submitted to the Department of Water Affairs.

7.6 Description of the Operational Phase of the WEF

The proposed development will be designed to have an operational life of at least 25 years as set out in the current REIPPPP by the DoE. There is the possibility to further expand the lifetime by an extra 25 years. The only development related activities on-site will be routine servicing and unscheduled maintenance, as detailed in the sections below.

Based on the developer's experience from other WEFs, the operational phase is likely to create approximately 20 permanent employment opportunities in addition to the employment opportunities across the other phases. Of this total, approximately 70% will be low and medium-skilled and 30% will be high skilled positions. The number and nature of employment opportunities will be refined as the development process progresses. The figures provided here are early estimates.

7.6.1 Routine Servicing

Wind turbine operations will be overseen by suitably qualified local contractors who will visit the site regularly to carry out maintenance. The following turbine maintenance will be carried out along with any other maintenance required by the manufacturer's specifications:

- Initial service;
- Routine maintenance and servicing;
- Gearbox oil changes; and
- Blade inspections.

Routine scheduled servicing will likely take place every three months with a main service likely to occur at twelve-monthly intervals. Servicing will include the performance of tasks such as maintaining bolts to the required torque, adjustment of blades, inspection of blade tip brakes and inspection of welds in the tower. In addition, oil sampling and testing from the main gearbox will be required once every year and oil and other consumables replaced at regular intervals. Technicians are on site daily to ensure that the turbines are operating safely and at their maximum efficiency.

Site tracks will be maintained in good order. Safe access will be maintained all year round.

The turbines are monitored 24 hours a day real-time via a supervisory control and data acquisition (SCADA) system.

Unscheduled Maintenance

Unscheduled maintenance associated with unforeseen events will be dealt with on an individual basis. In the unlikely event of a main component failure cranes may be mobilised to site to carry out repairs and/or replacement works.

7.7 Description of the Decommissioning Phase of the WEF

The Highlands North WEF will either operate for a minimum 25 years (duration of PPA with Eskom), and then be decommissioned and the site rehabilitated, or should a new PPA be secured, the project will be repowered to continue its operation for up to a further 25 years. It is impossible at this stage to anticipate the kind of advanced wind technology that will be available in the distant future.

Repowering would not be undertaken under this application or resulting Environmental Authorization, and would be subject to a new application at the time. In the event that the technology changes significantly, the operator will be required to engage with DEA to understand what additional requirements might need to be fulfilled in order to be authorised to use more advanced technology on the site.

In the event of decommissioning, typically, all above ground equipment will be dismantled and removed from the site. Cables and the turbine foundations will be cut off below ground level and covered with topsoil. Access tracks will be left for use by the landowners, or if appropriate, covered with topsoil or reduced in width.

This approach is considered to be best practice environmentally and less damaging than seeking to remove all foundations, underground cables in their entirety. Decommissioning will take account of the environmental legislation and technology available at the time of decommissioning.

7.8 Transportation of Wind Turbine Components to Site

Ngqura Port is the preferred port for particularly large equipment and machinery for the WEF development. The route from Ngqura Harbour travels north along Neptune Road, east along the R102 (Daniel Pienaar Street). Some abnormal load vehicles may be able to use the cloverleaf on-ramp to gain access to the N2, but abnormally long vehicles (carrying wind turbine blades) would need to pass through the interchange and turn right at the T-intersection at the end of Daniel Pienaar St and travel south to the end of Daniel Pienaar Street and turn south towards the interchange on the N2 and take the N2 eastbound On-Ramp. The route continues east along the N2 and takes the N10 northbound on-ramp towards Cookhouse. At Cookhouse the route follows the R63 westbound towards and through Somerset East to the site to the west of Somerset East.

A complete transportation management plan will be undertaken prior to construction, should the project be awarded preferred bidder status.

8 GEOLOGY, SOILS AND AGRICULTURE

8.1 Description of the Baseline Environment

8.1.1 Climate and Water availability

Rainfall for the study area is given as 436 mm per annum (The World Bank Climate Change Knowledge Portal, 2015). Rainfall and resultant moisture availability is insufficient to support viable, rain fed cultivation of crops. There are some small farm dams across the project area, with some very small patches of irrigated cultivation. Sufficient irrigation water is not available for any significant area of irrigated land.

8.1.2 Terrain, topography and drainage

The project is located across hilly terrain on the edge of a plateau that drops off steeply to the west. The highest part of the plateau is along the crest of the hills, near the western edge, that reaches an altitude of just over 1100 metres. The project area drops gradually eastwards onto the plateau to an altitude of around 900 metres (Figure 8.1). There is a wide range of slopes across the hilly terrain. There are a number of eastward flowing, non-perennial water courses across the project area. The underlying geology of the project area is mudstone and sandstone of the Beaufort Group of the Karoo Supergroup.

8.1.3 Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climatic conditions into different land types. The wind farm infrastructure is proposed almost entirely on a single land type, Fc168, although a very small part if it extends into a second land type, Db169 (Figure 8.2). Soils of both land types are very similar. They are predominantly very shallow, clay-rich, reasonably drained soils on underlying rock. Dominant soil forms are Glenrosa and Swartland. A smaller proportion of deeper Oakleaf soils also occur. A summary detailing soil data for the land types is provided in the Specialist Report (Volume II). The field investigation confirmed that the dominant soil types are shallow soils on underlying rock. The shallow, clay-rich soils are susceptible to erosion.

8.1.4 Agricultural Capability

Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rain fed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land.

The Proposed Development Area is classified with predominant land capability evaluation values of 5-6 (Table 8.1). The land capability of the more rugged, hilly terrain, drops all the way down to a value of 1 in places. The land capability of the Proposed Development Area is therefore classified as being unsuitable for the production of cultivated crops. The land capability is predominantly limited by the low climatic moisture availability and the shallow soils. The farmers report a stocking rate of 1 large stock unit per 10 hectares.

Table 8.1: Details of the 2017 Land Capability classification for South Africa

Land capability evaluation value	Description
1	Very Low
2	
3	Very Low to Low
4	
5	Low
6	Low to Moderate
7	
8	Moderate
9	Moderate to High
10	
11	High
12	High to Very High
13	
14	Very High
15	

8.1.5 Land use and Status

The Proposed Development Site is located in a sheep farming area. The only agricultural infrastructure within the proposed footprint area are small farm dams, wind pumps, stock watering points and fencing surrounding grazing camps. Three farmsteads lie within the Proposed Development Site but fall outside of the proposed footprint area. Access to the proposed developments is by way of farm access roads that will require upgrading. The Proposed Development Area is almost entirely grazed, natural veld (Figure 8.3). There are some areas of minor erosion but there are no areas of very significant erosion or other significant land degradation across the study area. Due to both the climate and soil limitations, the land is not suited for cultivation and grazing is the only viable agricultural land use. Small patches of previously cultivated land were designated as having high agricultural sensitivity, and should be avoided by the footprint of the development (Figure 8.1).

8.2 Assessment of Potential Impacts

The significance of an impact is a direct function of the degree to which that impact will affect current or future agricultural production.

The components of the project that can impact on soils, agricultural resources and productivity are:

- Occupation of the land by the total, direct, physical footprint of the proposed project including all roads;
- Construction activities that may disturb the soil profile and vegetation, for example for levelling, excavations, etc.

<table>
<tr><th colspan="8">Impact Phase: Construction, Operation and Decommissioning Phase</th></tr>
<tr><td colspan="8">Impact description: Loss of agricultural land use
Agricultural grazing land directly occupied by the development infrastructure, which includes roads and hardstands, will become unavailable for agricultural use. However, only a very small proportion of the total land surface is impacted in this way.</td></tr>
<tr><th></th><th>Extent</th><th>Duration</th><th>Intensity</th><th>Status</th><th>Significance</th><th>Probability</th><th>Confidence</th></tr>
<tr><td>Without Mitigation</td><td>L</td><td>M</td><td>L</td><td>Negative</td><td>L</td><td>L</td><td>H</td></tr>
<tr><td>With Mitigation</td><td>L</td><td>M</td><td>L</td><td>Negative</td><td>L</td><td>L</td><td>H</td></tr>
<tr><td colspan="3">Can the impact be reversed?</td><td colspan="5">Yes, once the wind farm is decommissioned, the footprint of the infrastructure can again be utilised as grazing land.</td></tr>
<tr><td colspan="3">Will impact cause irreplaceable loss or resources?</td><td colspan="5">No, because only a very small amount of grazing land is lost and such land is not a scarce resource.</td></tr>
<tr><td colspan="3">Can impact be avoided, managed or mitigated?</td><td colspan="5">Yes, to some extent.</td></tr>
<tr><td colspan="8">Mitigation measures:
The avoidance of high sensitivity areas by the design layout, and this has already been implemented during the design phase.</td></tr>
</table>

<table>
<tr><th colspan="8">Impact Phase: Construction, Operation and Decommissioning Phase</th></tr>
<tr><td colspan="8">Impact description: Soil degradation
Soil degradation can result from erosion and topsoil loss. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related soil profile disturbance. Soil degradation will reduce the ability of the soil to support vegetation growth.</td></tr>
<tr><th></th><th>Extent</th><th>Duration</th><th>Intensity</th><th>Status</th><th>Significance</th><th>Probability</th><th>Confidence</th></tr>
<tr><td>Without Mitigation</td><td>L</td><td>M</td><td>M</td><td>Negative</td><td>M</td><td>M</td><td>H</td></tr>
<tr><td>With Mitigation</td><td>L</td><td>M</td><td>L</td><td>Negative</td><td>L</td><td>L</td><td>H</td></tr>
<tr><td colspan="3">Can the impact be reversed?</td><td colspan="5">Yes, only to some extent and only with substantial inputs over a significant period of time.</td></tr>
<tr><td colspan="3">Will impact cause irreplaceable loss or resources?</td><td colspan="5">No, because only a very small amount of grazing land is lost and such land is not a scarce resource.</td></tr>
<tr><td colspan="3">Can impact be avoided, managed or mitigated?</td><td colspan="5">Yes</td></tr>
<tr><td colspan="8">Mitigation measures:
Implement an effective system of storm water run-off control using bunds and ditches, where it is required - that is at all points of disturbance where water accumulation might occur. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.
Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.
If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.</td></tr>
</table>

Impact Phase: Operational Phase							
Impact description: Generation of additional land use income Income will be generated by the farming enterprises through the lease of the land to the energy facility. This will provide the farming enterprises with increased cash flow and rural livelihood, and thereby improve their financial sustainability.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	L	Positive	M	H	H
With Mitigation	L	M	L	Positive	M	H	H
Can the impact be reversed?			Yes, as soon as income generation ceases at the end of the project.				
Will impact cause irreplaceable loss or resources?			No, not at all.				
Can impact be avoided, managed or mitigated?			No				

8.3 Conclusion

The proposed development is located on land zoned and used for agriculture (grazing). South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of potentially arable land. The assessment has found that the proposed development will only impact agricultural land which is of low agricultural potential and only suitable for grazing.

The significance of all agricultural impacts is low due to two important factors. Firstly, the actual footprint of disturbance of the wind farm (including associated infrastructure and roads) is very small in relation to the available grazing land on the effected farm portions. All agricultural activities will be able to continue unaffectedly on all parts of the farm other than the small development footprint for the duration of and after the project. Secondly, the proposed site is on land of limited agricultural potential that is only viable for grazing. These two factors also mean that cumulative regional effects as a result of other surrounding developments, also have low significance.

Small patches of previously cultivated land were designated as having high agricultural sensitivity, and should be avoided by the footprint of the development. The Final Mitigated development layout does avoid all of these areas.

Due to the low agricultural potential of the site, and the consequent low agricultural impact, there are no restrictions relating to agriculture which preclude authorisation of the proposed development and therefore, from an agricultural impact point of view, the development should be authorised.

9 FRESHWATER AND WETLANDS

9.1 Description of the Baseline Environment

The proposed development/s occur within the following catchments within the Great Karoo and Drought Corridor Ecoregions both located within the Mzimvubu-Tsitsikamma Water Management Area (Figure 9.1).

- Q80D – Klein Vis catchment
- Q80F – Brak River catchment
- N30B – Slotspruit, Klipplaat and Voël Rivers catchments

These catchments are characterised by perennial water courses and drainage lines associated with the mainstem systems listed above, and most flow only after high rainfall events. The Klein Vis (Little Fish) does however form part of the Fish-Sundays River Canal scheme that receives a constant supply of water from the Gariep Dam.

The Eastern Cape Biodiversity Conservation Plan identifies the subquaternary catchments associated with the Voël River as an Aquatic Critical Biodiversity Area Type 2 (Figure 9.2). This would however only be affected by two turbines and a small portion of a new road.

According to the National Freshwater Ecosystems Priority Area (NFEPA) wetland data, no natural wetlands could occur within the study area. The remaining waterbodies are artificial or man-made systems as shown in Figure 9.3. This was confirmed during the site visits and analysis of the various aerial images as well as supported by the updated National Wetland Inventory Data.

Figure 9.3 indicates the watercourses observed within the site. Any activities within these areas or the 32 m buffer (or the 1:100 floodline, whichever is the greatest) will require a Water Use License.

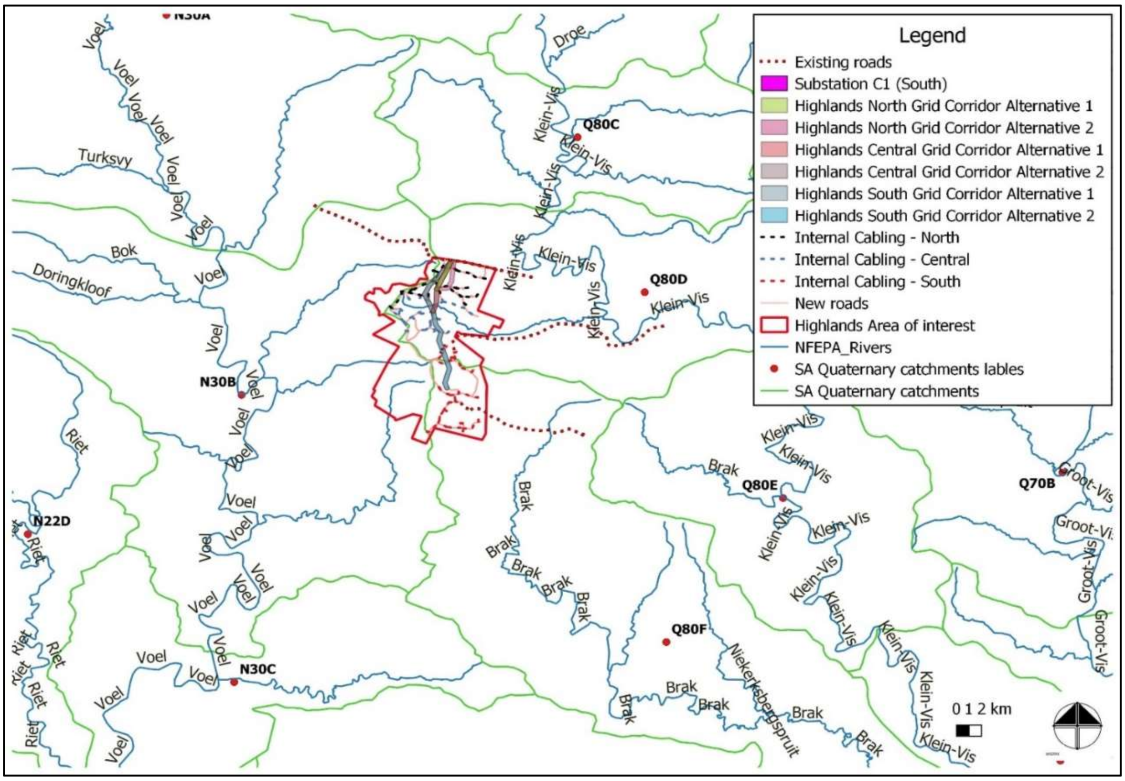


Figure 9.1: Quaternary Catchments and Mainstem Rivers within the Region

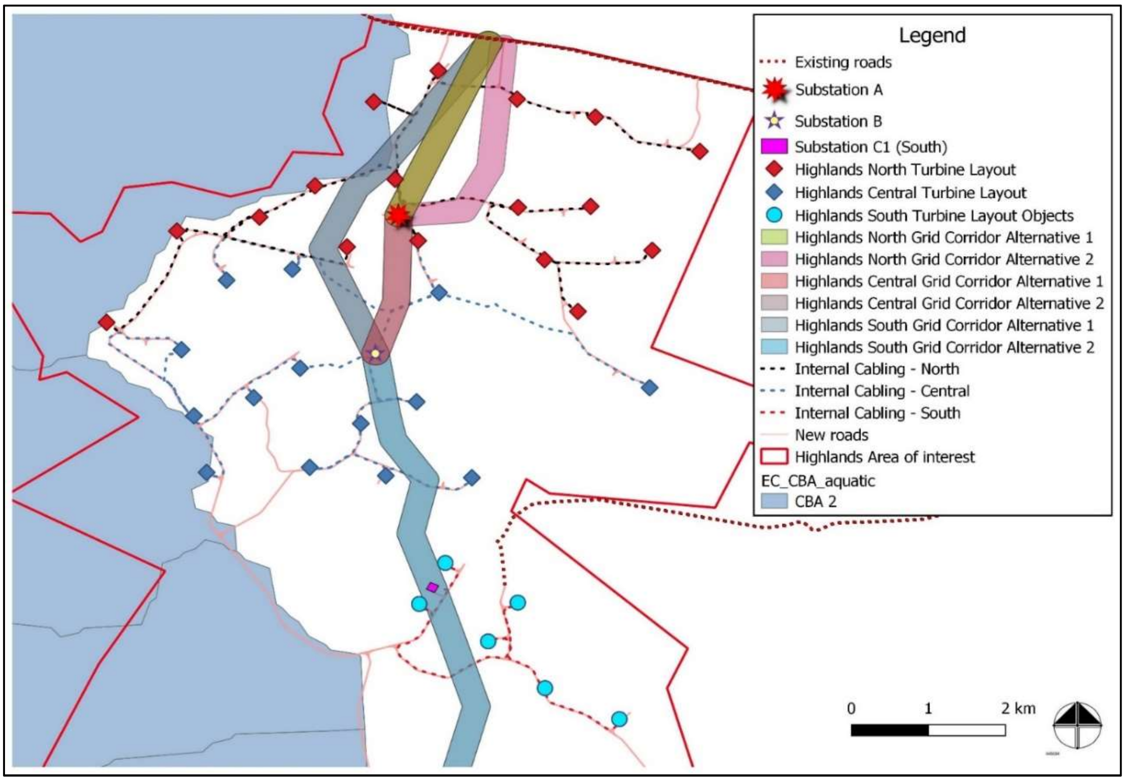


Figure 9.2: Aquatic Critical Biodiversity Areas according to the Eastern Cape Biodiversity Conservation Plan

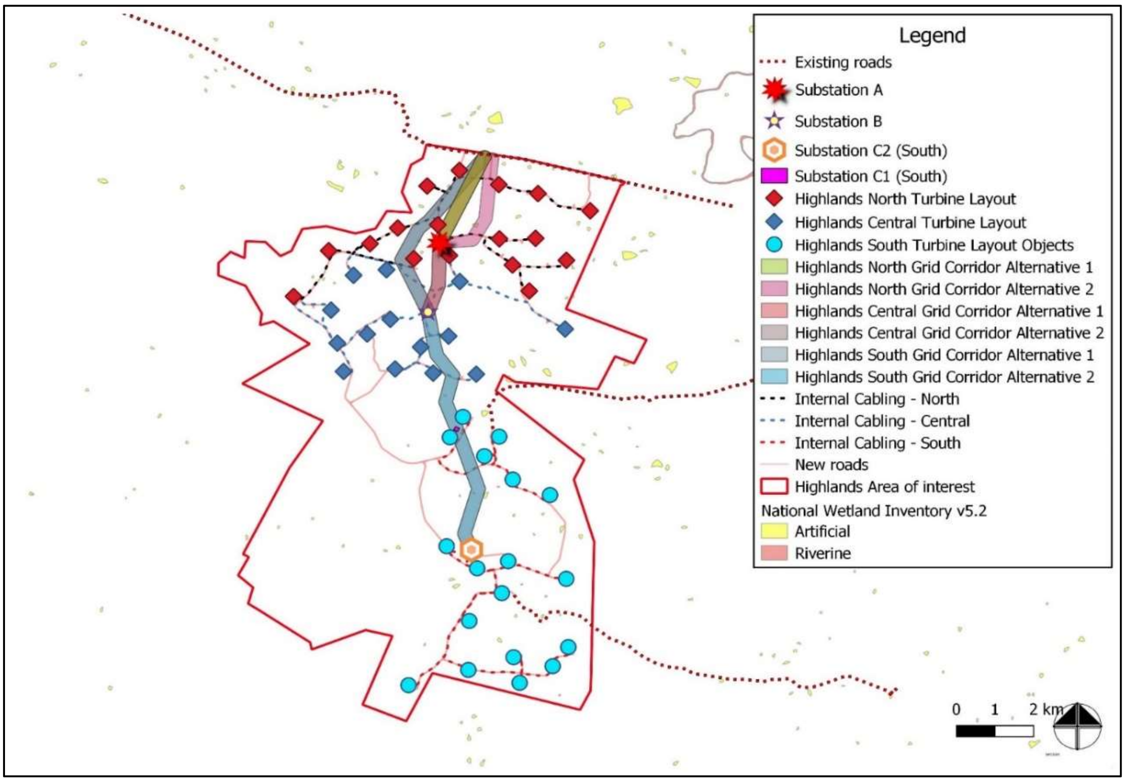


Figure 9.3: Confirmed waterbodies according to the National Wetland Inventory (SANBI, Ver 5.2) in relation to the proposed layout which were all artificial

9.1.1 Present Ecological State and Conservation Importance

The Present Ecological State of a river represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The Present Ecological State scores (PES) for the drainage lines and the rivers in the study area were rated as follows:

Sub quaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
7728	C	Moderate	Moderate
7787	C	Moderate	Moderate
7725	B	High	Moderate
7850	B	High	Moderate
7884	B	High	Moderate
7867	B	High	Moderate

It is thus evident that the study area systems are largely functional and or have limited impacts as a result of current land use practices. This was confirmed for several of the affected reaches located within the development footprint and in particular the areas that would be crossed by future access roads (Figure 9.4).

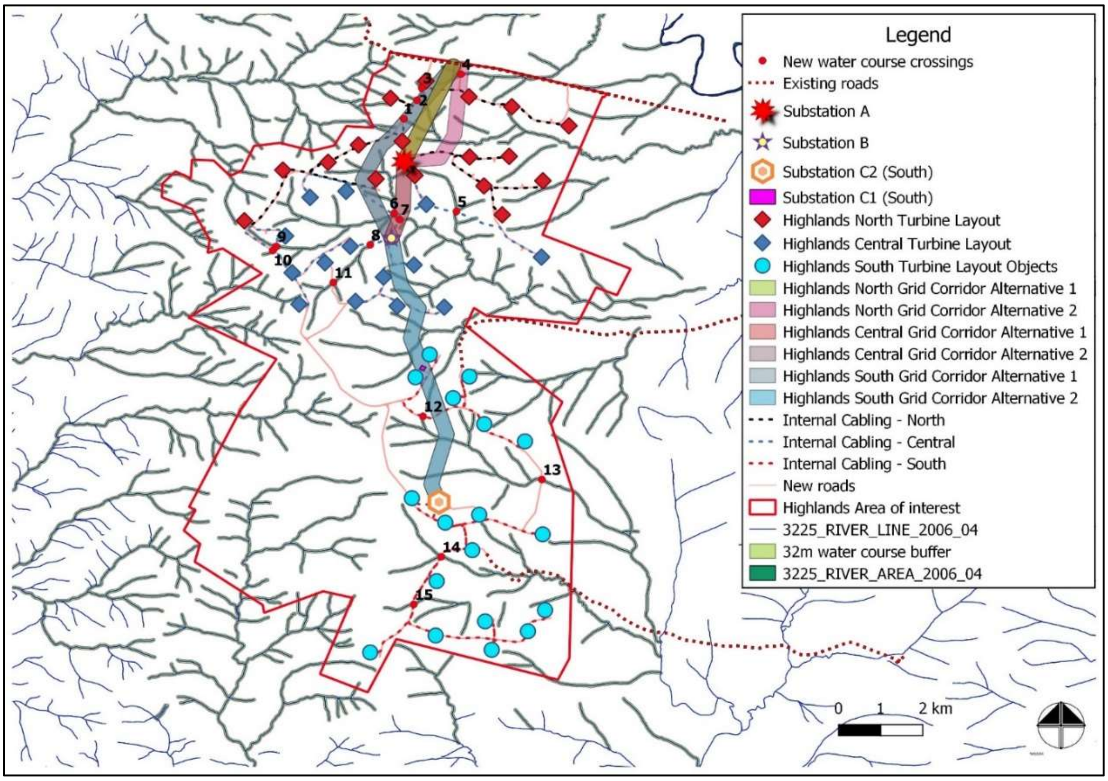


Figure 9.4: Watercourses and rivers within and adjacent to the study area

9.2 Assessment of Potential Impacts

The following impacts were not assessed as the factors were not present within the study area aquatic ecosystems:

- Wetland loss as no natural wetlands were observed in close proximity to any of the proposed infrastructure (i.e. within 500 m of the roads layout), and
- Loss of aquatic species of concern.

The following direct and indirect impacts were assessed with regard the riparian areas and water courses:

- Impact 1: Loss of riparian systems and water courses;
- Impact 2: Impact on riparian systems through the possible increase in surface water runoff on riparian form and function;
- Impact 3: Increase in sedimentation and erosion; and
- Impact 4: Potential impact on localised surface water quality

Impact Phase: Construction Phase							
Impact description: Loss of riparian systems and water courses during the construction phase The physical removal of the narrow strips of riparian zones and disturbance of any watercourses by the road crossings only, being replaced by hard engineered surfaces. This biological impact would however be localised, as a large portion of the remaining catchment would remain intact, while the significant structures (e.g. turbines and hard standing areas) have been placed well outside of these areas.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • Where water course crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (crossing should have a small footprint). • No vehicles to refuel or be maintained within drainage lines/ riparian vegetation. • Where possible culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.							
Residual impact	Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.						

Impact Phase: Operational Phase							
Impact description: Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or new road crossings on riparian form and function during the operational phase							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						

Mitigation measures: • Any storm water within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities. This is particularly important due to the levels of erosion already observed within the affected catchments.	
Residual impact	Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

Impact Phase: Construction and Operational Phase							
Impact description: Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • Any storm water within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities.							
Residual impact	During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream.						

Impact Phase: Construction and Operational Phase							
Impact description: Impact on localized surface water quality mainly during the construction phase During construction and to a limited degree the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities could be washed downslope via the ephemeral systems.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	Yes						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • Strict use and management of all hazardous materials used on site. • Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.). • Containment of all contaminated water by means of careful run-off management on the development site. • Strict control over the behaviour of construction workers.							

• Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced. • Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.	
Residual impacts	Residual impacts will be negligible after appropriate mitigation.

9.3 Conclusion

The proposed development would have a limited impact on the aquatic environment as all large structures will avoid the delineated natural systems, with a limited number of new water course crossings, i.e. the layout makes use of any of the existing roads, as far as practicable. Thus, presently no objection to the development taking place is made.

Figure 9.2 indicates the affected water courses and those that would trigger the need for a Water Use License application (a potential GA) in terms of Section 21 c and i of the National Water Act, should any construction take place within these areas. Should any of the present road crossings need to be upgraded then the opportunity exists to improve the current state (lack of habitat continuity) for example by replacing pipe culverts with box culverts, while also reducing the height of the bridge footings (culvert bases) to reinstate natural water course levels. This was mostly observed along the district roads within the area, but is in line with other projects within the region.

Furthermore, an application for the abstraction of groundwater (Section 21a) and the temporary storage of domestic waste (Section 21g - conservancy tanks, if exceeding 10 000 cm^3) may be required.

10 FLORA AND TERRESTRIAL FAUNA

10.1 Description of the Baseline Environment

10.1.1 Vegetation Patterns

There are three vegetation types within the study area (Figure 10.1). The lower lying valleys and low hills in the east consist of Camdebo Escarpment Thicket, while the higher lying areas and east-facing slopes consist of Bedford Dry Grassland and the major drainage systems are dominated by the Southern Karoo Riviere vegetation type. The majority of the development footprint is located within the Bedford Dry Grassland vegetation type. Each of these vegetation types is described below and more fully in the Specialist Report (Volume II) and illustrated as they occur within the site, showing the range of habitats and compositional variation evident within the study area.

The majority of drainage lines within the site are relatively small and not well developed, although there are some larger systems with riparian vegetation and a well-developed tree layer.

10.1.2 Faunal Communities

Mammals

Approximately 50 mammal species potentially occur at the site (see Appendix 2 of the Specialist Report, Volume II). Due to the diversity of habitats available, which includes rocky uplands and ridges, drainage lines and wetlands areas, as well as open plains and low shrublands, the majority of species with a distribution that includes the site are likely to be present in at least part of the broader site. Important habitats for mammals at the site include the drainage lines, thicket valleys in the west of the site, forest patches in the north and rocky outcrops along the mountain escarpment.

Overall, long-term impacts on mammals are likely to be restricted largely to habitat loss equivalent to approximately the footprint of the development. Most mammals appear to become habituated to wind turbines and do not avoid them to a significant degree. There may however be some species which are more wary of the turbines and which would experience a greater degree of habitat loss. Long-term impacts on mammals are likely to be of moderate to low intensity and of local significance only.

Reptiles

There is a wide range of habitats for reptiles present at the site, including rocky uplands and cliffs, open flat and lowlands and densely vegetated areas. As a result the site is likely to have a relatively rich reptile fauna which is potentially composed of 4 tortoise species, 12 snakes, 16 lizard species and skinks, 1 chameleon, 1 terrapin and 4 gecko species. Species observed at the site include Rock Monitor, Red-lipped Snake, Western Rock Skink, Red-sided Skink, Leopard Tortoise, Ground Agama and Rock Agama.

Important habitats for reptiles at the site include the rocky outcrops along the edge of the escarpment, densely vegetated drainage lines and thicket patches. As these features are largely outside of the development footprint, impact on important reptiles habitats would be low. In general, the major impact associated with the development would be habitat loss and fragmentation for reptiles, with the potential for increased levels of predation being a secondary impact which may occur as a result of vegetation clearing for roads and turbine pads. There are not likely to be any reptiles which are specifically restricted to the target ridges and which would be particularly vulnerable to impact as a result.

Amphibians

Although there are no perennial rivers within the site, there are numerous earth dams that hold water on a near-perennial basis as well as sheltered pools along some of the drainage lines that are likely used by the amphibians for breeding purposes. No listed species or species with a restricted distribution are known from the area. As the drainage lines and farm dams would not be directly impacted by the development, impact on important amphibian habitats would be relatively low. The higher-lying target ridges are not likely to have many amphibian species present on account of the general lack of water and suitable habitat features.

Direct impacts on amphibians at the site are likely to be fairly low. Amphibians are however highly sensitive to pollutants and the large amount of construction machinery and materials present at the site during the construction phase would pose a risk to amphibians should any spills occur.

10.1.3 Critical Biodiversity Areas and Broad Scale Ecological Processes

A large proportion of the Highlands WEF is located within a Tier 2 CBA (Figure 10.2). The CBA 2 status of the area indicates that the CBA which includes the site is related to the maintenance of ecosystem processes and not to protect biodiversity pattern as the area does not have any features of known high significance in this regard (i.e. rare habitats or an abundance of localized or endangered species). The underlying information associated with the CBA indicates that the CBA which includes the study area is designed as part of a corridor to maintain broad-scale ecological connectivity. Given the large scale of the CBA and the relatively small proportion of the CBA that falls within the development footprint, it is not likely that the development would compromise the overall functioning of the CBA as an ecological corridor.

Apart from the CBA 2 status of parts of the site, it also falls partly within a NPAES Focus Area, indicating that the area has been identified as a potential target for protected area expansion. The affected Camdebo Escarpment Focus area is over 421 000 ha in extent and the loss of less than 10 000 ha from this focus area is not considered highly significant.

10.1.4 Site Sensitivity Assessment

The ecological sensitivity map for the Proposed Development Site is illustrated in Figure 10.3. The western valleys and slopes along the edge of the escarpment which are dominated by thicket vegetation are considered to be high sensitivity as are the drainage lines which mostly drain in an easterly direction. The target ridges consist largely of open grassland with a low density of species of conservation concern. These areas are considered to be low to moderate sensitivity and are considered suitable targets for development. The higher lying ridges especially in the central and southern parts of the site are not within the development footprint and these areas are considered to have greater ecological value than the lower lying hills to the east where the majority of the development is concentrated.

10.2 Assessment of Potential Impacts

Impact Phase: Construction Phase							
Impact description: Impact on vegetation and listed plant species due to transformation within the development footprint							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	M	Negative	M	H	H
With Mitigation	L	M	M	Negative	M	H	H
Can the impact be reversed?			No, transformation is a necessary outcome of the development and will largely persist for the lifetime of the development and sometime thereafter. Some residual impact will remain even after decommissioning and rehabilitation.				
Will impact cause irreplaceable loss or resources?			No, no critical or rare habitats are within the development footprint.				
Can impact be avoided, managed or mitigated?			To some extent, through avoidance of sensitive areas, but some residual impact is likely.				
Mitigation measures: • Preconstruction walk-through of the approved development footprint to ensure that sensitive habitats and species are avoided where possible. • Search and Rescue of species of conservation concern (SCCs) should be conducted prior to clearing activities. • Ensure that lay-down and other temporary infrastructure is within low- sensitivity areas. • Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development. • The exact routing of the roads should be adjusted where necessary to avoid features of higher sensitivity such as rocky outcrops, as informed by the preconstruction walk-through of the facility. • Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes topics such as no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. • Demarcate sensitive areas in close proximity to the development footprint as no-go areas with construction tape or similar and clearly mark as no-go area.							
Residual impact			There will be some habitat loss that is an unavoidable impact of the development and cannot be effectively mitigated.				

Impact Phase: Construction Phase							
Impact description: Faunal impacts due to construction-phase noise and physical disturbance							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	H	Negative	M	H	H

With Mitigation	L	L	M	Negative	L	L	M
Can the impact be reversed?	Construction-phase disturbance will be transient, but some habitat loss would be long term.						
Will impact cause irreplaceable loss or resources?	Not likely as there do not appear to be any significant populations of species of conservation concern within the affected area.						
Can impact be avoided, managed or mitigated?	Only partly as noise and construction phase disturbance and habitat loss cannot be entirely avoided or mitigated.						

Mitigation measures:

- Preconstruction walk-through of the facility to identify areas of faunal sensitivity such as occupied burrows.
- 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.
- The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site.
- No fires should be allowed on site as the vegetation is vulnerable to runaway fires.
- No fuelwood collection should be allowed on-site.
- No dogs or cats should be allowed on site at the construction camps apart from those of the landowners.
- 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.
- 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.
- No unauthorized persons should be allowed onto the site and site access should be strictly controlled.
- 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.
- All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often needlessly persecuted.

Residual impact	Noise and disturbance during construction cannot be well mitigated, but would be transient. Some habitat loss for fauna would persist for the operational lifetime of the facility.

Impact Phase: Operational Phase							
Impact description: Faunal impacts due to operational phase activities							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	M	Negative	M	H	H
With Mitigation	L	M	L	Negative	L	L	H
Can the impact be reversed?	The impact will persist for the lifespan of the facility.						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Some management is possible, but residual impact from the wind turbines and general disturbance will persist, albeit at a low intensity.						

Mitigation measures:

- Management of the site should take place within the context of an Open Space Management Plan.
- No unauthorized persons should be allowed onto the site.
- Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location.

• The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone except landowners or other individuals with the appropriate permits and permissions where required. • 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. • If parts of the facility are to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of such fenced areas and not the outside.	
Residual impact	Residual impacts will be low and restricted to some low-intensity disturbance associated with the maintenance activities at the site as well as some noise impacts associated with the operation of the turbines.

Impact Phase: Operational Phase							
Impact description: Following construction, the site will be highly vulnerable to soil erosion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	M	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated.						
Will impact cause irreplaceable loss or resources?	The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources, but with mitigation, this can be avoided.						
Can impact be avoided, managed or mitigated?	With appropriate control measures, erosion risk can be well mitigated.						
Mitigation measures: • 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 shrubs and grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.							
Residual impact	With mitigation there would be negligible residual impact.						

Impact Phase: Operational Phase							
Impact description: Following construction, the site will be highly vulnerable to alien plant invasion.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	M	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H

Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated.
Will impact cause irreplaceable loss or resources?	With mitigation there would no loss of resources.
Can impact be avoided, managed or mitigated?	With appropriate control measures, alien plants can be controlled and reduced to very low impact.
Mitigation measures: • 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 species such as Opuntia are already present in the area and are likely to increase if not controlled. • Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as these 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. • Develop and implement an Invasive Alien Plant Management Plan.	
Residual impact	With mitigation there would be negligible residual impact.

Impact Phase: Operational Phase							
Impact description: Impact on Critical Biodiversity Areas and Broad-Scale Ecological Processes.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	M	Negative	M	H	H
With Mitigation	L	H	L	Negative	L	L	H
Can the impact be reversed?	The impact would last for the lifetime of the development.						
Will impact cause irreplaceable loss or resources?	Unlikely.						
Can impact be avoided, managed or mitigated?	To some extent, but some of the impact would result from the presence of the facility which cannot be avoided.						
Mitigation measures: • Minimise the development footprint, especially within the high sensitivity areas. • There should be an integrated management plan for the development area during operation, which is beneficial to fauna and flora. • Specific avoidance and mitigation may be required to reduce the impact on certain habitats of limited extent and high ecological or conservation significance.							
Residual impact	Some of the impact results from the presence of the facility and would therefore persist for as long as it was operational.						

Impact Phase: Decommissioning Phase							
Impact description: Faunal impacts due to decommissioning phase activities.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	H	Negative	M	H	H
With Mitigation	L	L	M	Negative	L	L	H
Can the impact be reversed?	The impact would be transient and persist for the decommissioning period only.						

Will impact cause irreplaceable loss or resources?	No.
Can impact be avoided, managed or mitigated?	Most of the impacts can be mitigated and those that cannot would be transient.
Mitigation measures: • Any potentially dangerous fauna such as snakes or fauna threatened by the decommissioning activities should be removed to a safe location prior to the commencement of decommissioning activities. • 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. • No excavated holes or trenches should be left open for extended periods as fauna may fall in and become trapped. • All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact, however, this should be in accordance with the facilities' decommissioning and recycling plan, and as per the agreements with the land owners concerned.	
Residual impact	Decommissioning would in principle return the site to its former state, but in practice, some degradation of the development footprint can be anticipated, which would reduce its long-term value as faunal habitat.

Impact Phase: Decommissioning Phase							
Impact description: Following decommissioning, the site will be highly vulnerable to soil erosion.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	M	Negative	H	H	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated.						
Will impact cause irreplaceable loss or resources?	The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources, but with mitigation, this can be avoided.						
Can impact be avoided, managed or mitigated?	With appropriate control measures, erosion risk can be well mitigated.						
Mitigation measures: • Compliance with the Erosion Management Plan and Rehabilitation Plan. • Any roads that will not be rehabilitated should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • There should be regular monitoring for erosion for at least 5 years after decommissioning by the applicant to ensure that no erosion problems develop as result of the disturbance, and if they do, to immediately implement erosion control measures. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.							
Residual impact	With mitigation, there would be little residual impact.						

Impact Phase: Decommissioning Phase							
Impact description: Following decommissioning, the site will be vulnerable to alien plant invasion.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**

Without Mitigation	L	H	M	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated.				
Will impact cause irreplaceable loss or resources?			With mitigation there would no loss of resources.				
Can impact be avoided, managed or mitigated?			With appropriate control measures, alien plants can be controlled and reduced to very low impact.				
Mitigation measures: • 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 two 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. • Compliance with the Invasive Alien Plant (IAP) Management Plan.							
Residual impact			With mitigation, there would be little residual impact.				

10.3 Conclusion

The footprint of the proposed project is largely restricted to the lower-lying eastern slopes and gentle hills of the site and are considered generally suitable for development. The abundance of plant species of conservation concern in these areas is low and species of high conservation concern were not observed within the development footprint.

Although there are a variety of mammals of conservation concern known from the broader area it is not likely that the affected areas are of high significance for these species and long-term impacts on listed fauna are likely to be low.

The majority of the Highlands North WEF lies within a tier 2 CBA aimed at maintaining the broad-scale connectivity of the landscape. Although the proposed development would result in some habitat loss within the CBA, this is not likely to compromise the overall functioning of the CBA as it is very large and the development occupies a very small proportion of the CBA. The majority of the development footprint lies within a NPAES focus area. The development however lies on the margin of the NPAES focus area and the extent of the development would not significantly impact ability to meet conservation targets elsewhere within the focus area which is large in comparison with the development site. Similarly, there are no other renewable energy developments in the immediate area with the result that cumulative impacts within 50 km of the site are still very low. In the wider area there are several existing wind farms, but these are on different ridge systems and the overall extent of cumulative impact in the area remains low.

Although there are extensive areas of sensitive habitat within the Proposed Development Area, the development footprint is restricted to the medium and low sensitivity parts of the site. These areas are considered suitable for development and there are no impacts associated with the Highlands North WEF that cannot be mitigated to a low level. As such there are no fatal flaws or high post-mitigation impacts that should prevent the development from proceeding. Based on the layouts provided for the assessment, the Highlands North WEF can be supported from a terrestrial ecology point of view.

The Final Mitigated Layout provided by the developer and which is being submitted for approval by DEA has been inspected in detail and avoids the no-go areas and high sensitivity features of the site and is therefore considered acceptable and meets the requirements of this study in terms of planning-stage mitigation and avoidance.

11 AVIFAUNA

11.1 Description of the Baseline Environment

The baseline avifauna environment for the proposed development site was defined utilising a desk-based study and informed by four seasons of pre-construction bird monitoring 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.

The following bird microhabitats were identified on the Proposed Development Site: Open Grasslands, Thicket and Scrubs, Cultivated Fields and Pastures, Rivers and Drainage Lines, Farm dams, Ridges and/or Cliffs, Farmsteads and Feeding Kraals, and Stands of Alien Trees.

Across all four seasonal surveys a total of 809 flight paths from 32 positively identified target species have been recorded on the proposed development site. This equates to approximately 3.41 target species birds per hour of observation.

For priority species only (including unidentified raptors which are likely priority species), the overall passage rate on the proposed development site is calculated as 2.75 birds/hour of observation. Considering that the data is heavily skewed by the influx of summer migrants, if one removes Amur Falcon and Lesser Kestrel for the calculation, the resultant passage rate for the remaining priority species is calculated at 1.60 birds/hour on the WEF site.

Overall 164 species were observed on the proposed development site. Of these 26 were priority species including 13 Red Data species. These results represent a relatively moderate to high diversity of species, and a relatively high number of Red Data and priority species in the specialists' experience of other WEF sites worked on in South Africa, and generally in the Eastern Cape, although some sites in the Eastern Cape have recorded similar numbers of Red data and priority species. A full list of recorded species is presented in Volume II: Bird Impact Assessment Report, Appendix I.

Following the conclusion of the monitoring work, and considering all the other desk-based data sources, the following species were identified as being key for the assessment of impacts of the WEFs and grid connections proposed on the development site. These 'focal species' are: Ludwig's Bustard; Blue Crane; Secretarybird; Cape Vulture; Verreaux's Eagle; Black Harrier; Amur Falcon; Lesser Kestrel; Jackal Buzzard; and African Rock Pipit.

11.2 Avifaunal Site Sensitivity

No-Go areas for turbines only (other infrastructure permitted) include nest buffers, steep slopes and steep slopes buffered by 200m; cultivated lands and a 200 m buffer of National Freshwater Ecosystem Priority Areas (NFEPA) rivers and wetlands (including dams) (Figure 11.1). They also include high and very high flight sensitivity zones buffered by 50 m (to allow for some error in observer accuracy).

No-Go areas for all infrastructure are 1 km buffers around selected active nest sites and 1.5 km buffers around active Verreaux's Eagle nest sites, in line with applicable guidelines, and primarily intended to reduce disturbance and displacement impacts.

11.3 Assessment of Potential Impacts

The main impacts on avifauna have been identified as (a) displacement through disturbance and habitat destruction and (b) mortality through collisions with turbines and/or powerlines and (c) mortality through electrocution on live power infrastructure.

