DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

VOLUME 1:

THE PROPOSED KOMSBERG EAST WIND ENERGY FACILITY, WESTERN CAPE PROVINCE

ON BEHALF OF

KOMSBERG WIND FARMS (PTY) LTD

APRIL 2016

DEA REFERENCE NUMBER:
14/12/16/3/3/2/857

Prepared For:

Komsberg Wind Farms (Pty) Ltd

The Oval, Fernwood House
1 Oakdale Road
Newlands
Cape Town

Prepared By:

Arcus Consultancy Services

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

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

Registered in South Africa No. 2012/215000/10

For reference purposes, this report should be cited as: Arcus Consultancy Services (2016) Draft Environmental Impact Report: Proposed Komsberg East Wind Farm Facility, Western Cape Province.

PROJECT DETAILS

DEA Reference Numbers:	East – 14/12/16/3/3/2/857
Arcus Reference No:	2023
Title:	Volumes 1, 2 & 3: Environmental Impact Assessment Process Environmental Impact Assessment Report for the Proposed Komsberg East Wind Energy Facility, Western Cape Province.
Authors:	Ashlin Bodasing and Emily Herschell - Arcus Consultancy Services Ltd
Sub-consultants:	• Liam Whitlow and Nobuhle Hughes - EIMS • Bernie Oberholzer and Quinton Lawson - Bernard Oberholzer Landscape Architects and MLB Architects • Dr Brian Colloty - Scherman Colloty and Associates • Tony Barbour - Tony Barbour Environmental Consultant and Researcher • Dr Garry Paterson - ARC Institute for Soils Climate and Water • Simon Todd - Simon Todd Consulting • Tim Hart and John Almond - ACO & Associates • Andrew Pearson and Anja Terörde - Arcus Consulting • Jonathan Aronson - Arcus Consulting • Morné de Jager- Enviro Acoustic Research
Project Applicant:	Komsberg Wind Farms (Pty) Ltd
Report Status:	Draft Environmental Impact Report
Public Review Period:	15th April – 15th May 2016

EXECUTIVE SUMMARY

INTRODUCTION

Arcus Consultancy Services Ltd. has been appointed by Komsberg Wind Farms (Pty) Ltd. to conduct the Environmental Impact Assessment (EIA) processes as required by the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended, for the proposed establishment of two wind energy facilities (WEFs), Komsberg East and West and their associated grid connections. The aim of the project is to generate electricity, the sale of which is likely to be contracted through the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) if successful. The WEFs will deliver electricity into the existing Eskom electricity grid via a high voltage grid connection. The proposed WEFs would have a maximum generation capacity of up to 275MW each.

In general, the study area and background information for both proposed WEFs is similar due to the proximity of the sites.

The Scoping Phase (the first phase of the Environmental Impact Assessment Process) for the proposals was completed in December 2015. Scoping entailed identifying the significant issues associated with the proposal. Issues and potential impacts were gathered from the public via a Public Participation Process (PPP) and from preliminary specialist studies. Fields of investigation that required further in-depth study were commissioned and investigations undertaken during this EIA Phase, the final phase of the EIA Process. Two separate Environmental Impact Assessment Reports have been compiled – one for the proposed Komsberg East WEF and one for the adjacent proposed Komsberg West WEF.

The proposed grid connections are also subject to two further separate, but related Basic Assessment processes.

This report is the Environmental Impact Assessment report for the proposed Komsberg East WEF.

SITE LOCATION AND PROJECT DESCRIPTION

The study area is located in the Western Cape Province near the border of the Northern Cape Province, approximately 60km north of Laingsburg and 40km south east of Sutherland, in the Moordenaars Karoo (**Figure 1-1a**).

This 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 study area covers a total area of approximately 15 740 hectares. The footprint of the proposed infrastructure would equate to less than one percent of the total area.

The proposed site is located in the Laingsburg Local Municipal area, which forms part of the Central Karoo District Municipality in the Western Cape Province.

The main access route to the proposed site is via the R354 and the Komsberg and Moordenaars Karoo District Roads which approach the study area from the west. Local district gravel roads are then used to access the site.

Currently, there are two occupied homesteads located within the study area. The main land uses in the area are linked to livestock farming. The proposed site is made up of a number of farms, and are zoned for Agricultural Use.

The Komsberg East WEF will consist of the following infrastructural components:

- Up to 55 wind turbines between 2MW and up to 5MW in capacity with a rotor diameter of up to 140m and a hub height of up to 120m;
- Foundations and hardstands associated with the wind turbines;
- Up to 8m wide internal access road to each turbine, the substation complex and the ancillary infrastructure, including underground cabling adjacent the roads. Road length would be up to approximately 40km in total;
- Medium voltage cabling between turbines and the substation, to be laid underground where practical;
- Overhead medium voltage cables between certain turbine strings or rows;
- A 100m x 150m on-site substation complex to facilitate stepping up the voltage from medium to high voltage to enable the connection of the wind farm to the national grid;
- An approximately 35km (Komsberg West) and an approximately 55km (Komsberg East) high voltage power line (132kV) from the on-site substation to the national grid at the Eskom Komsberg Main Transmission Substation;
- A 30m x 50m operations and services workshop area/office building for control, maintenance and storage; and
- Temporary infrastructure including a site camp, laydown areas and a batching plant totalling 150m x 100m in extent.

ENVIRONMENTAL REQUIREMENTS

On 4 December 2014, the Minister of Environmental Affairs promulgated new regulations in terms of Chapter 5 of the NEMA, *viz*, the EIA Regulations 2014 (Government Notices (GN) No. R. 982, R. 983, R. 984 and R. 985 in Government Gazette No. 38282 of 4 December 2014). These regulations came into effect on 8 December 2014.

The EIA Regulations 2014 published in Government Notice (GN) No. R982, provide for the control of certain Listed Activities. These activities are listed in GN No. R983 (Listing Notice 1 – Basic Assessment), R984 (Listing Notice 2 – Scoping & EIA Process) and R985 (Listing Notice 3 – Basic Assessment) of 4 December, and are prohibited to proceed until environmental authorisation has been obtained from the competent authority, in this case, the Department of Environmental Affairs (DEA).

The Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) as well as the Northern Cape Department of Environment and Nature Conservation (DENC) will be Commenting Authorities, amongst others.

The Listed Activities applicable to this proposed project are presented in **Table 1** below. All potential impacts associated with these Listed Activities have been considered and assessed in this EIA.

As this proposal triggers Listed Activities in Listing Notices 1 – 3, a full Scoping and EIA process is to be followed for this application.

Table 1: Applicable Listed Activities in terms of the NEMA.

LISTING NOTICE	ACTIVITIES
LN1 GN R983	11(i); 12 (iii, x, xii); 19 (i); 24 (ii); 27; 48 (iii); 56 (i, ii).
LN2 GN R984	1; 6, 15.
LN3 GN R985	4 (f)(i); 10(g)(i); 12(a)(ii); 14 (f)(i); 18 (f)(i); 23 (g)(i).

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

- Waste Management License/s as required by the NEMA; and
- Mining Permits as required by the Minerals and Petroleum Resources Development Act, 2002 (MPRDA) (Act No. 28 of 2002) (MPRDA).

These applications are not part of this application and a separate assessment would need to be conducted should these be required.

ASSUMPTIONS AND LIMITATIONS

- 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 Eskom's substation 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.

AREAS OF INITIAL INVESTIGATION

A number of specialist investigations have been completed for this Draft Environmental Impact Report (DEIR) (**Table 2**) and their findings are included in sections F and G of this document.

Table 2: Specialist Team and Fields of Investigation.

Specialist Team	Fields of Investigation
Bernie Oberholzer and Quinton Lawson *Bernard Oberholzer Landscape Architects and MLB Architects*	Visual Impact Assessment
Dr. Brian Colloty *Scherman Colloty and Associates Environmental and Aquatic Management Consulting*	Freshwater Ecology Assessment
Tony Barbour *Tony Barbour Environmental Consultant and Researcher*	Social Impact Assessment
Dr. Garry Paterson *ARC Institute for Soils Climate and Water*	Agricultural Potential
Simon Todd *Simon Todd Consulting*	Ecosystems - Fauna
Tim Hart and John Almond *ACO & Associates*	Heritage, Archaeology and Palaeontology
Andrew Pearson and Anja Terörde *Arcus Consulting*	Avifauna Assessment
Jonathan Aronson *Arcus Consulting*	Bat Assessment
Morné de Jager *Enviro Acoustic Research*	Noise Assessment
Hermanus Steyn *Aurecon*	Transport and Traffic Assessment
Liam Whitlow and Nobuhle Hughes *Environmental Impact Management Services (Pty) Ltd*	Public Participation Facilitators

PLANNING CONTEXT

Spatial framework and strategic planning/policy documents that are the most relevant to this proposal on a provincial, metropolitan and local level were reviewed as part of the Social Impact Assessment (SIA) that was conducted. The following planning policies are discussed in section G of the DEIR (this report – Volume 1) and in further detail in the Social Impact Assessment, which is included in **Volume 2**.

It is established that planning policy supports the development of renewable energy at all levels of governance. The intent of local, provincial and national policies aim to address energy supply issues, and aim to promote economic growth in South Africa.

The following national level legislation, policy and planning documents were assessed:

- National Energy Act, 2008 (Act No. 34 of 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); and
- Astronomy Geographic Advantage (AGA) Act, 2007 (Act 21 of 2007).

The following provincial and local policy and planning documents were reviewed, namely:

- White Paper on Sustainable Energy for the Western Cape Province (2010);
- The Western Cape Provincial Strategic Plan 2014-2019 (2014);
- The Western Cape Land Use Planning Act, 2014 (Act No. 3 of 2014);
- The Western Cape Provincial Spatial Development Framework (2014 Revision);
- The Western Cape Climate Change Response Strategy (2014);
- The Western Cape Infrastructure Framework (2013);
- The Western Cape Green Economy Strategy Framework (2013);
- The One Cape 2040 Strategy (2012);
- The Western Cape Amended Zoning Scheme Regulations for Commercial Renewable Energy Facilities (2011);
- The Western Cape Draft Strategic Plan (2010);
- The Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape – Towards a Regional Methodology (2006);
- The Guidelines for the Management of Development on Mountains, Hills and Ridges in the Western Cape (2002);
- Central Karoo District Municipality Integrated Development Plan (2012-2017);
- Laingsburg Local Municipality Integrated Development Plan (2012-2017); and
- Laingsburg Local Municipality Local Economic Development Strategy (2006).

NEED & DESIRABILITY

The Western Cape Department of Environmental Affairs and Development Planning's 2010 Guideline on Need and Desirability 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.*"

Section C of this report describes need and desirability for this type of energy development in detail, and provides an explanation as to why wind energy can be considered as an alternative to meeting the need for increased electricity demand over other sources of generation such as fossil fuels. Summarily, these reasons include:

- Positive impact on climate change;

- Overcoming the country's energy constraints;
- Diversification and decentralisation of supply;
- Reduced costs of energy; and
- Positive economic development including job creation.

With regards to this proposal, the wind resource in this area is competitive by national and international comparison. Average wind speeds across site are above viable levels with a relatively unidirectional wind rose. The fairly unidirectional wind allows for the placement of turbines in close proximity to each other with a reduced internal wake effect, which would support productivity and efficiency.

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.

The DEIR provides an outline of the site selection process that was undertaken in relation to the proposed WEFs that have not been progressed due to challenges that could not be overcome. Analysis of preliminarily site considerations were investigated to evaluate the project site. These factors included:

- Grid connection options and capacity availability on the existing national grid;
- The feasibility of site access;
- Technical construction issues such as geological conditions and topography; and
- Preliminary high level environmental considerations.

A number of projects within the applicant's portfolio have not reached EIA stage due to the wind monitoring campaign showing a lower than expected wind resource and/or other technical challenges that rendered them unviable. Wind monitoring has shown that the resource at the Komsberg East WEF to be competitive with no material technical challenges envisaged.

The proposed Komsberg East WEF is thus a preferred site, based on wind resource (high wind speeds recorded), proximity to existing grid infrastructure, land availability, limited technical constraints from a construction perspective and the absence of high level environmental issues at the monitoring and pre-feasibility stage.

Following the selection of a suitable site, consideration has been given to the design and layout of the WEF within the site during the EIA Phase. Wind turbines need to be sited in the optimum position to maximise the wind energy yield whilst mitigating environmental impacts. Various wind turbine designs and layouts have been considered for the site in order to maximise the electricity generation capacity and efficiency, whilst limiting environmental impact. This exercise has been conducted in consultation with the specialist team.

An additional alternative that was considered included the No-Development Scenario or "No-Go Option", which assumes that the proposed development does not proceed. It is equivalent to the future baseline scenario in the absence of the proposed development.

EIA PROCESS

An EIA process is a planning and decision-making tool used to describe and assess the physical, biological, social, and economic impacts that a proposed development may have. In order to inform the decision-making process, it is important that public comments are timeously collated. The EIA process allows for the environmental consequences of a proposed project to be identified up-front, investigated through an impact assessment process, and taken into consideration through the design of the development.

An independent Environmental Assessment Practitioner (EAP) and relevant and independent 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 mitigation which may enhance any positive impacts.

Arcus has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) to undertake the Public Participation Process (PPP) component for this EIA process.

The key phases that shall be part of this EIA 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.
- Scoping Phase: Collation of initial comments and specialist investigations into a concise report (Scoping Report) 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;
    - Identification of knowledge gaps; and
    - A Plan of Study for the EIA phase.
- EIA Phase: Investigate and comparatively assess the identified alternatives to determine a preferred alternative. The identified impacts will be assessed and relevant management and mitigation measures listed for inclusion in an Environmental Management Programme (EMPr). The findings are included in an EIA Report.
- Ongoing Public Consultation: Throughout the process, registered I&APs will be consulted. This involvement may be through dissemination of information by means of a public event/meeting, opportunities to review and comment on draft reports (Scoping & EIA), and project updates.

Once the relevant processes described above have been completed and the documentation submitted to the competent authority (DEA), the DEA will review the application and issue a decision (called an Environmental Authorisation). I&APs will be informed of the decision and their rights to appeal.

Overall, four independent (separate, but related) applications will be submitted for this and the related proposed projects:

Scoping and EIA Process:
1. Komsberg East Wind Energy Facility, Western Cape Province; and
2. Komsberg West Wind Energy Facility, Western and Northern Cape Provinces.
Basic Assessment Process:
3. Komsberg East Grid Connection, Western and Northern Cape Provinces; and
4. Komsberg West Grid Connection, Western and Northern Cape Provinces.

As agreed with the DEA at the pre-application meeting on the 25th June 2015 (**Appendix C**), a combined PPP will be conducted for all four applications.

Each application would be subject to a separate application for Environmental Authorisation to the DEA. Should authorisations for the grid connection infrastructure be granted, this may be entirely or partially transferred from the applicant to Eskom Holdings SOC Limited (Eskom) as applicable or if necessary.

The Draft Scoping Report was released in October 2015 for public review. All comments received from this review have been included in the Issues and Responses Trail of this DEIR (**Appendix H7**), and they have been responded to and addressed by the project team.

In terms of Public Participation, the following tasks have thus far been completed:

- Interested and Affected Parties (I&APs) have been identified throughout the process. Initial identification of I&APs was done by identifying all landowners adjacent to the site boundary. Ward councillors, Authorities and NGO's have also been informed;

- Advertisements were placed in local and regional newspapers (*Die Noordwester*, *Die Burger*) on Friday 28th August 2015 to notify the public of the proposal;
- Notification letters, and Background Information Documents were distributed on 31st August 2014;
- Five site notices were placed on the boundaries of the WEF and grid connection sites on 31st August 2015;
- The registration and comment period closed on 1st October 2015. A total of twenty-five comments were received from twenty-one I&APs and incorporated into an Issues Trail (**Appendix H7**).

After the initiation of the public process, correspondence for the remainder of the EIA process will be directed to I&APs who register and are placed on the project database. Correspondence with I&APs will be via post, fax, telephone and/or email.

SUMMARY OF FINDINGS

This EIR provides a description of the proposed Komsberg East WEF, and its preferred and alternative and final layouts. 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:

- Terrestrial Ecology (Flora and Fauna);
- Bats;
- Avifauna;
- Aquatic Ecosystems;
- Cultural Heritage, Archaeology and Palaeontology;
- Noise;
- Social Aspects; and
- Visual Aspects.

The specialist reports summarized in sections F and G of this report document the assessment of potential environmental impacts that may be experienced within the realms of both the biophysical and social environments, should the proposed project be developed. All specialist reports are included in **Volume 2** of this report.

A summary of the findings of the EIA Phase is provided below. The evaluation draws on the information gathered as part of the process, and the knowledge gained by the environmental assessment practitioners whilst undertaking the EIA, and presents an informed opinion of the environmental impacts associated with the proposal. The assessments of potential environmental impacts within this EIR were made on the preferred and alternative layouts of the wind farm (consisting of the WTGs and the substation/switching station and internal access roads) as provided by Komsberg Wind Farms (Pty) Ltd.

As a result of this assessment, the final layout was produced by incorporating mitigation measures, no-go areas and environmental constraints (i.e. 'embedded' mitigation), and the final layout was assessed once more by the specialist team.

No environmental fatal flaws were identified during the assessment. Mitigation measures to avoid impacts are primarily associated with the micro-siting of infrastructure, as well as measures to be utilised during the construction phase to prevent negative impacts from occurring. Where impacts cannot be avoided, appropriate environmental management measures must be implemented to mitigate impact. Environmental specifications for the management of potential impacts are detailed within the EMPr (**Volume 3**).

EVALUATION

Table 3 summarises the potential social and biophysical impacts identified in terms of their degrees of significance, both before and after mitigation. Medium impacts that remain the same with mitigation are highlighted below. This can indicate that the mitigation is embedded in the

layout or that no mitigation is possible, and so the impact significance remains the same. Positive impacts that can be enhanced are also highlighted below.

Table 3: Summary of EIA Phase Impacts – Significance before and after Mitigation.

Section	Discipline	Impact	Significance Before Mitigation	Significance after Mitigation
16.3	Visual	Construction Phase: Visual impact of wind turbines on receiving environment.	M- to H-	M-
16.3	Visual	Operation Phase: Visual impact of wind turbines on receiving environment.	M- to H-	M-
16.3	Visual	Decommissioning Phase: Visual impact of wind turbines on receiving environment.	L-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Design and construction: Impact on vegetation and listed plant species due to transformation within the development footprint.	H-	M-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Construction: Direct faunal impacts due to construction phase noise and physical disturbance, including potential impact on Critically Endangered Riverine Rabbits.	M-	M-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Construction: Impact of soil erosion as a result of ground disturbance.	H-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Operation: Faunal impacts due to operational phase activities.	M-	M-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Operation: Potential soil erosion impacts.	H-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Operation: Potential of alien plant invasion.	M-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Faunal impacts due to decommissioning phase activities.	M-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Vulnerability of site to soil erosion due to decommissioning phase activities.	H-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Vulnerability of site to alien plant invasion due to decommissioning phase activities.	H-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Cumulative impact on CBAs and broad scale ecological processes.	H-	M-
10.1.1	Bats	Direct Impact - Construction: Roost disturbance	M-	L-
10.1.1	Bats	Direct Impact – Construction: Roost destruction	M-	L-
10.1.2	Bats	Direct Impact - Operation: Bat mortality during commuting and/or foraging	H-	M-
10.1.2	Bats	Direct Impact - Operation: Bat mortality during migration	H-	M-

10.2.1	Bats	Indirect Impact - Construction: Habitat modification	M-	L-
10.2.1	Bats	Indirect Impact - Construction: Light Pollution	L-	L-
10.2.2	Bats	Indirect Impact – Operation: Habitat creation in high risk locations	L-	L-
10.2.2	Bats	Indirect Impact – Operation: Light Pollution	L-	L-
10.2.2	Bats	Indirect Impact – Operation: Loss of ecosystem services	M-	L-
12.1.1	Wetlands and Freshwater Ecology	Construction - Loss of riparian systems and water courses	M-	L-
12.1.1	Wetlands and Freshwater Ecology	Construction and Operation - Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and/or the 58 road crossings on riparian form and function during the operational phase.	M-	L-
12.1.1	Wetlands and Freshwater Ecology	Construction and Operation: Increase in sedimentation and erosion within the development footprint.	M-	L-
12.1.1	Wetlands and Freshwater Ecology	Construction and Operation: Impact on localized surface water quality.	M-	L-
11.2.1	Avifauna	Construction: Loss of habitat	M-	L-
11.2.2	Avifauna	Construction: Disturbance and displacement	M-	L-
11.2.3	Avifauna	Operation: Disturbance and displacement	M-	L-
11.2.4	Avifauna	Operation: Electrocution	H-	L-
11.2.5	Avifauna	Operation: Collisions with power lines.	H-	L-
11.2.6	Avifauna	Operation: Collisions with wind turbines.	H-	M-
11.2.7	Avifauna	Operation: Disruption of local bird movement patterns.	M-	M-
13.1	Cultural Heritage, Archaeology and Palaeontology	Construction: Possibility of encountering unique fossils during excavation for turbine foundations**.**	M-	L neutral/+
13.2	Cultural Heritage, Archaeology and Palaeontology	Construction: Displacement or destruction of archaeological material.	M-/neutral	M+/neutral
13.3	Cultural Heritage, Archaeology and Palaeontology	Displacement or destruction of colonial period heritage structures.	M-/neutral	M-/neutral
13.4	Cultural Heritage, Archaeology and Palaeontology	Construction and Operation: Alteration of sense of place and landscape quality.	M-	M-

14.1.4	Noise	Construction phase noise impact.	L-	Mitigation not required.
14.1.5	Noise	Operation phase noise impact (alternative layout) (Vestas and Acciona turbines)	L-	Mitigation not required.
14.1.5	Noise	Operation phase noise impact (preferred layout) (Vestas and Acciona turbines)	L-	Mitigation not required.
14.1.6	Noise	Noise impact: Cumulative Noise Levels (Vestas and Acciona) turbines.	L-	Mitigation not required.
15.2.1	Social	Construction: Creation of local employment, training and business opportunities.	M+	H+
15.2.2	Social	Technical advice for local farmers and municipalities.	Neutral	L+
15.2.3	Social	Improved cell phone reception in the area (improving security and improving emergency situations).	Neutral	L+
15.2.4	Social	Impact of construction workers on local communities – potential impacts on family structures and social networks.	M-	L-
15.2.5	Social	Construction: Potential influx of job seekers.	L-	L-
15.2.6	Social	Construction: Risk to safety, livestock and farm infrastructure.	M-	L-
15.2.7	Social	Construction: Increased risk of grass fires.	M-	L-
15.2.8	Social	Construction: Impacts associated with construction vehicles – potential dust, safety impacts and damage to road surfaces.	M-	L-
15.2.9	Social	Construction: Potential impacts associated with loss of farmland.	L-	L-
15.3.1	Social	Operation: Creation of employment and business opportunities and support for local economic development and development.	L+	M+
15.3.2	Social	Benefits associated with the establishment of a Community Trust.	M+	H+
15.3.3	Social	Development of infrastructure for the generation of clean, renewable energy.	M+	M+
15.3.4	Social	Impact on sense of place and rural character of the landscape.	H-	M-
15.3.5	Social	Potential impacts on local tourism.	L-	L-
15.4	Social	Potential impacts of decommissioning phase such as job losses.	M-	L-
15.6	Social	Cumulative impact on sense of place.	H-	M-

15.7	Social	Cumulative impact on local economy.	M+	H+
15.8	Social	Assessment of no-go option. – i.e. the overall general social benefit of the project (where H+ represents that the project is supported rather than not being developed).	M-	H+

It is clear from the table above that the majority of potential impacts are mitigatable from High or Medium significance to a Low or lower significance. There are also eight notable positive impacts related to social aspects.

The following additional observations are made:

Visual impact, sense of place and tourism

The heritage impact regarding the alteration to sense of place is a potential impact that would have medium negative significance, and with mitigation, it would remain of medium negative significance. According to the heritage specialist, mitigation for sense of place is not possible, hence the significance of the impact remains as is. The heritage specialist states that even though mitigation is not possible, the recommendations of the VIA must be implemented. The construction of a large facility such as a wind farm shall result in changes to the overall sense of place of the locality. While the impact may be considered local in terms of physical extent, there may also be wider implications in terms of the change in "identity" of the area.

Related to this impact, the visual specialist notes that the impacts of the wind turbines during both the construction and operational phases would be of high to medium negative significance, and with mitigation, would be reduced to medium negative, should all the mitigation measures be implemented.

With respect to visual and heritage sense of place impacts, the social specialist notes that there appear to be no major tourism activities and/or destinations in the immediate vicinity of the site that would be impacted upon by the proposed WEF. The impact on tourism in the area is therefore likely to be limited. The proposed WEF may also attract visitors to the area. No participating landowners who were interviewed raised concerns regarding the visual impact of the turbines.

The social specialist also notes that the visual impact of a WEF and the significance thereof associated with an area's sense of place is likely to vary from individual to individual. The careful positioning of each WTG would reduce the overall visual impact of the proposed WEF on the area's sense of place.

Positive Impacts

A number of positive impacts would be experienced should the proposed WEF be constructed. These lie within the social environment context and include:

- Creation of local employment, training and business opportunities during construction.
- The opportunity to provide technical advice to local farmers and municipalities regarding the installation of wind energy technology.
- The possibility for improved cell phone reception in the area, which would improve security and assist with emergency situations.
- The creation of employment and business opportunities and support for local economic development during the operation phase.
- The provision of community benefits associated with the establishment of a Community Trust.
- The development of infrastructure for the generation of clean, renewable energy will help to offset the total carbon emissions associated with energy generation in South

Africa, as well as drive development through power generation and contribute to solving the region's current power crisis.
- Cumulative impact on the local economy will create employment, skills development and training opportunities, creation of downstream business opportunities.
- The no-development option would result in a lost opportunity for South Africa to supplement its current energy needs with clean, renewable energy and a lost opportunity for the towns of Laingsburg, Sutherland and LLM, therefore the implementation of this proposed WEF would be a positive one.

Environmental Sensitivity Mapping

The proponent provided an initial layout to the specialist team for their assessment, taking into account the scoping phase outcomes and recommendations. This included 55 "preferred" turbine positions and 22 "alternative" locations, as well all the associated ancillary infrastructure such as roads, hardstands, laydowns, buildings and electrical cable and line routings.

The specialist team then identified a number of potentially sensitive areas on the site through their assessment processes. Certain specialist studies recommended that certain turbines be relocated or removed, and a "final" layout was produced and assessed by the specialists. This process is documented in detail in Section 19 of this DEIR.

Overall, the assessment of the final layout include:

Fauna and Flora:

There are no areas within the Komsberg East WEF that are considered highly sensitive, which relates to the aridity of this area and the lower abundance of species of concern. Therefore, there are no recommendations with regard to the placement or reduction in the number of turbines. The most sensitive area here is the high elevation node of development in the northeast of the site. Any localized sensitive features here can be avoided through turbine micro-siting following a preconstruction walk-through of the facility. The identified high sensitivity areas are important for flora, as well as fauna and effective environmental management in these areas will be important for reducing the overall cumulative impact of the development.

All turbines have been relocated outside of the Very High sensitivity areas (**Figure 9-1b**).

While all attempts to avoid these areas have been made, there are still some short sections of access road, which traverse through them. This is acceptable to the specialist and any micro-siting and further mitigation required, will be carried out during pre-construction walk-through surveys.

Significant changes to the location of the turbines within the proposed Komsberg East WEF have been made, mostly due to avifaunal considerations. Here, there has been an increase in the number of turbines proposed for the lower ridges to the south, and all turbines on several of the eastern ridges have been removed to reduce potential avifaunal impacts. This is ultimately also positive from a terrestrial ecological perspective, as a large number of turbines have been moved from areas which are considered to be medium-high sensitivity to areas which are of Medium sensitivity. As the lower ridges are more arid, and contain a lower abundance of species of conservation concern, the impact of the additional turbines on the lower ridges should lower the overall impact of the development compared to the assessed layout.

The recommended mitigation and avoidance measures must be implemented and a preconstruction walk-though of the final development footprint should be conducted to enable micro-siting of the turbines and access roads which shall reduce impacts on species and habitats of conservation concern.

Visual:

The visual specialist recommended that wind turbines on prominent elevations and outlying areas, especially peaks must be avoided, as should turbines located on slopes steeper than 1:5 gradient. The applicant was requested to replace or remove a number of turbines within the alternative and preferred options in order to adhere to their recommendations. These recommendations were

implemented in the design of the layout by the applicant (**Figure 9-19b**). As a result, three additional mitigation measures were recommended:

- Certain access roads on steep slopes in the current layout would need to be reviewed and micro-sited during the implementation phase to avoid visual scarring of mountain slopes.
- The final layout is generally acceptable, however, the position of certain wind turbines positions could be improved through micro-siting, in particular turbine numbers KE1, KE2, KE18, KE25 and KE45, in order to avoid visually sensitive steep slopes or scarp edges.
- Preferably locate the substation and O&M buildings on the proposed southern site, rather than the alternative northern site, which has a visually more sensitive ridgeline. Locate the proposed structures further away from the scarp edge (i.e. to the west). The applicant has confirmed that the alternative northern site shall be chosen.

It has been determined that the visual impact significance of the Komsberg East WEF would be medium-high before mitigation, given the number of wind turbines, the large size of turbines, and the nature of the receiving environment, as well as receptors in the area.

The need for 20m wide roads during construction in mountainous terrain, and the location of the substation and other operations / maintenance buildings on ridgelines in certain parts of the site were a further concern. These roads would be rehabilitated to 6-8m wide roads.

The potential visual impacts have been partly mitigated by relocating some of the turbines, in consultation with the specialists. In some cases, only micro-siting is required.

Buffers around topographic features, settlements and roads need to be implemented have generally been followed. The (southern) option for the substation and operations / maintenance buildings must should be used in preference to the alternative (northern) option. Where these mitigations have been implemented, as indicated in the final layout, the visual impact significance would potentially be reduced to medium.

The construction phase of the WEF and associated infrastructure would be short-term (<2 years) and would therefore have a lower visual significance rating.

Avifauna:

Generally the proposed project is situated in an area with a moderate species richness, and the WEF site does not appear to be overly sensitive in terms of avifauna. In the specialists opinion (based on experience in other parts of the country) the Komsberg/Sutherland area appears to be a relatively good area for the placement of a WEF, as the abundance and activity of priority species is generally low. However, some Red Data species are present, and these few species require protection.

The proponent has responded to the identified sensitivities and during the design of the final layout has adjusted the layout significantly, with more than 25 turbine positions being relocated or removed from the layout. The proponent has therefore adhered to the avifauna recommendations. Should a further reduction in the total turbine count be possible at implementation phase due to improved turbine technologies etc., this would consequently further reduce the impacts and significance levels as assessed in this report.

If all remaining mitigation measures are implemented, the specialist has noted that the impacts would be of medium negative significance, and would be acceptable.

Of concern to the specialists are the potential cumulative impacts of the additional (possibly up to seven) WEFs proposed for within 50km of the Komsberg WEF site. It was found that cumulatively the residual impact of collision from the Komsberg East and West WEFs and grid connections (with turbines and/or over-head power lines) may be of medium to high negative significance (low confidence). Conducting a detailed cumulative impact assessment of all of these facilities on a regional scale (which should include a population analysis of the regional Verreaux's Eagle

population, as well as some level of collision risk modelling or predictions for this population) is beyond the scope of this particular specialist study. The specialist shall, outside of the scope of this project, engage with the appropriate regional or national agency/ies in the context of strategic planning, regarding the commissioning of such a report by these bodies.

The confidence in the cumulative impact assessment is low (in the absence of a regional study), the specialist notes that the project may proceed (if all recommendations and mitigation measures are implemented) prior to such a study being implemented. This is due to the generally low numbers of priority species encountered on site and the low levels of flight activity, when compared with other regions worked in by the specialist.

Bats:

Based on the pre-construction monitoring data there are several species of bat that may be at risk from the project. No-go zones were identified and this necessitated the relocation of turbines.

The final layout reflects the implementation of the relocation of the seven turbines as recommended, and the implementation of the required no-go areas, and the stipulated buffers.

Noise

Considering the projected noise levels (all significantly less than 45dBA) as well as the expected daytime ambient sound level (higher than 45dBA), there is a very low risk for a noise impact during the construction phase (for the WEF and all construction activities).

The output of the modelling exercise indicated that there is low risk of a noise impact (low significance of a noise impact) for the WEF and for all locations where people currently reside. Mitigation is not required although generic measures are recommended for the developer to ensure that any potential noise impacts are minimised during the construction phase.

Due to the low significance of a noise impact, no routine noise measurement programme is recommended.

While this project will have a very slight noise impact at a number of the closest noise-sensitive receptors, these impacts are of low significance and can be considered insignificant. The significance of the noise impact during the operational phase is considered low for all receptors. No additional mitigation measures are required to be included in the EMPr.

Heritage

Most heritage occurrences are located in river valleys, all of which have been successfully avoided, which means that the physical impacts to heritage sites, buildings and places are generally low. The issues of impacts to landscape and sense of place are more challenging to resolve due to the size of wind turbines. The overall impact will remain of medium significance.

Social

The social specialist assessed the preferred and alternative layouts initially put forward for assessment by the applicant post the Scoping Phase. Within these layouts, certain participating and neighbouring farmers were affected and required changes to the layouts, which have now been addressed as part of the EIA process.

Freshwater Ecology

The proposed layout (**Figure 8-9b**) for the WEF has limited impact on the aquatic environment as the proposed structures can avoid the delineated watercourses with the exception of certain watercourse crossings. Use of any existing roads will support this. Based on the findings of this study, no objection to the authorisation of the proposed activities for the WEF facility is made.

No aquatic protected or species of special concern (flora) were observed during the site visit. Based on the site visit the significance of the impacts assessed for the aquatic systems after mitigation would be low.

Evolution of Layouts and the Final Site Development Plan (SDP)

The compilation of constraints from specialists – visual, heritage, ecological as well as I&AP input - have been considered as part of an iterative exercise by the EAP, together with the applicant, to develop a final proposed layout/site development plan which takes all constraints into account in order to produce a best practicable environmental option which is depicted in **Figure 4-1**.

It should be noted that in the process of removing and relocating the 55 turbine positions in line with the specialist constraints, the applicant determined that there were in fact 58 possible turbine positions that would be acceptable to the specialists, and which would be feasible for wind energy generation. The proponent has requested that these 58 positions are put forward for approval from the DEA in this final layout plan, with the maximum generation output of up to 275MW.

The approval of 58 turbines would allow the applicant flexibility to choose the most environmentally practicable and productive options, upon micro-siting. Not all of the 58 turbine positions would be constructed, and this would be limited to 55 turbines at most.

The third and final layout (**Figure 4-1**) indicates the turbine re-positioning and placement of associated infrastructure which has taken cognisance of the sensitive areas documented by the specialists. This layout is considered technically and financially feasible and is considered acceptable from an environmental perspective. Each specialist has assessed and commented on the final layout in their reports.

Each WTG must be micro-sited during the pre-construction phase through a walk-down of the final layout by an avifauna specialist, a bat specialist and by a terrestrial ecologist.

The evolution of alternatives is a process which has considered the extant nature and characteristics of the site, and has presented a reasonable and feasible preferred layout option. The preferred WEF site development plan has evolved logically, taking into account the site's constraints and opportunities, the specialists' findings, the project team's findings and inputs from the public. The first and alternative layouts were adapted as a result of these findings and the best practicable environmental option for the site has been created (**Figure 4-1**).

Cumulative Impacts

The specialists have each addressed concerns regarding cumulative impacts within their investigations. Cumulative impacts result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Most cumulative impacts are able to be reduced to medium negative significance with the implementation of mitigation measures. The visual impact and impact upon sense of place would remain high. This impact is difficult to mitigate and certain aspects of this impact are subjective.

In addition to potential negative impacts, the establishment of the Komsberg East WEF has the potential to result in significant positive cumulative socio-economic opportunities for the region. The positive cumulative impacts include the creation of employment opportunities, skills development and training opportunities, and downstream business opportunities. The Community Trust associated with the project would also create significant socio-economic benefits

Conclusion

This EIA process for the proposed Komsberg East Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in Government Notice GN 38282 of December 2014, in terms of Section 24(5) of NEMA, 1998 (Act No. 107 of 1998), and includes an assessment of the listed activities associated with the construction and operation of the proposed Komsberg East Wind Energy Facility.

The assessment for this proposed wind farm has highlighted potential impacts associated with this proposal and it has prioritised them in terms of high, medium or low significance, according to a standard methodology. The specialist assessments have determined that negative impacts would

result from the implementation of the proposal, and that these negative impacts can be mitigated to an acceptable level. The assessment has also identified a number of positive social and economic impacts.

It has been determined that:

- The turbines fall outside of the identified environmentally high sensitive areas;
- There are no environmental fatal flaws that would prevent the proposed WEF from being constructed on the identified site, provided that all mitigation, monitoring and management measures are implemented;
- This proposal represents an investment in clean, renewable energy; and
- The proposed Komsberg East WEF would be located directly adjacent to the proposed Komsberg West WEF (should both be approved). The proximity of both facilities within a REDZ would consolidate the impacts into a single node with a proven wind resource. The development of WEFs in viable nodes presents a certain amount of benefit through the minimisation of the extent of impacts.

With reference to the information available at this planning approval stage in the project cycle, the confidence in this environmental assessment is considered acceptable.

Based on the nature and extent of the proposed project, the local level disturbance predicted as a result of the construction and operation of the WEF, the findings of the EIA, and the understanding of the levels of significance in relation to the potential environmental impacts, it is the opinion of the environmental assessment practitioners that the application of the proposed project can be mitigated to an acceptable level, provided all mitigation documented within this EIR is implemented and adhered to.

Should a positive Environmental Authorisation be issued by the DEA for this application, it is recommended that the following additional mitigation is applied as conditions of the Environmental Authorisation:

- The preferred layout for implementation is indicated in **Figure 4-1**, and following final design (and micro-siting with relevant specialists), a final layout is to be submitted to the DEA for review and approval pre-construction.
- All mitigation measures documented within this report and the specialist reports (**Volume 2**) must be implemented and adhered to by the applicant.
- A comprehensive search for protected plant and mammal species must be undertaken within the footprint of the proposed infrastructure prior to construction.
- The EMPr (**Volume 3**) must form part of the contract with the contractors appointed to construct and maintain, operate and decommission the WEF.
- Specialist input (avifauna, bats and terrestrial ecology) must be sought during the detailed design phase which will determine the precise and final location of turbines. This would include specialists' walk-throughs/surveys as part of a micro-siting process.
- Strict environmental monitoring must take place during site mobilisation and construction phases and the EMPr must be included in all tender documentation.
- A comprehensive search for threatened and near-threatened plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is known. This must ideally take place during an appropriate season to maximise the likelihood of detecting plants of conservation concern. If any plants (or animals) of conservation concern are found within areas proposed for infrastructure, localised modifications in the position of infrastructure must be made (if possible) to avoid such populations and a suitable buffer zone around them applied, where applicable. Where it is not possible to relocate infrastructure, a permit may be required to be obtained in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.
- The EMPr must be enforced by an independent and suitably qualified Environmental Control Officer (ECO).

- The development of the WEF must be planned so that the clearing of vegetation is minimised.
- An on-going monitoring programme must be established to detect, quantify and manage alien plant infestations.
- Bird and bat monitoring programmes (in line with the latest version of the South African best practice bird and bat monitoring guidelines) must be commissioned during the operational phase. If necessary, and based on operational monitoring data, additional mitigation measures must be implemented during operation to minimise and control impacts.
- Any disturbance of the site must be kept to a minimum during construction and rehabilitated as quickly as possible.
- A storm water management plan and method statement must be implemented during construction and operation and must be compiled as part of the final design of the project. Effective storm water management measures are to be implemented across the site so as to prevent any erosion.
- Where feasible, training and skills development programmes for the local communities should be initiated at the initiation of the construction phase.
- Before construction is initiated construction managers/foremen must be informed about the possible types of heritage/archaeological/palaeontological sites/artefacts that may be encountered and the procedures that need to be followed should these be encountered.
- Fire prevention and fire management strategies must be implemented so as to reduce risks to landowners (Refer to the EMPr in **Volume 3**).
- Due to the low risk of noise impacts, no routine noise measurements are recommended. However, if a valid and reasonable noise complaint is registered relating to the operation of the facility, additional noise monitoring should be conducted by an acoustic consultant. Noise monitoring must be continued as long as noise complaints are registered.
- The developer should re-evaluate the noise study if the layout is changed (where any wind turbines are moved closer, or if any wind turbines are added within 1000m from any potential noise-sensitive receptor) or if the developer selects to use a different wind turbine that is louder than the turbine evaluated in this report (a higher sound power level).
- All other relevant permits must be obtained by Komsberg Wind Farms (Pty) Ltd, such as mining permits (borrow pits) and water use licences, if necessary.
- Upon decommissioning, the main facility and all associated infrastructure not required for the rehabilitation must be removed from the site, recycled where possible, and all disturbed areas appropriately rehabilitated. An ecologist must be appointed to provide input into the rehabilitation specifications.

PUBLIC PARTICIPATION SPECIALIST CONTACT DETAILS:

Environmental Impact Management Services (Pty) Ltd

Postal Address: P. O. Box 2083, Pinegowrie, 2123

Telephone: 011 789 7170

Fax: 011 787 3059

Email: komsberg@eims.co.za

Contact Person: Ms Nobuhle Hughes

VOLUME 1 ENVIRONMENTAL IMPACT REPORT STRUCTURE

Section	Title	Containing
A	DEA Information Requirements for Wind Farm Applications	Tables including information that is required by the DEA for Wind Farm Applications, and where this information is located in this EIA Report.
B	Project Overview.	1. Introduction and background to the proposed project. Project proponents and the EIA project team.
C	Project Description and Alternatives, Need & Desirability	2. Project description, including an overview of the site location, the proposed WEFs. 3. Need and desirability of the proposed development. 4. Consideration of alternatives.
D	Legislation and Policy Context	5. Environmental Legislative Context 6. Planning and National Legislation and Policy on Renewable Energy
E	EIA Phase Approach and Methodology	7. Scoping and EIA Process Methodology, including a description of specialist studies and survey methodologies conducted for this study. Description of Public Participation Process methodology.
F	Baseline Environment	8. The baseline environment is described for each area of investigation, namely visual, terrestrial ecology (flora and fauna), bats, wetlands and freshwater ecology, avifauna, cultural heritage, archaeology and palaeontology, noise and social.
G	Impact Assessments	9-17. For each field of investigation, this section documents: • Potential impacts; • Mitigation measures; and • Significance of impacts before and after mitigation, including a cumulative impact assessment.
H	Public Participation Process (PPP) and Issues Trail	18. This section describes the PPP undertaken to date and includes the Issues Trail.
I	Summary of Findings	19. Summarises the findings of the specialists' assessments.
FIGURES		
APPENDICES		

VOLUME 2 SPECIALIST STUDIES

Section	Study
1	Visual Impact Assessment
2	Social Impact Assessment
3	Noise Impact Assessment
4	Heritage, Archaeology and Palaeontology Assessment
5	Freshwater Ecology Assessment
6	Fauna and Flora Assessment
7	Avifauna Assessment
8	Bat Assessment
9	Traffic and Transport Assessment

VOLUME 3 ENVIONMENTAL MANAGEMENT PROGRAMME

Section	Study
1	Environmental Management Programme (EMPr)

VOLUME 1 ENVIRONMENTAL IMPACT REPORT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

APPENDICES

LIST OF FIGURES

9-18	Local context – viewpoints and distance radii.
9-19a 9-19b	Proposed layout based on visual constraints (preferred and alternative layouts) Proposed amended layout (final layout) indicating the layout changes after input from the visual specialist team.
9-20	DEA map indicating number of renewable energy applications 2015.
9-21	Overall environmental sensitivity map (final layout).
9-22	Infrastructure Locations – Locations where construction activities may take place.
9-23	Projected conceptual night-time noise rating levels during operation – East WEF (Acciona WTG).
9-24	Projected conceptual night-time noise rating levels during operation – Komsberg Cumulative (Acciona WTG).

ABBREVIATIONS, ACRONYMS AND UNITS

AGA	Astronomy Geographic Advantage Act, 2007 (Act No 27 of 2007)
ATNS	Air Traffic and Navigation Services SOC Limited
BGIS	Biodiversity Geographic Information System
BID	Background Information Document
CARA	Conservation of Agricultural Resources, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CCRS	Climate Change Response Strategy
CSP	Concentrated solar power
D:EA&DP	Department of Environmental Affairs and Development Planning (Western Cape)
DAFF	Department of Agriculture, Forestry and Fisheries
dB	Decibel
DEA	Department of Environmental Affairs (National)
DENC	Department of Environment and Nature Conservation (Northern Cape)
DENC	Provincial Department of Environmental Affairs and Nature Conservation (DENC)
DoE	Department Of Energy
DSR	Draft Scoping Report
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act, 1989 No. 73 of 1989)
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
ESA	Ecological Support Area
ESA	Early Stone Age
Eskom	Eskom Holdings SOC Limited
EWT	Endangered Wildlife Trust
FEPA	Freshwater Ecosystem Priority Area
FSR	Final Scoping Report
GHG	Greenhouse Gas
GIS	Geographical Information Systems
GNR	Government Notice Regulation
GPS	Global Positioning System
GWh	Gigawatt hour
HDI	Historically Disadvantaged Individuals
HIA	Heritage Impact Assessment
HV	High Voltage
HWC	Heritage Western Cape
Hz	Hertz
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IPP	Independent Power Producer
IRP	Integrated Resource Plan
IRP	Integrated Resource Plan
KHLM	Karoo Hoogland Municipality
kV	Kilovolt
kWh	Kilowatt Hours
LSA	Late Stone Age
LUPA	Western Cape Land Use Planning Act, 2014 (Act. No. 3 of 2014)
mamsl	Meters above mean sea level
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 Developments
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PES	Present Ecological State
PGDS	Provincial Growth and Development Strategy
PGWC	Provincial Government of the Western Cape
PICC	Presidential Infrastructure Co-ordinating Committee
PPA	Power Purchase Agreement
PPP	Public Participation Process

PSDF	Provincial Spatial Development Framework
PSDF	Provincial Spatial Development Framework
PSEIA	Plan of Study for EIA
PV	Solar photovoltaic
RBS	Revised Balanced Scenario
RE	Renewable Energy
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RSH	Rotor Swept Height
SABAAP	South African Bat Assessment Advisory Panel
SABIF	South African Biodiversity Information Facility
SABS	South African Bureau of Standards
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SALT	Southern African Large Telescope
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SANS	South African National Standards
SCADA	Supervisory Control and Data Acquisition
SDF	Spatial Development Framework
SDIP	Sustainable Development Implementation Plan
SEA	Strategic Environmental Assessment
SES	Sustainable Energy Strategy
SHEQ	Safety Health Environment and Quality
SIA	Social Impact Assessment
SIPS	Strategic Integrated Projects
SKA	Square Kilometre Array Project
SODAR	Sonic Detection and Ranging
SPV	Special Project Vehicle
TWI	Total Wetness Index
WCAQMP	Western Cape Air Quality Management Plan
WCCCRS	Western Cape Climate Change Response Strategy
WCIF	Western Cape Infrastructure Framework
WCP	Western Cape Province
WCPSP	Western Cape Provincial Strategic Plan
WEF	Wind Energy Facility
WHO	World Health Organisation
WTG	Wind Turbine Generator
WULA	Water Use License Application

GLOSSARY OF TERMS

'Do nothing' alternative or 'no-go option'	The 'do nothing' alternative, or 'no go' option is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.
Ambient noise	The all-encompassing sound at a point being composed of sounds from many sources both near and far. It includes the noise from the noise source under investigation.
Ambient sound level	The level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (e.g. sound from a particular noise source or sound generated for test purposes). Ambient sound level as per Noise Control Regulations.
Amplitude modulated sound	A sound that noticeably fluctuates in loudness over time.
Archaeology	Remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.
Attenuation	Term used to indicate reduction of noise or vibration, by whatever method necessary, usually expressed in decibels.
Broadband noise	Spectrum consisting of a large number of frequency components, none of which is individually dominant.
Calcrete	A soft sandy calcium carbonate rock related to limestone which often forms in arid areas.
Cultural landscape	The combined works of people and natural processes as manifested in the form of a landscape
Cumulative impacts	Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities
Cut-in speed	The minimum wind speed at which the wind turbine will generate usable power.
Cut-out speed	The wind speed at which shut down occurs.
Early Stone Age	The archaeology of the Stone Age between 700 000 and 2500 000 years ago.
Environmental management programme (EMPr)	An operational programme that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.
Fossil:	Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.
Generator	The generator is what converts the turning motion of a wind turbine's blades into electricity
Heritage:	That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999.
Holocene:	The most recent geological time period which commenced 10 000 years ago.
Late Stone Age	The archaeology of the last 20 000 years associated with fully modern people.
Midden	A pile of debris, normally shellfish and bone that have accumulated as a result of human activity.

Middle Stone Age:	The archaeology of the Stone Age between 20-300 000 years ago associated with early modern humans.
Miocene	A geological time period (of 23 million - 5 million years ago).
Nacelle	The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction.
Palaeontology	Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.
Palaeosole	An ancient land surface.
Pleistocene	A geological time period (of 3 million – 20 000 years ago).
Pliocene	A geological time period (of 5 million – 3 million years ago).
Rotor	The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute (rpm).
Structure (historic)	Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.
Tower	The tower supports the rotor, and is constructed from tubular steel and/or concrete. The nacelle and the rotor are attached to the top of the tower. The tower raises the wind turbine so that its blades safely clear the ground in order to reach the stronger winds at higher elevations. Large modern wind turbines are usually mounted on towers ranging from 80 to 130 m tall. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.
Wind rose	The diagrammatic representation of joint wind speed and direction distribution at a particular location. The length of time that the wind comes from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke.

ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP) - STATEMENT OF INDEPENDENCE

This Draft Environmental Impact Report has been commissioned by Komsberg Wind Farms (Pty) Ltd to undertake an Environmental Impact Assessment in terms of the 2014 EIA Regulations (R.982, Section 13) under the National Environmental Management Act, 1998 (Act No. 107 of 1998, as amended).

In compiling this report, the authors comply with the General Requirements for Environmental Assessment Practitioners (EAPs) as set out below:

"General requirements for EAPs and specialists

13. (1) An EAP and a specialist, appointed in terms of regulation 12(1) or 12(2), must-

(a) Be independent;

(b) have expertise in conducting environmental impact assessments or undertaking specialist work as required, including knowledge of the Act, these Regulations and any guidelines that have relevance to the proposed activity;

(c) Ensure compliance with these Regulations;

(d) 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 application;

(e) take into account, to the extent possible, the matters referred to in regulation 18 when preparing the application and any report, plan or document relating to the application; and

(d) Disclose to the proponent or applicant, registered interested and affected parties and the competent authority all material information in the possession of the EAP and, where applicable, the specialist, that reasonably has or may have the potential of influencing:

(i) Any decision to be taken with respect to the application by the competent authority in terms of these Regulations; or

(ii) The objectivity of any report, plan or document to be prepared by the EAP or specialist, in terms of these Regulations for submission to the competent authority; unless access to that information is protected by law, in which case it must be indicated that such protected information exists and is only provided to the competent authority."

ENVIRONMENTAL ASSESSMENT PRACTITIONERS

Ashlin Bodasing	
Qualifications	BA (Social Science)
Experience in Years	11 years
Experience	Ashlin Bodasing is the Team Leader at Arcus Consulting, located in Cape Town. Having obtained her Bachelor of Social Science Degree from the University of Kwa-Zulu Natal; she has over 9 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 through her former employment at Parsons Brinckerhoff and WSP Consulting in South Africa. 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, Namibia, Botswana, Lesotho and Zimbabwe.
Emily Herschell	
Qualifications	MPhil (Architecture and Planning) BSc (Honours) (Environmental and Geographical Science) BSc (Environmental and Geographical Science and Zoology) Pr. Sci. Nat. – Environmental Scientist
Experience in Years	14 years
Experience	Emily Herschell is a Senior Environmental Consultant with extensive experience in applying the principles of Integrated Environmental Management (IEM), and in applying the EIA Regulations to a number of development projects and initiatives in Southern Africa. Emily has co-ordinated and managed environmental processes within both the public and private sectors and for national, multi-national and international companies. As a project manager, she has conducted a variety of environmental investigations and evaluations, directing projects through tendering, design, construction and operational phases. She has led teams of varying sizes, responsible for undertaking assignments including *inter alia* Environmental Impact Assessments, Strategic Environmental Assessments, Environmental Management Plans and Programmes, Waste Management Licensing, site selection and screening exercises.

Appendix A includes the signed Declarations of Independence and the *Curricula Vitae* of the EAPs.

SECTION A 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) is 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 - General Site Information.

Description	Report Reference
Descriptions of all affected farm portions	Section 1.3
21 digit Surveyor General codes of all affected farm portions	Section 1.3
Copies of deeds of all affected farm portions	Appendix B
Photos of areas that give a visual perspective of all parts of the site	Figures 9-10 to 9-16
Photographs from sensitive visual receptors (tourism routes, tourism facilities, etc.)	Figures 9-17 and 9-18
Wind plant design specifications including:	
Type of technology	Section C
Structure height	Up to 120m hub and 190m tip
Surface area to be covered (including associated infrastructure such as roads)	Approximately 60ha.
Structure orientation	Vertical turbines with adjacent hardstands spread across the site, on ridges as well as ancillary infrastructure, such as substations, overhead power lines and roads.
Laydown area dimensions (Construction period and Operation)	Construction: Offices: approx. 4x20mx20m Laydown Area: between 3x60mx60m or 1x100x150m Operation: Operations and services workshop of approx.: 30mx50m Turbine hardstands of 30mx50m per turbine.
Generation capacity of the facility as a whole at delivery points	Up to 275MW. Dependent on REIPPPP requirements at the time.

Table B: DEA Information Requirements – Sample of Technical Details.

Component	Description/Dimensions
Number of Turbines	Up to 55
Hub Height	Up to 120m
Blade Length	Up to 70m
Rotor Diameter	Up to 140m
Area occupied by inverter transformer stations substations	Approx. 100m x 150m
Capacity of on-site substation	132kV

Area occupied by both permanent and construction laydown areas	Construction: Offices: approx. 4 x 20m x 20m Laydown Area: between 3 x 60m x 60m or 1 x 100m x 150m Operation: Operations and services workshop of approx.: 30m x 50m. Turbine hardstands of 30m x 50m per turbine.
Area occupied by buildings	As above.
Length of internal roads	Up to 50km
Width of internal roads	Up to 8m
Proximity to grid connection	55km (Komsberg East)
Height of fencing	Up to 3m around substation and offices
Type of fencing	Palisade and/or diamond mesh

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

Site Maps and GIS information	
Information	**Section of EIR**
All maps/information layers must also be provided in ESRI Shapefile format.	CD provided.
All affected farm portions must be indicated.	Figure 1-1a
The exact site of the application must be indicated (the areas that will be occupied by the application).	Figure 1-1a
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 8-13 and 9-2
Agricultural fields	Figure 9-2
Grazing areas	All farms are used for livestock grazing.
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 8-2
Critically endangered and endangered vegetation areas that occur on the site	Figure 8-1
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	Figures 8-10 and 8-11
Rivers, streams and water courses	Figures 8-8 and 8-9
Ridgelines and 20m continuous contours with height references in the GIS database	Figure 1-2 and 1-5
Fountains, boreholes, dams (in-stream as well as off-stream) and reservoirs.	Figures 8-8 and 8-9
High potential agricultural areas as defined by the Department of Agriculture, Forestry and Fisheries	No high potential agricultural areas exist on the site.
Buffer zones (also where it is dictated by elements outside the site): 500m from any irrigated agricultural land 1km from residential areas	Figure 9-2
Indicate isolated residential, tourism facilities on or within 1km of the site	Refer to Figure 8-13.
A slope analysis map/layer that include the following slope ranges:	Figure 1-5

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)	
A map/layer that indicate locations of birds and bats including roosting and foraging areas	Figures 9-3 and 9-4
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 4-1
River, stream and water crossing of roads and cables indicating the type of bridging structures that will be used.	Figure 8-9b
Substation(s) and/or transformer(s) sites including their entire footprint.	Figure 4-1
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 4-1
Cut and fill areas at turbine sites along roads and at substation/transformer sites indicating the expected volume of each cut and fill	Cut and fill areas will be identified during the detailed design phase and reported on in the appropriate EMP updates during preconstruction, for the DEA's approval.
Borrow pits	Contractors will be responsible for borrow pits if these are necessary, and for any permits required.
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	
All maps/information layers must also be provided in ESRI Shapefile format.	Refer to electronic copy.
The map/layer must cover an area of 20km around the site.	Maps cover an area of 20km around the site.
Indicate the following: Roads including their types (tarred or gravel) and category (national, provincial, local or private); Railway lines and stations Industrial areas Harbours and airports Electricity transmission and distribution lines and substations Pipelines Waters sources to be utilised during the construction and operational phases A visibility assessment of the areas from where the facility will be visible Critical Biodiversity Areas and Ecological Support Areas Critically Endangered and Endangered vegetation areas Agricultural fields Irrigated areas 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.	Factors of relevance are included in Figures 1-1, 1-3 to 1-4, 8-1, 8-2, 9-21.

The DEA approved and commented on the Final Scoping Report and Plan of Study for EIA on the 4th February 2016 (**Appendix D). Table E** indicates issues that are to be addressed as part of the EIA Phase, and where this information can be found.

Table E: Requirements of DEA upon Acceptance of Scoping Report and Plan of Study for EIA – Letter dated 04/02/2016.

TASK/ITEM	SECTION OF REPORT/EXPLANATION
i. The EIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	Section G
ii. The listed activities represented in the EIAr and the application form must be the same and correct.	A revised application form will be submitted with the Final EIR.
iii. The EAP must specify which sub-item in terms of GNR 983 Item 24 and 56 apply as this Department cannot authorise both, and the impacts relating to the specific activity must be adequately assessed.	Listing Notice 1 of GN 983: Activity 24 The development of- (ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; *Access tracks would be required between turbines. These tracks would be unsealed and would be up to 8 m in width. The tracks will be up to 20 m wide during construction, but will be reduced to 8 m during operation.* Listing Notice 1 GN 983 4: 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. *Existing roads would need to be widened or lengthened. These roads would currently have no road reserve and may be wider than 8 metres in some areas.*
iv. To provide detailed motivation and reasons on the applicability on Item 2 and 6 of GNR 984.	GNR 984 Listed Activity 2: Not applicable. A revised application form will be submitted with the Final EIR. GNR 984 Listed Activity 6: This activity is relevant as applicant would need to construct bridges over rivers and streams as part of the roads. This could result in the pollution, albeit temporary, of rivers/streams on site. All

	crossings of rivers would require a Water Use License in terms of the National Water Act, 1998 (Act No. 36 of 1998). These river crossings have been identified by the freshwater ecologist in this EIR.
v. The EIAr must provide the technical details for the proposed facility in a table format as well as their description and/or dimensions. A sample for the minimum information required is listed under point 2 of the EIA information required for wind energy facilities below.	Section A
vi. The EIAr must provide the four corner coordinate points for the proposed development site (note that if the site has numerous bend points, at each bend point coordinates must be provided) as well as the start, middle and end point of all linear activities.	Figure 1.1b
vii. The EIAr must provide the following: • Clear indication of the envisioned area for the proposed wind energy facility; i.e. placing of wind turbines and all associated infrastructure should be mapped at an appropriate scale. • Clear description of all associated infrastructure. This description must include, but is not limited to the following: ▪ Power lines; ▪ Internal roads infrastructure; and; ▪ All supporting onsite infrastructure such as laydown area, guard house and control room etc. All necessary details regarding all possible locations and sizes of the proposed satellite substation and the main substation.	Section C
viii. The EIAr must also include a comments and response report in accordance with Appendix 2 h (iii) of the EIA Regulations, 2014.	Section H
ix. The EIAr must include the detail inclusive of the PPP in accordance with Regulation 41 of the EIA Regulations.	Section H
x. Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies.	Section C
xi. It is imperative that the relevant authorities are continuously involved throughout the EIAr process as the development property possibly falls within geographically designated areas in terms of GN R. 985 Activity 4(f)(i)(aa), Activity 10 (g)(i), Activity 12(a)(i)(ii)(iv), Activity 14(iii)(vi)(x)(xii)(a)(c)(f)(i)(aa)(bb)(cc)(dd)(ee)(ff)(gg), Activity 18 (f) (i)(aa)(bb)(ii)(aa)(bb) and Activity23(iii)(vi)(x)(xii)(a)(b)(c)(g)(i)(aa)	Refer to section 8.1 of this report. The Department of Environmental Affairs and Development Planning, and the Department of Environment and Nature Conservation, as well as Cape Nature are key stakeholders in this process, and have been informed of the proposal at initiation of the EIA process. The site lies along the boundary of two fine-scale conservation plans, with the Namakwa District Biodiversity Sector Plan in the Northern Cape and the Biodiversity Assessment of the Central Karoo District Municipality covering those parts of the site within the Western Cape. The Biodiversity Assessments identify Critical Biodiversity Areas (CBAs) which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA map for the general area surrounding the site is depicted in Figure 8-2.

(bb)(cc)(dd)(ee)(ff)(gg)(hh). Written comments must be obtained and submitted to this Department. In addition, a graphical representation of the proposed development within the geographical areas must be provided.	
xii. The terms of reference for the visual assessment must also investigate the following: • Assess and rate the cumulative impact of multiple WEFs in the landscape. • The South African Astronomy Observatory must be thoroughly engaged and their comments included as part of the EIAr.	Section H and Section G
xiii. A significant amount of materials and equipment will be delivered to the site during the construction phase of the development. The EIAr must include a traffic assessment study. The study must determine the specific traffic needs during the different phases of implementation, namely wind turbine construction and installation, operation and decommissioning.	Volume 2
xiv. Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained? Proof of these agreements must be provided.	Section C
xv. The EIAr must provide a detailed description of the need and desirability, not only providing motivation on the need for clean energy in South Africa of the proposed activity. The need and desirability must also indicate if the proposed development is needed in the region and if the current proposed location is desirable for the proposed activity compared to other sites. The need and desirability must take into account cumulative impacts of the proposed development in the area.	Section C
xvii. The Department of Water and Sanitation (DWS) must be consulted during the course of the process. Proof of consultation must be provided for in the EIAr.	Section H
xviii. SENTECH must be consulted during the process to ensure that the WEF will not have any impact on the telecommunication signals in the area. Proof of consultation must be provided for in the EIAr.	Section H
xix. The EIAr must provide an indication of the internal access roads and the impacts associated with them must be adequately assessed in the EIAr and EMPr.	Section C, Section G and Volume 3
xx. The EIAr must provide an indication of the preferred powerline route alternative and provide an assessment and advantages and disadvantages of the alternative powerline route alternative.	Section C. A separate Basic Assessment process has been conducted to assess the advantages and disadvantages of the powerline route alternatives.
xxi. A copy of the final site layout map. All available biodiversity information must be	Section C

used in the finalisation of the layout map. Existing infrastructure must be used as far as possible e.g. roads. The layout map must indicate the following: • Wind Turbine positions and its associated infrastructure; • Permanent laydown area 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); • Wetlands, drainage lines, rivers, stream and water crossing of roads and cables indicating the type of bridging structures that will be used; • The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected by the facility and its associated infrastructure; • Substation(s) and/or transformer(s) sites including their entire footprint; • Connection routes (including pylon positions) to the distribution/transmission network; • All existing infrastructure on the site, especially roads; • Buffer areas; • Buildings, including accommodation; and • All "no-go" areas.	
xxii. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Section I
xxiii. A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Section I
xxiv. A shapefile of the preferred development layout/footprint must be submitted to this Department. The shapefile must be created using the Hartebeesthoek 94 Datum and the data should be in Decimal Degree Format using the WGS 84 Spheroid. The shapefile must include at a minimum the following extensions i.e. shp; .shx; .dbf; .prj; and, .xml (Metadata file). If specific symbology was assigned to the file, then the .avi and/or the .lyr file must also be included. Data must be mapped at a scale of 1:10 000 (please specify if an alternative scale was used). The metadata must include a description of the base data used for digitizing. The shapefile must be submitted in a zip file using the EIA application reference number as the title.	Included on electronic copy of report/CD.
You are required to submit an avifauna and bat pre-construction monitoring report together with the draft EIAr. Baseline monitoring must be undertaken for a period of 12 months. The avifauna and bat	Volume 2

preconstruction monitoring must be conducted in accordance with the minimum requirements guidelines produced by Bird Life South Africa and the South African Bat Advisory Panel. The baseline monitoring programme for avifauna and bats must cover the entire site as well as the height of the entire facility. i.e., you may be required to install more monitoring masts at height.	
The EIAr must include a cumulative assessment of the facility since there are other similar facilities proposed in the region. The specialist studies as outlined in the PoSEIA which is incorporated as part of the SR must also assess the facility in terms of potential cumulative impacts.	Section H
Ensure that all the relevant Listing Notice activities are applied for, that the Listing Notice activities applied for are specific and that they can be linked to the development activity or infrastructure in the project description.	Section D
The Environmental Management Programme (EMPr) to be submitted as part of the EIAr must include the following: i. All recommendations and mitigation measures recorded in the EIAr and the specialist studies conducted. ii. The final site layout map. iii. Measures as dictated by the final site layout map and micro-siting. iv. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process. v. A map combining the final layout map superimposed (overlain) on the environmental sensitivity map. vi. An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken. vii. A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase. viii. A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats. ix. An open space management plan to be implemented during the construction and operation of the facility. x. A traffic management plan for the site access roads to ensure that no hazards would	Volume 3

result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimize impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations. xi. A transportation plan for the transport of components, main assembly cranes and other large pieces of equipment. xii. A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off. xiii. A fire management plan to be implemented during the construction and operation of the facility. xiv. An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion. xv. An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems. xvi. Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	

SECTION B PROJECT OVERVIEW

1 INTRODUCTION

Komsberg Wind Farms (Pty) Ltd is proposing to construct a Wind Energy Facility (Komsberg East WEF) and its grid connection on a site located in the Western Cape Province ('the proposed project / development'). The proposed WEF would have a maximum generation capacity of up to 275MW. Arcus Consultancy Services Ltd. (Arcus) has been appointed by Komsberg Wind Farms (Pty) Ltd to undertake the environmental authorisation process for the proposed development.

The Scoping Phase (the first phase of the Environmental Impact Assessment Process) for this proposal was completed in December 2015. Scoping entailed identifying the significant issues associated with the proposal. Issues and potential impacts were gathered from the public via a Public Participation Process (PPP) and from preliminary specialist studies. Fields of investigation that required further in-depth study were commissioned and investigations undertaken during this EIA Phase, the final phase of the EIA Process.

The proposed grid connection for the WEF is the subject of a parallel Basic Assessment process.

1.1 Aim and Purpose of the Draft Environmental Impact Report

The purpose of this report is to present environmental and technical information regarding the proposed project. Information has been obtained from both specialists' investigations and through a public participation process:

This report will therefore:

- describe the technical details of the proposed project,
- describe the EIA methodology and process followed to date,
- present and discuss alternatives;
- describe the baseline environment;
- document the public participation process undertaken;
- identify possible impacts and provide an assessment of significance of these impacts;
- present mitigation measures for the design, construction, operation and decommissioning phases of the proposed project; and
- collate all mitigation measures into a Draft Environmental Management Programme (EMPr).

1.2 Overview of the Proposed Development

The Komsberg East WEF would consist of the following infrastructural components:

- Approximately 55 wind turbines of between 2 MW and 5 MW in capacity with a rotor diameter of up to 140m and a hub height of up to 120m;
- Foundations and hardstands (30m x 50m) associated with the wind turbines;
- Up to 8m wide internal access road to each turbine, the substation complex and the ancillary infrastructure, including underground cabling adjacent the roads. Road length will be up to 50km in total.
- Medium voltage cabling between turbines and the substation, to be laid underground where practical.
- Overhead medium voltage cables between turbine rows where necessary.
- 100m x 150m on-site substation complex to facilitate stepping up the voltage from medium to high voltage (up to 132kV) to enable the connection of the WEF to the national grid.

- An approximately 55 km high voltage power line from the on-site substation to the national grid at the Eskom Komsberg Main Transmission Substation.
- A 30m x 50m operations and services workshop area/office building for control, maintenance and storage; and
- Temporary infrastructure including a site camp, laydown areas and a batching plant totalling 150m x 100m in extent.

The total extent of the site is 15 740 hectares. It is proposed that the footprint of the WEF would be limited to approximately 60ha, which equates to less than one per cent of the project site.

Figure 1.1a shows the location of the proposed East WEF development. **Figures 1-2 and 1-3** indicate the initial preferred layout of the WEF and a layout depicting the proposed locations for alternative turbine positions. Associated infrastructure (access roads and buildings) is also indicated on these maps.

1.3 Project Location

The proposed development area is located approximately 60km north of Laingsburg and 40km south east of Sutherland in the foothills of the Komsberg mountain range.

The site is located in the Laingsburg Local Municipal area in the Western Cape Province, which falls within the Central Karoo District Municipality. The town of Sutherland is located approximately 40km to the north east of the site.

The project site is accessed via the R354 tarred road between Matjiesfontein and Sutherland to the west of the project area, and then using local district gravel roads.

The proposed WEF will be located within the WEF site boundary as shown in **Figure 1-2**. A substation and switching station will be located on site, with transmission lines leading to the Eskom Komsberg Main Transmission Substation, which is located to the south west of the site. Refer to **Figure 1-4**. Two temporary site camps and laydown areas would be required on the site during the construction phase.

Table 1-1 lists the names and erf numbers of the properties upon which the proposed WEF would be constructed.

Table 1-1: Property Details.

	Property Name	Erf number	Portion	SG number	Size (hectares)
1	Taayboschkraal	12	4	C04300000000001200004	2 782,9282ha
2	Taayboschkraal	12	3	C04300000000001200003	2919,1296ha
3	Taayboschkraal	12	1	C04300000000001200001	811,5327ha
4	Koornplaats	41	2	C04300000000004100002	1695,4694ha
5	Boschmans Kloof	9	3	C04300000000000900003	255,3623ha
6	Anys Riviers Plaat	13	0	C04300000000001300000	1548,5599ha
7	Dwars River	14	RE	C04300000000001400000	5024.1806ha

1.4 General Site Description

The proposed development area is located at the foot of the Komsberg Mountains near the border of the Northern and Western Cape Provinces in the Moordenaars Karoo.

The geology of the area is characterised by the mudstones and sandstones of the Beaufort Group belonging to the Karoo Sequence. The erosion of the alternating formations has resulted in the undulating ridges and valleys. The topography is a reflection of the geology of the area. The elevation ranges from about 800m in the valleys to a high point of 1450m, the higher areas being more exposed to wind. Steeper slopes are encountered in the eastern portion. Refer to **Figure 1-5** for a slope analysis map.

The vegetation is a reflection of substrate and rainfall. The higher elevations of the study area have mountain shale Renosterveld shrubland, while the lower lying areas of the Moordenaars Karoo to the south have a low succulent scrub. Exotic trees, including gums, poplars and willows are found around farmsteads. The exotic copses and shelterbelts provide some visual screening for the farmsteads.

The proposed development occurs within the Nama Karoo Ecoregion located within the Gouritz Water Management Area. The catchment is characterised by several perennial water courses and drainage lines, including the Buffels River that flows towards Laingsburg, and the Komsberg River in the western portion of the development area, the Koringplaas River and Dwars River.

The main land use in the area is livestock farming and related uses thereto.

The site is made up of a number of farms which are zoned for agricultural use. The relatively low rainfall and sparse vegetation limit the agricultural potential to mainly extensive grazing, such as Marino sheep for wool. Minimal arable farming occurs in the area, with crops confined to the alluvial valleys where irrigation is available. The farms, typically located in the more fertile valleys, tend to be large in area in order to be viable for sheep farming, with farmsteads being on average 10km apart. A series of Eskom power lines run along the southern edge of the study area.

1.5 Environmental Regulations

The EIA Regulations of 2014 state that the Environmental Impact Assessment Process is a consultative process, which has the following as objectives:

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

(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

(d) determine the

(i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and

(ii) degree to which these impacts-

(aa) can be reversed;

(bb) may cause irreplaceable loss of resources, and

(cc) can be avoided, managed or mitigated.

(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;

(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;

(g) identify suitable measures to avoid, manage or mitigate identified impacts; and

(h) identify residual risks that need to be managed and monitored."

These objectives will be achieved through the tasks undertaken during this EIA process for the proposed Komsberg East WEF development.

1.6 Project Proponents

Komsberg Wind Farms (Pty) Ltd is a South African registered company dedicated to the development of wind energy projects.

Komsberg Wind Farms (Pty) Ltd has established a platform for the development of wind energy projects in the area surrounding the Komsberg substation, given its excellent wind resource. This 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.

Komsberg Wind Farms (Pty) Ltd's wind farm projects are positioned for delivery under future rounds of the Department of Energy's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). The REIPPPP is described in section 6.1 of this report.

In accordance with the REIPPPP bidding requirements, Komsberg Wind Farms (Pty) Ltd has established an SPV in order to apply for and to obtain an Environmental Authorisation in the name of Komsberg East WEF company.

1.7 The EIA Project Team

1.7.1 *Environmental Assessment Practitioner (EAP)*

The co-ordination and management of this EIA process is being conducted by Arcus Consultancy Services (Arcus) with the lead EAP being Ashlin Bodasing supported by Emily Herschell. Refer to **Appendix A** for the EAPs' Declarations of Interest and Curricula Vitae.

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.

EIMS is assisting Arcus with the public participation process required as part of the EIA process for this proposed development.

1.7.2 *Specialist Team*

A team of technical specialists has been appointed to investigate the impacts associated with the proposed development. The specialist team is listed in the table below.

The fields of study identified as relevant to this application are as per the experience of the EAP in undertaking EIAs for this type of project. Identification has also been made in consultation with the specialists who are familiar with the locality and this nature of development. The DEA also agreed to the fields of study for the Scoping Phase at the Pre-Consultation Meeting held on the 25th June 2015. Refer to the minutes of this meeting in **Appendix B**.

The specialists have been selected based on their experience in the field of EIA and of renewable energy projects, and due to the locality of the proposed development.

Note that the field of Soils and Agricultural Potential was scoped out as a field of study requiring further investigation during the Scoping Phase of this process. This was based upon the specialist's findings that no high potential soils exist within the study area. All land types found on site are dominated by rock and shallow lithosols, which have low to very low arable potential.

Table 1-2: Specialist Team and Fields of Investigation.

Specialist Team	Fields of Investigation
Bernie Oberholzer and Quinton Lawson *Bernard Oberholzer Landscape Architects and MLB Architects*	Visual Impact Assessment
Dr Brian Colloty *Scherman Colloty and Associates Environmental and Aquatic Management Consulting*	Freshwater Ecology Assessment
Tony Barbour *Tony Barbour Environmental Consultant and Researcher*	Social Impact Assessment
Simon Todd *Simon Todd Consulting*	Ecosystems – Fauna and Flora
Tim Hart and John Almond *ACO & Associates*	Heritage, Archaeology and Palaeontology
Andrew Pearson and Anja Terörde *Arcus Consulting*	Avifauna Assessment
Jonathan Aronson *Arcus Consulting*	Bat Assessment
Morné de Jager *Enviro Acoustic Research*	Noise Assessment
Hermanus Steyn *Aurecon*	Traffic and Transport Assessment
Liam Whitlow and Nobuhle Hughes *Environmental Impact Management Services (Pty) Ltd*	Public Participation Facilitators

1.8 Assumptions and Limitations to the Study

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 Eskom's substation 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.

1.9 Structure of this Report

The Environmental Impact Report is set out in three volumes:

- Volume 1: Environmental Impact Report;

- Volume 2: Specialists' Studies; and
- Volume 3: Environmental Management Programme (EMPr).

Table 1-3: Structure of this Report.

Section	Title	Containing
A	DEA Information Requirements for Wind Farm Applications	Tables including information that is required by the DEA for Wind Farm Applications, and where this information is located in this EIA Report. DEA acceptance of Scoping Report letter – requirements for EIA Phase.
B	Project Overview.	1. Introduction and background to the proposed project. Project proponents and the EIA project team.
C	Project Description and Alternatives, Need & Desirability	2. Project description, including an overview of the site location, the proposed WEFs. 3. Need and desirability of the proposed development. 4. Consideration of alternatives.
D	Legislation and Policy Context	5. Environmental Legislative Context 6. Planning and National Legislation and Policy on Renewable Energy
E	EIA Phase Approach and Methodology	7. Scoping and EIA Process Methodology, including a description of specialist studies and survey methodologies conducted for this study. Description of Public Participation Process methodology.
F	Baseline Environment	8. The baseline environment is described for each area of investigation, namely visual, terrestrial ecology (flora and fauna), bats, wetlands and freshwater ecology, avifauna, cultural heritage, archaeology and palaeontology, noise and social.
G	Impact Assessments	9. For each field of investigation, this section documents: • Potential impacts; • Mitigation measures; and • Significance of impacts, including cumulative impacts before and after mitigation.
H	Public Participation Process (PPP) and Issues Trail	10. This section describes the PPP undertaken to date and includes the Issues Trail.
I	Summary of Findings	11. Summarises the findings of the specialists' assessments, and provides a conclusion to the study.
FIGURES		
APPENDICES		

SECTION C PROJECT DESCRIPTION, NEED AND DESIRABILITY & ALTERNATIVES

This section of the report describes the proposed location for the proposed WEF. It also provides a description of the proposed WEF itself and its operations in further detail. An explanation of wind energy generation, of how wind farms function, how they are constructed and operated is provided.

The section goes on to discuss the need and desirability of such a development and finally, as is required by the EIA Regulations of 2014, alternative options and the site selection process are presented.

2 PROJECT DESCRIPTION

2.1 Wind Energy Generation

Wind turbines are used to harness kinetic energy and convert this into a useable form, electricity. WEFs consume no fuel during operation and have no direct emissions as a result of electricity production. The economies of a WEF depend upon the wind resource available at a site and as such detailed information on speed, flow, direction and regularity of wind are vital when identifying locations and layouts for WEFs.

Wind turbines are mounted on a tower to elevate the generators above the ground where wind speeds are higher and the wind resource is more consistent and less turbulent. The kinetic energy of the wind is then used to turn the turbine blades, three of which are joined together to form a rotor. This movement produces mechanical power which is transmitted to the generator within a nacelle (on the top of the tower) either via a gearbox or through a direct drive design of turbine.

A diagram of a typical wind turbine is presented in **Plate 2-1**, and identifies the key components of a wind turbine.

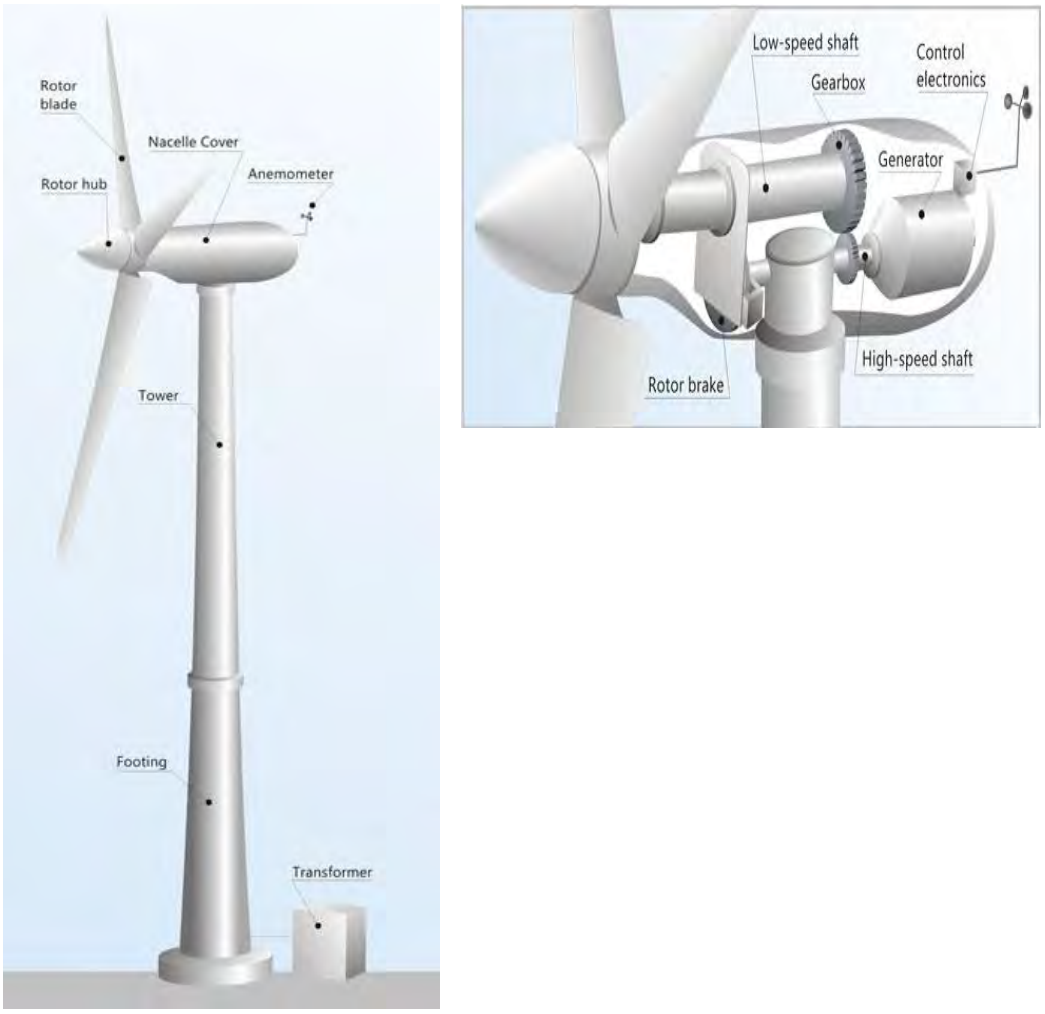


Plate 2-1: Typical example of wind turbine structure and components.

A typical wind turbine consists of four primary components:

- The foundation unit upon which the turbine is anchored to the ground;
- The tower which will have a hub height of up to 120m. The tower is a hollow structure allowing access to the nacelle. The height of the tower is a key factor in determining the amount of electricity a turbine can generate. The tower houses the transformer which converts the electricity to the correct voltage for transmission into the grid. The transformer can also be placed in a small housing outside the tower depending on the design;
- The nacelle (generator/turbine housing). The nacelle houses the gearbox and generator as well as a wind sensor to identify wind direction. The nacelle turns automatically ensuring the blades always face into the wind to maximise the amount of electricity generated; and
- The rotor which is comprised of three rotor blades with a diameter of up to 140m. The rotor blades use the latest advances in aeronautical engineering materials science to maximise efficiency. The greater the number of turns of the rotor the more electricity is produced.

The amount of energy a turbine can harness is dependent on the wind velocity and the length of the rotor blades. Wind turbines typically start generating power at wind speeds of between 10 - 15km/hour (3m/s), with speeds between 45-60km/hour (12–16m/s) required for full power operation. In a situation where wind speeds are excessive, the turbine automatically shuts down to prevent damage (28m/s) is designed to operate continuously, unattended and with low maintenance for more than 20 years or >120 000 hours of operation.

2.2 Wind Energy Facilities

It is important that wind turbines are sited in an optimum position to maximise the wind yield whilst adequately mitigating environmental impacts. The optimum layout of a WEF depends on a range of criteria. These vary depending on the type and size of turbine as well as the local topography and the turbulence which may be created by surface features. Turbine manufacturers generally recommend that turbines should be spaced between three and six rotor diameters apart, depending on the prevailing wind direction, turbine type and site characteristics. This can be reduced depending on the wind rose.

2.3 Komsberg East WEF

Overall, the applicant is applying for two WEFs which are directly adjacent to each other. There are thus four components comprising two WEFs and their two associated grid connections. These are:

- Komsberg East Wind Energy Facility, Western Cape Province (this study);
- Komsberg West Wind Energy Facility, Western and Northern Cape Provinces;
- Komsberg East Grid Connection, Western and Northern Cape Provinces; and
- Komsberg West Grid Connection, Western and Northern Cape Provinces.

It is proposed that the Komsberg East WEF will have a potential maximum installed capacity of 275MW, this being based on the use of 55-58 Wind Turbine Generators (WTG) with WTGs having a potential maximum rated power of 5MW each.

The maximum capacity applied for in this application is greater than the current Department of Energy's (DoE) limit of 140MW of installed capacity. The reason for applying for a greater capacity at this point in time is due to the long lead times involved in wind farm developments (2–5 years) from conception to construction. Hence, the applicant is applying for 275MW in order to cater for a potential change in policy in future Government procurement processes where the limit may be increased.

The level of installed capacity applied for (275MW) also relies on the proposed use of a 5MW wind turbine. The WTG capacity can only be confirmed to be technically or commercially optimal at the time of implementation.

Should a positive Environmental Authorisation be obtained for this WEF, and in the event that no change to installed capacity limits are made by Government and/or should the optimal turbine size for the site be of a rated power less than 5MW, the applicant will implement the approved layout to suit current policy and turbine type at the time of development.

A separate Environmental Authorisation is being sought for each WEF.

The approximately 55km (maximum) of linear transmission lines (grid connection) from the proposed Komsberg East WEF leading to the Eskom Main Transmission Substation is the subject of a separate environmental process (Basic Assessment Process), which is running in parallel to this one.

2.4 WEF Components

The WEF will comprise of the infrastructural components as described below. All dimensions described are maximums.

2.4.1 *Turbines*

The proposed WEF will comprise of approximately 55-58 turbines.

At this stage, it is envisaged that the turbines will each have a capacity to generate between 2 and 5MW of power and each turbine will have a maximum height to blade tip of 190m. The

turbines will be three-bladed horizontal-axis design with a hub height of up to 120m and a rotor diameter of up to 140m. The exact turbine model has not yet been selected and will be subject to competitive tendering. The turbine model will depend upon the technical, commercial and site specific requirements.

Each turbine will require a transformer and, depending on the selected model of turbine, this will be either located within the turbine tower or adjacent to the turbine on a concrete plinth.

The turbines would be placed on steel and concrete foundations, each foundation area occupying an area of up to 30m by 30m 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 5m deep and may include concrete and steel plinths depending upon local ground conditions.

For the purpose of this assessment, the applicant is currently considering the use of the Vestas V126 3.45/3.6 MW and the Acciona AW1253-3.15MW, amongst others.

The exact location of the turbines (preferred and alternative locations) on site are indicated on **Figures 1-2** and **1-3**.

2.4.2 *Hardstanding Areas*

A hardstanding area of up to 50m by 30m 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.

2.4.3 *Laydown Areas*

Two temporary laydown areas of up to 150m by 100m in size will be required for equipment and component storage during construction. These areas will be levelled and compacted and used for component storage. Temporary infrastructure would include the site camp, laydown areas and a batching plant.

2.4.4 *Electrical Cabling and Onsite Substation*

The electricity from the turbines will be transferred via a 33kV electrical network to a 33/132kV onsite substation. Where possible, cables will be placed underground. Where necessary, medium voltage overhead lines will be places between turbine strings. 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. It will be up to 100m by 150m in extent.

2.4.5 *Access*

The turbine locations will be accessed through a network of unsealed tracks which will be established across the WEF site. These access tracks will be up to 20m wide in parts during construction (including road reserve) depending on local topography, and will be reduced to between 6m and 8m during operation. The section of track not in use will be rehabilitated. 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.

2.4.6 *Compound*

There will also be a 30m x 50m operations and services workshop area/office building for control, maintenance and storage.

2.4.7 *Ancillary Equipment*

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

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

2.5 Description of Construction Phase

It is estimated that construction will take approximately 18 - 24 months subject to final design, 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 tracks and passing places;
- Enabling works to sections of the public roads (if required) to facilitate turbine delivery;
- Construction of the contractors' compound;
- Construction of crane pads;
- Construction of turbine foundations;
- Construction of substation and substation building;
- Excavation of the cable trenches and cable laying;
- Delivery and erection of wind turbines;
- Erection of electricity distribution line;
- 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 so that the civil engineering works would be continuing in some parts of the site, whilst wind turbines are 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 experience from other WEF developments, the construction phase is likely to create approximately 300 to 400 employment opportunities. Of this total, approximately 25% will be available to skilled personnel (engineers, technicians, management and supervisory), 15% to semi-skilled personnel (drivers, equipment operators) and 60% to low skilled personnel (construction labourers, security staff). The number and nature of employment opportunities will be refined as the development process progresses.

During the construction phase, water will be supplied from a number of boreholes on different land portions of the proposed project sites as listed above. Early estimations are that 25 000kl will be needed per annum during construction. 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 000m^3.

2.6 Description of Operational Phase

The proposed development would be designed to have an operational life of up to between 20 - 25 years. The current REIPPPP set out by the Department of Energy (DoE) grants a Power Producer Agreement (PPA) for 20 years. During operation of the development, the large majority of the WEF site will continue with agricultural use as it is currently. The only development-related activities on-site will be routine servicing and unscheduled maintenance, as detailed in the following sections.

Based on experience from other WEF developments, the operational phase is likely to create approximately 35 permanent employment opportunities. Of this total, approximately 70% (24) will be low and medium-skilled and 30% (11) will be high skilled positions. The number and nature of employment opportunities will be refined as the development process progresses.

Anticipated water usage for the operations stage is estimated to be in the range of 300m^3 annum at most, and this will be used for equipment cleaning, basic civil maintenance and for domestic water purposes e.g. sanitation, washing and drinking.

It is anticipated that only domestic waste water (sewage) will be generated during the construction and operation phases. All waste water would be stored in conservancy tanks (less than 5 000 m^3) and transported to a licensed wastewater treatment works (e.g. Laingsburg) as and when the tanks are full. No municipal services would be required.

2.6.1 *Routine Servicing*

Wind turbine operations would be overseen by suitably qualified local contractors who visit the site regularly to carry out maintenance. The following turbine maintenance would 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 would likely take place twice per year with a main service likely to occur at twelve-month 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 gear. Other visits to the site would take place approximately once per week to ensure that the turbines are operating at their maximum efficiency.

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

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

2.6.2 *Unscheduled Maintenance*

Unscheduled maintenance associated with unforeseen events would 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.

2.7 Description of Decommissioning Phase

At the end of the operational phase (20 – 25 years), the proposed development will be decommissioned, or may be repowered i.e. redesigned and refitted so as to operate for a longer period of time. Repowering would be subject to a new environmental application at that time.

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

Decommissioning would take account of the environmental legislation and technology at the time of decommissioning, and it would be funded by the project

2.8 Grid Connection associated with the WEF

The electricity generated from the WEF would need to be transferred from the onsite substations to the existing national grid.

Eskom has an existing grid network in the area and it is proposed that the electricity would be transferred to the existing Eskom Komsberg Main Transmission Substation via a 132kV overhead power line/s from the facility substations and switching stations. From the Komsberg Main Transmission Substation, the energy will be transferred to the existing high-voltage lines of the national grid.

The type of structures which will support the overhead lines would include:

- Concrete, steel or wood monopoles;
- Guy line supported steel structures;
- Free standing metal lattice towers; or
- Multi-pole structures such as H-towers or K-towers.
- The preferred structure is concrete or steel monopoles due to Eskom requirements, visual permeability and relatively limited footprint.

The exact route of the power lines will be informed by a separate EIA (Basic Assessment) process which will assess technical and environmental constraints. The route for the 132kV lines would include a servitude corridor of up to 34m in width if required. It is anticipated that a 55km corridor (maximum) would be required for this project. The proposed route for the overhead lines would follow existing linear infrastructure as far as possible, as this will potentially reduce the impacts associated with its construction and operation.[1]

At the Eskom Komsberg Main Transmission Substation, the distribution overhead lines will connect into a substation yard.

2.9 Landowners

Properties belonging to four owners would be affected by the proposed Komsberg East WEF (**Table 2-1**).

Table 2-1: List of farms and farm owners for Komsberg East WEF.

PROPERTY	FARM NAME	OWNER	EFFECTIVE OWNER
Taayboschkraal 12/3	Brinksfontein	Myburgh Family Trust	Mr. Billie Myburgh
Taayboschkraal 12/4	Gemsbokfontein	Standvastigheid Family Trust	Mr. Francois Conradie
Taayboschkraal 12/1	(Putterskraal)	PJD Stofberg	Mr. Pieter Stofberg
Koornplaats 41/2	Putterskraal	PJD Stofberg	Mr. Pieter Stofberg
Boschmanskloof 9/3[2]	(Anysrivier)	PJD Stofberg	Mr. Pieter Stofberg
Anys Rivier Plaat 13/0	(Anysrivier)	HLN Muller	Mr. Hennie Muller
Dwars Rivier 14/ RE	Anysrivier	HLN Muller	Mr. Hennie Muller

Brinksfontein forms part of larger stock farming operations based on the adjacent Wilgerboom. A farmstead is located on Brinksfontein (**Plate 2-2**). The house is not currently inhabited. The owners are in the process of renovating the house, with the purpose of establishing a guest farm facility (Myburgh, pers. comm). Access roads would be located across Brinksfontein. The East WEF grid connection transmission line would pass less than 1km to the south of Brinksfontein. A new access road is proposed on Brinksfontein.

[1] Note that the same route would be shared by the power lines for the proposed Komsberg West grid connection application.
[2] According to information provided by the applicant, the property belongs to Mr Pieter Stofberg. However, according to Mr. Hennie Muller, the property belongs to him.

Plate 2-2: Farmstead on Brinksfontein viewed from access road to Gemsbokfontein.