Impact Phase: Construction Phase							
Impact description: Destruction of habitat used by birds							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	M	Negative	M	H	H
With Mitigation	L	M	L	Negative	L	L	M
Can the impact be reversed?			Yes, areas disturbed during construction can be rehabilitated after construction and after decommissioning				
Will impact cause irreplaceable loss or resources?			No, rehabilitation of habitat is possible. There is extensive avifaunal habitat on the project site and beyond that will remain intact and be available for use				
Can impact be avoided, managed or mitigated?			Yes, the total area of impact (and thus the severity rating) can be minimised.				

Mitigation measures:

- A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat;
- Environmental Control Officers to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced;
- 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;
- No turbines should be constructed in no-go areas, while associated infrastructure should be avoided where possible in these areas;
- Prior to construction, an 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; Should priority species nests be located, a protective buffer may be applied, within which construction activities may need to be restricted during the breeding season for that species;
- Any clearing of large trees (>5m in height), especially stands of large alien trees (e.g. Blue Gum or Pine) on site should be approved first by an avifaunal specialist. Before, clearing, the location and description of the trees should be provided to the specialist, who may request the ECO to inspect the trees for any nests prior to clearing. .
- 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, an 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.

Impact Phase: Construction Phase							
Impact description: Disturbance and Displacement of Birds							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	M	Negative	M	M	M

With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?			Partially, in some areas of the operational WEF, birds disturbed during construction may return to their activities after completion of construction.				
Will impact cause irreplaceable loss or resources?			Possible, Disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.				
Can impact be avoided, managed or mitigated?			Partially, some disturbance is inevitable with the activities associated with construction.				

Mitigation measures:

- A site specific Construction Environmental Management Plan (CEMP) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. Environmental Control Officers 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 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. Following the specialist site walkthrough, any additional sensitive zones and no-go areas (e.g. nesting sites of Red Data species) are to be designated by the specialist who should advise on an appropriate buffer, within which construction activities may not occur during key breeding times;
- The construction Phase ECO, the onsite Environmental Manager, and the client's representative on site (e.g. the resident engineer) 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), construction 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;
- During the construction phase, an avifaunal specialist must conduct a nest survey/exploration of the WEF site. This should be done during and after, the breeding season (i.e. approximately in July and again in September) of large Eagles (e.g. Martial and Verreaux's Eagle). The aim will be to locate any nest sites not yet found, so that these may continue to be monitored during the construction and operation phases, along with the monitoring of already identified nest sites (see point below); and
- Appoint a specialist to design and conduct monitoring of the breeding of raptors at the various nests identified to date as well as any additionally located nests (see point above). This monitoring can be combined with the exploration described above, and should be conducted on two occasions (i.e. approximately in July and again in September) across each calendar year, during construction. The aim will be to monitor any disturbance to or displacement of the breeding birds during construction.

Impact Phase: Operational Phase							
Impact description: Bird mortality caused by collision with wind turbine blades and/or towers							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	H	Negative	M	H	M
With Mitigation	M	M	H	Negative	M	M	M
Can the impact be reversed?			Partially, bird fatalities caused by collisions with turbines are irreversible. However local populations may recover if the occurrence of deaths is low.				
Will impact cause irreplaceable loss or resources?			Possibly, collisions with turbines cause bird fatalities, which could significantly impact local and/or regional populations of certain species.				

Can impact be avoided, managed or mitigated?	Partially, the probability of the impact can potentially be reduced through informed placement of turbines.

Mitigation measures:

- The minimum number of turbines should be constructed to achieve the required MW output. It is preferable to have smaller number of turbines with larger rotor, compared with more turbines with smaller rotor.
- Turbines must not be constructed within any designated No-Go Areas. The turbine blade should not protrude into these areas, and therefore the bases should be constructed suitably far from these areas to prevent this;
- The hierarchy of sensitivity zones identified should be considered where possible with preferential placement of turbines in areas with no sensitivity score, followed by low sensitivity, medium sensitivity and medium-high sensitivity;
- Develop and implement a carcass search programme for birds as a minimum during the first three years of operation followed by year 5, 10, 15, 20 and 25, in line with the applicable South African monitoring guidelines;
- Develop and implement a minimum 12 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. The results of this monitoring and the carcass searchers should advise the need for any additional ongoing activity monitoring or nest surveys beyond the 12 month period;
- 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, relevant stakeholders 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 in the turbine area due to the construction and operation activities, while improving raptor habitat and promoting prey availability away from the site.
  - Implementing a carcass management plan on the WEF site, to remove any dead livestock as soon as possible, to reduce the likelihood of attracting vultures to the WEF site.
  - Using deterrent devices (e.g. visual and noise deterrents) and/or shutdown systems e.g. Automatic bird detectors (e.g. automated camera based monitoring systems – McClure et. al. 2018) if commercially available; or Radar Assisted Shutdown on Demand (RASOD) 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.
  - Possibly offset programmes if no suitable mitigation measures can be implemented to reduced impacts sufficiently.

Impact Phase: Operational Phase							
Impact description: Bird mortality caused by collision overhead powerlines on the WEF site.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	H	Negative	M	M	M
With Mitigation	L	M	M	Negative	L	L	M
Can the impact be reversed?	Possibly, bird fatalities caused by collisions with overhead power lines are irreversible. However local populations may recover if the occurrence of deaths is low.						
Will impact cause irreplaceable loss or resources?	Unlikely, collisions with overhead power lines causes bird fatalities which may significantly impact populations of certain species.						

Can impact be avoided, managed or mitigated?	Yes, reducing the total distance of overhead power lines and increasing their visibility by fitting bird flight diverters (BFD's) can reduce the number of collisions.

Mitigation measures:

- Place new internal power lines on the WEF underground where possible and technically feasible;
- Placement of electrical infrastructure should consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
- Where possible place new overhead power lines adjacent to existing power line or linear infrastructure (e.g. roads and fence lines);
- Attach appropriate marking devices (BFDs) on all new overhead power lines to increase visibility. The advice of a specialist should be sought regarding the type, placement and spacing of the BFDs to be used; 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.

Impact Phase: Operational Phase

Impact description: Bird mortality caused by electrocution on the WEF site.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	M	M	Negative	M	M	M
With Mitigation	L	M	M	Negative	L	L	H

Can the impact be reversed?	Possibly, bird fatalities caused by electrocution are irreversible. However local populations may recover if the occurrence of deaths is low.
Will impact cause irreplaceable loss or resources?	Possibly, electrocution from overhead power lines causes bird fatalities which could significantly impact populations of certain species.
Can impact be avoided, managed or mitigated?	Yes, reducing the total length of overhead power lines and using a safe pylon design can reduce the risk of electrocution.

Mitigation measures:

- Placement of electrical infrastructure should consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
- Place new internal power lines on the WEF underground where possible and technically feasible;
- Any new overhead power lines must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' monopole structures, with clearances between live components and possible bird perches (e.g. cross arms) of 1.8 m or greater. Each pylon should be fitted with a safe bird perch; 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.

Impact Phase: Operational Phase

Impact description: Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	M	M	Negative	M	M	L
With Mitigation	L	M	M	Negative	L	L	L

Can the impact be reversed?	Possibly, after decommissioning and rehabilitation displaced species will possibly return.

Will impact cause irreplaceable loss or resources?	Possible, disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.
Can impact be avoided, managed or mitigated?	Partially, some disturbance is inevitable with the operational activities

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; and
- 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.

Impact Phase: Operational Phase

Impact description: Disruption of Local Bird Movement Patterns (e.g. barrier effects).

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	M	M	Negative	L	L	L
With Mitigation	M	M	M	Negative	L	L	L

Can the impact be reversed?	Possibly.
Will impact cause irreplaceable loss or resources?	Possibly, impact is not well understood.
Can impact be avoided, managed or mitigated?	Possibly.

Mitigation measures:

- 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;
- 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; and
- Turbines must not be constructed within any No-Go areas.

Impact Phase: Decommissioning Phase

Impact description: Disturbance and Displacement of Birds

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	L	M	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M

Can the impact be reversed?	Unknown
Will impact cause irreplaceable loss or resources?	Unlikely, disturbance and potential displacement of birds may impact breeding and thus impact on the population of a species.
Can impact be avoided, managed or mitigated?	Partially, some disturbance is inevitable with the activities associated with decommissioning.

Mitigation measures:

- A site specific Environmental Management Plan must be implemented, for the decommissioning phase.
- Environmental Control Officers to oversee activities and ensure that the site specific EMP is implemented and enforced;
- The appointed Environmental Control Officer (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), 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.

11.4 Conclusion

Activity and abundance of priority species and red data species were found to be moderate to high on the proposed Highlands development. Activity of other resident Red Data species, e.g. Verreaux's Eagle, Blue Crane and Ludwig's Bustard was relatively constant across the year, at a moderate level. Activity of the non-Red Data raptors, Jackal Buzzard and Rock Kestrel was high to very high throughout the year, and these species are the ones most likely to suffer collision mortality.

Abundances of small passerines were found to be moderate, however it was predicted that the impacts to these birds was likely to be low.

Verreaux's Eagle were confirmed as breeding on and around the proposed development site, and all nests have been suitably buffered by 3 km, with no turbines proposed within these buffers. Recorded Verreaux's Eagle flight activity was relatively high compared with other priority species recorded, although when compared with the activity of this species on other WEFs in South Africa, the activity levels are moderate. All proposed turbines are located outside of high risk areas (e.g. ridge and slope buffers, nest buffers and high recorded flight activity areas) and therefore an additional year of monitoring is not recommended. While it is likely that this species will suffer collision mortality at some stage during operations of the proposed development, the amount and frequency of collisions are not expected to reach a level that would be unsuitable for the regional population. Furthermore, if mortalities are recorded certain mitigation options can be implemented (subject to the results of operational monitoring), that can reduce the levels of mortality.

Two Verreaux's Eagles (preferably one from each active territory) should be fitted with GPS tracking devices (subject to ethical clearance from BLSA ethics committee) at the start of the construction phase. This information would feed into the construction and operational monitoring programme and would assist in determining disturbance and displacement effects (as well as possible collision impacts).

Cape Vulture was only recorded during the final summer season, with an estimated minimum of 8 birds, being responsible for 11 recorded flights. Overall, this represented a very low passage rate, with most activity also being on the northern boundary of the proposed development site (an area that does not have proposed turbine locations in the latest layout). It was concluded that Cape Vulture is only likely to be an occasional visitor to the proposed Development site, and should mortalities occur for this species (which is unlikely but possible), they could be mitigated (or reduced in future) by implementing mitigation such as carcass management strategies and/or shut down on demand strategies. Regarding this species, more concern is around cumulative impacts. If low mortality manifests at the proposed Development, this may be acceptable (at the scale of the development). However, if this low level of mortality coincides with high levels of mortality at the WEFs in the Cookhouse/Bedford area, the cumulative impacts to the regional population could be high. It will be essential, to reduce cumulative effects, that all WEFs in the region implement mitigations and recommendations given by the respective avifaunal specialists, and that there is collaboration and sharing of information between specialists.

Ludwig's Bustard and Blue Crane were relatively widespread and abundant, although they did not fly regularly at turbine risk height. They are therefore more likely to be impacted upon by possible disturbance or through collisions with overhead power lines, associated with either the WEFs or the grid connections. Both of these impacts can be mitigated against. It will be vitally important to ensure all overhead lines are correctly marked with BFD's, and if the shortest routes for the grid connections are used the impacts are likely to be low-moderate and acceptable, although ongoing monitoring of overhead lines during operation will be required to confirm this. It is likely that the vast majority of spans will need to be mitigated, and suitable financial allowance should be made for this.

The rated impacts of each WEF phase and Grid Connection separately were found to be acceptable. However, if all phases are granted EA, they will not be constructed as separate WEFs, and not all turbines proposed for each phase would be constructed. Therefore an assessment of a WEF[13] up to a maximum of 140 MW and utilising turbine positions from all three phases (which is likely to result in less than 40 turbines being constructed) was conducted. This assessment found that the impact (post mitigation) of collision is likely to be moderate and the other identified impacts on avifauna are likely to be low. Therefore the construction of a medium sized WEF of less than 40 turbines would be acceptable, if all turbine positions are outside of all the identified avifaunal No-Go areas and all other mitigations and recommendations in this report are implemented. It is noted that based on the rapid pace of technology advancement, less turbines (each with a higher capacity) may be used to meet the required MW output, and wherever feasible this should be encouraged as for birds, fewer larger turbines are preferable than more smaller turbines.

The turbine positions in the assessed layout and the final mitigated layout avoid all avifaunal no-go areas and high sensitivity buffers and are acceptable.

12 BATS

12.1 Description of the Baseline Environment

12.1.1 Habitats

Micro-habitats available to bats in and around the site for foraging and commuting include grassland, livestock water points and dams, drainage lines, thicket and woodland vegetation, cultivated areas, and stands of alien trees around farmsteads. Roosting micro-habitats include rocky outcrops, trees and buildings.

12.1.2 Bat Species

The project falls within the actual or predicted distribution range of approximately 14 species of bat. Analysis of the acoustic monitoring data suggests that at least four species of bat are present (Table 12.1). The sensitivity of each of these species to the proposed WEF's is a function of their conservation status and the likelihood of risk to these species from WEF development. 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.

Table 12.1: Bat Species Recorded at the Project and their Sensitivity to WEFs

Species			Conservation Status[15]	

[13] Bid as two separate projects in the REIPP with two separate grid connections.

[15] 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.

	Species Code	# of Bat Passes[14]	National	International	Likelihood of Risk
Egyptian free-tailed bat *Tadarida aegyptiaca*	EFB	10,755	Least Concern	Least Concern	**High**
Natal long-fingered bat *Miniopterus natalensis*	NLB	1,937	Least Concern	Least Concern	**High**
Temminck's myotis *Myotis tricolor*	TM	224	Least Concern	Least Concern	**Medium-High**
Cape serotine *Neoromicia capensis*	CS	5,804	Least Concern	Least Concern	**Medium-High**

12.1.3 Spatio – Temporal Bat Activity Patterns

A total of 18 720 bat passes were recorded from 393 sample nights across the four species and across all bat detectors (Table 12.2). A median of 28 bat passes per night were recorded across the monitoring period. Overall, the levels of bat activity were low for most of the sampling period but this varied, and there were some periods when activity was moderate. Temporally isolated peaks in the total number of passes per night occurred in early August, at the end of October and during a one week period at the end of March leading into the beginning of April.

Table 12.2: Acoustic Monitoring Summary

Monitoring Location	Altitude (masl)	# of Sample Nights	% of Sample Nights with Bat Activity	Total number of Bat Passes
HIGH1	871	347	86.2	4003
HIGH2	957	370	74.3	2449
HIGH3	1001	246	68.7	4773
HIGH4	839	104	71.2	2922
HIGH5	991	303	55.1	765
METLOW	1093	296	76.7	3569
METHIGH	1183	296	23.6	239

The monitoring data revealed seasonal patterns in bat activity. Bats were more active in spring and autumn and least active in winter.

There was no clear pattern for individual species activity relative to months. All species had lowest activity in May and June.

Bat activity in accordance with altitude and proximity to features of importance for bats; the differences in the proportion of bat activity recorded in each season, at each monitoring location and the bat active times at the WEF site is described in the Bat Specialist Report (Volume II).

Very little bat activity was recorded below 12 °C. In winter, bat activity increased markedly for temperatures between approximately 16 °C and 23 °C. In summer, the majority of the activity was recorded between approximately 18 °C and 28 °C. In autumn, the majority of the bat activity was recorded between approximately 18 °C and 25 °C. In spring, the majority of the bat activity was recorded between approximately 16 °C and 26 °C.

The highest wind speed in which bats were recorded was 15.5 m/s but the average wind speed in which bats were recorded was 4.9 m/s at 10 m, and 6.5 m/s at 90 m. At 10 m across all seasons, very little activity was recorded above 6 m/s to 7.5 m/s. At 90 m, in autumn, spring and summer, approximately 30 % to 40 % of recorded bat activity occurred below wind speeds of 3 m/s (the potential cut-in speed of the candidate turbines). In winter, only 5 % occurred below 3 m/s. Approximately 80 % to 90 % of the bat activity

[14] A sequence of two or more echolocation calls separated from other calls by more than 500 milliseconds.

was recorded below 6.5 m/s in autumn, 8 m/s in spring, 9 m/s in summer and 10 m/s in winter respectively (Figure 12.1).

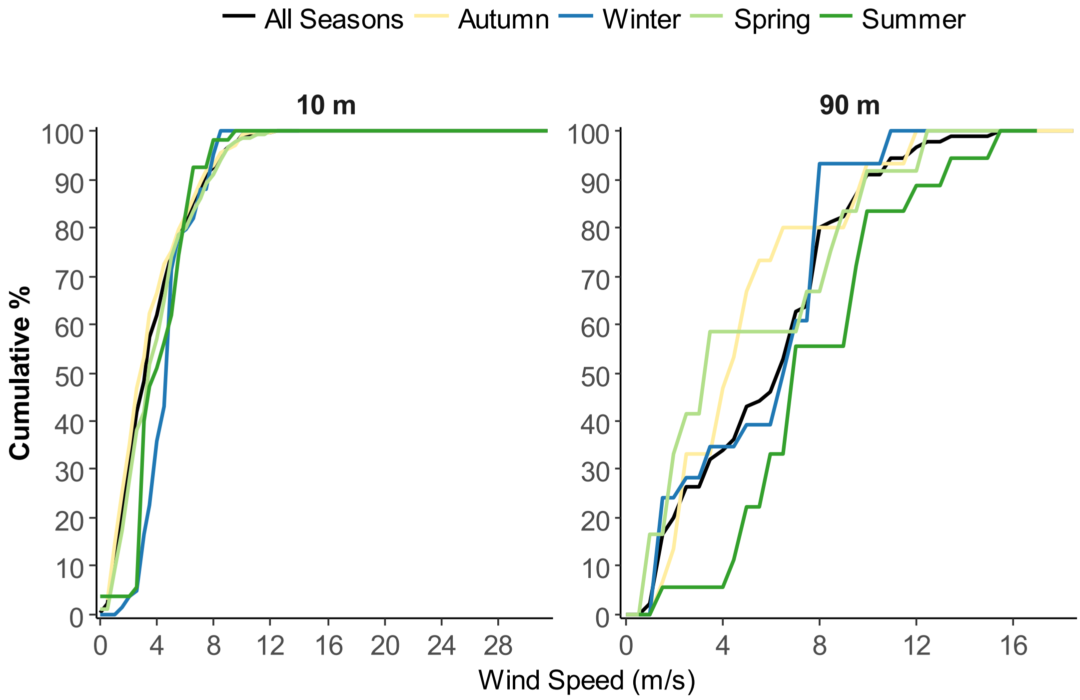


Figure 12.1: Accumulation curves of bat activity across all species with increasing wind speed per season.

12.1.4 Bloukrans Cave

During the May 2017 survey, it was estimated that approximately 2000 – 3 000 Cape horseshoe bats were present in the cave. These bats, which have a low risk to wind turbine induced mortality, were not recorded on the proposed development site. Several individual Natal long-fingered bats were also counted. In October 2017 (spring) a minimum of 500 Natal long-fingered bats were present in the cave but it is possible that over 1000 individuals were present.

Activity of Natal long-fingered bats on the site was low during the pre-construction monitoring. The period of highest activity for this species across the site was during November (1.8 passes per night) and December (1.9 passes per night). The distance from the cave to the edge of the proposed WEFs (approximately 8 km) therefore appears to be of a sufficient distance that most Natal long-fingered bats do not forage there.

The risks to Natal long-fingered bats would increase during the times of the year when they are moving to and from the cave (i.e. autumn and spring) as this might necessitate these bats moving across the wind farm, increasing risk of mortality. There was no obvious difference in Natal long-fingered bat activity recorded between autumn, spring and summer which might suggest that this species does not cross the site from the east (where there are known roosts) to reach the cave in the west, at least during the current monitoring period.

Based on these results and best-practise guidelines, a 20 km radial buffer has been placed around the cave inside which features that are important for bats have been buffered by larger distances than normal. For example, a 350 m wetland buffer has been applied as opposed to a 200 m buffer. This 20 km buffer encompasses the entirety of the proposed development site. In addition, a 5 km no go buffer must be placed around the cave but this does not impact the current development boundaries (Figure 12.2).

12.2 Assessment of Potential Impacts

WEFs have the potential to impact bats directly through collisions and barotrauma resulting in mortality, and indirectly through the modification of habitats. 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) is small compared to the size of the project.

Direct impacts to bats will be limited to species that make use of the airspace in the rotor-swept zone of the wind turbines. All the bat species that were recorded on site exhibit behaviour that may bring them into contact with wind turbine blades. They are thus potentially at risk of negative impacts if not properly mitigated, although the magnitude of these impacts are unknown at this stage.

Impact Phase: Construction Phase							
Impact description: 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 species involved; species that may 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. 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. Reducing roosting opportunities for bats is likely to have negative impacts. However, it is unlikely that this impact will occur as there are low numbers of roosting spaces where development is planned. Therefore, the significance of this impact would be low.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	L	Negative	L	L	M
With Mitigation	L	M	L	Negative	L	L	M
Can the impact be reversed?	Unknown						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • It may be possible to limit roost abandonment by avoiding construction activities near roosts. No confirmed roosts have been found at the project but there are potential roosts that bats may be using including trees, rocky crevices and buildings. • It is recommended that a bat specialist survey the confirmed turbine locations and all other proposed site infrastructure for the presence of roosts within 200 m before any construction activities commence and once the preliminary design and layout of each WEF is complete.							
Will this impact contribute to any cumulative impacts?	The cumulative impact of bats abandoning their roosts is dependent on the number of roosts affected, the species involved and extent of the impact across the assessed region. With effective management of the						

	construction process across the cumulative developments and limiting roost disturbance, the cumulative impacts can be reduced.

Impact Phase: Construction Phase							
Impact description: 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. It is likely that roost destruction will occur if construction activities require the removal of trees, buildings and blasting rocky outcrops. If bats are occupying such roosts at the time they are destroyed it is likely this could result in mortality. However, a low numbers of roosts will likely need to be destroyed resulting in the significance of this impact being low after mitigation.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	L	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?	No						
Will impact cause irreplaceable loss or resources?	Yes						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • The WEF 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 practice guidance, which includes a minimum buffer of 200 m. • 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. • 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.							
Will this impact contribute to any cumulative impacts?	The cumulative impact of destroying multiple roosts across a region will be negative. With mitigation, effective design of WEFs and preventing roost destruction, the cumulative impacts can be reduced.						

Impact Phase: Construction Phase
Impact description: Habitat modification

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Bats can be impacted indirectly through the modification or removal of habitats (Kunz et al. 2007b) and can also be displaced from foraging habitat by wind turbines (Millon et al. 2018). 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.							
Without Mitigation	L	M	L	Negative	L	L	M
With Mitigation	L	M	L	Negative	L	L	M
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	Yes						
Can impact be avoided, managed or mitigated?	Yes						
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.							
Will this impact contribute to any cumulative impacts?	Cumulative impacts should be low because of the limited amount of vegetation that would be removed at operating WEFs relative to the large area in the region that would not be developed. However, this will depend on the types of vegetation that are removed because the cumulative impact of removing endangered habitat will be greater than removing habitat that is not threatened.						

Impact Phase: Operational Phase							
Impact description: 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 (Grodsky et al. 2011; Horn et al. 2008; Rollins et al. 2012). These impacts will be limited to species that make use of the airspace in the rotor-swept zone of the wind turbines. All species of bat that were recorded at the project exhibit behaviour that may bring them into contact with wind turbine blades and so they are potentially at risk of negative impacts.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	M	L	Negative	L	L	M

Can the impact be reversed?	No
Will impact cause irreplaceable loss or resources?	Yes
Can impact be avoided, managed or mitigated?	Yes
Mitigation measures: • 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. Low lying areas, buildings, woodland/thicket and areas near water should be avoided. This has been adhered to as all turbines adhere to buffer zones around these features. • The type of turbine used may influence fatality. Taller towers have a positive relationship between the numbers of bats killed at some wind energy facilities in Greece and Canada (Barclay et al. 2007; Georgiakakis et al. 2012). However there are no published data on this relationship in South Africa but unpublished data from other pre-construction monitoring reports suggest that bat activity at height in South Africa is lower. However, some species in South Africa that are not adapted for flight at height have suffered mortality suggesting that some bats may be killed in the lower edge of the rotor swept zone. Therefore, it is preferable to use taller towers (Max aviation limit is 200 m in the Eastern Cape), but limit the rotor diameter such that the minimum distance between the blades and the ground is maximised. • Operational acoustic monitoring and carcass searches for bats must be performed, based on best practice, to monitor mortality and bat activity levels. Acoustic monitoring should include monitoring at height (from more than one location i.e. such as on turbines) 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.	
Will this impact contribute to any cumulative impacts?	The cumulative impacts will depend on the number of WEFs in the region, the species involved and the levels of bat mortality. Bats reproduce slowly (Barclay and Harder 2003) and their populations can take long periods of time to recover from disturbances so the cumulative impacts can be high if appropriate management and mitigation is not implemented.

Impact Phase: Operational Phase							
Impact description: Bat mortality during migration It has been suggested that some bats may not echolocate when they migrate (Baerwald and Barclay 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 is therefore considered here as a separate impact of the WEF on the Natal long-fingered bat, which is the only species recorded during pre-construction monitoring 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 site. It is therefore unlikely that mortality will occur during migration periods but during the operating lifespan of the WEFs it may be possible that migration patterns and species distributions may change in response to climactic and/or habitat shifts. There may also be inter-annual variation in bat movement patterns which cannot be observed with a single year of data.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	H	M	M	Negative	M	L	M
With Mitigation	M	M	M	Negative	L	L	M

Can the impact be reversed?	No
Will impact cause irreplaceable loss or resources?	Yes
Can impact be avoided, managed or mitigated?	Yes

Mitigation measures:

- 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. Low lying areas, buildings, woodland/thicket and areas near water should be avoided. This has been adhered to as all turbines adhere to buffer zones around these features.
- The type of turbine used may also influence fatality. Taller towers have a positive relationship between the numbers of bats killed at some wind energy facilities in Greece and Canada (Barclay et al. 2007; Georgiakakis et al. 2012). However there are no published data on this relationship in South Africa but unpublished data from other pre-construction monitoring reports suggest that bat activity at height in South Africa is lower. However, some species in South Africa that are not adapted for flight at height have suffered mortality suggesting that some bats may be killed in the lower edge of the rotor swept zone. Therefore, it is preferable to use taller towers (max aviation limit in the EC is 200 m) but limit the rotor diameter such that the minimum distance between the blades and the ground is maximised.
- 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 i.e. such as on turbines) and at ground level. In addition, surveys of the Bloukrans cave should be undertaken in spring and autumn to assess changes in the annual movement patterns of the Natal long-fingered bat.
- 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.

Will this impact contribute to any cumulative impacts?	The cumulative impacts will depend on the number of WEFs in the region, the species involved and the levels of bat mortality. Bats reproduce slowly (Barclay & Harder 2003) and their populations can take long periods of time to recover from disturbances so the cumulative impacts can be high if appropriate management and mitigation is not implemented. Impacts may also affect populations over a large geographic area (Lehnert et al. 2014; Voigt et al. 2012) if gene flow is prevented in migratory species.

Impact Phase: Operational Phase

Impact description: 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 low. However, if any bats do manage to do so, they would be at greater risk of mortality due to the proximity to wind turbines.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	M	L	Negative	L	L	M
With Mitigation	L	M	L	Negative	L	L	H

Can the impact be reversed?	Yes

Will impact cause irreplaceable loss or resources?	Yes
Can impact be avoided, managed or mitigated?	Yes

Mitigation measures:

- Bats should 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 or attempting to remove bats. Ongoing maintenance and inspections of buildings must be carried out to ensure no access to bats or actively roosting bats.

Will this impact contribute to any cumulative impacts?	If there are no roosting opportunities for bats at the project or other developments, the cumulative impacts will be low.

Impact Phase: Operational Phase

Impact description: 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 WEFs, 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 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.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	M	L	Negative	L	L	M
With Mitigation	L	M	L	Negative	L	L	H

Can the impact be reversed?	Yes
Will impact cause irreplaceable loss or resources?	Yes
Can impact be avoided, managed or mitigated?	Yes

Mitigation measures:

- This impact can be mitigated by using as little lighting as possible. Where lights need to be used such as at the substation and switching station and elsewhere, 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 & Rydell 1998) and should not be used as far as possible.

Will this impact contribute to any cumulative impacts?	Cumulative impacts should be low if mitigation is applied because fewer insects would be attracted to lighting, and hence fewer bats would be

	attracted to feed on them. This would reduce the likelihood of bats encountering wind turbines.

12.3 Conclusion

The impacts to bat during this phase are likely to be restricted to disturbance. Provided decommissioning activities are restricted to daylight hours, the impact to bats should be negligible.

The bat monitoring data collected and analysed to date suggest that the development of the proposed Highlands North WEF can be achieved without unacceptable risks to bats.

The increased occupation of the Bloukrans cave by the Natal long-fingered bat in October (spring) appears not to have influenced bat activity at the site. This migratory species would be at risk of encountering and colliding with wind turbines as it moves across the landscape to and from winter hibernacula towards the cave in autumn and spring but increased activity during these periods was not observed. It is not known which direction these bats would travel across the landscape to the cave but it is possible that they might move through the proposed WEF especially if they fly from the east, westwards towards the cave. The finding that activity is higher near water, buildings and in the valley or lowland areas is important as an initial step to reduce the impact of the proposed WEF's to bats as the facilities must be designed to avoid these areas based on the sensitivity map. No parts of the turbines, including the blade tips, should enter these buffers.

The significance ratings for the majority of the impacts to bats posed by the development are predicted to be low or medium before mitigation and low after mitigation. Impacts related to bat mortality during migration are predicted to be of medium significance before mitigation and low significance with mitigation. However, cumulative impacts may remain medium after mitigation.

13 NOISE

13.1 Description of the Baseline Environment

Residual Noise Levels

Residual noise levels were measured at four of the potential noise-sensitive developments considered to be representative of the types of acoustic environments present at noise-sensitive developments within the study area (Figure 13.1).

Table 13.1 summarises the results. As the measurements were made at a range of wind speeds, including those under which the turbines would operate, it is considered appropriate to assume the average of the four sets of measurements as representative residual noise levels for the purposes of the operational noise assessment.

Table 13.1: Residual Noise Levels

Location	Residual Noise Level, Day, Leq,16hr, dBA	Residual Noise Level, Night, Leq,8hr, dBA
ML1	44	36
ML2	49	29
ML3	46	42
ML4	44	35
Average	**48**	**36**

For the construction noise assessment, as construction noise is not wind speed-dependent in the way that operational noise is, it is considered that the typical outdoor levels in rural districts as described in SANS 10103 are the appropriate representative baseline residual noise levels for the study area , i.e.:

Day: 45 dBA, $L_{eq,16hr}$; and

Night: 35 dBA, $L_{eq,8hr}$.

13.1.1 Desired Rating Levels

Desired rating levels during the construction phase (10 dB above typical outdoor levels in rural districts) are:

- Day: 55 dBA, L_{eq}; and
- Night: 45 dBA, L_{eq}.

Desired rating levels during the operational phase are:

- Day: 55 dBA, L_{eq} (7 dBA above the daytime average residual noise levels); and
- Night: 45 dBA, L_{eq} (based on WHO and ETSU-R-97 Guidelines).

As the turbines would operate during both day and night, the night-time desired rating levels equates to an effective overall noise limit for operational noise of 45 dBA, L_{eq}.

13.2 Assessment of Potential Impacts

13.2.1 Construction Phase

Noise sources during construction would consist of the equipment and vehicles used in the construction process. Any noise from night-time activities is likely to be limited to a generator to maintain power to critical plant (pumps, security systems etc.). As the requirement for, and location of such plant is unknown, it has been assumed as a worst-case that their location may be at the closest point of infrastructure to each of the noise-sensitive developments under consideration.

Construction phase impacts have been determined for the closest noise-sensitive location to each construction activity, and are shown in Table 13.2.

Table 13.2: Predicted Construction Noise Levels, dBA, $L_{Req,T}$, Highlands North WEF

Activity	Location	Predicted Rating Level dBA, $L_{Req,T}$	Excess, dBA $\Delta L_{Req,T}$,		Impact Intensity	
			Day	Night	Day	Night
Construction of Tracks and Hardstanding	6	71	26	0	Very High	None
Excavation and Concreting of Turbine foundations	6	61	16	0	High	None
Turbine Erection	6	59	14	0	High	None
Generator	6	45	0	10	None	Medium

As can be seen from Table 13.2, potential impacts from construction of the Highlands North WEF are generally of high intensity for daytime periods, with the exception of the construction of tracks, which is potentially very high intensity and the generator of no intensity during the day and of medium intensity during the night. The duration of this effect would be limited, however, which is taken into account in the assessment of such effects.

Impact Phase: Construction
Potential impact description: Construction of Tracks and Hardstanding Detailed description of impact: 2 no. Tracked Excavators

1 no. Articulated Dump Truck 1 no. Bulldozer 1 no. Vibratory Roller 6 no. Haulage Trucks per hour							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	L	L	Negative	M	M	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?		YES – impact is temporary during construction phase.					
Will impact cause irreplaceable loss of resources?		NO					
Can impact be avoided, managed or mitigated?		YES					

Mitigation measures to reduce residual risk or enhance opportunities:

- Acoustic enclosures/screens should be used to contain noise-generating/equipment;
- Noise-generating plant should be located as far away from the noise sensitive receptors as is feasible;
- Plant and equipment covers and hatches should be properly;
- Silenced equipment should be used where possible;
- Plant should be turned off when not in use;
- Where practicable, mobile plant should be fitted with broadband, rather than tonal reversing alarms;
- The use of vehicle horns should be limited to emergency use only;
- Good public relations should be maintained with local residents that may be affected by noise from site operations.

Impact Phase: Construction							
Potential impact description: Excavation and Concreting of Turbine Foundations Detailed description of impact: 1 no. Tracked Excavator 1 no. Concrete Mixer Truck with pump and boom arm 2 no. Poker Vibrators 1 no. Dump Truck (tipping fill) 1 no. Roller (rolling fill) 1 no. concrete Batching Plant 1 no. Lorry 6 no. Haulage Trucks per hour							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	L	L	Negative	M	M	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?		YES – impact is temporary during construction phase.					

Will impact cause irreplaceable loss of resources?	NO
Can impact be avoided, managed or mitigated?	YES

Mitigation measures to reduce residual risk or enhance opportunities:

- Acoustic enclosures/screens should be used to contain noise-generating/equipment;
- Noise-generating plant should be located as far away from the noise sensitive receptors as is feasible;
- Plant and equipment covers and hatches should be properly;
- Silenced equipment should be used where possible;
- Plant should be turned off when not in use;
- Where practicable, mobile plant should be fitted with broadband, rather than tonal reversing alarms;
- The use of vehicle horns should be limited to emergency use only;
- Good public relations should be maintained with local residents that may be affected by noise from site operations.

Impact Phase: Construction

Potential impact description: Turbine Erection

Detailed description of impact:

1 no. Wheeled Mobile Crane

1 no. Mobile Telescopic Crane

1 no. Diesel Generator

2 no. Torque guns

5 no. Haulage Trucks per hour (Turbine Delivery)

	Intensity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	H	L	L	Negative	M	M	H
With Mitigation	L	L	L	Negative	L	L	H

Can the impact be reversed?	YES – impact is temporary during construction phase.
Will impact cause irreplaceable loss of resources?	NO
Can impact be avoided, managed or mitigated?	YES

Mitigation measures to reduce residual risk or enhance opportunities:

- Acoustic enclosures/screens should be used to contain noise-generating/equipment;
- Noise-generating plant should be located as far away from the noise sensitive receptors as is feasible;
- Plant and equipment covers and hatches should be properly;
- Silenced equipment should be used where possible;
- Plant should be turned off when not in use;
- Where practicable, mobile plant should be fitted with broadband, rather than tonal reversing alarms;
- The use of vehicle horns should be limited to emergency use only;
- Good public relations should be maintained with local residents that may be affected by noise from site operations.

Impact Phase: Construction							
Potential impact description: Generator (Night-time Use)							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	L	L	Negative	L	L	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?			YES – impact is temporary during construction phase.				
Will impact cause irreplaceable loss of resources?			NO				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: • Acoustic enclosures/screens should be used to contain noise-generating/equipment; • Noise-generating plant should be located as far away from the noise sensitive receptors as is feasible; • Plant and equipment covers and hatches should be properly; • Silenced equipment should be used where possible; • Plant should be turned off when not in use; • Good public relations should be maintained with local residents that may be affected by noise from site operations.							

The good practice measures detailed below should be implemented to manage the effects of noise from works on site:

- Where practicable, noise from fixed plant and equipment should be contained within suitable acoustic enclosures or behind acoustic screens;
- Noise-generating plant should be located as far away from the noise-sensitive receptors as is feasible for the particular activity;
- Plant and equipment covers and hatches should be properly secured to ensure there are no loose fixings causing rattling;
- Silenced equipment should be used where possible;
- Plant should be turned off when not in use;
- Where practicable, mobile plant should be fitted with broadband, rather than tonal reversing alarms;
- The use of vehicle horns should be limited to emergency use only; and
- Good public relations should be maintained with local residents that may be affected by noise from site operations. Effective communication should be established, keeping local residents informed of the type and timing of works, particularly in relation to temporary activities which may generate additional levels of noise.

13.2.2 Operational Phase

Sources of noise during operation of a wind turbine are both mechanical (from machinery housed within the turbine nacelle) and aerodynamic (from the movement of the blades through the air). Modern turbines are designed to minimise mechanical noise emissions from the nacelle through isolation of mechanical components and acoustic insulation of the nacelle. Aerodynamic noise is controlled through the design of the blade tips and edges.

In most modern wind turbines, aerodynamic noise is also restricted by control systems which actively regulate the pitch of the blades.

The majority of wind farms at planning stage do not have a preferred turbine model selected for installation; therefore a candidate turbine representative of a range of turbines has been selected to provide an appropriate estimate of noise levels. Once noise levels have been predicted at the potentially affected properties, compliance with noise limits can be assessed and design advice provided to ensure noise limits are met.

The candidate turbine for the purposes of the noise assessment is the Acciona AW132-3300, with an installed capacity of 3.3 MW, a rotor diameter of 132 m and a hub height of 84 m. These dimensions result in a tip height of 150 m, the maximum height in the range under consideration. The turbine is available in a standard configuration or in a noise-mitigated version with blade serrations and nacelle insulation.

In accordance with the GPG, an addition has been applied to the manufacturer's stated sound power level data to account for measurement uncertainties of 1.645 x uncertainty. The manufacturer's documentation states a typical uncertainty of up to 1 dB, therefore 1.6 dB has been added, as shown in Table 13.3 as 'Modelled Sound Power Level'.

Table 13.3: Manufacturers Noise Emission Data - Acciona AW132-3300

Wind Speed at 10m Height, ms^{-1}	**6**	**7**	**8**	**9**	**10**
Wind Speed at 84 m Height (Z_o = 0.05 m), ms^{-1}	8.4	9.8	11.2	12.6	14.0
Standard Configuration					
Manufacturer's Estimated Sound Power Level, dB L_{WA}	108.5	108.5	108.5	108.5	108.5
Modelled Sound Power Level, dB, L_{WA}	110.1				
Noise-Mitigated – with Blade Serrations and Nacelle Insulation					
Manufacturer's Estimated Sound Power Level, dB L_{WA}	106.0	106.0	106.0	106.0	106.0
Modelled Sound Power Level, dB, L_{WA}	107.6				

Table 13.4 details the predicted operational noise levels for the proposed Highlands North WEF. The excess of the predicted noise levels over the desired day and night rating levels and consequent impact intensity are also shown. Where '-' is shown, the predicted level is less than 20 dBA and no impact will occur.

Table 13.4: Predicted Operational Noise Levels, dBA, $L_{Req,T}$, Highlands North WEF

Location	**Predicted Rating Level dBA, $L_{Req,T}$**	**Excess, dBA $\Delta L_{Req,T,}$**		**Impact Intensity**	
		Day	**Night**	**Day**	**Night**
1	28	-20	-8	None	None
2	29	-19	-7	None	None
3	29	-19	-7	None	None
4	39	-9	3	None	Low
5	40	-8	4	None	Medium
6	45	-3	9	None	High

Location	Predicted Rating Level dBA, $L_{Req,T}$	Excess, dBA $\Delta L_{Req,T,}$		Impact Intensity	
		Day	Night	Day	Night
7	21	-27	-15	None	None
8	33	-15	-3	None	None
9	31	-17	-5	None	None
10	-	-	-	None	None
11	-	-	-	None	None
12	-	-	-	None	None
13	-	-	-	None	None
14	-	-	-	None	None
15	40	-8	4	None	Medium
16	-	-	-	None	None
17	-	-	-	None	None
18	-	-	-	None	None

As can be seen from Table 13.4, there would be no effects during the day at any of the receptors. At night there would be:

- No effects at 14 locations;
- Low effects at 1 location (4);
- Medium effects at 2 locations (5 and 15); and
- High effects at 1 location (6).

It should be noted that location 6 is a hunting lodge which is not permanently occupied.

Impact Phase: Operation							
Potential impact description: Operation – Day Detailed description of impact: Wind Turbines, Wind Turbine Auxiliary Plant, Transmission Line and Substation							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	L	L	H	Negative	L	L	H
With Mitigation	L	L	H	Negative	L	L	H
Can the impact be reversed?			YES – Impact would be reversed after decommissioning				
Will impact cause irreplaceable loss of resources?			NO – Impact would be reversed after decommissioning				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: None Required							

Impact Phase: Operation
Potential impact description: Operation – Night

Detailed description of impact: Wind Turbines, Wind Turbine Auxiliary Plant, Transmission Line and Substation							
	Intensity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	L	H	Negative	M	M	H
With Mitigation	M	L	H	Negative	M	M	H
Can the impact be reversed?			YES – Impact would be reversed after decommissioning				
Will impact cause irreplaceable loss or resources?			NO – Impact would be reversed after decommissioning				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: Use of noise-mitigated turbine model for WTG16 The candidate turbine is available in a noise-mitigated configuration with blade trailing edge serrations and nacelle insulation, which would reduce noise emissions by 2.5 dBA. The turbine WTG16 would require to be installed in this configuration. It should be noted that mitigation of turbines 16 is only required in respect of location 6. As stated above this is not permanently occupied, so subject to agreement with the appropriate landowner, mitigation of turbines 16 may not be necessary in practice. Should a turbine model other than the candidate be installed, consideration should be given to the noise emission of that turbine model and appropriate mitigation included if necessary.							

13.2.3 Decommissioning Phase

Noise sources during decommissioning would be similar to, though fewer than, those during construction and the duration shorter. Effects during decommissioning would therefore be no greater than those during construction.

13.3 Conclusion

The level of impact of noise effects for the Highlands North WEF has been assessed as low during construction and decommissioning with mitigation; as low during day-time operation and as high during night-time operation for one location. Turbine WTG16 requires mitigation in the form of installation of a noise-mitigated turbine model or an agreement with the respective landowner to ensure the affected residence remains unoccupied for the duration of the activity.

14 HERITAGE, ARCHAEOLOGY AND PALAEONTOLOGY

14.1 Description of the Baseline Environment

Palaeontological aspects

The Highlands WEF project area is underlain by potentially fossiliferous bedrocks of the Lower Beaufort Group and younger superficial sediments of the Masotcheni Formation. Combined desktop and field studies of the project area show that *in practice* the bedrocks and superficial sediments here are generally are of *low* palaeontological sensitivity because scientifically important fossils (notably well-preserved vertebrate and vascular plant remains) are rare.

Archaeological aspects

Very little is known of the archaeology of this part of the Eastern Cape as little systematic work has been done. The Albany Museum in Grahamstown holds stone artefacts from the Craddock area that were donated by members of the public from as early as the 1880s. Some of these collections derive from freshwater mussel middens containing stone artefacts and pottery from the banks of the Great Fish River.

The majority of observations from this region come from the Cookhouse/Bedford area – some 45 km east of Somerset East. There, surveys have documented numerous occurrences of Early (ESA), Middle (MSA) and Late Stone Age (LSA) archaeological material and a range of more recent heritage resources such as farm houses (sometimes fortified), ruins, sheds, stone kraals, historic refuse middens, farm cemeteries, unmarked graves and stone cairns.