Gemsbokfontein forms part of farming operations based on Saaiplaas farm (adjacent to Eskom Komsberg substation near the R354). Gemsbokfontein is used for seasonal grazing. A farm house and labourer's cottages are located on Gemsbokfontein, but these appear to be uninhabited at present (**Plate 2-3**).

Seven turbines are proposed on Gemsbokfontein, namely on high ground more than 3 km to the south-east of the farmstead (**Plate 2-4**). In addition, the proposed East WEF transmission line would be located approximately 3 km to the south of the farmstead.

Plate 2-3: Farmstead on Gemsbokfontein viewed from the access road.

Plate 2-4: Ridge on which turbines are proposed, located approximately 3 km to the south-west of the Gemsbokfontein farmstead.

Putterskraal belongs to Mr Pieter Stofberg, whose main operations are based in Rawsonville. A farm manager and three labourer households currently reside on Koornplaats 41/2 ('Putterskraal'). The properties are used for extensive grazing by sheep and goats (**Plate 2-5**). Fodder crops are cultivated for own use near the Putterskraal farmstead (**Plate 2-6**). A number of turbines (both alternative options) are proposed on Taayboschkraal 12/1 and Koornplaats 41/2.

Plate 2-5: Putterskraal farmstead and kraals.

Plate 2-6: View from Putterskraal yard.

The owners of Anysrivier reside on Anysrivier. In addition, four labourer households work and reside on Anysrivier (**Plate 2-7**). The properties are used for extensive grazing by sheep and goats. Fodder cropping areas and small fruit and olive orchards are associated with the farmstead. Another small fodder cropping area is located to the south of the farmstead (Muller, H, pers. comm).

Approximately one third of the proposed Komsberg East WEF turbines are proposed on the Muller properties (**Plate 2-8**).

Plate 2-7: Anysrivier farmstead and labourers cottages viewed from the north.

Plate 2-8: View to north-west of Anysrivier farmstead.

3 THE NEED FOR AND DESIRABILITY OF THE PROPOSED DEVELOPMENT

3.1 Western Cape Department of Environmental Affairs and Development Planning's 2010 *Guideline on Need and Desirability*.[3]

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, operational wind energy facilities 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. The SIA (**Volume 2**) details the national, provincial and local plans and policies, and most if not all, are in support of the development of renewable energy facilities. The findings of the SIA demonstrate 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 Western Cape Department of Environmental Affairs and Development Planning's 2010 Guideline on Need and Desirability 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 concepts of need and desirability answer the question of whether an activity is being proposed at the right time in the right place. The guidelines pose a number of questions that should be considered in the EIA investigation, which are addressed in further detail below.

The proposed development's land use is in line with the relevant Spatial Development Framework and projects and programmes identified as priorities by the credible IDP.

- The National Development Plan (NDP) – Vision for 2030 (National Planning Commission, 2011) identifies 'energy' as a key area for investment in infrastructure, with an objective of at least 20 000MW of capacity to come from renewable sources.

[3] DEA&DP's (2010) Guideline on Need and Desirability, EIA Guideline and Information Document Series. Western Cape Department of Environmental Affairs & Development Planning (D:EA&DP).

- The Western Cape Spatial Development Framework (SDF) names energy diversification as a key policy that must be pursued. It states that emergent IPPs and sustainable energy producers must be supported and encouraged to thrive in the rural areas as means to uplift stagnating economies. It also encourages and supports renewable energy generation at scale for climate change mitigation.
- The proposed development is in line with the Central Karoo District Municipality Integrated Development Plan and the Spatial Development Framework, the Laingsburg Local Municipality Integrated Development Plan and Local Economic Development Plan.

Development of this type of land use should occur here at this point in time.

- The proposed development itself will not cause a significant change in land use, as the development site is primarily low intensity agriculture (sheep grazing), which would continue once the development is constructed.
- The proposed WEF would contribute positively towards the creation of employment and local economic development, in an area with high levels of unemployment and low levels of economic growth. The area is not suitable for alternative more profitable types of land use.
- The relevant SDFs and IDPs call for the promotion of energy infrastructure and renewable energy in particular.
- Wind power is the most cost effective form of electricity generation in the country and this project would make use of the area's wind resources to provide cost-effective electricity to the national grid.

The community and area need the activity, which is a societal priority: it would create jobs and drive economic development locally and nationally.

- The NDP identifies energy infrastructure as a key investment area and the country is facing a national energy crisis.
- The region suffers from a stagnating economy with low levels of economic growth and high unemployment rates. The Western Cape SDF supports energy developments particularly in these rural areas to combat this problem. The proposed development of the WEF will create jobs and contribute towards socio-economic development in an area with otherwise few opportunities.

There is adequate capacity for the required services currently available and no additional capacity must be created to cater for the development.

- The existing Eskom Komsberg Substation will be able to provide a connection to the national grid.
- The local municipalities will not be required to supply services. Should any adjustments to public roads be necessary, these will be made in agreement with the local roads authority.
- Any water required during construction will be sourced from existing boreholes or if additional water is required, this would be delivered in 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.

The proposed development is not directly provided for in municipal planning. The overall effect of the development would be beneficial to the municipality and is in line with its planning in terms of economic development and job creation.

- Any additional infrastructure required will be provided and maintained by the applicant. There is therefore no cost involved to the municipality.
- The land has low agricultural potential and the economic yield is currently low. The construction of the WEF would lead to an increased income for the property owners of the land that the servitude and WEF are located on.

- The WEF would lead to employment and contract opportunities locally.

The proposed development is part of a national programme to address an issue of national concern.

- The National Integrated Resource Plan for Electricity (IRP2) (2011) states that 42% of the national electricity supply should come from renewable energy sources by 2030. The proposed development will contribute towards this goal.
- The proposed development of the WEF falls under the National Infrastructure Plan.
- The proposed development would help to address unemployment in the area and drive economic development.

The proposed development is the best practicable environmental option for this site.

- The proposed development of the will contribute towards lower carbon emission goals to combat climate change and provide cleaner energy than coal which currently makes up the large majority of the national energy mix.
- The current land use is non-arable, low-potential grazing land with a low per m2 yield. Therefore the opportunity cost of not proceeding is high in terms of yield per m2.
- The proposed final site development plan (SDP)/layout minimises negative environmental impacts, having complied with specialists' recommendations where feasibly possible.

The approval of this application will not compromise the integrity of the existing approved and credible municipal IDP and SDF as agreed to by the relevant authorities.

- The relevant IDPs supports the improvement of the local electricity supply and the improvement of electrical infrastructure, as well as local economic development and job creation, which the proposed activity will contribute to.
- The proposed development is supported by the Western Cape SDF, which promotes IPPs and renewable energy developments.

The approval of this application will not compromise the integrity of the existing environmental management priorities for the area.

- Throughout the EIA process, Critical Biodiversity Areas (CBAs), sensitive areas and no-go areas in the proposed development site were identified through specialist input. The presented final layout avoids these areas where possible, and if not possible due to wind farm viability, mitigation measures are to be implemented to assist in reducing negative impacts and enhancing positive impacts. The integrity of the existing environmental management priorities would not be compromised, as long as the recommended mitigation measures in the EIR are implemented.

Location factors favour this land use in this area.

- The region was identified through a wind mapping process as being favourable for wind energy facilities due to feasible wind resources. A variety of alternative locations were considered. In addition, road access, favourable terrain and landowner support were factors contributing to site selection.
- Land use will not change significantly as low intensity grazing would continue in the area post-construction.
- Water resource saving in the Karoo area– 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 area, the Karoo needs to be conserving such resources wherever possible;
- This 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 predicted impacts on sensitive natural and cultural areas will be of overall low-medium significance with the implementation of all mitigation measures documented in this EIR.

- Detailed specialist impact assessments have identified potential impacts and predicted the significance of these impacts using a standard significance rating methodology. No-go and sensitive areas have been identified and the design of the WEF has taken these into consideration.
- Mitigation measures were identified by the specialists that minimise environmental impacts and lower the significance rating of these impacts.

It is anticipated that the proposed development will have an impact of low negative to neutral significance on people's well-being and a low negative impact on visual receptors.

- The Social Impact Assessment (SIA) found any health risks (noise, shadow, flicker and electro-magnetic radiation) from the proposed WEF to be of low negative significance.
- The impact of noise associated with the WEF was determined as of low negative significance by the noise impact specialist study.
- The visual impact of the proposed development will be of medium negative significance with mitigation measures as determined by a specialist study on visual impacts.
- The high positive social impacts of the proposed development would outweigh negative social impacts, should mitigation be implemented.
- The SIA found the construction phase to have a high positive impact should enhancement mitigation be implemented, especially with respect to the creation of employment and business opportunities, and the operational phase to have a medium positive significance, notably with respect to the creation of employment and business opportunities and the establishment of a Community Trust.
- The promotion of clean, renewable energy will have a medium positive impact on the region.
- The impact of a benefit from technical advice for local farmers associated with the proposed development was assessed as of low positive significance in the SIA.
- Improved cell phone reception resulting from the proposed development would be of low positive significance.
- The presence of construction workers and an influx of job seekers associated with the construction phase of the proposed development would both be of low negative significance to local communities with mitigation.
- The risk to safety, livestock and farm infrastructure would be of low negative significance with mitigation, and the risk of grass fires would be of low negative significance with mitigation.
- Impacts associated with the use of construction vehicles would be of low negative significance.
- The potential impact on farmland and loss of productive land would be of low negative significance with mitigation.
- The potential impact on tourism by the proposed development would also be of low negative significance.

The proposed development infrastructure will not result in unacceptable opportunity costs.

- The current land use is low-intensity grazing and the land is not suitable for other agricultural uses. The yield per m^2 is very low.
- The proposed development would increase the yield per m^2 as the landowners will be paid for the use of their land. This could increase agricultural investments in the area.
- The opportunity cost of not proceeding with the proposed development is therefore high.

It is likely that the proposed development will have negative and positive cumulative impacts.

- Cumulative impacts have been assessed in section I of this EIR. Should mitigation recommendations supplied by each specialist not be applied appropriately, the proposed development combined with other WEFs or developments proposed within a 100 km radius has the potential to have high combined negative cumulative impacts on biodiversity.
- The positive cumulative impacts include the creation of employment, skills development and training opportunities, creation of downstream business opportunities. This benefit is rated as High Positive with enhancement.
- In the SIA, the potential for cumulative impacts associated with combined visibility and sequential visibility is high. The significance with mitigation is rated a medium negative. This visual impact would need to be viewed within the context of the area being identified as a Renewable Energy Development Zone by the CSIR under the DEA's SEA process. The area has been identified as an area where renewable energy should be concentrated.
- In terms of visual impact, the proposed WEF would result in industrial type development in the local landscape setting. The potential cumulative visual impact of the wind farms together could be high negative.
- In terms of terrestrial ecosystems, there would be cumulative impacts on CBAs and broad scale ecological processes, and this has been rated by the specialist as a medium negative impact before mitigation. Alien plant invasion could contribute towards cumulative habitat loss and degradation in the area. If aliens are effectively controlled, then this contribution would be low. The presence of the WEF would also disrupt the connectivity of the landscape for some species, which would avoid traversing the cleared areas and may impact upon their ability to disperse or maintain gene flow between subpopulations. The facility will require management and if this is not done appropriately, it could impact adjacent intact areas through impacts such as erosion, alien plant invasion and contamination from pollutants, herbicides or pesticides.
- Refer to the cumulative impact assessment in section I of this document.

The proposed development will impact on the area's current sense of place.

- The social specialist noted that the components associated with the proposed facility would have a visual impact and would impact on the landscape and rural area's sense of the place. Due to the isolated location of the site, the WEF will not be visible from the N1 to the south.
- The social specialist noted that the cumulative visual impact associated with the establishment of a number of WEFs in the region would have a medium negative impact on the on the area's rural sense of place and character of the landscape, after mitigation. Due to the proximity of the different sites for various proposed WEFs and associated power lines in the area, the WEFs could be viewed as a single large WEF as opposed to a number of separate WEFs. While viewing these WEFs as a single large facility, as opposed to separate facilities, does not necessarily reduce the overall visual impact on the scenic character of the area, it does reduce the potential cumulative impact on the landscape. Viewing each of the proposed WEFs as a single, large WEF eliminates the cumulative impacts associated with combined visibility and sequential visibility. This therefore reduces the potential cumulative impact of the WEFs on the landscape. The proximity of the WEFs also has the benefit of concentrating the visual impacts on the area's sense of place in to one area as opposed to impacting on a number of more spread out areas.
- The heritage specialist notes that the proposed WEF would result in additional industrial-type development in the local landscape setting, which would result in changes to the overall sense of place of the locality. The heritage impact on the area's sense of place would be medium negative.
- The visual impact and the significance thereof associated with a WEF on the area's sense of place is likely to vary from individual to individual.

The proposed land use will not set a precedent.

- The proposed development will not lead to a change in the current agricultural land use in the area, be a reason for additional WEFs to be developed there (notwithstanding that the site lies within a REDZ). The site will either be rezoned to Special Purpose: Agriculture and Wind Energy Facility or it will remain under an Agriculture zoning with a Consent Use for Renewable Energy. This will depend on the province and/or municipality's requirements.

The proposed development infrastructure will not affect any person's rights.

- Section 24 of Chapter 2 (The Bill of Rights) of The Constitution of South Africa states that everyone has the right to an environment that is not harmful to their wellbeing, and to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development, and use of natural resources while promoting justifiable economic and social developments
- The proposed WEF will contribute towards the prevention of pollution and unsustainable ecological degradation through the use of non-renewable energy resources. It would promotes sustainable development and use of renewable energy has a much smaller carbon footprint than coal, which is currently the dominant form of electricity generated in South Africa.

The proposed development will not compromise the 'urban edge'.

- The proposed development is outside of any urban areas. The closest town is Sutherland which is approximately 40km away.

3.2 Need and Desirability Expanded

This section describes need and desirability for this type of wind energy development in further detail, and provides an explanation as to why wind energy can be considered as an alternative of meeting the need for increased electricity demand over other sources of generation such as fossil fuels. These reasons include:

- Positive impact on climate change;
- Overcoming the country's energy constraints;
- Diversification and decentralisation of supply;
- Reduced costs of energy; and
- Positive economic development including job creation.

3.2.1 *Climate Change*

The global scientific consensus is that the world's climate is changing and that these changes are largely caused by human activities4. Of these human activities, increase in carbon dioxide (CO2) 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 CO2 in absolute and per capita terms.

The following climate change impacts have been predicted in relation specifically to South Africa[5]:

- 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;

[4] http://adsabs.harvard.edu/abs/2013ERL.....8b4024C (accessed 17th July 2015)

[5] http://www.cop17-cmp7durban.com/en/south-africa-on-climate-change/effects-of-climate-change-on-south-africa.html (accessed 17th July 2015).

- There will be significant changes in rainfall patterns and this, coupled with increased evaporation, will result in significant changes in respect of water availability;
- South Africa's 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 generally more productive than dryland farming, irrigated lands remain vulnerable to reductions in available water;
- Predictions suggest that maize production in summer rainfall areas and fruit and cereal production in winter rainfall areas will 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 the oceans, including rising sea levels and the warming of the Agulhas current and parts of the Benguela current, there is no certainty as to what impacts these could have on the ocean, the creatures living in the seas or on communities dependant on the sea;
- Due to the 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;
- 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 been conservatively estimated at being roughly 1 billion rand per year between 2000 and 2009.

As explained in National Treasury's Carbon Tax Policy Paper (May, 2013)[6], 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 inequality[7].

Under the Copenhagen Accord[8], South Africa pledged in 2009 to ensure that its greenhouse gas emissions deviate from the business-as-usual growth trajectory by around 34% by 2020 and 42% by 2025.

Renewable energy projects play a significant role in assisting the transition to a low-carbon economy.

3.2.2 *Energy Constraints*

South Africa faces major energy constraints, with the country's energy reserve margin (i.e., the amount of electric generation resources planned to be available in the electricity generation system, as compared to the system's expected maximum demand for the year) of currently between 0%-5%. Internationally, reserve margin requirements are usually kept at about 15% of total demand. To ensure that South Africa's economy can continue to grow, the energy constraint can be addressed by constructing additional electricity generators.

[6]National Treasury Carbon Tax Policy Paper. Available online http://www.treasury.gov.za/public%20comments/Carbon%20Tax%20Policy%20Paper%202013.pdf (accessed 17th July 2015).
[7] http://www.treasury.gov.za/public%20comments/Carbon%20Tax%20Policy%20Paper%202013.pdf (accessed 17th July 2015).
[8] Copenhagen Accord https://unfccc.int/meetings/copenhagen_dec_2009/items/5262.php (accessed 17th July 2015).

WEFs in particular have a relatively short construction period when compared to other conventional generation technologies of the same scale, meaning that much-needed power can be added to the grid from WEFs over the short term. WEFs comparatively produce the most cost-effective electricity in the country.

3.2.3 Diversification and Decentralisation of Supply

With its abundant coal supplies, approximately 92.6% of South Africa's energy needs are currently met through coal-fired generators, with nuclear energy contributing 5.7% and the balance by pumped storage (1.2%), hydroelectric (0.5%) and gas turbines (0.1%).

Electricity generation is dominated by the state-owned power company Eskom, which currently produces over 96.7% of the power used in the country.[9]

A diversification of energy supplies, particularly with respect to renewable energy sources, would lead to greater energy security and economic and environmental benefits.

The deployment of various renewable technologies increases the diversity of electricity sources and, through local decentralised generation, contributes to the flexibility of the system and its resistance to central shocks.

According to the International Energy Agency, "*renewable energy resources … exist virtually everywhere, in contrast to other energy sources, which are concentrated in a limited number of countries. Reduced energy intensity, as well as geographical and technological diversification of energy sources, would resul t in far-reaching energy security and economic benefits."*[10]

Progress in this regard has been made under the DoE's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). According to the DoE's Integrated Resource Plan for Electricity 2010-2030, South Africa is aiming to procure 9,200 MW of wind power by 2030. Further information on the REIPPPP and the Integrated Resource Plan is presented in section 6.1 of this report.

3.2.4 Reduced Cost of Energy

In terms of cost, wind energy is globally one of the cheapest forms of new generation capacity available[11]. Under the REIPPPP, the fully-indexed tariffs for wind energy projects have dropped from R1.15/kilowatt hour (kWh) to as low as 60c/kWh[12], representing globally very competitive prices for energy generation. With Eskom currently producing power at between 97,22c/kWh and 183,13c/kWh[13] and with electricity from the coal-fired power stations currently under construction expected to cost more than 97c/kWh[14][15], wind energy is one of the lowest cost forms of new generation capacity in South Africa.

In addition to the levelised cost of developing, financing, constructing, operating and decommissioning energy generation facilities, all energy generators produce an external cost (or externality) such as the additional indirect costs incurred by society and the environment, including health, climate change, environmental, mining and water costs.

---

[9] http://www.usea.org/sites/default/files/event-file/497/South_Africa_Country_Presentation.pdf (accessed 17th July 2015).

[10] www.iea.org/textbase/npsum/ETP2012SUM.pdf (accessed 17th July 2015)

[11] https://about.bnef.com/press-releases/renewable-energy-now-cheaper-than-new-fossil-fuels-in-australia/ (accessed 17th July 2015)
http://www.bloomberg.com/news/2013-02-06/australia-wind-energy-cheaper-than-coal-natural-gas-bnef-says.html (accessed 17th July 2015).
http://www.eia.gov/forecasts/aeo/electricity_generation.cfm (accessed 17th July 2015).

[12] https://en.wikipedia.org/wiki/Energy_in_South_Africa (accessed 17th July 2015).

[13] http://mybroadband.co.za/news/energy/126818-south-african-electricity-prices-eskom-vs-city-power.html (accessed 17th July).

[14] http://mygreenhome.org.za/wp-content/uploads/2014/04/How-to-understand-your-utilty-costs-25-AprilV5.pdf (accessed 17th July 2015).

[15] http://mg.co.za/article/2012-08-24-00-eskom-grilled-on-power-price (accessed 17th July 2015).

WEFs produce relatively small external costs when compared to other energy generation technologies.

3.2.5 Economic Development and Job Creation

It terms of macro-economics, a CSIR study calculated that South Africa's wind and solar photovoltaic (PV) projects generated nearly R4-billion more in financial benefits during the first half of 2015, than what they cost the country to develop. Savings were derived from the replacement of diesel and coal fuel costs, with 2TWh of wind and solar energy replacing the electricity that would have otherwise been generated from diesel- or coal-fired stations. Wind projects are cash positive for Eskom by approximately R300-million; saving R1.5-billion in fuel payments while costing only R1.2-billion in tariff payments to IPPs.

The REIPPPP requires economic development commitments from onshore wind energy projects at a local scale. The main economic development beneficiaries of approved projects are currently communities living within a 50 km radius of renewable energy facilities.

WEFs in South Africa will create skilled and unskilled jobs, particularly during the construction period, where between 300 and 400 jobs will be made available. 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. WEFS create indirect jobs in accommodation, catering and other services that would 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 WEFs 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.

The surrounding communities of successful projects under the REIPPPP are required to have an equity stake in the project, which are either funded by a financier or by other equity partners. Community ownership of an operating WEF is generally conducted via a broad-based community trust, with the surrounding communities as beneficiaries of the dividends paid to shareholders in the project company. The dividend revenue will be invested in community development initiatives as outlined in the community trust deeds. In this way, successful REIPPPP projects are required to invest a percentage of gross revenue in socio-economic development and enterprise development, primarily with the surrounding communities and in some cases beyond a 50 km radius of the project. A number of critical infrastructure and social programmes are developed to support and enrich the areas in which the wind facilities are installed.

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

3.2.6 *The Komsberg Wind Energy Resource*

The Komsberg East WEF is located in a proven high wind resource area.

The wind resource in the Komsberg area is competitive by national and international comparison. This is evidenced by the awarding of projects by the DoE on neighbouring properties, as well as from mast readings on-site. Average wind speeds across site are above the threshold to support

viability, with a relatively unidirectional wind rose. The fairly unidirectional wind allows for the placement of turbines in close proximity to each other along the top of ridges with a reduced internal wake effect. This further supports productivity and efficiency and reduced impact.

3.3 Conclusion

It can be deduced from the above that this type of development is needed at this time – South Africa currently has an energy constraint, is in need of job creation, economic development drivers and clean energy resources. The current poor economic environment and the high wind resource show that it is also desirable in this particular location. The site falls within a REDZ, and is located in an area with a feasible wind resource.

4 ALTERNATIVES ASSESSMENT

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. This section describes alternatives in relation to the proposed development site specifically.

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.

4.1 The No Development Scenario or "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 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;
- No additional electricity will be generated onsite 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;
- There is no opportunity for additional employment (permanent or temporary) in the local area where job creation is identified as a key priority; and
- 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, and these have been outlined in section 3.2.
- 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;
- 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 in the sections above.

Addressing climate change is one of the benefits associated with the implementation of this proposed development. 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.

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

4.2 Technology Alternatives

Additional renewable energy technologies include hydro-electric power, photo voltaic 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 to generate the equivalent energy of the proposed WEF.

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 sites' 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, however the specific design at the site should be informed by the EIA process as outlined below.

Various wind turbine designs and layouts will be considered for the site in order to maximise the electricity generation capacity and efficiency. 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.

4.3 Site Selection and Site Alternatives

Table 4-1 provides an outline of the site selection process undertaken in relation to the proposed WEF. The table indicates possible sites that were not progressed due to challenges that could not be overcome.

Table 4-1: Site Selection Summary for the Proposed Komsberg East WEF.

	Site A	Site B	Site C	Site D	Preferred Site (Komsberg)
Location Description	Western Cape	Eastern Cape	Northern Cape	KZN	Western Cape/Northern Cape
Wind Resource	Poor	Good	Excellent	Good	Excellent
Grid Connection	Close with capacity.	At distance, limited capacity available	Challenging but feasible	Challenging but feasible	Available
Land Use and Land Availability	Suitable land use, able to secure	Land challenges but able to secure	Limited land available	Suitable land use, able to secure	Suitable land use and able to secure REDZ Focus Area.

Site Access	Good	Challenging due to cost implications	Moderately challenging but feasible	Good	Good
Environmental Sensitivity	Moderate sensitivity	Low sensitivity	Moderate sensitivity	High sensitivity	Moderate sensitivity
Status of Development	Not advanced due to poor wind resource.	Not advanced due to grid constraints	Not advanced due to land agreements	Not advanced due to grid and high sensitivity.	In progress, advanced to full feasibility phase

4.3.1 *The Preferred Site Alternative (Komsberg East)*

An analysis of preliminarily considerations were investigated to evaluate the project site. These included:

- Grid connection options and capacity availability on the existing national grid;
- The feasibility of site access;
- Technical construction issues such as geological conditions and topography; and
- Preliminary high level environmental considerations.

A number of projects investigated did not reach EIA stage due to the wind monitoring campaign showing a lower than expected wind resource and/or other technical challenges that have rendered them unviable. This is not the case with the proposed Komsberg East WEF. Wind monitoring has shown the resource to be competitive and no material technical challenges are envisaged.

The proposed Komsberg site is therefore the preferred site, based on the measured wind resource (high wind speeds recorded), proximity to existing grid infrastructure, land availability, minimum technical constraints from a construction perspective and the absence of high level environmental issues at the monitoring and pre-feasibility stage. It is for this reason that two wind farm applications of up to 275MW each are being made for this site (the proposed Komsberg East and West WEFs).

As is shown above, four other sites were discounted in the site selection process due to a number of considerations.

4.4 Design Evolution of Alternatives

Following the selection of a suitable site using the process outlined above, consideration is given to the design of the WEF 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.

Information collated at the scoping stage has been used to inform the design of the WEF progressively. Best practice advises that the EIA should be an iterative process rather than a post design environmental appraisal. In this way, the findings of the technical environmental studies have been used to inform the design of a development.

Two layouts (Alternative 1, **Figure 1-2**) were initially created taking the findings of the specialists' scoping level reports into account. The layouts included an initially "preferred" layout of 55 WTG positions, which took advantage of the high wind resource areas (being located mainly on ridges or high points) and an "alternative" layout, which included alternative positions for the WTGs (**Figure 1-3**). As the specialists' findings (from their assessments) and WTG productivity information became available, the WTG locations were adjusted to accord with their recommendations and no-go areas/constraints whilst where possible retaining those locations

that were optimal in terms of energy production (and hence, project viability). The final layout (**Figure 4-1**) proposed has been assessed by the specialists (refer to section 19 of this report). .

Table 4-2 shows the co-ordinates of the final proposed WTGs pre- and post-assessment.

Table 4-2: Co-ordinates for the final WTG layout.

Komsberg East					
BEFORE ASSESSMENT			POST ASSESSMENT 01.03.2016		
WTG No.	EAST	SOUTH	WTG No.	EAST	SOUTH
PREFERRED ALTERNATIVE			FINAL LAYOUT		
1	20° 59' 42.0894" E	32° 41' 52.6668" S	removed		
2	20° 59' 42.5343" E	32° 42' 05.3112" S	KE04	20° 59' 43.2924" E	32° 42' 03.9384" S
3	20° 59' 40.8785" E	32° 42' 14.6538" S	KE05	20° 59' 43.0228" E	32° 42' 17.6428" S
4	20° 59' 37.0218" E	32° 42' 22.4956" S	KE06	20° 59' 37.9905" E	32° 42' 25.5665" S
5	20° 59' 34.3658" E	32° 42' 31.4380" S	KE07	20° 59' 33.6110" E	32° 42' 34.2046" S
6	20° 59' 29.2087" E	32° 42' 39.2798" S	KE08	20° 59' 27.6180" E	32° 42' 41.1538" S
7	20° 59' 20.6501" E	32° 42' 47.6219" S	KE09	20° 59' 20.6262" E	32° 42' 46.9662" S
8	20° 59' 25.1976" E	32° 43' 06.2696" S	KE10	20° 59' 13.7109" E	32° 42' 52.7461" S
9	20° 59' 14.0381" E	32° 43' 18.5138" S	KE14	20° 59' 14.0144" E	32° 43' 19.1807" S
10	20° 59' 12.7833" E	32° 43' 32.7591" S	KE15	20° 59' 12.5138" E	32° 43' 35.0931" S
11	20° 59' 52.2321" E	32° 43' 55.0466" S	KE35	20° 59' 51.9314" E	32° 43' 57.2434" S
12	20° 59' 58.9891" E	32° 43' 47.6050" S	KE34	20° 59' 57.4258" E	32° 43' 49.8392" S
13	21° 00' 03.8453" E	32° 43' 36.9617" S	KE33	21° 00' 01.5368" E	32° 43' 40.6813" S
14	21° 00' 27.5809" E	32° 43' 32.0884" S	KE32	21° 00' 04.1108" E	32° 43' 29.9646" S
15	21° 00' 00.0977" E	32° 43' 20.0149" S	KE31	21° 00' 05.1479" E	32° 43' 17.8840" S
16	21° 00' 03.7537" E	32° 43' 10.7723" S	KE30	21° 00' 10.3724" E	32° 43' 10.4472" S
17	21° 00' 18.7149" E	32° 43' 11.1350" S	KE29	21° 00' 16.2882" E	32° 43' 03.6273" S
18	21° 00' 19.4193" E	32° 42' 59.4410" S	KE28	21° 00' 24.5472" E	32° 42' 59.6974" S
19	21° 00' 19.0737" E	32° 42' 46.2963" S	KE27	21° 00' 21.7170" E	32° 42' 41.6311" S
20	21° 00' 23.9306" E	32° 42' 35.3528" S	KE26	21° 00' 25.5318" E	32° 42' 31.7610" S
21	21° 00' 27.6419" E	32° 42' 25.8726" S	KE25	21° 00' 29.3972" E	32° 42' 21.7942" S
22	21° 00' 31.9099" E	32° 42' 16.2673" S	KE24	21° 00' 37.4132" E	32° 42' 17.6101" S
23	21° 00' 44.0044" E	32° 42' 18.8313" S	KE23	21° 00' 46.7066" E	32° 42' 14.3186" S
24	21° 00' 56.0551" E	32° 42' 19.8693" S	removed		
25	21° 01' 08.0725" E	32° 42' 22.4080" S	removed		
26	21° 01' 00.9025" E	32° 42' 37.9167" S	removed		
27	21° 01' 08.0269" E	32° 42' 59.5910" S	removed		
28	21° 01' 24.4046" E	32° 43' 14.4118" S	removed		
29	21° 01' 38.3028" E	32° 43' 19.4895" S	removed		
30	21° 01' 19.9566" E	32° 43' 23.1791" S	removed		
31	21° 01' 16.4466" E	32° 43' 32.8594" S	removed		
32	21° 01' 32.3921" E	32° 43' 44.3782" S	removed		

33	21° 01' 24.9424" E	32° 43' 52.7453" S	KE40	21° 01' 28.4455" E	32° 43' 51.3893" S
34	21° 02' 22.0838" E	32° 43' 21.6133" S	removed		
35	21° 02' 30.1292" E	32° 43' 12.9336" S	removed		
36	21° 02' 46.0909" E	32° 43' 13.0962" S	removed		
37	21° 02' 30.2379" E	32° 43' 00.4518" S	removed		
38	21° 02' 33.9942" E	32° 42' 51.2092" S	removed		
39	21° 02' 37.3301" E	32° 42' 40.1288" S	removed		
40	21° 02' 21.9536" E	32° 42' 29.1154" S	removed		
41	21° 02' 22.9107" E	32° 42' 16.9682" S	removed		
42	21° 02' 25.7896" E	32° 42' 06.6025" S	removed		
43	21° 02' 29.6293" E	32° 41' 57.3707" S	removed		
44	21° 02' 33.2770" E	32° 41' 47.9768" S	removed		
45	21° 03' 22.1057" E	32° 42' 01.1233" S	KEALT08	21° 03' 21.9119" E	32° 42' 02.4322" S
46	21° 03' 25.2896" E	32° 41' 50.4076" S	KEALT07	21° 03' 24.7089" E	32° 41' 51.6493" S
47	21° 03' 09.2848" E	32° 41' 33.3912" S	removed		
48	21° 02' 50.3364" E	32° 41' 31.0996" S	KEALT06	21° 02' 53.2783" E	32° 41' 26.1047" S
49	21° 02' 52.9244" E	32° 41' 21.9571" S	KEALT05	21° 03' 03.6071" E	32° 41' 22.8206" S
50	21° 02' 54.9343" E	32° 41' 12.3194" S	removed		
51	21° 02' 53.4191" E	32° 40' 57.8040" S	KEALT01	21° 02' 53.0324" E	32° 40' 57.2020" S
52	21° 03' 08.0539" E	32° 41' 00.4254" S	KEALT02	21° 03' 06.7814" E	32° 41' 00.0219" S
53	21° 03' 18.2358" E	32° 41' 05.5882" S	KEALT03	21° 03' 24.3366" E	32° 41' 09.6918" S
54	21° 03' 33.3870" E	32° 41' 18.7329" S	removed		
55	21° 03' 44.6366" E	32° 41' 21.1717" S	KEALT04	21° 03' 43.8150" E	32° 41' 22.0880" S
ALTERNATIVE 2			removed		
1 or 56	20° 58' 58.9237" E	32° 42' 59.0003" S	KE11	20° 59' 04.8750" E	32° 42' 56.3823" S
2 or 57	20° 58' 16.1378" E	32° 43' 49.4649" S	KE12	20° 58' 24.9864" E	32° 43' 44.8281" S
located between			KE13	20° 58' 13.5738" E	32° 43' 49.9565" S
3 or 58	20° 59' 12.5292" E	32° 43' 43.5025" S	KE16	20° 59' 10.3606" E	32° 43' 46.3941" S
4 or 59	20° 59' 06.9728" E	32° 43' 51.1442" S	KE17	20° 59' 05.2109" E	32° 43' 54.2849" S
5 or 60	20° 58' 59.7156" E	32° 44' 00.3868" S	KE18	20° 59' 00.2146" E	32° 44' 02.3055" S
6 or 61	20° 59' 23.9743" E	32° 44' 32.0301" S	removed		
7 or 62	21° 01' 18.9560" E	32° 41' 47.8597" S	removed		
8 or 63	21° 01' 35.4751" E	32° 42' 06.9411" S	removed		
9 or 64	21° 01' 42.9902" E	32° 42' 26.3559" S	removed		
10 or 65	21° 01' 49.3999" E	32° 44' 15.3619" S	KE41	21° 01' 51.2370" E	32° 44' 13.6944" S
11 or 66	21° 01' 49.7468" E	32° 44' 30.2076" S	KE42	21° 01' 48.9751" E	32° 44' 28.7632" S
12 or 67	21° 02' 08.1020" E	32° 44' 28.7442" S	KE43	21° 02' 14.7194" E	32° 44' 26.7753" S
13 or 68	21° 01' 45.1380" E	32° 44' 43.7900" S	KE44	21° 01' 48.2493" E	32° 44' 41.6234" S
located between			KE45	21° 01' 42.4491" E	32° 44' 48.8341" S
located between			KE46	21° 01' 31.1521" E	32° 44' 51.8892" S
14 or 69	21° 01' 59.9917" E	32° 44' 49.2305" S	KE47	21° 02' 15.4597" E	32° 44' 51.0337" S

15 or 70	21° 03' 00.2432" E	32° 43' 40.2487" S	removed		
16 or 71	21° 03' 22.4460" E	32° 43' 56.3325" S	removed		
17 or 72	21° 03' 19.6983" E	32° 44' 06.7007" S	removed		
18 or 73	21° 03' 19.1444" E	32° 44' 19.6453" S	removed		
19 or 74	21° 03' 41.5953" E	32° 42' 05.2661" S	removed		
20 or 75	21° 03' 48.8955" E	32° 42' 31.1606" S	removed		
21 or 76	21° 04' 03.9924" E	32° 42' 40.9333" S	removed		
22 or 78	21° 04' 14.4299" E	32° 42' 52.1437" S	removed		
revised area			KE01	20° 59' 33.0012" E	32° 41' 36.1069" S
revised area			KE02	20° 59' 18.4829" E	32° 41' 45.6210" S
revised area			KE03	20° 59' 02.6964" E	32° 41' 54.4200" S
revised area			KE19	20° 58' 43.5348" E	32° 44' 21.1059" S
revised area			KE20	20° 58' 39.0369" E	32° 44' 29.7759" S
revised area			KE21	20° 58' 33.6553" E	32° 44' 37.4064" S
revised area			KE22	20° 58' 27.2746" E	32° 44' 43.9001" S
revised area			KE36	20° 59' 04.4672" E	32° 45' 13.9128" S
revised area			KE37	20° 58' 58.5859" E	32° 45' 21.2188" S
revised area			KE38	20° 58' 53.1263" E	32° 45' 32.0970" S
revised area			KE39	20° 58' 44.5542" E	32° 45' 38.3308" S
revised area			removed		
revised area			removed		
revised area			KE48	21° 02' 30.6025" E	32° 44' 55.4779" S
revised area			KE49	21° 01' 39.2703" E	32° 45' 23.5178" S
revised area			KE50	21° 01' 32.2388" E	32° 45' 29.3322" S
revised area			removed		
revised area			removed		
revised area			removed		

This approach has allowed the applicant to avoid high impacts through evolving the design of the proposed development. This mitigation is thus embedded in the layout and design of the final site development plan, and is termed 'embedded mitigation'.

SECTION D LEGISLATIVE AND POLICY CONTEXT

This section of the report outlines the key environmental and planning legislative requirements and guiding principles underpinning the EIA process and the proposed development.

5 ENVIRONMENTAL LEGISLATIVE CONTEXT

5.1 Environmental Acts

5.1.1 The National Environment Management Act, 1998 (Act No. 107 of 1998) (NEMA)

Section 2 of the 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 Interested and Affected Parties (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 4 December 2014, the Minister of Environmental Affairs promulgated new regulations in terms of Chapter 5 of the NEMA, *viz*, EIA Regulations 2014 (Government Notices (GN) No. R. 982, R. 983, R. 984 and R. 985 in Government Gazette No. 38282 of 4 December 2014). These regulations came into effect on 8 December 2014.

The EIA Regulations 2014 published in Government Notice (GN) No. R982, provide for the control of certain Listed Activities. These activities are listed in GN No. R983 (Listing Notice 1 – Basic Assessment), R984 (Listing Notice 2 – Scoping & EIA Process) and R985 (Listing Notice 3 – Basic Assessment) of 4 December 2014, and are prohibited to commence until environmental authorisation has been obtained from the competent authority, in this case, the Department of Environmental Affairs (DEA). A Listing Notice 4 was also published but is yet to be promulgated.

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 GN No. 982.

The Listed Activities applicable to this proposed project are presented in **Table 5-1** below. All potential impacts associated with these Listed Activities will be considered and adequately assessed in this EIA process.

As this proposal triggers Listed Activities in Listing Notices 1 – 3, a full Scoping and EIA process is to be followed for this application (and the related applications).

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.

Table 5-1: NEMA Listed Activities relevant to the Proposed Development.

Listing Notices 1 - 3 4 December 2014	Listed Activity	Project Description
Listing Notice 1 GN 983 Activity 11 (Basic Assessment)	*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.*	The WEF will require transmission lines in order to connect to the grid. Electrical reticulation will be installed to transfer electricity from the turbines to an onsite substation. Cables will be installed underground where feasible.
Listing Notice 1 GN 983 Activity 12 (Basic Assessment)	*The development of-* *(iii) bridges exceeding 100 square metres in size;* *(x) buildings exceeding 100 square metres in size;* *(xii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs-* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; -* *excluding-* *(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;* *(dd) where such development occurs within an urban area; or* *(ee) where such development occurs within existing roads or road reserves.*	The proposed WEF may include construction of buildings and infrastructure within 32 m of a watercourse(s). Bridges may be required to cross watercourses for access tracks. The location and extent of these water crossings will be determined through the EIA Phase. The footprint of the buildings will be at least 400m^2. The footprint of the turbines and associated infrastructure may exceed 100m^2 in total.
Listing Notice 1 GN 983 Activity 19 (Basic Assessment)	*The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from-* *(i) a watercourse;* *but excluding where such infilling, depositing , dredging, excavation, removal or moving -* *(a) will occur behind a development setback;* *(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.*	The construction of the WEF would likely include the excavation of soil in watercourses/drainage line areas, and infilling/deposition may exceed 5 cubic metres. The construction of associated infrastructure, such as access tracks crossing watercourses would require excavation and/or infilling of watercourse areas.
Listing Notice 1 GN 983 Activity 24 (Basic Assessment)	*The development of-* *(ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* *but excluding-* *(a) roads which are identified and included in activity 27 in Listing Notice 2 of 2014; or* *(b) roads where the entire road falls within an urban area.*	Access tracks will be required between turbines. These tracks will be unsealed and will likely be between 3-8 m in width. The tracks will be up to 20 m wide during construction, but will be reduced to 3-4 m during operation. This will be confirmed during the EIA process.
Listing Notice 1 GN 983 Activity 27 (Basic Assessment)	*The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	The infrastructure and building area of the proposed WEFs will require clearing of at least 1 hectare of indigenous vegetation in total.
Listing Notice 1 GN 983 Activity 48 (Basic Assessment)	*The expansion of -* *(iii) bridges where the bridge is expanded by 100 square metres or more in size;* *Where such expansion or expansion and related operation occurs –* *(a) within a watercourse;* *excluding-* *(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;*	Existing bridges over watercourses may need to be expanded / widened.

Listing Notices 1 - 3 4 December 2014	Listed Activity	Project Description
	(ee) where such expansion occurs within existing roads or road reserves.	
Listing Notice 1 GN 983 Activity 56 (Basic Assessment)	*The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre-* *(i) where the existing reserve is wider than 13,5 meters; or* *(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 may need to be widened or lengthened. These roads would currently have no road reserve and may be wider than 8 metres in some areas.
Listing Notice 2 GN 984 Activity 1 (Scoping and EIA)	*The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more, excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs within an urban area.*	The WEF will consist of a number of wind turbines for electricity generation of more than 20 megawatts.
Listing Notice 2 GN 984 Activity 6 (Scoping and EIA)	*The development of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding -* *(i) activities which are identified and included in Listing Notice 1 of 2014;* *(iii) the development of facilities or infrastructure for the treatment of effluent, wastewater or sewage where such facilities have a daily throughput capacity of 2000 cubic metres or less.*	The construction of the WEF may require a Water Use License in terms of the National Water Act, 1998 (Act No. 36 of 1998).
Listing Notice 2 GN 984 Activity 15 (Scoping and EIA)	*The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	The construction of the WEF would require the clearance of more than 20 hectares of vegetation in total across the site.
Listing Notice 3 GN 985 Activity 4 (Basic Assessment)	*The development of a road wider than 4 metres with a reserve less than 13,5 metres.* *(f) In Western Cape:* *i. Areas outside urban areas;* *(aa) Areas containing indigenous vegetation;*	Internal and external access roads will be constructed, which are wider than 4m. The site falls outside of an urban area and parts of the site fall within Critical Biodiversity Areas (CBAs).
Listing Notice 3 GN 985 Activity 10 (Basic Assessment)	*The development 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.* *(g) In Western Cape:* *i. All areas outside urban areas.*	Fuel storage during construction is likely to exceed $30m^3$. The proposed on-site substation is likely to require the use of transformer oils/other hazardous substances during the operational phase. The site falls outside of an urban area and parts of the site fall within a CBA area.
Listing Notice 3 GN 985 Activity 12 (Basic Assessment)	*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) In Eastern Cape, Free State, Gauteng, Limpopo, North West and Western Cape provinces:* *i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;* *ii. Within critical biodiversity areas identified in bioregional plans;* *iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.*	The proposed development would require the clearance of natural vegetation in excess of $300m^2$ in areas of natural vegetation across the site in total. Parts of the site fall within CBA areas.
Listing Notice 3 GN 985 Activity 14 (Basic Assessment)	*The development of-* *(iii) bridges exceeding 10 square metres in size;* *(vi) bulk storm water outlet structures exceeding 10 square metres in size;* *(x) buildings exceeding 10 square metres in size;* *(xii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs -* *(a) within a watercourse;*	Bridges and infrastructure may be constructed within 32m of watercourse(s). The site lies outside of an urban area, and parts of the site lie within CBAs.

Listing Notices 1 - 3 4 December 2014	Listed Activity	Project Description
	(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; *(f) In Western Cape:* *i. Outside urban areas, in:* *(aa) A protected area identified in terms of NEMPAA, excluding conservancies;* *(bb) National Protected Area Expansion Strategy Focus areas;* *(cc) World Heritage Sites;* *(dd) Sensitive areas as identified in an environmental management framework as contemplated in Chapter 5 of the Act and as adopted by the competent authority;* *(ee) Sites or areas listed in terms of an International Convention;* *(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(gg) Core areas in biosphere reserves;*	
Listing Notice 3 GN 985 Activity 18 (Basic Assessment)	*The widening of a road by more than 4 metres; or the lengthening of a road by more than 1 kilometre.* *(f) In Western Cape:* *i. All areas outside urban areas:* *(aa) Areas containing indigenous vegetation;* *(bb) Areas on the estuary side of the development setback line or in an estuarine functional zone where no such setback line has been determined.; or* *ii. In urban areas:* *(aa) Areas zoned for conservation use; or* *(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority.*	Existing farm roads would need to be widened or lengthened. The site lies outside urban areas, and contains indigenous vegetation.
Listing Notice 3 GN 985 Activity 23 (Basic Assessment)	*The expansion of-* *(iii) bridges where the bridge is expanded by 10 square metres or more in size;* *(iv) dams where the dam is expanded by 10 square metres or more in size;* *(vi) bulk storm water outlet structures where the structure is expanded by* *10 square metres or more in size;* *(x) buildings where the building is expanded by 10 square metres or more in size;* *(xii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; where such development occurs-* *(a) within a watercourse;* *(b) in front of a development setback adopted in the prescribed manner; or* *(c) If no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *Excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.* *(g) In Western Cape:* *i. Outside urban areas, in:* *(aa) A protected area identified in terms of NEMPAA, excluding conservancies;* *(bb) National Protected Area Expansion Strategy Focus areas;* *(cc) World Heritage Sites;* *(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(ee) Sites or areas listed in terms of an International Convention;* *(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	The construction of the WEF may include the expansion of existing bridges over watercourses. The site lies outside of urban areas, and CBAs are present on site.

Listing Notices 1 - 3 4 December 2014	Listed Activity	Project Description
	(gg) Core areas in biosphere reserves; or *(hh) Areas on the estuary side of the development setback line or in an estuarine functional zone where no such setback line has been determined.*	

5.1.2 *DEA - Preferred Application Process*

As noted, the overall proposed project is for the development of two wind energy facilities and their associated grid connections and infrastructure. As per the DEA's requirements, the EIA process is to include:

One Draft Scoping Report compiled for:

- Komsberg East and West Wind Energy Facilities, Western and Northern Cape Provinces.

Two Final Scoping Reports compiled for:

- Komsberg East Wind Energy Facility, Western Cape Province; and
- Komsberg West Wind Energy Facility, Northern and Western Cape Provinces.

Two individual Environmental Impact Reports and Environmental Management Programmes (EMPrs) will be compiled and submitted for the WEF components as follows:

- Komsberg East Wind Energy Facility, Western Cape Province (this study); and
- Komsberg West Wind Energy Facility, Western and Northern Cape Provinces.

Two Basic Assessment Processes (which will also include EMPrs) will be conducted for the:

- Komsberg East Grid Connection, Western and Northern Cape Provinces; and
- Komsberg West Grid Connection, Western and Northern Cape Provinces.

A combined Public Participation Process (PPP) is being conducted for all the above.

Each application is subject to a separate Environmental Authorisation from the DEA. Should authorisations for the grid connection infrastructure be granted, this will be entirely or partially transferred from the proponent to Eskom Holdings SOC Limited (Eskom) as applicable or if necessary. The grid connection infrastructure will be routed from a start location within the WEF site boundary to the existing national grid.

Refer to the minutes of the Pre-Consultation Meeting held with the DEA on the 25th June 2015 (**Appendix C**).

5.1.3 *The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)*

Section 38 (1) of the 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 300m in length;*

(c) any development or other activity which will change the character of a site; and

(i) exceeding 5 000m² 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 EIA 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). Heritage Western Cape (HWC) (the provincial authority) acknowledges that the aesthetics of a landscape/place/area are protected by and like any other form of heritage, should be considered a grade-able entity.

During the Scoping Phase of this process, a Notice of Intent to Develop (NID) was submitted to HWC.

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

In terms of the Subdivision of Agricultural Land Act (Act 70 of 1970), any application for change of land use must be approved by the Minister of Agriculture.

5.1.5 *Conservation of Agricultural Resources, 1983 (Act No. 43 of 1983) (CARA)*

CARA 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.

5.1.6 *The Environment Conservation Act, 1989 (Act No.73 of 1989) (ECA), the National Noise Control Regulations: GN R154 of 1992 (NCR) and the Western Cape Provincial Noise Control Regulations: PN 200 of 2013*

The ECA allows the Minister of Environmental Affairs and Tourism ("now the Minister of Water and Environmental Affairs") to make regulations regarding noise, amongst other concerns. The Minister has made noise control regulations under the ECA, adopted in Provincial Notice 627 of 1998 by the Western Cape Provincial Authority.

In terms of section 25 of the ECA, the national noise-control regulations 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. The Western Cape has promulgated Provincial Noise Control Regulations.

These regulations define "disturbing noise" as a noise, excluding the unamplified human voice, which—

a) exceeds the rating level by 7 dBA;

b) exceeds the residual noise level where the residual noise level is higher than the Assessment level;

c) exceeds the residual noise level by 3 dBA where the residual noise level is lower than the rating level; or

d) in the case of a low-frequency noise, exceeds the level specified in Annex B of SANS 10103.

These Regulations prohibits anyone for causing a disturbing noise.

5.1.7 *National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (AQA)*

Section 34 of the 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.

5.1.8 *Draft Model Air Quality Management By-law for adoption and adaptation by Municipalities*

Draft model air quality management by-laws for adoption and adaptation by municipalities was published by the Department of Environmental Affairs in the Government Gazette of 15 July 2009 as General Notice (for comments) 964 of 2009. Section 18 specifically focuses on Noise Pollution Management, with sub-section 1 stating:

"No person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, animal, machine, device or apparatus or any combination thereof."

The draft regulations differs from the current provincial Noise Control Regulations as it defines a disturbing noise as a noise that is measurable or calculable of which the rating level exceeds the equivalent continuous rating level as defined in SANS 10103.

5.1.9 *National Water Act, 1998 (Act No. 36 of 1998) (NWA)*

The 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 WEFs, 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.

Water Use License Applications (WULAs) and/or General Authorisations will be required in terms of the NWA for this application. These applications will be made to the relevant department, prior to construction.

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

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

Endangered – Martial Eagle, Ludwig's Bustard

Protected – Blue Crane, Kori Bustard

5.1.11 *The Nature and Environmental Conservation Ordinance No 19 of 1974; Western Cape Nature Conservation Laws Amendment Act of 2000.*

These were developed to protect both animal and plant species within the various provinces of the country 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.

5.1.12 *Additional Relevant Legislation*

The proponent or applicant must also comply with the provisions of other relevant national legislation. Additional relevant legislation that has informed the scope and content of this Final Scoping 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).

5.2 Conventions and Treaties

5.2.1 *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 or conservation and monitor these components in light of any activities that have been identified which are likely to have adverse impacts on biodiversity. The CBD is based on the precautionary principle which states that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat and that in the absence of scientific consensus the burden of proof that the action or policy is not harmful falls on those proposing or taking the action.

5.2.2 *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".

5.2.3 *The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) (1999)*

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

5.3 Policies and Guidelines

5.3.1 *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:

- Integrated Environmental Management (IEM) Guideline Series (Series 2) Scoping in the EIA process (2002)
- 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)
- IEM Guideline Series (Series 12): Environmental Management Plans (EMP) (2002)
- IEM Guideline Series (Series 15): Environmental impact reporting (2002).

5.3.2 *National Wind and Solar PV SEA Specialist Report: Landscape Assessment (CSIR Report for Dept. Environmental Affairs (in process) and Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (2006)*

Setbacks for wind turbines are indicated in **Table 5-2** below based on the Provincial Government of the Western Cape (PGWC) guidelines (2006), and on more recent guidelines developed by the Authors with the CSIR (2014) (The buffers are nominal and subject to site-specific micro-siting and viewsheds).

Table 5-2: Setbacks for Wind Turbines.

Landscape features/criteria	PGWC 2006 Guidelines	Recommended Guidelines (2014)
Project area boundary	-	270m (subject to turbine specification).
Ephemeral streams/ tributaries	-	250m (not considered of visual significance)
Perennial rivers, wetland features	500m	500m
Major ridgelines, peaks and scarps	500m	As per visual informants map, where the buffer has been applied to peaks.
Local district gravel roads	500m	500m
Scenic passes and poorts	review if	1 to 3km (can be less if outside the viewshed).
R354 arterial route	review if	1 to 3km (can be less if outside the viewshed).
Farmsteads (inside the project	400m	800m[16]
Farmsteads (outside the project	400m	2 to 4km (can be less if outside the viewshed).
Private nature reserves/ game farms/	500m	2 to 5km (can be less if outside the viewshed).
South African Large Telescope (SALT)	-	25km (can be less if outside the viewshed).

5.3.3 ***Noise Standards***

5.3.3.1 *National*

Four South African Bureau of Standards (SABS) scientific standards are considered relevant to noises from a Wind Energy Facility. They are:

- SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication';
- SANS 10210:2004. 'Calculating and predicting road traffic noise';
- SANS 10328:2008. 'Methods for environmental noise impact assessments'; and
- SANS 10357:2004. 'The calculation of sound propagation by the Concave method'.

The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes. The recommendations that the standards make are likely to inform decisions by authorities, but non-compliance with the standards will not necessarily render an activity unlawful *per se.*

5.3.3.2 *International*

There are a number of international guidelines that are relevant and the four described below are selected as they are used by different countries in the subject of environmental noise management, with the last two specifically focussing on noise associated with wind energy facilities. Due to the lack of local regulations specifically relevant to WEFs, these guidelines will also be considered during the determination of the significance of noise impacts.

Guidelines for Community Noise (WHO, 1999)

The World Health Organization's (WHO) document on the *Guidelines for Community Noise* is the outcome of the WHO- expert task force meeting held in London, United Kingdom, in

[16] The general literature recommends 500m to 2km buffer between wind turbines and residential buildings.

April 1999. It is based on the document entitled "Community Noise" that was prepared for the World Health Organization and published in 1995 by the Stockholm University and Karolinska Institute.

The scope of WHO's effort to derive guidelines for community noise is to consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments.

Guidance on the health effects of noise exposure of the population has already been given in an early publication of the series of Environmental Health Criteria. The health risk to humans from exposure to environmental noise was evaluated and guidelines values derived. The issue of noise control and health protection was briefly addressed.

The document uses the L_{Aeq} and $L_{A,max}$ descriptors to define noise levels with the instrument likely using the "Fast"-time weighting. This document was important in the development of the SANS 10103 standard.

Night Noise Guidelines for Europe (WHO, 2009)

Refining previous Community Noise Guidelines issued in 1999, and incorporating more recent research, the World Health Organization has released a comprehensive report on the health effects of night time noise, along with new (non-mandatory) guidelines for use in Europe. Rather than a maximum of 30dB inside at night (which equals 45-50 dB max outside), the WHO now recommends a maximum year-round outside night-time noise average of 40 db to avoid sleep disturbance and its related health effects.

The report notes that only below 30dB (outside annual average) are "*no significant biological effects observed*," and that between 30 and 40dB, several effects are observed, with the chronically ill and children being more susceptible; however, *"even in the worst cases the effects seem modest." Elsewhere, the report states more definitively, "There is no sufficient evidence that the biological effects observed at the level below 40dB (night, outside) are harmful to health." At levels over 40dB, "Adverse health effects are observed" and "many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected."*

The Assessment and Rating of Noise from Wind Farms (ETSU, 1997)

This report describes the findings of a Working Group on Wind Turbine Noise, facilitated by the United Kingdom Department of Trade and Industry. It was developed as an Energy Technology Support Unit[17] (ETSU) project. The aim of the project was to provide information and advice to developers and planners on noise from wind turbines. The report represents the consensus view of a number of experts (experienced in assessing and controlling the environmental impact of noise from wind farms). Their findings can be summarised as follows:

1. Absolute noise limits applied at all wind speeds are not suited to wind farms; limits set relative to the background noise (including wind) are more appropriate.
2. LA90,10 mins is a much more accurate descriptor when monitoring ambient and turbine noise levels.
3. The effects of other wind turbines in a given area should be added to the effect of any proposed wind energy facility, to calculate the cumulative effect.
4. Noise from a wind energy facility should be restricted to no more than 5dBA above the current ambient noise level at a NSD. Ambient noise levels is measured onsite in terms of the LA90,10 min descriptor for a period sufficiently long enough for a set period.

[17] ETSU was set up in 1974 as an agency by the United Kingdom Atomic Energy Authority to manage research programmes on renewable energy and energy conservation. The majority of projects managed by ETSU were carried out by external organizations in academia and industry. In 1996, ETSU became part of AEA Technology plc which was separated from the UKAEA by privatisation.

5. Wind farms should be limited to within the range of 35dBA to 40dBA (day-time) in a low noise environment. A fixed limit of 43dBA should be implemented during all night time noise environments. This should increase to 45dBA (day and night) if the NSD has financial investments in the wind energy facility.
6. A penalty system should be implemented for wind turbine/s that operates with a tonal characteristic.

This is likely the guideline used in the most international countries to estimate the potential noise impact stemming from the operation of a Wind Energy Facility. It also recommends an improved methodology (compared to a fixed upper noise level) on determining ambient sound levels in periods of higher wind speeds, critical for the development of a wind energy facility. Because of its international importance, the methodologies used in the ETSU R97 document will be recommended in this Scoping Report for implementation during the Environmental Noise Impact Assessment phase should projected noise levels (from the proposed WEF at PSRs) exceed the zone sound levels as recommended by SANS 10103:2008.

The document uses the $L_{Aeq,f}$ and L_{A90} descriptors to define noise levels using the "Fast"-time weighting.

Noise Guidelines for Wind Farms (MoE, 2008)[18]

This document establishes the sound level limits for land-based wind power generation facilities and describes the information required for noise assessments and submissions under the Environmental Assessment Act and the Environmental Protection Act, Canada.

The document defines:

- Sound Level Limits for different areas (similar to rural and urban areas), defining limits for different wind speeds at 10m height; and
- The Noise Assessment Report, including:
  - Information that must be part of the report
  - Full description of noise sources
  - Adjustments, such as due to the wind speed profile (wind shear)
  - The identification and defining of potential sensitive receptors
  - Prediction methods to be used (ISO 9613-2)
  - Cumulative impact assessment requirements
  - It also defines specific model input parameters
  - Methods on how the results must be presented
  - Assessment of Compliance (defining magnitude of noise levels)

Table 5-3: Summary of Sound Level Limits for Wind Farms (MoE).

Wind speed (m/s) at 10 m height	4	5	6	7	8	9	10
Wind Turbine Sound Level Limits, Class 3 Area, dBA	40	40	40	43	45	49	51
Wind Turbine Sound Level Limits, Class 1 & 2 Areas, dBA	45	45	45	45	45	49	51

The document used the $L_{Aeq,1h}$ noise descriptor to define noise levels. It is not clear whether the instrument must be set to the "Fast" or "Impulse" time weighing setting, but, as the

[18] Noise Guidelines for Wind Farms Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities Ministry of the Environment, Ontario, October 2008.

"Fast" setting is used in most international countries it is assumed that the instrument will be set to the "Fast" setting.

It should be noted that these Sound Level Limits are included for the reader to illustrate the criteria used internationally. Due to the lack of local regulations specifically relevant to wind energy facilities this criteria will also be considered during the determination of the significance of the noise impact.

5.3.4 *Wind Energy Facility Guidelines*

The following guidelines are relevant to the proposed WEFs 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 (2014);
- South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (2014); and
- Best Practice Guidelines for Avian Monitoring and Impact Mitigation at Proposed Wind Energy Development Sites in Southern Africa. BirdLife South Africa/Endangered Wildlife Trust (2012).

6 PLANNING AND NATIONAL LEGISLATION AND POLICY ON RENEWABLE ENERGY

This section provides a review of energy legislation as relevant to renewable energy projects. It also documents the review of applicable planning policies at national, provincial and municipal levels.

It is established that policy supports the development of renewable energy at all levels of governance. The intent of local, provincial and national policies aim to address energy supply issues, and aim to promote economic growth in South Africa.

The mechanism for the development of renewable energy facilities, by independent power producers in South Africa is the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). This programme is elaborated upon below.

6.1 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

The REIPPPP is the mechanism which the DoE has provided for Independent Power Producers (IPPs), that is, private companies, to develop, construct and operate renewable energy facilities in South Africa.

Renewable energy in terms of the REIPPPP includes projects making use of any onshore wind, solar thermal, solar photovoltaic, biomass, biogas, landfill gas, or small hydro technologies.

The REIPPPP is a selection process which enables the DoE to evaluate potential renewable energy developments proposed by the IPP's through a competitive bidding process.

The bid is first evaluated to confirm that it is compliant with the bidding requirements. Bidding requirements include a completed EIA process and Environmental Authorisation from the competent authority. Compliant bids are then evaluated against two main criteria; price of electricity from the project and its economic development commitments.

In terms of the project's economic development commitments, bidders must demonstrate how a project would contribute towards elements such as job creation, local content and local manufacturing, rural development and community involvement, education and development of skills, enterprise development, socio-economic development and participation by historically disadvantaged individuals (HDIs). Reporting to demonstrate

compliance with commitments made by the project over the life of the project is a strict requirement of the REIPPPP.

The most competitive compliant projects are awarded "Preferred Bidder Status" based on 70/30 split between the price and project's economic development commitments.

If awarded Preferred Bidder Status, the IPP would enter into an implementation agreement with the DoE and a Power Purchase Agreement (PPA) with Eskom. Once operational, the electricity would be sold to Eskom under the PPA at the agreed bid price. Eskom then distributes the energy through the national grid to energy users.

6.2 National Legislation and Policy

National planning policies and relevant national legislation have been individually reviewed within the Social Impact Assessment (SIA) (Refer to **Volume 2** of this EIR). The findings of this review are that the establishment of a WEF in this area would be supported by national, provincial and local policies and planning documents.

The following national level legislation, policy and planning documents were assessed:

- National Energy Act, 2008 (Act No. 34 of 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 Electricity (2010-2030);
- The National Development Plan (2011);
- New Growth Path Framework (2010);
- National Infrastructure Plan (2012); and
- Astronomy Geographic Advantage (AGA) Act, 2007 (Act 21 of 2007).

The detail and intention of each policy listed above is elaborated upon in the SIA, which is included in **Volume 2** of this report.

6.3 Provincial Policy

The following provincial and local policy and planning documents were reviewed:

- White Paper on Sustainable Energy for the Western Cape Province (2010);
- The Western Cape Provincial Strategic Plan 2014-2019 (2014);
- The Western Cape Land Use Planning Act, 2014 (Act No. 3 of 2014);
- The Western Cape Provincial Spatial Development Framework (2014 Revision);
- The Western Cape Climate Change Response Strategy (2014);
- The Western Cape Infrastructure Framework (2013);
- The Western Cape Green Economy Strategy Framework (2013);
- The One Cape 2040 Strategy (2012);
- The Western Cape Amended Zoning Scheme Regulations for Commercial Renewable Energy Facilities (2011);
- The Western Cape Draft Strategic Plan (2009 - 2014);
- The Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape – Towards a Regional Methodology (2006);
- The Guidelines for the Management of Development on Mountains, Hills and Ridges in the Western Cape (2002);
- Central Karoo District Municipality Integrated Development Plan (2012-2017);
- Central Karoo Spatial Development Framework;
- Laingsburg Local Municipality Integrated Development Plan (2012-2017); and
- Laingsburg Local Municipality Local Economic Development Strategy (2006).

The detail and intent of each policy listed above is described in the SIA included in **Volume 2** of this EIR.

SECTION E ENVIRONMENTAL IMPACT ASSESSMENT PHASE APPROACH AND METHODOLOGY

7 APPROACH AND METHODOLOGY FOR EIA PHASE

The EIA process commences with formally notifying the DEA of the proposed development(s) through the submission of application forms. Following this notification, the EAP, along with a project team of technical specialists, commence the Scoping Phase, in order to inform decision regarding the appropriate "scope" of the EIA phase.

The existing environmental baseline of the site proposed for development is established during this phase through specialist studies. The type of development is considered and its anticipated impacts on the existing environment. The methodology of how these impacts should be assessed within the EIA phase is determined.

A Draft Scoping Report (DSR) and Plan of Study for Environmental Impact Assessment is compiled which is made available for public review for a legislated period of 30 days. All comments received in response to the DSR are considered, responded to in an Issues Trail and incorporated into a Final Scoping Report (FSR). The FSR is submitted to the DEA, as the competent authority, for approval.

Depending on the comments received from the DEA, and whether or not any substantive changes need to be made to the FSR, Interested and Affected Parties (I&APs) may then be provided with a second opportunity to comment on the FSR and submit their comments directly to the DEA. Should this be the case, Arcus will update the Issues Trail, and provide responses to the DEA for a second time.

Should the FSR be approved by the DEA, the EIA Phase can be initiated, which includes further detailed specialist investigation, site visits and assessments.

The DEA approved and commented on the Final Scoping Report and Plan of Study for Scoping for this proposal on the 4th February 2016. Refer to **Appendix D** for a copy of this letter and to **Table 10-5** for a list of requirements and where these can be found in this report.

A Draft EIA Report (Draft EIR) is then compiled and incorporates these findings. The DEIR is made available for stakeholder review for a period of 30 days (**this document**). Comments are again considered and responded to in a Final EIA Report (Final EIR).

I&APs are then notified of the availability of the Final EIR for public review, and comments are submitted directly to the DEA.

Once a Final EIR has been submitted within 106 days of acceptance of the Final Scoping Report, the competent authority (the DEA) will make a decision within 107 days on whether or not to grant or refuse Environmental Authorisation for the application.

7.1 EIA Phase

The EIA Phase must be undertaken in line with the approved plan of study for environmental impact assessment. The environmental impacts, mitigation and closure outcomes as well as the residual risks of the proposed activity must be set out in the EIR.

As per the 2014 EIA Regulations, "the objective of the environmental impact assessment process is to, through a consultative process -

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
(d) determine the
(i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
(ii) degree to which these impacts –
(aa) can be reversed;
(bb) may cause irreplaceable loss of resources, and
(cc) can be avoided, managed or mitigated;
(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
(g) identify suitable measures to avoid, manage or mitigate identified impacts; and
(h) identify residual risks that need to be managed and monitored".

The above activities are completed through consultation with:

- The lead authorities involved in the decision-making for the EIA application (in this case, the DEA);
- The public, I&APs and other relevant organisations to ensure that local issues are well understood; and
- The EIA 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 during this phase is to present key stakeholders with the findings of the assessments, obtain and document feedback and address all issues raised.

The process/procedural tasks undertaken during this EIA Phase process include:

Table 7-1: Procedural Tasks to be undertaken for EIA Phase.

Task	Anticipated Date
Pre-Consultation Meeting with the DEA	25 June 2015
Submission of Application Forms and Draft Scoping Report (DSR)	November 2015
Public Review of DSR and Plan of Study	September/October 2015
Submission of Final Scoping Report and Plan of Study to the DEA	November 2015
Acceptance/Rejection of Final Scoping Report and Plan of Study for EIA	January/February 2016
Submission of Draft Environmental Impact Report (EIR) to DEA and Public Review period	15th April – 15th May 2016
Submission of Final Environmental Impact Report	May 2016

7.1.1 *Content of Environmental Impact Assessment Reports (EIRs)*

The content of EIRs is legislated as per Appendix 2 of the Environmental Impact Assessment Regulations 2014 GN R. 982 as promulgated in terms of the NEMA. For ease of reference, **Table 7-2** below indicates the legislated requirements for the contents of EIRs, and the location of this information in this report.

Table 7-2: Legislative Requirements for the content of this EIR.

Appendix 2 Requirements	Location in EIR
2 (a) details of- *(i)the EAP who prepared* *the report; and* *(ii) the expertise of the EAP, including a curriculum vitae;*	Appendix A
(b) 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;*	Section 1.3
(c) 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;*	Figures 1.1 – 1.4
(d) 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 associated structures and infrastructure related to the development;*	Section 1.3 Section D
(e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	Section D Section 2.4
(f) 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 3
(g) a motivation for the preferred development footprint within the approved site;	Section 4.4
(h) a full description of the process followed to reach the proposed development footprint within the approved site, including- *(i) details of the development footprint alternatives considered;*	Section 4.4
(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 H
(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 H
(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section F
(v) the impacts and risks identified, 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 G
(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Appendix E
(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	Section G

the geographical, physical, biological, social, economic, heritage and cultural aspects;	
(viii) the possible mitigation measures that could be applied and level of residual risk;	Section G
(ix) if no alternative development locations for the activity were investigated the motivation for not considering such;	Section 4.3
(x) a concluding statement indicating the preferred alternative development location within the approved site	
(xi) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure 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 E Section G Section 7.2
(j) 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 mitigated;*	Section G
(k) where applicable, a summary of the findings and recommendations of 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 assessment report;	Section I
(l) 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 I
(m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	Section I
(n) the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Section I
(o) 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 I
(p) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 1.7
(q) 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 I
(r) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	N/A

(s) an undertaking under oath or affirmation by the EAP in relation to- *(i) the correctness of the information provided in the report;* *(ii) the inclusion of comments and inputs from stakeholders and interested and affected parties;* *(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and* *(iii) 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;*	Section 17
(t) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	Section I Page 277.
(u) an indication of any deviation from the approved scoping report, including the plan of study, including: *(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and* *(ii) a motivation for the deviation;*	No deviations.

7.2 Specialist Studies

Eight specialist studies were commissioned for the EIA phase, to investigate the potential impacts associated with the implementation of the proposed development. EIMS was engaged to assist with the facilitation of the Public Participation Process (PPP) for this application.

The specialist studies involved the gathering of data relevant to identifying and assessing environmental impacts that may occur as a result of the proposed development, and was completed according to the relevant guidelines for specialist studies.

As required by the new 2014 EIA Regulations, specialists were required to assess the significance of impacts. As such, specialists were supplied with a standard method in their terms of reference which is used to determine the significance of impacts to ensure objective assessment and evaluation, while enabling easier multidisciplinary decision-making. Refer to **Appendix E** for this detailed methodology.

Specialists have also recommended mitigation measures to minimise potential impacts or enhance potential benefits during the design, construction and operation, and closure phases of the proposed development. Design phase mitigation measures will be taken into consideration during the development of the final layouts of the WEFs ('embedded mitigation'). The specialist EIA Phase reports are presented in **Volume 2** of this report.

The sections below outline the methodologies undertaken for each specialist EIA Phase level study.

7.2.1 *Visual Impact Assessment (VIA)*

The 'Guideline for Involving Visual and Aesthetic Specialists'[19], issued by the Provincial Government of the Western Cape, was used as guidance for the compilation of the VIA.

A site visit to the proposed Komsberg West development site and surroundings was carried out on 25 June 2015, being mid-winter. The season was not a major consideration for carrying out a visual assessment.

The visual assessment methodology has included the completion of the following tasks:

- Mapping of the study area location and its landscape context;

[19] Oberholzer, B. 2005. *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes*. Edition 1. CSIR Report No. ENV-S-C 2005 053 F. Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning, Cape Town.

- Mapping of the projected viewsheds and distance radii of the proposed WEF to determine the possible zone of visual influence;
- Identification of important viewpoints and view corridors, and a photographic survey from selected viewpoints, taking into account possible sensitive receptors;
- Identification of landscape characteristics, including topographical and geological features, vegetation cover, land use, cultural landscapes, protected areas and farmsteads;
- Identification and mapping of visual / landscape constraints, including buffers, for the proposed WEF;
- Assessment of possible visual impacts or risks associated with the project, with the help of photographic montages to simulate the proposed WEF; and
- Formulation of possible mitigations and recommendations to minimise potential adverse visual impacts.

7.2.2 ***Flora and Fauna Impact Assessment***

7.2.2.1 *Data Sourcing and Review*

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

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map[20] as well as the National List of Threatened Ecosystems (2011), where relevant.
- Critical Biodiversity Areas for the site and surroundings were extracted from the Namakwa District Biodiversity Sector Plan.[21]
- Information on plant and animal species recorded for the Quarter Degree Squares (QDS) 3220DB 3220DD 3221CA 3221CC was extracted from the SABIF/SIBIS database hosted by SANBI. This is a considerably larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has probably not been well sampled in the past.
- The IUCN conservation status of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants.
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA. This includes rivers, wetlands and catchments defined under the study.
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).

Fauna:

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and the Animal Demography Unit (ADU) databases[22].
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Skinner and Chimimba (2005) for mammals[23].

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

[21] Desmet, P and Marsh A. 2008. *Namakwa District Biodiversity Sector Plan*. Available from BGIS at http://bgis.sanbi.org/namakwa/project.asp.

[22] http://vmus.adu.org.za.

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

- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.
- The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria 2014, and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming, the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

7.2.2.2 *Site Visit*

A site visit to the study area was conducted from the 4th-6th December 2015. During the site visit, the different biodiversity features, habitat, and landscape units present at the site were investigated in the field. Most parts of the potentially affected ridges are not accessible and had to be accessed on foot. The ridges were accessed at multiple sites and large sections of the ridges were hiked on foot and full plant species lists recorded.

Attention was paid to the presence of sensitive features and habitats along the ridges that might be impacted by the development. During the site visit, all plant and animal species observed were recorded. Active searches for reptiles and amphibians were also conducted within habitats likely to harbour or be important for such species. The presence of sensitive habitats such as wetlands or pans and unique edaphic (soil) environments, such as rocky outcrops or quartz patches, were noted in the field if present and recorded on a GPS and mapped onto satellite imagery of the site.

Apart from this site visit, the area has also been visited in the past at different times of the year for a variety of other assessments. This includes the adjacent Mainstream Sutherland WEF which includes adjacent portions of some of the same ridges as this current study. This information has also been used to inform the current study as appropriate.

7.2.2.3 *Sensitivity Mapping & Assessment*

An ecological sensitivity map of the site was produced by integrating the information collected on-site with the available ecological and biodiversity information available in the literature and various spatial databases. This included delineating the different habitat units identified in the field and assigning sensitivity values to the units based on their ecological Mapped sensitive features such as wetlands, drainage lines and water bodies were collated properties, conservation value and the potential presence of species of conservation concern. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- Low – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- Medium- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.

Branch W.R. 1998. *Field guide to snakes and other reptiles of southern Africa.* Struik, Cape Town
Skinner, J.D. & Chimimba, C.T. 2005. *The mammals of the Southern African Subregion*. Cambridge University Press, Cambridge.

- High – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
- Very High – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.

In some situations, areas were also classified between the above categories, such as Medium-High, where it was deemed that an area did not fit well into a certain category, but rather fell most appropriately between two sensitivity categories.

7.2.2.4 *Limitations to Note*

- The major potential limitation associated with the sampling approach is the narrow temporal window of sampling. Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant and animal species present are captured. However, this is rarely possible due to time and cost constraints and therefore, the representivity of the species sampled at the time of the site visit should be critically evaluated.
- The site visit for the current study took place in summer. There is no optimal season for site visits to the area, as it lies along a gradient from predominantly winter rainfall in the west to predominantly summer or aseasonal rainfall in the east. Although it was relatively dry at the time, due to it having been a relatively low rainfall growing season, the vegetation was sufficiently grown-out and active that most perennial species were growing or in flower and few species were present that could not be identified. It is however likely that the number of annuals, forbs and geophytes recorded is relatively low and that more such species would be present in wetter years. However, having visited the area in the past during wet seasons, this is not seen as a significant limitation for the current study and the timing and extent of the current site visit is not considered to be a limiting factor which might compromise the results.
- The lists of amphibians, reptiles and mammals for the site are based on those observed at the site, as well as those likely to occur in the area based on their distribution and habitat preferences. Several site visits have been conducted during various seasons to the area and information on fauna observed in the area is included where relevant. This represents a sufficiently conservative and cautious approach which takes the study limitations into account.

7.2.3 **Bats**

The baseline environment for bats was investigated by conducting a desktop review of relevant literature and databases which was supplemented with data collected from field surveys at the proposed WEFs. These field surveys were part of the twelve months of bat monitoring undertaken in accordance with the South African Good Practice Guidelines for Surveying Bats in Wind Energy Facility Developments – Pre-construction[24] ('the guidelines'). The aim of the monitoring programme was to determine the potential impacts on bats due to the project and if necessary to make mitigation recommendations to avoid or reduce potential impacts. The on-site monitoring for the project commenced in February 2015 and was completed on 24th January 2016. The monitoring data collected during this period have been used to inform this study. The data spanned all four seasons in the region and

[24] Sowler, S. and Stoffberg, S. 2014. South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments – Pre-construction, 3rd Edition.

are therefore suitable to provide an indication of potential levels of bat activity at the proposed project site.

7.2.3.1 *Desktop Review*

A desktop study of available bat locality data, literature and mapping resources was undertaken to determine the likelihood of bats being present at the proposed project. This included:

- Academic sources such as research papers and published texts;
- Published information on other nearby renewable energy developments;
- Bat distribution records and maps; and
- A review of the habitats on the site to identify, if possible, habitats, roosts and features which may be associated with bats.

7.2.3.2 *Field Surveys - Acoustic Monitoring and Roost Surveys*

The survey approach focused on the use of passive acoustic monitoring to record bats across the project site. A desk-based mapping exercise initially recommended the installation of bat detectors (SM2Bat+, Wildlife Acoustics) at nine locations. Three additional locations were added in July and August 2015 yielding 12 locations in total (**Figure 7-1**). Topography, vegetation types, land use, landscape features important for bats (e.g. linear features, potential roosts and water), road access, the size of the site and the proposed turbine locations were used to determine the number and locations of bat detectors.

At ten of the monitoring locations the detectors were installed on temporary aluminium masts with ultrasonic microphones mounted at 12m. At two locations bat detector microphones were mounted at 12m and 80m above ground level on two lattice meteorological masts ('met masts'). Arcus installed the detectors on the 12m masts from 10 - 17 February 2015 and 12 - 16 August 2015. The met mast detectors were installed by FASS Towers on 23 February 2015 (MET1) and Obelisk Energy on 26 July 2015 (MET2). All detectors were configured to record every night from 30 minutes before sunset until 30 minutes after sunrise. Data were manually retrieved from each detector between the following dates:

- 22 – 28 March 2015
- 15 – 17 April 2015
- 21 – 29 June 2015
- 11 – 13 August 2015
- 13 – 22 October 2015
- 30 November 2015 – 2 December 2015
- 22 – 24 January 2016

Driven transects were not undertaken because the nature of the site made their use unsuitable. Road access was very limited to non-existent in areas relevant to proposed turbine locations on the higher lying ridges. Where road access was possible on ridges, static detectors were used. Existing roads were confined to lower lying areas where turbines are not planned. In these areas, the distribution of static detectors sampled habitats representative of the site including drainage areas, riparian zones and foothill areas. As such, driven transects would not provide sufficient additional data to warrant their use.

Potential structures that bats could use as roosts were investigated during the day for the presence or evidence (e.g. guano and culled insect remains, etc.) of roosting bats whenever the specialist was on site. These included buildings, rocky outcrops and trees. Landowners were also asked if they were aware of any (active or abandoned) bat roosts or the presence of caves within the project or local region.

7.2.3.3 *Data Analysis – Bat Echolocation Call and Meteorological Data Analyses*

Bats emit ultrasonic echolocation calls for orientation, navigation and foraging. These calls can be recorded by bat detectors enabling bat species to be identified from various features in their calls (e.g. the frequency of the call). A sequence of calls is called a bat pass and quantifying the number of bat passes recorded can be used to quantify the relative abundance of bat species. However, bat passes recorded from bat detectors cannot be used to directly estimate population sizes because it cannot distinguish between a single bat flying past a detector multiple times or multiple bats of the same species passing a detector once each.

Acoustic data from each bat detector were converted to zero-crossing format using Kaleidoscope (Version 3.1.3, Wildlife Acoustics) and analysed using AnalookW (Version4.1t, www.hoarybat.com). Bat species were identified from their echolocation calls using species-specific filters based on various call parameters. To aid in species identification, full-spectrum bats calls were also used to examine call sequences using Kaleidoscope.

Data from each detector were automatically processed using the scan function in AnalookW which counted the number of files that passed each species' filter. The number of AnalookW files was then used as a proxy for the number of bat passes. A bat pass was defined as a sequence of two or more echolocation calls separated from other calls by more than 500 milliseconds.

Meteorological data from the 80m lattice mast MET2 were obtained and analysed in relation to bat activity. Data spanned the period from 27 July 2015 through 22 January 2016 and included wind speed (ms^{-1}), temperature (°C) and barometric pressure (mbar). No wind speed data were available at 12m so wind shear calculations, a standard method to extrapolate wind speeds at heights beyond the range from which wind speeds were recorded, were used to estimate wind speed at 12m thereby making full use of the bat activity data recorded nearer ground level. All weather data were logged every ten minutes (between 17:00 and 07:00) and the number of bat passes was summed for each of these intervals from the output of the AnalookW analysis such that they corresponded to the prevailing weather when they were recorded. Meteorological data were also obtained from the MET1 from April 2015 to January 2016. These were not analysed in relation to bat activity as the limited amounts of bat activity at this location resulted in the analysis lacking sufficient power to provide meaningful results.

Activity accumulation curves demonstrate how bat activity accumulates against an increasing measured variable (e.g. increasing wind speed) thus providing an estimate of the bat activity at (or below, or above) a given state of the measured variable (e.g. at a given wind speed). These curves were generated by adding the number of bat passes from a higher wind speed/temperature to the total number of bat passes recorded from all lower wind speeds, thus giving a running (and increasing) total of the number of bat passes. From these values, the accumulated proportion of total activity was calculated for each wind speed by dividing the accumulated total by the total number of bat passes recorded. The curves do not imply a causal relationship between bat activity and wind speed, but instead provide a useful tool to examine the likely amount of bat activity at given wind speed or temperature which may be useful to understand during turbines operation. Accumulation curves were generated for wind speed at 12m and 80m.

Generalised Linear Models (GLMs) were used to investigate the relationship between the number of bat passes and wind speed, temperature and barometric pressure. The entire dataset was divided into several smaller datasets for analysis and the first division only included data between 20:00 and 05:00 (the peak time of bat activity at MET2). This dataset was then divided into presence-absence (i.e. ≥0 passes) and presence-only data (i.e. ≥1 passes). Each of these datasets were also separated by season. Analyses were also repeated on a new dataset which grouped all data into thirty minute time periods which was divided into smaller datasets as before. Data from 12m and 80m were analysed

separately. The number of bat passes is a count variable and was therefore modelled under the assumptions of a Negative Binomial distribution.

7.2.4 Aquatic Ecosystems

- Compilation of maps depicting demarcated waterbodies delineated to a scale of 1:10 000 after a site visit has been conducted.
- Determination of the desktop ecological state of any aquatic systems, estimating their biodiversity, conservation and ecosystem function importance with regard ecosystem services.
- Recommendation of buffer zones and No-go areas around any delineated wetland areas based on the relevant legislation, for example, Conservation Plan guidelines or best practice.
- Assessment of the potential impacts, based on the supplied methodology.
- Provision of mitigation measures regarding project related impacts, including engineering services that could negatively affect demarcated aquatic areas.
- Provision of relevant aspects with regard to the compilation of the Environmental Management / Monitoring Plans.

7.2.5 Avifauna

The approach to the study followed that which was required by the Best Practice Guidelines applicable at the time of the surveys ('the Guidelines') and those of the NEMA EIA process.

The approach consisted of three stages:

- The avifaunal baseline at the project site was defined through a desktop study, a twelve month pre-construction monitoring programme and a nest survey;
- The results of this were used to create an Avifaunal Sensitivity Map and Avifaunal No-Go Areas Map to inform turbine placement design, and to identify potential impacts;
- The potential impacts of the proposed project were assessed with and without identified mitigation measures.

The following terminology is used:

- Priority species = all species occurring on the Birdlife South Africa (BLSA) and Endangered Wildlife Trust (EWT) Avian Sensitivity Map priority species list25. This list consists of 107 species with a priority score of 170 or more, and most likely to be affected negatively by WEFs. The priority score was determined by BLSA and EWT after considering various factors including bird families most impacted upon by WEFs, physical size, species behaviour, endemism, range size and conservation status;
- Red Data species: Species whose regional conservation status is listed as Near-Threatened, Vulnerable, Endangered or Critically Endangered in the Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland;
- Endemic or Near-endemic: Endemic or near endemic (i.e. ~70% or more of population in RSA) to South Africa (not southern Africa as in field guides) or endemic to South Africa, Lesotho and Swaziland. Taken from BirdLife South Africa Checklist of Birds in South Africa, 2014.
- Target species (i.e. the species to be recorded by each particular method) per survey method were as follows:
  - Walked Transects: all birds;
  - Driven Transects: all raptors; all large (non-passerine) priority species;
  - Vantage Point Surveys: all raptors; all large (non-passerine) priority species;
  - Incidental Observations: all raptors; all large (non-passerine) priority species; and

[25] Retief, E, Anderson, M., Diamond, M., Smit, H., Jenkins, A. & Brooks, M. (2011) Avian Wind Farm Sensitivity Map for South Africa: Criteria and Procedures used. *Priority species list updated in 2014 by BLSA*.

- Focal sites: all species associated, utilising or interacting at/with the focal site.

7.2.5.1 *Defining the Baseline and Identifying Potential Impacts*

The baseline avifauna environment for the WEF was defined utilising a desk based study and informed by on site seasonal monitoring (over a twelve month period), a specialist nest survey, as well as previous experience from monitoring and field work conducted by the specialists in the immediate area. After collation of the baseline data from the sources of information listed above the potential impacts of the project were identified, for both the construction and operational phases. This was done by reviewing existing literature and data available (both locally and internationally) on the potential impacts of WEFs on avifauna and considering the potential avifaunal community on the project site.

7.2.5.2 *Twelve Month Pre-Construction Bird Monitoring Survey Design*

At the time of commencement of the surveys, there was no designation of the proposed Komsberg East or Komsberg West WEFs, and the whole site was therefore referred to as 'the WEF site'. For the purposes of this section, 'the WEF site' is therefore defined as the area enclosed by the farm portions that constitute both the proposed Komsberg East and Komsberg West WEFs.

The monitoring techniques used were walked transects (WT); Driven transects (DT); bird flight activity through vantage point (VP) observations; Focal site (FS) surveys, nest surveys and incidental records. In order to provide useful comparative data in the event of the construction and operation of the project, surveys were also undertaken at a nearby control site (**Figure 8-3**). The control site was located approximately 7km south of the eastern section of the WEF site, and approximately 20km east of the south western section of the WEF site, and was selected primarily on the basis of its accessibility and similarity of the predominant habitats to the project site. The WEF and control sites were visited on 18, 19 and 20 March 2015 by the avifaunal specialist in order to identify focal sites and confirm the locations and accessibility of the vantage points, driven transects, walked transects.

The primary aims of the twelve month pre-construction avifaunal monitoring survey were:

- To estimate the number/density of birds regularly present or resident within the broader impact area[26] of the project before its construction;
- To document patterns of bird movements in the vicinity of the project before its construction;
- To estimate the collision risk to key species by analysing the frequency with which individuals or flocks fly at rotor swept height (RSH);
- To inform comment on the merits of the application in the avifaunal impact assessment report;
- To establish a pre-impact baseline of bird numbers, distributions and movements; and
- To mitigate impacts by informing the final design, construction and management strategy of the project.

Note that the following amendments were made to the survey:

- A focussed Verreaux's Eagle nest search was added to the winter seasonal surveys.
- Five additional focal sites (FS2-FS6) were located during the winter season, and added to the survey protocols for the remaining two surveys (spring and summer).

[26] The broader impact area was defined as the WEF site itself, and up to 1 km from the boundary of the WEF site. As the WEF site is large and only smaller areas within it would have turbines located on it, this definition of the broader impact area was deemed sufficient.

Twelve Month Pre-Construction Bird Survey Methodology

Four seasonal surveys were carried out: Autumn (21-31 March 2015); winter (20-30 June 2015 and 03-06 August 2015); spring (13-22 October 2015); and summer (07-16 January 2016).

Walked Transects

The purpose of the walked transect surveys was to estimate bird populations and densities across the site, with a particular focus on small terrestrial species and passerines.

Seven walked transects were sampled in the WEF and two were sampled in the control site and referred to as control walked transects (CWT) (**Figure 8-4**). Each transect was 1 km in length and was conducted twice during each seasonal survey, resulting in eight replications of each transect across the monitoring programme. Transects were conducted by a pair of observers who walked from the start to the end point of the transect, whilst recording all birds seen or heard up to 150m on either side of the transect. The perpendicular distance in meters to the transect line was noted as well as number and age of individuals, their behaviour and if they were seen or heard. Beyond 150m, only priority species were noted and were recorded as incidental sightings.

Vantage Points

Twelve vantage points were surveyed in the WEF site (six within the proposed Komsberg East site), and one in the control site (CVP). The locations of the VPs were designed to maximise coverage of the ridges identified by the developer for potential turbine placement, taking into account accessibility. Observer pairs monitored a viewshed of 360 degrees with a radius of 2.5km from each VP (**Figure 8-5**)**.** VP locations did not change between surveys. The viewsheds were the focus of observation, however if target species were noted beyond these (or if a species being recorded flew out of the viewshed but was still visible), they would also be recorded. For each flight of a target species the flight path was recorded on a large scale map along with data on the number/species of bird(s) and type of flight.

Flight heights were recorded through five height bands: 1: 0-20m; 2: 20-40m; 3: 40-120m; 4: 120-160m and 5: >160m. Each VP was surveyed for twelve hours per seasonal survey. The control site VP was surveyed for a total of nine hours per seasonal survey. A total of 612 hours of VP observations were therefore carried out during the twelve month programme. Co-ordinates and total hours surveyed are presented in **Table 7-3** below.

Table 7-3: Vantage Point Geographic Co-ordinates and Hours Surveyed.

VP	Co-ordinates		Autumn	Winter	Spring	Summer	Total time surveyed
	South	East					
1 (West)	32.7851°	20.80876°	12h25m	12h	12h	12h	*48h25m*
2 (West)	32.749°	20.82127°	12h	12h	12h	12h	*48h*
3 (West)	32.7396°	20.84521°	11h45m	12h	12h	12h	*47h45m*
4 (West)	32.754°	20.85059°	11h50m	12h	12h	12h	*47h50m*
5 (West)	32.7786°	20.865692°	12h	12h	12h	12h	*48h*
6 (West)	32.7121°	20.87541°	12h	12h	12h	12h	*48h*
7 (East)	32.7411°	21.036174°	12h	12h	12h	12h	*48h*
8 (East)	32.7062°	20.97328°	12h	12h	12h	12h	*48h*
9 (East)	32.7319°	20.99825°	12h	12h	12h	12h	*48h*
10 (East)	32.7113°	21.01895°	12h	12h	12h	12h	*48h*
11 (East)	32.7013°	21.04248°	12h	12h	12h	12h	*48h*
12 (East)	32.7086°	21.06386°	12h	12h	12h	12h	*48h*
CVP (Control)	32.8545°	21.06733°	9h	9h	9h	9h	*36h*

Total	*153h*	*153h*	*153h*	*153h*	***612 hours***

h=hours; m=minutes

Average passage rates and standard deviations (SD) were calculated as the average number of individuals recorded flying per hour of vantage point observations.

Driven Transects

Large terrestrial priority species and raptors were sampled using five driven transects on the WEF site and one driven transect on the control site (**Figure 8-4**).

Each transect was conducted twice during each seasonal survey, resulting in eight replications of each transect across the monitoring programme. Transects were conducted by a pair of observers driving slowly (approximately 30km/hr) with the vehicle windows open, and stopping regularly to scan important habitats such as ridges, cliffs and open areas. All target species were recorded, along with the geographical location of the observers for each record.

Focal Sites

Focal sites are any identifiable features within the landscape that are likely to support notable avifauna (e.g. a roost or nesting site) or sites that have the potential to support breeding pairs or large densities of avifauna (e.g. dams, wetlands, river systems) and these sites may change as the project progresses and other focal sites become evident. A total of six focal sites (**Table 7-4**) were surveyed for the presence of priority species. FS1 was surveyed over all four seasons. Following the winter season (survey 2), FS2-FS6 were added and surveyed during each of the two remaining seasonal surveys. No focal sites were identified in the control site. When surveyed during a particular season, focal sites were visited on two occasions during the applicable season.

Table 7-4: Geographic Positions and Descriptions of Focal Sites.

Focal Site	Co-ordinates		Description
	South	East	
FS1	32.713240°	21.031210°	Two cliff faces (east and west) approximately 300 m apart, viewed from the same point (FS1). Each cliff face has one Verreaux's Eagle nest structure.
FS2	32.7275611°	20.9307972°	Verreaux's Eagle roost on *Eucalyptus* trees.
FS3	32.7301083°	20.9335027°	Verreaux's Eagle roost/perch on rocks.
FS4	32.7281694°	20.831105°	Martial Eagle roost on Poplar copse.
FS5	32.6927667°	21.0403°	African Harrier Hawk nest.
FS6	32.6769611°	20.77903°	Verreaux's Eagle nest.

Incidental Records

Relevant incidental observations of target species were recorded while commuting to or from, or on the WEF site and control site, but outside the survey protocols and times described above, e.g. when driving *en route* to survey locations.