Historical aspects

The following list indicates the dates at which the various farms in the study area were first surveyed and granted:

- Lekker Water 101 (SG 469/1816) was surveyed in 1816 and first granted to Jurgens Potgieter in May 1818.
- Rietfontein 102 (SG 2588/1940) represents the consolidation of various portions of other farms, including Lekkerwater (first granted to JJ Potgieter in 1818).
- Spaarwater 103 was surveyed in 1816 and originally granted to JJ Potgieter in May 1818.
- Coetzees Fontein 104 (SG 479/1816) was surveyed in 1816 and first granted to Laurens Erasmus in 1818. Subsequently in 1860, it was surveyed again for Joshua Norden. The new boundaries show a public road bisecting the property, and a house on the land.

Many of the farms in the area, were surveyed relatively early (1816) and there is a high possibility of significant early farm buildings in the area, as well as farm cemeteries. Halkett *et al.* (2010) recorded many significant heritage buildings in the area south of Bedford.

14.1.1 Summary of the Heritage indicators

Findings of the heritage study is broadened in the Heritage Impact Assessment (Volume II). Fossils were located in several places in the northern half of the study area but sensitive locations are not impacted by turbine placements. In general the project area is largely of low palaeontological sensitivity. Precolonial and colonial traces are quite common on the landscape but are strongly tied to the valleys where water and good soil can be obtained. These areas are away from the proposed developments. There are, however, occasional scatters of ESA and/or MSA artefacts located on the exposed hills which could be impacted by the proposed developments. The majority of these resources are likely to be of very low cultural significance and of no further concern. Graves, buildings and other historical resources are also concentrated in river valleys and should not generally be an issue.

The cultural and natural landscape would be impacted but, given the fact that the proposed projects lie within a REDZ, it is expected that a new 'electrical layer' will be added to the landscape over time.

14.2 Assessment of the Potential Impacts

- No assessment of impacts to built heritage resources is included because no impacts are expected.
- Impacts to archaeological resources and/or graves would only occur during the construction phase and thus no assessments for operation and decommissioning are provided.

- Impacts to the cultural landscape remain consistent throughout the lifespan of the project and would only cease after the decommissioning phase is complete and the land rehabilitated. The cultural landscape impact assessments provided thus cover construction, operation and decommissioning.
- Further significant impacts on fossil heritage during the operational and decommissioning phases of the wind farm are not anticipated, so these phases are not separately assessed here.

Impact Phase: Construction Phase							
Impact description: Impacts on archaeological resources Archaeological resources may be damaged or destroyed during clearing of the ground or excavation of foundations.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	L	Negative	M	M	H
With Mitigation	L	H	L	Negative	L	L	H
Can the impact be reversed?			No, once archaeological artefacts are disturbed/destroyed the site cannot be recreated.				
Will impact cause irreplaceable loss or resources?			Yes, heritage resources are regarded as unique.				
Can impact be avoided, managed or mitigated?			Yes, it is often easy to realign a section of road if needed but, if this is not possible then archaeological mitigation can be easily effected (there are no identified no-go areas within the present footprint).				
Mitigation measures: • Commission an archaeological walk-through survey to identify sites within final footprint • Carry out any archaeological mitigation for sites of cultural significance that cannot be avoided							

Impact Phase: Construction Phase							
Impact description: Impacts on graves Graves may be damaged or destroyed during clearing of the ground or excavation of foundations.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	H	Negative	M	L	H
With Mitigation	L	H	L	Negative	L	L	H
Can the impact be reversed?			No, once graves are disturbed/destroyed they cannot be recreated.				
Will impact cause irreplaceable loss or resources?			Yes, every grave is unique.				
Can impact be avoided, managed or mitigated?			Yes, it is often easy to realign a section of road if needed but, if this is not possible then exhumation can be effected (avoidance is strongly preferred).				
Mitigation measures: • Commission an archaeological walk-through survey to identify graves within final footprint • Carry out exhumation of graves that cannot be avoided							

Impact Phase: Construction / Operational and Decommissioning Phase
Impact description: Impacts to the cultural landscape

The cultural landscape would be altered through the addition of a new 'layer' comprising of large wind turbines and related infrastructure.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	M	H	H
With Mitigation	M	M	M	Negative	M	H	H
Can the impact be reversed?			Yes, if the facility is decommissioned and the land rehabilitated then the impacts would cease.				
Will impact cause irreplaceable loss or resources?			No, because there are many other areas with very similar cultural landscape character.				
Can impact be avoided, managed or mitigated?			No, it is not possible to avoid the impacts. However, mitigation measures can very slightly reduce the severity of impacts.				
Mitigation measures: • Minimise cut and fill operations • Minimise unnecessary surface disturbance • Ensure effective rehabilitation of the development area after construction and again after decommissioning • Further measures would be as described by the visual assessment practitioner.							

Impact Phase: Construction Phase							
Impact description: Palaeontological heritage resources Destruction, disturbance or damage of fossils preserved at or below the surface of the ground due to surface clearance and excavations during the construction phase (*e.g.* for wind turbine footings, access roads, hard standing & laydown areas, building foundations).							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	L	Negative	M	M	M
With Mitigation	L	H	L	Negative	L	L	M
Can the impact be reversed?			No, lost fossils cannot be re-created while disturbance leads to permanent loss of contextual scientific data.				
Will impact cause irreplaceable loss or resources?			Possible, but unlikely. Most fossils are of widespread occurrence within the outcrop area of a given rock unit outside the project area. However, loss of unique, rare or exceptionally-preserved specimens cannot be discounted.				
Can impact be avoided, managed or mitigated?			Yes				
Mitigation measures: • Monitoring of all substantial excavations (e.g. wind turbine foundations) by ECO for fossil material on an on-going basis during construction phase. • Application of Chance Fossil Finds Procedure (See Appendix 2 of the Specialist Report in Volume II): safeguarding new fossil finds and reporting to ECPHRA by ECO for possible recording and sampling / collection by professional palaeontologist.							

14.3 Conclusion

The fieldwork conducted shows that archaeological resources could be found almost anywhere in the Proposed Development Area but that the vast majority are likely to be of low cultural significance. Aside from impacts to the cultural landscape which are unavoidable but only of generally medium significance, no other aspects of heritage are expected to be impacted. Although a further survey will be required prior to the commencement of construction, it is considered highly unlikely that heritage resources that would require avoidance will be found. Rather, it is likely that some archaeological mitigation may be needed for any resources that cannot be avoided. Such mitigation can be easily effected where required.

It was concluded that the six proposed components of the proposed Highlands WEFs – three WEFs and associated infrastructure and three powerlines – will not have significant cumulative impacts on heritage resources that cannot be mitigated and, from a heritage perspective, can be supported.

15 VISUAL

15.1 Description of the Baseline Environment

The Highlands site is a gently undulating upland area at about 1100 m elevation. The region to the north of the R63 Route becomes much more mountainous, where the *Groot Bruintjieshoogte* range overlooks the site, with a short pass on the R63. The western part of the site, including the scarp with its steeper slopes, has been incised by the *Voëlrivier* and its tributaries, and the eastern part by the *Brakrivier* and its tributaries.

The geology has a primary influence on landforms, and the character of the landscape, or 'sense of place'. The geology of the Highlands site consists of mudstones and sandstones of the Adelaide Formation, Beaufort Group, which forms part of the extensive Karoo Supergroup. The dolerite dykes and sills, which intruded the area are responsible for many of the peaks and ridges in the general area.

The rugged west-facing escarpment consists of Camdeboo Escarpment Thicket, a 2 to 3 m succulent thicket, with *Portulacaria afra* (spekboom) dominant, as well as aloe species. The eastern part of the site consists of Bedford Dry Grassland, an open dry grassland interspersed with *Acacia karoo* woodland, especially in the drainage lines. (Mucina and Rutherford, 2006). Copses of exotic shade trees (pine, wattle, palms) have historically been planted around the farmsteads. Invasive prickly pear and sisal plants are also common.

The study area has a pleasing rural character with green pastures grazed by cattle and sheep (including mohair producers), interspersed by crops and woodland along the alluvial stream courses. There are numerous farmsteads, both on the site and in the immediate surroundings. These range from about 2.5 to 7.5 km apart.

The low escarpment, which runs along the western side of the site is the main scenic feature of the study area. The skyline of the escarpment edge is considered to be particularly visually sensitive. Any turbines located on the scarp edge would tend to be seen in silhouette against the sky. A parcel of land on the western border of the site forms part of the Mountain Zebra-Camdeboo Protected Environment (PE), managed by a PE Landowners Association. The PE parcel is on a south-west facing slope of the scarp face, and is therefore orientated away from the proposed wind farms. The parcel is not known to have any tourism facilities that could be affected by the proposed wind farms. The remaining upland, covered mainly in grassland, tends to be visually exposed, and wind turbines would be potentially visible over long distances.

There are a number of game farms and tourist facilities in the general area, such as East Cape Safaris at Kaalplaas, Kamala Game Reserve - also indicated as Kampala Game Reserve on maps, Vaalklip Game Farm and Side by Side Safaris.

Other receptors are travellers on the R63 Route, which runs across the northern portion of the site, and includes the Bruintjieshoogte Pass, with roadside view sites.

Visibility

Degrees of visibility are listed below, but may be subject to foreground topography and the number of turbines that are visible.

- High: Prominent feature within the observer's viewframe 0-2.5km
- Mod-high: Relatively prominent within observer's viewframe 2.5-5km
- Moderate: Only prominent with clear visibility as part of the wider landscape 5-10km
- Marginal: Seen in very clear visibility as a minor element in the landscape 10-20km

Visual Exposure

Visual exposure of the proposed development is determined by the geographic area within which the project would be visible. The turbines would be located on a visually exposed upland. Some areas to the north and west would be in a view shadow, and therefore not affected by the wind farms.

Landscape Integrity

Visual quality tends to be enhanced by scenic or rural intactness of the landscape, as well as absence of other visual intrusions. The Proposed Development would partly alter the character of the landscape, although farming could continue.

Visual Sensitivity

The low escarpment along the western edge is a scenic feature, particularly when seen from the R63 and Bruintjieshoogte Pass. Sensitive features and receptors are indicated on Figures 15.1, 15.2, 15.3 and 15.4, and overall visual sensitivity is indicated on Figure 15.5.

Cultural landscapes, such as the farmsteads in the surroundings, generally form part of a separate heritage study, but are important in that they may be visually sensitive.

Visual Absorption Capacity (VAC)

This is the potential of the landscape to screen the wind farms from view. The upland site is gently undulating, and therefore visually exposed, i.e. has low visual absorption capacity. The area to the north of the R63 is partly screened by the *Bruintjieshoogte* range.

The overall visual impact intensity is assessed in Table 15.1 below, using the criteria described above.

Table 15.1: Visual Impact Intensity (severity): Wind Farms

Visual Criteria	Comments	North WEF
Visibility of turbines (distance)	Visible from R63, farmsteads, game farms.	High
Visibility of lights at night	Navigation lights on turbines, security lighting at substation/s, O&M buildings.	Medium
Visual exposure (viewshed)	Exposed upland, partly screened by landforms mainly to the north and west.	Medium
Landscape integrity (rural intactness)	Rural cattle farming character.	Medium
Landscape sensitivity (features, receptors)	Escarpment, R63 / *Bruinjieshoogte* Pass, Protected Environment.	High

Visual absorption capacity	Visually exposed upland plateau, with some screening by topography.	Med-High
Overall impact intensity	Summary	Med-high

15.2 Assessment of Potential Impacts

Impact Phase: Construction Phase							
Impact description: Potential visual effect of construction activities, including cranes, construction traffic, dust and noise affecting the rural sense of place. • The construction activities would be highly visible (within 2,5km) for a section of the R63, the *Bruintjieshoogte* Pass and Lekkerwater farmstead. • The construction activities would be moderately visible (within 10km) of about 10 farmsteads in the area. • The construction activities would be mainly local in scale but could extend further along the arterial routes in terms of heavy-duty trucks. • The activities would be of short term duration.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	M	Negative	M	H	H
With Mitigation	L	L	M	Negative	M	M	M
Can the impact be reversed?	Yes, through site rehabilitation.						
Will impact cause irreplaceable loss or resources?	No, areas disturbed by construction activities can be rehabilitated.						
Can impact be avoided, managed or mitigated?	Yes, some mitigation has already been achieved through careful siting of wind turbines in response to specialist studies. Further mitigation can be achieved through careful siting and visual screening of related infrastructure. Visual mitigation is possible through careful siting of the construction camp and stockpiles, as well as visual screening.						
Mitigation measures: • Substation and O&M buildings to be located in visually unobtrusive positions, or alternatively screened with earth berms and planting. • Location of the construction camp, batching plant and related storage/stockpile areas in unobtrusive positions in the landscape, away from arterial or district roads, or alternatively screening measures utilized. • Clear demarcation of construction camps, limited in size to only that which is essential. • Employment of dust suppression and litter control measures. Formulation and adherence to an Environmental Management Programme (EMPr), monitored by an Environmental Control Officer (ECO). • Areas disturbed during construction to be rehabilitated to original state.							

Impact Phase: Operational Phase							
Impact description: Potential visual intrusion of wind turbines, assembly pads, access roads, substation, and operations/maintenance buildings on the rural landscape. • Navigation lights on the turbines and security lighting at the substation at night. • Highly visible (within 2.5 km) for a section of the R63, the Bruintjieshoogte Pass and Lekkerwater farmstead. • Moderately visible (within 10 km) of about 10 farmsteads in the surrounding area. • The wind farm would be local in scale, beyond the site. Navigation lights visible over longer distances. • The visual intrusion of the wind farm would be of long term duration, but is reversible.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**

Without Mitigation	M	M	M	Negative	M	H	H
With Mitigation	M	M	M	Negative	M	M	H
Can the impact be reversed?		Yes, but only over the long term through decommissioning.					
Will impact cause irreplaceable loss or resources?		No, scenic resources would be restored after decommissioning in the long term.					
Can impact be avoided, managed or mitigated?		Yes, some mitigation has already been achieved through careful siting of wind turbines in response to specialist studies. Lighting and signage can be managed.					
Mitigation measures: • Positioning of turbines has already been mitigated through iterative layouts based on specialist studies. • Navigation lights to be to Civil Aviation Authority requirements. • Lighting at substations and O&M buildings to be minimised through use of reflectors, low-level bollard lights and movement sensors so that lights only come on when required. • Signage to be minimised as far as practical, and billboard type signs avoided.							

Impact Phase: Decommissioning Phase							
Impact description: Potential visual intrusion of remaining structures, platform earthworks and access roads on the rural landscape.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	M	H	H
With Mitigation	L	L	L	Neutral	L	M	M
Can the impact be reversed?		Yes, through the removal of structures and rehabilitation of the site.					
Will impact cause irreplaceable loss or resources?		No, the landscape would be restored after rehabilitation.					
Can impact be avoided, managed or mitigated?		Yes, through the removal of structures and rehabilitation of the site.					
Mitigation measures: • Turbines and above-ground structures to be demolished or recycled for new uses. • Access roads no longer required to be ripped and regraded. • Exposed or disturbed areas revegetated for grazing pasture or natural vegetation to blend with surroundings.							

15.3 Conclusion

The potential visual impact significance of the proposed Highlands North WEF during construction would be medium, and could be **medium** during the operation phase. Required mitigation has already been implemented through siting of the wind turbines in response to the specialist studies.

The layout of the proposed turbines succeeds in avoiding practically all the major visual constraints for the study area, occupying the least sensitive parts of the site.

The fact that the proposed wind farms could potentially be dismantled during the decommissioning phase in the long term, and the site restored to more or less its original state, is a positive consideration.

It is the opinion of the Visual Specialists that the final mitigated Highlands North WEF turbine layout does not present a potential fatal flaw in visual terms. Mitigations have been implemented through various iterations and refinements to the layout taking the specialist studies into account. Additional visual mitigations have been recommended that should form part of the conditions for environmental authorisation.

16 SOCIAL

16.1 Description of the Baseline Environment

The proposed Highlands WF is located in the Blue Crane Route Local Municipality (BCRLM), within the Eastern Cape Province in the Sarah Baartman District Municipality (SBDM), previously known as the Cacadu District Municipality (DM).

The main settlements in the municipality are Somerset East, which serves as the administrative and commercial centre, Cookhouse and Pearson. The most significant roads passing through the area are the N10, R61, R63, and the R390.

16.1.1 Provincial Socio-Economic Context

The Eastern Cape Province faces significant social challenges: namely, addressing poverty, income inequality, food insecurity, and unemployment.

Population

According to the 2011 census, the province was home to 6.7 million people, which constituted 12.7% of the national population. The Province's population grew by 4.5% between 2001 and 2011. In terms of population the SBDM makes up 7% of the provinces total population. It is also important to note that youth constitute the largest share of the population in all DMs.

Poverty and inequality

The Eastern Cape Province had the highest poverty levels in South Africa in 2011. Within the province itself the SBDM was ranked the second best in terms of poverty levels.

In terms of inequality, South Africa is one of the most unequal societies in the world. The inequality level in the SBDM was marginally higher than the national figure in 2011. Income equality however, remains a major challenge facing the Eastern Cape Province.

Food security

The Eastern Cape has one of the highest levels of food insecurity in South Africa. According to the estimates, about 78% of the households in the province may be classified as food insecure. This is significantly higher than national average. Vulnerability to food insecurity is widespread. Food insecurity is relatively lower in the SBDM (66%-71%). Within the SBDM the food insecurity levels in the BCRLM are between 40-60% of households, which makes the BCRLM one of the least food-insecure LMs in the DM.

Economic Performance

The Eastern Cape Province accounted for 7.8% of the national GDP in 2011 making it the fourth largest economy in South Africa. The most important sector in the Eastern Cape economy is the tertiary sector, which contributed 76.7% of the regional GDP, followed by the secondary sector (21.2%), and the primary sector (2.2%). Within the tertiary sector the most important sub-sectors were finance, real estate and business services (22.4%), general government services (21.2%) and wholesale and retail trade (13.8%). Within the Secondary Sector the most important sub-sectors were manufacturing (17.5%), followed by construction (2.6%). The most important sub-sector in the Primary Sector was agriculture, forestry and fishing (2.1%) followed by mining and quarrying (0.1%). I

Employment

In terms of employment a total of 1.3 million people were employed in the Eastern Cape in 2011, which makes up 9.7% of the total number of people employed in the whole country. The rate of unemployment in the province increased from 28.2% in the 3rd Quarter of 2011 to 30% in the 3rd Quarter of 2012, an increase of 1.8 percentage points.

This is despite a 2.5% increase in employment. This simultaneous increase in both the unemployment rate and employment levels is explained by an increase in the total size of the labour force (by 5%), in excess of the increase in the total number of new jobs.

In terms of key sectors, more than 60% of the 1.3 million people employed in the province in the third quarter of 2012 were employed in three sub-sectors, namely, government, social and personal services (26.1%), wholesale and retail (23.5%), and manufacturing (12.2%). The primary sectors, comprising mining and quarrying (0.1%) and agriculture, forestry, hunting and fisheries (4.5%) employed far fewer numbers of people. The role of agriculture, forestry, hunting and fisheries sub-sector in terms of employment has fallen significantly since 2002. The share of agriculture, forestry, hunting and fisheries declined to 4.5% from 21.1%, a significant decline of 16.6 %. During the same period all of the other sub-sectors reported an increase in their contribution to employment.

In terms of employment by occupation category, in 2008, elementary occupations made up of 28.4% of total employment, followed by service workers and shop and market sales at 13.4% and technical and associate professionals at 11.4%. In 2011, elementary activities decreased to 24.1% while employment in service workers and shop and market sales workers as well as technical and associate professionals increased respectively to 14.9% and 14.4%. Between the two years, employment declined in the unskilled job categories while employment in the semi-skilled and skilled categories increased – evidence of skill-biased employment growth. This reflects the decrease in the contribution of the agriculture, forestry, hunting and fisheries sectors which would have employed a large number of unskilled workers.

The key employment sectors in the SBDM were Community Services (~24%), Trade (~23%) and Agriculture (~22%). However, while the contribution towards employment in the Community Services and Trade sectors increased between 2002 and 2011, the contribution of the Agriculture sector declined significantly over the same period.

The Manufacturing sector also accounted for sizable proportion of employment in the province. However, total employment in manufacturing significantly declined in the metros between 2002 and 2011. The share of agriculture in total employment also declined in all the metros and DMs for the same period. The decline was significant in the SBDM (~10.8%), where it is a relatively important economic activity.

16.1.2 Municipal – level Socio-Economic Context

Population

The population of the Blue Crane Route Local Municipality (BCRLM) increased from 35 407 in 2001 to 36 002 in 2011, which represents a marginal increase of ~0.1% and an annual average increase of 0.17%. SBDM increased from 388 206 in 2001 to 450 584 in 2011 (~16%) over the same period, with an annual increase of ~1.49%.

The majority of the population in the BCRLM in 2011 was Black African (59%), followed by Coloured (33%) and Whites (6.8 %). The dominant languages within the Municipality are isiXhosa (50.1%), Afrikaans (42.2%) and English (3.3%).

Education

The education levels in both the SBDM and BCRLM improved for the period 2001 to 2011, with the percentage of the population over 20 years of age with no schooling in the SBDM decreasing a high of 19.8% to 10.5%. The percentage of the population over the age of 20 with matric also increased in both the SBDM and BCRLM, from 11.7% to 18.9% in the BCRLM. Despite these increases the figures are significantly lower than the national (28.4%) average. Low education levels, specifically higher education, therefore remains a challenge in both the SBDM and BCRLM.

16.1.3 Municipal Service Levels

Access to municipal services as measured in terms of flush toilets, refuse removal, piped water and electricity, increased in both the SBDM and BCRLM for the period 2001 to 2011. The service levels in the SBDM and BCRLM are also higher than the provincial and national averages for each of the municipal service categories. The improvement in service levels therefore represents a positive socio-economic improvement over the ten year period between 2001 and 2011.

16.1.4 Local Economy

The most important economic sectors in the SBDM are Community Services (36%), Trade (18%) which includes tourism, Finance (17%) which includes Real Estate, Agriculture (7%), Manufacturing (7%) and Transport (7%) (Figure 16.1).

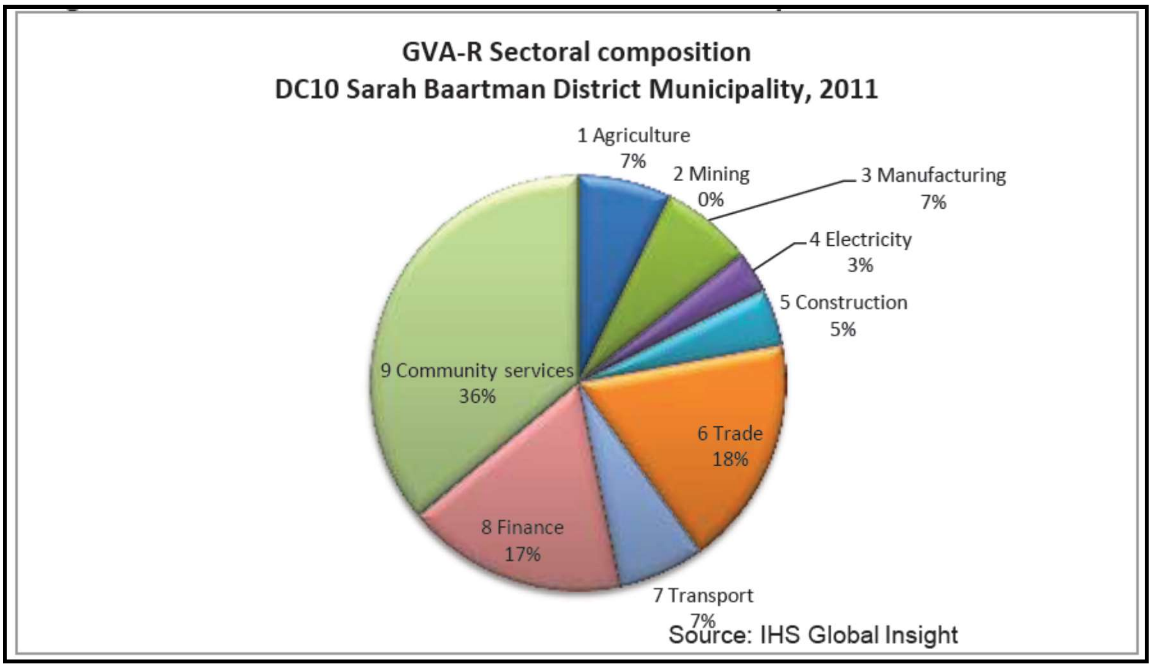


Figure 16.1: Sarah Baartman DM GVA-R Sector composition (Source: IHS Global Insight)

The SBDM IDP identifies the agriculture and tourism sectors as the sectors that have the greatest potential for economic development.

The IDP also notes that opportunities exist in the renewable energy sector. In this regard the IDP refers to the development of a number of wind generation initiatives in the SBDM, noting that eight of the thirteen approved wind farm developments in South Africa are located in the district. In addition, the Blue Crane Route region has been identified by the National Department of Environmental Affairs as one of three potential wind generation 'preferred locations' in the country.

The economy of the BCRLM is largely based on agriculture. The key economic activities include intensive farming operations (cash crops, lucerne, dairy etc.), extensive farming operations (cattle, sheep, goats and game farming) with the agricultural sector contributing 28% of all value added and accounting for 41% of formal employment.

The IDP notes that while the agriculture sector is a key sector its' role has declined in recent years. Manufacturing has also shown relatively weak growth over the past seven years and appears to have been hard hit by the recession of 2008. Construction growth has also been highly cyclical with a progressive decline over the past four years. In terms of growth sectors Trade (which includes retail and tourism) has shown consistently positive growth since 2009 and appears to have recovered rapidly after the recession. Transport has also shown consistently positive growth and rapid recovery after the recession. After a notable pre-recession property boom, finance (which includes real estate) is indicating positive growth once more. Community Services has also shown consistently positive growth since 2002. The IDP also notes that while tourism spend has shown rapid growth over recent years is appears to have flattened out in recent years. In this regard there has been a decline in the number of international and domestic tourists since 2009. Despite the decline the tourism sector has been identified as an important growth sector. The renewable energy sector is also regarded as an important growth sector.

The BCRLM has also identified the need to broaden the local economy through the establishment of a strong industrial sector in smaller rural towns in order to create employment opportunities and make these towns more sustainable. The initiative to develop a stronger industrial sector is linked to the lack of value adding. In this regard the BCRLM IDP notes that the majority of the agricultural products are exported in their raw form with limited values adding. The IDP identifies the need to establish a local industrial cluster with the required facilities to address this issue.

16.2 Policy and Planning Context

Legislative and policy context plays an important role in identifying and assessing the potential social impacts associated with a proposed development. In this regard a key component of the SIA process is to assess the proposed development in terms of its fit with key planning and policy documents.

For the purposes of the meeting the objectives of the SIA the following national, provincial and local level policy and planning documents were reviewed, namely:

- National Energy Act (2008);
- White Paper on the Energy Policy of the Republic of South Africa (December 1998);
- White Paper on Renewable Energy (November 2003);
- Integrated Resource Plan (IRP) for South Africa (2010-2030);
- The National Development Plan (2011);
- New Growth Path Framework (2010);
- National Infrastructure Plan (2012);
- Strategic Environmental Assessment for wind and solar energy in South Africa (CSIR, 2015);
- Eastern Cape Provincial Growth and Development Strategy (2004-2014);
- Sarah Baartman District Municipality Integrated Development Plan (2015/2016 Review);
- Sarah Baartman District Municipality Spatial Development Framework (2013);
- Northern Cape Spatial Development Framework;
- Blue Crane Route Local Municipality Integrated Development Plan (2015/2016 Review).

The findings of the review indicated that renewable energy is strongly supported at a national, provincial and local level (more in depth review can be seen in the Social Impact Assessment Report, Volume II). The development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all make reference to renewable energy. At a provincial level the development of renewable energy is supported by the Eastern Cape Provincial Growth and Development Plan (ECPGDP), The Sarah Baartman District Municipality Integrated Development Plan (IDP) and the Blue Crane Route Local Municipality Integrated Development Plan (IDP). The site is also located in a Renewable Energy Development Zone (REDZ). The general area has therefore been identified as suitable for the establishment of renewable energy facilities. However, there is a need to ensure that the siting of renewable energy facilities (including wind farms) does not impact on the areas tourism potential. In this regard the area to north of the site and the R63 is identified as Tourist Focus Area in the SBDM SDF.

16.3 Wind Energy Related Impacts

In this section, the typical issues / impacts related to the establishment of a WEF and associated infrastructure (such as on-site substations and power lines) are discussed. It is important to note that over the next few years several WEFs (including substations and power lines) are likely to be constructed in South Africa. The development and associated environmental assessment of WEFs in South Africa is relatively new, and thus it is valuable to draw on international experience. This section of the report therefore draws on international literature and web material (of which there is significant material available) to describe the generic impacts associated with WEFs and associated infrastructure such as on-site substations and power lines. It should be noted that the section is not specific to the site but merely a review of international literature.

16.3.1 Health Related Impacts

The potential health impacts typically associated with WEFs include, noise, dust, shadow flicker and electromagnetic radiation. The findings of a literature review undertaken by the Australian Health and Medical Research Council published in July 2010 indicate that there is no evidence of wind farms posing a threat to human health. The research also found that wind energy is associated with fewer health effects than other forms of traditional energy generation, and may therefore in fact result in the minimization of adverse health impacts for the population as a whole (WHO, 2004).

The overall conclusion of the review undertaken by the Australian Health and Medical Research Council (July, 2010) is that, based on current evidence, wind turbines do not pose a threat to health if planning guidelines are followed.

16.3.2 Wind Turbine Generators

The height of the turbines and the fact that a WEF comprises a number of these turbines distributed across the site would result in the development typically being visible over a large area.

Internationally, studies have demonstrated that there is a direct correlation between the number of turbines and the degree of objection to a WEF, with less opposition being encountered when fewer turbines are proposed. Certain objectors to wind energy developments also mention the “sky space” occupied by the rotors of a turbine. As well as height, "sky space" is an important issue. “Sky space” refers to the area in which the rotors would rotate.

The visual prominence of the development would be exacerbated within natural settings, in areas of flat terrain or if located on a ridge top. Even dense stands of wooded vegetation are likely to offer only partial visual screening, as the wind turbines are of such a height that they will rise above even mature large trees.

16.3.3 Shadow Flicker

Shadow flicker is an effect which is caused when shadows repeatedly pass over the same point. It can be caused by wind turbines when the sun passes behind the hub of a wind turbine and casts a shadow that continually passes over the same point as the rotor blades of the wind turbine rotate (http://www.ecotricity.co.uk).

The effect of shadow flicker is only likely to be experienced by people situated directly within the shadow cast by the rotor blades of the wind turbine. As such, shadow flicker is only expected to have an impact on people residing in houses located within close proximity of a wind turbine (less than 500m) and at a specific orientation, particularly in areas where there is little screening present. Shadow flicker may also be experienced by and impact on motorists if a wind turbine is located in close proximity to an existing road. The impact of shadow flicker can be effectively mitigated by choosing the correct site and layout for the wind turbines, taking the orientation of the turbines relative to the nearby houses and the latitude of the site into consideration. Tall structures and trees will also obstruct shadows and prevent the effect of shadow flicker from impacting on surrounding residents (http://www.ecotricity.co.uk).

16.3.4 Motion Based Visual Intrusion

An important component of the visual impacts associated with wind turbines is the *movement* of the rotor blades. Labelled as motion-based visual intrusion, this refers to the inclination of the viewer to focus on discordant, moving features when scanning the landscape. Evidence from surveys of public attitudes towards WEFs suggest that the viewing of moving rotor blades is not necessarily perceived negatively (Bishop and Miller, 2006). The authors of the study suggest two possible reasons for this; firstly when the turbines are moving they are seen as being 'at work', 'doing good' and producing energy. Conversely, when they are stationary they are regarded as a visual intrusion that has no evident purpose. More interestingly, the second theory that explains this perception is related to the intrinsic value of wind in certain areas and how turbines may be an expression or extension of an otherwise 'invisible' presence.

Famous winds across the world include the Mistral of the Camargue in France, the Föhn in the Alps, or the Bise in the Lavaux region of Switzerland. The wind, in these cases, is an intrinsic component of the landscape, being expressed in the shape of trees or drifts of sands, but being otherwise invisible. The authors of the study argue that wind turbines in these environments give expression, when moving, to this quintessential landscape element. In a South African context, this phenomenon may well be experienced if wind farms are developed in areas where typical winds, like berg winds, or the south-easter in the Cape are an intrinsic part of the environment. In this way, it may even be possible that wind farms will, through time form part of the cultural landscape of an area, and become a representation of the opportunities presented by the natural environment.

16.3.5 Landscape Impacts

Landscapes change over time, both naturally and through human intervention. In addition, landscape values, being subjective, change not only with time, but also from person to person. As a result, there are a wide variety of opinions of what is valued and what is not. The perceptions by which we value landscapes are influenced by a range of factors such as visual, cultural, spiritual, environmental, and based on memories or different aesthetics.

The social specialist notes (Volume II) that cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one wind farm at a time, but if each successive stretch of the road is dominated by views of a wind farm, then that can be argued to be a cumulative visual impact.

Cumulative impacts may be visual and aesthetic, but they can also occur in relation to non-visual values about landscape. Non-visual values include sounds/noise, associations, memories, knowledge and experiences or other cultural or natural values. As an example, locating four wind farms in a valley previously best known for its historic wineries might change the balance of perception about the valley's associational character, irrespective of whether all four wind farms were sited in a single view shed.

In Scotland the primary argument employed to oppose wind farms is related to the impact on valued landscapes. As in the South African case, the visual impacts are exacerbated by the fact that the locations with the greatest wind resources are often precisely those exposed upland areas which are most valued for their scenic qualities, and which are often ecologically sensitive. The establishment of wind farms together with the associated service roads and infrastructure, transforms landscapes which are perceived to be natural into 'landscapes of power'.

16.3.6 Impact of Wind Farms on Tourism

A review of international literature in the impact of wind farms was undertaken as part of the SIA. Three articles were reviewed, namely:

- Atchison, (April, 2012). Tourism Impact of Wind Farms: Submitted to Renewables Inquiry Scottish Government. University of Edinburgh
- Glasgow Caledonian University (2008). The economic impacts of wind farms on Scottish tourism. A report prepared for the Scottish Government
- Regeneris Consulting (2014). Study into the Potential Economic Impact of Wind Farms and Associated Grid Infrastructure on the Welsh Tourism Sector

The most comprehensive appears to be a review undertaken by Professor Cara Aitchison from the University of Edinburgh in 2012 which formed part Renewable Energy Inquiry by Scottish Government. The research by Aitchison found that previous research from other areas of the UK has demonstrated that wind farms are very unlikely to have any adverse impact on tourist numbers (volume), tourist expenditure (value) or tourism experience (satisfaction). In addition, to date, there is no evidence to demonstrate that any wind farm development in the UK or overseas has resulted in any adverse impact on tourism. In conclusion, the findings from both primary and secondary research relating to the actual and potential tourism impact of wind farms indicate that there will be neither an overall decline in the number of tourists visiting an area nor any overall financial loss in tourism-related earnings as a result of a wind farm development. A study by the Glasgow Caledonian University (2008) found that only a negligible fraction of tourists will change their decision whether to return to Scotland as a whole because they have seen a wind farm during their visit.

The study also found that 51.0% of respondents indicated that they thought wind farms could be tourist attractions. In this regard, the visitor centre at the Whitelee Wind Farm in east Ayrshire Scotland run by ScottishPower Renewables has become one of the most popular 'eco-attractions' in Scotland, receiving 200 000 visitors since it opened in 2009. The potential impact of the proposed Highlands WEFs on the perceptions of visitors, specifically international visitors, has been raised by owners of adjacent game farming operations.

16.3.7 Impact of Wind Farms on Property Values

The literature review undertaken as part of the Social Impact Assessment (SIA) does not constitute a property evaluation study and merely seeks to comment on the potential impact of wind farms on property values based on the findings of studies undertaken overseas[16]. The literature reviewed was based on an attempt by the social specialists to identify what appear to be "scientifically" based studies that have been undertaken by reputable institutions. In this regard it is apparent that there are a number of articles available on the internet relating to the impact of wind farms on property values that lack

[16] Annexure F contains a more detailed review of the documents

scientific vigour. The literature review also sought to identify research undertaken since 2010. The literature review does not represent an exhaustive review.

In total five articles were identified and reviewed namely:

- Stephen Gibbons (April, 2014): Gone with the wind: Valuing the Visual Impacts of Wind turbines through house prices. London School of Economics and Political Sciences & Spatial Economics Research Centre, SERC Discussion Paper 159;
- Review of the Impact of Wind Farms on Property Values, Urbis Pty Ltd (2016): Commissioned by the Office of Environment and Heritage, NSW, Australia;
- Yasin Sunak and Reinhard Madlener (May 2012): The Impact of Wind Farms on Property Values: A Geographically Weighted Hedonic Pricing. School of Business and Economics / E.ON Energy Research Center, RWTH Aachen University. Model Working Paper No. 3/2012;
- Martin D. Heintzelman and Carrie M. Tuttle (March 3, 2011): Values in the Wind: A Hedonic Analysis of Wind Power Facilities. Economics and Financial Studies School of Business, Clarkson University;
- Ben Hoen, Jason P. Brown, Thomas Jackson, Ryan Wiser, Mark Thayer and Peter Cappers (August 2013): A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States. Ernest Orlando Lawrence Berkeley National Laboratory.

Three of the articles indicate that wind farms have the potential to impact on property values, while two indicate that the impacts are negligible and or non-existent.

In terms of the proposed project the most relevant study is the Urbis study (2016). The authors of the study found that appropriately located wind farms within rural areas, removed from higher density residential areas, are unlikely to have a measurable negative impact on surrounding land values. In this case of the proposed Highlands WEFs the issue of appropriate location has been raised by owners of adjacent game farming operations.

16.4 Assessment of Potential Impacts

16.4.1 Construction Phase Impacts

Impact Phase: Construction Phase							
Impact description: Creation of employment and business opportunities during the construction phase							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Positive	M	M	H
With Mitigation	H	L	H	Positive	M	H	H
Can the impact be reversed?			Yes, By not implementing the project				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed or mitigated?			Yes				
Mitigation measures: Employment • Where reasonable and practical the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. Due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area; • Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria;							

• Before the construction phase commences the proponent should meet with representatives from the BCRLM and BCRLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase; • The local authorities, relevant community representatives and local farmers should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project; • Where feasible a training and skills development programmes for local workers should be initiated prior to the initiation of the construction phase; • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. Business • The proponent should liaise with the SBDM and BCRLM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work; • Where possible, the proponent should assist local BBBEE companies to complete and submit the required tender forms and associated information. • The SBDM and BCRLM, in conjunction with the local business sector and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project. Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.

Impact Phase: Construction Phase							
Impact description: Potential impacts on family structures and social networks associated with the presence of construction workers							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Can the impact be reversed?			Yes, By not implementing the project				
Will impact cause irreplaceable loss or resources?			Unlikely at a community level				
Can impact be avoided, managed or mitigated?			Yes				
Mitigation measures: • Where possible the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories; • The proponent should consider the need for establishing a Monitoring Forum (MF) in order to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should be established before the construction phase commences, and should include key stakeholders, including representatives from the SBDM and BCRLM, farmers and the contractor(s). The MF should also be briefed on the potential risks to the local community and farm workers associated with construction workers; • The proponent and the contractor(s) should, in consultation with representatives from the MF, develop a code of conduct for the construction phase. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be dismissed. All dismissals must comply with the South African labour legislation; • The proponent and contractor (s) should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase; • The contractor should provide transport to and from the site on a daily basis for low and semi-skilled construction workers. This will enable the contractor to effectively manage and monitor the movement of construction workers on and off the site;							

• Where necessary, the contractors should make the necessary arrangements to enable low and semi-skilled workers from outside the area to return home over weekends and/ or on a regular basis. This would reduce the risk posed to local family structures and social networks; • It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

Impact Phase: Construction Phase							
Impact description: Potential impacts on family structures, social networks and community services associated with the influx of job seekers							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	L	Negative	L	L	M
With Mitigation	M	L	L	Negative	L	L	M
Can the impact be reversed?			Yes, By not implementing the project				
Will impact cause irreplaceable loss or resources?			Unlikely at a community level				
Can impact be avoided, managed or mitigated?			Yes				
Mitigation measures: • The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities.							

Impact Phase: Construction Phase							
Impact description: Potential risk to safety of farmers and farm workers, livestock and damage to farm infrastructure associated with the movement of construction workers on and to the site							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Can the impact be reversed?			Yes, repairing damage and compensating for stock losses etc.				
Will impact cause irreplaceable loss or resources?			Unlikely at a community level				
Can impact be avoided, managed or mitigated?			Yes				

Mitigation measures:
• The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase proven to be associated with the construction activities for the WF will be compensated for. The agreement should be signed before the construction phase commences; • Contractors appointed by the proponent should provide daily transport for workers to and from the site. This would reduce the potential risk of trespassing on the remainder of the farm and adjacent properties; • The proponent should consider the option of establishing a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. This committee should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before the contractors move onto site; • The proponent should hold contractors liable for compensating farmers in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below); • The Environmental Management Programme (EMP) should outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested; • Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms. • Contractors appointed by the proponent must ensure that construction workers who are found guilty of trespassing, stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation; • The housing of construction workers on the site should be limited to security personnel.

Impact Phase: Construction Phase							
Impact description: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Can the impact be reversed?			Yes, repairing damage and compensating for losses etc.				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed or mitigated?			Yes				

Mitigation measures: • The proponent should enter into an agreement with the local farmers in the area whereby losses associated with fires that can be proven to be associated with the construction activities for the WF will be compensated for. The agreement should be signed before the construction phase commences; • Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas; • No smoking should be permitted on site, except in designated areas; • Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months; • Contractor to provide adequate firefighting equipment on-site; • Contractor to provide fire-fighting training to selected construction staff; • No construction staff, with the exception of security staff, to be accommodated on site over night; • As per the conditions of the Code of Conduct, in the event of a fire proven to be caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the firefighting costs borne by farmers and local authorities.

Impact Phase: Construction Phase							
Impact description: Potential dust and safety impacts and damage to road surfaces associated with movement of construction related traffic to and from the site							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Can the impact be reversed?			Yes, by rehabilitating disturbed areas.				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed or mitigated?			Yes				
Mitigation measures: • As far as possible, the transport of components to the site along the N10 should be planned to avoid weekends and holiday periods; • The contractor should inform local farmers and representatives from the SBDM and BCRLM Tourism of dates and times when abnormal loads will be undertaken; • The contractor must ensure that damage caused by construction related traffic to the gravel public roads and local, internal farm roads is repaired on a regular basis throughout the construction phase. The costs associated with the repair must be borne by the contractor; • Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis[17], adhering to speed limits and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers; • All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits; • The Contractor should ensure that workers are informed that no waste can be thrown out of the windows while being transported to and from the site. Workers who throw waste out windows should be fined; • The Contractor should be required to collect waste along access roads on a weekly basis; • Waste generated during the construction phase should be transported to the local permitted landfill site. • EMP measures (and penalties) should be implemented to ensure farm gates are closed at all times; • EMP measures (and penalties) should be implemented to ensure speed limits are adhered to at all times.							

[17] Treated effluent (non-potable) water should be used for wetting of roads and construction areas

Impact Phase: Construction Phase							
Impact description: The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the WEFs and power lines will damage farmlands and result in a loss of farmlands for grazing.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Can the impact be reversed?	Yes, by rehabilitating disturbed areas.						
Will impact cause irreplaceable loss or resources?	No, however, disturbed areas will need to be rehabilitated						
Can impact be avoided, managed or mitigated?	Yes						

Mitigation measures:

- The location of wind turbines, access roads, laydown areas etc. should be informed by the findings of the soil and vegetation study. In this regard areas of high potential agricultural and sensitive vegetation soils should be avoided;
- The developer should consult with affected property owners in order to enable them to factor construction activities into their farming schedules;
- The location of wind turbines, access roads, laydown areas etc. should be discussed with the locally affected landowner in the finalisation process and inputs provided should be implemented in the layout as best as possible;
- The footprint areas for the establishment of individual wind turbines should be clearly demarcated prior to commencement of construction activities. All construction related activities should be confined to the demarcated area and minimised where possible;
- An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase;
- All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase. The rehabilitation plan should be informed by input from the soil scientist and discussed with the local farmer;
- The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed;
- The implementation of the Rehabilitation Programme should be monitored by the ECO;
- All workers should receive training/ briefing on the reasons for and importance of not driving in undesignated areas;
- EMP measures (and penalties) should be implemented to strictly limit all vehicle traffic to designated roads and construction areas. Under no circumstances should vehicles be allowed to drive into the veld;
- Disturbance footprints should be reduced to the minimum.
- Compensation should be paid by the developer to farmers that suffer a permanent loss of land due to the establishment of the WEF. Compensation should be based on accepted land values for the area.