Focussed Verreaux's Eagle Nest Search

Prior to the second (winter) seasonal survey, an initial analysis of Verreaux's Eagle flight data (i.e. the location of flight paths) collected to date, as well as an examination of publically available satellite imagery and 1:50 000 maps, was conducted to determine focus areas for this search. Fifty-one cliff faces and/or ridges with potential cliff habitat (C1-C51) were identified. The avifaunal specialist and an assistant visited the site over four days (3 to 6 August 2015) and surveyed each of the 51 cliffs. From 8–9 February 2016, additional cliffs (C52-C59) were surveyed by the avifaunal specialist. The cliffs were accessed either by vehicle or foot, so that a suitable viewpoint as close to each cliff could be found. Cliffs were surveyed using a combination of 10x42 zoom binoculars as well as a tri-pod mounted 20-60 x 60 Nikon Prostaff 5 fieldscope. The aim was to locate Verreaux's Eagle nests (which are typically large), however the presence of any raptor nest (active or inactive) was noted if observed. Relevant incidental observations of priority species were also recorded by the specialist (during the August visit but not during the February visit) while commuting to and from the cliffs, and this data was added to the incidental observation results for the winter survey.

Determination of Avian Sensitivity Zones

Avifaunal Sensitivity Zones were designated based on landscape features and observed flight activity during twelve months of avifaunal monitoring on the WEF site.

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

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

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

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

Where:

- PSS is the Priority Species Score.
- N is the number of birds that are associated with the flight line.
- X is the length of the flight line section that is within a particular Grid Square.
- Y is the length of the whole flight line.
- D is the duration of the whole flight.
- P is the proportion of the flight line at Risk Height.

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

The resultant GCSS scores were categorised as follows: Low (2 – 20,000); Medium (20,000-120,000); Medium-High (120,000-300,000); and High (>300,000).

Additional Sensitivity zones were identified by buffering the following landscape features:

- Priority species and/or raptor nests
- Raptor Roost sites
- Steep slopes
- National Freshwater Ecosystem Priority Areas (NFEPA) Rivers and Wetlands

- Agricultural Lands
- Dolerite Sills (i.e. rocky outcrops)

The resultant Avifaunal Sensitivities and No-Go Areas Map (**Figure 9-4**), which identified no-go areas, was submitted to the developer to inform turbine placement. It was recommended that the hierarchy of sensitivity scores be considered, with preferential turbine placement in areas with Low or Unknown Sensitivity areas, and decreasing preference through to Medium-High Sensitivity areas. High Sensitivity Zones were designated as no-go areas.

Impact Assessment Methodology

The potential impacts of each component of the proposed development were identified and assessed individually. It is assumed that by using the focal species as surrogates, which if protected and conserved will result in the protection of the remaining species. The impact is assessed by considering the worst-case scenario occurring for one or more of the focal species.

The significance methodology used was consistent with that used in the preliminary assessment in the scoping report and is included in **Appendix E**.

Assumptions and Limitations

- The SABAP1 data covers the period 1986-1997. Bird distribution patterns can change regularly according to availability of food and nesting substrate.
- There is still limited information available on the environmental effects of wind energy facilities in South Africa. Approximately fifteen commercial scale facilities are currently in operation, many of which have only recently begun operating, and monitoring reports (detailing impacts) are not readily available. Therefore, estimates of impacts are mostly based on knowledge gained internationally, which should be applied with caution to local species and conditions.
- While sampling effort was as recommended in the guidelines, to achieve statistically powerful results it would need to be increased beyond practical possibilities. The data was therefore interpreted using a precautionary approach.
- Practical constraints (e.g. limited access roads) did not allow all available cliff habitat to be searched during the focussed Verreaux's Eagle nest search.
- At the time of the survey the maximum blade tip height of proposed turbines was assumed to be 160m. Therefore flight heights were recorded in the following height bands: 1: 0-20m; 2: 20-40m; 3: 40-120m; 4: 120-160m and 5: >160m. Using these bands, the flight height analysis that was done assumed that flights within bands 2, 3 and 4 were within Rotor Swept Height (RSH) and the avifaunal sensitivity map was based on this definition of the RSH. It is now proposed to utilise turbines with a maximum blade tip height of 190m. Since height is difficult to judge in the field, it can be assumed that most flights recorded as above 160m were in fact very high flights and probably above 190m. However, some flights that were recorded as above could have actually been within rotor swept height. This was considered in the impact assessment and a precautionary approach was adopted.

7.2.6 Cultural Heritage, Archaeology and Palaeontology

This specialist report was conducted under Section 38 (8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) as part of an EIA.

In the arid Karoo areas, the season in which the work is done does not influence the outcome of the study as visibility is good all year round.

Prior to commencing the field component, heritage sites visible on Google Earth were identified and plotted. All visible farm tracks were identified, traced and converted into GPX files for upload into GPS receivers for use in the field.

Any heritage sites found during the site inspection were photographed and plotted. Site co-ordinates were not included for security reasons but will be provided on request to researchers and heritage authorities. Different areas of the landscape were investigated by field workers and this increased the diversity of areas surveyed.

The study area was well-known to the specialists due to experience of similar studies nearby. The findings of the investigation are thus derived from desktop based background study, prior knowledge of the area and a site inspection during which time samples of the different land forms in the project area were walked, driven and searched.

7.2.6.1 *Limitation to note*

The investigation was limited due to the large size of the project area and the difficulties experienced in accessing certain areas of the site, poor farm track conditions and inaccessible ridges. Many farm tracks had not been used for years and their condition was poor.

7.2.7 **Noise Impact Assessment**

Site-specific measurements were undertaken based on the alternative layouts provided. The potential noise impact was evaluated using a sound propagation model. Conceptual scenarios were developed for construction and operational phases (as well as the alternative and preferred layouts for the WEF).

Ambient (background) noise levels were previously measured at other locations within 150km of the proposed development, indicating an area with a sound level character typical of a rural area (away from dwellings, plantations, roads and towns), during periods when wind speeds were below 3m/s. These measurements are considered applicable, as the topography, vegetation and meteorological conditions are similar.

Wind induced noises are normally seen as unwanted noises, with measurements reflecting acoustic interference (due to wind induced noises) normally discarded. However, for the purposes of this study, it will be included, as the typical operating noise of the WEF will only be emitted during times when wind induced noise levels are relevant.

The measurement of ambient sound levels is defined by the South African National Standard SANS 10103:2008 as: "*The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication*". The standard specifies the acceptable techniques for sound measurements including:

- type of equipment;
- minimum duration of measurement;
- microphone positions;
- calibration procedures and instrument checks; and
- weather conditions.

Ambient sound measurements are ideally collected when wind speeds are less than 3m/s with no measurements collected when wind speeds exceed 5m/s. Due to the fact that WEFs will only be in operation during periods that the wind is blowing, it is critical that ambient sound level measurements reflect expected sound levels at various wind speeds. Due to the complexity of these measurements, the following methodology was used:

- Compliance with the latest version of SANS 10103;
- The sound measuring equipment was calibrated directly before, and directly after the measurements were collected. In all cases drift was less than 0.2dBA between these two measurements;

- The measurement equipment made use of a windshield specifically designed for outdoor use during increased wind speeds;
- The areas where measurements were recorded was selected so as to limit the risks of direct impacts by the wind on the microphone;
- Measurements took place in 10-minute bins for at least two full night-time periods; and
- Noise data was synchronised with the wind data measured onsite using an anemometer at a 1.5m height.

Ambient sound levels were measured over a period of two nights during October 2015 with the locations used to measure ambient (background) sound levels are presented in **Figure 7-2**.

Note that in order to determine the noise impact from the final layout (**Figure 4-1**), the noise specialist re-modelled and assessed the potential noise impacts on all identified potential noise-sensitive receptors for the construction and operational phases. The methodology used was similar to the one used in the October 2015 study. The results of this study are reflected in an addendum to the noise report, which is included in **Volume 2** of this report.

7.2.8 **Social Aspects**

The approach to the Social Impact Assessment (SIA) study is based on the Western Cape Department of Environmental Affairs and Development Planning Guidelines for Social Impact Assessment (February 2007). These guidelines are based on international best practice and have also been endorsed by DEA. The key activities in the SIA process embodied in the guidelines include:

- Describing and obtaining an understanding of the proposed intervention (type, scale, location), the communities likely to be affected and determining the need and scope of the SIA;
- Collecting baseline data on the current social environment and historical social trends;
- Identifying and collecting data on the Social Impact Assessment variables and social change processes related to the proposed intervention. This requires consultation with affected individuals and communities;
- Assessing and documenting the significance of social impacts associated with the proposed intervention; and
- Identifying alternatives and mitigation measures.
- The following tasks were completed:
- Review of demographic data from Census 2011 and other available sources;
- Review of relevant planning and policy frameworks for the area;
- Site specific information collected during the site visit to the area and interviews with interested and affected parties;
- Review of information from similar studies, including the EIAs undertaken for the Suurplaat WEF and the Hidden Valley WEF, both near Sutherland; and
- Literature review of social issues associated with wind energy facilities.

The identification of potential social issues associated with proposed wind energy facility is based on observations during the project site visit, review of relevant documentation, experience with similar projects and the area.

7.2.8.1 *Limitation to note*

- Demographic data is presented at municipal level, as no ward-level information could be obtained. It is assumed that conditions within the relevant municipalities are comparable across wards.

7.3 Public Participation Process

Public participation is an essential component of the EIA process. The process of public involvement encourages Interested and Affected Parties (I&APs) to contribute their comments and concerns regarding the proposed development during the Scoping Phase.

In general, the public participation process ensures that:

- The public is notified of the proposed project and afforded the opportunity to register as I&APs;
- Key I&APs are identified as directed by legislation and informed about the proposed development and its implications;
- All issues, underlying concerns and suggestions raised by I&APs are understood, documented and addressed; and
- Areas that require further specialist investigation are identified and feedback is provided to I&APs.

The PPP for this EIA process takes cognisance of the IEM Guideline Series (Series 3): Stakeholder engagement (2002) and the IEM Guideline Series (Guideline 7): Public Participation in the EIA process (October 2012).

Throughout the process thus far, stakeholders have been encouraged to communicate with the PPP team to raise issues, ask questions or make suggestions. Communication has been through telephonic means or in written form.

As agreed at the Pre-Consultation Meeting held with the DEA on the 25th June 2015 (**Appendix C**), a combined PPP is being conducted for the four overall components of this project, namely:

- Komsberg East Wind Energy Facility, Western Cape Province; and
- Komsberg West Wind Energy Facility, Northern and Western Cape Provinces.
- Komsberg East Grid Connection, Western and Northern Cape Provinces; and
- Komsberg West Grid Connection, Western and Northern Cape Provinces.

The Draft Scoping Report was released in October 2015 for public review. All comments received from this review have been included in the Issues and Responses Trail (**Appendix H7**), and they have been responded to and addressed by the project team.

Each I&AP that commented has received the response to their comment via email. Registration of I&APs will continue throughout the EIA process, however comments on all draft reports will need to be received within the specified time periods so as to ensure they can be taken into account in the final documents.

The PPP methodology is outlined below.

7.3.1 Methodology

The following tasks have been undertaken as part of the public engagement process:

7.3.1.1 *Pre-Scoping*

- Placing notification advertisements of the proposed project in one local (*Die Noordwester*) and one regional newspaper (*Die Burger*) on the 28th August 2015 – in English and Afrikaans. Refer to **Appendix H1** for copies of these advertisements.
- Placement of five A3 posters (in English and Afrikaans) in public areas in the towns of Laingsburg and Sutherland on the 1st September 2015. Refer to **Appendix H2** for photographs of these posters, and a map indicating the location of where the posters were placed.
- Placement of five A1 posters (in Afrikaans and English) within and around the proposed sites. Refer to **Appendix H2** for photographs of these posters.

- Distribution of initial notification letters, the Background Information Document (BID) (in English and Afrikaans) and comment sheets to affected and surrounding landowners, the municipal councillors of the affected areas and the relevant organs of state on 28th August 2015. Refer to **Appendix H3** for copies of the notification letters and the BIDs, and for proof of notification
- An ongoing list of relevant stakeholders and interested and affected parties has been compiled (refer to **Appendix H4** for the I&AP database).
- Ongoing telephonic communication with landowners and adjacent landowners in order to ensure that occupiers of their properties have been informed, and obtaining the occupiers' contact details where possible. Refer to **Appendix H5** which documents this ongoing process.

7.3.1.2 *Scoping Phase*

- Notification letters were sent out to registered I&APs, key stakeholders, and organs of state to inform them of the availability of the Draft Scoping Report (30 day review period). Refer to **Appendix H6** for these and for proof of delivery
- An Issues Trail/Comments and Responses Report was compiled, recording comments and/or queries received and the responses provided. Refer to Appendix H7 for a copy of the current Issues Trail, and to **Appendix H8** for copies of original comments.
- Due to issues raised during the process thus far, a Focus Group Meeting was held with Falcon Oil & Gas Limited on 30th October 2015. Refer to **Appendix H9** for the minutes of this meeting.

7.3.1.3 *Impact Assessment Phase*

- On submission of the Draft EIR to the DEA, a public review period will be held in April/May 2016. Notification letters are to be sent out to registered I&APs, key stakeholders, and organs of state to inform them of the availability of the Draft EIR (30 days).
- The Draft EIR will be made available in the Sutherland and Laingsburg Public Libraries, and on the EIMS company website. Electronic and/or hard copies will also be made available to relevant organs of state.
- An Issues Trail/Comments and Reponses Report shall be compiled, recording further comments and/or queries received and the responses provided. This report will be forwarded to the competent authority (the DEA), and will be included in the Final EIR to be submitted to the DEA, and made available on the EIMS website.
- Notification letters shall be distributed to all registered I&APs, key stakeholders, and organs of state to inform them of the decision by the DEA and the appeal procedure.
- Placement of advertisements in the same local and regional newspapers (in English and Afrikaans) to inform readers of the decision taken by the DEA.

Focus Group Meetings or One-on-One meetings have been, and shall be held, if necessary, throughout the EIA process. Furthermore, I&APs will also be able to register on the I&AP database throughout the duration of the EIA process.

SECTION F BASELINE ENVIRONMENT

This section of the report provides a description of the key characteristics of the baseline environment for each field of investigation.

8 BASELINE ENVIRONMENT DESCRIPTION

8.1 Terrestrial Ecology Baseline Environment

8.1.1 *Flora*

8.1.1.1 *Broad Scale Vegetation Patterns*

According to the national vegetation map, four vegetation types occur within the proposed development area (**Figure 8-1**). The majority of the site falls within the Central Mountain Shale Renosterveld vegetation type, followed with a much smaller extent by Koedoesberge-Moordenaars Karoo and Gamka Karoo and a minor extent of Roggeveld Shale Renosterveld along the northern borders of the site.

Central Mountain Shale Renosterveld occurs in the Western and Northern Cape Provinces on the southern and southeastern slopes of the Klein Roggeveldberge and Komsberg, below the Komsberg section of the Great Escarpment as well as farther east below Besemgoedberg and Suurkop and in the west in the Karookop area. It is associated with clayey soils overlying Adelaide Subgroup mudstones and subordinate sandstones.

Although this vegetation type is classified as Least Threatened, it has a very limited extent of 1236km^2 and is not formally conserved anywhere. Levels of transformation are however low and it is considered to be 99% intact. Although no endemic species are known to occur within this vegetation type, little is known about this Renosterveld type and it has been poorly sampled.

Experience from this and other projects in the area indicate that this should be considered to be a relatively sensitive vegetation type with a relatively high abundance of species of conservation concern and in context of the site should in fact be considered to have a higher sensitivity than those areas of Koedoesberge-Moordenaars Karoo. The Komsberg area is also a recognized centre of plant diversity and endemism and the majority of this diversity is associated with the high elevation areas of Central Mountain Shale Renosterveld.

The Koedoesberge-Moordenaars Karoo vegetation type has an extent of 4714km^2. This unit occurs in the Western and Northern Cape Provinces on the Koedesberge and Pienaar se Berg low mountain ranges bordering on the southern Tanqua Karoo and separated by the Klein Roggeveld Mountains from the Moordenaars Karoo in the broad area of Laingsburg and Merweville.

The vegetation type is associated with slightly undulating to hilly landscape covered by low succulent scrub with scattered tall shrubs. It occurs on mudstones, shale and sandstone of various origins including Adelaide Subgroup, Ecca Group and Dwyka Group diamictites, which give rise to shallow skeletal soils. This vegetation type is classified as Least Threatened and has not been significantly impacted by transformation. Conservation status is however poor and of the target of 19%, only a very small proportion is conserved within the Gamkapoort Nature Reserve.

At least fourteen endemic species are known from this vegetation type, which is a high number considering that this vegetation unit occupies less than 5000km^2. In addition, the majority of listed species known from the broader area are associated with this vegetation type. It is poorly known and little research has been conducted within this unit.

The Gamka Karoo vegetation type has a total extent of 20 324 km^2 and occurs in the large basin bound by the Nuweveld Mountains in the north and northwest and the Swartberg

and adjacent Cape Fold Mountains in the south. Gamka Karoo is classified as Least Threatened and less than 1% has been transformed. The vegetation type is poorly protected as less than 2% falls within formal protected areas compared to the target of 16%. Gamka Karoo is characterised by irregular to slightly undulating plains covered in dwarf spiny shrubland dominated by karoo dwarf shrubs, with occasional low trees. Dense stands of perennial bunchgrasses cover broad sandy bottomlands. Geology consists of mudstones and sandstones of the Beaufort Group with some Ecca shales supporting very shallow and stony soils of the Glenrosa and Mispah forms. The latter stony soils are likely to be characteristic of the site. It is regarded as one of the most arid units of the Nama-Karoo Biome, with rainfall varying from 100mm in some areas in the rain shadow of the Cape Fold Mountains to about 240mm against the great escarpment.

The Riverine Rabbit *Bunolagus monticularis*, which is listed as Critically Endangered, is known to occur within this vegetation unit in the broad area and may occur along the northern margin of the site associated with this vegetation unit.

8.1.1.2 *Habitat Types*

Plate 8-1: Typical ridgeline habitat on identified wind turbine target ridges within the Komsberg East study area. These ridges are noticeably more arid than the ridges to the west.

Plate 8-2: Drainage system within the Komsberg East study area, dominated by *Acacia karoo* with *Phragmites australis* in the foreground.

8.1.1.3 *Listed and Protect Plant Species*

According to the SANBI SIBIS database, 514 indigenous species have been recorded from the four quarter degree squares around the site. This includes 22 species of moderate to high conservation concern. Species that can be confirmed present include *Boophone disticha* (Declining), *Brunsvigia josephinae* (VU), *Eriocephalus grandiflorus* (Rare) *Drimia altissima* (Declining) and *Adromischus phillipsiae* (Rare). No species of very high

conservation concern were observed at the site. In the broader context of the Roggeveld and escarpment, the abundance of listed species is generally concentrated along the higher, wetter ground to the west of the site and the areas affected by the turbines are not considered to be within the areas, which have been observed to have high densities and diversity of listed and local endemic species. Within the site, such species are concentrated along the higher ridges in the west and along the drainage lines, especially within the higher-lying ground before these enter the lower more arid plains of the site.

8.1.1.4 *Critical Biodiversity Areas and Broad Scale Ecological Processes*

The site lies along the boundary of two fine-scale conservation plans, with the Namakwa District Biodiversity Sector Plan in the Northern Cape and the *Biodiversity Assessment of the Central Karoo District Municipality*[27] covering those parts of the site within the Western Cape. These district-wide biodiversity assessments were commissioned to inform Spatial Development Frameworks (SDFs), Biodiversity Sector plans, Environmental Management Frameworks (EMFs), Strategic Environmental Assessments (SEAs) and the Environmental Impact Assessment (EIA) process.

The Biodiversity Assessments identify Critical Biodiversity Areas (CBAs) which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives. The CBA map for the general area surrounding the site is depicted below in **Figure 8-2**.

Given that the objective of CBAs is to identify biodiversity priority areas which should be maintained in a natural to near natural state, development within these areas without adequate mitigation and management is not encouraged and may not be compatible with the objectives of the CBA. The likely implications and impacts of development within the CBAs and their immediate environment is a potential concern that needs to be carefully addressed through avoidance of sensitive areas identified in the EIA as well as thereafter through the implementation of a robust and effective environmental management plan that reduces construction and persistent operational phase impacts. Pertinent issues in this regard include establishing why the area has been identified as a CBA and if there are any mitigation measures that can be implemented that can significantly reduce or avoid impacts on the CBAs or those receptors which were identified as being significant.

In terms of the two CBA maps and the implications of their potentially competing coverage of the study area, the *Biodiversity Assessment of the Central Karoo District Municipality* should receive precedence as it is more recent and is based on more data than the CBA map for the Namakwa District which does not have verified biodiversity features within the study area. Within the study area, a large proportion of the CBA is related to the fact that is has been identified as a priority area within the National Protected Area Expansion Strategy for South Africa (NPAES). This area was identified as a priority area on the grounds that apart from being an extensive tract of unfragmented natural vegetation, it is also an area of high climate and landscape variation which is likely to be resilient to climate change. Such areas are likely to be more climatically stable over time, providing *refugia* where plants and animals can persist. In this context, it is important to recognize if there are not similar areas that can perform the same function and which contain a similar set of species available elsewhere. Therefore any impacts on species or features of concern need to be managed on-site.

The development of the facility would result in an expected maximum direct habitat loss of approximately 50ha. The direct impact of this habitat loss is likely to be relatively low following mitigation, particularly local adjustment of the final turbine locations based on a preconstruction walk-through of the site. This would be effective at reducing the abundance

[27] Skowno, A.L. Holness S.D and P. Desmet. 2009. Biodiversity Assessment of the Central Karoo District Municipality. DEAP Report EADP05/2008, 52 pages.

of species and habitats of conservation concern within the development footprint. For many fauna, impacts spread beyond the direct footprint of the roads and turbines and for sensitive fauna, particularly those which avoid the proximity of the turbines due to turbine movement (flicker) or noise, the footprint of the facility would be much larger. Approximately 800ha of each facility is within 250m of the wind turbines and turbine noise would typically still be significant for many fauna at this distance. Within this area, the noise would amount to habitat degradation and would be likely to reduce the abundance of affected species within this area.

Given the distribution of the turbines along the ridges, there are still extensive areas of unaffected habitat between the strings of turbines which would facilitate and maintain connectivity of the landscape. The major direction of faunal movement at the site would be between the higher-lying and low-lying parts of the site and not across the ridges. As such, the valleys are likely to more important for faunal movement than the ridges themselves. With all these different factors taken into consideration, a significant impact on broad-scale landscape connectivity would be unlikely.

8.1.2 ***Fauna***

8.1.2.1 *Mammals*

At least fifty mammal species potentially occur at the site (**Appendix F**). Due to the diversity of habitats available the majority of species are likely to be present. The mammalian community is relatively rich and due to the remote and inaccessible nature of large parts of the area, probably has not been highly impacted upon by human activities, aside from livestock grazing.

Despite trapping and hunting by the local landowners, medium sized carnivores such as jackal and caracal appear to remain relatively common in the area. The ridges, hills and uplands, with rocky outcrops, rocky bluffs and cliffs provide suitable habitat for species which require or prefer rock cover such as Cape Rock Elephant Shrew, *Elephantulus edwardii*, Hewitt's Red Rock Hare *Pronolagus saundersiae*, Namaqua Rock Mouse *Micaelamys namaquensis* and Rock Hyrax, *Procavia capensis*. The lowlands are likely to contain an abundance of species associated with lowland habitats such as deeper soils and floodplain habitats, which includes Brants's Whistling Rat *Parotomys brantsii*, the Bush Vlei Rat *Otomys unisulcatus*, Hairy-footed Gerbil *Gerbillurus paeba* and Common Duiker *Sylvicapra grimmia*. Minimal, if any, turbines and few access roads are proposed to be located in the lowland areas.

A number of antelope are relatively common. Springbok are confined by fences and occur only where farmers have introduced them or allowed them to persist and should be considered as part of the farming system rather than as wildlife *per se*. Both Duiker and Steenbok *Raphicerus campestris* are adaptable species that are able to tolerate moderate to high levels of human activity and are not likely to be highly sensitive to the disturbance associated with the development. Klipspringer *Oreotragus oreotragus* and Grey Rhebok *Pelea capreolus* are usually present along the ridges of the area and are somewhat more specialized in their habitat requirements. Klipspringer are associated with steep slopes, cliffs and rocky outcrops and of the antelope present may be most vulnerable to impact from the development due to greater overlap between their habitat and the distribution of the wind turbines. While the turbines would not be located on the cliffs as such, they would generate impact through noise, disturbance and turbine blade movement. Kudu are present along the wooded drainage lines, which characterise the lowlands of the site and while they are likely to move away from the area during construction, long-term impacts on this habitat are likely to be low.

The Riverine Rabbit *Bunolagus monticularis* which is listed as Critically Endangered and is regarded as the most threatened mammal in South Africa is known to occur within the

broad area. This species is usually associated with alluvial terraces and floodplains of ephemeral rivers of the karoo and may occur within the larger drainage systems of the site.

In context of the site, this species is likely to be largely restricted to the Komsberg Mountains and to the areas on top of the plateau, which would not be impacted by the development. It is not likely to be present within the Komsberg East development area as there is no typically suitable habitat present within the affected areas. In terms of impact, the drainage lines where Riverine Rabbits are likely to occur are not likely to be significantly affected by the development, however, the large amount of traffic present in the area during construction is likely to pose a threat to this species. It appears to be vulnerable to collisions with vehicles in the vicinity of drainage lines and it is likely that some individuals would be lost to collisions with vehicles during the course of construction at the site.

8.1.2.2 *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 riparian areas. A relatively rich reptile fauna is likely which is potentially composed of seven tortoise species, twenty snakes, seventeen lizards and skinks, two chameleons and ten geckos. The area has been poorly sampled as illustrated by the fact that there are only eighteen records representing nine species for the four quarter degree squares around the site, within the ReptileMap database of the ADU. Consequently, the estimate of potential richness is based on broad-scale distribution maps in the literature and not the ADU database.

Some little-known species which have previously been listed but have been recently downgraded to Least Concern may occur in the area, this includes Fisk's House Snake *Lamprophis fiskii* and the Namaqua Plated Lizard *Gerrhosaurus typicus*. The only currently listed species which may occur at the site is the Karoo Padloper *Homopus boulengeri* which is listed as Near Threatened.

Species observed in the area include Karoo Tent Tortoise *Psammobates tentorius tentorius*, Angulate Tortoise *Chersina angulata*, Puff Adder *Bitis arietans*, Karoo Girdled Lizard *Cordylus polyzonus*, Southern Rock Agama *Agama atra*, Namaqua Plated Lizard *Gerrhosaurus typicus*, Cape Skink *Mabuya capensis*, Namaqua Sand Lizard *Pedioplanis namaquensis* and Cape Cobra *Naja nivea*.

Although there are a variety of different habitats present, the generally intact nature of the area means that most habitats have associated reptiles. Habitats of specific sensitivity include drainage lines and vleis and the rocky bluffs and cliffs of the site. Along the ridges, there are few habitats present of specific significance and the majority of impact on reptiles would probably result from habitat loss, especially from the access roads of the site which may be up to 20m wide during construction.

In general, the predominant potential 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.

8.1.2.3 *Amphibians*

Although there are no perennial rivers within the site, the larger drainage lines are likely to have pools which contain water on a near-perennial basis. There may be irrigation dams which would also represent important breeding sites for water-dependent species. The amphibian diversity is likely to be relatively low, as the site lies within the distribution range of only eight frog and toad species. No species of conservation concern are known from the area and all the species which may be present are quite widespread species of low conservation concern.

The Karoo Dainty Frog, *Cacosternum karooicum*, is listed as Data Deficient reflecting the little-known distribution and ecology of this species. To date, the Karoo Dainty Frog has been recorded from a few scattered locations across the Karoo in the Western and Northern Cape Provinces, but it is likely that it occurs more widely across the Karoo in general. The site also falls within the distribution of two other regional endemic species, the Cape Sand Frog, *Tomopterna delalandii* and the Raucous Toad, *Amietophrynus rangeri*. The Cape Sand Frog occurs in lowlands and valleys in fynbos and Succulent Karoo throughout most of the Western Cape and into Namaqualand. The Raucous Toad is more widely distributed and occurs throughout much of South Africa inland and along the east coast into Gauteng and Mpumalanga. There do not therefore appear to be any range-restricted species which occur at the site which would be vulnerable to population-level impacts.

In general, the most important areas for amphibians at the site are the riparian areas, seeps and wetlands and the man-made earth dams, which occur in the area. As these are widely recognized as sensitive habitats, impacts to these areas are avoided largely at the design phase of the development and a minimum amount of infrastructure has been located in the vicinity of these features. Consequently, direct impacts on amphibians at the site are likely to be fairly low. Amphibians are 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.

8.2 Bat Baseline Environment

8.2.1 *Habitats*

The project is located in the vicinity of the Komsberge which forms part of the south-western edge of the Great Escarpment. It occurs in a botanically rich region which transitions from Succulent Karoo to Nama-Karoo Biomes with the Fynbos Biome also represented across most of the project site. The project site is relatively topologically diverse and consists of large flat plains, undulating hills and steep slopes, with the high Roggeveld Mountains and Great Escarpment to the north. The slopes and broad ridges are mostly covered by shale Renosterveld with scattered Renosterbos shrubland and non-succulent Karoo shrubs. The undulating hilly landscapes to the south are covered mostly by low succulent scrub and scattered shrubs, with patches of grass on the flatter plains. The eastern areas are dominated by Karoo dwarf spiny shrubs and drought resistant grasses, such as *Aristida* and *Stipagrostis* species in the flatter plains. Land use on site is primarily grazing. Other habitats relevant to bats include rocky outcrops, cliffs, farm dams, seasonal pans, ephemeral rivers and drainage lines dominated by relatively denser and taller riparian trees and scrub vegetation. Taller trees are also associated with farmsteads located within the proposed WEF site.

Habitat and topographical features that are favourable for bats include the linear edges created by the drainage lines and riparian vegetation which are used as cues by bats for flight paths while foraging and to navigate while commuting. The water sources described above, and the few farm dams (**Figure 9-2**) will attract bats to drink and to forage. In South African agricultural landscapes, wetland areas and surrounding habitats are recognised as important foraging areas for bats but there is limited water available for the majority of the year. The large trees, artificial lighting in the vicinity of the farm buildings, and nearby facilities used for animal husbandry should also attract bats by providing both roosting and foraging opportunities.

Potential roosting sites are provided by rocky crevices, buildings and trees. Shallow caves are present in some areas of the site (landowner H. Miller, *pers. comm.*). Dolerite sills, a prominent feature of the landscape, may provide roosting opportunities for bats and several of the larger sills have been mapped (**Figure 9-2**). No confirmed bat roosts have been located thus far but a potential roost was located in a large rocky crevice on the farm Anysrivier which had small deposits of bat guano.

8.2.2 *Bat Species*

The site falls within the actual or predicted distribution range of approximately 13 species of bat. However, the distributions of some bat species in South Africa, particularly rarer species, are poorly known, so it is possible that more (or fewer) species may be present. Analysis of acoustic monitoring data from the field surveys suggests that at least five species of bat are present (**Table 8-1**). There was some evidence that an additional species, Lesueur's wing-gland bat, was recorded but very infrequently. This is a rare bat, endemic to southern Africa and classified as near threatened in South Africa. Limited reference echolocation data for this species are available making it difficult to confirm if the calls recorded and analysed in this study were from this species. Therefore, only data for the five confirmed species are presented in this report. The sensitivity of each of these five species to the project is a function of their conservation status and the likelihood of risk to these species from the proposed WEF development. The likelihood of risk was determined from the guidelines and is based on the foraging and flight ecology of bats and migratory behaviour.

Table 8-1: Bat Species Recorded at the Project and their Sensitivity to WEFs.

Species	Likelihood of Risk[28]	Species Code	# of Bat Passes[29]	Conservation Status	
				National[30]	International[31]
Long-tailed serotine *Eptesicus hottentotus*	Medium	LTS	2 640	Least Concern	Least Concern
Cape serotine *Neoromicia capensis*	Medium-High	CS	14 482	Least Concern	Least Concern
Natal long-fingered bat *Miniopterus natalensis*	High	NLB	885	Near Threatened	Least Concern
Roberts's flat-headed bat[32] *Sauromys petrophilus*	High	RFB	7 691	Least Concern	Least Concern
Egyptian free-tailed bat *Tadarida aegyptiaca*	High	EFB	35 929	Least Concern	Least Concern

8.2.3 *Acoustic Monitoring Results*

The findings presented below reflect a combination of the results of the bat monitoring on both the proposed Komsberg East and Komsberg West WEF sites.

8.2.3.1 *Overall Activity Patterns*

A total of 61,627 bat passes were recorded from 347 sample nights from five species across all bat detectors. Overall, the levels of bat activity were moderate to high with a strong seasonal and species-specific effect based on the experience of the specialist and compared to other sites. Across all detectors, bats were recorded on 94% of the sample nights. Even though this value dropped for individual monitoring locations, the number of nights with bat activity was high at a number of locations (**Table 8-2**). Refer to the locations labelled 'east'. The Egyptian free-tailed bat and the Cape serotine were the most frequently recorded species accounting for approximately 82% of total bat activity.

Table 8-2: Acoustic Monitoring Summary.

[28] Based on the guidelines.

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

[30] Red Data Book of the Mammals of South Africa: A Conservation Assessment Friedman, Y., Daly, B. eds., 2004. Red Data Book of the Mammals of South Africa: A Conservation Assessment. CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust, South Africa.

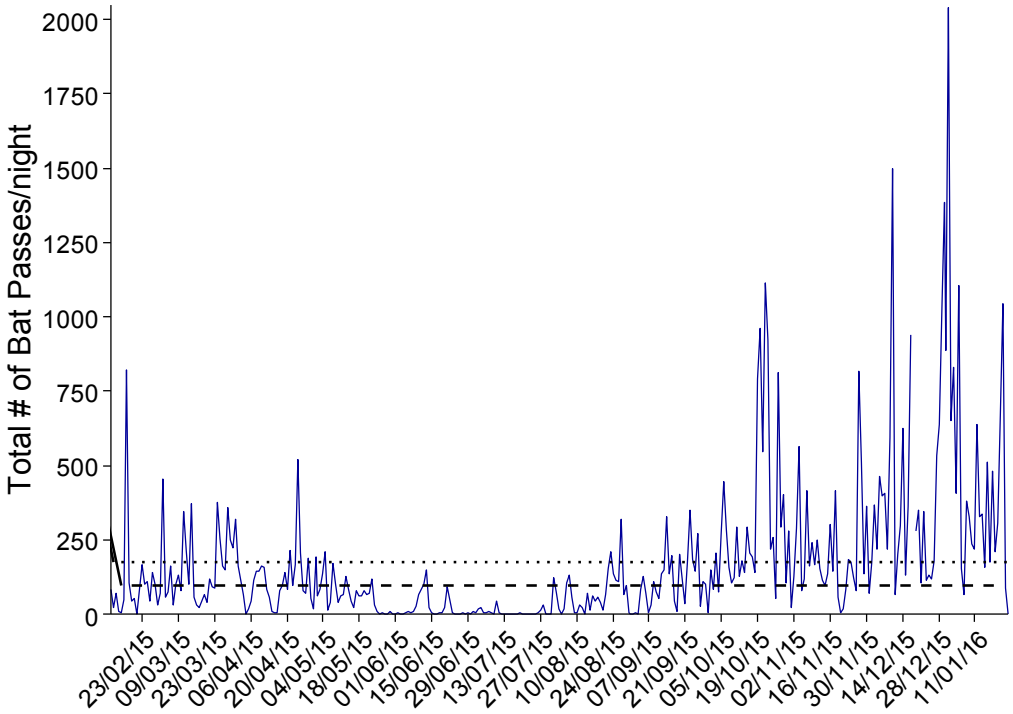
[31] International Union for the Conservation of Nature (IUCN) Red List version 3.1 IUCN, 2013. IUCN Red List of Threatened Species. Version 2013.2. www.iucnredlist.org. Downloaded on 20 February 2014.

[32] This species is endemic to South Africa. .

Monitoring Location (Figure 7-2)	Altitude (masl)	Habitat	# of Sample Nights[33]	% of Sample Nights with Bat Activity	Total number of Bat Passes
KOM1	1,023	Riparian	347	65.1	5,990
KOM2	1,093	Riparian	347	85.9	8,315
KOM3	1,218	Drainage Area	340	70.9	4,197
KOM4	1,220	Riparian	340	80.3	8,618
KOM5	1,164	Drainage Area	339	78.8	7,613
KOM6	1,140	Ridge	297	57.2	2,049
KOM7	1,181	Foothill	345	60.6	3,400
KOM8	1,090	Foothill	345	73.6	3,239
KOM9	1,273	Foothill	164	82.9	2,640
KOM10	1,343	Ridge	160	81.3	1,888
MET1 (Low)	1,276	Ridge	220	44.5	1,064
MET1 (High)	1,276 (+80 m)		334	0.09	137
MET2 (Low)	1311	Ridge	181	80.0	12,139
MET2 (High)	1311 (+80 m)		181	26.0	338

The variation in the total number of bat passes per night across all monitoring locations was high over the course of the monitoring, ranging from 0 to 2,058 bat passes a night with a median of 95 and a mean of 177.6 (**Graph 8-1**). On several nights, bat activity was very high which suggests that activity is episodic and may respond quickly to changes in environmental conditions (e.g. temperature, rainfall or wind speed) and the availability of insect prey. For example, on 18/12/2016, a total of 2,058 bat passes were recorded but on the following night 281 bat passes were recorded. This nightly variation in bat activity is typical in the specialist's experience.

[33] Differences in the number of sample nights are because detectors were installed on different dates and because of technical faults with the acoustic equipment.

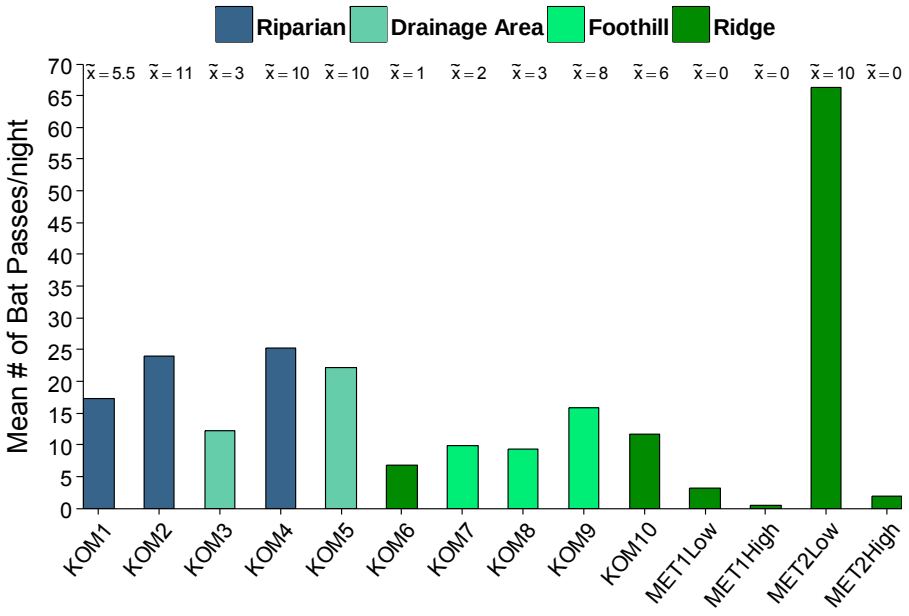


Graph 8-1: The total number of bat passes/night across all detectors during the sampling period. The dotted and dashed lines show the mean (177.6) and median (95) number of bat passes per night respectively.

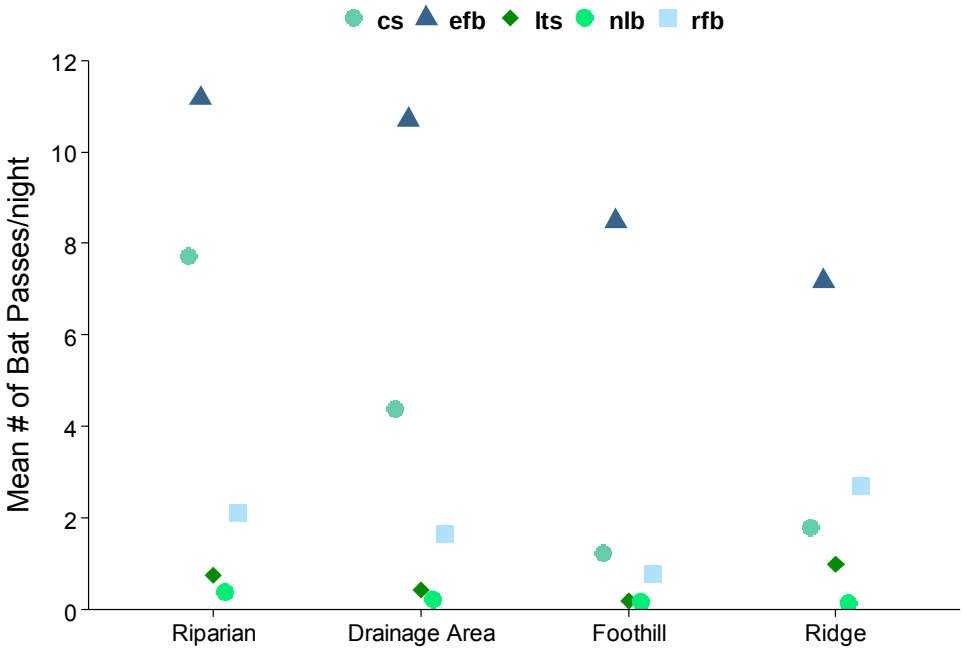
8.2.3.2 *Spatial Activity Patterns*

Bat activity was highest at MET2Low, KOM2, KOM4 and KOM5 (**Table 8-2**; **Graph 8-2**). At these locations mean bat activity ranged from 66.3 bat passes/night to 22.3 bat passes/night. Large variation in the number of bat passes per night was also evident at these locations compared to other locations. The median number of bat passes was highest at MET2Low, KOM2, KOM4 and KOM5 (**Graph 8-2**). The lowest mean activity was at MET1High and MET2High where 0.41 bat passes/night and 1.8 bat passes/night were recorded respectively.

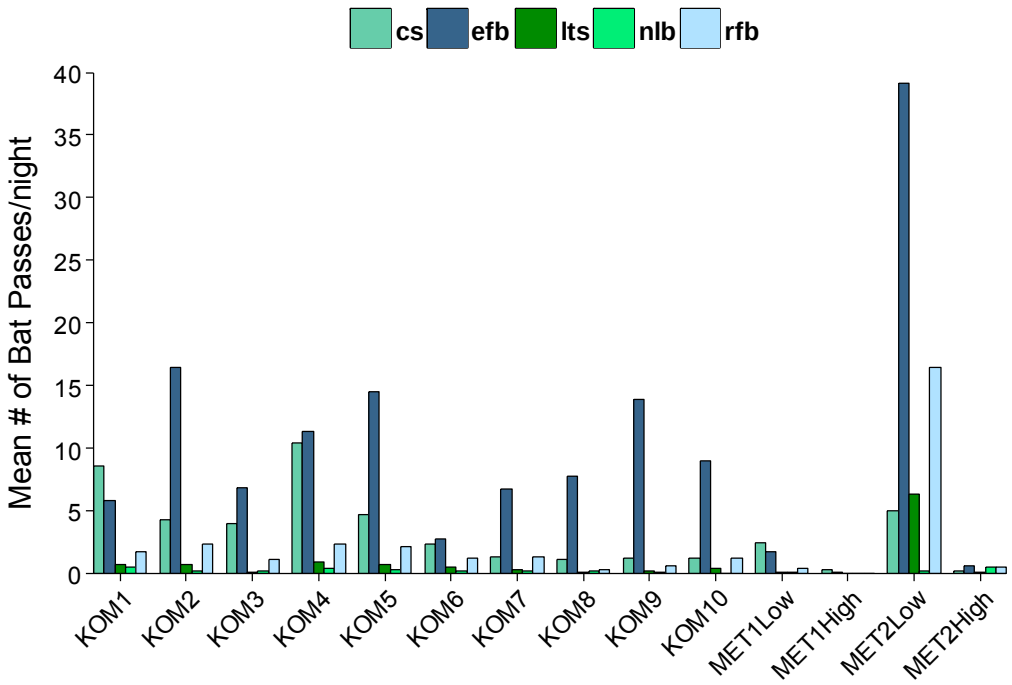
There was a negative relationship between altitude and bat activity. Average and median bat activity was higher in riparian zones and in drainage areas compared to ridges and foothill areas. However, total bat activity was higher on ridges compared to drainage areas but this was mostly due to activity at MET2Low. The distribution of activity levels for some species reflected this negative relationship but did not for others (**Graph 8-3**). The Egyptian free-tailed bat, the Cape serotine and the Natal long-fingered bat had higher activity in riparian and drainage areas compared to foothills and ridges. Roberts's flat-headed bat and the Long-tailed serotine had slightly higher activity on the ridges than the riparian and drainage areas. Each of the five species was recorded at each monitoring location.



Graph 8-2: The mean number of bat passes/night in different habitats over the study period at each monitoring location. The median number of bat passes per night for each monitoring location is shown above the plot.



Graph 8-3: The mean number of bat passes/night in the different habitats for each species across all monitoring locations.

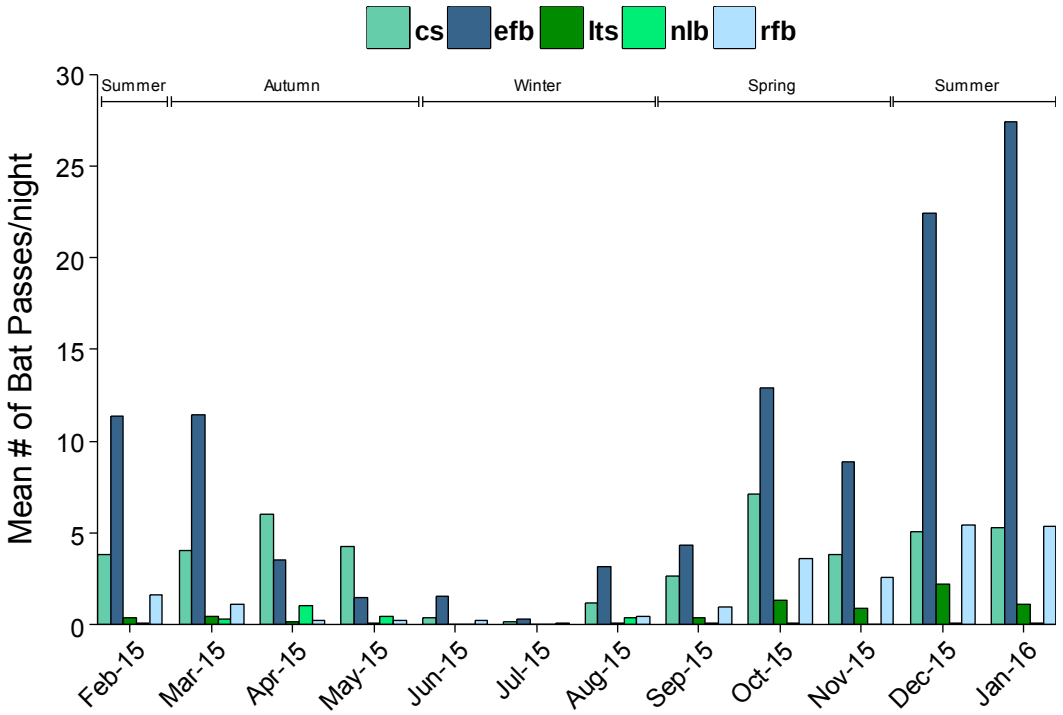


Graph 8-4: The mean number of bat passes/night for five species at each monitoring location.