Impact Phase: Construction Phase							
Impact description: The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the WEFs and power lines will damage farmlands and result in a loss of farmlands for grazing.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Can the impact be reversed?	Yes, by rehabilitating disturbed areas.						
Will impact cause irreplaceable loss or resources?	No, however, disturbed areas will need to be rehabilitated						

Can impact be avoided, managed or mitigated?	Yes

Mitigation measures:

- The location of wind turbines, access roads, laydown areas etc. should be informed by the findings of the soil and vegetation study. In this regard areas of high potential agricultural and sensitive vegetation soils should be avoided;
- The developer should consult with affected property owners in order to enable them to factor construction activities into their farming schedules;
- The location of wind turbines, access roads, laydown areas etc. should be discussed with the locally affected landowner in the finalisation process and inputs provided should be implemented in the layout as best as possible;
- The footprint areas for the establishment of individual wind turbines should be clearly demarcated prior to commencement of construction activities. All construction related activities should be confined to the demarcated area and minimised where possible;
- An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase;
- All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase. The rehabilitation plan should be informed by input from the soil scientist and discussed with the local farmer;
- The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed;
- The implementation of the Rehabilitation Programme should be monitored by the ECO;
- All workers should receive training/ briefing on the reasons for and importance of not driving in undesignated areas;
- EMP measures (and penalties) should be implemented to strictly limit all vehicle traffic to designated roads and construction areas. Under no circumstances should vehicles be allowed to drive into the veld;
- Disturbance footprints should be reduced to the minimum.
- Compensation should be paid by the developer to farmers that suffer a permanent loss of land due to the establishment of the WEF. Compensation should be based on accepted land values for the area.

16.4.2 Operational Phase Impacts

Impact Phase: Operational Phase

Impact description: Development of infrastructure to generate clean, renewable energy

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	M	M	Positive	M	M	H
With Mitigation	M	H	M	Positive	H	H	H

Can the impact be reversed?	Yes, by removing infrastructure.
Will impact cause irreplaceable loss or resources?	No
Can impact be avoided, managed or mitigated?	Yes

Mitigation measures:

- Implement a skills development and training programme aimed at maximizing the number of employment opportunities for local community members;
- Maximise opportunities for local content, procurement and community shareholding;
- Establish a visitor centre. As indicated in the literature review, visitor centres in Scotland have attracted large numbers of visitors to wind farms.

Impact Phase: Operational Phase

Impact description: Creation of employment and business opportunities associated with the operational phase

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence

Without Mitigation	M	M	L	Positive	M	M	H
With Mitigation	M	M	M	Positive	H	H	H
Can the impact be reversed?	Yes, by removing project.						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						

Mitigation measures:

Employment

- Where reasonable and practical the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. Due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area;
- Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria;
- Before the construction phase commences the proponent should meet with representatives from the BCRLM and BCRLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase;
- The local authorities, relevant community representatives and local farmers should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project;
- Where feasible a training and skills development programmes for local workers should be initiated prior to the initiation of the construction phase;
- The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Business

- The proponent should liaise with the SBDM and BCRLM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work;
- Where possible, the proponent should assist local BBBEE companies to complete and submit the required tender forms and associated information.
- The SBDM and BCRLM, in conjunction with the local business sector and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project.
- The proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's and locals employed during the operational phase of the project;
- The proponent, in consultation with the SBDM and BCRLM, should investigate the options for the establishment of a Community Development Trust.

Impact Phase: Operational Phase							
Impact description: Establishment of a community trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	M	Positive	M	L	H
With Mitigation	M	H	H	Positive	H	H	H
Can the impact be reversed?	Yes, by not implementing the project.						

Will impact cause irreplaceable loss or resources?	No
Can impact be avoided, managed or mitigated?	Yes
Mitigation measures: • The SBDM and BCRLM should be consulted as to the structure and identification of potential trustees to sit on the Trust. The key departments in the SBDM and BCRLM that should be consulted include the Municipal Managers Office, IDP Manager and LED Manager; • Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; • Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the WEF.	

Impact Phase: Operational Phase							
Impact description: The generation of additional income represents a significant benefit for the local affected farmer(s) and reduces the risks to their livelihoods posed by droughts and fluctuating market prices for sheep and farming inputs, such as feed etc.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	L	Positive	L	L	H
With Mitigation	M	M	M	Positive	M	H	H
Can the impact be reversed?	Yes, by not implementing agreements.						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • Implement agreements with affected landowners.							

Impact Phase: Operational Phase							
Impact description: Visual impact associated with the proposed WEF and the potential impact on the areas rural sense of place.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	M – H	M	M
With Mitigation	M	M	M	Negative	M – H	M	M
Can the impact be reversed?	Yes, by removing turbines.						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • The recommendations contained in the VIA should be implemented; • Recommended that the applicants meet with the affected landowners to discuss the possibility relocating wind turbines that have the highest potential visual impact.							

Impact Phase: Operational Phase

Impact description: Visual impact (based on comments from stakeholders who did not identify major concerns) associated with the proposed WEF and the potential impact on the areas rural sense of place.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	L	Negative	L	M	M
With Mitigation	M	M	L	Negative	L	M	M
Can the impact be reversed?	Yes, by removing turbines.						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • The recommendations contained in the VIA should be implemented; • Recommended that the applicants meet with the affected landowners to discuss the possibility relocating wind turbines that have the highest potential visual impact.							

Impact Phase: Operational Phase							
Impact description: Potential impact on property values and current operations linked to the visual impact associated with the proposed WF and the potential impact on the areas rural sense of place.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	M	M	Negative	M	M	M
Can the impact be reversed?	Yes, by removing turbines.						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • The recommendations contained in the VIA should be implemented; • Recommended that the applicants meet with the affected landowners to discuss the possibility relocating wind turbines that have the highest potential visual impact; • The option of compensation for impact on property values and current operations should be considered.							

Impact Phase: Operational Phase							
Impact description: Potential impact of the WF on local tourism							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	L	Negative	L	L	H
With Mitigation	M	M	L	Negative	L	L	H
Can the impact be reversed?	Yes, by removing turbines.						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						

Mitigation measures: • The recommendations contained in the VIA should be implemented; • Recommended that the applicants meet with the affected landowners to discuss the possibility relocating wind turbines that have the highest potential visual impact.

Impact Phase: Operational Phase							
Impact description: Potential impact of the WF on adjacent tourism operations associated with game farming and hunting							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	M	M	Negative	M	M	M
Can the impact be reversed?		Yes, by removing turbines.					
Will impact cause irreplaceable loss or resources?		No					
Can impact be avoided, managed or mitigated?		Yes					
Mitigation measures: • The recommendations contained in the VIA should be implemented; • Recommended that the applicants meet with the affected landowners to discuss the possibility relocating wind turbines that have the highest potential visual impact.							

16.4.3 Operational Phase Impacts

Impact Phase: Decommissioning Phase							
Impact description: Social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Can the impact be reversed?		Yes, by removing turbines.					
Will impact cause irreplaceable loss or resources?		No					
Can impact be avoided, managed or mitigated?		Yes					
Mitigation measures: • The proponent should ensure that retrenchment packages are provided for all staff retrenched when the WEF is decommissioned. • All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning; • The proponent should investigate the option of establishing an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 20 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure.							

Alternatively, the funds from the sale of the WEF as scrap metal should be allocated to the rehabilitation of the site.

16.5 Conclusion

The development of the proposed Highlands North WEF will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also benefit the local community. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated with a coal based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The findings of the SIA also indicate that the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives.

The Proposed Development Site is also located within a REDZ. The area has therefore been identified as suitable for the establishment of renewable energy facilities. However, a key concern identified during the SIA relates to the visual impacts associated with the wind turbines and the potential impact on existing, established game farming and hunting operations in the area, specifically the area to the north, east and south of the site. The majority of these operations cater for up-market overseas visitors and the existing "African veld" sense of place represents a key component of their marketing strategy. The establishment of a wind farm on their western boundary would impact on the areas current sense of place, which in turn, may negatively impact on their operations and property values. The potential impacts will be largely be confined to four to five existing game farming operations. The potential localised impact would therefore need to be considered within the context of the location of the Highlands WEFs within the Cookhouse Wind REDZ and the significant socio-economic benefits associated with the establishment of renewable energy facilities.

17 TRAFFIC AND TRANSPORTATION

17.1 Description of the Baseline Environment

The existing sites are farmlands with low trip generation, evidenced by the gravel roads serving the farms and low traffic volumes observed during a site visit in July 2018.

Considering the sites location, Ngqura Port is the preferred port for particularly large equipment and machinery for with the WEF development.

Starting from Ngqura Harbour the route travels north along Neptune Road, east along the R102 (Daniel Pienaar Street).

Some abnormal load vehicles may be able to use the cloverleaf on-ramp to gain access to the N2, but abnormally long vehicles (carrying wind turbine blades) would need to pass through the interchange and turn right at the T-intersection at the end of Daniel Pienaar St and travel south to the end of Daniel Pienaar Street and turn south towards the interchange on the N2 and take the N2 eastbound On-Ramp. The route continues east along the N2 and takes the N10 northbound on-ramp towards Cookhouse. At Cookhouse the route follows the R63 westbound towards and through Somerset East to the site to the west of Somerset East. (See Figure 17.1 below).

Apart from the N2 which is a divided carriageway with two lanes per direction, the N10 and R63 are two-lane undivided roads. The N10 has a number of passing lanes, but its narrow road reserve and tight horizontal curves through Olifantskop Pass requires special attention for particularly long abnormal load vehicles.

The tarred route from Ngqura Port at Koega to the WEF site west of Somerset East is in a good condition. During the site visit it was observed that the above roads have sufficient spare capacity to accommodate the proposed development traffic, as well as expected traffic from other similar (solar) energy projects in the area.

The gravel Minor Roads (MN00412 from R63 to the WEF sites and MN50171 leading from MN00412) are lightly trafficked roads (as observed on-site) and are in reasonable condition. Their vertical alignment, local dips and bumps, would need to be flattened to accommodate particularly low abnormal load vehicles. Judging the condition of the above roads, and SANRAL prioritised projects, it seems unlikely that these roads will be upgraded in the near future.

The gravel roads on the WEF sites are not suited for the WEF and the site will require an extensive new road network to enable access to each wind turbine site.

The construction period is expected to last approximately 18 months to be completed. The construction period will generate the most traffic, both on public roads and on-site.

The trip generation and average trips to site is as follows:

Highlands North WEF 5687 trips to site = 14 trips to site per day over 18 month build period.

Figure 17.1: Route to site

17.2 Assessment of Potential Impacts

17.2.1 Construction period impacts

Increased traffic flow on route to site, with abnormal load vehicles, some being very large, resulting in slow speeds, impedance to other traffic on local, national, regional and minor roads. This can be mitigated with a Transport Management Plan that should indicate preferable times for abnormally large vehicles to travel on the road network, when background traffic is lower.

Restrictions on route. These and other related issues would need to be mitigated by a Transport Management Plan that will confirm the best route to site and resolve issues in relation to the machinery and equipment transport to site. The route poses a few restrictions for abnormally long, low vehicles as are noted as below:

- The Neptune Road N2 cloverleaf interchange on-ramps are too tight for abnormally long vehicles, (i.e. transport wind turbine blade). Vehicles not able to negotiate the cloverleaf on-ramp would need to continue to the end of Neptune Road and turn east onto the R367, continue onto the R334 and R102 and take the interchange N2 eastbound on-ramp towards the N10.
- Olifantskop Pass, north of Paterson, has a number of very tight horizontal curves where abnormally long vehicles will track across the opposing lane. It would be necessary to close the pass to the public to allow abnormally long vehicles passage. It is suggested that abnormally long vehicles should travel in convey through the pass to limit its impact. Consideration should also be given to travelling during off-peak periods and on days when traffic flow is lower (i.e. Tuesday to Wednesday).
- The low 4.85 m Rail over Road bridge at Cookhouse is a major height restriction. The road sag curve vertical alignment under the bridge further restricts available height to bridge soffit for long vehicles. An alternate route might be required to bypass this low structure in Cookhouse. This alternate route is shorter distance, carries less traffic, has a Road over Rail structure and is preferred over the route through Cookhouse. The southernmost portion of this route has some very tight bends and accommodating long vehicle turning radii will need to be resolved.
- The R63 makes a 90 degree turn in Somerset East CBD. Vehicle body tracks will need to be applied to this intersection to determine vehicle turning space required. It appears that street furniture would need to be temporarily removed and vehicle parking prohibited to enable long vehicles to make the turn (utilising the full road reserve width). Traffic law-enforcement would need to be on duty to enforce one-way travel through this intersection.
- The gravel surfaced Minor Roads (MR00412 from R63 to the sites and MR50171 leading from MR00412) are in reasonable condition, but their vertical alignment, local dips and bumps, could need flattening to accommodate particularly low abnormal load vehicles.

Degradation of gravel minor road pavement that has potential for vehicle damage or crashes. This can be mitigated by regular maintenance of the minor roads.

Dust on Minor Roads: This has potential to cause accidents due to reduced visibility for motorists. This can be mitigated by reduced travel speed for construction vehicles on the Minor Roads.

Potential crashes at R63/M00142 intersection with motorists not expecting construction vehicles using intersection, over an extended period of time. This can be mitigated by ensuring construction vehicles are roadworthy, construction vehicle drivers are licensed, and by installation temporary roadworks "crossing vehicles" warning signage on the R63 approaches to Minor Road MN00412.

Inadequate road network on-site: The site will require an extensive road network to enable vehicles to reach the laydown areas, substation sites and sites for each wind turbine. This can be mitigated by a Transport Management Plan with roads on-site designed according to vehicle requirements. To save costs, the on-site roads providing access to the Turbine locations will be narrow. This poses potential conflict for two-way traffic movement by large vehicles. It is likely that a one-way route will be considered to overcome this potential issue.

Accident risk in work-zones: There is increased potential for workers being injured by vehicles on-site where the construction activities overlap. This can be mitigated by proper planning to limit overlapping of work zone construction activities.

Impact Phase: Construction Phase							
Impact description: Traffic congestion, impedance to traffic flow due to increase in traffic volumes.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Can the impact be reversed?			Yes				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed or mitigated?			Yes, manage and mitigate traffic				
Mitigation measures: Obtain and adhere to a Transport Management Plan to: • Ensure safe transport of materials, equipment, etc. to site; • Optimise route selection and time of travel; • Co-ordinate traffic law-enforcement and transport to site.							

Impact Phase: Construction Phase							
Impact description: Constraints for large vehicles en-route to site could result in unacceptable traffic impact (safety and congestion). Abnormally long, low or high vehicles will experience constraints along the chosen route, i.e. inadequate space to accommodate turning movements at some intersection and interchange ramps, N10 Olifantskop Pass horizontal alignment inadequate for very long vehicles (transporting turbine blades), low rail over road bridge at Cookhouse with road in a vertical dip, restricted turning space on R63 in Somerset East, low speed road design on minor roads could be problematic for very low vehicles, no suitable roads on-site to access Wind Turbine locations.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	H	Negative	M	H	H
With Mitigation	M	L	L	Negative	L	L	H
Can the impact be reversed?			Yes				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed or mitigated?			Yes, impacts can be managed and mitigated				
Mitigation measures: Obtain and adhere to a Transport Management Plan to: • Ensure safe transport of materials, equipment, etc. to site; • Optimise route selection and time of travel; • Co-ordinate traffic law-enforcement and transport to site; • Design on-site roads to facilitate access to laydown areas, substations and wind turbines; • Conduct a dry-run priori to implementation of the Transport Management Plan.							

Impact Phase: Construction Phase							
Impact description: Deterioration of gravel Minor Roads. Additional heavy traffic on Minor roads could degrade the existing road pavement.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	M	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes, impacts can be managed and mitigated						
Mitigation measures: Carry out regular maintenance of the road to ensure that its condition is maintained or improved: • Document condition of gravel roads prior to construction. • Upgrade gravel roads to suitable condition for proposed construction vehicles. • Ensure that the minor road is left in a better condition post-construction.							

Impact Phase: Construction Phase							
Impact description: Additional traffic on gravel Minor Roads will result in more dust that reduces visibility and increases potential for crashes on the Minor Roads.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	H	L	H	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes, impacts can be managed and mitigated						
Mitigation measures: Reduce travel speed on gravel road to reduce dust: • Post speed restriction signage for construction vehicles on minor roads.							

Impact Phase: Construction Phase							
Impact description: Additional traffic at the Minor Road M00412 intersection with the R63 increases chances of vehicle crashes							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	H	Negative	M	M	M
With Mitigation	L	L	H	Negative	L	L	M
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	No						

Can impact be avoided, managed or mitigated?	Yes, impacts can be managed and mitigated
Mitigation measures: Alert motorists to construction traffic at the access: • Place warning construction vehicle signage on the R63 on each approach to Minor Road M00412. • Ensure that all construction vehicles are roadworthy • Ensure that all construction vehicles have appropriate driver's license.	

17.2.2 Operational Period Impacts

The WEF will be operational all hours, except during maintenance, breakdowns or interruption of the connection to the Eskom grid. Regular maintenance will be minimal with very few vehicles. A small staff component is anticipated during the operation phase of the project, with possibly technicians/maintenance and security personnel on site as required.

Maintenance vehicle traffic flow on route to site, could possibly include abnormal load vehicles, resulting in slow speeds, impedance to other traffic on local, national, regional and minor roads.

This can be mitigated in a Transport Management Plan that should indicate preferable times for abnormally large vehicles to travel on the road network when background traffic is lower and requisite procedures for safe passage.

In general, operations (including maintenance) will have very low traffic flow and should have a negligible impact.

Impact Phase: Operational Phase							
Impact description: Constraints for large maintenance related vehicles en-route to site could result in unacceptable traffic impact (safety and congestion). Abnormally long, low or high vehicles will experience constraints along the chosen route, i.e. inadequate space to accommodate turning movements at some intersection and interchange ramps, Olifantskop pass horizontal alignment inadequate for very long vehicles (transporting turbine blades), restricted turning space on R63 in Somerset East, low rail over road bridge at Cookhouse with road in a vertical dip, low speed road design on minor roads could be problematic for very low vehicles.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	H	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes, impacts can be managed and mitigated						
Mitigation measures: Refer to Transport Management Plan to: • Ensure safe transport of materials, equipment, etc. to site; • Optimise route selection and time of travel; • Co-ordinate traffic law-enforcement and transport to site.							

17.2.3 Decommissioning Phase Impacts

The WEF is expected to be operational for 25 years with possibility of extending to a further 25 years. Trip generation at the decommissioning stage is likely to be outside commuter peak hours. Decommissioning will entail less traffic than the construction phase, and components would be transported to the local dump if not recyclable, or sold to local scrap merchants or other if items have salvage value. Decommissioning should be in accordance with the agreement reached with the affected land owners. Daily trips for the decommissioning period is expected to be low and will typically comprise dump trucks or low-bed vehicles, with components cut to size on site. Minor road condition and dust is a potential issue requiring mitigation to prevent crashes and possible injury.

Impact Phase: Decommissioning Phase							
Impact description: Deterioration of gravel Minor Roads. Additional heavy traffic on Minor roads could degrade the existing road pavement.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	M	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes, impacts can be managed and mitigated						
Mitigation measures: Carry out regular maintenance of the road to ensure that its condition is maintained or improved: • Document condition of gravel roads prior to construction. • Upgrade gravel roads to suitable condition for proposed construction vehicles. • Ensure that the minor road is left in a better condition post-construction.							

Impact Phase: Decommissioning Phase							
Impact description: Additional traffic on gravel Minor Roads will result in more dust that reduces visibility and increases potential for crashes on the Minor Roads.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	H	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes, impacts can be managed and mitigated						
Mitigation measures: Reduce travel speed on gravel road to reduce dust: • Post speed restriction signage for construction vehicles on minor roads.							

17.3 Conclusion

It can be concluded that the Proposed Development will not have undue detrimental impact on traffic and that identified impacts can be suitable mitigated. It is the reasoned opinion of the specialist that the development of the Highlands WEFs and grids can be approved, from a traffic and transport engineering perspective, subject to the specific requirements and mitigation measures specified.

18 CUMULATIVE IMPACTS

18.1 Geology, Soils and Agriculture

The formal assessment of the cumulative impact of the North WEF has been assessed by consideration of all renewable energy developments within 35 km of this development. This includes only two other developments, the Middleton Wind Energy Project and the Pearston Solar PV project. These developments have very similar impacts within a similar agricultural environment, within the same Renewable Energy Development Zone (REDZ), although the solar development occupies a greater footprint of grazing land than the wind facilities.

Impact Phase: Cumulative Phase							
Impact description: Regional loss of agricultural land use Agricultural grazing land directly occupied by the development infrastructure, which includes roads and hardstands, will become unavailable for agricultural use. However, only a very small proportion of the total land surface is impacted in this way.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	L	Negative	L	L	H
With Mitigation	L	M	L	Negative	L	L	H
Can the impact be reversed?			Yes, once the wind farm is decommissioned, the footprint of the infrastructure can again be utilised as grazing land.				
Will impact cause irreplaceable loss or resources?			No, because only a very small amount of grazing land is lost and such land is not a scarce resource.				
Can impact be avoided, managed or mitigated?			Yes, to some extent.				
Mitigation measures: • The avoidance of high sensitivity areas by the design layout, and this has already been implemented during the design phase.							

18.2 Freshwater and Wetlands

In the assessment of this project, the surrounding projects within a 35 km radius of the site were assessed. From an aquatic environment standpoint, these projects don't share any of the same direct subquaternary catchment and thus the other projects are too far removed. These would also not share any of the new roads, as it has been shown in the past that the access roads have always had some form of impact on aquatic systems, while internal structures (hard stands and turbines) to a lesser degree.

Presently, no significant cumulative impacts with regard to the proposed turbine placement, hardstands and associated underground cabling were identified as these are located outside of the delineated aquatic systems and their buffers for the proposed site.

Impact Phase: Cumulative Phase
Impact description: Overall cumulative impact during the construction and operational phases In the assessment of this project, the surrounding projects within a 35km radius of the site were assessed, including a number of Solar projects The author has also reviewed the outcomes of the remaining projects as part of this EIA or other EIA / WUL applications in the region. All of the projects have indicated that aquatic impact avoidance as part of their layouts design process coupled mitigation, i.e. selecting the best possible routes to minimise the local and regional impacts and improving the drainage or hydrological conditions within these rivers so that the cumulative impact would be negligible. However, the worse-case scenario has been assessed below, i.e. only the minimum of mitigation is

implemented by the other projects, noting only a small number of projects ever reach the construction phase and that flows within these systems are sporadic.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	Yes						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • Improve the current storm water and energy dissipation features not currently found along the tracks and roads within the region • Install properly sized culverts with erosion protection measures at the present road / track crossings. Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.							

18.3 Flora and Terrestrial Fauna

According to a map of DEA-registered projects as at July 2018, there are no other renewable energy applications in the immediate vicinity of the site, with the nearest facilities being the Golden Valley, Amakhala Emoyeni and Middleton Wind Energy projects near to Cookhouse. Apart from these wind energy projects, there are also some solar energy developments around Pearston west of the project site. The solar projects are however on the plains and do not affect the same environment as the Highlands project. Given the distance and extent of these different developments, it is clear that the current level of cumulative impact around the Highlands site is relatively low. From a terrestrial ecology point of view, there are also few linkages between the different facilities and as such the potential disruption of ecological processes is unlikely. The major broad-scale ecological corridors that are likely to be operating in the area include an east-west corridor along the great escarpment to the north of the site as well as a north-south and east-west corridor associated with the bands of thicket vegetation that occur on the western slopes of the site going through to Jansenville in west and south towards Kirkwood. As the development footprint in these areas remains very low, it is highly unlikely that these would be impacted to a significant degree by renewable energy development. Given the location and extent of current developments in the area, the Highlands WEF would generate habitat loss equivalent to approximately 200 ha and while this would contribute to habitat loss at the local scale, broader implications for cumulative impacts would remain low.

18.4 Avifauna

The cumulative effect of the Proposed Highlands Development along with the actual and predicted impacts of the operational and proposed facilities surrounding Highlands, has the potential to affect various bird species at a higher significance than the impacts of the Proposed Highlands Development alone. Key species that may possibly be impacted upon cumulatively include Cape Vulture, Blue Crane, Ludwig's Bustard, Martial Eagle, Amur Falcon, Lesser Kestrel, Rock Kestrel Jackal Buzzard and potentially Verreaux's' Eagle and Black Harrier. Of these, Cape Vulture is of primary concern, as it has suffered collision mortality in the Bedford/Cookhouse area. Even though collisions of Cape Vulture, are not highly likely at Highlands (due to the low abundance and activity of the species on the site), they are possible and even a few mortalities may result in a cumulative impact of high significance.

The cumulative habitat destruction impact for the proposed Highlands development is concluded to be of moderate significance.

If all operational facilities implement appropriate and effective mitigation as outlined by their respective specialists, and if all mitigation measures outlined in this report are implemented for the proposed Highlands development, the cumulative impact after mitigation is likely to have a moderate significance.

Impact Phase: Cumulative Phase							
Impact description: Cumulative impact of all impacts on avifauna							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	H	M	H	Negative	H	M	M
With Mitigation	H	M	M	Negative	M	L	M
Can the impact be reversed?	Partially						
Will impact cause irreplaceable loss or resources?	Possibly						
Can impact be avoided, managed or mitigated?	Partially						
Mitigation measures: • All mitigation measures listed in Section 11 of this report and recommended for other projects (Avifaunal Specialist Report, Volume II) must be adhered to.							
Residual impacts	Residual impacts will be negligible after appropriate mitigation.						

18.5 Bats

The cumulative impact on bats was considered by searching for current and potential future development of wind energy facilities within a 35 km and 250 km radius of the project. One project is within the 35 km radius and approximately 67 project applications (nine operational, 14 in process and 44 approved) are within the 250 km radius. It is not likely that all of these facilities will reach commercial operation. This scale was chosen because it represents the average distance between known Natal long-fingered bat roosts within the geographic region the north-eastern subpopulation of this species is located. The proposed Highlands wind energy facilities are located within this region and it is possible that these bats migrate seasonally between such roosts. (Miller-Butterworth et al. 2003). It is important to consider cumulative impacts across the entire scale potentially affected animals 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. Three of the four species recorded during the pre-construction monitoring do not migrate over such large distances. 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) and up to at least 24 km for some fruit bats (Jacobsen et al. 1986).

Cumulative impacts on bats could increase as new facilities are constructed (Kunz et al. 2007b) 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. 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 and fruit bats) even if the appropriate mitigation measures are applied. Further research into the populations and behaviour of South African bats, both in areas with and without wind turbines, is needed to better inform future assessments of the cumulative effects of WEFs on bats.

Impact Phase: Cumulative Phase							
Impact description: Cumulative Impacts Cumulative indirect impacts to bats, such as those relating to changes to the physical environment (e.g. roost and habitat destruction) are likely to be low across the cumulative impact regions. Cumulative direct impacts to bats, specifically those related to bat mortality, are likely to be higher. For non-migratory species cumulative direct impacts could have a medium or high significance before mitigation but could reduce to medium or low with appropriate turbine siting and operational mitigation if determined as being necessary based on operational monitoring. Direct impacts on migratory species (i.e. the Natal long-fingered bat) may be high before mitigation but could also reduce to medium with appropriate turbine siting and operational mitigation. However, these ratings would be dependent on all other surrounding wind energy facilities also adopting similar mitigation strategies to reduce impacts to bats. Limited data are available on the actual impacts to bats at the nine operational facilities in the cumulative impact region. In addition, pre-construction monitoring data of bat activity are not a good predictor of the impacts that may be expected at operational wind farms (Hein et al. 2013), limiting their use in understanding and predicting cumulative impacts. Data from one operational wind farm in the cumulative impact region (approximately 130 km south of the proposed Highlands WEFs) which we were able to access suggested that impacts to bats are high. No current information is available to suggest that operational mitigation strategies are being applied at this specific facility. The addition of wind farms in the cumulative impact region may therefore have negative consequences particularly for the north-eastern subpopulation of the migratory Natal long-fingered bat. However, because of a lack of published data on the impact of wind energy facilities on bats in South Africa, and limited baseline data on bat population size and demographics, the confidence in this assessment is low.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	H	M	H	Negative	H	M	L
With Mitigation	H	M	L	Negative	M	M	M
Can the impact be reversed?			No				
Will impact cause irreplaceable loss or resources?			Yes				
Can impact be avoided, managed or mitigated?			Yes				
Mitigation measures: • As this impact is unlikely to occur, no mitigation options are provided.							
Will this impact contribute to any cumulative impacts?			The cumulative impacts will depend on the number of WEFs in the region, the species involved and the levels of bat mortality. Bats reproduce slowly (Barclay and Harder 2003) and their populations can take long periods of time to recover from disturbances so the cumulative impacts can be high if appropriate management and mitigation is not implemented.				

18.6 Noise

The cumulative impact assessment considers the cumulative effects of the proposed development, and other renewable energy projects within 35 km of the proposed Development. Two such other projects have been identified:

- Middleton Wind Energy farm; and
- Pearston Solar Farm.

Each of the above are located more than 20 km from the proposed Development. As such, there is no possibility of cumulative impacts. The cumulative assessment therefore only considers the cumulative effects of the six components of the proposed development.

Impact Phase: Construction Phase							
Impact description: Construction of Tracks and Hardstanding 2 no. Tracked Excavators 1 no. Articulated Dump Truck 1 no. Bulldozer 1 no. Vibratory Roller 6 no. Haulage Trucks per hour							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	H	Negative	M	M	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?			No				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed or mitigated?			Yes				
Mitigation measures: • Acoustic enclosures/screens should be used to contain noise-generating/equipment; • Noise-generating plant should be located as far away from the noise sensitive receptors as is feasible; • Plant and equipment covers and hatches should be properly; • Silenced equipment should be used where possible; • Plant should be turned off when not in use; • Where practicable, mobile plant should be fitted with broadband, rather than tonal reversing alarms; • The use of vehicle horns should be limited to emergency use only; • Good public relations should be maintained with local residents that may be affected by noise from site operations.							

Impact Phase: Construction Phase							
Impact description: Excavation and Concreting of Turbine Foundations 1 no. Tracked Excavator 1 no. Concrete Mixer Truck with pump and boom arm 2 no. Poker Vibrators 1 no. Dump Truck (tipping fill) 1 no. Roller (rolling fill) 1 no. concrete Batching Plant 1 no. Lorry 6 no. Haulage Trucks per hour							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**

Without Mitigation	L	L	H	Negative	M	M	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?	No						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						

Mitigation measures:

- Acoustic enclosures/screens should be used to contain noise-generating/equipment;
- Noise-generating plant should be located as far away from the noise sensitive receptors as is feasible;
- Plant and equipment covers and hatches should be properly;
- Silenced equipment should be used where possible;
- Plant should be turned off when not in use;
- Where practicable, mobile plant should be fitted with broadband, rather than tonal reversing alarms;
- The use of vehicle horns should be limited to emergency use only;
- Good public relations should be maintained with local residents that may be affected by noise from site operations.

Impact Phase: Construction Phase

Impact description: Turbine Erection

1 no. Wheeled Mobile Crane

1 no. Mobile Telescopic Crane

1 no. Diesel Generator

2 no. Torque guns

5 no. Haulage Trucks per hour (Turbine Delivery)

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	L	H	Negative	M	M	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?	No						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						

Mitigation measures:

- Acoustic enclosures/screens should be used to contain noise-generating/equipment;
- Noise-generating plant should be located as far away from the noise sensitive receptors as is feasible;
- Plant and equipment covers and hatches should be properly;
- Silenced equipment should be used where possible;
- Plant should be turned off when not in use;
- Where practicable, mobile plant should be fitted with broadband, rather than tonal reversing alarms;
- The use of vehicle horns should be limited to emergency use only;
- Good public relations should be maintained with local residents that may be affected by noise from site operations.

Impact Phase: Construction Phase

Impact description: Generator (Night-time Use)

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence

Without Mitigation	L	L	M	Negative	L	L	H
With Mitigation	L	L	L	Negative	L	L	H
Can the impact be reversed?	No						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						

Mitigation measures:

- Acoustic enclosures/screens should be used to contain noise-generating/equipment;
- Noise-generating plant should be located as far away from the noise sensitive receptors as is feasible;
- Plant and equipment covers and hatches should be properly;
- Silenced equipment should be used where possible;
- Plant should be turned off when not in use;
- Where practicable, mobile plant should be fitted with broadband, rather than tonal reversing alarms;
- The use of vehicle horns should be limited to emergency use only;
- Good public relations should be maintained with local residents that may be affected by noise from site operations.

Impact Phase: Operational Phase

Impact description: Operation – Day

Wind Turbines, Wind Turbine Auxiliary Plant, Transmission Line and Substation

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	L	Negative	L	L	H
With Mitigation	L	H	L	Negative	L	L	H
Can the impact be reversed?	No						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						

Mitigation measures:

- None required

Impact Phase: Operational Phase

Impact description: Operation – Night

Wind Turbines, Wind Turbine Auxiliary Plant, Transmission Line and Substations

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	H	Negative	H	M	H
With Mitigation	L	H	M	Negative	M	M	H
Can the impact be reversed?	Yes, impact would be reversed after decommissioning.						
Will impact cause irreplaceable loss or resources?	No, impact would be reversed after decommissioning.						
Can impact be avoided, managed or mitigated?	Yes						

Mitigation measures:
Use of noise-mitigated turbine: The candidate turbine is available in a noise-mitigated configuration with blade trailing edge serrations and nacelle insulation, which would reduce noise emissions by 2.5 dBA. The following turbines would require to be installed in this configuration: • Cumulatively: turbines 16, 17, 31 and 41 to 48. It should be noted that mitigation of turbines 16 and 17 are only required in respect of location 6 which is not permanently occupied, so subject to agreement with the appropriate landowner, mitigation of turbines 16 and 17 may not be necessary in practice. Mitigation of turbine 31 is required in respect of locations 8 and 9, and mitigation of turbines 41 to 48 in respect of locations 12, 13 and 14. It is understood that agreement may be possible with landowners that noise levels are acceptable and / or relocation of farmworkers at these locations, in which case the use of noise-mitigated turbines may not be necessary. • Should a turbine model other than the candidate be installed, consideration should be given to the noise emission of that turbine model and appropriate mitigation included if necessary.

18.7 Heritage, Archaeology and Palaeontology

In general heritage information from the area is very limited and the cumulative assessment below is thus based partly on the author's specialist knowledge of the landscape and the likely distribution of heritage resources within it. Only four other projects from within a 35 km radius are known. These are the proposed Middleton Wind Energy Project and three proposed Solar PV projects near Pearston.

It is concluded that the cumulative impact significance of the proposed North WEF is low. It can be argued that, following effective mitigation, our scientific understanding of the palaeontology of this region of the Eastern Cape could be markedly improved – a positive cumulative impact outcome that would partially offset the inevitable loss of fossils during WEF construction.

Impact Phase: Construction Phase							
Impact description: Impacts on archaeological resources Archaeological resources may be damaged or destroyed during clearing of the ground or excavation of foundations.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	L	Negative	M	M	H
With Mitigation	L	H	L	Negative	L	L	H
Can the impact be reversed?			No, once archaeological artefacts are disturbed/destroyed the site cannot be recreated.				
Will impact cause irreplaceable loss or resources?			Yes, heritage resources are regarded as unique.				
Can impact be avoided, managed or mitigated?			Yes, it is often easy to realign a section of road if needed but, if this is not possible then archaeological mitigation can be easily effected (there are no identified no-go areas within the present footprint).				
Mitigation measures: • Commission an archaeological walk-through survey to identify sites within final footprint • Carry out any archaeological mitigation for sites of cultural significance that cannot be avoided							

Impact Phase: Construction Phase
Impact description: Impacts on graves

Graves may be damaged or destroyed during clearing of the ground or excavation of foundations.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	H	Negative	M	L	H
With Mitigation	L	H	L	Negative	L	L	H
Can the impact be reversed?			No, once graves are disturbed/destroyed they cannot be recreated.				
Will impact cause irreplaceable loss or resources?			Yes, every grave is unique.				
Can impact be avoided, managed or mitigated?			Yes, it is often easy to realign a section of road if needed but, if this is not possible then exhumation can be effected (avoidance is strongly preferred).				
Mitigation measures: • Commission an archaeological walk-through survey to identify graves within final footprint • Carry out exhumation of graves that cannot be avoided							

Impact Phase: Construction / Operational and Decommissioning Phase							
Impact description: Impacts to the cultural landscape The cultural landscape would be altered through the addition of a new 'layer' comprising of large wind turbines and related infrastructure.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	M	H	H
With Mitigation	M	M	M	Negative	M	H	H
Can the impact be reversed?			Yes, if the facility is decommissioned and the land rehabilitated then the impacts would cease.				
Will impact cause irreplaceable loss or resources?			No, because there are many other areas with very similar cultural landscape character.				
Can impact be avoided, managed or mitigated?			No, it is not possible to avoid the impacts. However, mitigation measures can very slightly reduce the severity of impacts.				
Mitigation measures: • Minimise cut and fill operations • Minimise unnecessary surface disturbance • Ensure effective rehabilitation of the development area after construction and again after decommissioning • Further measures would be as described by the visual assessment practitioner.							

18.8 Visual

The development of the proposed North WEF, when seen together with the existing wind farms and power lines in the vicinity, would result in cumulative visual impacts resulting in further change to the largely rural character to the area.

Besides the proposed Highlands WEFs, there are existing Eskom powerlines parallel with the R63 Route, an approved solar PV farm near Pearston and a proposed Middleton wind farm south of Cookhouse on the N10 National Route, both within 35 kilometres of the Highlands site.

The Environmental Impact Report (EIR) for the Solar PV Farm near Pearston indicated that the visual impact would be moderate both before and after mitigation, (CEN, 2012). No specialist visual assessment was included in the EIR and no negative cumulative impacts were identified. Except for the brief Scoping Report, no further information could be found on the proposed Middleton Wind Energy Facility, including specialist visual studies.

The fact that the proposed Highlands WEFs fall within the gazetted Cookhouse REDZ means that it would form part of a renewable energy node.

Given that the renewable energy projects mentioned above are not within viewing distance of each other and that they form part of REDZ, the cumulative visual impact significance is considered to be low in the local context.

18.9 Social

Impact Phase: Operational Phase							
Impact description: Cumulative visual impact associated with the establishment of a WEF on the areas rural sense of place and character of the landscape							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	L	Negative	L	M	M
With Mitigation	M	M	L	Negative	L	M	M
Can the impact be reversed?	Yes, by removing turbines.						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • The recommendations contained in the VIA should be implemented.							

Impact Phase: Operational Phase							
Impact description: Cumulative impact associated with the establishment of a number of renewable energy facilities that has the potential to place pressure on local services, specifically medical, education and accommodation							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	L	Negative	L	L	H
With Mitigation	M	L	L	Negative	L	L	H
Can the impact be reversed?	Yes, by implementing effective mitigation.						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • The Eastern Cape Provincial Government, in consultation with the SBDM and BCRLM and the proponents involved in the development renewable energy projects in the SBDM and BCRLM area should consider establishing a Development Forum to co-ordinate and manage the development and operation of renewable energy projects in the area, with the specific aim of mitigating potential negative impacts and enhancing opportunities. This would include identifying key needs, including capacity of existing services, accommodation and housing and the implementation of an accredited training and skills development programmes aimed at maximising the opportunities for local workers to be employed during the construction and operational phases of the various proposed projects. These issues should be addressed in the Integrated Development Planning process undertaken by the SBDM and BCRLM.							

Impact Phase: Operational Phase							
Impact description: Cumulative impact associated with the establishment of a number of renewable energy facilities in the region that will create employment, skills development and training opportunities, creation of downstream business opportunities.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	M	Positive	M	L	H
With Mitigation	M	H	M	Positive	H	M	H
Can the impact be reversed?	Yes, by not implementing the project.						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: • The proposed establishment of suitably sited renewable energy facilities within the SBDM and BCRLM should be supported.							

18.10 Traffic and Transportation

The construction period is expected to last approximately 18 months for each phase, and run consecutively (WEF including GRID substations and connections). The construction period will generate the most traffic, both on public roads and on-site.

The trip generation and average trips to site, for each Phase, is as follows:

WEF Build:

North WEF – 5687 trips to site = 14 trips to site per day over 18 month build period.

Central WEF - 4683 trips to site = 12 trips to site per day over 18 month build period.

South WEF - 6021 trips to site = 25 trips to site per day over 18 month build period.

Assuming a worst case scenario, that the project incorporates all six components the total number of trips to site is 16391, at an average of 41 trips to site per day.

There is one wind and several solar projects approved in the Pearston Area. It could be assumed that these projects will be completed before the Highlands WEF is approved and constructed, judging by the approvals process timelines.

The 140 MW power project in Middleton (approximately 35 km from Highlands WEF) is still in process and possibly that construction could coincide with the Highlands WEF and GRID project construction.

It is estimated that the Middleton (wind energy) project would generate on average around 41 trips to site per day assuming the project is built in just under a year. It is estimated that this would include 3 to 4 abnormal vehicle trips (from Ngqura Port) to site per day for 87 days. Apart from a few ISO truck container deliveries, other vehicle trips are more local in nature.

The 5 solar plants in Pearston area, totalling 230 MW, is expected to generate some 10 heavy vehicle trips to site per day (from Port Elizabeth or Koega) and some 6 buses and some 80 light vehicle trips (mostly staff and workers arriving in the AM and departing in the PM, from nearby towns such as Pearston and Somerset East).

As a worst case scenario it is assumed that all these developments could coincide with the Highlands WEF abnormal load trips to site, along the N2 and N10.

Impact Phase: Construction Phase							
Impact description: Constraints for large vehicles en-route to site could result in unacceptable traffic impact (safety and congestion). Abnormally long, low or high vehicles will experience constraints along the chosen route, i.e. inadequate space to accommodate turning movements at some intersection and interchange ramps, N10 Olifantskop Pass horizontal alignment inadequate for very long vehicles (transporting turbine blades).							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	H	Negative	M	H	H
With Mitigation	M	L	L	negative	L	L	H
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	No						
Can impact be avoided, managed or mitigated?	Yes						
Mitigation measures: Prepare a Transport Management Plan to: Where possible co-ordinate safe transport of materials, equipment, etc. to site, most particularly through the N10 Olifantskop Pass; Co-ordinate traffic law-enforcement and transport to site.							

19 SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

This BAR has provided a description of the proposed Highlands North Wind Energy Facility and its associated infrastructure. It has also discussed the need and desirability of the proposed project. The environmental legislation and planning contexts for the proposed WEF has been documented, including the proposed site's baseline environment. Specialist investigations and detailed assessments have been conducted for the following areas of study:

- Geology, soils and agriculture;
- Freshwater and wetlands;
- Flora and terrestrial fauna;
- Avifauna;
- Bats;
- Noise;
- Cultural Heritage, Archaeology and Palaeontology;
- Visual.
- Social; and
- Traffic and Transport;

The above studies assessed the potential impacts of the proposed development. A summary of the potential impacts is included in the table below.

19.1 Summary of Construction Phase Impacts

Construction Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Loss of Agricultural land	L	M	L	Negative	L	L	H

Construction Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
With Mitigation	L	M	L	Negative	**L**	L	H
Soil degradation	L	M	M	Negative	M	M	H
With Mitigation	L	M	L	Negative	**L**	L	H
Wetlands and freshwater							
Loss of riparian systems and water courses	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Increase in sedimentation and erosion	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Impact on localized	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Terrestrial Ecological Impacts							
Impact on vegetation	L	H	M	Negative	M	H	H
With Mitigation	L	M	M	Negative	**M**	H	H
Faunal impacts	L	L	H	Negative	M	H	H
With Mitigation	L	L	M	Negative	**L**	L	M
Avifauna							
Destruction of habitat used by birds	L	M	M	Negative	M	H	H
With Mitigation	L	M	L	Negative	**L**	L	M
Disturbance and Displacement of Birds	L	L	M	Negative	M	M	M
With Mitigation	L	L	L	Negative	**L**	L	M
Bats							

Construction Phase	**Extent**	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Roost disturbance	L	M	L	Negative	L	L	M
With Mitigation	L	M	L	Negative	**L**	L	M
Roost destruction	L	H	L	Negative	M	M	M
With Mitigation	L	L	L	Negative	**L**	L	M
Habitat modification	L	M	L	Negative	L	L	M
With Mitigation	L	M	L	Negative	**L**	L	M
Noise							
Construction of Tracks and Hardstanding	L	L	H	Negative	M	M	H
With Mitigation	L	L	L	Negative	**L**	L	H
Excavation and Concreting of Turbine Foundations	L	L	H	Negative	M	M	H
With Mitigation	L	L	L	Negative	**L**	L	H
Turbine Erection	L	L	H	Negative	M	M	H
With Mitigation	L	L	L	Negative	**L**	L	H
Generator (Night-time Use)	L	L	M	Negative	L	L	H
With Mitigation	L	L	L	Negative	**L**	L	H
Heritage and Archaeology							
Impacts on archaeological resources	L	H	L	Negative	M	M	H
With Mitigation	L	H	L	Negative	**L**	L	H
Impacts on graves	L	H	H	Negative	M	L	H
With Mitigation	L	H	L	Negative	**L**	L	H
Impacts to the cultural landscape	M	M	M	Negative	M	H	H

Construction Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
With Mitigation	M	M	M	Negative	**M**	H	H
Palaeontology							
Impacts to palaeontological resources	L	H	L	Negative	M	M	M
With Mitigation	L	H	L	Negative	**L**	L	M
Visual							
Visual effect on sense of place	L	L	M	Negative	M	H	H
With Mitigation	L	L	M	Negative	**M**	M	M
Social							
Employment and business creation opportunities	M	L	M	Positive	M	M	H
With Mitigation	H	L	H	Positive	**M**	H	H
Construction workers on local communities	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	**L**	L	H
Impact of job seekers on local communities	M	L	L	Negative	L	L	M
With Mitigation	M	L	L	Negative	**L**	L	M
Risk to safety, livestock, farm infrastructure and farming operations	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	**L**	L	H
Impact of increased risk of fires	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	**L**	L	H

Construction Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Impacts associated with construction vehicles	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	**L**	L	H
Impact on farmland	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Traffic							
Traffic Flow	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	**L**	L	M
Route Constraints	M	L	H	Negative	M	H	H
With Mitigation	M	L	L	Negative	**L**	L	H
Minor Road Degradation	L	L	M	Negative	M	M	M
With Mitigation	L	L	L	Negative	**L**	L	M
Minor Road Dust	L	L	H	Negative	M	M	M
With Mitigation	L	L	L	Negative	**L**	L	M
Intersection Road Safety	L	L	H	Negative	M	M	M
With Mitigation	L	L	H	Negative	**L**	L	M

19.2 Summary of Operational Phase Impacts

Operational Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Loss of Agricultural land	L	M	L	Negative	L	L	H
With Mitigation	L	M	L	Negative	**L**	L	H
Soil degradation	L	M	M	Negative	M	M	H
With Mitigation	L	M	L	Negative	**L**	L	H

Operational Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Generation of additional land use income	L	M	L	Positive	M	H	H
With Mitigation	L	M	L	Positive	**M**	H	H
Wetlands and freshwater							
Riparian systems	L	L	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Sedimentation and erosion	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Localized surface water quality	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Terrestrial Ecological Impacts							
Faunal impacts	L	M	M	Negative	M	H	H
With Mitigation	L	M	L	Negative	**L**	L	H
Soil erosion	L	H	M	Negative	M	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alien plant invasion	L	H	M	Negative	M	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
CBAs and Ecological Processes	L	H	M	Negative	M	H	H
With Mitigation	L	H	L	Negative	**L**	L	H
Avifauna							
Bird collisions with turbines	M	M	H	Negative	M	H	M
With Mitigation	M	M	H	Negative	**M**	M	M
Bird collisions with overhead powerlines	L	M	H	Negative	M	M	M

Operational Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
With Mitigation	L	M	M	Negative	**L**	L	M
Bird mortality electrocution	L	M	M	Negative	M	M	M
With Mitigation	L	M	M	Negative	**L**	L	H
Disturbance / displacement	M	M	M	Negative	M	M	L
With Mitigation	L	M	M	Negative	**L**	L	L
Local Bird Movement Patterns	M	M	M	Negative	L	L	L
With Mitigation	M	M	M	Negative	**L**	L	L
Bats							
Bat mortality commuting / foraging	M	M	M	Negative	M	M	M
With Mitigation	M	M	L	Negative	**L**	L	M
Bat mortality migration	H	M	M	Negative	M	L	M
With Mitigation	M	M	M	Negative	**L**	L	M
Habitat creation in high risk locations	L	M	L	Negative	L	L	M
With Mitigation	L	M	L	Negative	**L**	L	H
Light pollution	L	M	L	Negative	L	L	M
With Mitigation	L	M	L	Negative	**L**	L	H
Noise							
Operational Noise (Day)	L	H	L	Negative	L	L	H
With Mitigation	L	H	L	Negative	**L**	L	H
Operational Noise (Night)	L	H	H	Negative	H	M	H
With Mitigation	L	H	M	Negative	**L**	M	H
Heritage and Archaeology							

Operational Phase	**Extent**	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Impacts to the cultural landscape	M	M	M	Negative	M	H	H
With Mitigation	M	M	M	Negative	**M**	H	H
Visual							
Potential visual	M	M	M	Negative	M	H	H
With Mitigation	M	M	M	Negative	**M**	M	H
Social							
Clean, renewable energy infrastructure	M	M	M	Positive	M	M	H
With Mitigation	M	H	M	Positive	**H**	H	H
Employment and business opportunities	M	M	L	Positive	M	M	H
With Mitigation	M	M	M	Positive	**H**	H	H
Community Trust	M	H	M	Positive	M	L	H
With Mitigation	M	H	H	Positive	**H**	H	H
Benefits associated with income generated for affected farmer(s)	M	M	L	Positive	L	L	H
With Mitigation	M	M	M	Positive	**M**	H	H
Rural sense of place (landscape)	M	M	M	Negative	M	M	M
With Mitigation	M	M	M	Negative	**M**	M	M
Rural sense of place (stakeholders)	M	M	L	Negative	L	M	M
With Mitigation	M	M	L	Negative	**L**	M	M
Property values	M	M	M	Negative	M	M	M

Operational Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
With Mitigation	M	M	M	Negative	**M**	M	M
Regional tourism	M	M	L	Negative	L	L	H
With Mitigation	M	M	L	Negative	**L**	L	H
Adjacent tourism	M	M	M	Negative	M	M	M
With Mitigation	M	M	M	Negative	**M**	M	M
Traffic							
Route Constraints	M	L	H	Negative	M	M	H
With Mitigation	M	L	L	Negative	**L**	L	H

19.3 Summary of Decommissioning Phase Impacts

Decomm. Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Agricultural land	L	M	L	Negative	L	L	H
With Mitigation	L	M	L	Negative	**L**	L	H
Soil degradation	L	M	M	Negative	M	M	H
With Mitigation	L	M	L	Negative	**L**	L	H
Terrestrial Ecological Impacts							
Faunal impacts	M	L	H	Negative	M	H	H
With Mitigation	L	L	M	Negative	**L**	L	H
Soil erosion	M	H	M	Negative	H	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alien plant invasion	L	H	M	Negative	M	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Birds							
Disturbance and Displacement	L	L	M	Negative	M	M	M

Decomm. Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
With Mitigation	L	L	L	Negative	**L**	L	M
Heritage and Archaeology							
Impacts to the cultural landscape	M	M	M	Negative	M	H	H
With Mitigation	M	M	M	Negative	**M**	H	H
Visual							
Visual intrusion	M	M	M	Negative	M	H	H
With Mitigation	L	L	L	Neutral	**L**	M	M
Social							
Loss of jobs and income	M	M	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	**L**	L	H
Traffic							
Minor Road Degradation	L	L	M	Negative	M	M	M
With Mitigation	L	L	L	Negative	**L**	L	M
Minor Road Dust	L	L	H	Negative	M	M	M

19.4 Summary of Cumulative Impacts

The proposed Highlands WEFs, were assessed cumulatively, with respective to other renewable energy developments within a minimum of 35 km radius to a maximum of 500 km. Cumulatively the proposed WEFs have been assessed to have a low impact significance with the implementation of appropriate and effective mitigation measures (as prescribed in this BAR), with regards to visual, traffic and transportation, terrestrial ecology, aquatics, heritage, archaeology and palaeontology and agricultural potential. Birds assessed that the proposed Highlands WEFs may have a medium cumulative impact on avifauna in the region, while bats assessed the WEF to potentially have a medium impact on bat population taking into consideration of renewable energy developments within a 500 km radius of the development site (due to the migratory nature of bats).

In terms of noise impacts, other renewable energy facility developments are located more than 20 km from the Proposed Development. As such, there is no possibility of cumulative impacts. The cumulative noise assessment therefore only considers the cumulative effects of the Highlands WEFs development. The operation of the Highlands WEFs at night has the potential to have a medium impact to the residential occupants within less than 2 km from turbines. Land owners have confirmed that there are no permanent residents or occupiers in any of the houses on site. Some farm workers live there temporarily. Mitigations proposed with respect to the potential cumulative impact have reduced impacts from high to medium with the use of noise mitigated turbines in certain locations, or with agreements with landowners that there are no permanent residents or occupiers within 2 km of operating turbines.

During the construction phase potential impacts to the cultural landscape was assessed to be of a medium significance. Employment opportunities, skills development and potential business opportunities with the construction and operation of the WEF was assessed to be of a high positive significance.

20 IMPACT STATEMENT

The proposed Highlands North Wind Energy Facility and its associated infrastructure has, as part of the proposed Highlands Wind Energy Facilities and associated infrastructure, including grid connection infrastructure is located within the Cookhouse REDZ, and has the potential to provide much needed renewable energy to the country's grid. The use of renewable energy to provide power to South Africa is supported at International, National, Provincial and Local Government Levels. Further, given South Africa's need for additional electricity generation and the need to decrease the country's dependency on coal-based power, renewable energy has been identified as a national priority, with wind energy identified as one of the most readily available, technically viable and commercially cost-effective sources of renewable energy.

The potential positive impacts associated with the proposed project is further recognised through the creation of jobs for the local community, and the positive contributions to the socio-economic development of the surrounding areas and local communities.

Should the Highlands North WEF be developed, the actual physical footprint of the wind turbines and associated on-site infrastructure will occupy an area of land equivalent to less than 1% of the total Proposed Development Site. Small livestock grazing and other agricultural activities can continue in parallel with the operation of the turbines. The project will have no significant impact in terms of loss of agricultural productivity. The Final Mitigated Layout avoids all sensitive areas identified by the specialists' investigations (Figure 20.1). Should the additional mitigation measures identified by specialists and the recommendations of the EMPr be effectively implemented the negative impacts associated with the proposed project will be significantly reduced. The study has concluded that there are no negative high residual impacts, including potential cumulative impacts associated with the proposed development.

Taking into consideration the findings of the BA process for the proposed project and the fact that recommended mitigation measures have been used to inform the project layout design, it is the opinion of the Environmental Assessment Practitioner (EAP) that the majority of negative impacts associated with the implementation of the proposed project have been mitigated to acceptable levels. While the residual impacts of the project will have an impact on the local environment, and potentially on four to five existing game and hunting tourism operations, the extent of the benefits associated with the implementation of the projects will benefit a much larger group of people, in terms of renewable energy supply and positive local and regional economic impact. In addition, the area has been designated a Renewable Energy Development Zone for wind energy in particular, through a Strategic Environmental Impact Assessment by National Government.

Overall, it is recommended that the Highlands North WEF be approved, subject to the implementation of all recommended mitigation measures and management actions contained in all the specialist reports.

20.1 Conditions to be included in the EA

All recommendations and proposed mitigation measures detailed in the specialists report (Volume II) and EMPr (Appendix B) must be implemented and adhered to.

20.1.1 Ecology

A specialist must be appointed to conduct a walkthrough of the final development footprint prior to the commencement of construction.

20.1.2 Freshwater and Wetlands

Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off.

All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination. Washing and cleaning of equipment should also be done in berms or bunds, in order to trap any cement and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel. It is therefore suggested that all construction camps, lay down areas, batching plants or areas and any stores should be more than 32 m from any demarcated water courses, unless agreed otherwise with the Environmental Control Officer (ECO).

It is further recommended that a comprehensive rehabilitation plan be implemented from the project onset within areas of disturbance (inclusion of buffers) to ensure a net benefit to the aquatic environment. This should from part of the suggested walk down as part of the final EMPr preparation. The walkdown is required as the final cut/fill and embankments for roads and other structures could not be provided at this point, thus it would be important to evaluate in terms of the aquatic environment and evaluate the need for a Water Use License / GA for these areas.

20.1.3 Avifauna and Bats

Operational phase monitoring of birds and bats must be undertaken according to applicable guidelines current at the start of the operational phase. The monitoring should not be undertaken according to those guidelines that are current at the time of the environmental authorisation. The information collected during the operational monitoring must be shared with Bird Life SA and EWT, as well as the South African Bat Association Panel (or any other agency that comes into effect, which centrally collects information to inform the effects of WEF on birds and bats). Monitoring and carcass searching must be undertaken throughout the life span of the development, at an agreed frequency with specialists.

20.1.4 Noise

Noise due to the operation of the Proposed Development is not to exceed 45 dBA, $L_{eq,16hr}$ at any residential dwelling present at the time of this consent. The submission for approval of a construction noise management plan prior to the commencement of construction is required.

20.1.5 Visual

Ensure that visual management measures are included as part of the EMPr, monitored by an Environmental Control Officer (ECO), including siting of the construction camp and stockpiles, dust suppression and litter control measures, as well as rehabilitation of any borrow pits and haul roads, with monthly reporting to an environmental management team.

Ensure that visual mitigation measures are monitored by management on an on-going basis, including the maintenance of rehabilitated areas, control of signage, lighting and wastes on the site, with interim inspections by the ECO.

20.1.6 Heritage, Archaeology and Palaeontology

- Monitoring of all substantial excavations (e.g. wind turbine foundations) for fossil material on an on-going basis during construction phase;
- Application of Chance Fossil Finds Procedure (See Appendix 2 of palaeontological specialist study): safeguarding new fossil finds and reporting to ECPHRA by ECO for possible recording and sampling by professional palaeontologist;
- The access road via Farm 105/rem must not be used;
- The large valley on Farm 105/1 must be avoided; especially the archaeological site between waypoints 1781, 1793 and 1796;
- A minimum 30 m buffer to be maintained around all graves, ruins and buildings (but note possible exception in next recommendation);
- The fence incorporating historical stone fence posts (waypoint 1720 lies on this fence line) should be avoided if possible;
- A final walk-down survey of the authorised footprints should be carried out at least 6 months before the start of construction in order for any archaeological mitigation requirements to be determined and carried out;
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

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Appendix A:

Declaration of Independence and Curriculum Vitae

JANUARY 2019

APPENDIX 9
9.1 DECLARATION OF THE EAP

I, _____Ashlin Bodasing___________________, declare that –

- I act as the independent environmental assessment practitioner in this application;
- I have expertise in conducting environmental impact assessments, 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 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 will take into account, to the extent possible, the matters listed in Regulation 18 of the Regulations when preparing the application and any report relating to the application;
- 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, unless access to that information is protected by law, in which case it will be indicated that such information exists and will be provided to the competent authority;
- I will perform all obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I am aware of what constitutes an offence in terms of Regulation 48 and that a person convicted of an offence in terms of Regulation 48(1) is liable to the penalties as contemplated in section 49B of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

- ~~I have a vested interest in the proposed activity proceeding, such vested interest being:~~

____

____

____

____

Signature of the environmental assessment practitioner

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

12 September 2018
Date

CURRICULUM VITAE

Ashlin Bodasing

Technical Director and Environmental Assessment Practitioner

Email: ashlinb@arcusconsulting.co.za Tel: +27 (0) 21 412 1529

Specialisms

- Environmental Impact Assessments
- Environmental Management Plans
- Environmental Feasibility Studies
- Environmental Due Diligence and Compliance
- Client Relationship Management

Summary of Experience

Ashlin Bodasing is a Technical Director at Arcus Consultancy Services South Africa (Pty) Ltd. She manages the Arcus South African office and the team based in Cape Town.
Having obtained her Bachelor of Social Science Degree (Geography and Environmental Management) from the University of Kwa-Zulu Natal; she has over eleven years' experience in the environmental consulting industry in southern Africa. She has gained extensive experience in the field of Integrated Environmental Management, environmental impact assessments and public participation. She has also been actively involved in a number of industrial and infrastructural projects, including electricity power lines and substations; road and water infrastructure upgrades and the installation of telecommunication equipment, green and brown field coal mines, as well as renewable energy facilities, both wind and solar. Ashlin has excellent Project Management experience and has gained major project experience in the development of Environmental Impact Assessments, Environmental Management Plans and the monitoring of construction activities. Her areas of expertise include project management, environmental scoping and impact assessments, environmental management plans, environmental compliance monitoring and environmental feasibility studies. Experience also includes International Finance Corporation Performance Standards and World Bank Environmental Guidelines environmental due diligence reviews. She has worked in Mozambique, Namibia, Botswana, Lesotho and Zimbabwe.

Professional History

2017 – Present – Technical Director, Arcus Consultancy Services South Africa
2015 - 2017 – Team Leader, Arcus Consultancy Services Ltd
2012 – 2015 – Lead Environmental Officer, Tweefontein Optimisation Project, Glencore / Xstrata Coal Mine, Witbank, Mpumalanga, South Africa (secondment)
2007-2015 - Senior Environmental Assessment Practitioner, Parsons Brinckerhoff Africa
2005-2007 – Environmental Consultant, WSP Environment and Energy

Ashlin spent over 2 years at the Glencore (previously Xstrata Coal SA) – Tweefontein Optimisation Project, as the sole environmental officer permanently on site overseeing all their construction projects, ensuring contractor compliance to EMP and Environmental Authorisations. This included the construction of the internal and external infrastructure packages. Roles include ensuring all construction and development are in line with the EIA and EMP for the project. Areas of responsibility include the Mine Infrastructure Area, the Explosives Magazine Area, construction of a secondary school, construction of residential houses, and the rail load out facility. Role also included review of environmental impact assessment applications and reports submitted to the department of environmental affairs for the project.

Qualifications and Professional Interests

- **University of Kwa-Zulu Natal, 2004**
  Bachelor of Social Science (Geography and Environmental Management)

Project Experience

<u>Environmental Impact Assessments</u>

- **San Kraal Wind Energy Facility, 2016- present**. Project Director (client liaison) and EAP.

- **Phezukomoya Wind Energy Facility, 2016 – present**. Project Director (client liaison) and EAP.
- **Kolkies and Karee Wind Energy Facilities, 2016-2016**. Project Director (Client liaison) and EAP.
- **Komsberg East and West Wind Energy Facilities 2015-2016**. Project Director (Client Liaison) and EAP.
- **Umsinde Emoyeni Wind Energy Facilities – 2015- present.** Project Director (Client Liaison) and EAP.

Ecological Impact Assessments and Monitoring

- **Komsberg Wind Farms, 2015-2016.** Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of techncial and specialists impact assessments.
- **Kolkies and Karee Wind Energy Facilities 2015-2016.** Project Director (Client Liaison), coordination and management of bird and bat specialists and review of technical and impact assessment reports.
- **Umsinde Wind Energy Facilities, Additional Bird Monitoring**. Project Director. Coordination and management of bird specialists and review of technical reports.
- **Kap Vley Wind Energy Facility, Bird and Bat Pre-Construction Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.
- **Highlands Wind Energy Facility, Bird and Bat Pre-Construction Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.
- **Hopefield Wind Farm –Operational Monitoring.** Project Manager. Coordination and management of bird and bat specialists, review of technical reports.
- **Gouda Wind Farm – Operation Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.

Feasibility Studies and Due Diligence Reviews

- **Ecological due diligence for IFC PS6 – Wind Energy Developments:** Project Manager. Review and reporting on bird and bat specialist reports to IFC/World Bank Standards – Various sites across South Africa.
- **Power Plant – Ghana**. Project Manager Compilation of environmental due diligence for refinancing, IFC and World Bank Standards, on behalf of Botswana Development Corporation.
- **Ecological Feasibility Study.** Project Director. Review of the feasibility of a site for a wind energy facility in relation to bats.
- **Environmental Feasibility Study.** Project Director and EAP. Review of a proposed site for the development of industrial facility.

Previous Project Experience

Environmental Scoping and Impact Assessments and Project Management for:

- eThekwini Municipality
- Moreland Developments
- RBCH – Bulk Materials and Handling Facility
- SAPREF
- Mittal Steel Permit Amendment
- Transnet Projects
- ArcelorMittal South Africa
- MCA-Lesotho
- Talbot Group Holdings (Australian Mining Company)

- Ncondezi Energy – Mozambique

Environmental Management Plans and Compliance Monitoring

- Nongoma Road Monitoring – Compliance Monitoring
- eThekwini Municipality - Taxi Holding Areas: Canberra Road and Umgeni Road Compilation of the EMP; and Bi-monthly compliance monitoring (site visits) and reporting.
- EMP for Kwezi V3 - Kwamashu Fuel Tank Exemption
- eThekwini Municipality - Ridgeview Road – Compliance Monitoring
- eThekwini Municipality and Merz and Mclellen - Phoenix Overhead Transmission Lines – Compliance Monitoring
- eThekwini Municipality and Merz and Mclellen - E8546 E8699 Compliance Monitoring
- eThekwini Municipality and Merz and Mclellen - Environmental Assessment and EMP
- EMP for eThekwini Municipality - Parlock Switching Station

Training and Auditing

- Petronet Alien Plant Training - Compilation of the training material for alien plant identification and removal methods.
- eThekwini Municipality - Taxi Holding Areas – Canberra and Umgeni Road - Contactor and workforce training.
- eThekwini Municipality - Kingsway Road Taxi Rank - Contactor and workforce training.

Environmental Reviews / Terms of Reference

- Biotherm Energy - Environmental Project Manager: Independent review of environmental impact assessment reports and management plans compiled for 3 wind farms in the Western Cape and 2 PV Solar Plants in the Northern Cape, to ensure compliance to IFC and World Bank Standards.
- Government of Zimbabwe – Hwange Power Station - Environmental Project Manager: Compilation of the Terms of Reference for Environmental Management Plan and Environmental and Social Audit of the Hwange Power Plant in Zimbabwe.

Pre-Feasibility Studies

- Pre-feasibility studies for eThekwini Municipalit, Investec, Sekoko Coal Resources, Mulilo, Sekoko Mining and MCA-Lesotho for renewable energy, coal mines and power plants.

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Appendix B:

Environmental Management Programme (EMPR)

For

THE PROPOSED HIGHLANDS NORTH WIND ENERGY FACILITY, EASTERN CAPE PROVINCE

On behalf of

HIGHLANDS NORTH WIND ENERGY FACILITY (RF) (PTY) LTD

JANUARY 2019

Prepared By:

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

Glossary of Terms

Construction Phase: The activities pertaining to the preparation for and the physical construction of the proposed development

Contractor: Persons/organisations contracted by the Developer to carry out parts of the work for the proposed project

Engineer / Project Director (PD): Person/organisation appointed by the Developer to oversee the work of all consultants, sub-developers, contractors, residents and visitors.

Environment: The environment is defined as the surroundings within which humans exist and that are made up of – the land, water and atmosphere of the earth; micro-organisms, plant and animal life; any part or combination of (i) and (ii) and the interrelationships among and between them; and the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental and Social Manager (ESM) also known as the Environmental Control Officer (ECO): Person/organisation appointed by the Developer who will provide direction to the Principal Agent concerning the activities within the Construction site. The ECO will also be responsible to liaise with the independent auditor who will conduct an environmental audit during the construction phase of the project according to the provisions of the Environmental Management Programme.

Independent Auditor: The person or entity who will conduct an environmental audit during the construction phase of the project according to the provisions of the Environmental Management Programme and Environmental Authorisation.

Environmental Management Programme (EMPR): The EMPR is a detailed plan for the implementation of the mitigation measures to minimise negative environmental impacts during the life-cycle of a project. The EMPR contributes to the preparation of the contract documentation by developing clauses to which the contractor must adhere for the protection of the environment. The EMPR specifies how the construction of the project is to be carried out and includes the actions required for the Post-Construction Phase to ensure that all the environmental impacts are managed for the duration of the project's life-cycle. Therefore the EMPR will be a working document, which will be reviewed when necessary, or if required by the authorities. A revision will be done once the detailed design of the proposed development has been completed.

Operational Phase (Post Construction): The period following the Construction Phase, during which the proposed development will be operational.

Pre-Construction Phase: The period prior to commencement of the Construction Phase, during which various activities associated with the preparation for the Construction Phase: detailed final designs, micro siting, etc. will be undertaken.

Rehabilitation: Rehabilitation is defined as the return of a disturbed area to a state which approximates the state (where possible) which it was before disruption. Rehabilitation for the purposes of this specification is aimed at post-reinstatement revegetation of a disturbed area and the insurance of a stable land surface. Revegetation should aim to accelerate the natural succession processes so that the plant community develops in the desired way, i.e. promote rapid vegetation establishment.

Site Manager: The person, representing the Contractor, responsible for all the Contractor's activities on the site including supervision of the construction staff and activities associated with the Construction Phase.

Project Area: This refers to the authorised area for the proposed development to take place. Farm portions numbers are outline in the EMPR.

Local Community: People residing or present in the region and near the construction activities, including the owners and/or managers of land affected by construction, workers on the land, and people in nearby towns and villages.

Public: Any individual or group concerned with or affected by the Project and its consequences, including the local community, local, regional, and national authorities, investors, workforce, customers, consumers, environmental interest groups, and the general public.

Construction Area / Site: The land on which the Project is to be located. It includes the site, construction campsite, access roads and tracks, as well as any other area affected or disturbed by construction activities. The EMPR (particularly the specifications for rehabilitation) is relevant for all areas disturbed during construction.

Access Roads and Tracks: All newly established roads and tracks, and areas cleared or driven over to provide access to/from the construction areas, and for the transportation of the construction workforce, equipment and materials.

Environmental Impact: The effect of an activity on the environment, whether desirable or undesirable. Undesirable or negative environmental impacts will result in damage and/or pollution of, or detriment to the environment, or in danger to the public, whether immediate or delayed.

Environmental Incident: An unexpected or sudden occurrence related to the Project, including major emissions, spills, fires, explosions, floods or erosion leading to serious or potentially serious negative environmental impacts.

Fugitive Dust: Can be defined as natural and/or human-associated dust becoming airborne due to the forces of wind or human activity.

Fauna and Flora / Plants and Animals: Any individual or group of micro-organisms, plants or animals.

General Waste and Construction Rubble It includes waste paper, board, cardboard, benign organic and domestic waste and uncontaminated construction debris such as used bricks, wood, waste concrete, unused subsoil and rubble from excavations or demolished structures.

Heritage Sites and Artefacts: Heritage sites and artefacts can be defined as any object or site of cultural, historical, archaeological or palaeontological significance found in or on the land. Historical objects are objects older than 50 years with architectural, historical, scientific, cultural, social, spiritual, linguistic, technological or aesthetic value. For example: buildings or parts thereof, graves or burial sites, milestones, numismatic objects (i.e. coins and beads), and military objects.

Archaeological objects include material remains resulting from human activity which are older than 100 years and which are in a state of disuse, such as tools, artefacts, human and hominoid remains and artificial features and structures.

Palaeontological objects include any fossilised remains of animals or plants.

Hazardous Substances: Substances which are potentially dangerous and may affect human and/or environmental health. This would be because of the substances' inherent chemical and physical composition, which could be toxic, poisonous, flammable, explosive, carcinogenic or radioactive. Hazardous waste includes, but is not limited to: human excrement, the by-products and wastes associated will the use of hazardous substances (i.e. used fuel, oil, lubricants and solvents), as well as items such as spent batteries, old oil filters, light bulbs, tyres, circuit boards, etc. which requires special collection and handling. When left abandoned, even substances such as scrap metal, wire, tins, broken glass and plastic could be harmful to people, wild and domestic animals. For example: plastic could be ingested by animals; people and animals could be injured by broken glass or metal objects; and animals could get trapped in drums, tins and bottles or get entangled in plastic or metal wiring. Even if buried, such objects may become exposed over time due to wind erosion, scavengers or future human activities. Because of the sensitive nature of the area, these substances are all regarded as 'hazardous waste' for the purposes of this EMPR.

Hydrological Features: Hydrological features include, but are not limited to:

- wetlands;
- open water;
- vegetated drainage channels;
- subterranean water;
- marine environments;
- estuarine environments.

Life Support Systems: Life support systems include, but are not limited to: an ecological system in which its outputs are vital for sustaining specialised habitats; an ecological system in which its outputs are vital for sustaining human life (e.g. water purification).

Mitigation: Environmental management measures designed to avoid, limit or remedy undesirable environmental impacts.

Monitoring: Structured observation, measurement and evaluation of environmental data over a period of time to assess the efficiency of environmental mitigation and rehabilitation measures.

Rehabilitation: Measures implemented to restore a damaged Environment.

Sensitive Sites: Environmentally sensitive sites include, but are not limited to:

- Areas with high conservation value due to the presence of important plant specimens, pristine habitats, high biodiversity, important water resources or heritage features and artefacts;

- Areas particularly prone to erosion once disturbed (i.e. steep slopes);
- Vulnerable areas with low potential for rehabilitation / slow rate of recovery (i.e. rock outcrops, steep slopes); and
- Areas in close proximity of sensitive receptors, such as farm homesteads, viewpoints or tourist stopovers.

Specialised habitats: Specialised habitats include, but are not limited to, areas which are:

- Priority breeding habitats;
- Refuge areas;
- Vital for species survival (important for, part, or all of its life cycle);
- Essential for species performance;
- Cryptic habitats, etc.

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Figure List:

1 INTRODUCTION

1.1 Background

WKN Windcurrent South Africa (Pty) Ltd (the Developer) are proposing to develop the Highlands Wind Energy Facilities (WEFs), and associated infrastructure including Grid Connection Infrastructure near the town of Somerset East, in the Eastern Cape Province (Figure 1).

There are six components to the proposed development, representing three development phases under separate applications:

- **Highlands North WEF**:
- Electrical Grid Connection and Associated Infrastructure for Highlands North WEF;
- Highlands Central WEF;
- Electrical Grid Connection and Associated Infrastructure for Highlands Central WEF;
- Highlands South WEF; and
- Electrical Grid Connection and Associated Infrastructure for Highlands South WEF

In order to bid in the Renewable Energy Independent Power Producers Procurement Programme, the developer is require to bid the projects under a special purpose vehicle (SPV). For the purposes of the Highlands WEFs, each wind farm and grid connection per phase will share the SPV, which will be the applicant for the environmental application and environmental authorisation.

Highlands North WEF and Grid Connection will share Highlands North Wind Energy Facility RF (Pty) Ltd, as the Applicant.

Arcus Consultancy Services Pty ('Arcus') have been appointed by WKN Windcurrent to compile and submit Environmental Management Programme (EMPR) to the Department of Environmental Affairs (DEA) as part of the Basic Assessment process for the Highlands WEFs and associated infrastructure including grid connection. The Highlands North WEF and the Highlands North Electrical Grid Connection have both separately applied for environmental authorisation from the DEA and therefore require separate EMPR's.

This document represents the Environmental Management Programme (EMPR) for the **Highlands North WEF**.

This document, the environmental management programme (EMPR) must be seen as dynamic, and be updated when and if required, throughout the lifecycle of the project.

The EMPR outlines measures to be implemented in order to minimise adverse environmental degradation associated with construction of the proposed development. It serves as a guide for the contractor and the construction workforce on their roles and responsibilities concerning environmental management on site, and it provides a framework for environmental monitoring throughout the construction and operational period of the proposed development.

1.2 Details of the Applicant and the Environmental Assessment Practitioner

Details of Applicant	
Project Applicant	Highlands North WEF RF Propriety Limited
Company Registration	2013/211320/07
Contact Person	Alan Wolfromm
Postal Address	PO Box 762, Wilderness 6560
Telephone	082 529 4909
Fax	None
Email	MrWolf@wkn-windcurrent.com

Environmental Assessment Practitioner	
EAP	Arcus Consultancy Services South Africa Pty Ltd
Contact Person	Ashlin Bodasing
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1.3 Purpose and Aims of this Document

According to the Western Cape's Department of Environmental Affairs and Development Planning, Guideline for Environmental Management Plan (2005), and Environmental Management Programme (EMPR) is defined as "an *environmental management tool used to ensure that undue or reasonably avoidable adverse impact of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the project are enhanced."*

This EMPR outlines measures to be implemented in order to minimise adverse environmental degradation and enhance positive impacts associated with the wind energy facility. It serves as a guide for the contractor and the workforce on their roles and responsibilities concerning environmental management on site, and it provides a framework for environmental monitoring throughout the construction and operational periods. The purpose of the EMPR is to:

- Encourage good management practices through planning and commitment to environmental issues;
- Define how the management of the environment is reported and performance evaluated;
- Provide rational and practical environmental guidelines to:
    - Minimise disturbance of the natural environment;
    - Prevent pollution of land, air and water;
    - Protect indigenous flora and fauna;
    - Prevent soil erosion and facilitate re-vegetation;
- Comply with all applicable laws, regulations, standards and guidelines for the protection of the environment;
- Adopt the best practicable means available to prevent or minimise adverse environmental impacts;
- Identify and mitigate against any potential impact on ecology;
- Describe all monitoring procedures required to identify impacts on the environment; and
- Train employees and contractors with regard to environmental obligations.

1.4 The Proposed Project

The proposed Highlands North WEF will comprise of up to 17 turbines, each having a maximum installed capacity of up to 5 megawatts (MW). Turbines will have a maximum height to tip of blade of 200 m, with a hub height of 135 m and a rotor diameter of 150 m. The proposed Highlands North WEF will be located within the northern portion of the development site boundary and within an area of approximately 2500 ha, (Figure 1). The actual footprint of the proposed development will only cover approximately 1-2% of this.

The proposed location of turbines seeking approval from the DEA is presented in Figure 2. These locations have been identified based on specialist constraints and sensitivity mapping conducted through various phases, including feasibility, and impact assessment. This allowed placement of turbines in areas of medium to low sensitivity (Figure 3).

If awarded Preferred Bidder Status, the Highlands North Wind Energy Facility (RF) Pty Ltd would enter into an implementation agreement with the Department of Energy (DoE) and a Power Purchase Agreement (PPA) with the buyer of the energy, which is in the majority of cases Eskom. Once operational the electricity would be sold to Eskom under the PPA at the agreed bid price. Eskom then distribute the energy through the national grid to the energy users.

1.5 Proposed Project Infrastructure Components

The proposed project will comprise the following components as described below. It should be noted as the final design of the proposed project is not yet finalised, all dimensions are maximums as is required by the EIA process. The final design may include infrastructure which is of equal or less than dimensions to those stated below but not more than.

1.5.1 Turbines

The proposed Highlands North WEF will comprise of 17 turbines with a maximum generation capacity of 5 MW per turbine. Internal roads will connect the turbines. On-site cabling will largely follow the road infrastructure where possible, and will be either overhead, or underground, where technically feasible. One on-site substation location (Substation A) will form part of this application. Turbines will have a maximum height to blade tip of 200 m (a hub height of up to 135 m, and a rotor diameter of up to 150 m).

The exact turbine model has not been selected yet and will be subject to competitive tendering after further wind analysis has been completed. The turbine model will depend upon the technical, commercial and site specific requirements.

The turbine rotor speed will vary according to the energy available in the wind, the wind speed. The turbines will generate power in wind speeds between approximately 3 metres per second (m/s) and 28 m/s (depending on the model of turbine) with maximum power output usually achieved at wind speeds of around 10 – 12 m/s. At average wind speeds greater than approximately 28 m/s the turbines would will automatically turn the angle of the blade to reduce energy capture (this is known as 'pitching') and stop turning to prevent damage.

The turbines will be placed on steel and concrete foundations which will each occupy an area of up to 30 m by 30 m in total (which includes the maximum total area that may need to be disturbed during construction of the foundation), and be typically up to 3 m deep and may include concrete and steel plinths depending upon local ground conditions.

Once construction is complete, much of the foundation area can be rehabilitated.

1.5.2 Hardstanding Areas

A hardstanding area of up to 100 m by 50 m will be established adjacent to each turbine location. This will be used to provide a platform for cranes to operate during construction (and unscheduled maintenance), as well as a clear area to lay out turbine components prior to erection.

1.5.3 Laydown Areas

Up to three additional temporary laydown areas of up to one hectare in size will be required for equipment and component storage during construction. These areas will be levelled and compacted and used for component storage.

1.5.4 Electrical Cabling and Onsite Substation

The electricity from the turbines will be transferred via a 33 kV electrical network to a 33/132 kV onsite substation. Where feasible and possible this will be underground. The onsite substation will house electrical infrastructure such as transformers and switch gear to enable the energy to be transferred into the existing national grid.

1.5.5 Access

The turbine locations will be accessed through a network of unsealed tracks which will be established across the project site. These access tracks will be up to 9 m wide during construction, depending on local topography, but will be reduced to between 4 m and 6 m during operation. Such roads are required to facilitate access for the cranes and abnormal load deliveries of turbine components.

Existing farm access tracks will be upgraded and utilised where possible, as will existing watercourse crossings.No borrow pits will be established on site. All material required for the construction of the proposed project will be imported to site.

1.5.6 Compound

There will also be an on-site office compound, including site offices, parking and an operation and maintenance facility including a control room.

1.5.7 Ancillary Equipment

In addition to the key components outlined above, the WEF will also require:

- Anemometer masts;
- Security fencing; and
- CCTV monitoring towers.

2 LEGAL FRAMEWORK

An application for Environmental Authorisation, in term of the National Environmental Management Act, Act 107, 1998 (NEMA), Environmental Impact Assessment Regulations, 2014 (as amend 2017), has been submitted to the Department of Environmental Affairs. The environmental authorisation process that is being followed for the proposed development, is a basic assessment process (BA). This reason for this is the proposed development is situated within the Cookhouse Renewable Energy Development Zone (REDz).

The Department of Environmental Affairs (DEA) undertook Strategic Environmental Assessments (SEAs) to contribute to regulatory requirements which aim to facilitate the implementation of sustainable energy. These SEAs identified geographical areas best suited for the development of wind and solar PV energy projects.

The Renewable Energy Development Zones (REDZs) were defined through a two phase SEA process. Phase 1 was a positive and negative mapping exercise that firstly evaluated development potential based on wind and solar resources and other pull factors such as socio-economic considerations (positive mapping), and secondly assessed environmental and technical constraints such as bird and bat sensitivity and topography (negative mapping). Phase 2 was a prioritisation process that involved extensive consultation with the renewable energy industry, key stakeholders, national, provincial and local authorities, primarily aimed at identifying the areas that best serve both the strategic objectives of the country (which include economic, environmental and socio-political considerations) and the needs of the industry.

As a result of these SEAs eight REDZs were allocated and subsequently gazetted by the Minister of Environmental Affairs on the 16th February 2018. Wind and solar PV projects within these REDZs will now be subject to a Basic Assessment and not a full Environmental Impact Assessment (EIA) process, accelerating the application process.

This section of the EMPR will need to be updated to include the recommendations and requirements that are outlined in the Environmental Authorisation, should this project be authorised by the DEA. Table 2.1 below highlights the listed activities being applied for environmental authorisation.

Table 2.1: The NEMA EIA Regulations Listed Activities Applicable to the Proposed WEF

Listing Notices 1 - 3 **07 April 2017**	***Listed Activity***	***Description of project activity that triggers listed activity***
Listing Notice 1 **GN R 327** **Activity 11**	*The development of facilities or infrastructure for the transmission and distribution of electricity—* *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.*	Medium voltage powerlines will be installed to transfer electricity from the turbines to an on-site substation. Cables will be installed underground where feasible.
Listing Notice 1 **GN R 327** **Activity 12**	*The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs (a) within a watercourse (c) if no development setback exists within 32 m of a watercourse, measured from the edge of a watercourse*	Infrastructure will be required at 5 water-crossings within 32 metres of a watercourse that covers an area of more than 100 m.
Listing Notice 1 **GN R 327** **Activity 19**	*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;*	The construction of the WEF includes the excavation of soil in watercourses/drainage line areas, and infilling/deposition may exceed 5 cubic metres and in some instances may exceed 10 cubic metres. Borrow pits for the sourcing of aggregate material may be required. Figure 7.1 shows the location of water crossings. The construction of associated infrastructure, such as access tracks crossing watercourses will require excavation and/or infilling of watercourse areas.
Listing Notice 1 **GN R 327** **Activity 24**	*The development of a road—* *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;*	Access roads of 6 - 12 m will be required between turbines.
Listing Notice 1 **GN R 327** **Activity 27**	*The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation*	The infrastructure and building area of the proposed WEF will require clearing of at least 1 hectare of indigenous vegetation in total.
Listing Notice 1 **GN R 327** **Activity 48**	*The expansion of—* *(i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more;* *where such expansion occurs—* *(a) within a watercourse;*	Existing bridges over watercourses will need to be expanded or widened.

Listing Notices 1 - 3 **07 April 2017**	***Listed Activity***	***Description of project activity that triggers listed activity***
	(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	
Listing Notice 1 **GN R 327** **Activity 56**	*The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre-* *(ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas.*	Existing farm access roads will need to be widened or lengthened. These roads currently have no road reserve and may be wider than 8 m in some areas.
Listing Notice 2 **GN R 325** **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.*	The WEF will consist of up to 17 turbines for electricity generation with a combined capacity of more than 20 MW.
Listing Notice 2 **GN R 325** **Activity 6**	*The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.*	The construction of the WEF will require a Water Use License in terms of the National Water Act, 1998 (Act No. 36 of 1998).
Listing Notice 3 **GN R 324** **Activity 4**	*The development of a road wider than 4 metres with a reserve less than 13,5 metres* *a. Eastern Cape* *i. Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ee) Critical Biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	Internal and external access roads will be constructed which are wider than 4 m. The site falls outside of an urban area and parts of the site fall with a NPAESF and a Tier 2 CBA.
Listing Notice 3 **GN R324**	*The development and related operation of facilities or infrastructure for the storage, or*	Fuel storage during construction is likely to exceed 30 m^3. The proposed on-site substation will require the use of transformer oils/other hazardous substances during the operational phase.

Listing Notices 1 - 3 07 April 2017	*Listed Activity*	*Description of project activity that triggers listed activity*
Activity 10	*storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres.* *a. Eastern Cape* *i. Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ee) Critical Biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	
Listing Notice 3 **GN R324** **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.* *a. Eastern Cape* *ii. Within critical biodiversity areas identified in bioregional plans;*	The proposed development will require the clearance of natural vegetation in excess of 300 m^2 in areas of natural vegetation. Parts of the site fall within a Tier 2 Critical Biodiversity Area.
Listing Notice 3 **GN R324** **Activity 14**	*The development of—* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(c) if no development setback has* *been adopted, within 32 metres of a* *watercourse, measured from the edge* *of a watercourse;* *a. Eastern Cape* *i. Outside urban areas:*	Bridges and associated infrastructure will be constructed within 32 m of watercourse(s). The site lies outside of an urban area and a portion of the site falls with an NPAESF area and a Tier 2 Critical Biodiversity Area.

Listing Notices 1 - 3 **07 April 2017**	***Listed Activity***	***Description of project activity that triggers listed activity***
	(bb) National Protected Area Expansion Strategy Focus areas; *(ff) Critical biodiversity areas or ecosystem service areas as identified in* *systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	
Listing Notice 3 **GN R324** **Activity 18**	*The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *a. Eastern Cape* *i. Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ee) Critical biodiversity areas or ecosystem service areas as identified in* *systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	Existing farm roads will need to be widened or lengthened. The site lies outside urban areas, and a portion of the site falls with an NPAESF area and a Tier 2 Critical Biodiversity Area.
Listing Notice 3 **GN R324** **Activity 23**	*The expansion of—* *(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;* *where such expansion occurs—* *(a) within a watercourse;* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *a. Eastern Cape* *i. Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;*	The construction of the WEF will include the expansion of existing bridges over watercourses. The site lies outside of any urban area, and parts of the site fall within a Tier 2 Critical Biodiversity Area.