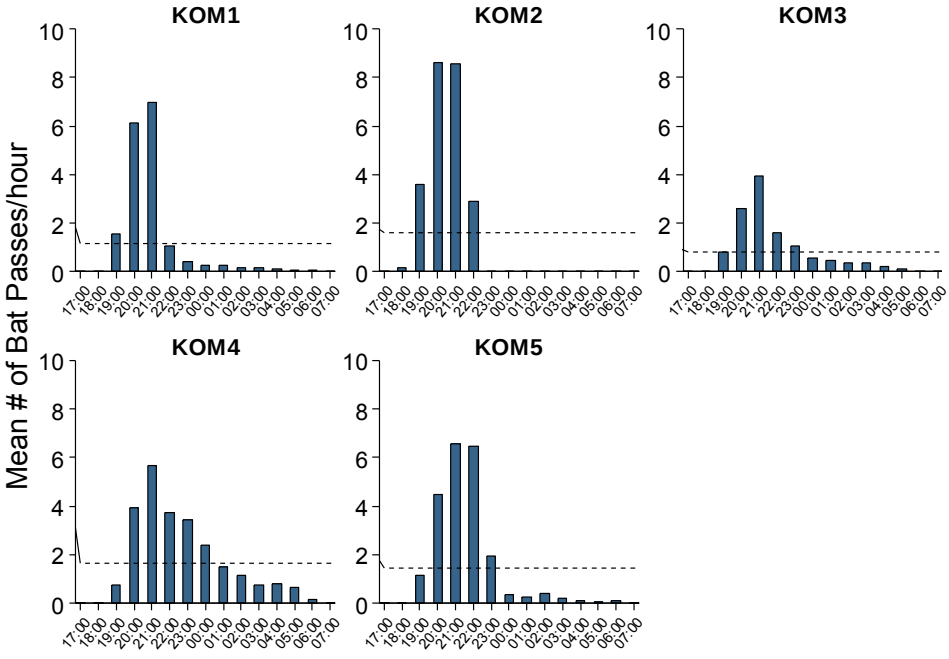
The frequency with which each species was recorded varied among locations but the Egyptian free-tailed bat and the Cape serotine were the most frequently recorded species at most locations (**Graph 8-4**). Mean activity for these two species peaked at MET2Low with 39.1 bat passes/night and KOM4 with 10.4 bat passes/night respectively. The Natal long-fingered bat and the Long-tailed serotine had very low activity across most monitoring locations peaking at KOM1with a mean of 0.5 bat passes/night and MET2Low with a mean of 6.3 bat passes/night (although this was an outlier driven by summer activity patterns – refer to **Graphs 8-4 and 8-6**). Roberts's flat-headed bat also had its highest mean activity at MET2Low with 16.5 bat passes/night but if this location is excluded, its mean activity for the site as a whole was very low at 1.2 bat passes/night.

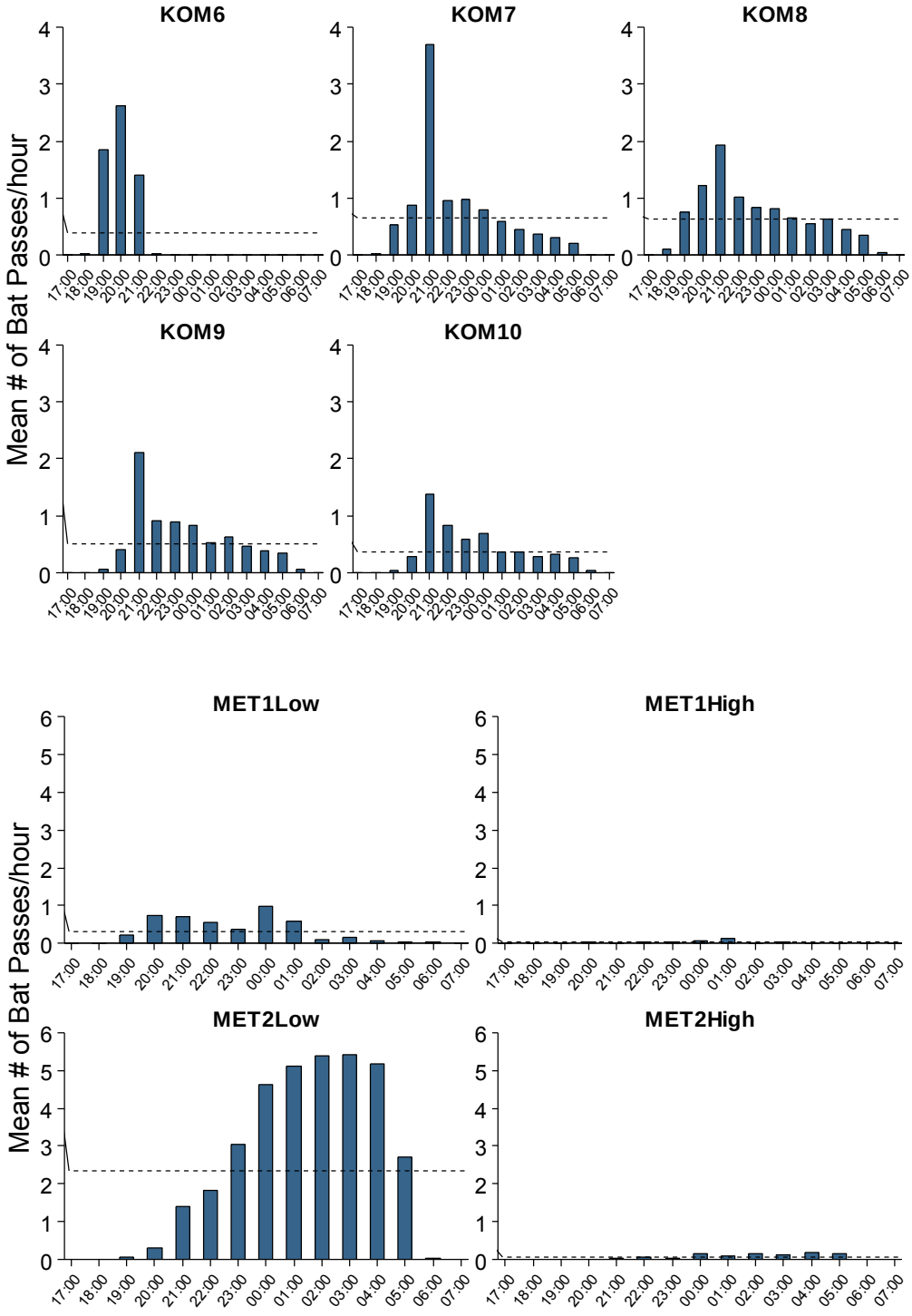
8.2.3.3 *Temporal Activity Patterns*

Bats were recorded on all the sample nights in summer, all but one night in autumn (at the end of autumn on 31/05/2015), on 79% of sample nights in winter and all but one night at the start of spring (01/09/2015). Bat activity peaked in summer (mean: 324.2, median: 180; bat passes/night), decreased through autumn (mean: 87.5, median: 72; bat passes/night) into winter (mean: 33.0, median: 6; bat passes/night) before increasing again in spring (mean: 217.6, median: 146; bat passes/night). The highest levels of activity were recorded in December 2015 (mean: 489.9, median: 351; bat passes/night) and the lowest levels of activity were recorded in July 2015 (mean: 6.2, median: 2; bat passes/night). Most species followed this trend except for the Cape serotine and Natal long-fingered bat which had slightly higher activity in spring and autumn respectively compared to summer (**Graph 8-5**). In winter, there were periods in early June and late August when more than 100 bat passes were recorded per night (**Graph 8-1**).



Graph 8-5: The mean number of bat passes/night for five species across the twelve months sampled.



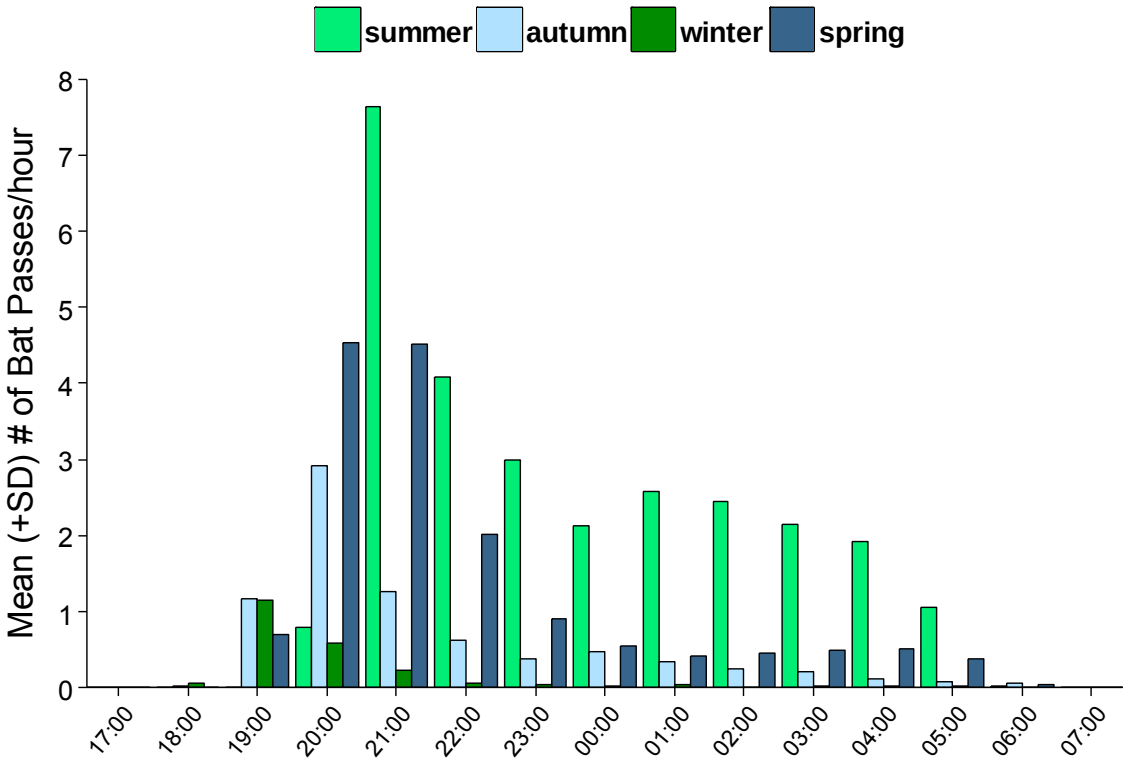


Graph 8-6: The mean number of bat passes/hour (of all species) in each time period for each monitoring locations. The dashed line shows the mean number of bat passes/hour per night.

The mean number of bat passes per hour peaked at different times at each monitoring location but was generally highest between 19:00 and 21:00 (**Graph 8-6**). The two met masts were the only locations where activity peaked in the early morning. The mean number of bat passes per hour was highest at KOM2 between 20:00 and 21:00 with 8.6 bat passes. At some monitoring locations (e.g. KOM2 and KOM6) bats were only recorded

during the first few hours of the night whereas at others bats were recorded throughout most of the night.

In winter and autumn bat activity started the earliest compared to other seasons (between 18:00 and 20:00). In winter activity peaked between 19:00 and 20:00 and declined for the rest of the night with only a slight increase again between 04:00 and 06:00 (**Graph 8-7**). Activity in autumn peaked an hour later compared to winter (between 20:00 and 21:00) and did not increase after this. In spring bat activity also peaked between 20:00 and 21:00 and peaked slightly later in the evenings between 03:00 and 05:00. In summer bat activity started the latest, at 20:00, peaking between 21:00 and 22:00.

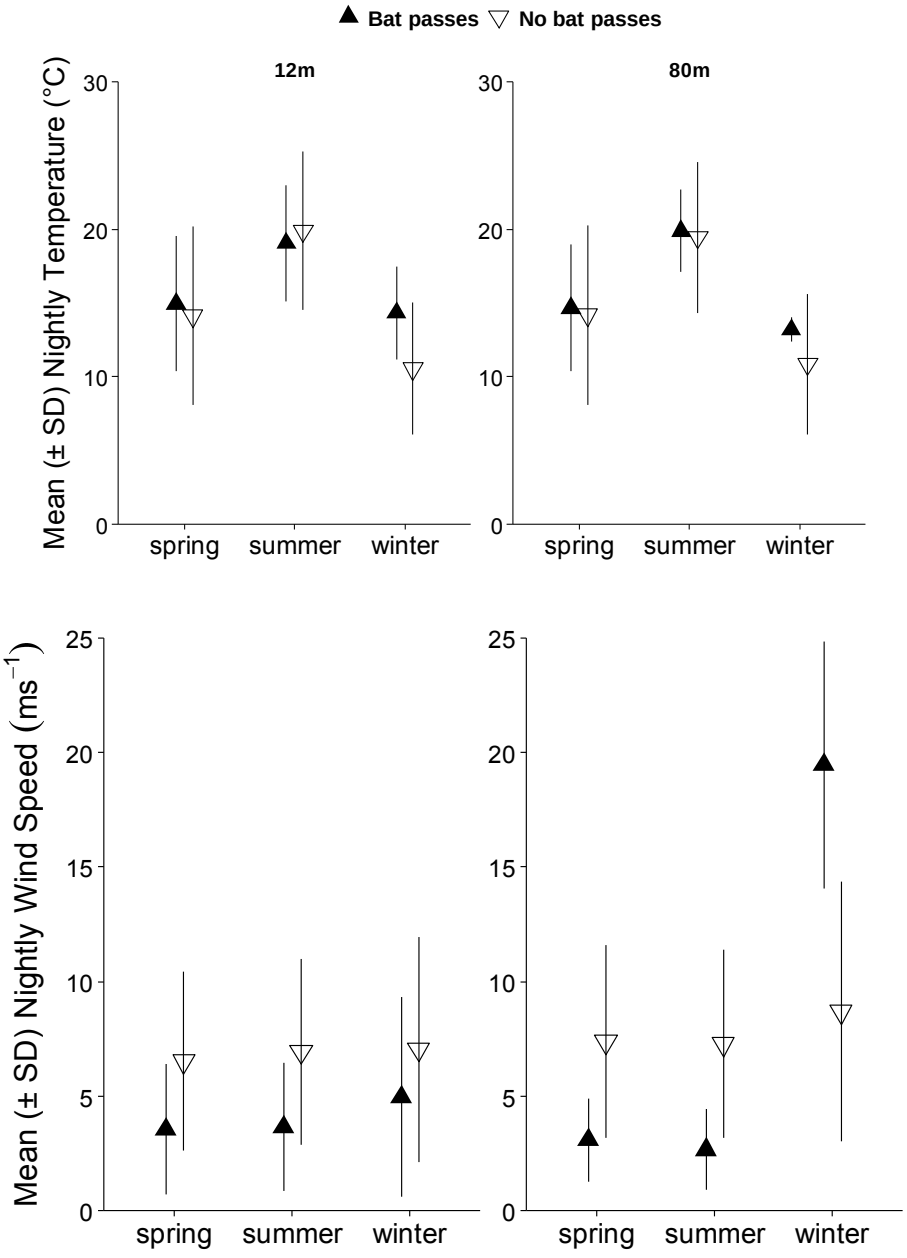


Graph 8-7: The mean number of bat passes (of all species and across all sites) per hour in each time period per season.

8.2.3.4 *Meteorological Analysis (**Graph 8-8**)*

Bat activity showed general positive and negative correlations with temperature and wind speed respectively. In spring at 12m at MET2, the mean nightly temperature that bats were active in (i.e. when bat passes *were* recorded) was 14.9°C compared to a mean of 14.1°C for nights that bats were not active. There was a similar pattern in winter but the difference in temperature when bats were and were not recorded was greater. Summer had an opposite effect at 12m as bats were active in lower temperatures that they were not active. At 80m, bats were active in higher temperatures across all seasons compared to temperatures they were not active in and again, this difference was greatest in winter.

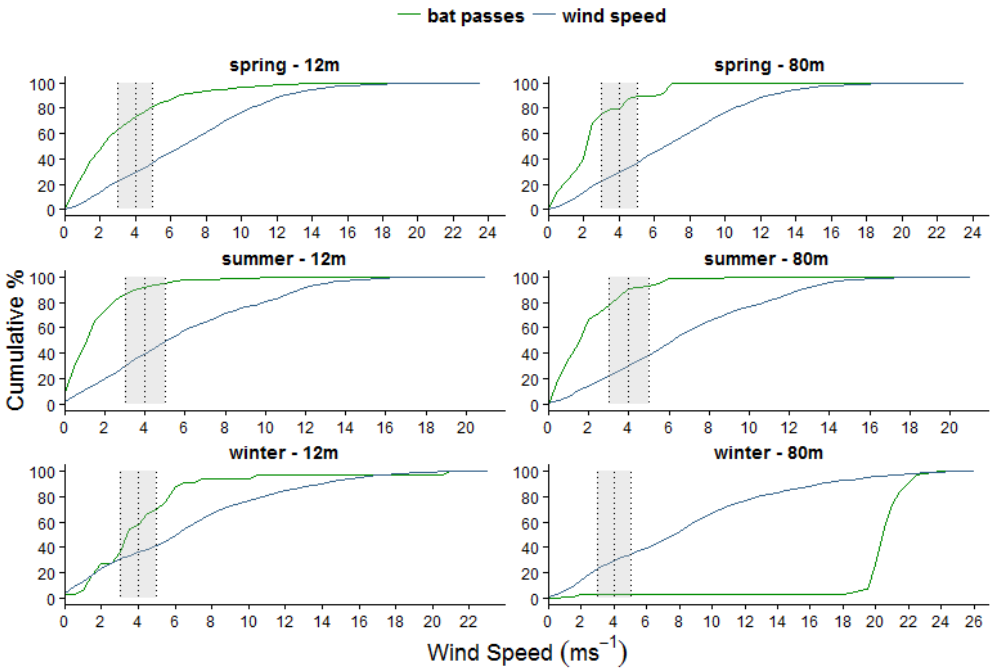
Bats tended to be more active at lower wind speeds. For example, in spring the mean nightly wind speed that bats were active in at 12m was 3.5ms^{-1} compared to 6.5ms^{-1} for nights that bats were not active. Summer and winter showed the same pattern. At 80m in spring and summer this difference was greater as bats were active at lower mean nightly wind speeds. At 80m in winter, the mean nightly wind speed when bats were recorded at 80m was 1.1ms^{-1}.



Graph 8-8: The influence of mean nightly temperature and mean nightly wind speed on bat activity in spring, summer and winter at MET2.

The profile of cumulative bat activity is very different from the profile of cumulative wind speed for all six combinations of season and height (**Graph 8-9**). They accumulate at different rates indicating that bat activity is influenced by wind speed. The accumulation curves showed that bats can be active at high wind speeds (for example up to 16.5ms^{-1} in spring at 12m) and that accumulated bat activity levels varied seasonally. In spring at 12m, 73% of the accumulated bat activity levels occurred below 3ms^{-1}, a typical cut-in speed for many wind turbines, compared to 87% in summer and 37% in winter. Accumulated activity also varied with height; 87% versus 77% at 3ms^{-1} at 12m and 80m respectively in summer for example. The steep change in accumulated bat activity in winter at 80m was due to a sharp increase in activity by the Natal long-fingered bat and the Cape serotine on 01/08/2015. These bats were recorded at wind speeds between 20ms^{-1} and 22ms^{-1}.

If changing the cut-in speed of high risk wind turbines were required (for example, based on operational phase data), this would have a noticeable impact on the proportion of bats that could be potentially at risk of spinning blades. For example, data from 80m in spring showed that 75% of bat activity occurred below 3ms^{-1} and that this increased to 79% of bat activity as wind speed increased to 4ms^{-1} and 90% for a wind speed of 5 ms^{-1}. In summer at 80m, 77% of bat activity occurred below 3ms^{-1}, 90 % below 4ms^{-1} and 93% below 5ms^{-1}.



Graph 8-9: Accumulation curves of bat activity across all species with increasing wind speed at MET2 in spring, summer and winter. The grey band highlights the range of typical wind turbine cut-in speeds from 3ms-1 to 5ms-1.

8.2.4 *Baseline Conclusion*

The analysis of the relationship between bat activity and wind speed, temperature and barometric pressure showed mixed results across all models. Only wind speed and temperature emerged as significant predictors of bat activity in most models. However, despite the model results suggesting significant relationships between bat activity and these two predictor variables, the magnitude was small across all models. In addition, post-hoc tests showed that the data did not fit any of the models well, suggesting that the models have low predictive use.

General trends evident in the bat activity data are a dominance of recorded activity levels by two species, a decrease in bat activity with altitude and greater activity in lower lying areas, higher bat activity for three hours in the early evening, a seasonal pattern with lower activity in autumn and winter and higher activity in spring and summer, a positive but weak relationship between bat activity and temperature and a negative but weak relationship between bat activity and wind speed.

Most bat activity involved the Egyptian free-tailed bat and the Cape serotine which together accounted for approximately 83% of total bat activity. Both species are of Least Concern nationally and internationally and according to the guidelines, they have a high and medium-high likelihood of risk from WEFs respectively. The Cape serotine displays foraging behaviour that may bring this species within the rotor-swept zone of wind turbine blades;

it forages at a range of heights including near to the ground, on the edge of vegetation and in open air relatively high above the ground (for example, at least 40m, J. Aronson, *pers. obs.*). This may bring these bats into the range of the lower sweep of turbine blades.

The Egyptian free-tailed bat is a high-flying species whose morphology and echolocation enable fast flight in open areas and these bats are therefore at risk of encountering wind turbine blades across most of the rotor-swept zone. Monitoring of operational WEFs in South Africa has confirmed that Cape serotine and Egyptian free-tailed bats have suffered mortality by wind turbines.

The species recorded least often was the Natal long-fingered bat which has the highest national conservation status of the five species recorded being listed as Near Threatened. This is a migratory species and is protected under an international agreement in the Convention on the Conservation of Migratory Species of Wild Animals (1979).

The majority of bat mortalities at wind energy facilities in North America and Europe are migratory species therefore it may be assumed that the Natal long-fingered bat is at risk from wind turbines in South Africa. This species migrates during autumn (April and May) and spring (September and October) between summer maternity roosts and winter hibernating sites which are generally located at higher latitudes. The species is reported to migrate distances from approximately 150km to 560km. This species did have higher activity in autumn and it is unclear if this is related to any migration events, but it is likely that there is a local population of the Natal long-fingered bat on the site and surrounds.

Bat activity was higher in riparian zones and in drainage areas compared to ridges and foothill areas. This could be because the more complex habitat in these areas and access to water is more favourable for bats. Linear edges created by the drainage lines and riparian vegetation are used as cues by bats for flight paths while foraging and to navigate while commuting.

On average across the twelve monitoring locations, the activity of Roberts's flat-headed bat was greater in riparian and drainage areas but its presence was notable at MET2Low, with an average of 16.5 bat passes/night on this ridge. An important finding is that 90% of the activity of this species at MET2 occurred during two brief periods during the year across December and January (i.e. summer); one lasting 16 days and the other 11 days. Roberts's flat-headed bat is also a free-tailed bat with similar flight behaviour to Egyptian free-tailed bats and is also at high risk from WEFs and it is endemic to southern Africa.

The higher activity at MET2 could be due to the nearby presence of rocky habitat providing roosting opportunities under slabs of exfoliated rock or narrow crevices and cracks which this species appears to be adapted to use. The Long-tailed serotine and the Egyptian free-tailed bat are also known to roost in rock crevices. Compared to the other monitoring locations, both species had the highest mean activity per night at MET2, 6.3 bat passes/night and 39.1 bat passes/night respectively. As with Roberts's flat-headed bat, the vast majority of this activity came in brief periods in December and January. For example, for the Long-tailed serotine, 75% of activity at MET2Low occurred during a nine day period in December and a 5 day period in January. For the Egyptian free-tailed bat, 80% of activity occurred during a 17 day period in December and a 12 day period in January.

Prominent geological features of the landscape at Komsberg are dolerite sills running along ridgelines and in higher lying areas, including near MET2. These features present roosting opportunities for these three, and possibly other, species of bat in the form of rocky habitat.

Bat activity peaked at different times at each monitoring location but was generally highest in the early evening (between 19:00 and 21:00) which is typical for many insectivorous bats. A second peak later in the night before sunrise is sometimes also possible but this was mostly not observed except at the met masts where bat activity appeared to peak later in the night. There was also a clear seasonal effect in peak activity times with activity starting and peaking earlier in winter and latest in summer. In spring, there appeared to

be a small second peak in activity in the early hours of the morning. Emergence times of bats from their daytime roosts is influenced by a range of factors including sunset times and the later sunset times in spring and summer result in the later peaks in bat activity. The impact of seasons on bat activity is also expressed at a nightly and monthly scale and is a consistent pattern also observed in this study.

These patterns may be mediated through environmental conditions such as wind speed, temperature, rainfall, humidity and barometric pressure which themselves vary seasonally have been shown to influence bat activity in numerous studies. However, in this study the GLM models had very low predictive power and only showed very small effects of environmental variables on bat activity. Whilst the specialist is satisfied with the conclusiveness of this report and the assessment findings, the addition of other predicator variables (for example, moon phase, humidity or rainfall) could improve the model fitting or alternatively, the different statistical methodologies could be attempted.

8.3 Avifauna Baseline Environment

8.3.1 ***Bird Micro-habitats***

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

The proposed project site is relatively topographically diverse and consists of large relatively flat plains, undulating hills and steep slopes, with the high Roggeveld Mountains and Great Escarpment to the north. Aerial photographs, satellite imagery, and most importantly field work has been used to identify the following micro-habitats on the project site:

8.3.1.1 *Karoo Plains and Scrub*

Large areas of the project site consist of relatively flat or undulating areas of Karoo scrub vegetation, occasionally interspersed with grasses. These open areas, are primarily at lower altitudes between the ridges and are likely to be utilised by terrestrial birds such as bustards, korhaans, francolins and storks. A variety of raptors may also forage over these open scrub areas, such as Southern Pale Chanting Goshawk, Jackal Buzzard, Martial Eagle and possibly Black Harrier. The scrubland habitat is also suitable for many small passerine birds such as larks, eremomelas and prinias, many of which are endemic or near-endemic species.

8.3.1.2 *Cultivated Lands and Pastures*

Limited areas of irrigated agricultural land and pastures occur around farmhouses or near associated with watercourses and rivers. These areas may provide a feeding ground for many species of birds, as land preparation makes insects, seeds, bulbs and other food sources readily available. This habitat type may be used by ibises, herons, storks, egrets, geese, francolins and a variety of passerine species.

8.3.1.3 *Rivers and Drainage Lines*

While the rivers, streams and drainage lines may not always carry water, these features are dominated by denser and taller riparian scrub (such as *Acacia Karoo*) and generally have a higher abundance of bird life than the surrounding vegetation.

Drainage lines, streams and rivers may form flyways for amongst others, ibises, ducks, cormorants, geese and storks, while riparian scrub will host a number of smaller passerine species. Rivers responsible for eroding cliff faces into the landscape may also therefore

indirectly provide roosting and nesting habitat for geese, ibises, herons, storks, Hamerkop and raptor species such as Rock Kestrel, Verreaux's Eagle, African Harrier Hawk and Jackal Buzzard.

8.3.1.4 *Farm Dams*

Dams are important attractions for various bird species in the South African landscape, and in the Karoo are often the only source of water during the dry season. Dams, although limited on the project site, may (when they contain water) attract various waterfowl, such as Spur-winged Goose, South African Shelduck, and Egyptian Goose. Storks, African Spoonbill, herons and egrets may also frequent these water bodies, as well as fish-eating raptors such as African Fish Eagle. Blue Cranes are known to use farm dams as roost sites.

8.3.1.5 *Ridges and/or Cliffs*

The high Roggeveld Mountains and Great Escarpment characterise the north of the project site. Numerous long ridges run north to south from the escarpment, particularly in the eastern and western farm portions of the project site. The central area of the site has less hills and ridges, and is more open and flat.

The hills and ridges are important for various raptors, e.g. Rock Kestrel, African Harrier Hawk, Jackal Buzzard and Verreaux's Eagle, that may use the slopes for soaring and to gain lift. Rocky outcrops and cliffs may be important nesting habitat for various raptors, most importantly Verreaux's Eagle, which is likely to spend time hunting along rocky outcrops and ridges. Black Stork may also nest on suitable cliffs. Rocky ridges are also home to Rock Hyrax ('Dassie') an important prey species of Verreaux's Eagle, which will hunt regularly in these areas. African Rock Pipit is also found on rocky slopes.

8.3.1.6 *Farmsteads and Feeding Kraals*

Farmsteads are disturbed areas surrounding farm houses or areas of human activity, while feeding kraals are areas where livestock gather for food, shelter and water provided by the farmer. These habitats are frequented by small passerine birds such as sparrows, starlings, weavers and larks but also by egrets, ibis and guineafowl. Farmsteads are utilised by a variety of raptors such as Black-shouldered Kite and Barn Owl, which prey on various rodent species that occur in these areas.

8.3.1.7 *Stands of Alien Trees*

Stands of alien trees such as poplars and blue gums occur scattered around the site, mainly near farmsteads, rivers and drainage lines. These are frequently utilised as roosts by raptors such as Verreaux's Eagle and Martial Eagle, and also frequented by a variety of passerines such as doves, starlings and weavers.

8.3.2 ***Results of the Avifaunal Community Desktop Study***

8.3.2.1 *Southern African Bird Atlas Project 1*

The SABAP1 data was collected between 1986 and 1997 and is one of the best long term data sets on bird distribution and abundance available in South Africa at present. This data was collected in quarter degree squares, with the WEF site covering the following squares: 3220DB, 3220DD, 3221CA and 3221CC (**Figure 8-6**). **Table 8-4** indicates the reporting rate for all raptors and priority species recorded by the SABAP1 data within these squares, as well as giving a total number of species recorded in each square which varied from 62 to 106, with the latter being recorded in square 3221CA, which also has the most records of priority species (11 out of 16). The SABAP1 project recorded a total of 147 species for the pentads considered.

Table 8-3: Raptors and Priority Species recorded by SABAP1 in the Quarter Degree Squares covering the project site.

Species	Priority Species Score	Regional Red Data Status	Report rate (%) **			
			3220DB	3220DD	3221CA	3221CC
Total species			*98*	*100*	*106*	*62*
Number of cards submitted			*8*	*12*	*5*	*5*
African Rock Pipit	200	NT	-	-	20	-
Barn Owl	-	-	-	-	20	-
Black-chested Snake-Eagle	230	-	-	17	-	-
Black Harrier	345	EN	13	-	-	-
Black Korhaan (pre-split)	180/270*	-	13	-	-	-
Black-shouldered Kite*	174	-	-	-	20	-
Black Stork	330	V	-	-	20	-
Gabar Goshawk	-	-	-	-	-	20
Greater Kestrel	174	-	-	-	20	-
Grey-winged Francolin	190	-	13	8	80	40
Jackal Buzzard	250	-	38	-	20	-
Karoo Korhaan	240	NT	13	17	60	40
Little Sparrowhawk	-	-	-	-	20	-
Ludwig's Bustard	320	EN	13	17	-	-
Martial Eagle	350	EN	13	8	-	-
Rock Kestrel	-	-	63	42	40	20
Pale Chanting Goshawk	200	-	-	25	20	20
Spotted Eagle-owl	170	-	-	-	40	-
Steppe Buzzard	210	-	-	-	20	-
Verreaux's Eagle	360	V	50	17	60	20

** Northern Black Korhaan has a score of 180, while Southern Black Korhaan has a score of 270.*
*EN = Endangered; V = Vulnerable; NT = Near-threatened. **Report rates are percentages of the number of times a species was recorded in the square, divided by the number of times that square was counted. It is important to note that these species were recorded in the entire quarter degree square in each case and may not actually have been recorded on the proposed WEF site.*

8.3.2.2 *Southern African Bird Atlas Project 2*

This project is part of an ongoing study by the Animal Demography Unit (ADU), a research unit based at the University of Cape Town (UCT). SABAP2 data was examined for the pentads (which are roughly 8km x 8km squares, and are smaller than the squares used in SABAP1) which had been counted and as there is only data for three pentads covered by the project site (3240_2050, 3240_2045, 3235_2055 and 3240_2100) data from the following surrounding pentads have also been examined as, due to the inherent mobility of birds, species recorded in these pentads may be present on the project site: 3235_2045, 3235_2050, 3230_2055, and 3235_2100 (**Figure 8-6**). These additional pentads cover a large area and thus data from these pentads is used with caution.

While SABAP2 coverage in the project site and immediate area is relatively poor with most pentads having five or less cards submitted[34] and some having not been counted at all, a total of 113 species including thirteen priority species have been recorded by the SABAP2 data considered. **Table 8-5** shows the reporting rates for Priority Species and Raptors recorded in the Pentads considered. Pentads shown in bold in this table are those covered by the WEF site farm boundaries. Seven regional Red Data Priority Species or raptors were recorded, including three classified as *Endangered*: Ludwig's Bustard, Martial Eagle and Black Harrier. Priority species or raptors with relatively high reporting rates and recorded across a number of pentads are: Martial Eagle, Verreaux's Eagle, Jackal Buzzard, Grey-winged Francolin, Pale Chanting Goshawk, Rock Kestrel and Karoo Korhaan.

Table 8-4: Raptors and priority species recorded in the SABAP2 Pentad Squares covering the site and immediate surrounding area.

Species	Priority Species Score	Regional Red Data Status	Report rate (%) **							
			3240_ 2050	**3240_ 2045**	**3235_ 2055**	**3240_ 2100**	3235_ 2045	3235_ 2050	3230_ 2055	3235_ 2100
Total species			*50*	*77*	*28*	*30*	*58*	*58*	*24*	*57*
Number of cards submitted			*3*	*12*	*3*	*1*	*4*	*8*	*2*	*5*
African Rock Pipit	200	NT	-	-	-	-	-	-	-	60
Black Harrier	345	EN	-	-	-	-	-	12.5	-	-
Booted Eagle	230	-	-	-	-	-	-	25	100	40
Grey-winged Francolin	190	-	-	83.33	33.33	-	-	25	-	20
Jackal Buzzard	250	-	100	58.33	-	-	25	37.5	100	60
Karoo Korhaan	240	NT	33.33	33.33	33.33	-	-	62.5	-	40
Ludwig's Bustard	320	EN		16.67	-	-	50	-	-	-
Martial Eagle	350	EN	-	25	-	-	50	25	100	20
Rock Kestrel	-	-	66.67	58.33	-	-	75	62.5	-	80
Southern Black Korhaan	270	V	-	33.33	-	-	-	-	-	-
Spotted Eagle-owl	170	-	-	-	-	-	50	-	-	-
Steppe Buzzard	210	-	-	16.67	-	-	-	-	-	-
Pale Chanting Goshawk	200	-	*Ad Hoc*	41.67	66.67	-	50	25	-	20
Verreaux's Eagle	360	V	66.67	8.33	-	100	-	12.5	-	40

*EN = Endangered; V = Vulnerable; NT = Near-threatened. **Report rates are essentially percentages of the number of times a species was recorded in the pentad, divided by the number of times that pentad was counted. It is important to note that these species were recorded in the entire pentad in each case and may not actually have been recorded on the proposed WEF site.*

[34] Each time that birds in a pentad have been counted by a citizen scientist registered with the ADU, a pentad 'card' is submitted online to the ADU. The number of cards therefore indicate the number of times a pentad has been counted.

8.3.2.3 *Coordinated Waterbird Count (CWAC) Data*

There are no CWAC sites within 50km of the proposed project site.

8.3.2.4 *Important Bird Area (IBA) Project*

The proposed development is not situated within an IBA and there are no IBA's within 50 km of the proposed project site.

8.3.2.5 *Bird Impact Assessment for the proposed Sutherland Renewable Energy Facility (SREF)*

This study, conducted by *AVISENSE* Consulting cc, was authored by Dr. Andrew Jenkins. The study covered an area to the immediate north and west of the proposed project site. The study included a desktop component, two short site visits (4 to 8 April and 21 October 2010) and an impact assessment.

The desktop study identified that approximately 210 bird species may potential occur on the proposed SREF site, including 14 Regional Red Data species, 69 endemics or near-endemics, and four Regional Red Data endemics (Ludwig's Bustard, Blue Crane, Black Harrier and Sclater's Lark). The study noted that some species were included despite the fact that they were not recorded in SABAP1 or SABAP2 data for the area as the habitat on the site was deemed suitable by Dr. Jenkins to potentially support such species. Seventeen priority species that had not been recorded by SABAP1 or SABAP2 for the Komsberg WEF site were listed as potentially present, namely African Fish Eagle, African Marsh Harrier (*Endangered*), Black Kite, Black Sparrowhawk, Blue Crane (*Near-threatened*), Burchell's Courser (*Vulnerable*), Cape Eagle-owl, Greater Flamingo (*Near-threatened*), Kori Bustard (*Near-threatened*), Lanner Falcon (*Vulnerable*), Lesser Flamingo (*Near-threatened*), Lesser Kestrel, Peregrine Falcon, Rufous-breasted Sparrowhawk, Sclater's Lark (*Near-threatened*), Secretarybird (*Vulnerable*) and White Stork.

During the two site visits in 2010, a total of 73 species were recorded on the SREF site and included eight priority species, namely Jackal Buzzard, Booted Eagle, Martial Eagle (*Endangered*), Verreaux's Eagle (*Vulnerable*), Southern Pale Chanting Goshawk, Karoo Korhaan (*Near-threatened*), African Rock Pipit (*Near-threatened*) and Rufous-breasted Sparrowhawk. The site visits recorded a priority species (Rufous-breasted Sparrowhawk) that had not been recorded in SABAP data for the Komsberg site. Other points of interest included an immature Martial Eagle and a pair of Secretarybirds (*Vulnerable*) observed in the *'broader impact area'* as well as a suspected Verreaux's Eagle nest on the Komsberg pass. The report also noted "*Three pairs of Martial Eagle nest on pylons on the Droeriver-Muldersvlei 400 kV line about 14-20km to the south (DRO-MVL towers 447, 506 & 513 and 542)"* as well as an additional "*three Verreaux's Eagle nests in the greater area*".

8.3.2.6 *Pre-construction Bird Monitoring Report and Updated Avifaunal Assessment for the Three Phased Hidden Valley Wind Energy Facility.*

This study was conducted by the Endangered Wildlife Trust in 2014, and included four seasonal surveys across a twelve month period recording 153 species, including 21 priority species and 8 Regional Red Data species. This study recorded species that were not recorded by the SABAP1 or SABAP2 data for the Komsberg WEF site, including five priority species: Black Sparrowhawk, Blue Crane (*Near-threatened*) during the spring survey, Cape Eagle-Owl during the winter and spring surveys, Lanner Falcon (*Vulnerable*) during the summer survey and Rufous-breasted Sparrowhawk during the winter and spring surveys.

8.3.3 Komsberg WEF Twelve Month Pre-construction Monitoring Results

8.3.3.1 *Walked Transects*

In the WEF site, bird numbers were highly variable across the seven transects, ranging from 0 to 90 birds per kilometre transect, with an overall average of 29.21 (SD±22.98) (**Table 8-6**). The number of species per transect ranged from 1 to 28 with an average of 11.36 (SD±7.51) species per transect in the WEF.

Table 8-5: Summary of 1 km walked transect results across all seasons – WEF.

Transect Ref	IKA* (all birds) Mean ± SD	IKA (target species) Mean ± SD	Species richness Mean ± SD
WT2	26.5 (±13.31)	0.25 (±0.46)	11.25 (±5.87)
WT3	4.38 (±3.29)	0.13 (±0.35)	2.75 (±2.12)
WT6	41.63 (±22.81)	0.00 (±0.00)	16.63 (±8.40)
WT8	47.50 (±21.48)	0.63 (±1.77)	18.25 (±5.90)
WT9	18.25 (±12.71)	0.00 (±0.00)	8.25 (±4.98)
WT10	41.00 (±17.99)	0.00 (±0.00)	15.88 (±4.52)
WT11	25.25 (±30.11)	0.00 (±0.00)	6.50 (±4.63)
Total	29.21 (±22.98)	0.14 (±0.70)	11.36 (±7.51)

**IKA: Index of Kilometric Abundance = Birds/km; SD = Standard Deviation*

Priority species were also recorded in the WEF transect surveys and included Jackal Buzzard (WT2), Martial Eagle (WT2), Karoo Korhaan (WT6) and Verreaux's Eagle (WT6).

A total of 82 species including three Red Data species (Karoo Korhaan, Martial Eagle and Verreaux's Eagle), four priority species and 19 endemic or near-endemic species were found during walked transect surveys on the WEF site. The highest number of birds (380 individuals) was recorded on WT8 and the highest number of species was recorded on WT6 (60). Both transects were located at lower altitudes, on close proximity to drainage lines. The lowest number of birds (35) and species (14) was recorded on WT3 (the latter being located on the Komsberg West WEF site).

Table 8-6: Small terrestrial species transect results – WEF.

Transect	Number of Individual Birds	Total Species Recorded	Priority Species (P) and Red Data Species (Status)*	Non-Priority, Frequently Recorded and/or Abundant.
WT2	212	45	Jackal Buzzard (250), Martial Eagle (350, EN)	Cape Bunting, Karoo Chat, Karoo Prinia, Barn Swallow
WT3	35	14	-	Grey-backed Cisticola
WT6	333	60	Karoo Korhaan (240, NT), Verreaux's Eagle (360, VU)	Cape Bunting, Grey-backed Cisticola, Karoo Chat, Karoo Long-billed Lark, Karoo Scrub Robin, Three-banded Plover
WT8	380	56	-	Acacia Pied Barbet, Bokmakierie, Cape Bunting, Karoo Chat, Karoo Long-billed Lark, Karoo Prinia, Red-faced Mousebird
WT9	146	35	-	Acacia Pied Barbet, Cape Bunting, Karoo Chat, Layard's Tit-babbler, Red-faced Mousebird
WT10	328	54	-	Acacia Pied Barbet, Cape Bunting, Layard's Tit-babbler, Mountain Wheatear, White-

Transect	Number of Individual Birds	Total Species Recorded	Priority Species (P) and Red Data Species (Status)*	Non-Priority, Frequently Recorded and/or Abundant.
				throated Canary, Yellow Canary
WT11	202	28	-	Black-headed Canary, Cape Bunting, Mountain Wheatear
CWT1	115	24	Karoo Korhaan (240, NT); Pale Chanting Goshawk (200)	Karoo Long-billed Lark, Karoo Chat, Cape Bunting, Mountain Wheatear
CWT2	593	66	Karoo Korhaan (240, NT); Spotted Eagle Owl (170); Verreaux's Eagle (360, VU)	Cape Robin Chat, Acacia Pied Barbet, Southern Double-collared Sunbird, Cape Turtle Dove, Cape White-eye, Chestnut-vented Tit-babbler, Karoo Prinia

**Red Data Status (*Taylor *et al.* 2015*) status: NT=Regionally Near-Threatened; VU= Regionally Vulnerable*

The number of birds recorded on the two control site walked transects ranged from 5 to 109 birds per kilometre transect (**Table 8-7**), with an overall average of 44.25 (SD±39.24). The two control transects varied greatly in habitat, with the transect running along a riverbed (CWT2) showing consistently high numbers of birds, while abundance was generally low on CWT1 which ran across open scrub.

Four priority species were recorded during walked transect surveys on the control site (**Table 8-8**). These were Verreaux's Eagle (CWT2), Karoo Korhaan (CWT1, CWT2), Spotted Eagle Owl (CWT2) and Pale Chanting Goshawk (CWT1, CWT2).

Table 8-7: Summary of four seasonal surveys 1km walked transect results - control site.

Walked Transect Reference	IKA (all birds) Mean ± SD	IKA (target species) Mean ± SD	Species richness Mean ± SD
CWT1	14.38 (±11.45)	2.50 (±2.62)	6.13 (±3.04)
CWT2	65.13 (±38.88)	1.13 (±1.25)	25.88 (±9.28)
Total	44.25 (±39.24)	1.81 (±2.10)	16.00 (±12.19)

8.3.3.2 *Vantage Points*

Average ± SD passage rates of target species per vantage point over the four surveys ranged from 0.27 to 1.54 target birds per hour in the WEF.

The overall average ± SD passage rate for the WEF was 0.63 ± 1.17 target birds per hour of observation (**Table 8-9**). The average passage rate of target species per hour from four seasonal surveys in the control site was 0.50 (±0.88).

The standard deviations were high mostly because the incidences of target birds were not normally distributed throughout the day.

Table 8-8: Seasonal average passage rate of target species per hour from four seasonal surveys.

Vantage Point	Passage Rate (individuals per hour) Mean (±SD)				
	S1	S2	S3	S4	Average
1	0.25 (±0.45)	0.33 (±0.65)	0.00 (±0.00)	0.50 (±0.80)	**0.27 (±0.57)**
2	0.83 (±1.19)	0.33 (±0.78)	0.75 (±0.87)	1.25 (±1.91)	**0.79 (±1.27)**

Vantage Point	Passage Rate (individuals per hour) Mean (±SD)				
	S1	S2	S3	S4	Average
3	0.25 (±0.45)	0.17 (±0.39)	0.67 (±0.65)	0.92 (±1.16)	**0.50 (±0.77)**
4	0.42 (±0.90)	0.17 (±0.39)	1.25 (±1.86)	1.00 (±1.60)	**0.71 (±1.35)**
5	0.58 (±0.90)	0.17 (±0.58)	0.75 (±1.36)	0.33 (±0.78)	**0.46 (±0.94)**
6	0.08 (±0.29)	0.25 (±0.45)	0.75 (±1.36)	0.25 (±0.62)	**0.33 (±0.81)**
7	0.42 (±1.00)	1.00 (±1.65)	0.67 (±0.89)	0.83 (±1.19)	**0.73 (±1.20)**
8	0.62 (±1.66)	0.08 (±0.29)	0.33 (±0.49)	0.25 (±0.45)	**0.33 (±0.92)**
9	1.50 (±1.62)	0.25 (±0.62)	0.17 (±0.39)	1.00 (±1.21)	**0.73 (±1.18)**
10	1.58 (±2.50)	1.58 (±1.68)	1.08 (±1.51)	1.92 (±1.88)	**1.54 (±1.89)**
11	1.08 (±1.83)	0.42 (±0.79)	0.58 (±0.90)	1.25 (±1.48)	**0.83 (±1.33)**
12	0.42 (±0.90)	0.00 (±0.00)	0.17 (±0.39)	0.67 (±0.78)	**0.31 (±0.66)**
Average	**0.67 (±1.34)**	**0.40 (±0.92)**	**0.60 (±1.05)**	**0.85 (±1.29)**	**0.63 (±1.17)**
Control	0.44 (±1.01)	0.89 (±1.17)	0.56 (±0.73)	0.11 (±0.33)	**0.50 (±0.88)**

The flight paths of a total of thirteen positively identified target species were recorded from vantage points, including twelve priority species and eleven raptors (ten of which are priority species).

The total number of flight paths recorded over four seasons was 306 with a total of 363 individuals observed (although it must be noted that the same individual birds may have been seen multiple times over the period of the survey). Raptors accounted for at least 290 flight paths (95%).

The most frequently recorded species was Verreaux's Eagle which, with 144 flight paths, accounted for 47% of flight paths, while Rock Kestrel was the second most frequently recorded species and accounted for 21% of flight paths, followed by Jackal Buzzard with 16% of flights. Together, these three species therefore constituted 255 flight paths, or 83% of all recorded flights.

While target species utilised each of the height categories, 82% of flights included at least some time at RSH (height bands two (20-40m), three (40-120m) and four (120-160m) while 187 flights, or 61% of flights included 50% or more of their duration at RSH (i.e. between 20m and 160m). A summary of flight paths by target species is presented in **Table 8-10**. A high proportion of Verreaux's Eagle flights (81%) included some time at RSH.

Table 8-9: Flight path target species – WEF Site.

Species	Species Priority Score*	Red Data Status	Total no. of Flight paths	Total no. of birds recorded**	Estimated minimum number of separate individuals	No. of flights with a portion at RSH (% of flights with a portion at RSH)
African Harrier-Hawk	190	-	7	7	3	6 (85.7 %)
Black Stork	330	VU	6	8	3	6 (100 %)
Booted Eagle	230	-	2	2	1	1 (50.0 %)
Greater Kestrel	174	-	3	4	2	2 (66.7 %)

Species	Species Priority Score*	Red Data Status	Total no. of Flight paths	Total no. of birds recorded**	Estimated minimum number of separate individuals	No. of flights with a portion at RSH (% of flights with a portion at RSH)
Jackal Buzzard	250	-	48	49	5	39 (81.3 %)
Karoo Korhaan	240	NT	1	2	2	0 (0 %)
Lanner Falcon	300	VU	1	1	1	1 (100 %)
Martial Eagle	350	EN	6	6	2	5 (83.3 %)
Pale Chanting Goshawk	200	-	5	5	2	3 (60.0 %)
Peregrine Falcon	240	-	1	1	1	1 (100 %)
Rock Kestrel	-	-	63	69	6	56 (88.9 %)
Steppe Buzzard	210	-	3	3	2	3 (100 %)
Verreaux's Eagle	360	VU	144	189	8	117 (81.3 %)
Unidentified Species	-	-	9	9	-	7 (77.8 %)
Unidentified Raptor	-	-	7	8	-	3 (43 %)
Totals			**306**	**363**	**NA**	**250 (81.7 %)**

** Priority species (Retief et al. 2011, updated 2014). EN = Endangered NT = Near-threatened, VU= Vulnerable. ** Multiple observations may have been made of the same individuals at different times.*

While the total number of flight paths recorded for all target species was highest in summer (103 flights), followed by autumn (81 flights), spring (75) and winter (47), the number of Verreaux's Eagle flight paths recorded was highest in autumn (58 flights), fairly equal in winter (33) and summer (34), and lowest during spring (19). This may be due to increased activity around the nest site in autumn in preparation for breeding in winter, followed by the provisioning of food to the nest site during winter as chicks would be unable to forage for themselves.

The estimated minimum number of Verreaux's Eagles which conducted flights on or around the WEF site was eight - individual eagles consisting of three territorial adult pairs, and two separate juveniles. The possible presence of 'floaters' (i.e. non-territorial adults) and additional juveniles, dispersing from other territories, is noted, and therefore this number of individuals is a minimum estimate. Juvenile eagles may be more at risk from collision (as they are still perfecting their flying skills, learning to hunt, exploring new terrain), including when dispersing from the home territories into unfamiliar areas. Of the 144 Verreaux's Eagle flights recorded, 15 (10%) included flights of juveniles or immature birds.

The total number of flight paths recorded at the control site VP over four seasons was 13 with a total of 18 individuals observed (although it must be noted that the same individual birds may have been seen multiple times over the period of the survey) (**Table 8-11**). Three target species were recorded at the control site VP, of which two were priority species. Verreaux's Eagle and Pale Chanting Goshawk each accounted for 38.5% of flight paths with Rock Kestrel making up the balance. Target species utilised all height bands, however Verreaux's Eagle was only recorded above rotor swept height.

Table 8-10: Flight path target species - control site.

Species	Species Priority Score*	Red List Status	Total no. of Flight paths	Total no. of birds recorded**	No. of flights with a portion at RSH (% of flights with a portion at RSH)
Pale Chanting Goshawk*	200	-	5	7	3 (60 %)
Rock Kestrel	-	-	3	3	3 (100 %)
Verreaux's Eagle*	360	VU	5	8	0 (0 %)
Totals			**13**	**18**	**6 (46 %)**

**Priority species (Retief et al. 2011, updated 2014). VU=Vulnerable. ** Multiple observations may have been made of the same individuals at different times.*

8.3.3.3 *Incidental Observations*

A total of 244 individuals (which may include multiple observations of the same bird) from 184 incidental observations of target species, with 14 positively identified species, were made. Of these 14 species, 13 were priority species with Rock Kestrel being the only non-priority species recorded (**Table 8-12**).

The species most regularly recorded incidentally was Karoo Korhaan, with 36 records (accounting for 20% of all incidental records) totalling 75 individuals. It was often seen in small groups of 2 to 4 birds, and mostly on the lower lying flat areas. Rock Kestrel and Jackal Buzzard were also regularly recorded and each species accounted for 19% of incidental records. Pale Chanting Goshawk was recorded incidentally on 30 occasions (16%), while there were 22 incidental records (12%) of Verreaux's Eagle. These five species therefore account for 85% of all incidental records. Karoo Korhaan were mostly observed in the central regions of the WEF, in the lower lying open areas. Most records of Martial Eagle were in the west, particularly near the identified roost site. One record of White Stork was made in the agricultural lands at Putterskraal. Verreaux's Eagle were recorded incidentally throughout, but more often in the central and eastern areas. Pale Chanting Goshawk, Jackal Buzzard and Rock Kestrel were often perched on electricity or telephone poles near the main dirt roads.

Table 8-11: Number of incidental records of target species during four seasonal surveys.

Species	Number of observations	Total individuals**	Maximum flock count
Black Harrier*	2	2	1
Black-chested Snake Eagle*	1	1	1
Black Stork*	1	1	1
Greater Flamingo*	1	1	1
Greater Kestrel*	2	3	2
Jackal Buzzard*	50	51	2
Karoo Korhaan*	40	84	4
Lanner Falcon*	2	2	1
Ludwig's Bustard*	2	2	1
Martial Eagle*	11	15	2
Pale Chanting Goshawk*	38	39	2
Rock Kestrel	43	47	2
Steppe Buzzard*	3	3	1
Verreaux's Eagle*	29	41	3
White Stork*	1	5	5
Unidentified Owl	1	1	1
Unidentified Raptor	4	4	1

Species	Number of observations	Total individuals**	Maximum flock count
TOTALS	**231**	**302**	**NA**

**Priority species (Retief et al. 2011, updated 2014). Italics = endemics or near-endemics. ** Multiple observations may have been made of the same individuals at different times.*

8.3.3.4 *Focal Sites*

Summarised results from four seasonal surveys at the six focal sites are shown in **Table 8-13** below, with the following key findings:

- Although Verreaux's Eagles were observed interacting with both nest structures at FS1, it was confirmed that the active nest structure, within which the pair of Eagles successfully raised and fledged a chick (observed during the course of monitoring), was the nest on the south western cliff face.
- The stand of *Eucalyptus* trees at FS2, is an important Roost for a pair of Verreaux's Eagles (Note: This is a different pair to the pair breeding at FS1). It is likely that this pair may attempt to nest in the vicinity (or possibly in the trees), although no nest site could be located.
- The stand of alien trees at FS4, is an important roost for a pair of Martial Eagles. It is possible that this pair may have a nest in the vicinity, although no nest site could be located.
- In the subsequent visits to the African Harrier Hawk Nest site (FS5) in spring and summer, the breeding pair could not be located, and it could not be confirmed whether they had bred successfully.
- In the subsequent visits to the Verreaux's Eagle nest site outside of the WEF (FS6) in spring and summer, the breeding pair could not be located, and it could not be confirmed whether they had bred successfully. A Black Stork and a Martial Eagle were observed at this location, soaring above the cliffs during spring.

Table 8-12: Summary of focal Site results (number of individuals counted during each of the two counts, per season, is given in brackets).

Focal Site visit	Survey 1 (autumn)		Survey 2 (winter)		Survey 3 (spring)		Survey 4 (summer)	
	Priority Species (number of individuals)	**Notes**	**Priority Species (number of individuals)**	**Notes**	**Priority Species (number of individuals)**	**Notes**	**Priority Species (number of individuals)**	**Notes**
FS1.1	Verreaux's Eagle (1)	One adult Verreaux's Eagle recorded perched at the nest.	0 (0)	No birds recorded at or interacting with the focal site.	Verreaux's Eagle (1)	Juvenile on the active nest site on the south western cliff.	0 (0)	No birds recorded at or interacting with the focal site.
FS1.2	0 (0)	No birds recorded at or interacting with the focal site.	Verreaux's Eagle (2)	A pair of Verreaux's Eagles were at the active nest site on the south western cliff.	0 (0)	-	0 (0)	No birds recorded at or interacting with the focal site.
FS2.1					0 (0)	-	0 (0)	
FS2.2					0 (0)	-	Verreaux's Eagle (1)	Verreaux's Eagle was flushed from Eucalyptus tree perch.
FS3.1					0 (0)	-	0 (0)	
FS3.2					0 (0)	-	Verreaux's Eagle (2)	Verreaux's Eagle was flushed from Eucalyptus tree (FS2) and flew to Rock perch (FS3) where it was joined by a second bird.
FS4.1					Martial Eagle (2)	Pair of Martial Eagles perched on trees	0 (0)	Martial Eagle not present[35]
FS4.2					0 (0)	-	0 (0)	
FS5.1					0 (0)	-	0 (0)	
FS5.2					0 (0)	-	0 (0)	Cinnamon-breasted Warbler recorded.
FS6.1					Martial Eagle (1); Black Stork (1).	No birds on Verreaux's Eagle nest. Martial Eagle and Black Stork flying very high overhead	0 (0)	No birds on Verreaux's Eagle nest.
FS6.2					0 (0)		0 (0)	No birds on Verreaux's Eagle nest.

[35] Note: Martial Eagle was seen at this location outside of the survey times and was recorded as an incidental record.

8.3.3.5 *Focussed Nest Search*

Of the 59 surveyed cliffs, four cliffs were found to have a total of four raptor nests. An active Verreaux's Eagle nest was located at Cliff 41 (C41), approximately 6 km west of the WEF site boundary (subsequently designated as FS6). An inactive Verreaux's Eagle nest was located at C40 approximately 3.3 km west of the WEF site boundary, while an inactive unidentified raptor nest was located at C39 approximately 2.3 km west of the WEF site boundary. One nest of an unidentified raptor (likely either a Jackal Buzzard or an African Harrier Hawk) was located within the WEF site at C12.

The specialists confirmed the presence of two regular Verreaux's Eagle roosts (FS2 and FS3) and a Martial Eagle roost (FS4) on the WEF site. A pair of Verreaux's Eagle regularly utilised a stand of eucalyptus trees (FS2) as well as a rocky outcrop (FS3) in close proximity to the farm house at Brinksfontein as a perch and roost. This pair was recorded by other survey methods described above, along with a third bird (a sub-adult) recorded at the same location during DT3 in winter, indicating the possibility of a nest in the area. Verreaux's Eagle do occasionally nest in trees. A thorough search of the *Eucalyptus* trees as well as surrounding cliffs (C28, C29 and C30) did not reveal the presence of a nest. The landowner has confirmed that he has observed this pair of birds carrying sticks and branches. This indicates that the pair may have attempted to build a nest, but failed or that a nest has not been found but may exist in the broader area (the former explanation being more likely).

A pair of Martial Eagles were observed (incidentally and during walked transects) in the area surrounding a stand of alien trees (FS4) in the west of the WEF site. This stand of trees was thoroughly searched by the specialist during the nest survey, who flushed a pair of Martial Eagles. Evidence of a regular roost was found (**Figure 9-3),** as well as an inactive unidentified raptor nest, believed to be too small to be utilised by Martial Eagle.

Additional active and/or inactive nest sites located outside of the nest survey (i.e. during routine monitoring surveys) include: An active Verreaux's Eagle nest and an inactive Verreaux's Eagle nest (both located during the site set up by the specialist and designated as FS1) and an active African Harrier Hawk nest (FS5) located by observers during surveys at VP11 in winter.

The locations of all inactive and active raptor nests and roost sites located in and around the WEF to date (utilising all survey methods including the focussed Verreaux's Eagle Nest Search) are shown in **Figure 9-3**.

8.3.4 ***Species Summaries***

8.3.4.1 *Seasonal Surveys*

A combined total of 135 species was recorded in and around the WEF and control site during the four seasonal surveys (Refer to the avifaunal assessment in **Volume 2** of this EIR for the full list). This included 20 priority species and 24 South African endemic or near endemic species. A total of nine Red Data species were observed across all four surveys (**Table 8-14**), including three species listed as regionally *Endangered*, three as *Vulnerable* and three as *Near-threatened*.

Table 8-13: Red data species recorded during four seasonal surveys on the WEF and control sites.

Species	Red Data Status
Black Harrier	*Endangered*
Ludwig's Bustard	*Endangered*
Martial Eagle	*Endangered*
Black Stork	*Vulnerable*

Species	Red Data Status
Lanner Falcon	*Vulnerable*
Verreauxs' Eagle	*Vulnerable*
African Rock Pipit	*Near-threatened*
Greater Flamingo	*Near-threatened*
Karoo Korhaan	*Near-threatened*

Generally the highest diversities and abundances of small passerine species were found on the lower lying walked transects, associated with drainage lines, riparian scrub habitat. The more exposed transects, on higher ridges (where most turbines are planned) generally recorded fewer species and lower numbers of birds. Open karoo scrublands were frequented by chats, larks and korhaans, while regularly recorded species associated with drainage lines and denser thicket habitats were: Acacia Pied Barbet, Cape Robin Chat, Bokmakierie, Karoo Prinia, Grey-backed Cisticola, Cape Bunting, and Red-faced Mousebird. A red listed passerine, African Rock Pipit (Near-Threatened), was recorded within the WEF site, particularly around the top of the ridges near VP9.

Waterbirds were scarce while raptors were generally observed flying over all habitat types. Key foraging areas for raptor species such as Verreaux's Eagle, Jackal Buzzard, Greater Kestrel and Rock Kestrel were generally observed along steep slopes or ridges at higher altitude. In contrast, Pale Chanting Goshawk was mostly observed in the lower flat areas, Birds of the family Corvidae (crows and ravens) were abundant with White-necked Raven, in particular, being one of the most regularly observed larger species, including flocks of up to 30 birds.

Key findings from the four seasonal surveys can be summarised as follows:

- 135 species identified;
- 20 priority species recorded;
- 24 South African endemic or near endemic species recorded;
- Red Data species recorded;
- The overall average ± SD passage rate for the WEF was 0.63 ± 1.17 target birds per hour of observation, which is relatively low compared with other WEF sites worked on by the specialists;
- A total of 306 flights and 363 individuals of 13 species (12 of which are priority species) were recorded on the WEF site. 144 (47%) of these flights were by Verreaux's Eagle. This Red Data species is listed as Vulnerable;
- Raptors constituted the majority of flight paths (94%) recorded within the WEF, with Verreaux's Eagle being the most commonly recorded vantage point target species;
- Rock Kestrel was the second most frequently recorded species and accounted for 21 % of flight paths, followed by Jackal Buzzard with 16% of flights.
- 82% of flights included at least some time at RSH (height bands two (20-40m), three (40-120m) and four (120-160m) while 187 flights, or 61% of flights included 50% or more of their duration at RSH;
- A high proportion of Verreaux's Eagle flights (81%) included some time at RSH;
- Three target species were recorded in 13 flight paths at the control site. The two priority species, Verreaux's Eagle and Pale Chanting Goshawk, were recorded in five flight paths each, while three flights of Rock Kestrel were recorded;
- The lower lying, flat open areas were, were utilised by terrestrial species such as the Red Data Karoo Korhaan and Ludwig's Bustard. The former was more abundant and the latter was scarce;
- No flights of Karoo Korhaan or Ludwig's Bustard were recorded over four seasons of VP monitoring on either the WEF or control sites;
- Species such as Egyptian Goose, Spur-winged Goose, Crowned Lapwing, and Hadeda Ibis, although generally common in South Africa, were relatively scarce on the WEF and were usually observed near to farm houses and pockets of agricultural lands;

- The species most regularly recorded incidentally was Karoo Korhaan. Rock Kestrel, Jackal Buzzard, Pale Chanting Goshawk and Verreaux's Eagle were also regularly recorded incidentally. These five species accounted for 85% of all incidental records;
- Two active Verreaux's Eagle nests were located, of which one is situated within the WEF;
- Verreauxs' Eagle is the species of most concern to the development and was observed across the site in relatively high abundance when compared to other priority species. This species is a particular focus of recommended mitigation measures;
- An active African Harrier Hawk nest is located within the WEF site; and
- Important roost locations for Verreaux's and Martial Eagles were identified.

8.3.5 *Overview*

Overall, the baseline environment in terms of avifauna at the proposed WEF site was found to be typical for the vegetation, habitat and micro-habitat types in the region. In general, few important avifaunal micro-habitats exist, and the most important of these were found to be ridgelines (with associated cliff's and rocky outcrops) and rivers and drainage lines (with associated riparian thickets as well as cliffs).

The combined avifaunal community which potentially exists comprises of up to 192 species, including 25 priority species, 28 endemic or near-endemic species and 11 Red Data species. During the twelve months of monitoring, 135 of these 192 species were recorded in and around the WEF and control sites, including 20 of the 25 priority species, 24 of the 28 South African endemic or near-endemic species, and 9 of the 11 Red Data species. These three figures are all moderate, when compared with the specialists' experience on other WEF sites in South Africa.

It is not only the presence (or potential presence) of certain species on a site that is important, but also the abundance of those species, as well as their behaviour. It is also possible that climatic conditions during the year of monitoring (which included periods of drought) may have reduced the overall number of species recorded. Many species have highly sporadic movements in response to rainfall and other factors such as food (e.g. Ludwig's Bustard, Amur Falcon, Lesser Kestrel, White Stork) and may not have been present, or were present in lower numbers during the survey year. Examination of historical data sources (e.g. SABAP data) was therefore used to try to determine the likely abundance of these species on the WEF site outside of the monitoring year. Of the four species mentioned above, only Ludwig's Bustard was recorded in the historical SABAP data examined.

Of the nine Red Data species recorded, two (Verreaux's Eagle and Karoo Korhaan) were found to have a moderate abundance (in comparison to other areas of South Africa worked in by the specialists) while the remaining species had a low abundance. Of these, only Verreaux's Eagle recorded relatively high flight activity (relative to other priority species on the WEF site). Therefore, when considering the potential impacts of the proposed development, these are two of the most important species.

Verreaux's Eagle is red listed as *Vulnerable* is a priority species, and is known to collide with wind turbines in South Africa Verreaux's Eagle were generally more active in the north east of the WEF, along prominent ridgelines and near to the identified nest site. During the spring survey the chick at the active nest site had fledged and was observed flying. It was not observed at the nest again in summer and it is expected that this individual was chased from the territory by the breeding pair.

Although Verreaux's Eagle had high flight activity relative to other species on the WEF site, the majority of activity was by only a few birds and it is estimated that approximately seven individuals were responsible for all 144 flights recorded over the twelve months of monitoring. Furthermore, when compared to other areas worked on by the specialists, the levels of activity are considered moderate.

The rough density (approximately 1 pair/93km^2)[36] of Verreaux's Eagle and its surrounds is low when compared to other relatively high density populations of this species studied in other parts of the region (e.g. Nuweveld escarpment, Beaufort West: mean density 1 pair/24km^2); Cederberg, W Cape: mean inter-pair distance 4.7km (n = 22, range 3.4-7.2km); Sandveld, W Cape: mean inter-pair distance 5.8km (n = 24, range 1.6-15.2km); proposed Umsinde Emoyeni WEF, Murraysberg : approximately 1 pair/57km^2. Nonetheless, this population (of approximately three breeding pairs and one or two juveniles), together with the Martial Eagle pair observed in the west of the site, represent an important biodiversity asset of the site, and are likely to be important components of the local ecology.

There are two confirmed active nests of a priority species or raptor on the WEF site to date: one Verreaux's Eagle nest and one African Harrier Hawk nest. Three inactive (or unused) raptor nests have also been located, two belonging to unidentified species and one to Verreaux's Eagle. Outside of the WEF site, within 7km from the site boundary, two additional Verreaux's Eagle nests have been located one of which has been confirmed as active by the avifaunal specialists during the winter nest survey. One inactive unidentified raptor nest has also been located (**Figure 9-3**). Given the extent of the site, the range of habitats and (in some cases) the observation of juveniles, it is possible that the following priority species or raptors are also breeding on or in close proximity to (i.e. within approximately 5km) the WEF site: Pale Chanting Goshawk; Booted Eagle; Jackal Buzzard; Cape Eagle-owl, Karoo Korhaan; Rock Kestrel and Martial Eagle.

The pair of Verreaux's Eagles that were utilising *Eucalyptus* trees as a roost (FS2) during the winter survey were not observed in the trees during the spring survey but they were observed foraging further to the north. They were again observed using the roost during summer. After discussion with a farm worker it seems that these individuals may have arrived in the area relatively recently and as a result have not yet set up a breeding territory or selected a suitable nesting site.

Black Stork (*Vulnerable*) was observed in the spring survey and the summer survey, but not during autumn or winter. The summer observations included a group of three birds observed flying from VP7. This species is thought to have complex seasonal movements and may be locally nomadic in the Karoo. This species is a cliff-nester, and breeding mainly takes place in winter.

A Greater Flamingo (*Near-threatened*) was observed in the spring and summer surveys but not in the previous two surveys. This species is capable of long distance movements between inundated water sources and may occasionally transit through the WEF site in response to rainfall events. It should be noted though that the Greater Flamingo is not common in the area, and information from SABAP 2, has no record of this species on the site. In the absence of more information it is considered unlikely for this species to occur on the WEF site, and unlikely to be at significant risk from the development.

During the winter survey an owl was recorded but the species could not be determined. During the spring survey an owl was observed and positively identified to be a Spotted Eagle-Owl. While both the Spotted and Cape Eagle-Owls are priority species only the former has been confirmed to be on the WEF site to date. A Western Barn Owl was recorded during the summer surveys.

Although not a Red Data species or a priority species, the Rock Kestrel population of the area was relatively large (compared with other raptors), and this predator may play in important role in the ecosystem. This species has been known to collide with turbines in South Africa (pers. obs.), and is therefore potentially at risk.

Small terrestrial species are potentially more vulnerable to the impacts of habitat destruction and displacement, however the species richness and abundance of passerines on the site was

[36] This figure is approximate, and should be used with caution, as it is based on 3 pairs of eagles (and two active nests) being located within an area of approximately 280km^2, within which additional nests may be located.

relatively low. The index of kilometric abundance (IKA) for small terrestrial species was extremely varied across the different walked transects and across seasons on the WEF, and therefore it was difficult to draw any firm patterns and conclusions. Numbers were highly variable across the seven transects, yet the overall IKA from all walked transects of 29.21 (SD±22.98) birds per kilometre is comparable with other WEFs worked on by the specialists. Apart from African Rock Pipit (which was not overly abundant), few Red Data passerines were recorded. A number of South African Endemic or Near-endemic passerines were recorded, with notable species being Cinnamon-breasted Warbler, Ground Woodpecker, Karoo Lark and Sickle-winged Chat. Passerines were generally more abundant along draining lines at lower altitudes.

The most important species to be considered in the impact assessment are the priority species and/or Red Data species and/or endemic/near endemic species, that were found to be relatively abundant on site, or are potentially present due to availability of habitats, or had high levels of activity, or displayed high risk behaviour (e.g. flying at risk height). These, 'focal species' were determined to be the following: Verreaux's Eagle, Black Harrier, Martial Eagle, Black Stork, African Harrier Hawk, Jackal Buzzard, Rock Kestrel, Pale Chanting Goshawk, Spotted Eagle-owl, Ludwig's Bustard, Karoo Korhaan, African Rock Pipit, Ground Woodpecker, Cinnamon breasted Warbler, Cape Spurfowl, Karoo Prinia, Grey-winged Francolin, Large-billed Lark, Karoo Lark, Karoo Eremomela, and Sickle-winged Chat.

8.4 Aquatic Ecosystems Baseline Environment

The proposed development occurs within the following catchments within the Nama Karoo Ecoregion located within the Gouritz Water Management Area (**Figure 8-7**). The river catchments are:

- J11A – Komsberg / Venter rivers catchment; and
- J11B – Bierfontein se Laagte / Koringplaas / Swaerkraal se /Dwars rivers catchment area.

These catchments are characterised by several perennial water courses and drainage lines associated with the mainstem systems listed above, with the larger systems containing alluvial riverbeds/washes.

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all of watercourses within the site have been assigned a condition score of AB indicating that they are largely intact with respect to biological significance. This is mainly due to the catchments falling with the headwaters of the Buffels River that flows towards Laingsburg, and forming part of an upstream Fish Freshwater Ecosystem Priority Area (Fish FEPA).

According to the National Freshwater Ecosystems Priority Area (NFEPA) wetland data, several natural wetlands could occur within the study area. The remaining waterbodies are artificial or man-made systems as shown in **Figure 8-8**. No natural wetlands were observed within the study area as the potential wetlands observed were either farm dams /borrow-pits **(Plate 8-1)** or agricultural fields **(Plate 8-2)** misidentified by the National Wetland Inventory (Ver 4) as wetland areas.

Figure 8-9a indicates significant watercourses observed within the site **(Plate 8-3)**. Any activities within these areas or the 32m buffer (or the 1:100 floodline, whichever is the greatest) will require a WULA or a General Authorisation.

Based on the preferred and alternative layouts, 55 water course crossings (including 14 crossings related to the alternative layout) would be required for this proposal (The co-ordinates for each of the respective crossings for the final layout is provided in **Appendix G –** 58 crossings in total. Refer to **Figure 8-9b**.

Upgrades along the public roads will likely be required in parts.

8.4.1 *Present Ecological State (PES) and Conservation Importance*

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

The national PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included The new PES system incorporates EI (Ecological Importance) and ES (Ecological Sensitivity) separately as opposed to EIS (Ecological Importance and Sensitivity) in the old model. The new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators, and the Recommended Ecological Category (REC) is also still contained within the new model, with the default REC being B, when little or no information is available to assess the system or when only one of the above mentioned parameters is assessed then overall PES is rated between a C or D.

The PES scores for the drainage lines and the rivers in the study area were rated as follows in **Table 8-5** (DWS, 2014 – where A = Natural or Close to Natural & B = Moderately Modified):

Table 8-14: PES Scores for the sites.

Sub-quaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
7980	A	High	Moderate
7820	A	High	Moderate
7821	A	High	High
7923	B	High	High
7772	B	High	Moderate
7863	A	High	High
7782	B	High	High
7901	A	High	High

It is evident that the study area systems are largely functional and or have experienced limited impact as a result of current land use practices. This was confirmed for each of the affected reaches located within the development footprint and in particular the areas that would be crossed by the proposed road layout shown in **Figure 8-9b**. The systems observed are largely natural, with small or narrow riparian zones, dominated by the species *Searsia lancea* and *Vachellia karroo.* The only obligate species observed included small areas of *Juncus rigidus* and *Phragmites australis* associated with small pools created by road culverts found throughout the study area.

Plate 8-3: Small borrow pit area associated with past road works that was identified as a natural wetland by NFEPA and was classified as an artificial or man-made dam in this study.

Plate 8-4: A view of agricultural fields that were shown as a natural wetland by NFEPA and thus not a waterbody.

Plate 8-5: A typical water course observed within the study area, consisting of a dry riverbed and narrow riparian zone, with no obligate/facultative plant species.

8.5 Heritage, Archaeology and Palaeontology Baseline Environments

8.5.1 *Palaeontology*

The thick Abrahamskraal succession is well known for its diverse fossil assemblages of the Middle Permian Tapinocephalus Assemblage Zone. These include a wide range of fossil vertebrates - notably various small- to large-bodied therapsids ("mammal-like reptiles") and

reptiles - as well as fossil plants of the Glossopteris Flora and low diversity trace fossil assemblages.

Numerous important fossil sites have been documented in the Moordenaars Karoo region just to the southeast of the study area but very few sites are known from the study area itself. There are local verbal reports of large fossil bones and petrified wood having been found here, but most of the material appears to have been misplaced, and precise locality details are currently unavailable. Bedrock exposure levels in the broader Komsberg–Moordenaars Karoo study region are generally poor due to the pervasive cover by superficial sediments (colluvium, alluvium, soils, and calcrete) and vegetation.

Nevertheless, a sufficiently large outcrop area of Abrahamskraal Formation sediments, exposed in stream and riverbanks as well as steep hillslopes and erosion gullies, has been examined during the present field study to infer that macroscopic fossil remains are rare here. Exceptions include low-diversity trace fossil assemblages (small-scale invertebrate burrows, possible plant stem or root casts) and fragmentary plant remains. The latter include horsetail ferns (arthrophytes), moulds of woody plant material and locally abundant blocks of ferruginised and silicified wood that have weathered out from the base of channel sandstones.

8.5.2 *Pre-colonial Heritage of the Area*

Little was known of the archaeology of the study area until recently and no commercial heritage impact assessments are listed on the SAHRA database for this area. There has been some limited impact assessment and research work around Sutherland. A small rock shelter on the grounds of the South African Astronomical Observatory in Sutherland has been excavated. It contained a Later Stone Age assemblage with a relatively high proportion of small convex scrapers and thin-walled potsherds of indigenous manufacture, ostrich eggshell and some *Nassarius kraussianus* (a type of marine shell) beads. The presence of the shell beads points to cultural ties with people along the Cape coast, while the small scrapers can be assigned to the Wilton industry, distinct from the large elongated scrapers typically associated with the interior sites along the Orange River.

A survey was also undertaken for a golf course to the south of the Sutherland urban edge. The most significant find was a complex of thirteen stone enclosures which are typical of the *Khoekhoen kraals*. A single highly dispersed artefact scatter consisting of mainly waste material (flakes made from *hornfels* or indurated shale) was also found. A dense artefact scatter associated with a shallow rock shelter outside the study area was found indicating that archaeological sites may be found in areas sheltered from the wind (an important consideration given Sutherland's extreme temperature ranges).

Work undertaken by the specialist to the east of the site (Zuurplaats WEF, Hart *el al, 2010*[37]*)*, observed the following:

- Pre-colonial archaeological material: Includes Early Stone Age (ESA), Middle Stone Age (MSA) and Later Stone Age (LSA) artefact scatters. Open sites are extremely sparse on the upper plateau with only one MSA site being recorded – a scatter associated with a dry pan. The most common raw materials used by precolonial people are hornfels, quartzite, chert, and also quartz and Karoo shale. Occasional flakes that were noted randomly on the landscape lie scattered on the land surface which represents the "litter" of the Stone Age. On the upper plateau even incidental artefacts are scarce. In the southern portion of the study area, but not within the project site, a significant and well preserved Early Stone Age site containing complete and highly refined bifaces (hand axes) attributable to the Fauresmith industry was found on the farm Klipfontein.
- Stone kraals: The most common form of pre-colonial site on the upper plateau were stone kraals or kraal clusters, which could be between 300 and just over 1000 years of age. The kraal complexes (which are distinctly different from colonial period stock kraals) tend to be

[37] Hart, T., Halkett, D., Webley, L and Bluff, K. 2010. *Heritage impact assessment: proposed Suurplaat wind energy facility near Sutherland*, Western Cape and Northern Cape Provinces. Prepared for Savannah Environmental (Pty) Ltd. ACO Associates cc.

found along the leeward slopes of low ridges (or where minimal wind affects the area). These typically consist of dry stone piled wall enclosures in a roughly circular configuration, sometimes interlocking but not more than half a meter high, and ranging from 3 - 4 meters to 9m in diameter. They are likely to have been associated with reed mat huts or brush shelter/s), probably erected a few meters away from the main 'kraal' where small stock such as fat tailed sheep and goats were kept. Often found in proximity to the larger 'kraals' are lammerkraals (lambs' kraals), which are much smaller (about 1m in diameter) and a bit higher (usually a few more layers of stones added to the wall) than the adjoining larger 'kraal'.

Notable complexes were recorded in the area of Hartebeestfontein and at Vinkekuil on the escarpment. Also associated with these 'kraals' is artefactual material, fine thin red burnished pottery, and ostrich egg shell. At a site alongside the access road to Waterval is a complex of 'kraals' below and on top of a ridge.

Below the escarpment (foothills of the Komsberg Range) and not within the project site, open Khoekhoen encampments were observed, situated among the Kameeldoring trees along the dry river beds in the bottom of valleys. The sites are typically quite large (60–80m in diameter), artefactually rich with very fine thin walled and burnished Cape Coastal pottery. There are numerous stone features, informal stone artefacts, grinding surfaces, as well as a number of graves, some of which have broken grinding stones placed on top. Also evident were discreet ash middens and animal bone. On two of the sites, there is evidence of European goods (19th century glass and ceramics) which may indicate some form of continuous use of the sites by Khoekhoen herders into the colonial period.

Archaeological sites of this kind are very rare in the Western Cape, having been only previously recorded in the Richtersveld.

8.5.3 ***Colonial Heritage***

The early settlement of the Roggeveld and Sutherland area commenced around 1750. The early farmers found the escarpment, which enjoys the highest rainfall, particularly suitable for small stock farming during the summer months but these farmers moved down into the valleys and plains of the Karoo to escape the extreme winters. The escarpment seems to have been where most of the springs were found, and vegetation of both the *Onder Karoo* as well as the Sak River region in Bushmanland could be exploited.

Drought, poor grazing and attacks by the San caused many farms to be abandoned. Disputes over farm boundaries were intense. In the 18th century, there were numerous independent Khoekhoen kraals located amongst the Trekboer farms in the Roggeveld.

Resistance to the Trekboers in the Roggeveld came initially from the San who resisted fiercely throughout the Great Karoo, at times beating back the vanguard of *Trekboer* farmers. In 1754, attacks from the San are reported to have increased and flocks of sheep and herds of cattle belonging to the *Trekboers* were driven out of the area. This increased to the extent that it is described as a type of guerrilla warfare. Livestock was stolen, Khoikhoi herders and slaves killed, and Trekboer farms attacked. The colonists fought back by establishing the *Kommando* system – and this lead to the officially sanctioned "hunting" of San was in 1777. In some instances, bounties were obtainable from the local *landdrost*.

There was apparently a massacre of 186 San in the Roggeveld in 1765. The only confirmation of this is from the farm Oorlogskloof near Sutherland. There are a great many graves, some 30, laid out in three groups, with piles of rocks above them. There is also a separate gravestone with the date 1768. Another mass grave is located on the farm Gunsfontein (to the west of Schietfontein (Scholtzenhof) - and this is now part of a private nature reserve), possibly dating to the rebellion of the 1770's. Somewhere in the valleys of the escarpment is a large cave or shelter where some of the few surviving San made their last stand against the *kommando's* before being massacred and buried close to where they fell. To date the site of this event has not been identified.

The San were gradually driven from the Roggeveld northward to the extent that by 1809, there is reported to have been only one settled "Bushmen" kraal left in the area. European settlement became more permanent from the beginning of the 19th century. The farmers' main source of income was small stock, since wheat could only be grown with great difficulty in isolated and protected valleys when conditions permitted. There was very little grazing and standing water for cattle.

During the early years of settlement in the Roggeveld, many of the Trekboers lived in grass huts or *Matjieshuise (*mat covered houses), and in tents and some travellers found farmers living in *Matjieshuise* as late as 1839. Attempts at constructing more permanent structures were inhibited by the lack of suitable wood for roofs.

During the South African War, the threat of Boer incursions led British forces to build fortifications at a number of strategic passes through the Roggeveld. A stone redoubt was constructed on the farm Gunsfontein at the top of the Brandkloof and Maleishoek passes. With the Boer leader Manie Maritz active in the Calvinia District, many young men from the Roggeveld joined the Boer cause. One of the followers was Jan Fourie of Welgemoed. There appears to have been some skirmishes in the vicinity of Skietfontein (Komsberg) in 1901. One of the stone structures located on Beerenvallei during the survey may relate to the Anglo Boer war.

8.5.4 ***History of the Farms***

Indications are that most of the farms in the study area would have started as loan farms. A loan farm was given out after a person petitioned the government for permission to use a piece of land. They paid tithes to the government for the use but it was not generally recorded in title deeds with surveyor's diagrams. Many of these loan farms were circular in shape because of a custom that allowed the farmer to take a measurement from a central spot, such as a homestead, spring or rock formation. Weak springs are at the centres of most of loan farms. This indicates the importance of even water resources on this landscape. The formal granting of title deeds only took place in the early 19th century. Due to the kinds of artefacts and structures found on the landscape, many of the farms seem to have been established informally long before land was formally granted or loaned.

8.5.5 ***Identified Sensitivities***

8.5.5.1 *Palaeontology*

Any form of bedrock excavation has the potential to affect continental sediments of the Middle Permian Beaufort Group. These sediments underlie the great majority of the study area and are renowned for their rich fossil heritage of terrestrial vertebrates (most notably mammal-like reptiles or therapsids), as well as fish, amphibians, molluscs, trace fossils (e.g. trackways) and plants (e.g. petrified wood). The upper Abrahamskraal Formation stratigraphic interval represented in the study area is of special palaeontological significance in that it contains a record of extinctions among continental biotas preceding the disastrous End-Guadalupian Mass Extinction Event in the marine realm some 260.4 million years ago. The palaeontological sensitivity of these Beaufort Group rocks is therefore considered to be very high. Caenozoic surface sediments in the study area (e.g. alluvium, colluvium) are generally of low palaeontological sensitivity, but local concentrations of scientifically valuable fossils (e.g. mammalian bones, teeth) may also occur here.

There are verbal accounts of sizeable fossil bones seen by local farm workers, and occasional collected specimens can be seen at farmsteads in the region (for example, Gemsbokfontein in the Komsberg East WEF site). This material has mostly been lost or locality data is unavailable. Vertebrate fossils clearly occur here, but are apparently rare.

From a scientific viewpoint, the most interesting fossil site recorded during the present field study is a moderately extensive palaeosurface on the upper surface of a channel sandstone bed. The palaeosurface – the bed of an ancient river or pond - preserves numerous tetrapod

tracks as well as a few recognisable trackways and other trace fossils (*this site occurs just outside the Komsberg study area and, given its sensitivity, precise locality details are not provided here*). The palaeosurface features subdued, slightly-asymmetrical current ripples, as well as delicate rill marks indicating very shallow, falling water levels.

The associated tetrapod trackways were apparently generated by meter-sized animals with a sprawling posture – as suggested by occasional belly marks, cuspate tail impressions and arcuate digit impressions. The most likely candidates are predatory rhinesuchid temnospondyls ("labyrinthodont" amphibians) that are represented by rare body fossils in the Abrahamskraal Formation and are the only temnospondyls recorded from the *Tapinocephalus* Assemblage Zone. A curious feature of this trace fossil assemblage is the paired sets of straight, bipartite or tripartite "tram lines" that may have been generated by trailing temnospondyl digits as they floated above the pond or riverbed, or were swept along by a current while the river was still actively flowing.

Fossil plants in the Lower Beaufort Group rocks of the study area are represented by locally abundant, comminuted plant stems (notably sphenophyte ferns) and unidentifiable plant debris. These fossils are preserved as ferruginised moulds within breccio-congomerate lenses at or close to the base of channel sandstones of the Kooornplaats Member. Several blocks of dense, heavily-ferruginised and -silicified fossil wood have been found but not *in situ*. There is little doubt that this material has also weathered out of nearby channel sandstone bodies. The presence of sizeable petrified logs is indicated by the local concentration and size of some fossil wood blocks as well as by drag marks incised into channel sandstone surfaces that are most plausibly attributed to floating logs.

No fossils were observed within the various Late Caenozoic superficial deposits represented within the study area during the present field study.

In sum, several important Middle Permian fossil vertebrate sites are known from the Komsberg – Moordenaarskaroo region but these are found outside of the present study area. Numerous good exposures of Lower Beaufort Group bedrocks are available within the area but only isolated fossil bone fragments were observed during the study. There are local verbal accounts of sizeable fossil bones being seen here, but the material has apparently been removed or detailed site data is not available. Plant fossils, including poorly-preserved petrified wood from sizeable logs, is locally common and well-preserved trackways of large (meter-sized) amphibians are known to occur in this region.

8.5.5.2 *Archaeological Heritage*

Experience throughout the Karoo has shown that high ridges seldom attracted any form of prehistoric occupation. Ridge tops tend to be dry, windswept and very cold in winter, and those of the Komsberg are no exception. The ridge tops at Komsberg are extremely harsh, covered with loose shale and almost devoid of soil and vegetation. Unless there was a large rock shelter, source of water or a raw material, it is not expected that the system of ridges with the study area are likely to be sensitive in terms of archaeology. There are few rock shelters in the project area, and those which do exist have steeply sloping floors not suitable for habitation. The turbine sites which are normally situated on high ground are likely to be relatively insensitive.

Very few archaeological sites were recorded during the survey. Only one questionable artefactual find was recorded on any of the ridges, while several ephemeral scatters of ESA and MSA material were recorded in river gravels and valley bottoms. No late Stone Age archaeological sites were recorded.

Valley bottoms were rather more favoured by both pre-colonial and historical occupation. Here there are normally sources of water, shelter from the prevailing winds as well as the potential for grazing small stock on or close to the sandy river beds. Also important were low ridges on or adjacent to flat plains. Khoikhoi kraals were almost always built adjacent to or against low ridges and cliffs; however none were identified in the project areas in the areas that were

accessed. Within the valley bottoms evidence of colonial period settlement is quite prolific. There are numerous stone walled kraals, simple dwellings and single room abodes made of dry stone. In the project area and outside, several threshing floors have been found indicating that early European settlers in the area were growing wheat which is considered non-viable in the area today. While not yet scientifically verified it would appear that this part of the Karoo was able to carry a greater population in terms of people and livestock in the 18th and 19th centuries than today.

Table 8-15: Description of the various archaeological occurrences recorded on the proposed Komsberg East site. GPS data is not provided for security reasons. To be read in conjunction with Figures 8-10 and 8-11.

032	A small round stone ruin – single space, possibly shepherds hut
033	A small rock shelter/overhang that has been walled off – no deposit or artefacts noted, To the left of the track high up on the ridge
034	Two small stone ruins next to river, on other side of an historic stone kraal (oval-rectangle) (**Plate 8-6**).
035	Recent picnic/camping place. Stone seats, fire pit and ?memorial
036	Gemsbokfontein farm house. A vernacular 18-19th century vernacular house with stope and end benches, loft and traditional fireplace, cooking shelter made of bush behind the house. Casement windows, very old glass panes (Grade 3B).
037	Gemsbokfontein cemetery some 50 m south of south of the farm house, single grave. Also abandoned stone kraals situated close to the river.
Y001	Small stone hut next to large rectangular kraal (over 20m long) built in small slope otherwise very flat area between the ridges. Some ceramics not much else. Small stone oven (1-2m) behind hut
037	Possible grave/stone cairn

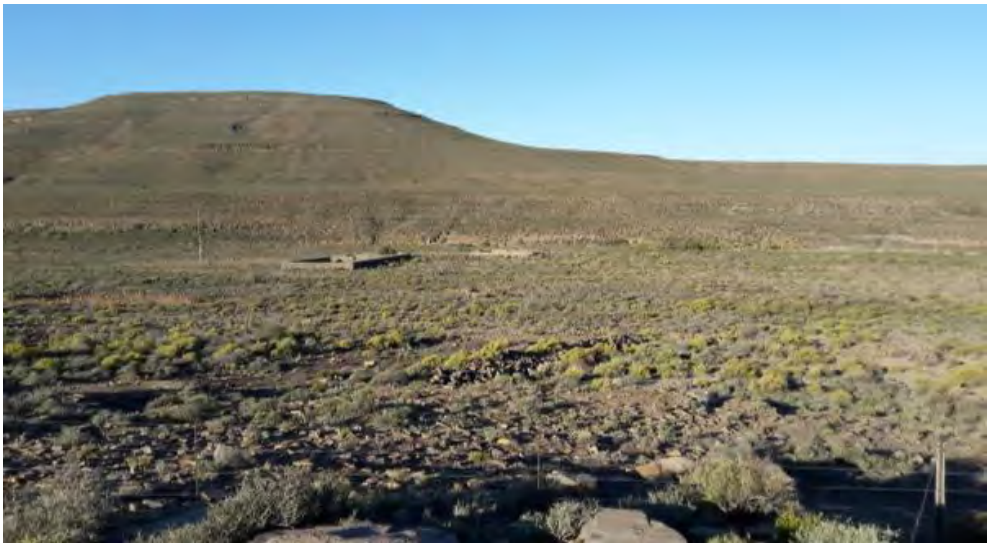


Plate 8-6: Though difficult to make out against the landscape, there are a number of kraals in this photo, all differing in age.

8.5.5.3 *Historic farmhouse*

An historic farmhouse worthy of heritage grading were identified in the project area (refer to **Plate 8-7**). The farm house at Gemsbokfontein is a well-preserved vernacular structure of white washed stone with a pitched corrugated iron roof, large externally protruding hearth and chimney, and a solder (attic) accessed through the end gable. There is a traditional stoep (veranda) with benches at the end that extends the length of the property. The fenestration consists of smallish Dutch style casement windows, even the glass window panes are intact showing the distinct signs of flowing and warpage that is characteristic of very old glass. The property is used from time to time. Clearly the owners have taken some care to conserve its heritage qualities. There are outbuilding ruins and stone kraals in the area, as well as a traditional brushwood outdoor kookskerm (cooking shelter). To the south lies a small cemetery.

Plate 8-7: Well-preserved vernacular cottage at Gemsbokfontein.

Grading: Given the completeness of the site, the suggested grading is IIIb.

Other farms in the area have been extensively modernised, however the presence of old kraals associated with most of them indicates a long history.

8.5.5.4 *Landscape and Setting*

Aesthetic impacts along the Great Escarpment and Roggeveld/Moordenaars Karoo Mountains are a concern. The combined effect of WEFs in the region would impact the aesthetic qualities of the region, which may diminish the value of the landscape as an aesthetic resource and potentially impact the potential for conservation and hunting related enterprises, which in recent years have become popular throughout the central Karoo, although remain very limited in this immediate region.