Listing Notices 1 - 3 **07 April 2017**	***Listed Activity***	***Description of project activity that triggers listed activity***
	(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	

3 ENVIRONMENTAL IMPACT ASSESSMENT

The EMPR has been developed based on the findings and recommendations of the environmental assessments undertaken for the proposed development.

3.1 Summary of Findings

During the environmental assessment process, impacts on both the biophysical and socio-economic environments were assessed. The following specialist's studies were commissioned based on the sensitivities of the site and the potential impacts of the proposed development:

- Visual;
- Terrestrial Ecology (Flora and Fauna);
- Bats;
- Wetlands and Freshwater;
- Birds;
- Soils, Land Use and Agricultural Potential;
- Heritage and Palaeontology;
- Noise;
- Traffic and Transportation; and
- Socio-Economic.

The assessment has found that the proposed development will only impact agricultural land which is of low agricultural potential and only suitable for grazing.

The significance of all agricultural impacts is low due to two important factors. Firstly, the actual footprint of disturbance of the wind farm (including associated infrastructure and roads) is very small in relation to the available grazing land on the effected farm portions. All agricultural activities will be able to continue unaffectedly on all parts of the farm other than the small development footprint for the duration of and after the project. Secondly, the proposed site is on land of limited agricultural potential that is only viable for grazing. These two factors also mean that cumulative regional effects as a result of other surrounding developments, also have low significance.

It was further assessed that the proposed development would have a limited impact on the aquatic environment as all large structures will avoid the delineated natural systems, with a limited number of new water course crossings, i.e. the layout makes use of any of the existing roads, as far as practicable.

From an ecological perspective the development site is largely restricted to the lower-lying eastern slopes and gentle hills of the site and are considered generally suitable for development. The abundance of plant species of conservation concern in these areas is low and species of high conservation concern were not observed within the development footprint.

Although there are a variety of mammals of conservation concern known from the broader area it is not likely that the affected areas are of high significance for these species and long-term impacts on listed fauna are likely to be low.

The majority of the Highlands North WEF lies within a Tier 2 CBA aimed at maintaining the broad-scale connectivity of the landscape. Although the proposed development would result in some habitat loss within the CBA, this is not likely to compromise the overall functioning of the CBA as it is very large and the development occupies a very small proportion of the CBA. The majority of the development footprint area lies within a NPAES focus area. The development area is however located on the margin of the NPAES focus area and the extent of the development would not significantly impact the ability to meet conservation targets elsewhere within the focus area which is large in comparison with the development site.

Although there are extensive areas of sensitive habitat within the Proposed Development Area, the development footprint has taken this into consideration and is restricted to the medium and low sensitivity parts of the site. These areas are considered suitable for development and there are no ecological impacts associated with the Highlands North WEF that cannot be mitigated to a low level.

Activity and abundance of priority species and red data species were generally found to be moderate to high on the proposed Highlands development site after one year of pre-construction monitoring. Activity was particularly high in summer, coinciding with the arrival of migratory raptors. Activity of other resident Red Data species, e.g. Verreaux's Eagle, Blue Crane and Ludwig's Bustard was relatively constant across the year, at a moderate level. Activity of the non-Red Data raptors, Jackal Buzzard and Rock Kestrel was high to very high throughout the year, and these species are the ones most likely to suffer collision mortality.

Abundances of small passerines were also found to be moderate, with a relatively moderate to high diversity of species recorded, including a number of endemics or near-endemics. However, due to most of these species being relatively common, and the extensive available habitats for this birds on and around the development site, it was predicted that the impacts to these birds was likely to be low.

The bat monitoring data collected and analysed to date suggest that the development of the proposed Highlands North WEF can be achieved without unacceptable risks to bats.

The increased occupation of the Bloukrans cave by the Natal long-fingered bat in October (spring) appears not to have influenced bat activity at the site. This migratory species would be at risk of encountering and colliding with wind turbines as it moves across the landscape to and from winter hibernacula towards the cave in autumn and spring but increased activity during these periods was not observed. It is not known which direction these bats would travel across the landscape to the cave but it is possible that they might move through the proposed WEF especially if they fly from the east, westwards towards the cave. The finding that activity is higher near water, buildings and in the valley or lowland areas is important as an initial step to reduce the impact of the proposed WEF's to bats as the facilities must be designed to avoid these areas based on the sensitivity map. No parts of the turbines, including the blade tips, must enter these buffers.

The significance ratings for the majority of the impacts to bats posed by the development are predicted to be low or medium before mitigation and low after mitigation. Impacts related to bat mortality during migration are predicted to be of medium significance before mitigation and low significance with mitigation. However, cumulative impacts may remain medium after mitigation.

The level of impact of noise effects for the Highlands North WEF has been assessed as low during construction and decommissioning with mitigation; as low during day-time operation and medium during night-time operation, without requiring mitigation.

Cumulative impacts are expected to be low during construction and decommissioning with mitigation, low during day-time operation (no mitigation required) and medium during night-time operation with mitigation.

The fieldwork conducted shows that archaeological resources could be found almost anywhere in the Proposed Development Area but that the vast majority are likely to be of low cultural significance. Aside from impacts to the cultural landscape which are unavoidable but only of generally medium significance, no other aspects of heritage are expected to be impacted. Although a further survey will be required prior to the commencement of construction, it is considered highly unlikely that heritage resources that would require avoidance will be found. Rather, it is likely that some archaeological mitigation may be needed for any resources that cannot be avoided. Such mitigation can be easily effected where required.

The potential visual impact significance of the proposed Highlands North WEF during construction would be medium, and could be medium during the operation phase. Required mitigation has already been implemented through siting of the wind turbines in response to the specialist studies.

The layout of the proposed turbines succeeds in avoiding practically all the major visual constraints for the study area, occupying the least sensitive parts of the site.

The development of the proposed Highlands North WEF will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also benefit the local community. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated with a coal based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The findings of the SIA also indicate that the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives.

The Proposed Development Site is also located within a REDZ. The area has therefore been identified as suitable for the establishment of renewable energy facilities.

From the assessment, it is evident that the construction and the operation of the WEF will have negative impacts both socially and environmentally but when appropriate mitigation measures are applied the potential socio-economic positive impacts around local / regional economic stimulation and renewable energy into the national grid are generally seen to be outweighed by negative impacts.

Overall the project has a positive economic impact regionally and for South Africa as a whole as power generated from the WEF will feed into the National Eskom grid, create job opportunities, and contribute to the local and regional economy.

4 ENVIRONMENTAL MANAGEMENT PROGRAMME

This section forms the core of the EMPR and outlines the specific mitigation measures for those key impacts identified in the section above.

4.1 Environmental Awareness and Compliance

The philosophy that has been used for the compilation of this management programme is derived from the principles of the National Environmental Management Act, 1998 (Act No. 107 of 1998) which states that development must be socially, economically and environmentally sustainable. Sustainable development requires that:

- The disturbance of ecosystems and loss of biodiversity are avoided (minimised or remedied);
- Pollution and degradation of the environment are avoided or minimised and remedied; Waste is avoided or minimised and re-used or re-cycled where possible and otherwise disposed of in a responsible manner;
- A risk averse and cautious approach is applied;
- Negative impacts on the environment and on people's environmental rights be anticipated; and, prevented and where they cannot altogether be prevented, are minimised and remedied.

The Act makes provision that anyone who causes pollution or degradation of the environment is responsible for preventing impacts occurring, continuing or recurring and for the costs of repair of the environment.

4.2 Roles and Responsibilities for Good Environmental Management

The developer, together with the each appointed contractor will be responsible for environmental management on site during the construction and operational phases of the proposed development. Specific roles and responsibilities are highlighted below.

Developer Representative – Environmental Manager

- Review and approve EMPR prior to authorisation by DEA.
- Review and approve any EMPR updates or amendments.
- Ensure environmental requirements are integrated into the project plans, method statements and tender processes.
- Support the site environmental control officer during the construction phase, to ensure implementation of the EMPR.
- Follow up and close out all environmental incidents and non-conformances.
- Appointment a suitably qualified independent environmental control officer during the construction phase.

Principal Contractor Representative - Environmental Control Officer

An independent environmental consultant will arrange for inspections of the construction activities and EMPR implementation throughout the construction phase. After each inspection, the ECO will produce a monitoring report that will be submitted to the client, DEA and Eastern Cape Environmental Department. Relevant sections of the minutes of customary (monthly) site meetings will be attached to the monitoring report.

The Environmental Control Officer (ECO) will be responsible for overseeing the implementation of the EMPR during the construction and operations phases, and for monitoring, reviewing and verifying compliance of the contractor with the EMPR, record-keeping and updating of the EMPR as and when necessary.

The ECO will:

- Be fully knowledgeable with the contents of the EMPR;
- Be fully knowledgeable with the contents of all relevant environmental legislation and ensure compliance with them;
- Ensure that the contents of the EMPR are communicated to the contractor, all site staff, and the contractor and /or site manager are made aware of the contents of the EMPR, through presentations and discussions;
- Ensure that compliance to the EMPR is monitored by regular and comprehensive inspection of the site and surrounding areas;
- Report on any incidents of non-compliance and ensure mitigation measure are implemented as soon as practical.

During *construction*, the Environmental Control Officer will be responsible for the following:

- Meeting on site with the Construction Manager prior to the commencement of construction activities to confirm the construction procedure and designated activity zones;
- Daily / weekly (depending on the extent of construction activities, at any given time) monitoring of site activities during construction to ensure adherence to the specifications contained in the EMPR, using a monitoring checklist that is to be prepared by an independent environmental assessment practitioner at the start of the construction phase;
- Preparation of the monitoring report based on the site visit;
- Conducting an environmental inspection on completion of the construction period and signing off the construction process with the Construction Manager; and
- Maintain an Incidents Register and Complaints Register on site.

During *operation*, the Environmental Control Officer will be responsible for:

- Overseeing the implementation of the EMPR for the operation phase;
- Ensure that the necessary environmental monitoring takes place as specified in the EMPR;
- Update the EMPR and ensure that records are kept of all monitoring activities and results; and
- Maintain an Incidents Register and Complaints Register on site.

During *decommissioning*, the Environmental Control Officer will be responsible for:

- Overseeing the implementation of the EMPR for the decommissioning phase; and
- Conducting an environmental inspection on completion of decommissioning and "signing off" the site rehabilitation process.

4.3 Training and Induction of Employees

The contractor has a responsibility to ensure that all personnel involved in the project are aware of and are familiar with the environmental requirements for the project. The EMPR shall be part of the terms of reference (ToR) for all contractors, sub-contractors and suppliers. All Contractors have to give some assurance that they understand the EMPR and that they will undertake to comply with the conditions therein. All senior and supervisory staff members shall familiarise themselves with the full contents of the EMPR. They shall know and understand the specifications of the EMPR and be able to assist other staff members in matters relating to the EMPR.

The Contractor must ensure that all staff working on site has an environmental induction. The presentation can include the following topics;

- What is meant by "Environment"?
- Why the environment needs to be protected and conserved.

- How construction activities can impact on the environment.
- What can be done to militate against such impacts?
- Awareness of emergency and spills response provisions.
- Social responsibility during construction e.g. being considerate to local residents.

A detailed environmental management and training program must be developed. The purpose of this is to ensure that all staff and workers understand what is required of them. The main components of the program can incorporate the following:

- Concept of sustainability and the reasons for good environmental management and practice
- Potential environmental impacts
- Mitigation measures
- Establishing a chain of responsibility and decision making
- Specific training requirements of certain staff, and the potential hazardous associated with the job.
- Methodologies to be used for field sampling
- Training in the use of field equipment
- Training in identification of non-compliance situations and procedures to be followed in such instances
- Reporting requirements
- Fire management
- HIV/AIDS

4.4 Complaints Register and Environmental Incidents Book

The Contractor must record any complaints received from the community. The complaint must be brought to the attention of the site manager and Environmental Control Officer, who will respond accordingly.

The following information will be recorded:

- Time, date and nature of the complaint;
- Response and investigation undertaken; and,
- Actions taken and by whom.

All complaints received will be investigated and a response (even if pending further investigation) will be given to the complainant within 7 days.

All environmental incidents occurring on the site will be recorded. The following information will be provided:

- Time, date, location and nature of the incident, and
- Actions taken and by whom.

4.5 Construction Environmental Monitoring

Environmental audits must be undertaken by an independent environmental consultant who will act as the Environmental Control Officer twice monthly, and on a daily basis or what is deemed necessary by the ECO during times of heavy earth works and vegetation clearing, in order to ensure compliance of all aspects of the EMPR.

In order to facilitate communication between the ECO and the Resident Engineer and Contractor, it is vital that a suitable chain of command is structured that will ensure that the ECO's recommendations have the full backing of the project team before being conveyed to the Contractor. In this way, penalties as a result of non-compliances with the EMPR may be justified as failure to comply with instruction from the highest authority.

4.6 Dealing with Non Compliance with the EMPR

There may be difficulties encountered with carrying out the mitigation measures within the EMPR, this may result in non-compliance with the EMPR. It may be possible that the contractor and or the developer put in place procedures to motivate staff members to comply with the EMPr and to deal with non-compliance. The developer must make this known to the contractor at the earliest stage possible, even during the tender phase.

4.7 EMPR Amendments and Instructions

No EMPR amendments shall be allowed without the approval of the DEA. Amendments may be possible, following discussions with the relevant ECO or environmental consultant, who may propose EMPR amendments on behalf of the developer or issue EMPR instructions, corrective actions, remediation or rehabilitation. These correction actions must be completed within the specified timeframes.

5 DESIGN PHASE / PRE–CONSTRUCTION PHASE MITIGATION MEASURES

The objectives of the pre-construction phase are:

- To promote environmental awareness.
- To define roles and responsibilities for environmental management;
- To ensure suitable environmental training and induction to all contractors, sub-contractors and labourers; and
- To ensure that all legal obligations and contractual conditions have been met prior to commencing of construction.

Mitigation measures for Legal Compliance.

- Appoint an independent environmental control officer
- Appoint an internal environmental co-ordinator or environmental officer, to oversee day to day environmental activities.
- Staff must be educated as to the need to refrain from indiscriminate waste disposal and/or pollution of local soil and water resources and receive the necessary safety training.
- Before construction begins, all areas to be developed must be clearly demarcated with fencing, by a qualified surveyor.
- The contractor must ensure compliance with conditions described in the environmental authorisation.
- No construction camps are allowed on site. No workers are allowed to stay overnight in the construction area.
- Confirm with ECO, suitable sites for the construction camps (equipment and batching etc.) and storage areas for materials. All construction equipment must be stored within this construction camp and all associated oil changes etc. (no servicing) must take place within this camp.
- Unskilled labourers must be drawn from the local market where possible.
- Training of site staff.
- Environmental awareness training for construction staff, concerning the prevention of accidental spillage of hazardous chemicals and oil; pollution of water resources (both surface and groundwater), air pollution and litter control and identification of archaeological artefacts.
- Project Manager shall ensure that the training and capabilities of the Contractor's site staff are adequate to carry out the designated tasks.
- Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitised to any potential hazards associated with their tasks.

- No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the Contractor and certified competent by the Project Manager.

The developer must ensure that the following mitigation measures are applied to the proposed project prior to the construction phase. These measures must be included in an updated EMPR to be submitted to the DEA for approval.

Prior to the submission of the final layout plan to the DEA for approval, the following specialists must visit the site to assist with the micro-siting the layout and do a walkthrough of all power lines:

- Flora and fauna specialists;
- Bat specialist;
- Avifaunal specialist;
- Aquatic specialist; and
- Palaeontologist.

Following the selection of turbine to be used for the project, the developer must update the layout plan / site development plan, this together with the following management plans, to be developed and / or updated, must be submitted to the DEA for approval:

- Traffic Management Plan – this plan will include the necessary arrangements to transport all equipment and infrastructure to site, including the necessary road transport permits.
- Construction Site Traffic Management Plan – this will be in the form of a site layout, showing the flow of traffic during the construction phase taking into consideration existing land users.
- Storm water Management Plan – once the final layout plan has been produced the appointed responsible engineers must produce a storm water management plan for the site, during the construction and operational phases of the project.
- A health and safety plan must be drawn up to ensure worker safety.

The construction of the WEF will result in water crossings for the expansion of existing and / the construction of new bridges over water courses. The developer must ensure that Water Use Licences are applied for and approved, prior to the start of construction. All mitigation measures proposed in the water use licence must be adhered to and included in an updated EMPR and submitted to the DEA for approval.

Should any telephone communication lines require moving this will have to be facilitated and approved by Telkom.

Develop a Project Layout and Access Plan to show the intended use of the area. The plan shall clearly indicate and/or describe the location and details of:

- Servitudes.
- Areas and routes to be cleared – including the size / width of the cleared areas.
- The construction campsite and rest areas to be used during construction.
- Waste disposal sites to be used during construction.
- Sources of construction materials.
- Power supply during construction.
- Existing roads and tracks to be used as transportation routes, and routes to gain access to construction areas.
- New tracks deemed necessary to provide access to construction activities.
- Any informal residential structures found within the property.
- Affected land use, 1:50 year floodlines.
- Sensitive areas.

5.1 Method Statements

Prior to construction the developer must ensure that the contractor supply the following method statements:

- Vegetation clearing;
- Cement mixing;
- Hazardous waste management;
- Emergency preparedness and response;
- Hazardous spills clean up;
- Topsoil stockpiling management;
- Laydown area management; and
- Hazardous materials management.

5.2 Site Establishment

The object of site establishment is to ensure that an appropriate site is selected for the construction camp/site office and that the site office is managed in an environmentally responsible manner with minimal impact on the environment.

Mitigation Measures

Before establishing the construction office areas, carefully plan the layout and develop a Construction Site Office Plan[1]. The Construction Site Office Plan shall provide a description of the site and shall show, on a reasonably scaled map, the intended use of the site. Indicate and/or describe the location, size / quantity / capacity and design of:

- Access routes;
- Ablution facilities (including details on the handling of sewage and wastewater);
- On-site waste management facilities (waste containers, etc.);
- Design of bunds and other structures for containment of hazardous substances;
- Fencing;
- Water storage and supply;
- Power supply (for cooking, space heating, lighting, etc.);
- Fire extinguishers, first aid kit and any other relevant safety equipment;
- Other structures and buildings (offices, storerooms, workshops, etc.);
- Other storage areas and stockpiles (i.e. topsoil, construction materials, equipment, etc.).
- Location of areas to be rehabilitated upon completion of the construction period, providing measures to be used for rehabilitation.
- An area within the site must be demarcated for a construction site office, which will include storage area. This area must be fenced off.
- Site establishment shall take place in an orderly manner and all required amenities shall be installed at the lay down area before the main workforce move onto site.
- The construction camp shall have the necessary ablution facilities with chemical toilets at commencement of construction.
- The Contractor shall inform all site staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate sanitary activities be allowed other than in supplied facilities.
- The Contractor shall supply waste collection bins and all solid waste collected shall be disposed of at a registered landfill.
- Potable water for use by on site workers must be made available on a daily basis at the site office and the working areas on site.

[1] To form part of the Project Layout and Access Plan.

- A certificate of disposal shall be obtained by the Contractor and kept on file. Where a registered waste site is not available close to the construction site, the Contractor shall provide a method statement with regard to waste management.
- The disposal of waste shall be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site.

Siting, Establishing and Management of Storage Material and Facilities

- Choice of location for storage areas must take into account prevailing winds, distances to water bodies, general onsite topography and water erosion potential of the soil. Impervious surfaces must be provided where necessary.
- Storage areas must be designated, demarcated and fenced.
- Storage areas must be secure so as to minimize the risk of crime. They must also be safe from access by children / animals etc.
- Fire prevention facilities must be present at all storage facilities.
- Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater regime around the temporary storage area(s).
- These pollution prevention measures for storage must include a bund wall high enough to contain at least 110% of any stored volume, and this must be sited away from drainage lines on site with the approval of the Engineer.
- Any water that collects in the bund must not be allowed to stand and must be removed immediately and the hydrocarbon digestion agent within must be replenished.
- All legal compliance requirements with respect to Fuel storage and dispensing must be met.
- All fuel storage tanks (temporary or permanent) and associated facilities must be designed and installed in accordance with the relevant oil industry standards, SANS codes and other relevant requirements.
- Areas for storage of fuels and other flammable materials must comply with standard fire safety regulations.
- Flammable fuel and gas must be separated from all welding workshops, assembly plants and loading bays where ignition of gas by an accidental spark may cause an explosion or fire.
- The tank must be erected at a safe distance from buildings, boundaries, welding sites and workshops and any other combustible or flammable materials.
- Symbolic safety signs depicting "No Smoking", "No Naked Flames" and "Danger" are to be prominently displayed in and around the fuel storage area.
- The capacity of the tank must be clearly displayed and the product contained within the tank clearly identified.
- There must be adequate fire-fighting equipment at the fuel storage and dispensing area or areas.
- The storage tank must be removed on completion of the construction phase of the project.
- All such tanks to be designed and constructed in accordance with a recognised code (international standard).
- The rated capacity of tanks must provide sufficient capacity to permit expansion of the product contained therein by the rise in temperature during storage.
- Only empty and externally clean tanks may be stored on the bare ground. All empty and externally dirty tanks must be sealed and stored in an area where the ground has been protected.
- Any electrical or petrol-driven pump must be equipped and positioned so as not to cause any danger of ignition of the product.
- If fuel is dispensed from 200 litre drums, the proper dispensing equipment must be used.

- The drum must not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage tank must be stored in a waterproof container when not in use.
- All waste fuel and chemical impregnated rags must be stored in leak-proof containers and disposed of at an approved hazardous waste site.
- The amounts of fuel and chemicals stored on site must be minimised.
- Storage sites must be provided with bunds to contain any spilled liquids and materials.
- These storage facilities (including any tanks) must be on an impermeable surface that is protected from the ingress of storm water from surrounding areas in order to ensure that accidental spillage does not pollute local soil or water resources.
- Clear signage must be placed at all storage areas containing hazardous substances / materials.
- Material Safety Data Sheets (MSDSs) shall be readily available on site for all chemicals and hazardous substances to be used on site. Where possible, the available MSDSs must additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or escapes.
- Storage areas containing hazardous substances / materials must be clearly signed.
- Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures.
- A suitable Waste Disposal Contractor must be employed to remove waste oil. These wastes must only be disposed of at licensed landfill sites designed to handle hazardous wastes.
- The contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training.
- All excess cement and concrete mixes are to be contained on the construction site prior to disposal off site.
- Any spillage, which may occur, shall be investigated and immediate action must be taken.

6 CONSTRUCTION PHASE MITIGATION MEASURES

The following sections form the core of the EMPR during the construction phase of the proposed development. The developer is to ensure that the contractor complies with all mitigation measures during the construction period. The major sources of potential impacts include, the turbine footprint construction, the construction of buildings and infrastructure, the construction of roads and bridges, and vehicle operation, and spillages.

The following is not allowed on site:

- No poaching of any animals or harvesting of any flora;
- No construction camp, for workforce accommodation is allowed on site; contractors are to ensure suitable housing for staff outside of the proposed development footprint.
- No cooking or fires allowed on site; and
- No alcohol or drugs are allowed on site.

6.1 Potential Construction Phase Impacts

The following impacts are likely to occur during the construction of the proposed WEF. Specific mitigation measures for each impact is presented below.

- The accidental, negligent, or deliberate spillage or inappropriate disposal of hazardous substances could result in air, soil and water pollution and may affect the health and well-being of people, plants and animals.
- Excessive noise could be made by the construction activity which would affect neighbouring communities.

- Potential damage to the soil structure, soil compaction and loss of soil fertility.
- Loss of the vegetation cover and increased erosion risks.
- Dust related problems.
- Safety hazards to the public, workers and animals in the area.
- Disturbance to local hydrology from construction activities.
- Pollution of surface water bodies
- Dust can be a nuisance to the construction workforce and to the public and can negatively affect the growth and recovery rate of plants. Potential sources of fugitive dust include, but are not limited to:
  - Demolition of concrete foundations and existing buildings;
  - Grading / movement of soil;
  - Transportation and unloading of construction materials;
  - Vehicular movement over unsurfaced roads and tracks; and,
  - Wind erosion of stockpiles.
- Construction activities will result in the exposure of the soil to erosive factors, i.e. wind and water, and the compaction of the soil in other areas;
- Illegal poaching and collection of animals and plant material.
- Loss of established indigenous and exotic habitat
- Unnecessary trampling of vegetation and harm to animals.
- Degradation of the scenic quality due to the major earthworks and any unsightly structures.
- Damage or loss of important cultural, historical or pre-historical sites and artefacts.
- Damage to existing roads and tracks, power lines, pipelines, etc.
- Dangerous conditions near road.
- Trespassing and illegal access onto land.

Table 6.1 below presents a summary of the potential impacts as assessed by specialists for the construction phase of the WEF.

Table 6.2 below provides the mitigation measures to be implemented for the potential impacts identified.

Table 6.1: Summary of Construction Phase Potential Impacts and Significance Rating

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Loss of Agricultural land	L	M	L	Negative	L	L	H
With Mitigation	L	M	L	Negative	L	L	H
Soil degradation	L	M	M	Negative	M	M	H
With Mitigation	L	M	L	Negative	L	L	H
Wetlands and freshwater							
Loss of riparian systems and water courses during the construction phase	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Impact on localized surface water quality mainly during the construction phase	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Terrestrial Ecological Impacts							
Impact on vegetation and listed plant species due to transformation within the development footprint	L	H	M	Negative	M	H	H
With Mitigation	L	M	M	Negative	M	H	H
Faunal impacts due to construction-phase noise and physical disturbance	L	L	H	Negative	M	H	H
With Mitigation	L	L	M	Negative	L	L	M
Avifauna							
Destruction of habitat used by birds	L	M	M	Negative	M	H	H

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
With Mitigation	L	M	L	Negative	L	L	M
Disturbance and Displacement of Birds	L	L	M	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Bats							
Roost disturbance	L	M	L	Negative	L	L	M
With Mitigation	L	M	L	Negative	L	L	M
Roost destruction	L	H	L	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Habitat modification	L	M	L	Negative	L	L	M
With Mitigation	L	M	L	Negative	L	L	M
Noise							
Excavation and Concreting of Turbine Foundations	L	L	H	Negative	M	M	H
With Mitigation	L	L	L	Negative	L	L	H
Construction of Tracks and Hard standing	L	L	H	Negative	M	M	H
With Mitigation	L	L	L	Negative	L	L	H
Turbine Erection	L	L	H	Negative	M	M	H
With Mitigation	L	L	L	Negative	L	L	H
Generator (Night-time Use)	L	L	M	Negative	L	L	H
With Mitigation	L	L	L	Negative	L	L	H
Heritage and Archaeology							
Impacts on archaeological resources	L	H	L	Negative	M	M	H
With Mitigation	L	H	L	Negative	L	L	H
Impacts on graves	L	H	H	Negative	M	L	H
With Mitigation	L	H	L	Negative	L	L	H

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Impacts to the cultural landscape	M	M	M	Negative	M	H	H
With Mitigation	M	M	M	Negative	M	H	H
Palaeontology							
Impacts to palaeontological resources	L	H	L	Negative	M	M	M
With Mitigation	L	H	L	Negative	L	L	M
Visual							
Potential visual effect of construction activities, including cranes, construction traffic, dust and noise affecting the rural sense of place.	L	L	M	Negative	M	H	H
With Mitigation	L	L	M	Negative	M	M	M
Social							
Impact of employment and business creation opportunities	M	L	M	Positive	M	M	H
With Mitigation	H	L	H	Positive	M	H	H
Impact of the presence of construction workers in the area on local communities	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Impact of job seekers on local communities	M	L	L	Negative	L	L	M
With Mitigation	M	L	L	Negative	L	L	M
Risk to safety, livestock, farm infrastructure and farming operations	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Impact of increased risk of fires	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Impacts associated with construction vehicles	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Impact on farmland due to construction related activities	M	L	M	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H
Traffic							
Traffic Flow	M	L	M	Negative	M	M	M
With Mitigation	M	L	M	Negative	L	L	M
Route Constraints	M	L	H	Negative	M	H	H
With Mitigation	M	L	L	Negative	L	L	H
Minor Road Degradation	L	L	M	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Minor Road Dust	L	L	H	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	M
Intersection Road Safety	L	L	H	Negative	M	M	M
With Mitigation	L	L	H	Negative	L	L	M

Table 6.2 Design and Construction Phase Mitigation Measures

Mitigation Measure	Responsibility	Timing / Frequency
Route Clearing		
Off-road driving and the creation of new tracks, other than those described during Project Layout and Access Plan, are prohibited and will be regarded as unwanted tracks or unwarranted disturbed areas. All unwanted tracks or unwarranted disturbed areas shall be properly rehabilitated	Contractors engineer will be responsible for the creation of new roads. The ECO will be responsible for monitoring this activity	During site establishment Monthly thereafter.
When a new path is created: Carefully plan the route and have it clearly marked out so that drivers exactly know where to drive.	Site engineer/site manager ECO to monitor	Monthly
Establish the track by simply driving over the ground if there are no obvious obstacles (i.e. large rocks, high plants or rough terrain).	ECO to monitor Site engineer/site manager	
Keep tracks as narrow as possible and only drive on marked out routes (as per the Layout and Access Plan).		
No bulldozers will be used in bush clearing outside of the construction footprint. Only inflatable tyre earthmoving equipment must be used to reduce damage to vegetation.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
If obstacles are far enough apart, divert the track around obstacles. Only obstacles that could interfere with the safe construction and operation of the development need to be removed.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Where possible, remove obstacles by hand. Shrubs are to be cut or crushed rather than being completely uprooted in areas where landscaping or rehabilitation will be undertaken on completion of the construction. Leave vegetation in place wherever possible, especially around the perimeter of the site to provide screening and habitat. Indigenous plants can be planted to replace alien vegetation.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Only undertake earthworks in an area if it is unavoidable, and keep the size of platforms as small as possible.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Sensitive sites within the construction area must be demarcated to avoid accidental destruction of sensitive areas. The workforce must be made aware of these areas, and why they are sensitive.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Impacts on vegetation and listed or protected plant species resulting from construction activities		

Mitigation Measure	Responsibility	Timing / Frequency
Preconstruction walk-through of the approved development footprint by a qualified specialist to ensure that sensitive habitats and species are avoided where possible.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Search and Rescue of species of conservation concern (SCCs) must be conducted prior to clearing activities.	ECO to monitor Site engineer/site manager	During site establishment
Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near drainage areas.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
All construction vehicles must adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Temporary lay-down areas must be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas must be rehabilitated after use.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Ensure that lay-down and other temporary infrastructure is within low- sensitivity areas.	ECO to monitor Site engineer/site manager	Design Phase During site establishment
Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment and post construction
The exact routing of the roads must be adjusted where necessary to avoid features of higher sensitivity such as rocky outcrops, as informed by the preconstruction walk-through of the facility.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Design Phase Pre-Construction ECO to monitor throughout construction.

Mitigation Measure	Responsibility	Timing / Frequency
Demarcate sensitive areas in close proximity to the development footprint as no-go areas with construction tape or similar and clearly mark as no-go area	Developer / Site Engineer ECO to monitor Site engineer/site manager	Design Phase Pre-Construction ECO to monitor throughout construction.
Alien Plant Invasion Risk		
Wherever excavation is necessary, topsoil must be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
The recovery of the indigenous grass layer must be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
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.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
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.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
An alien plant management plan must be submitted as part of the EMPR to be approved by the DEA and implemented on site.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Regular alien clearing must be conducted using the best-practice methods for the species concerned. The use of herbicides must be avoided as far as possible.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Increased Erosion Risk and Soil Degradation		
Dust suppression and erosion management must be an integrated component of the construction approach.	ECO to monitor Site engineer/site manager	Weekly
Regular monitoring for erosion problems along the access roads and other cleared areas.	ECO to monitor Site engineer/site manager	Weekly
Erosion problems must be rectified on a regular basis.	ECO to monitor Site engineer/site manager	Weekly
Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season.	ECO to monitor Site engineer/site manager	Monthly

Mitigation Measure	Responsibility	Timing / Frequency
A low cover of vegetation must be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Disturbance near to drainage lines or the pan must be avoided and sensitive drainage areas near to the construction activities must be demarcated as no-go areas.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Implement an effective system of storm water run-off control using bunds and ditches, where it is required - that is at all points of disturbance where water accumulation might occur. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
If an activity will mechanically disturb the soil below surface in any way, then any available topsoil must first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Direct Faunal Impacts		
All personnel must undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Preconstruction walk-through of the facility to identify areas of faunal sensitivity such as occupied burrows	Developer ECO to monitor Site manager	Pre- construction.
Any fauna threatened by the construction activities must be removed to safety by the ECO or appropriately qualified environmental officer.	ECO to monitor Site engineer/site manager	During site establishment Weekly.
All construction vehicles must adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.	ECO to monitor Site engineer/site manager / safety officer	During site establishment. Weekly.
During construction any fauna directly threatened by the construction activities must be removed to a safe location by the ECO or other suitably qualified person.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Weekly.
The illegal collection, hunting or harvesting of any plants or animals at the site must be strictly forbidden. Personnel must not be allowed to wander off the construction site.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Weekly.

Mitigation Measure	Responsibility	Timing / Frequency
No fires must be allowed on site as the vegetation is vulnerable to runaway fires.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Weekly.
No fuelwood collection must be allowed on-site.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.
No dogs or cats must be allowed on site at the construction camps apart from those of the landowners.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.
If any parts of site such as construction camps must be lit at night, this must be done with low-UV type lights (such as most LEDs) as far as practically possible, which do not attract insects and which must be directed downwards	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
No unauthorized persons must be allowed onto the site and site access must be strictly controlled.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.
All construction vehicles must 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 must apply within the facility as well as on the public gravel access roads to the site.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.
All hazardous materials must be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site must be cleaned up in the appropriate manner as related to the nature of the spill.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
If trenches need to be dug for water pipelines or electrical cabling, these must not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open must have places where there are soil ramps allowing fauna to escape the trench.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Loss of rare, endemic or protected species		
All alien plant re-growth, which is currently high within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed crossings.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Monthly.

Mitigation Measure	Responsibility	Timing / Frequency
A final pre-construction walkdown must be conducted, as part of a Plant Search and Rescue plan, with the appropriate permits in place.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
» Where any roads and crossings will be upgraded, the following applies: 1. All pipe culverts must be removed and replaced with suitably sized box culverts, where road levels are raised. 2. River levels, regardless of the current state of the river / water course will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a post authorisation walkdown, prior to commencement of the construction phase. 3. Approach road embankments especially where large cut and fill areas will be required must be rehabilitated during the construction process, to minimise erosion. Suitable stormwater management systems must be installed and monitored during the first few months of use. Any erosion / sedimentation must be prevented.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase. During site establishment. Monthly thereafter.
Loss of functional habitat within the site and near any of the required crossing upgrades		
A final walkdown must also be conducted post authorisation to assist with the development of the stormwater management plan and Riverine Rehabilitation and Monitoring plan.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
All alien plant re-growth must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed crossings	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment. Monthly thereafter.
All pipe culverts must be removed and replaced with suitably sized box culverts, where road levels are raised.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
River levels, regardless of the current state of the river / water course will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a post authorisation walkdown, prior to commencement of the construction phase	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase. Monthly thereafter.
Approach road embankments especially where large cut and fill areas will be required must be rehabilitated during the construction process, to minimise erosion	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.

Mitigation Measure	Responsibility	Timing / Frequency
Suitable stormwater management systems must be installed and monitored during the first few months of use. Any erosion / sedimentation must be prevented.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Weekly.
Avifaunal Habitat Destruction		
No turbines must be constructed in no-go areas, while associated infrastructure must be avoided where possible in these areas The turbine blade must not protrude into these areas, and therefore the bases must be constructed suitably far from these areas to prevent this	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
The minimum number of turbines must be constructed to achieve the required MW output where possible. It is preferable to have smaller number of turbines with larger rotor, compared with more turbines with smaller rotor.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
Prior to construction, an avifaunal specialist must 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; Should priority species nests be located, a protective buffer may be applied, within which construction activities may need to be restricted during the breeding season for that species.	ECO to monitor Site engineer/site manager	Prior to construction
During construction laydown areas and temporary access roads must 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.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Any clearing of large trees (>5m in height), especially stands of large alien trees (e.g. Blue Gum or Pine) on site must be approved first by an avifaunal specialist. Before, clearing, the location and description of the trees must be provided to the specialist, who may request the ECO to inspect the trees for any nests prior to clearing	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
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, an avifaunal specialist is to be contacted for further instruction	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
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 and included within the EMPR.	ECO to monitor Site engineer/site manager	Post construction

Mitigation Measure	Responsibility	Timing / Frequency
All contractors are to adhere to the EMPR and must apply good environmental practice during construction.	ECO to monitor Site engineer/site manager	Throughout construction
Avifaunal Disturbance and Displacement		
Prior to construction, the avifaunal specialist must 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. Following the specialist site walkthrough, any additional sensitive zones and no-go areas (e.g. nesting sites of Red Data species) are to be designated by the specialist who must advise on an appropriate buffer, within which construction activities may not occur during key breeding times.	ECO to monitor Site engineer/site manager	Monthly and when required.
The construction Phase ECO, the onsite Environmental Manager, and the client's representative on site (e.g. the resident engineer) 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), construction 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.	ECO to monitor Site engineer/site manager	Pre-construction, post final design
During the construction phase, an avifaunal specialist must conduct a nest survey/exploration of the WEF site. This must be done during and after, the breeding season (i.e. approximately in July and again in September) of large Eagles (e.g. Martial and Verreaux's Eagle). The aim will be to locate any nest sites not yet found, so that these may continue to be monitored during the construction and operation phases, along with the monitoring of already identified nest sites.	ECO to monitor Site engineer/site manager	As per specialist requirements.
Appoint a specialist to design and conduct monitoring of the breeding of raptors at the various nests identified to date as well as any additionally located nests (see point above). This monitoring can be combined with the exploration described above, and must be conducted on two occasions (i.e. approximately in July and again in September) across each calendar year, during construction. The aim will be to monitor any disturbance to or displacement of the breeding birds during construction.	Developer / Site Engineer ECO to monitor Site engineer/site manager	As per specialist requirements.
Bird collisions		

Mitigation Measure	Responsibility	Timing / Frequency
Attach appropriate marking devices (BFDs) on all new overhead power lines to increase visibility. The advice of a specialist must be sought regarding the type, placement and spacing of the BFDs to be used	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Pre-Construction Design Phase.
Any new overhead power lines must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' monopole structures, with clearances between live components and possible bird perches (e.g. cross arms) of 1.8 m or greater. Each pylon must be fitted with a safe bird perch	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Pre-Construction Design Phase.
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.	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Pre-Construction Design Phase.
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.	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Pre-Construction Design Phase.
Bat Roost disturbance and/or destruction		
Designing the layout of the project to avoid areas that are more frequently used by bats may reduce the likelihood of mortality and must be the primary mitigation measure. Low lying areas, buildings, woodland/thicket and areas near water must be avoided.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
Turbine placement must only be in areas of Low-Medium and Medium bat sensitivity. No part of any turbine, including the rotor swept zone must be constructed within areas of Medium-High or High bat sensitivity.	ECO to monitor Site engineer/site manager	Pre-construction / design phase.
It is recommended that a bat specialist survey the confirmed turbine locations and all other proposed site infrastructure for the presence of roosts within 200 m before any construction activities commence and once the preliminary design and layout of each WEF is complete	Developer / Site Engineer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
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.	Developer to appoint ECO to monitor Site engineer/site manager	Pre-construction / design phase.

Mitigation Measure	Responsibility	Timing / Frequency
If occupied roosts are confirmed these must be buffered based on best practise guidance, which includes a minimum buffer of 200 m	Developer ECO	Pre-construction / design phase.
Clearing of natural and agricultural areas be kept to a minimum.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Blasting activities not to occur within 2km of any known bat roosts.	ECO to monitor Site engineer/site manager	During blasting activities
Dust suppression measures to be used during the full construction phase	ECO to monitor Site engineer/site manager	Weekly
Any new roosts discovered, must be reported and incorporated into the adaptive management plan.	ECO to monitor Site engineer/site manager	Monthly and as required during construction
Roost searches to continue during construction and operational phases.	ECO to monitor Site engineer/site manager	As required by the specialist
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.	Developer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
Bat Habitat Modification		
Clearing of natural and agricultural areas be kept to a minimum	ECO to monitor Site engineer/site manager	Pre-construction / design phase. Monthly thereafter.
Before construction commences, a bat specialist must 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	Developer to appoint ECO to monitor Site engineer/site manager	Pre-construction / design phase.
During construction laydown areas and temporary access roads must 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	ECO to monitor Site engineer/site manager	Pre-construction / design phase.
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	ECO to monitor Site engineer/site manager	Post construction. Weekly.

Mitigation Measure	Responsibility	Timing / Frequency
Loss of riparian systems and water courses		
Where water course crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (crossing must have a small footprint).	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
No vehicles to refuel within drainage lines/ riparian vegetation.	ECO to monitor Site engineer/site manager	Weekly
During the operational phase, monitor culverts to see if erosion issues arise and if any erosion control if required.	ECO to monitor Site engineer/site manager	monthly
Where possible culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or roads on riparian form and function		
Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Increase in sedimentation and erosion within the development footprint		
Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Impact on localized surface water quality		
Strict use and management of all hazardous materials used on site.	ECO to monitor Site engineer/site manager	Weekly
Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.).	ECO to monitor Site engineer/site manager	Weekly
Containment of all contaminated water by means of careful run-off management on the development site.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Strict control over the behaviour of construction workers.	ECO and safety to monitor Site engineer/site manager	Weekly
Working protocols incorporating pollution control measures (including approved method statements by the contractor) must be clearly set out in the EMPR for the project and strictly enforced.	ECO to monitor	During site establishment

Mitigation Measure	Responsibility	Timing / Frequency
	Site engineer/site manager	Monthly thereafter.
Appropriate ablution facilities must be provided for construction workers during construction and on-site staff during the operation of the facility.	ECO to monitor Site engineer/site manager	Weekly
Potential visual effect of construction activities, including cranes, construction traffic, dust and noise affecting the rural sense of place		
Substation and O&M buildings to be located in visually unobtrusive positions, or alternatively screened with earth berms and planting	Site engineer/site manager	Design phase
Location of the construction camp, batching plant and related storage/stockpile areas in unobtrusive positions in the landscape, away from arterial or district roads, or alternatively screening measures utilized	ECO to monitor Site engineer/site manager	Design phase
Clear demarcation of construction camps, limited in size to only that which is essential.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Employment of dust suppression and litter control measures. Formulation and adherence to an Environmental Management Programme (EMPR), monitored by an Environmental Control Officer (ECO).	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Visual mitigation during construction		
Access and haul roads to use existing farm tracks as far as possible.	ECO to monitor Site engineer/site manager	During site establishment Weekly
Construction camp, stockpiles and lay-down area to be located out of sight of district roads, possibly in the vicinity of the proposed substation and O&M buildings.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Disturbed areas rather than pristine or intact land to preferably be used for the construction camp. Construction camp and laydown areas to be limited in area to only that which is essential	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Measures to control wastes and litter to be included in the contract specification documents.	ECO to monitor Site engineer/site manager	During site establishment Weekly thereafter.
Provision to be made for rehabilitation/ re-vegetation of areas damaged by construction activities.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Damage or destruction of Archaeological resources during clearing of the ground or excavation of foundations		

Mitigation Measure	Responsibility	Timing / Frequency
A final walk-down survey of the authorised footprints for all six projects must be carried out at least 6 months before the start of construction in order for any archaeological mitigation requirements to be determined and carried out	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
The employment of a palaeontologist during the construction phase, establishment of on-site curation facilities and identification of a repository for specimens.	ECO to monitor Site engineer/site manager	During site establishment When required during construction.
During the construction phase a chance-finds procedure must be applied should substantial fossil remains such as vertebrate bones, teeth or trackways, plant-rich fossil lenses or dense fossil burrow assemblages be exposed by excavation or discovered within the development footprint.	Environmental Control Officer must safeguard the fossils, preferably *in situ*, and alert the responsible heritage management authority, so that appropriate action can be taken by a professional palaeontologist	When required during construction
The fence incorporating historical stone fence posts (waypoint 1720 lies on this fence line) must be avoided if possible	Developer ECO to monitor Site engineer/site manager	Pre-construction / design phase.
If any archaeological material or human burials are uncovered during the course of development then work in the immediate area must be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.	Developer / Site Engineer ECO to monitor Site engineer/site manager	Throughout construction. Weekly checks.
Archaeological material and rock engravings		
Conduct a final walk down of roads and check turbines positions for archaeological material.	ECO to monitor Site engineer/site manager	During site establishment. Monthly thereafter.
Application of Chance Fossil Finds Procedure (See Appendix 2 of palaeontological specialist study): safeguarding new fossil finds and reporting to ECPHRA by ECO for possible recording and sampling by professional palaeontologist	ECO to monitor Site engineer/site manager	Throughout construction. Monthly.
Check dolerite clusters and flat dolerite rafts for rock engravings. Rock engravings must be assigned co-ordinates, photographed (so as to record detail) and moved out of harm's way, or the road adjusted to avoid them.	ECO to monitor Site engineer/site manager	Throughout construction. Monthly.

Mitigation Measure	Responsibility	Timing / Frequency
Graves		
In the event of human bones being found on site, an archaeologist must be informed immediately and the remains removed under an emergency permit. This process will incur some expense as removal of human remains is at the cost of the developer. Time delays may result while application is made to the authorities and an archaeologist is appointed to do the work.	ECO to monitor Site engineer/site manager	Throughout construction.
All identified grave yards must be mapped and co-ordinates given to the developer and the contractor. These areas must be avoided, as far a practical. The contractor is to ensure that the work force are aware of these areas, and buffers applied around them.	ECO to monitor Site engineer/site manager	Throughout construction.
A minimum 30 m buffer to be maintained around all graves, ruins and buildings	ECO to monitor Site engineer/site manager	Pre-construction and throughout construction
Creation of local employment, training, and business opportunities		
Where reasonable and practical the proponent must appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. Due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area	Developer/ site manager	Pre-construction and throughout construction
Where feasible, efforts must be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria	Developer/ site manager	Pre-construction and throughout construction
Before the construction phase commences the proponent must meet with representatives from the BCRLM and BCRLM to establish the existence of a skills database for the area. If such as database exists it must be made available to the contractors appointed for the construction phase	Developer/ site manager	Pre-construction and throughout construction
The local authorities, relevant community representatives and local farmers must be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project	Developer/ site manager	Pre-construction and throughout construction
Where feasible a training and skills development programmes for local workers must be initiated prior to the initiation of the construction phase	Developer/ site manager	Pre-construction and throughout construction
The recruitment selection process must seek to promote gender equality and the employment of women wherever possible.	Developer/ site manager	Pre-construction and throughout construction
The proponent must liaise with the SBDM and BCRLM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.)	Developer/ site manager	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Timing / Frequency
prior to the commencement of the tender process for construction contractors. These companies must be notified of the tender process and invited to bid for project-related work		
Where possible, the proponent must assist local BBBEE companies to complete and submit the required tender forms and associated information.	Developer/ site manager	Pre-construction and throughout construction
The SBDM and BCRLM, in conjunction with the local business sector and representatives from the local hospitality industry, must identify strategies aimed at maximising the potential benefits associated with the project	Developer/ site manager	Pre-construction and throughout construction
Impacts of Construction workers on Local Community		
Where possible the proponent must make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories	Developer/ site manager	Pre-construction and throughout construction
The proponent must consider the need for establishing a Monitoring Forum (MF) in order to monitor the construction phase and the implementation of the recommended mitigation measures. The MF must be established before the construction phase commences, and must include key stakeholders, including representatives from the SBDM and BCRLM, farmers and the contractor(s). The MF must also be briefed on the potential risks to the local community and farm workers associated with construction workers	Developer/ site manager	Pre-construction and throughout construction
The proponent and the contractor(s) must, in consultation with representatives from the MF, develop a code of conduct for the construction phase. The code must identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code must be dismissed. All dismissals must comply with the South African labour legislation	Developer/ site manager	Pre-construction and throughout construction
The proponent and contractor (s) must implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;	Developer/ site manager	Pre-construction and throughout construction
The contractor must provide transport to and from the site on a daily basis for low and semi-skilled construction workers. This will enable the contractor to effectively manage and monitor the movement of construction workers on and off the site;	Developer/ site manager	Pre-construction and throughout construction
Where necessary, the contractors must make the necessary arrangements to enable low and semi-skilled workers from outside the area to return home over weekends and/ or on a regular basis. This would reduce the risk posed to local family structures and social networks	Developer/ site manager	Pre-construction and throughout construction
No construction workers, with the exception of security personnel, must be permitted to stay over-night on the site.	Developer/ site manager	Pre-construction and throughout construction
Impacts on family structures, social networks and community services associated with the influx of job seekers		

Mitigation Measure	Responsibility	Timing / Frequency
The proponent must implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities;	Developer/ site manager	Pre-construction and throughout construction
Risk to safety of farmers and farm workers, livestock and damage to farm infrastructure associated with the movement of construction workers on and to the site		
The proponent must enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase proven to be associated with the construction activities for the WEF will be compensated for. The agreement must be signed before the construction phase commences;	Developer/ site manager	Pre-construction and throughout construction
The proponent must establish a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. This committee must be established prior to commencement of the construction phase. The Code of Conduct must be signed by the proponent and the contractors before the contractors move onto site.	Developer/ site manager	Pre-construction and throughout construction
The proponent must hold contractors liable for compensating farmers in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This must be contained in the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement must also cover loses and costs associated with fires caused by construction workers or construction related activities.	Developer/ site manager	Pre-construction and throughout construction
The Environmental Management Programme (EMP) must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested;	Developer/ site manager ECO to monitor	Pre-construction and throughout construction
The contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.	Developer/ site manager Safety officer	Pre-construction and throughout construction
The contractors appointed by the proponent must ensure that construction workers who are found guilty of trespassing, stealing livestock and/or damaging farm infrastructure are dismissed and charged. This must be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation;	Developer/ site manager Safety officer	Pre-construction and throughout construction
The housing of construction workers on the site must be strictly limited to security personnel.	Developer/ site manager Safety officer	Pre-construction and throughout construction
The contractors appointed by the proponent must provide daily transport for low and semi-skilled workers to and from the site. This would reduce the potential risk of trespassing on the remainder of the farm and adjacent properties.	Developer/ site manager Safety officer	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Timing / Frequency
Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires		
The proponent must enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase proven to be associated with the construction activities for the WEF will be compensated for. The agreement must be signed before the construction phase commences;	Developer/ site manager	Pre-construction and throughout construction
The contractor must provide adequate firefighting equipment on-site;	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
Contractor must ensure that open fires on the site for cooking or heating are not allowed except in designated areas;	Developer/ site manager ECO to monitor	Daily. Pre-construction and throughout construction
The contractor must ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care must be taken during the high risk dry, windy winter months;	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
The contractor must provide fire-fighting training to selected construction staff;	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
No construction staff, with the exception of security staff, to be accommodated on site over night;	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
As per the conditions of the Code of Conduct, in the event of a fire proven to be caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor must also compensate the firefighting costs borne by farmers and local authorities.	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
Potential dust and safety impacts and damage to road surfaces associated with movement of construction related traffic to and from the site		
The contractor must inform local farmers and representatives from the SBDM and BCRLM Tourism of dates and times when abnormal loads will be undertaken	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction
The contractor must ensure that damage caused by construction related traffic to the gravel public roads and local, internal farm roads is repaired on a regular basis throughout the construction phase. The costs associated with the repair must be borne by the contractor.	Developer/ site manager ECO to monitor	Daily. Pre-construction and throughout construction

Mitigation Measure	Responsibility	Timing / Frequency
Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis[2], adhering to speed limits and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.	Developer/ site manager ECO to monitor	Daily. Pre-construction and throughout construction
The contractor must ensure that all construction vehicles adhere to speed limits and vehicles used to transport sand and building materials must be fitted with tarpaulins or covers;	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction
All workers must receive training/ briefing on the reasons for and importance of closing farm gates and driving slowly; Speed limits must be applied. Construction vehicles limit of 40 km/hr on site.	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction. Monthly
All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction. Monthly
The Contractor must ensure that workers are informed that no waste can be thrown out of the windows while being transported to and from the site. Workers who throw waste out windows must be fined.	Site engineer/ site manager Safety officer and ECO	Daily. Pre-construction and throughout construction
The Contractor must be required to collect waste along the road reserve on a daily basis.	Site engineer/ site manager ECO	Daily. Pre-construction and throughout construction
Waste generated during the construction phase must be transported to the registered landfill.	Site engineer/ site manager ECO	Weekly throughput construction
EMPR measures (and penalties) must be implemented to ensure farm gates are closed at all times.	Site engineer/ site manager Developer to implement ECO	Daily. Pre-construction and throughout construction
EMPR measures (and penalties) must be implemented to ensure speed limits are adhered to at all times.	Site engineer/ site manager Developer to implement ECO	Daily. Pre-construction and throughout construction
As far as possible, the transport of components to the site along the N10 must be planned to avoid weekends and holiday periods	Developer/ site manager ECO to monitor	Daily. Pre-construction and throughout construction
Impact on Farmland due to Construction Related Activities		

[2] Treated effluent (non-potable) water must be used for wetting of roads and construction areas

Mitigation Measure	Responsibility	Timing / Frequency
The location of wind turbines, access roads, laydown areas etc. must be informed by the findings of key specialist studies, including the soil and botanical study. In this regard areas of high potential agricultural soils must be avoided;	Site engineer/ site manager Developer to implement ECO	Weekly. Pre-construction and throughout construction
The location of wind turbines, access roads, laydown areas etc. must be discussed with the locally affected landowners in the finalisation process and inputs provided must be implemented in the layout as best as possible;	Site engineer/ site manager Developer to implement ECO	Weekly. Pre-construction and throughout construction
All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., must be rehabilitated at the end of the construction phase. The rehabilitation plan must be informed by input from a botanist with experience in arid regions;	Site engineer/ site manager Developer to implement ECO	Weekly post construction
The implementation of a rehabilitation programme must be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme must be drawn up the Environmental Consultants appointed to undertake the EIA;	Site engineer/ site manager Developer to implement ECO	Tender phase
The implementation of the Rehabilitation Programme must be monitored by the ECO;	Site engineer/ site manager Developer to implement ECO	Weekly
All workers must receive training/ briefing on the reasons for and importance of not driving in undesignated areas;	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly
EMPR measures (and penalties) must be implemented to strictly limit all vehicle traffic to designated roads and construction areas. Under no circumstances must vehicles be allowed to drive into the veld;	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Daily
Disturbance footprints must be reduced to the minimum.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly
The footprint areas for the establishment of individual wind turbines must be clearly demarcated prior to commencement of construction activities. All construction related activities must be confined to the demarcated area and minimised where possible;	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly
General Construction Mitigation Measures		

Mitigation Measure	Responsibility	Timing / Frequency
Potable toilets must be supplied to the workforce in areas of activity. One toilet per 14 workers must be implemented. Females must have separate toilets. A licenced contractor must be appointed by the contractor to provide this facility, and ensure that wastes are correctly disposed of. Servicing must take place on a weekly basis, proof of which must be retained on site by the contractor.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Weekly
Waste skips must be provided in areas of construction activity as well as within the lay down areas, along with waste bins. Wastes must be separated into the following categories: • General waste, compactable and non-compactable • Waste paper recycling • Scrap metal • Globes and fluorescent tubes • Rubber waste • Medical waste • Chemical waste • Hazardous waste	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Weekly
Health and Safety		
Implementation of safety measures, work procedures and first aid must be implemented on site.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly
Workers must be thoroughly trained in using potentially dangerous equipment	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly
Contractors must ensure that all equipment is maintained in a safe operating condition.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly
A safety officer must be appointed.	Developer to implement	Pre-construction
A record of health and safety incidents must be kept on site.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly

Mitigation Measure	Responsibility	Timing / Frequency
Any health and safety incidents must be reported to the project manager immediately.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction.
First aid facilities must be available on site at all times.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Workers have the right to refuse work in unsafe conditions.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Daily
The contractor must ensure that all construction workers are well educated about HIV/ AIDS and the risks surrounding this disease. The location of the local clinic where more information and counselling is offered must be indicated to workers.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Material stockpiles or stacks, such as, pipes must be stable and well secured to avoid collapse and possible injury to site workers / local residents	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
An STI and HIV/AIDS awareness campaign must be launched, which is not only directed at construction workers but also at the community as a whole.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Condoms must be distributed by placing them at centrally located points and by ensuring that construction workers and community members are aware of the availability and location of condoms. The distribution of condoms must be approached with the necessary cultural sensitivity.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Access at the construction site must be controlled to prevent sex workers from either visiting and/or loitering at the construction camp.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Ensure that the local community communicate their expectations of construction workers' behaviour with them.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks

Mitigation Measure	Responsibility	Timing / Frequency
Personal Protective Equipment (PPE) must be made available to all construction staff and their usage must be compulsory. Hard hats and safety shoes must be worn at all times and other PPE worn were necessary i.e. dust masks, ear plugs etc.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
No person is to enter the site without the necessary PPE.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Pre-construction, construction and operation activities must be undertaken during daylight working hours between the hours of 07:00 – 17:00 on weekdays and 07:00 – 13:00 on Saturdays. No activity will be allowed on Sundays.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
The workforce is to be provided with sufficient potable water and under no circumstances are they to use untreated water from the local watercourses for drinking.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Noise		
Construction site yards and other noisy fixed facilities must be located well away from noise sensitive areas adjacent to the development sites.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
All construction vehicles and equipment are to be kept in good repair.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Portable acoustic shields must be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators).	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Construction staff working in areas where the 8-hour ambient noise levels exceed 75dBA must wear ear protection equipment.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Blasting operations are to be strictly controlled with regard to the size of explosive charge in order to minimise noise and air blast, and timings of explosions. The number of blasts per day must be limited, blasting must be undertaken at the same times each day and no blasting must be allowed at night.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks

Mitigation Measure	Responsibility	Timing / Frequency
With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor and ECO must liaise with local residents on how best to minimise impact, and the local population must be kept informed of the nature and duration of intended activities.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Noise suppression measures must be applied to all construction equipment. Construction equipment must be kept in good working order and where appropriate fitted with silencers which are kept in good working order.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Should the vehicles or equipment not be in good working order, the Contractor may be instructed to remove the offending vehicle or machinery from site.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Where possible labour shall be transported to and from the site by the contractor or his Sub-Contractors by the contractors own transport.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Construction activities are to be contained to reasonable hours during the day and early evening. Night-time activities near noise sensitive areas must not be allowed.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Construction activities must be undertaken during daylight working hours between the hours of 07:00 – 17:00 on weekdays and 07:00 – 13:00 on Saturdays. No activity will be allowed on Sundays.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Should any equipment, such as generators on-site, generating excessive noise, they must be fitted with appropriate noise abatement measures.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Traffic Congestion, Impedance to Traffic Flow due to Increase in Traffic Volumes		
Transport Management Plan to be produced to include: • Ensure safe transport of materials, equipment, etc. to site; • Optimise route selection and time of travel; • Co-ordinate traffic law-enforcement and transport to site; • Design on-site roads to facilitate access to laydown areas, substations and wind turbines; Conduct a dry-run priori to implementation of the Transport Management Plan.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Design Phase / Pre-construction

Mitigation Measure	Responsibility	Timing / Frequency
Minor Road Degradation due to Increased Traffic		
Document condition of gravel roads prior to construction.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Upgrade gravel roads to suitable condition for proposed construction vehicles.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Ensure that the minor road is left in a better condition post-construction.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Intersection Road Safety		
Place warning construction vehicle signage on the R63 on each approach to Minor Road M00412.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Ensure that all construction vehicles are roadworthy.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.
Ensure that all construction vehicles have appropriate drivers licence.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Monthly checks.

6.2 Post Construction

- Once construction has been completed on site and all excess material has been removed, the storage area shall be rehabilitated. If the area was badly damaged, re-seeding shall be done and fencing in of the area shall be considered if livestock/faunal species specific to the area may subsequently have access to such an area.
- Such areas shall be rehabilitated to their natural state. Any spilled concrete shall be removed and soil compacted during construction shall be ripped, levelled and re-vegetated.
- Only designated areas must be used for storage of construction materials, soil stockpiles, machinery and other equipment.
- Specific areas must be designated for cement/concrete mixing/ batching plants. Sufficient drainage for these plants must be in place to ensure that soils do not become contaminated.
- The construction camp must be kept clear of litter at all times.
- Spillages within the construction camp need to be cleaned up immediately and disposed of in the hazardous skip bin for correct disposal.
- All remaining material including building rubble and waste are to be removed from the site.
- All areas disturbed must be managed to ensure efficient drainage.
- The area designated for the deposition of spoil material is to be levelled and shaped to ensure the efficient drainage of the site. Under no circumstances is general or hazardous waste to be disposed of at this site.

6.2.1 Infrastructure

- Disassemble all temporary infrastructure units and remove components from the working areas and contractors camp. This will include storage structures and containers, water storage container, power supply, workers accommodation, sewage systems
- Drain all potable chemical toilets, being careful not to spill the contents. Transfer the waste to an appropriate disposal site.
- Drain all waste water and sewage associated with temporary ablution facilities and transfer the waste to an appropriate disposal site to be identified by the contractor.
- Disassemble all fencing around the camp and either sell, suction or donate to the local community or transfer the waste components to a disposal site or the contractor’s base.
- Do not leave any components, waste or infrastructure units within the working area and camp unless specifically required for the operation and maintenance phases and as agreed by the ECO

6.2.2 Contaminated Substrate and Pollution Control Structures

- Excavate all areas of contaminated substrate, transfer the contaminated substrate to an appropriate disposal site and treat the affected areas.
- Remove all plastic linings used for pollution control and transfer to an appropriate disposal site.
- Break up all concrete structures that have been created and remove concrete waste to an appropriate disposal site.

6.2.3 Waste

- Remove all remaining construction materials from the camp and working areas and either sell, auction, donate to the local community or transfer the waste components to a disposal site or the contractor’s base.

- Remove all construction debris, litter and domestic waste from the camp and working areas and transfer to an appropriate disposal site. Remove all waste receptacles from the camp and working areas and either sell, auction, donate to the local community or transfer the waste components to a disposal site or the contractor's base.

7 OPERATIONAL PHASE MITIGATION MEASURES

Once the construction and commissioning of the WEF is completed the project becomes operational. The operator of the WEF has the responsibility to ensure that the mitigation measures proposed for the operational phase of the WEF is implemented and conducted appropriately.

During the operation and maintenance of the WEF (including the normal operation of the turbines themselves) a certain amount of disturbance results. An operational WEF will normally have various day to day activities occurring on site, such as (but not limited to) security control, routine maintenance, road clearing/cleaning, grass/bush cutting and clearing.

These factors can all 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).

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 studies have recorded distances of 80 m, 100 m, 200 m and 300 m (Larsen & Madsen 2000, Shaffer & Buhl 2015) but distances of 600 m (Kruckenberg & Jaehne 2006) and up to 800 m have been recorded (Drewitt & Langston 2006).

Raptors are generally fairly tolerant of wind farms, and continue to use the area for foraging (Thelander *et al.* 2003, Madders & Whitfield 2006), so are not affected by displacement, which however increases their collision risk.

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 (unless a large roost in discovered on site and bats are reluctant to leave this roost if disturbed) because the project footprint (i.e. turbines, roads and infrastructure) is small relative to the area monitored.

The developer has the responsibility to ensure that all operational mitigation measures outlined in this document, and all revisions thereof, are complied with.

7.1 Potential Operation Phase Impacts

Table 7.1 below provides a summary of the potential impacts of the operation of the WEF, as assessed by specialists.

Table 7.2 presents the mitigation measure to be implemented for the potential impacts identified.

Table 7.1 Summary of Operation Phase Impacts

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Loss of Agricultural land	L	M	L	Negative	L	L	H
With Mitigation	L	M	L	Negative	L	L	H
Soil degradation	L	M	M	Negative	M	M	H
With Mitigation	L	M	L	Negative	L	L	H
Generation of additional land use income	L	M	L	Positive	M	H	H
With Mitigation	L	M	L	Positive	M	H	H
Wetlands and freshwater							
Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or new road crossings on riparian form and function	L	L	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Impact on localized surface water quality mainly during the construction phase	L	M	L	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Terrestrial Ecological Impacts							
Faunal impacts due to operational phase activities	L	M	M	Negative	M	H	H
With Mitigation	L	M	L	Negative	L	L	H
Soil erosion	L	H	M	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	L	H
Alien plant invasion	L	H	M	Negative	M	H	H

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
With Mitigation	L	L	L	Negative	L	L	H
Critical Biodiversity Areas and Broad-Scale Ecological Processes	L	H	M	Negative	M	H	H
With Mitigation	L	H	L	Negative	L	L	H
Avifauna							
Bird mortality caused by collision with wind turbine blades and/or towers	M	M	H	Negative	M	H	M
With Mitigation	M	M	H	Negative	M	M	M
Bird mortality caused by collision overhead powerlines on the WEF site	L	M	H	Negative	M	M	M
With Mitigation	L	M	M	Negative	L	L	M
Bird mortality caused by electrocution on the WEF site	L	M	M	Negative	M	M	M
With Mitigation	L	M	M	Negative	L	L	H
Disturbance to birds resulting in temporary/permanent displacement or disrupting breeding success	M	M	M	Negative	M	M	L
With Mitigation	L	M	M	Negative	L	L	L
Disruption of Local Bird Movement Patterns (e.g. barrier effects)	M	M	M	Negative	L	L	L
With Mitigation	M	M	M	Negative	L	L	L
Bats							
Bat mortality during commuting and/or foraging	M	M	M	Negative	M	M	M
With Mitigation	M	M	L	Negative	L	L	M
Bat mortality during migration	H	M	M	Negative	M	L	M
With Mitigation	M	M	M	Negative	L	L	M
Habitat creation in high risk locations	L	M	L	Negative	L	L	M
With Mitigation	L	M	L	Negative	L	L	H
Light pollution	L	M	L	Negative	L	L	M
With Mitigation	L	M	L	Negative	L	L	H

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Noise							
Operational Noise (Day)	L	H	L	Negative	L	L	H
With Mitigation	L	H	L	Negative	L	L	H
Operational Noise (Night)	L	H	M	Negative	M	M	H
With Mitigation	L	H	L	Negative	L	L	H
Heritage and Archaeology							
Impacts to the cultural landscape	M	M	M	Negative	M	H	H
With Mitigation	M	M	M	Negative	M	H	H
Visual							
Potential visual intrusion of remaining structures, platform earthworks and access roads on the rural landscape.	M	M	M	Negative	M	H	H
With Mitigation	M	M	M	Negative	M	M	H
Social							
Implementation of clean, renewable energy infrastructure	M	M	M	Positive	M	M	H
With Mitigation	M	H	M	Positive	H	H	H
Impact of employment and business creation opportunities	M	M	L	Positive	M	M	H
With Mitigation	M	M	M	Positive	H	H	H
Establishment of a community trust funded by revenue generated from the sale of energy	M	H	M	Positive	M	L	H
With Mitigation	M	H	H	Positive	H	H	H
Assessment of benefits associated with income generated for affected farmer(s)	M	M	L	Positive	L	L	H
With Mitigation	M	M	M	Positive	M	H	H
Impact on sense of place and rural character of the landscape	M	M	M	Negative	M – H	M	M
With Mitigation	M	M	M	Negative	M – H	M	M

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Impact on sense of place and rural character of the landscape (based on comments from stakeholders)	M	M	L	Negative	L	M	M
With Mitigation	M	M	L	Negative	L	M	M
Impact of potential impact on property values	M	M	M	Negative	M	M	M
With Mitigation	M	M	M	Negative	M	M	M
Impacts on tourism in the region	M	M	L	Negative	L	L	H
With Mitigation	M	M	L	Negative	L	L	H
Impacts on adjacent tourism operations associated with game farming and hunting	M	M	M	Negative	M	M	M
With Mitigation	M	M	M	Negative	M	M	M
Traffic							
Route Constraints	M	L	H	Negative	M	M	H
With Mitigation	M	L	L	Negative	L	L	H

Table 7.2 Operational Phase Mitigation Measures

Mitigation Measure	Responsibility	Timing / Frequency
Ecology		
Management of the site must take place within the context of an Open Space Management Plan. A draft Open Space Management Plan is included in this EMPR and must be updated once the final site development plan is finalised and submitted to the DEA for approval.	Developer / Operator ECO	Throughout operation. Monthly checks
Erosion management at the site must take place according to the Erosion Management Plan and Rehabilitation Plan. A draft Erosion Management Plan and Rehabilitation Plan is included in this EMPR and must be updated once the final site development plan is finalised and submitted to the DEA for approval.	Developer / Operator ECO	Throughout operation. Monthly checks
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.	Developer / Operator ECO	Throughout operation. Monthly checks
Update and implement an the Invasive Alien Plant Management Plan.	Developer / Operator ECO	Throughout operation. Monthly checks
There must be an integrated management plan for the development (i.e. Highlands North, South and Central) area during operation, which is beneficial to fauna and flora.	Developer / Operator ECO	Throughout operation. Monthly checks
Wherever excavation is necessary, topsoil must be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. The recovery of the indigenous shrub/grass layer must be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas. 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 species such as *Opuntia* are already present in the area and are likely to increase 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 must be conducted using the best-practice methods for the species concerned. The use of herbicides must be avoided as far as possible.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
All roads and other hardened surfaces must have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.	Site engineer/ site manager Developer to implement	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Timing / Frequency
Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. All erosion problems observed must be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. All cleared areas must be revegetated with indigenous perennial grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.	ECO and Safety Officer	
No unauthorized persons must be allowed onto the site. Any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities must be removed to a safe location. The collection, hunting or harvesting of any plants or animals at the site must be strictly forbidden. If the site must be lit at night for security purposes, this must be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects. All hazardous materials must be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site must be cleaned up in the appropriate manner as related to the nature of the spill. All vehicles accessing the site must adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises. If parts of the facility are to be fenced, then no electrified strands must be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands must be placed on the inside of the fence and not the outside.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. Monthly checks
Birds		
Develop and implement a carcass search programme for birds as a minimum during the first three years of operation followed by year 5, 10, 15, 20 and 25, in line with the applicable South African monitoring guidelines. This program must include monitoring of all internal overhead power lines.	Developer to implement. Specialists to be appointed.	Operational Phase. Monthly checks.
Operational phase bird monitoring, in line with applicable guidelines, must be implemented and must include monitoring of all raptor nest sites for breeding success.	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Operational Phase. Monthly checks.

Mitigation Measure	**Responsibility**	**Timing / Frequency**
Develop and implement a minimum 12 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. The results of this monitoring and the carcass searchers must advise the need for any additional ongoing activity monitoring or nest surveys beyond the 12 month period	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Operational Phase. Monthly checks.
Conduct frequent and regular review of operational phase monitoring data (activity and carcass) and results by an avifaunal specialist. This review must also establish the requirement for continued monitoring studies (activity and carcass) throughout the operational and decommissioning phases of the development	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Throughout operation. Monthly checks.
The above reviews must 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, relevant stakeholders and an independent review), the specialist must 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 must 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 in the turbine area due to the construction and operation activities, while improving raptor habitat and promoting prey availability away from the site. ○ Implementing a carcass management plan on the WEF site, to remove any dead livestock as soon as possible, to reduce the likelihood of attracting vultures to the WEF site. ○ Using deterrent devices (e.g. visual and noise deterrents) and/or shutdown systems e.g. Automatic bird detectors (e.g. automated camera based monitoring systems – McClure et. al. 2018) if commercially available; or Radar Assisted Shutdown on Demand (RASOD) 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. Possibly offset programmes if no suitable mitigation measures can be implemented to reduced impacts sufficiently.	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Throughout operation. Monthly checks.
Place new internal power lines on the WEF underground where possible and technically feasible.	Site engineer/ site manager	Throughout operation. monthly checks

Mitigation Measure	Responsibility	Timing / Frequency
	Developer to implement ECO and Safety Officer	
Where possible place new overhead power lines adjacent to existing power line or linear infrastructure (e.g. roads and fence lines);	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. monthly checks
Bats		
Operational acoustic monitoring and carcass searches for bats must be performed, based on best practice, to monitor mortality and bat activity levels. Acoustic monitoring must include monitoring at height (from more than one location i.e. such as on turbines) and at ground level. In addition, surveys of the Bloukrans cave must be undertaken in spring and autumn to assess changes in the annual movement patterns of the Natal long-fingered bat.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. monthly checks
If mortality does occur, the level of mortality must 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) must be targeted during specific seasons and time periods for specific turbines coincident with periods of increased bat activity.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Throughout operation. monthly checks
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.	Developer / Operator to implement. Specialists to be appointed. ECO to Monitor.	Throughout operation. Monthly checks.
Operational monitoring according to Aronson *et al.* (2014) or any more recent revisions to this document, reporting and adaptive management will be key to keeping the residual impact of the facility as low as possible. This data must be fed into the SANBI database to assist with enhancing the scientific knowledge base for information decision making and mitigation recommendations	Site engineer/ site manager Developer to implement ECO	Throughout operation. Monthly checks.
Pre-construction and operational monitoring bat data to feed into the SANBI bird and bat toolkit. Monthly carcass searching reports to be submitted to the SABAAP.	Site engineer/ site manager Developer to implement ECO	Throughout operation. monthly checks

Mitigation Measure	Responsibility	Timing / Frequency
As new information becomes available with regard to successful mitigation strategies tested, this information must feed into the adaptive management plan.	Site engineer/ site manager Developer to implement ECO	Throughout operation. monthly checks
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 must be consulted before any work is undertaken on that infrastructure or attempting to remove bats. Ongoing maintenance and inspections of buildings must be carried out to ensure no access to bats or actively roosting bats	Site engineer/ site manager. Developer to implement. Specialist to be appointed. ECO to monitor.	Throughout operation. monthly checks
Where lights need to be used such as at the substation and switching station and elsewhere, these must 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 & Rydell 1998) and must not be used as far as possible.	Site engineer/ site manager Developer to implement ECO	Throughout operation. monthly checks
Social		
Implement a skills development and training programme aimed at maximizing the number of employment opportunities for local community members.	Developer to implement	Throughout operation. Monthly checks
Maximise opportunities for local content, procurement and community shareholding.	Developer to implement	Throughout operation. Monthly checks
Pre-Construction, conduct a local community needs assessment to establish whether or not a visitor centre would be an appropriate expenditure for the potential funds flowing to the community. As indicated in the literature review of the Basic Assessment Report (2018), visitor centers in Scotland have attracted large numbers of visitors to wind farms.	Developer to implement	Design Phase / Preconstruction Post Construction to implement if required.
The proponent must implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme must be to maximise the number of South African's and locals employed during the operational phase of the project.	Developer to implement	Throughout operation. Monthly checks
The proponent, in consultation with the SBDM and BCRLM, must investigate the options for the establishment of a Community Development Trust.	Developer to implement	Throughout operation. Monthly checks

Mitigation Measure	Responsibility	Timing / Frequency
The SBDM and BCRLM must be consulted as to the structure and identification of potential trustees to sit on the Trust. The key departments in the SBDM and BCRLM that must be consulted include the Municipal Managers Office, IDP Manager and LED Manager.	Developer to implement	Throughout operation. Monthly checks
Clear criteria for identifying and funding community projects and initiatives in the area must be identified. The criteria must be aimed at maximising the benefits for the community as a whole and not individuals within the community.	Developer to implement	Throughout operation. Monthly checks
Strict financial management controls, including annual audits, must be instituted to manage the funds generated for the Community Trust from the WEF.	Developer to implement	Throughout operation. Monthly checks
Noise		
The candidate turbine is available in a noise-mitigated configuration with blade trailing edge serrations and nacelle insulation, which would reduce noise emissions by 2.5 dBA. The following turbines would require to be installed in this configuration: • Phase 1 individually: turbine 16; • Phase 2 individually: turbine 31; • Phase 3 individually: turbines 41 to 48; and • Cumulatively: turbines 16, 17, 31 and 41 to 48. It must be noted that mitigation of turbines 16 and 17 are only required in respect of location 6. As stated above this is not permanently occupied, so subject to agreement with the appropriate landowner, mitigation of turbines 16 and 17 may not be necessary in practice. Mitigation of turbine 31 is required in respect of locations 8 and 9, and mitigation of turbines 41 to 48 in respect of locations 12, 13 and 14. It is understood that agreement may be possible with landowners that noise levels are acceptable and / or relocation of farmworkers at these locations, in which case the use of noise-mitigated turbines may not be necessary. Should a turbine model other than the candidate be installed, consideration should be given to the noise emission of that turbine model and appropriate mitigation included if necessary.	Developer to implement	Throughout operation. Monthly checks

8 ALIEN INVASIVE MANAGEMENT PLAN

8.1 Purpose of the Alien Invasive Management Plan

The purpose of the Alien Invasive Management Plan is to provide a framework for the management of alien and invasive plant species during the construction and operation of the Highlands North Wind Energy Facility. The broad objectives of the plan includes the following:

- Ensure alien plants do not become dominant in parts or the whole site through the control and management of alien and invasive species presence, dispersal & encroachment
- Initiate and implement a monitoring and eradication programme for alien and invasive species
- Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

8.2 Problem Outline

Alien plants replace indigenous vegetation leading to severe loss of biodiversity and change in landscape function. Potential consequences include loss of biodiversity, loss of grazing resources, increased fire risk, increased erosion, loss of wetland function, impacts on drainage lines, increased water use etc.

In addition, the Conservation of Agricultural Resources Act (Act 43 of 1983), as amended in 2001, requires that land users clear *Declared Weeds* from their properties and prevent the spread of *Declared Invader Plants* on their properties.

Table 3 of CARA (the Conservation of Agricultural Resources Act) lists all declared weeds and invader plants. Alien plants are divided into 3 categories based on their risk as an invader.

- Category 1 - These plants must be removed and controlled by all land users. They may no longer be planted or propagated and all trade in these species is prohibited.
- Category 2 – These plants pose a threat to the environment but nevertheless have commercial value. These species are only allowed to occur in demarcated areas and a land user must obtain a water use licence as these plants consume large quantities of water.
- Category 3 – These plants have the potential of becoming invasive but are considered to have ornamental value. Existing plants do not have to be removed but no new plantings may occur and the plants may not be sold.

The following guide is a useful starting point for the identification of alien species: Bromilow, C. 2010. *Problem Plants and Alien Weeds of South Africa*. Briza, Pretoria.

8.2.1 Vulnerable Ecosystems and Habitats

Certain habitats and environments are more vulnerable to alien plant invasion and are likely to bear the brunt of alien plant invasion problems at the site. In addition, construction activities and changes in water distribution at the site following construction are also likely to increase and alter the vulnerability of the site to alien plant invasion.

Areas at the site which are likely to require specific attention include the following:

- Wetlands, drainage lines and other mesic areas
- Cleared and disturbed areas such as road verges, crane pads and construction footprints etc.

- Construction camps and lay-down areas which are cleared or are active for an extended period

8.2.1.1 Wetlands, drainage lines and other mesic areas

There are a relatively large number of drainage lines at the site as well as a number of artificial wetlands. Disturbance within these areas often results in alien plant invasion on account of the greater water and nutrient availability in this habitat. Although there are no turbines within such areas, numerous road crossings will be required. The disturbance footprint within such areas must be minimized and these areas must be checked for alien species more than the surrounding landscape.

8.2.1.2 Cleared and disturbed areas

Cleared and disturbed areas are clearly vulnerable to invasion on account of the lack of existing plant cover to resist invasion as well as the disturbance created during construction which promoted the germination and establishment of alien plant species.

8.2.1.3 Construction camps and laydown areas

Construction camps and lay down areas are either cleared of vegetation or prolonged activities in these areas result in negative impact on indigenous vegetation. In addition, repeated vehicle and human activity in these areas usually results in the import of alien plant seed on clothes, dirty vehicles or with construction machinery and materials

8.3 General Clearing and Guidance Principles

- Alien control programs are long-term management projects and must include a clearing plan which includes follow up actions for rehabilitation of the cleared area. Alien problems at the site must be identified during pre-construction surveys of the development footprint. This may occur simultaneously to other required reaches and surveys. The clearing plan must then form part of the pre-construction reporting requirements for the site.
- The plan must include a map showing the alien density & indicating dominant alien species in each area.
- Lighter infested areas must be cleared first to prevent the build-up of seed banks.
- Pre-existing dense mature stands ideally must be left for last, as they probably won't increase in density or pose a greater threat than they are currently.
- Collective management and planning with neighbours may be required in the case of large woody invaders as seeds of aliens are easily dispersed across boundaries by wind or water courses.
- All clearing actions must be monitored and documented to keep track of which areas are due for follow-up clearing.

8.4 Clearing Methods

- Different species require different clearing methods such as manual, chemical or biological methods or a combination of both.
- However care must be taken that the clearing methods used do not encourage further invasion. As such, regardless of the methods used, disturbance to the soil must be kept to a minimum. Fire is not a natural phenomenon in the area and fire must not be used for alien control or vegetation management at the site.
- The best-practice clearing method for each species identified must be used. The preferred clearing methods for most alien species can be obtained from the DWAF Working for Water Website. http://www.dwaf.gov.za/wfw/Control/

8.5 Use of Herbicide for Alien Control

Although it is usually preferable to use manual clearing methods where possible, such methods may create additional disturbance which stimulates alien invasion and may also be ineffective for many woody species which re-sprout. Where herbicides are to be used, the impact of the operation on the natural environment must be minimised by observing the following:

- Area contamination must be minimised by careful, accurate application with a minimum amount of herbicide to achieve good control.
- All care must be taken to prevent contamination of any water bodies. This includes due care in storage, application, cleaning equipment and disposal of containers, product and spray mixtures.
- Equipment must be washed where there is no danger of contaminating water sources and washings carefully disposed of in a suitable site.
- To avoid damage to indigenous or other desirable vegetation, products must be selected that will have the least effect on non-target vegetation.
- Coarse droplet nozzles must be fitted to avoid drift onto neighbouring vegetation.
- The appropriate health and safety procedures must also be followed regarding the storage, handling and disposal of herbicides.

For all herbicide applications, the following guidelines must be followed:

Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation.

9 ALIEN PLANT MANAGEMENT PLAN

9.1 Construction Phase Activities

The following management actions are aimed at reducing soil disturbance during the construction phase of the development, as well as reducing the likelihood that alien species will be brought onto site or otherwise encouraged.

Construction Phase Action	Frequency
The ECO is to provide permission prior to any vegetation being cleared for development.	Daily
Clearing of vegetation must be undertaken as the work front progresses – mass clearing must not occur unless the cleared areas are to be surfaced or prepared immediately afterwards.	Weekly
Where cleared areas will be exposed for some time, these areas must be protected with packed brush, or appropriately battered with fascine work. Alternatively, jute (Soil Saver) may be pegged over the soil to stabilise it.	Weekly
Cleared areas that have become invaded can be sprayed with appropriate herbicides provided that these are such that break down on contact with the soil. Residual herbicides must not be used.	Weekly
Although organic matter is frequently used to encourage regrowth of vegetation on cleared areas, no foreign material for this purpose must be brought onto site. Brush from cleared areas must be used as much as possible. The use of manure or other soil amendments is likely to encourage invasion.	Weekly
Clearing of vegetation is not allowed within 32 m of any wetland, 80 m of any wooded area, within 1:100 year floodlines, in conservation servitude areas or on slopes steeper than 1:3, unless permission is granted by the ECO for specifically allowed construction activities in these areas	Weekly
Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material such as	Weekly

building sand or dirty earth-moving equipment.) Stockpiles must be checked regularly and any weeds emerging from material stockpiles must be removed.	
Alien vegetation regrowth on areas disturbed by construction must be controlled throughout the entire site during the construction period.	Monthly
The alien plant removal and control method guidelines must adhere to best-practice for the species involved. Such information can be obtained from the DWAF Working for Water website.	Monthly
Clearing activities must be contained within the affected zones and may not spill over into demarcated No Go areas.	Daily
Pesticides may not be used. Herbicides may be used to control listed alien weeds and invaders only	Monthly
Wetlands and other sensitive areas must remain demarcated with appropriate fencing or hazard tape. These areas are no-go areas (this must be explained to all workers) that must be excluded from all development activities.	Daily

9.1.1 Monitoring Actions - Construction Phase

The following monitoring actions must be implemented during the construction phase of the development.

Monitoring Action	**Indicator**	**Timeframe**
Document alien species present at the site	List of alien species	Pre-construction
Document alien plant distribution	Alien plant distribution map within priority areas	3 Monthly
Document & record alien control measures implemented	Record of clearing activities	3 Monthly
Review & evaluation of control success rate	Decline in documented alien abundance over time	Biannually

9.2 Operational Phase Activities

The following management actions are aimed at reducing the abundance of alien species within the site and maintaining non-invaded areas clear of aliens.

Operational Phase Action	**Frequency**
Surveys for alien species must be conducted regularly. Every 6 months for the first two years after construction and annually thereafter. All aliens identified must be cleared.	Every 6 months for 2 years and annually thereafter
Where areas of natural vegetation have been disturbed by construction activities, revegetation with indigenous, locally occurring species must take place where the natural vegetation is slow to recover or where repeated invasion has taken place following disturbance.	Biannually, but revegetation must take place at the start of the rainy season
Areas of natural vegetation that need to be maintained or managed to reduce plant height or biomass, must be controlled using methods that leave the soil protected, such as using a weed-eater to mow above the soil level.	When necessary
No alien species must be cultivated on-site. If vegetation is required for esthetic purposes, then non-invasive, water-wise locally-occurring species must be used.	When necessary

9.2.1 Monitoring Actions - Operational Phase

The following monitoring actions must be implemented during the construction phase of the development.

Monitoring Action	Indicator	Timeframe
Document alien species distribution and abundance over time at the site	Alien plant distribution map	Biannually
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Quarterly
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

9.3 Decommissioning Phase Activities

The following management actions are aimed at preventing the invasion, by alien plant species, of the re-vegetated areas created during the decommissioning phase. Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to operation.

Decommissioning Phase Action	Frequency
All damaged areas shall be rehabilitated if the infrastructure is removed and the facility is decommissioned	Once off
All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction.	Once off, with annual follow up re-vegetation where required
Maintain alien plant monitoring and removal programme for 3 years after rehabilitation.	Biannually

9.3.1 Monitoring Actions - Decommissioning Phase

The following monitoring and evaluation actions must take place during the decommissioning phase of the development

Monitoring Action	Indicator	Timeframe
Monitor newly disturbed areas where infrastructure has been removed to detect and quantify any aliens that may become established for 3 years after decommissioning and rehabilitation	Alien plant surveys and distribution map	Biannually until such time as the natural vegetation has recovered sufficiently to resist invasion.
Monitor re-vegetated areas to detect and quantify any aliens that may become established for 3 years after decommissioning and rehabilitation	Alien plant surveys and distribution map	Biannually for 3 years
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien	Annually for 3 years

	distribution and cover over time at the site	

10 PLANT RESCUE AND PROTECTION PLAN

10.1 Purpose

The purpose of the plant rescue and protection plan is to implement avoidance and mitigation measures to reduce the impact of the development on listed and protected plant species and their habitats. Although this report identifies those species suitable for search and rescue at the site, it is important to note that a preconstruction walk-through of the site would also be important to refine the list of species identified for search and rescue, as well as locate such species prior to construction.

The objective of reusing plants on the project area is to prevent the loss of species either directly or through future extinction and minimising impacts of development on population dynamics of species of conservation concern.

Preserving the natural configuration of habitats as part of ecosystems, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist.

10.2 Effect of removing individual species of conservation concern

Species of conservation concern are declining either due to overexploitation or because their range of occupancy is limited and further infringed on by development. Most plant populations require a certain minimum number of individuals within a population or metapopulation to allow for sufficient genetic transfer between individuals. This prevents genetic erosion and hence weakening of the ability of individuals to persist in their environments. Similarly, where the distance between metapopulations is significantly increased due to fragmentation and the resultant loss of some populations, populations may suffer genetic decline due to restricted movement of pollen. Pollinators or other species that depend on a particular plant species for a specific microhabitat or food source may be equally affected because of the reduction of available resources. Therefore the aim of plant rescue actions are always to maintain as many individuals of a plant population in as close proximity to the original habitat as possible to minimise loss of individuals and fragmentation of populations to prevent the creation of future extinction debts of the development.

10.3 Plant Rescue and Protection

Successful plant rescue can only be achieved if:

- Species can be removed from their original habitat with minimal damage to the plant, especially the roots.
- All plants removed are safely stored and treated according to their specific requirements prior to being transplanted again.
- They are relocated into a suitable habitat and protected from further damage and all disturbances to aid their re-establishment.
- Timing of planting activities is planned with the onset of the growing season.
- Steps are taken where necessary to aid the initial establishment of vegetation, including occasional watering.

10.4 Time of Planting

- All planting shall be carried out as far as is practicable during the period most likely to produce beneficial results (i.e. during the peak growing season), but as soon as possible after completion of a section of earthworks.

- Drainage line rehabilitation preparation must be done during autumn, and planting of appropriate species in these areas must commence during early spring after the first rains.

10.5 Plant Search and Rescue

Prior to construction, once all the areas where topsoil will be removed or areas will be transformed have been demarcated, the ECO and contractor will be responsible to remove all bulbous species from the topsoil, as well as succulents and small indigenous shrubs that can be transplanted. These are to be kept in a raised, protected position in a designated area until they can be replanted again as part of the rehabilitation process. Further details are listed in the Re-vegetation and Habitat rehabilitation Plan.

11 RE-VEGETATION AND HABITAT REHABILITATION PLAN

The Revegetation and Habitat Rehabilitation Plan addresses the need to mitigate all impacts leading to disturbed vegetation, loss of species and/or agricultural potential, disturbed soil surfaces, and generally bare soils prone to erosion and further degradation on the proposed development site. The plan overlaps to some degree with the Erosion Management Plan, and for successful rehabilitation, it is imperative that this plan is at all times used in conjunction with other EMPRs mentioned.

The objective of the plan is therefore to provide:

- Protocols for the removal, temporary storage and replanting of plant species of conservation concern Protocols for the rehabilitation of vegetative cover across the project area
- Tools for planning the rehabilitation work and responding to unforeseen events Guidelines on implementation and post-implementation tasks Criteria for evaluating rehabilitation success
- A summary of items to be included in the rehabilitation budget to ensure that there is sufficient allocation of resources on the project budget so that the scale of EMPR-related activities is consistent with the significance of project impacts

The objective of rehabilitation and revegetation of the development area is:

- Preventing the loss of species either directly or through future extinction and minimising impacts of development on population dynamics of species of conservation concern.
- Preserving the natural configuration of habitats as part of ecosystems, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist.
- Preserving or re-creating the structural integrity of natural plant communities. Actively aid the improvement of indigenous biodiversity according to a desirable end state according to a previously recorded reference state. This reference state, if healthy, will be dynamic and able to recover after occasional disturbances without returning to a degraded state.
- Improving the ecosystem function of natural landscapes and their associated vegetation.
- Successful rehabilitation can only be achieved with: »A long-term commitment »Practical, adaptive management »Viable goals of desired outcomes

Prior to vegetation rehabilitation, all stakeholders involved must be consulted to determine:

- What the rehabilitation is ultimately aiming for– rehabilitation of cropping/grazing lands or rehabilitation of indigenous vegetation, after soil erosion and storm water management is in place and IAPs have been cleared?
- A clear definition of incompatible and compatible vegetation on and in the immediate surroundings of the development must be defined and maintained as such. No tree or

shrubs shall be allowed to grow to a height in excess of the horizontal distance of that tree or shrub from the nearest newly developed structure or to grow in such a manner as to endanger the development or its operation

- Who will take long-term ownership and hence responsibility for the rehabilitation and its subsequent monitoring and management? Continued monitoring of vegetation establishment and composition, as well as erosion detection will have to be coupled with continued follow-up maintenance of rehabilitation and erosion control from commencement of activity up to the decommissioning phase.
- The ultimate objective for rehabilitation must focus on the stabilisation of soil erosion, retaining agricultural potential of transformed areas and /or the establishment of a dense and protective plant cover and the maintenance of habitats to enable vegetation to persist and flourish on rehabilitated areas indefinitely, ultimately relying only on environmental resources.

11.1 Map and create management areas

The entire project area must be mapped and divided into management areas indicating:

- Current land cover
  - Roads and residential
  - Areas with IAPs, subdivided further in sparse or dense infestations where applicable
  - Transformed areas
  - Untransformed indigenous vegetation

For every one of the management areas, the project proponent, in consultation with the land users, will have to decide what intervention will be necessary, desirable, and feasible to enable the development of the project and long-term sustainable maintenance of infrastructure. Thus for every management area there must be an operational outline on:

- what will happen there
- what needs to be mitigated – including storm water- and erosion management
- which management units need priority intervention/mitigation
- how will this mitigation / intervention be done (method statements) including schedule of work
- realistic and desirable end states including list of species that must be established to initiate rehabilitation after initial revegetation
- approximate timeframes
- monitoring protocol to evaluate success or failures of interventions
  - establish permanently marked transects and monitor with fixed-point photography who will be responsible for doing what how will different actions be integrated to achieve and maintain or improve the desirable end state of the environment of that management unit

Special attention will have to be given to drainage zones, as these not only have very active morphodynamics, but are also distributers of seeds – both indigenous and of IAPs. Thus clearing a downstream invasion of aliens to enable maintenance of the development will be futile if the upstream IAPs are not cleared or at least aggressively controlled.

11.2 Setting realistic rehabilitation goals

Rehabilitation efforts typically aim at improving ecosystem function that consists of a series of processes, which can in the end be evaluated against a desired outcome or reference state of the vegetation and environment.

Attainable goals of rehabilitation on the project area must be possible and viable for at least the following:

- Stabilisation of soils
- Stabilisation of riparian areas
- Storm water reduction through management and wetland integrity
- Clearing of IAPs
    - The degree to which IAPs can be cleared from the project area needs to be determined according to desirability, available project funding, personnel and project requirements
- Restoring and/or rehabilitating vegetative cover on non-transformed areas to obtain an acceptable vegetation cover that can be maintained or persists on its own indefinitely.

11.3 Remove or ameliorate the cause of degradation

This will include:

- Physical rehabilitation of topsoil where it has been removed.
- Topsoil on areas that have not been cultivated are considered as the upper 20 - 30 cm only. These contain the most important nutrients, micro flora and –fauna essential for nutrient cycling processes. Topsoils are also an important source of seeds.
- Subsoils and overburden substrata lack the above elements and will first have to be used for physical rehabilitation of landscapes as and where necessary, and then overlain with topsoils.
- Stabilisation of topsoils and prevention of erosion – refer to the Erosion management plan.
- Removal of all invasive vegetation – refer to the Alien Invasive Management Plan
    - Where it is desirable to use brush or logs of the cleared vegetation for soil stabilisation, such material must be free of regenerative material – e.g. seeds or root suckers.

11.4 Initial Revegetation

Immediately after clearing of vegetation, the soil surface must be inspected for signs of erosion and stabilised as soon as possible. After completion of construction, such erosion stabilisation must preferably be with a cover of vegetation. A dense initial grass or other perennial cover will be desirable. The appropriate seed mix must be determined in consultation with an ecologist familiar with the area. The aim of the first vegetation cover is to form a protective, relatively dense indigenous layer to slow runoff, increase moisture infiltration into the soil, and gradually change the soil nutrient status in order for it to be more favourable for other desirable indigenous vegetation to become established.

11.5 Natural seed banks and improvement of plant structural and compositional diversity

It is expected that soil seed banks of indigenous vegetation will be present to initiate initial vegetation cover, but may not be sufficient to establish an acceptable cover of desirable species. After deciding which indigenous species must be re-introduced, seed must be ideally collected from site or an environmentally-matched site nearby.

Seed collection may be done throughout the year as seed ripens, but can also be restricted to summer, when a large amount of the perennial seed should have ripened. Seeds must be stored in paper or canvas bags dusted with insecticide, and sown at the onset of the rainy season.

Alternatively, slower-growing perennials may be raised from seed or cuttings in a nursery and then transplanted once established. It will be beneficial to investigate if community members would be able to create and maintain such a nursery, or if there are nurseries in the area, that raise indigenous flora from the area.

The final vegetation cover must resemble the original (non-encroached) vegetation composition and structure as far as practicable possible or permissible within each management unit.

For drainage areas:

- First restore drainage line morphology following the guidelines of the Erosion Management Plan – without that ecological recovery cannot be initiated
- Determine if natural seed sources may be present further upstream
- If such upstream seed sources are still present, rehabilitation of riparian vegetation after soil erosion management will most likely occur naturally, PROVIDED that follow-up monitoring of the establishment of vegetation is carried out, and all invasive species eradicated as they emerge. This can only be achieved with a long-term commitment (> 5 years minimum)
- Should no upstream seed resources be available, suitable species (as determined in consultation with an ecologist) must be sown or planted.

11.6 Monitoring and follow-up action

Throughout the lifecycle of the development, regular monitoring and adaptive management must be in place to detect any new degradation of ecosystems affected by the development, and remedy these as soon as detected.

During the construction phase, the ECO and contractor will be responsible for initiating and maintaining a suitable monitoring system. Once the development is operational, the project proponent will have to identify a suitable entity that will be able to take over and maintain the monitoring cycle and initiate adaptive management as soon as it is required. Monitoring personnel must be adequately trained.

The following are the minimum criteria that must be monitored:

- Composition and density of replanted vegetation, distinguishing between species introduced for initial revegetation only and species that are part of the pre-determined desirable end state
- Associated nature and stability of surface soils
  - It is recommended that permanent transects are marked and surveyed annually according to the LFA technique (Tongway and Hindley 2004), adapted to integrate both surface soil characteristics and the vegetation to be monitored
- Re-emergence of IAPs
  - If noted, remedial action must be taken immediately according to Working for Water specifications
- Nature and dynamics of riparian zones
  - Stability of riparian vegetation
  - Any form of bank erosion, slumping or undercutting
  - Stability of channel form and width of streams – if this increases, it shows that vegetation on plains and/or riparian areas and upper drainage lines are not yet in a stable enough state to be fully functional in reducing excess runoff and the ecosystem overall is losing valuable resources

11.7 Timeframes and duration

- Rehabilitation will occur during construction, as areas for the re-application of topsoil and revegetation become available or where revegetation can be initiated after clearing of invasives or to stabilise erosion.
- The initial revegetation period post construction is estimated to be over a period of 6 (minimum) to 12 months (maximum), or a time period specified by the Horticultural Landscape Contractor, particularly if planting of trees and shrubs occurs.
- The rehabilitation phase (including post seeding maintenance) must be at least 12 months (depending on time of seeding and rainfall) to ensure establishment of an acceptable plant cover is achieved (excluding invasive plant species or weeds).
- If the plants have not established and the acceptable plant cover is not achieved within the specified maintenance period, maintenance of these areas shall continue until at acceptable plant cover is achieved (excluding alien plant species or weeds).
- Additional seeding or planting may be necessary to achieve acceptable plant cover. Hydroseeding may have to be considered as an option in this case.
- Any plants that die, during the maintenance period, shall be replaced by the Horticultural Landscape Contractor (at the Horticultural Landscape Contractor's cost if it was due to insufficient maintenance).
- Succession of natural plant species must be encouraged
- Monitoring of rehabilitation success and follow-up adaptive management, together with clearing of emerging invasives shall be carried on until the decommissioning phase has been completed.

12 OPEN SPACE MANAGEMENT PLAN

The objective of open space management is to restore, enhance and rehabilitate open spaces, improve climate change adaptations through the minimisation of biodiversity loss, and mitigate against environmental degradation. Management actions consider open spaces and natural areas as well as community perceptions of these.

In the context of the proposed grid connections and substations the primary purpose of the open plan management plan is therefore to:

- Minimise visual impact on the character of the area; and
- Maintain biodiversity within the area to ensure that no long-term negative impacts occur on the local environment.

The proposed grid connection connections and associated infrastructure have the potential to impact negatively on the character of the area, as identified in the Visual Impact Assessment conducted during the EIA phase. The following actions must be implemented to minimise this visual impact:

- Grid connection route to avoid visually sensitive peaks, major ridgelines, scarp edges and slopes steeper than 1:5 gradient
- Substation to be sited in unobtrusive low-lying areas, away from roads and habitations, and screened by berms and/or tree-planting where feasible.
- Operations and maintenance buildings and parking areas to be located in an unobtrusive area and consolidated to avoid sprawl of buildings in the open landscape.
- Access roads to be in sympathy with the contours, avoid steep 1:5 slopes and drainage courses, and kept as narrow as possible.
- Access and haul roads to use existing farm tracks as far as possible.
- Construction camp, stockpiles and lay-down area to be located out of sight of district roads, possibly in the vicinity of the proposed substation and O&M buildings.
- Disturbed areas rather than pristine or intact land to preferably be used for the construction camp. Construction camp and laydown areas to be limited in area to only that which is essential.

- Measures to control wastes and litter to be included in the contract specification documents.
- Provision to be made for rehabilitation/ re-vegetation of areas damaged by construction activities.

In order to maintain biodiversity the Alien Invasive, Plant Rescue and Protection and Re-vegetation and Habitat Management Plans must be adhered to.

In addition the following actions must be implemented by the Contractor and Project Company:

- Promote environmental awareness in all employees and sub-contractors and create an understanding of the environmental sensitivities of the project site;
- No waste, including organic matter may be disposed of anywhere on site, except in provided bins placed at convenient locations, especially during the construction period. Disciplinary actions must be taken against littering.
- Open spaces are to be kept free of alien plants and weeds;
- Indigenous plants may not be collected or removed from the site;
- Access to the facility must be strictly controlled
- All visitors and contractors must be required to sign-in
- Signage at the entrance must indicate that disturbance to fauna and flora is strictly prohibited.

The following activities must not be permitted by anyone except the landowner or his representatives:

- No fires within the site
- No hunting, collecting or disturbance of fauna and flora, except where required for the safe operation of the facility and only by the Environmental Officer on duty and with the appropriate permits and landowner permission.
- No driving off of demarcated roads
- No interfering with livestock.

12.1 Grazing Management

The development of the wind energy facility will not prevent the site from being used for its current landuse of extensive livestock production. Extensive livestock grazing is compatible with biodiversity maintenance provided that it is implemented according to the basic principles of sustainable grazing management. While the majority of these are beyond the scope of the current plan, the following basic principles must be adhered to:

- A grazing management plan for the site must be developed in cooperation with Agricultural Extension services.
- The stocking rate applied must be within the recommended limits as identified by the Department of Agriculture.
- Livestock must be rotated through the different paddocks at the site in a manner which allows for the growth and recovery of the vegetation between grazing events.
- Precautions must be taken to ensure that the development of the site does not increase the risk of stock theft within the facility. These include access control as previously described, as well as security patrols.

13 TRAFFIC MANAGEMENT PLAN

The objective of the traffic management plan is the prevention of incidents from the use of vehicles and disturbance of local traffic on public roads during the construction, operation and decommissioning phases of the proposed projects. Traffic volumes are most likely to increase during the construction phase. However, due to the remote location of the site, and the low volume of traffic on public roads in the area the impact is expected to be low.

Actions to be implemented by the Contractor and Project Company:

- Site-specific traffic plan to be developed and implemented during the detailed design phase prior to construction;
- Limit use of private cars by arranging mini bus transport service for workers;
- Monitor for overloading of vehicles;
- Use only well trained, suitably qualified and experienced drivers in possession of an appropriate and valid driver's license;
- All vehicles must be roadworthy and serviced regularly;
- Clear and visible signage must be placed on and around site, clearly demarcating safe entry and exit points;
- Require all drivers to abide by standard road and safety procedures on site;
- When travelling on public roads all speed limits and rules of the road must be adhered to; and
- Limit dust generation by applying dust suppressants and postponing dust generating activities during period of strong winds and enforcing a strict speed limit of 40 km/h on unpaved roads.

Monitoring actions to be conducted by the ECO

- Maintain incidents/complaints register for community complaints;
- Monitor dust generation and implementation of management actions detailed above.

14 TRANSPORTATION MANAGEMENT PLAN

The Transportation Management Plan aims to ensure the safe transportation of all components required for the construction of the proposed projects to the construction site. This includes the, turbines, substation transformers, electrical cables and pylon structures.

The following actions must be implemented by the developer and Contractor:

- Apply for all relevant permits for abnormal loads and route clearances with the relevant authorities prior to construction;
- Appoint a qualified specialist to conduct a detailed site-specific Transport Risk Assessment during the detailed design phase and prior to construction;
- Determine the pre-construction condition of the road immediately prior to construction by carrying out a condition assessment or from recent pavement management system condition assessments if available from the Provincial Authorities;
- Public notices regarding any planned abnormal load transports must be placed at the construction site to inform affected parties;
- Abnormal loads must conform with legal maximum dimensions, and vehicles carrying abnormal loads must display sufficient signage;
- Any roads damaged during the transportation of components, or from other construction vehicles must be rehabilitated and returned to pre-construction conditions.

The following monitoring activities must be carried out by the ECO:

- Conduct site audits and report non-compliance with the above-mentioned conditions

15 STORMWATER MANAGEMENT PLAN

The objective of the storm water management plan (SWMP) is to prevent increased soil erosion, to contain any contaminated run-off and to avoid water logging and pollution. The Erosion Management Plan (see below) must therefore be seen in conjunction with the SWMP. Actions are listed that will ensure that storm water is channelled in a controlled manner from roads and substations towards natural drainage lines, without impeded natural surface flows.

- Develop and implement a site-specific storm water management plan during the detailed design phase of the projects and prior to construction;
- In the detailed design phase of the project minimise any water crossings and utilise existing roads wherever possible;
- Enforce 32 m construction buffers of all rivers, streams and waterbodies;
- Should new roads be required to cross any banks or channels these must be secured with erosion protection (i.e. gabions etc);
- Monitor for erosion during the clearing of vegetation;
- Avoid hard-engineered surfaces (i.e. construct gravel roads and not asphalt roads wherever possible);
- Roads in steep areas must be equipped with side drainages and culverts that channel the run-off to natural drainage lines without gaining velocity and causing erosion;
- Construction camps and temporary ablution facilities must be located beyond the 1:100 year floodline;
- Stockpiles must be located on flat areas and protected from erosion;
- The substation site design must include side water outlets and an adequate slope to allow storm water run-off from the paved areas; and
- Prevent surface run-off from areas of potential contamination.

16 EROSION MANAGEMENT PLAN

16.1 Purpose

The purpose of the erosion management plan is to implement avoidance and mitigation measures to reduce the erosion potential and the likely impact of erosion associated with the construction and operational phases of the proposed facility. As part of the management plan, measures to protect hydrological features from erosion damage are included.

16.2 Scope and Limitations

This plan is intended at introducing measures aimed at reducing the negative impacts of erosion on biodiversity as well as reducing the vulnerability of the site to erosion problems during the construction and operational phases of the development. The focus is on managing runoff and reducing the construction phase impact on ecologically sensitive areas. The plan does not cover engineering-side issues which are of relevance to soil management and erosion. Therefore issues such as the potential presence of heaving clays, compressible soils, perched water tables, dispersive soils and corrosive groundwater at the site are beyond the general scope of this study and are not directly dealt with. These issues would need to be addressed and their relevance assessed during detailed geotechnical investigation of the site.

16.3 Background

16.3.1 Types of Erosion

Erosion comes in several forms, some of which are not immediately obvious. The major types of erosion are briefly described below:

Raindrop impact

This is the erosion that occurs due to the "bomb blast" effect of raindrop impact. Soil particles can be blasted more than a meter into the air. Apart from loosening soil particles, the effect can also break soil aggregates apart and form a clay seal on the surface which resists infiltration and results in increased levels of runoff. This effect is most important when large areas of exposed soils are present. If the site is cleared, then this effect will play an important role as it results in the soil surface becoming sealed which reduces infiltration and increases runoff, leading to erosion.

Sheet Erosion

This is the removal of a shallow and uniform layer of soil from the surface. It is caused initially by raindrop splash and then by runoff. Sheet erosion is often difficult to see as no perceptible channels are formed. Accumulated sediment at the bottom of the slope is often the only indicator. This is likely to be an important erosion type at the site given the gently sloping nature of the site and the susceptible soils.

Rill Erosion

This is the removal of soil from the surface whereby small channels or rills up to 300 mm are formed. It is caused by runoff concentrating into depressions, wheel tracks etc.

Gully Erosion

This is the removal of soil from the surface and sub-surface caused by concentrated runoff eroding channels greater than 300mm deep. Gully erosion often begins as rill erosion.

Wind Erosion

Wind erosion results from soil particles being picked up, bounced or moved by the wind. Wind erosion is primarily a problem in arid areas and may affect sands soils as well as fine-textured soils. Vegetation cover is usually an effective barrier to wind erosion, but large soils losses or degradation can occur in disturbed areas or on croplands.

16.3.2Promoting Factors

Rainfall characteristics

High-intensity, short-duration storm events have much greater erosion potential than low intensity, longer duration storm events with the same runoff volume. Intense storms produce larger raindrops, and are more likely to break up the soil and dislodge particles.

Soil erodibility

Soil erodibility is determined by the soils ability to resist detachment and transport due to rainfall, runoff and infiltration capacity. Well-structured soils with a high clay content are generally least erodible. Some clays are dispersible meaning that they break down when wet and become highly erodible. Silts and fine sands are highly erodible.

Length and Steepness of Slope

Steeper slopes cause runoff velocities to increase, resulting in increased erosion. As the slope length increases the opportunity for runoff to concentrate and achieve an erosive velocity increases.

Soil Surface Cover

Soil surface cover such as vegetation and mulch protect the soil surface from raindrop impact, reduce flow velocity, disperse flow, and promote infiltration and the deposition of sediment. This is a basic principle underlying many erosion control approaches which aim to modify the surface characteristics in order to reduce the flow velocity and reduce the potential for erosion. In this regard it is important to note that many of the practices which are used to enhance rehabilitation potential are also useful in reducing erosion potential.

16.3.3Erosion and Sediment Control Principles

The goals of erosion and sediment control during and after construction at the site must be to:

- Protect the land surface from erosion;
- Intercept and safely direct run-on water from undisturbed upslope areas through the site without allowing it to cause erosion within the site or become contaminated with sediment.
- Progressively revegetate or stabilise disturbed areas.
- Prevent damage to hydrological features such as drainage lines or wetlands, either within or adjacent to the site.

These goals can be achieved by applying the following principles:

1. Integrate project design with site constraints.
2. Plan and integrate erosion and sediment control with construction activities.
3. Minimise the extent and duration of disturbance.
4. Control stormwater flows onto, through and from the site in stable drainage structures.
5. Use erosion controls to prevent on-site damage.
6. Use sediment controls to prevent off-site damage.
7. Control erosion and sediment at the source.
8. Stabilise disturbed areas promptly.
9. Inspect and maintain control measures.

16.3.4On-Site Erosion Management

Exposed and unprotected soils are the main cause of erosion in most situations. Therefore, the erosion management plan and the revegetation and rehabilitation plan must be closely linked to one another and must not operate independently, but must rather be seen as complementary activities within the broader environmental management of the site and must therefore be managed together.

General factors to consider regarding erosion risk at the site includes the following:

- Soil loss will be greater during wet periods than dry periods. Intense rainfall events outside of the wet season, such as occasional unseasonal showers can also however cause significant soil loss. Therefore precautions to prevent erosion must be present throughout the year.
- Soil loss is related to the length of time that soils are exposed prior to rehabilitation or stabilization. Therefore the gap between construction activities and rehabilitation must be minimized. Allied to this the fact that topsoil does not store well and must preferably be used within a month or at most within 3 months to aid in the revegetation and rehabilitation of disturbed areas.
- Phased construction and progressive rehabilitation are important elements of the erosion control strategy.
- The extent of disturbance will influence the risk and consequences of erosion. Therefore large areas must not be cleared at a time, especially in areas such as slopes where the risk of erosion is higher.

16.4 Concentration of flows into downstream areas

Road crossings over drainage lines, streams and wetlands can impact downstream wetland ecosystems. Crossings that result in narrowing of the downstream system can result in concentration of flows and channelisation downstream. This may result in a loss of wetland function, and result in the drying out and shrinkage of the wetland area. Erosion and increased vulnerability to invasion of drier banks by alien vegetation may occur.

- Culverts must be adequately spaced such that they do not result in shrinkage of downstream wetlands. Where roads cross minor drainage channels, a single culvert may be adequate, aligned with the downstream drainage line. Where more substantial wetland systems are intercepted by a road, sufficient culverts must be provided such that downstream shrinkage of wetland width does not occur. Moreover, culverts must be aligned, as far impossible, with existing, natural channels.
- All crossings of drainage systems must ensure that both surface and shallow subsurface flows can be accommodated where appropriate and that unnatural channelisation does not occur downstream.

16.5 Runoff Concentration

The increase in hardened surfaces associated with roads, and other infrastructure will lead to a significant increase in volume and velocity of flow generated from these areas during large rainfall events.

Runoff from road surfaces is usually channelled off of the road surface towards the downslope side of the road. On steep slopes, the volumes and velocity of runoff generated may result in erosion of the surrounding areas. Therefore specific measures to curb the speed of runoff water is usually required in such areas, such as rock beds or even gabions. In addition, these areas must be monitored for at least a year after construction to ensure that erosion is not being initiated in the receiving areas. Once erosion on steep slopes has been initiated, it can be very difficult to arrest.

16.5.1 Diversion of Flows

Diversion of flows from natural drainage channels may occur when roads interrupt natural drainage lines, and water is forced to run in channels along the manipulated road edge to formalized crossing points. Even slight diversion from the natural drainage line can result in excessive downstream erosion, as the new channel cuts across the slope to reach the valley bottom. Should the access road to the site traverse any major drainage lines, the following principles must apply.

- Adequate culverts must be provided along the length of all roads to prevent diversion of flow from natural drainage lines.
- Culverts must be carefully located, such that outlet areas do in fact align with drainage lines.
- The downstream velocity of runoff must be managed, such that it does not result in downstream erosion – on steep slopes, where roads have been constructed on cut areas, allowance must be made for culverts to daylight sufficiently far down the slope that their velocities are managed and erosion does not occur.
- Where necessary, anti-erosion structures must be installed downstream of road drains – these may comprise appropriate planting, simple riprap or more formal gabion or other structures.
- Roads and their drainage system must be subject to regular monitoring and inspection, particularly during the wet season, so that areas where head cut erosion is observed can be addressed at an early stage.

16.6 Monitoring Requirements

16.6.1 Construction Phase

The following monitoring actions must be implemented during the construction phase of the development

Monitoring Action	Indicator	Timeframe
Identify all river and drainage line crossings affected by the development	Map of sites of potential concern	Preconstruction
Monitor cleared areas for erosion problems	Record of monitoring site, problems encountered and remedial actions implemented	Monthly during the rainy season and following significant rainfall events otherwise
Monitor vegetation clearing activities near sensitive areas such as wetlands or drainage lines	Activity log of monitoring actions and any mitigation and avoidance measures implemented	Monthly during the rainy season and following significant rainfall events otherwise
Monitor revegetated and stabilised areas	Record of monitoring site, problems encountered and remedial actions implemented	Monthly during the rainy season and following significant rainfall events otherwise

16.6.2 Operational Phase

The following monitoring actions must be implemented during the operational phase of the development:

Monitoring Action	Indicator	Timeframe
Monitor for the development of new erosion problems across the site, with a focus on areas where water has been diverted or collected from upslope onto downslope areas	Map of erosion problem areas	Quarterly
Document erosion control measures implemented	Records of control measures and their success rate.	Quarterly
Document the extent of erosion at the site and the remedial actions implemented	Decline in erosion and vulnerable bare areas over time	Biannually

17 FIRE MANAGEMENT PLAN

The National Veld and Forest Fires Act states that it is the landowner's responsibility to ensure that the appropriate equipment as well as trained personnel are available to combat fires.

Although fires are not a regular occurrence at the site, fires may occasionally occur under the right circumstances. Ignition risk sources in the area include the following:

- Lightning strikes
- The railway line which runs through the facility
- Personnel within the facility

- Infrastructure such as transmission lines

17.1.1 Firebreaks

Extensive firebreaks are not recommended as a fire risk management strategy at the site. The site is very large compared to the extent of the infrastructure and the maintenance of firebreaks would impose a large management burden on the operation of the facility. In addition, the risk of fires is not distributed equally across the site and within many of the lowlands of the site, there is not sufficient biomass to carry fires and the risk of fires within these areas is very low. Rather targeted risk management must be implemented around vulnerable or sensitive elements of the facility such as substations or other high risk components. Within such areas, the extent over which management action needs to be applied is relatively limited and it is recommended that firebreaks are created by mowing and that burning to create firebreaks is not used as this in itself poses a risk of runaway fires. Where such firebreaks need to be built such as around substations, a strip of vegetation 5 - 10 m wide can be cleared manually and maintained relatively free of vegetation through manual clearing on an annual basis. However if alien species colonise these areas, more regular clearing must be implemented.

18 FUEL STORAGE MEASURES

18.1 Storage Tanks

The storage tanks will be within contained areas to prevent spills contaminating soil and water, and with a design to capture and contain a volume of spill of at least 110% of the volume of stored fuel. These containers can be built in concrete and painted with anti-corrosive paint. The floor of the container must be inclined to permit the collection of the spilled liquids.

The storage tanks must also have a cover protection on top, prepared for drainage and collection of runoff.

18.2 GENERAL PROCEDURES

- Transport routes for the transport of fuel will be clearly indicated;
- Pollution control equipment (spill and leak cleaning kits) must be readily available;
- Ensure personnel training, including: measures to prevent fuel spills, to treat/clean fuel spills, how to react on spill of flammable liquids on clothing and in the inhalation of vapours, leaks simulations; fuel vapour recovery processes, etc. Keep records of all training;
- Maintain the premises and equipment in a clean and tidy state;
- Regularly clean outdoor areas with a broom;
- Wastewater from outside areas must be directed to the contaminated water drainage system, and not enter the storm water system;
- Used oils (waste oil) will be collected, re-used, stored and disposed of in line with disposal procedures for hazardous wastes;
- Ensure the proper management of other hazardous wastes (contaminated soils, used spilling kits, waste lube, etc.).

FILLING OPERATIONS

- Isolate the area by cones and a rope;
- Prohibit refuelling operations during tank filling operations;
- Avoiding having people who are not involved in the operation within a 10 metre radius;
- Prohibit smoking and the use of mobile telephones or any other ignition sources during tank filling operations or vehicle refuelling, within a 3 metre radius;

- Use a tight-fill cap to completely seal off the connections between the tubing and the truck's and station's tanks;
- Engines must be turned off during refuelling;
- Prevent overflowing and spilling situations when the storage tanks are being filled (verify filling sensors and be aware of overflow alarms).

Preventing Accidents with fuel mixtures

- Establish a procedure to deal with the potential occurrence of these situations, such as:
- The chemicals and reaction mechanisms associated with the substances mixed or blended must be well understood and documented
- Chemical and process hazards must be understood and addressed and the facilities must ensure that process equipment, controls, and procedures are designed, installed and maintained to safely operate the process
- All employees must understand the chemical and process hazards
- Facilities must establish a system for Standard Operating Procedures and ensure that they are understood and followed
- Display clear and informative messages for users of the station, as to how to deal with this situation;
- Prepare a procedure to suitably dispose of wastes recovered from the batches of fuel mixture.

Spill Kits

- Emergency spill kits of absorbent material (e.g. sand) must be provided and stored next to the higher risk sites, and must be easily-accessible, ideally outside, in order to allow an immediate response when a spill occurs. This will be clearly labelled and ready for use.
- Drums for the storage of contaminated material must be provided.
- An accurate drawing of the local drainage system shall be posted next to the spill kit.

Closure Phase

- During the closure phase, there may be loss of product into the soil, as a result of a deliberate or accidental release during closure and removal of tanks and tubing. In addition, this risk may arise outside of the facility site, if the tanks and/or tubing are not properly disposed of.
- In the closure phase, it is important to remove all tanks and pipes. A risk may arise if the tanks are left on site with residual products. As the integrity of the equipment will no longer be ensured or monitored.
- During closure, it must be ensured that facilities do not present a risk to the environment, health or safety. Measures must be taken to ensure that the closure does not result in an unacceptable risk, including:
    - Any and all waste products will be removed from the tanks. Care will be taken to ensure that no product is lost into the soil. Tank closure must be carried out safely, with the removal of explosive vapours, for example by filling the tanks with water or inert gases. All tanks will be safe prior to their removal from the ground. Similar methods will be employed prior to the removal of the pipes.
    - Water used in this process will be contaminated with residual product, and thus a water contamination risk may arise if the contaminated water is not disposed of in a way which is appropriate for hydrocarbon contamination. This would normally imply the removal to a suitable waste handling facility.
    - According to best environmental practices, the tanks, tubing and distributors will be disposed of. However, if the tanks remain in situ, it will be ensured that the

procedure is safe. After making the tanks inert and safe, they will be filled in with sand, concrete, inert mud or hydrophobic foam.

- The tanks and associated tubing which are no longer considered appropriate or safe for fuel storage will not be used for storage of other hydrocarbons, without first ensuring their integrity.
- The oil/water separators will be removed for disposal, off the facility site. Otherwise they will be filled in a similar way to the tanks. Regardless of the fate of the oil/water separator, all liquid and mud waste will be removed (off the facility site) and all the inlets and outlets will be sealed.
- Whatever drainage system left behind will be modified to ensure that it does not serve as a path for pollutants to reach groundwater or other waters.
- If the deactivation is temporary, product can be left in the tanks. In this case, all monitoring procedures will be carried out as if the facility were in operation. If for any reason the monitoring cannot carry on, the tanks will be emptied and made inert.
- Personnel involved in the closure of a filling and fuel station will be aware and respect obligations with regards to waste disposal, in line with the best practices described above.

Environmental Aspect	Action or Measure
Prevent accidental spills from entering the stormwater drainage system	Provide cleaning equipment conceived specifically to deal with minor spills as may occur at the station. Place a clearly-identified spill kit in a visible location for each fuelling line.
	Develop a step-by-step guide to use of the spill kit.
	Develop an evacuation plan and/or response procedures for emergencies involving large fuel spills.
	Train the whole team in the emergency response procedures. Make sure that all staff knows where the emergency equipment is to be found and is acquainted with its maintenance.
	Label all of the stormwater drains on site in the proximity of the facilities as "Clean Water Only".
	Inspect the fuel distribution area in order to confirm that rainwater drained or emptied from the roof doesn't enter the areas marked out.
	Check whether the embankment around the fuel distribution area is in good condition and has the capacity to contain a fuel leak in the event of an emergency.
Minimise the risks of environmental contamination and from issues of workers' health and safety	Provide training to the staff regarding the disposal of material contaminated with fuel, such as absorbent material from the spill kit, soaked in fuel.
	Ensure that the product safety cards for all fuels and oils are up-to-date and accessible at all times.
Minimise the risks of fuel leaks as may result in pollution of the sub-soil and groundwater	Check if there is fuel, from a possible leak, in the spill containment sumps installed at the tank's discharge nozzle.
	Check if there is fuel, from a possible leak, in the all tanks containment sumps, installed on the manhole to the storage tanks. In the event of suspected leakage, report it immediately.

Environmental Aspect	Action or Measure
	Check if there is fuel or lube, from a possible leak in the containment sumps installed under the tanks.
Minimise the risks of fuel leaks as this may result in pollution of the sub-soil and groundwater	Check if there is fuel, from a possible leak, in the chambers of the containment sumps installed under the pumps
Minimise the risks of harmful emissions to the atmosphere and the loss of fuel	Check that lids, flanges and connections are closed.
	Confirm that the ventilation conduits are not blocked.
	Supervise the fuel deliveries.
Minimise the risks of water pollution	Carry out an Oil-Water Separator inspection to ensure effective treatment.
Integrity control	Adequate maintenance and calibration of the monitoring equipment

19 AVIFAUNA MONITORING AND MANAGEMENT PLAN

19.1 Construction Phase Bird Monitoring Programme

Construction phase bird monitoring must be conducted in line with the current best practise guidelines[3] and applicable species specific guidelines (i.e. Verreaux's Eagle guidelines[4]). Construction phase bird monitoring must be conducted throughout the entire construction phase of the WEF.

For the purposes of compiling this programme it assumed that the length of the construction phase will be 12 months, and hence this programme is based on a 12 month period. The length (and scope) of the programme must be revised once the construction schedule has been finalised, and any additional pre-construction bird monitoring has been completed.

An Environmental Control Officer (ECO) must oversee activities and ensure that the site specific EMPR is implemented and enforced.

19.1.1 General Construction Phase Mitigation Requirements

- Construction activities must be conducted to reduce unnecessary destruction of habitat;
- High traffic areas and buildings such as offices, batching plants, storage areas etc. must where possible be situated in areas that are already disturbed and existing roads and farm tracks must be used where possible;
- The minimum footprint areas of infrastructure must be used wherever possible, including road widths and lengths;
- No turbines must be constructed in no-go areas, while associated infrastructure must be avoided where possible in these areas;
- The lowest feasible number of turbines must be constructed for the required MW output. Therefore, fewer larger (i.e. with a higher MW output) turbine models must be favoured where possible;
- Any clearing of large trees (>5m in height), especially stands of large alien trees (e.g. Blue Gum or Pine) on site must be approved first by an avifaunal specialist. Before,

[3] Birds and Wind-Energy Best-Practice Guidelines. Third Edition, 2015 (Jenkins et al. 2015).
[4] Verreauxs' Eagle and Wind Farms-Guidelines for impact assessment, monitoring and mitigation. BirdLife SA, 2017.

clearing, the location and description of the trees must be provided to the specialist, who may request the ECO to inspect the trees for any nests prior to clearing;

- 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 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), construction 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; 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.

19.1.2Avifaunal Walkthrough

- Prior to construction, an avifaunal specialist must conduct a site walkthrough, covering the final infrastructure layout and 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.
- Should priority species nests be located, a protective buffer may be applied, within which construction activities may need to be restricted during the breeding season for that species.
- Following the specialist site walkthrough, any additional sensitive zones and no-go areas (e.g. nesting sites of Red Data species) are to be designated by the specialist who must advise on an appropriate buffer, within which construction activities may not occur during key breeding times.

19.1.3Construction Phase Nest Surveys

- During the construction phase, an avifaunal specialist must conduct a nest survey/exploration of the WEF site. This should be done during and after, the breeding season (i.e. approximately in July and again in September) of large Eagles (e.g. Martial and Verreaux's Eagle). The aim will be to locate any nest sites not yet found, so that these may continue to be monitored during the construction and operation phases, along with the monitoring of already identified nest sites;
- Appoint a specialist to design and conduct monitoring of the breeding of raptors at the various nests identified to date as well as any additionally located nests (see point above). This monitoring can be combined with the exploration described above, and must be conducted on two occasions (i.e. approximately in July and again in September) across each calendar year, during construction. The aim will be to monitor any disturbance to or displacement of the breeding birds during construction; and
- A specialist must conduct a search (during spring/summer breeding seasons) for breeding sites of Blue Cranes and monitor any such sites for breeding success/failure during the construction phase.

19.1.4Reporting

- An avifaunal specialist must confirm the reporting requirements, but these must be in line with guideline requirements and reports must be submitted to relevant stakeholders in line with applicable guidelines. At least two construction phase bird monitoring reports should be produced per year.

19.2 Operational Phase Bird Monitoring Plan

The aim of the operational phase monitoring will be to determine the actual impacts of the WEF on avifauna. These impacts can then be assessed against observed activity of birds on site during the same time (and associated environmental conditions) that the impacts were realised. Operational monitoring is therefore critical to:

1. Determine the actual impacts of the WEF;
2. Determine if additional mitigation is required (adaptive management); and
3. Improve future assessments

19.2.1General

Operational phase (i.e. post-construction) bird monitoring at the Highlands WEF must commence once all turbines have been erected and the blades are turning. This may be during the commissioning phase. The latest that monitoring should commence is on the commercial operation date of the facility. An avifaunal specialist must be appointed to design the site specific monitoring methodology (e.g. exact survey locations, sampling frequencies and sampling times etc.) and to implement the monitoring plan.

Monitoring must be done in line with the latest bests practise guidelines applicable at the time of monitoring commencing. Operational monitoring must have two components: Bird Activity Monitoring (BAM) and Carcass Searches (CS). In the first year, BAM and CS must run concurrently, and reporting must be combined where possible, allowing for the results of fatality monitoring to be interpreted against the results of the bird activity on the site over the same time period. The results of this monitoring and the carcass searchers in year one should advise the need for any additional ongoing activity monitoring or nest surveys beyond the first year month period. CS monitoring must continue regardless for the second and third year of operations, and then as a minimum must be conducted again in years 5, 10, 15, 20 and 25 of the facility.

Reports must be generated as part of operational monitoring programme and must be submitted to Birdlife SA, Endangered Wildlife Trust (EWT), Department of Environmental Affairs (DEA) and the relevant provincial environmental department/authority.

19.2.2Bird Activity Monitoring

- Bird Acitivy Monitoring (BAM) must repeat the survey protocols used in pre-construction monitoring (amended where these are outdated, to be more in line with current best practise for pre-construction monitoring), over at least the first one year of operations.
- BAM must be conducted over at least four separate seasonal site surveys per 12 month period.
- BAM must include Vantage Point (VP) Surveys, from the same VP locations used during pre-construction monitoring (where possible), over at least 12 hours per VP per season.
- BAM must also include transect (walked and driven) surveys, incidental observations, and surveys of relevant focal sites including nest sites.

19.2.3Carcass Searches

- Carcass Searches (CS) must be done for the first three years of operations. The need for further fatality monitoring (i.e. carcass searching) should then be reviewed, but at a minimum it must happen in year 5, 10, 15, 20, 25 etc. (i.e. every 5 years).
- Regular CS must cover 75% of all turbines or a minimum of 20 turbines. The turbine search interval should be determined by a specialist, in line with recorded scavenger rates at the site, but a minimum each turbine (selected for regular CS) must be searched every 5 days. Turbines not selected for regular CS, must be searched at least once every two weeks (14 days).

- As a minimum, the radius of the search area below each turbine should be equal to 75 % of the turbine height (ground to vertical blade tip).
- In order to determine the probability of an observer detecting a carcass, a total of four searcher efficiency trials (i.e. one per season) must be conducted each year. Trials should be conducted for each individual or search pair, under the supervision of the avifaunal specialist.
- The rate of removal/decay of carcasses should be estimated by conducting scavenger removal trials (four sets of trials per year). Fresh carcasses (where possible) of birds of similar size (and species where possible) to the priority species on the site must be used where possible.
- Reporting should include fatality estimation based on the results of the scavenger and efficiency trials, and the actual number of fatalities recorded by the searchers.
- CS should must also be conducted under any met masts and the grid connection powerline on a weekly basis.

19.2.4Programme Revision

The above programme is based on current best practise and knowledge. At the time of commencement of the WEF operations, this programme must be reviewed by a bird specialist for relevance, and updated if/where required.

20 DECOMMISSIONING PHASE

Should the WEF be decommissioned a decommissioning plan must be produced. The plan must include details on the decommissioning and dismantling of the WEF, taking in consideration the potential environmental impact associated with it. Environmental monitoring plans must be produced so ensure no pollution occurs during this phase. The plan must include the steps that will be taken to rehabilitate the area after the WEF is dismantled, as well as recycling options of the equipment and structures.

21 CONCLUSION

In terms of the National Environmental Management Act 107 of 1998 everyone is required to take reasonable measures to ensure that they do not pollute the environment. Reasonable measures include informing and educating employees about the environmental risks of their work and training them to operate in an environmentally acceptable manner.

Furthermore, in terms of the 'Act', the cost to repair any environmental damage shall be borne by the person responsible for the damage.

It is therefore imperative that the management plan is successfully implemented, as a failure to comply could have legal implications.

The environmental impacts on the site will not be significant if the construction management is well implemented, and a set of operational guidelines are developed by the long term site management body.

ARCUS

Appendix C:

WATER USE LICENSE APPLICATION

JANUARY 2019

Anja Albertyn

From:	Ewulaas_Do_Not_Reply@dws.gov.za
Sent:	06 December 2018 14:19
To:	Anja Albertyn
Subject:	Pre-Application Water Use Enquiry have been submitted to the department

Dear Mrs Anja Albertyn ()

A request for consultation for the following Pre-Application Water Use Enquiry have been submitted to the department:

Highlands North Wind Energy Facility

Your request for consultation was submitted to:

Name : Mrs L. Fourie (WULA Manager)
e-Mail : FourieL4@dws.gov.za
Tel : 0437010248

Thank you,
e-WULAAS Team

e-WULAAS

In Production