Within the project area, the proposed turbines would be confined to ridge tops as would most of the proposed road infrastructure. This will protect the valley bottoms which are quite scenic with river beds, cliffs and ruins. The turbines are fairly generously spaced, yet visual impacts will occur. The VIA for this project has indicated general visual impacts of medium significance.

Considering the intactness of the landscape, its strong natural qualities combined with the strong overlay of historical sites and ruins, a landscape grading of generally IIIB significance is recommended, however there are enclaves and valleys within the site that could be worthy of a higher grade.

8.6 Noise Baseline Environment

8.6.1 *Noise Sensitive Developments*

A desktop exercise was conducted to assess the noise-sensitive developments (NSD) within the WEF sites, using the then Department of Environment and Tourism's Environmental Potential Atlas, with available topographical maps used to identify potential NSDs in the area (within area proposed, as well as potential NSD's up to 2km from boundary of facility). The data was imported into GoogleEarth® to allow a more visual depiction of the areas where NSDs were identified. The NSD assessment indicated that there are a number of such developments that occur in the area, which are indicated on **Figure 8-12.**

Note that as a result of the public participation process, a landowner (Mr J Biesenbach) on an adjacent farm to the south of the site requested that the specialist re-model and assess the potential noise impact on his homestead in particular. The results of this exercise are reflected in an addendum to the noise report which is included in **Volume 2** of this EIR.

8.6.2 *Ambient Sound Measurements*

Ambient (background) noise levels were previously measured at other locations within 150km of the proposed development, indicating an area with a sound level character typical of a rural area (away from dwellings, plantations, roads and towns), during periods when wind speeds were below 3m/s. These measurements were considered applicable, as the topography, vegetation and meteorological conditions are similar.

Wind induced noises are normally seen as unwanted noises, with measurements reflecting acoustic interference (due to wind induced noises) normally discarded. However, for the purpose of this study it will be included, as the typical operating noise of the wind energy facility will only be emitted during times when wind induced noise levels are relevant. Site-specific measurements were conducted during the EIA phase and discussed in the following section.

Refer to **Figure 7-2** which indicates the exact location of where ambient sound levels were measured.

Measurement point KASL01 – (NSD05)

The measurement location was just in front of their front porch, next to their outside barbeque boma. The microphone was approximately 6 m from the front of the house or any significant vegetation.

There were large conifers in the area that created a significant level of the background noise when wind blew through it. Other sounds were the voices of the farmer and his family and workers on the property (doing gardening) as well as some free-roaming chickens. The sound of bird calls were heard at times, although wind-induced noises dominated.

The equipment that was used to gather data is presented in **Table 8-7**. Measured data is presented in **Graph 8-1** (equivalent and 10-minute A-weighted measurements, impulse and fast descriptor).

Table 8-16: Equipment used to gather data at NSD05.

Equipment	Model	Serial no	Calibration
SLM	Svan 977	36176	11th November 2015
Microphone	ACO 7052E	25685	11th November 2015
Calibrator	B & K	1558840	9th January 2015
Weather Station	WH3081PC	-	-

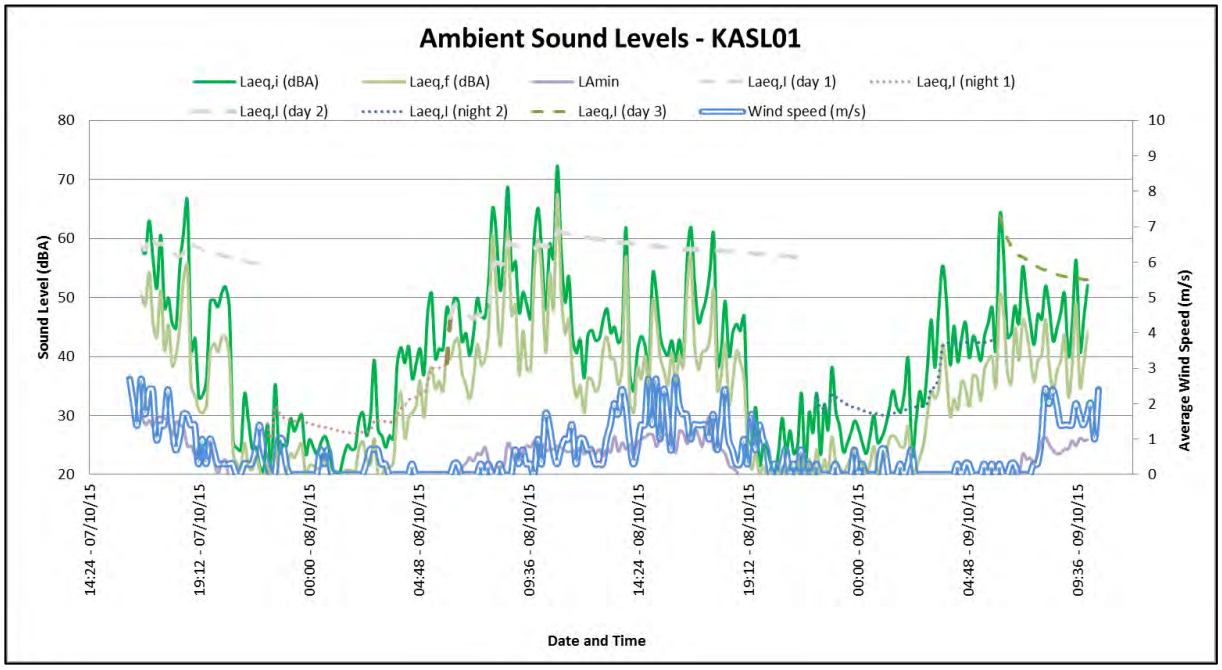
*Microphone fitted with the appropriate windshield.

Measured $L_{Aeq,i}$ day/night-time data: During the daytime **$L_{Aeq,i}$** values ranged from 20.2 to 72.3dBA. The night-time **$L_{Aeq,i}$** values (night-time reference period 22:00 – 06:00) ranged from 19.8 to 55.3dBA. The daytime arithmetic mean was 45.0dBA while the night-time average was 32.1dBA. The equivalent daytime sound levels ("average" value over 16 hours) were 55.4 (afternoon only), 47.0 and 53.0 (morning only) dBA. The equivalent night-time sound levels ("average" value over 8 hours) were 38.9 and 42.7dBA. Measured data indicated an area that is relatively quiet with natural sounds and wind induced noises impacting on most measurements. Ambient sound levels are illustrated in **Graph 8-1.**

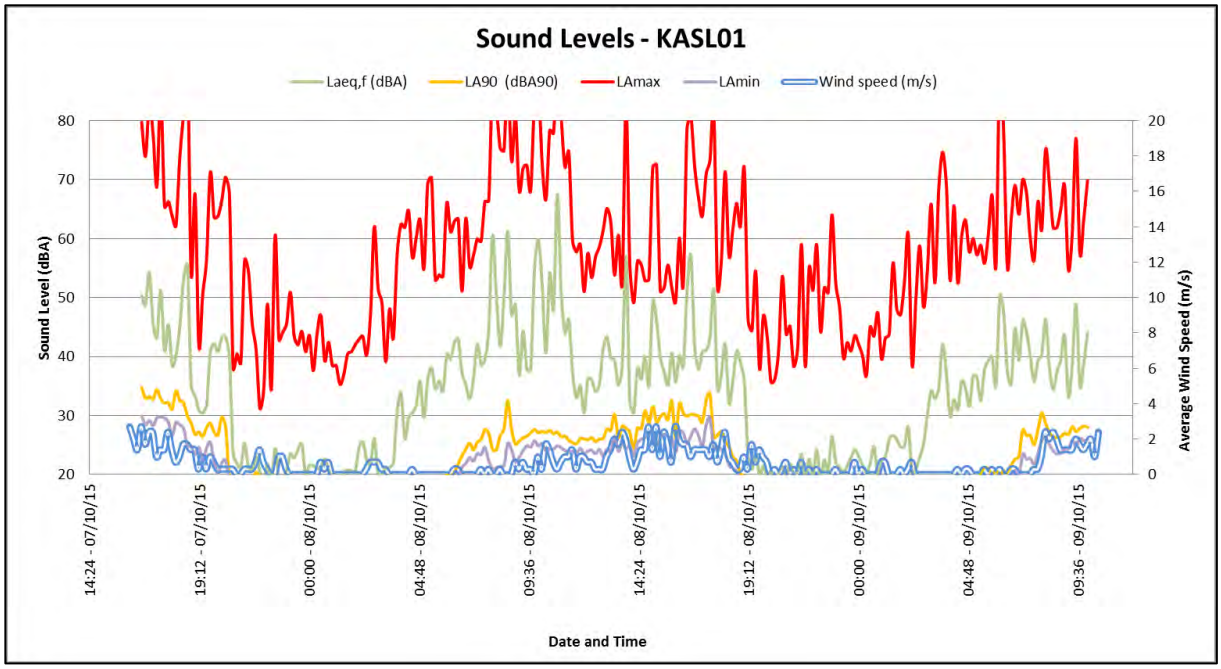
Measured $L_{Aeq,f}$ day/night-time data: During the daytime **$L_{Aeq,f}$** values ranged from 19.0 to 67.4dBA. The night-time **$L_{Aeq,f}$** values (night-time reference period 22:00 – 06:00) ranged from 18.7 to 21.2dBA. The daytime arithmetic mean was 38.6dBA while the night-time average being 25.7dBA. The equivalent daytime sound levels were 46.3 (afternoon), 39.7 and 43.4 (morning) dBA. Night-time equivalent sound levels were 30.0 and 32.6dBA. Ambient sound levels are illustrated in **Graph 8-1**.

Measured 10-minute $L_{A90,f}$ day/night-time data: **L_{A90}** is a statistical indicator that describes the noise level that is exceeded 90% of the time and frequently used to define the background sound level internationally. Daytime values ranged from 18 to 35 dBA90 averaging at 25.8 dBA90. The night-time **L_{A90}** values ranged from 18 to 21 dBA90 (night-time reference period 22:00 – 06:00) averaging at 18.3 dBA90. Measured **L_{A90}** data also confirm an area that is quiet, becoming silent at night. This is illustrated in **Graph 8-2**.

$L_{Aeq,i}$ - $L_{Aeq,f}$ average difference, day/night-time: The average daytime difference between the **$L_{Aeq,i}$** and **$L_{Aeq,f}$** variables was 5dBA while the night-time average difference was 6.5dBA. There are various impulsive noises in the area, likely due to bird calls, although the source is unknown.



Graph 8-10: Ambient Sound Levels measured at KASL01.



Graph 8-11: 10 minute maximum, 90th percentile, equivalent and minimum sound levels measured at KASL01.

L_{Amax} night-time occurrences: There were eight noise events during the two night-time periods where the sound level exceeded 65dBA. Night-time maximum noise events may affect sleeping patterns in humans (if they occur frequently at night).[38]

Third octave spectral analysis:

Third octaves were measured and are displayed in **Graphs 8-3 to 8-6**.

Lower frequency (20 – 250Hz) – Noise sources of significance in this frequency band would include nature (wind especially) and sounds of anthropogenic origin (such as electric motors) and vehicles (engine revolutions). Lower frequencies tend to travel further through the atmosphere than higher frequencies. Daytime measurements indicated some acoustic energy in the very low frequencies, mainly due to wind, with a variety of other sounds from various source and different intensities. Night-time sounds however indicate a sound with a peak frequency at 100 and 160Hz. This may be attributed to an electric motor that was not heard during the times the instruments was deployed or collected (due to a very low level, less than 30dB).

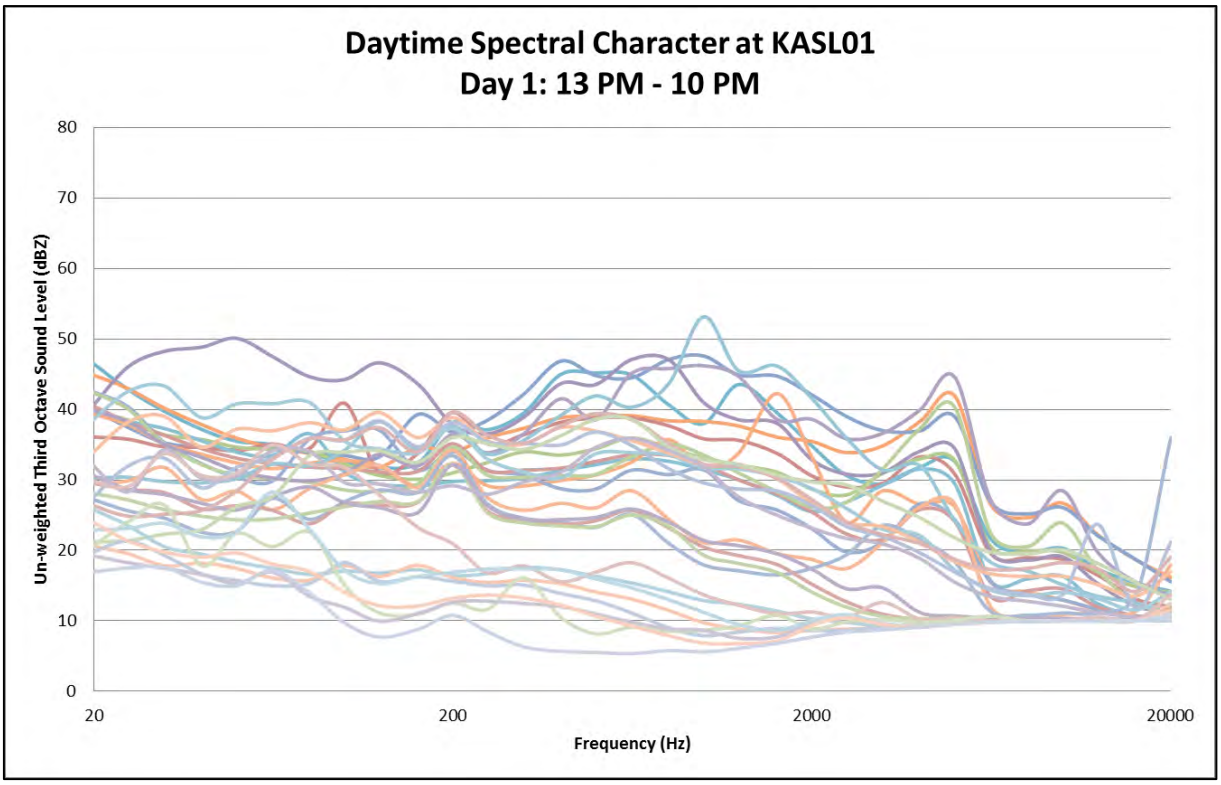
Third octave surrounding the 1000Hz – This range contains energy mostly associated with human speech (350Hz – 2,000Hz; mostly below 1,000Hz) and dwelling noises (including sounds from larger animals such as chickens, dogs, goats, sheep and cattle).

Daytime sound indicates that wind-induced noises created a constant background noise with a variety of other sounds impacting on the measurements. This was likely due to household and agricultural sounds typical around farming houses during the day. While acoustic energy in the lower frequencies dominated in a number of measurements (due to wind-induced noises), a few measurements indicate noises from different sources, typical of a rural area. It should be noted that the wind induced noises could also mask other noises in this frequency band. Night-time noises showed a clear character with peaks at 315Hz (likely a harmonic from the electric motor), a peak in the 630 – 800Hz range and a peak at 1,600Hz. These sounds were possibly from farm animals (sheep) in the vicinity of the house that was not seen during instrument deployment or collection although the source was not defined.

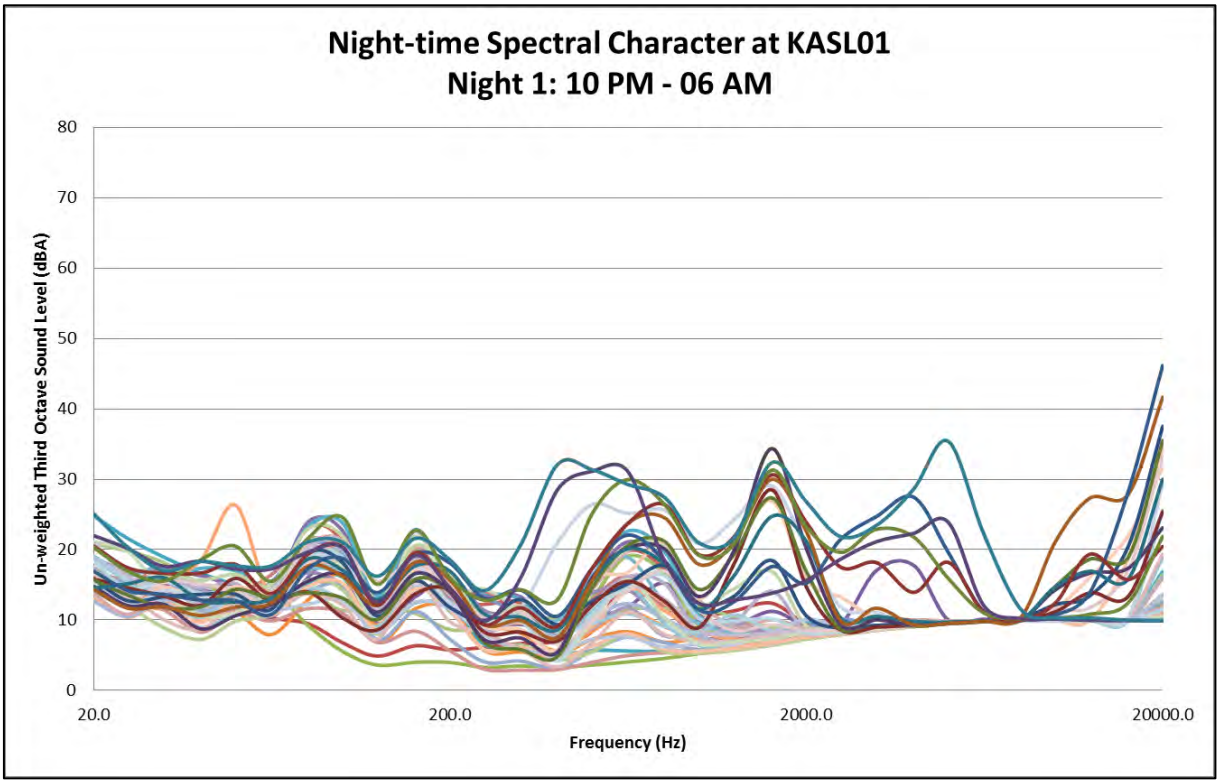
[38] World Health Organization, 2009, `*Night Noise Guidelines for Europe.*

Higher frequency (2,000Hz upwards) – Smaller faunal species such as birds, crickets and cicada use this range to communicate and hunt etc. Measurements however indicated relative low sounds in these frequency ranges during the measurement period, likely due to the free-roaming chickens in the area. There were sound with peaks in the 12,500 – 16,000Hz, generally attributed to cicada species, with significant sounds in the frequencies 20,000Hz and higher (bats in echolocation range).

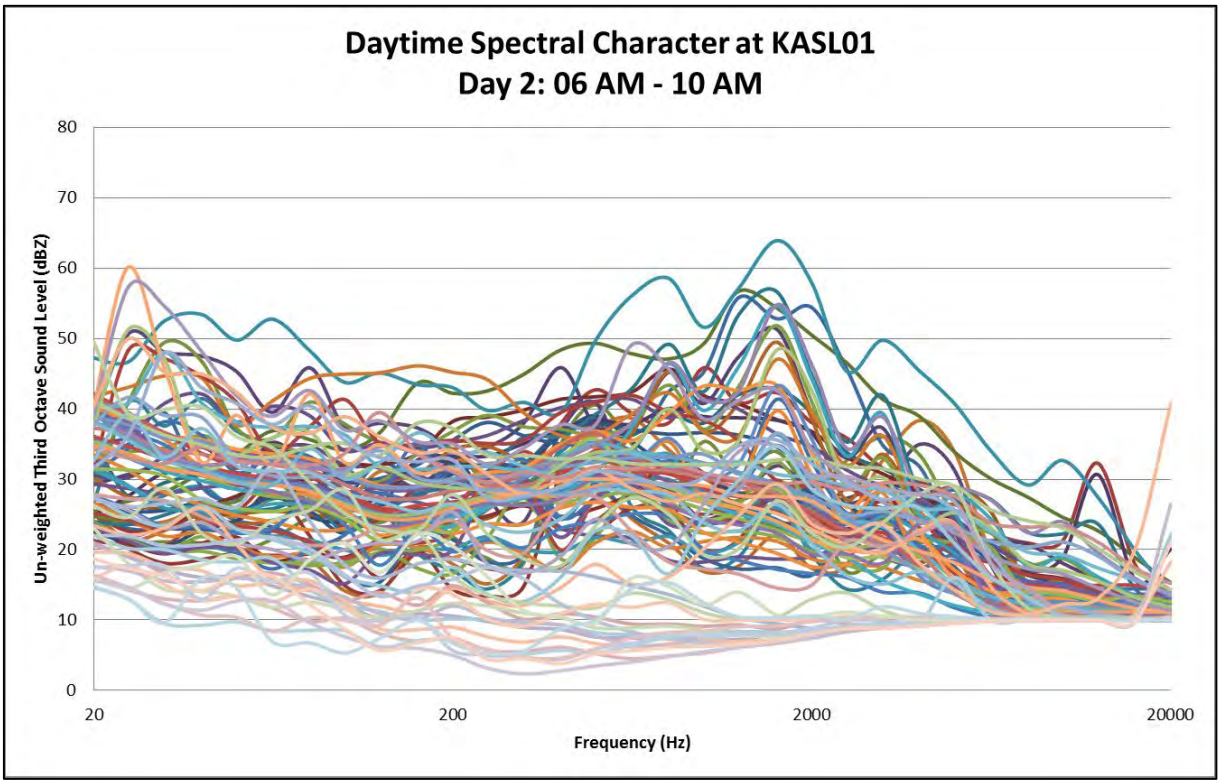
Spectral data analysis concludes that the area has few, non-significant, anthropogenic activities impacting on ambient sound levels with wind-induced noises dominating the ambient soundscape (during the day). While elevated sound levels were measured during the day, the site can be considered naturally quiet. The location is very quiet at night.



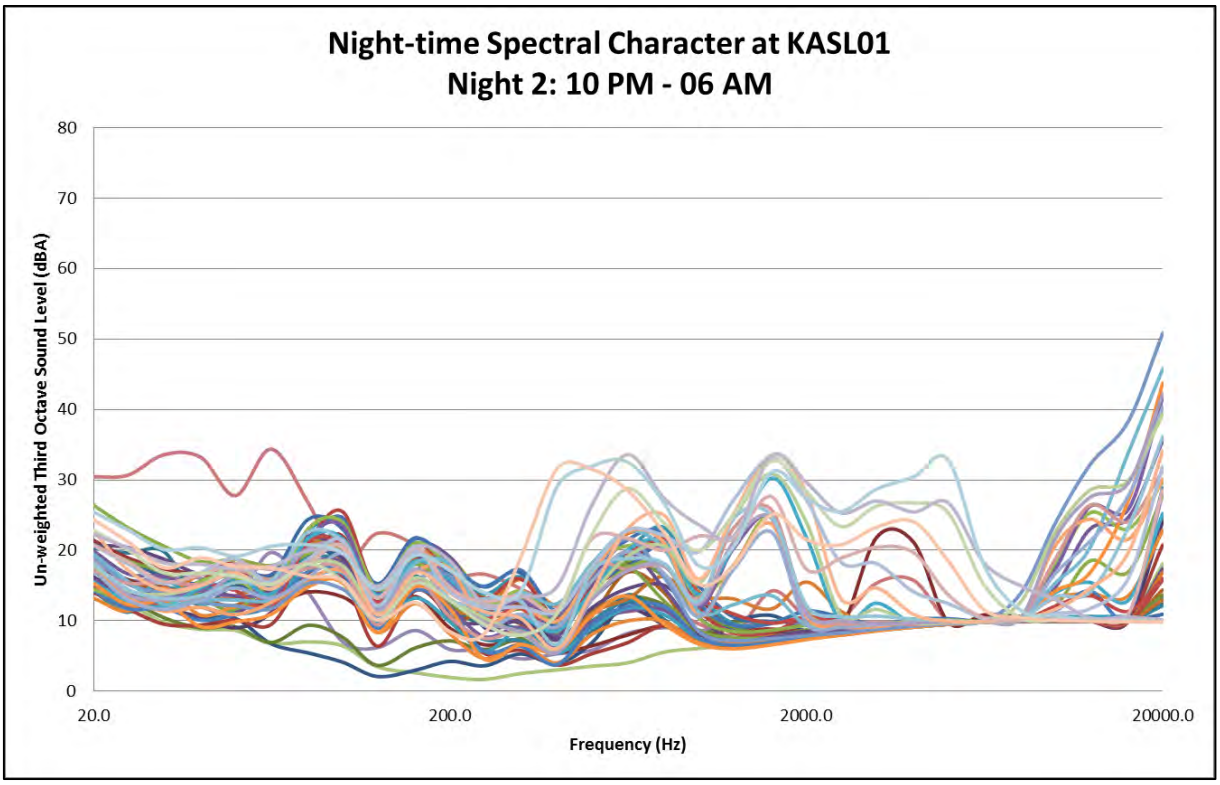
Graph 8-12: Spectral frequency distribution as measured on-site at KASL01 – first day.



Graph 8-13: Spectral frequency distribution as measured on-site at KASL01 – first night.



Graph 8-14: Spectral frequency distribution as measured on-site at KASL01 – second day.



Graph 8-15: Spectral frequency distribution as measured on-site at KASL01 – second night.

SANS 10103 Rating Level: While the area has a rural development character, ambient sound level measurements indicated an area where wind-induced and insect sounds raised the ambient sound levels during the day. Other sounds likely relate to agricultural activities in the vicinity of the measurement locations. The character of these noises however is very different from urban areas with sounds from natural origin mainly dominating. The dwelling has a sound character typical of a rural noise district.

Ambient Sound Levels – Summary

Considering the results of the ambient sound measurements, the main source of daytime sound was from the wind, with other sounds from various sources raising the sound levels at times. The night-time periods were generally quiet. While the sound levels were slightly elevated at times the area is naturally quiet and the SANS 10103 (**Table 8-8**) rating levels are typical of a rural noise district.

Table 8-17: Acceptable Zone Sound Levels for noise in districts (SANS 10103:2008).

1	2	3	4	5	6	7
Type of district	Equivalent continuous rating level ($L_{Req.T}$) for noise dBA					
	Outdoors			Indoors, with open windows		
	Day/night $L_{R,dn}$[a]	Daytime $L_{Req,d}$[b]	Night-time $L_{Req,n}$[b]	Day/night $L_{R,dn}$[a]	Daytime $L_{Req,d}$[b]	Night-time $L_{Req,n}$[b]
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with one or more of the following: workshops; business premises; and main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

8.6.3 ***Potential Noise Sources***

Increased noise levels are directly linked with the various activities associated with the construction of a WEF and its related infrastructure, as well as the operational phase of the activity. The most significant stage relating to noise is generally the operational phase, and not the construction phase. This due to the relatively short duration of construction activities

8.6.3.1 *Construction Phase – Equipment, Material Supply and Traffic.*

The equipment likely to be required during the construction phase typically includes:

- excavator/graders, bulldozer(s), dump trucks(s), vibratory roller, bucket loader, rock breaker(s), drill rig, flatbed truck(s), pile drivers, TLB, concrete truck(s), crane(s), fork lift(s) and various 4WD and service vehicles.

There are a number of factors that determine their audibility, as well as the potential of a noise impact on receptors. Maximum noises generated can be audible over a large distance however, they are generally of very short duration. If maximum noise levels exceed 65dBA at a receptor, or if it is clearly audible with a significant number of instances where the noise level exceeds the prevailing ambient sound level with more than 15dB, the noise can increase annoyance levels and may ultimately result in noise complaints.

Average or equivalent sound levels are another factor that impacts on the ambient sound levels and is the constant sound level that the receptor can experience.

Instead of transporting the required material to the sites using concrete trucks, portable concrete batching plants may be required to supply concrete onsite. Batching plant equipment may be relocated between the sites as the works progress to different areas of the site. The need for such batching plants, the number, and whether they will be moved is as yet unknown.

Similarly, the need and potential location(s) for borrow pit(s) may be necessary. A portable rock crusher plant and screen will most likely be required should the developer selects the use of a borrow pit.

Blasting may be required as part of the civil works to clear obstacles or to prepare foundations. Should a borrow pit be used to supply rocks for construction purposes, blasting can also be expected. However, no information regarding the use, or the feasibility borrow pits is available at this stage of the process.

Blasting is not considered in the noise assessment for the following reasons:

- Blasting is highly regulated, and control of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use minimum explosives and will occur in a controlled manner. With regards to blasting in borrow pits, explosives are used with a low detonation speed, reducing vibration, sound pressure levels and air blasts. The breaking of obstacles with explosives is also a specialized field, and when correct techniques are used, it causes less noise than using a rock-breaker.
- People are generally more concerned over ground vibration and air blast levels that might cause building damage than the impact of the noise from the blast.
- Blasts are an infrequent occurrence, with a loud but a relative instantaneous character. Potentially affected parties normally receive sufficient notice (siren), and the knowledge that the duration of the siren noise as well as the blast will be over relative fast, resulting in a higher acceptance of the noise.

The last significant source of noise during the construction phase is additional traffic to and from the site, as well as traffic on the site. If used, borrow pit(s), onsite crushing and screening and concrete batching plants would significantly reduce heavy vehicle movement to and from the site.

Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated would be dependent upon the construction activities being conducted, which would vary during the construction period.

8.6.3.2 *Operational Phase*

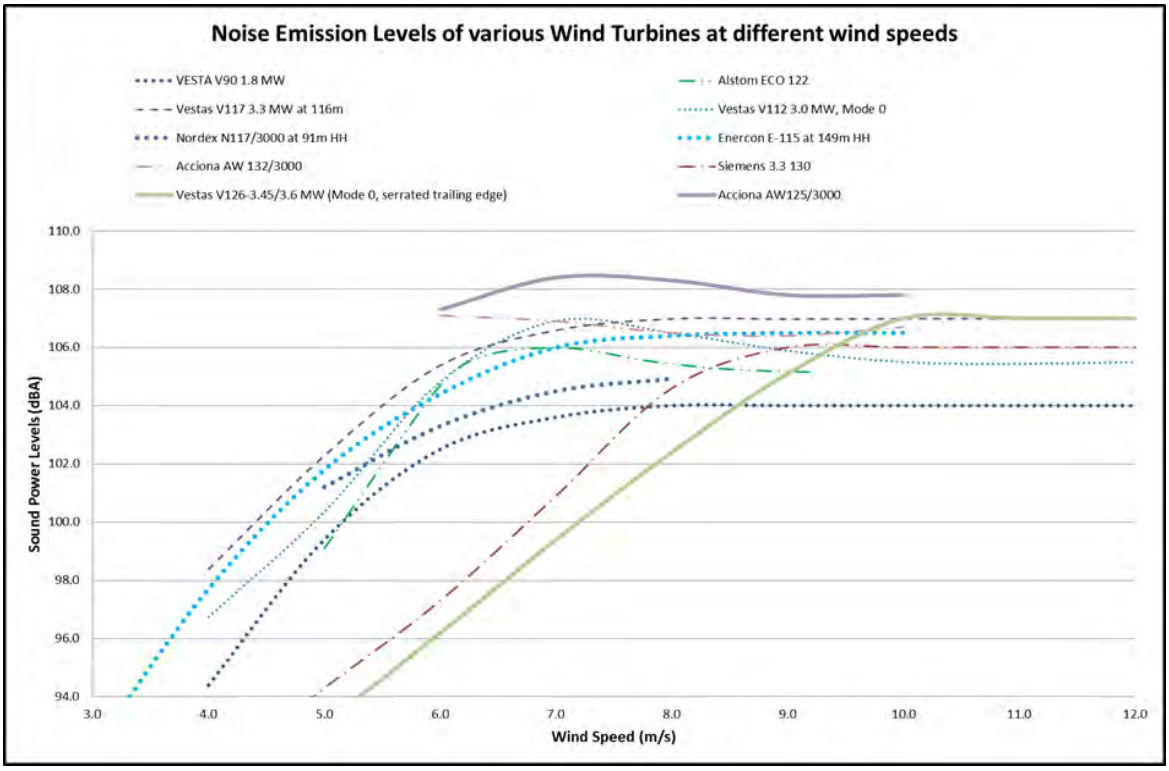
The proposed development would be designed to have an operational life of up to 25 years, although the producer agreement with the state may only be 20 years. During operation of the development, the large majority of the WEF site will continue with agricultural use. The only development related activities on-site will be routine servicing and unscheduled maintenance. The noise impact from maintenance activities is insignificant, with the main noise source being the wind turbine blades and the nacelle (components inside).

Noise emitted by wind turbines can be associated with two types of noise sources. These are aerodynamic sources, due to the passage of air over the wind turbine blades, and mechanical sources, which are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment for yaw, blade pitch, etc.

Aerodynamic noise is emitted by a wind turbine blade through a number of sources such as:

- Self-noise due to the interaction of the turbulent boundary layer with the blade trailing edge.
- Noise due to inflow turbulence (turbulence in the wind interacting with the blades).
- Discrete frequency noise due to trailing edge thickness.
- Discrete frequency noise due to laminar boundary layer instabilities (unstable flow close to the surface of the blade).
- Noise generated by the rotor tips.

As the wind speed increases, noises created by the wind turbine also increase. At a low wind speed, the noise created by the wind turbine is generally relatively low, and increases to a maximum at a certain wind speed when it either remains constant, increases very slightly or even drops as illustrated in **Graph 8-16**. The applicant is investigating a number of different wind turbine models; not excluding the possibility of larger models that are not yet available in the commercial market. Therefore, for the purpose of this noise assessment, a worst-case scenario will be investigated, making use of the sound power emission levels of the Acciona AW125/3000 turbine. The applicant is also considering the use of the Vestas V126 3.45/3.6 MW and the Acciona AW125/3150 turbines. While the sound power emission levels of the Vestas V126 3.45/3.6 are similar to the Vestas V117 3.3 MW, the sound power emission levels of the Acciona AW125/3000 are approximately 1.5dB higher than either the Vestas WTGs.



Graph 8-16: Noise emissions curve of a number of different wind turbines (for illustration purposes only).

Control Strategies to manage Noise Emissions during operation

Wind turbine manufacturers provide their equipment with control mechanisms to allow for a certain noise reduction during operation that can include:

- A reduction of rotational speed, and/or
- the increase of the pitch angle and/or reduction of nominal generator torque to reduce the angle of attack.

These mechanisms are used in various ways to allow the reduction of noise levels from the wind turbines, although this also results in a reduction of power generation. Enabling these various noise control strategies can reduce noise emissions up to 3dB.

Mechanical noise is normally perceived within the emitted noise from wind turbines as an audible tone(s) which is, subjectively, more intrusive than a broad band noise of the same sound pressure level. Sources for this noise is normally associated with:

- the gearbox and the tooth mesh frequencies of the step up stages;
- generator noise caused by coil flexure of the generator windings which is associated with power regulation and control;
- generator noise caused by cooling fans; and
- control equipment noise caused by hydraulic compressors for pitch regulation and yaw control[39].

Tones are noises with a narrow sound frequency composition (e.g., the whine of an electrical motor). Annoying tones can be created in numerous ways: machinery with rotating parts, such as motors, gearboxes, fans and pumps, often create tones. An imbalance or repeated impacts may cause vibration that, when transmitted through surfaces into the air, can be heard as tones. The best and most well-known example of a tonal noise is the buzz created by a flying mosquito.

[39] Yaw is the angle of rotation of the nacelle around its vertical axis. Efficient yaw control is essential to ensure that wind turbines always face directly into the wind.

Where complaints have been received due to the operation of wind farms, tonal noise from the installed wind turbines appears to have increased the annoyance perceived by the complainants and indeed has been the primary cause for complaint.

However, tones were normally associated with the older models of turbines. All turbine manufacturers have started to ensure that sufficient forethought is given to the design of quieter gearboxes and the means by which these vibration transmission paths may be broken. Through the use of careful gearbox design and/or the use of anti-vibration techniques, it is possible to minimise the transmission of vibration energy into the turbine supporting structure. The benefits of these design improvements have started to filter through into wind farm developments, which are using these modified wind turbines.

New generation wind turbine generators do not emit any clearly distinguishable tones.

Another form of noise to consider is magnetostriction. This is when the sheet steel used in the core of the transformer tries to change shape when being magnetised. When the magnetism is taken away, the shape returns, only to try and deform in a different manner when the polarity is changed.

This deformation is not uniform; consequently it varies all over a sheet. With a transformer core being composed of many sheets of steel, these deformations is taking place erratically all over each sheet, and each sheet is behaving erratically with respect to its neighbour. The result is the "hum" frequently associated with transformers. While this may be a soothing sound in small home appliances, various complaints are lodged in areas where people stay close to these transformers. At a voltage frequency of 50Hz, these "vibrations" take place 100 times a second, resulting in a tonal noise at 100Hz.

This is a relatively easy noise to mitigate with the use of acoustic shielding and/or placement of the transformer and will not be considered further.

Lastly, there is corona noise, which is caused by the partial breakdown of the insulation properties of air surrounding the conducting wires. It can generate an audible and radio-frequency noise, but generally only occurs in humid conditions, as provided by fog or rain. A minimum line potential of 70kV or higher is generally required to generate corona noise depending on the electrical design. Corona noise does not occur on domestic distribution lines.

Corona noise has two major components: a low frequency tone associated with the frequency of the AC supply (100Hz for 50Hz source) and broadband noise. The tonal component of the noise is related to the point along the electric waveform at which the air begins to conduct. This varies with each cycle and consequently the frequency of the emitted tone is subject to great fluctuations. Corona noise can be characterized as broadband 'crackling' or 'buzzing'.

It is generally only a feature during fog or rain. It will not be further investigated, as corona discharges results in:

- Power losses,
- Audible noises,
- Electromagnetic interference,
- A purple glow,
- Ozone production; and
- Insulation damage.

Electrical Service Providers, such as ESKOM, design power transmission equipment to minimise the formation of corona discharges. It is an infrequent occurrence with a relatively short duration compared to other operational noises.

"Low frequency sound" is the term used to describe sound energy in the region below ~200Hz. The rumble of thunder and the throb of a diesel engine are both examples of sounds with most of their energy in this low frequency range. Infrasound is often used to describe sound energy in the region below 20Hz. Almost all noise in the environment has components

in this region although they are of such a low level that they are not significant (wind, ocean, thunder).

Due to the low rotational rates of the blades of a WTG as well as the size of these blades, significant acoustic energy is radiated by large wind turbines in the infrasonic range. The levels of infrasound radiated by the largest wind turbines are very low in comparison to other sources of acoustic energy in this frequency range such as sonic booms, shock waves from explosions, etc. The danger of hearing damage from wind turbine low-frequency emissions is non-existent. However, sounds in a frequency range less than 100Hz can, under the right circumstances, be responsible for annoying nearby residents.

Except very near the source, most people outside cannot detect the presence of low-frequency noise from a wind turbine, and low-frequency noise from natural events (especially wind related) already exist.

Amplitude modulation: Although very rare, there is one other characteristic of wind turbine sound that increases the sleep disturbance potential above that of other long-term noise sources. The amplitude modulation of the sound emissions from the wind turbines creates a repetitive rise and fall in sound levels synchronised to the blade rotation speed, sometimes referred to as a "swish" or "thump".

The mechanism of this noise is not known, though various possible reasons have been put forward. Although the prevalence of complaints about amplitude modulation is relatively small, it is not clear whether this is because it does not occur often enough or whether it is because housing is not in the right place to observe it. Furthermore the fact that the mechanism is unverified means that it is not possible to predict when or whether it will occur.

Even though there are thousands of wind turbine generators in the world, amplitude modulation is one subject receiving the least complaints and due to very few complaints, little research has gone into this subject.

It is included in this report so as to highlight all potential risks, albeit extremely low risks such as this (low significance due to very low probability).

8.7 Socio-Economic Baseline Environment

8.7.1 *Baseline Environment: Administrative, Demographic and Socio-Economic Context*

8.7.1.1 *Administrative Context*

The site is located in the Western Cape Province, within the Laingsburg Local Municipality (LLM), which forms part of the Central Karoo District Municipality (CKDM) The LLM is one of three local municipalities that make up the CKDM in the Western Cape Province (**Plate 8-8**). The town of Laingsburg is the administrative seat of the LLM. Beaufort West is the administrative seat of the CKDM.

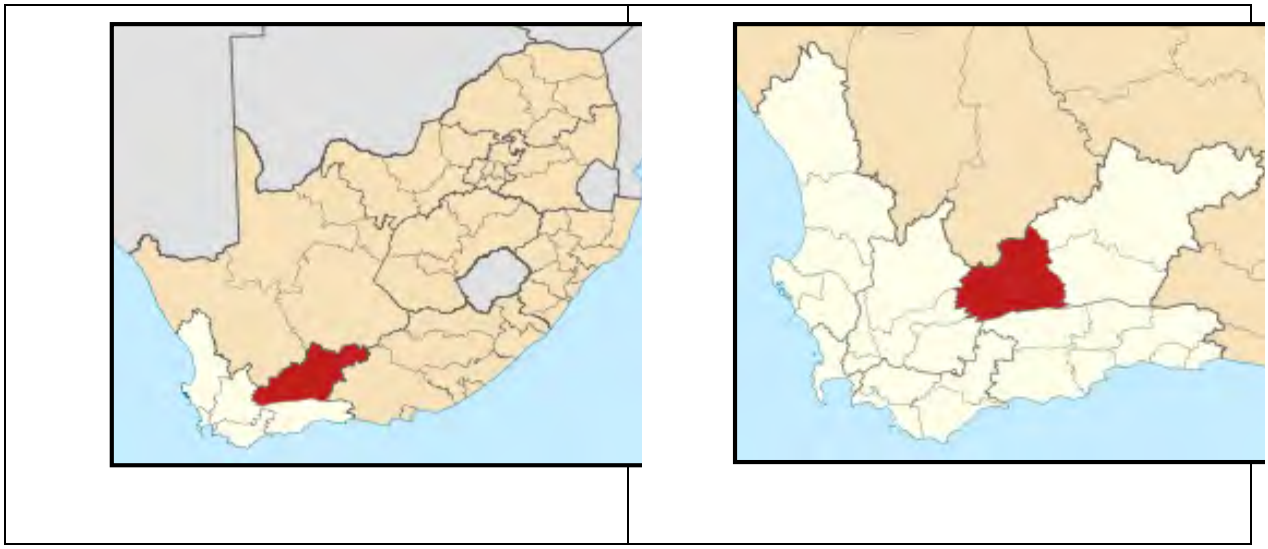


Plate 8-8: Location of Central Karoo District Municipality (left) and Laingsburg Local Municipality (right) within the Western Cape Province (white) (Source: Wikipedia).

8.7.1.2 *Study Area Towns*

Sutherland: Sutherland was established in 1857 on the farm De List in order to provide the Roggeveld region with a church site. The town is located on the south-western edge of the Great Escarpment, and is renowned as one of the coldest places in South Africa. Sub-zero winter temperatures are common in winter, and the Roggeveld Mountains to the north of town are often covered in snow.

The town is modest in size. The historic (white) part of town is centered on the Dutch Reformed Church building. Streets are laid out in a grid pattern, are generously proportioned, and characteristically lined with mature Aleppo pines and cypresses. Spatially, the town remains largely segregated. Erven in this part of town are generous in size, and many are planted with orchards. The Coloured areas of Kerkgronde, Skema and Hopland are located on the east side of the main town. A substantial number of traditional cut-stone dwellings survive in town, as do a number of historic braakdakhuise (thatched stone houses) in various states of disrepair in Kerkgronde.

Retail and services are essentially concentrated along the two tarred roads in town, namely the tarred main road, Piet Retief Street (an extension of the R354) and Sarel Cilliers Street (an extension of the R356). Retail establishments include a number of superettes, butcheries, an agricultural co-op/ hardware store, and at least five liquor stores. A post office and one bank (Standard) are located in Piet Retief Street.

Two primary schools and one secondary school are located in the town. A hospital is also located in Sutherland. However, the services provided by the hospital are limited. The nearest fully operational hospital is in Calvinia, approximately 160km north of Sutherland. The town has no resident doctors or dentists, and no pharmacy is located in town.

Unlike Laingsburg, Sutherland is relatively isolated and does not benefit from high volumes of passing traffic. This spatial isolation has direct negative consequences with regard to maintaining economically viable operations not linked to primary agriculture, as well as attracting investment capital into the Municipality. As a result, residents of Sutherland typically travel to Worcester or even Cape Town on a monthly basis to do their shopping etc. The town is not serviced by any public transport, and people without cars typically hire someone from the local community to provide transport for trips out of town.

The town itself has seen only some modest growth as lifestyle resettlement destination over the past decade. Of significant importance in this regard was the establishment of the town as tourist / astronomical destination since the commissioning of the South African Large Telescope

(SALT) in 2005. The establishment of the town as tourism destination has resulted in modest growth in available retail facilities. This has been further stimulated by the presence of a resident population and visiting researchers at the SAAO/ SALT facility.

A further consequence has been a steep increase in property prices since 2005, and the scarcity of available rental stock. The increase in property prices has made it even more difficult for historically disadvantaged members of the community to acquire property in the traditionally white part of town. The existing scarcity of available rental stock is likely to have potential implications in terms of the town's ability to accommodate personnel associated with the construction phase. In addition, competition for available rental stock is also likely to impact on visiting researchers at the SAAO/ SALT facility.

Laingsburg: The town of Laingsburg is located on the N1 and essentially represents the gateway to the Great Karoo. The town was established in 1881 along the banks of the ephemeral Buffelsrivier, mainly to provide a stop-over for travelers to the Kimberley diamond fields. The town's Victorian origins are still visible in a number of late-Victorian style houses located along the main road and some of the side roads. The town serves as regional agricultural service centre for its hinterland, but service and retail opportunities associated with the N1 also play an important role in the town's economy.

The N1 provides a direct road link to Cape Town and the more densely populated Boland to the south-west, and Beaufort West, the Orange Free State and Gauteng to the north-west. While relatively large distances separate the municipality from other large urban areas, the N1 nevertheless ensures that the town is not isolated. While many benefits are associated with this situation, it has at the same time increased the town's vulnerability to infectious diseases such as TB and HIV, and more recently, to the influx of hard drugs such as tik. "Highway relationships" and prostitution linked to the movement of truckers along the N1 constitute a significant risk with regard to the transmission of STDs and of unwanted pregnancies.

Laingsburg's location in proximity to the real or imagined economic opportunities associated with people movement along the N1 has been specifically significant. This situation of urban concentration (and rural depopulation) has gained significant momentum over the past decade or so as a result of significant labor shedding by the agricultural sector in the wake of implementation of the Extension of Security of Tenure Act, 1997 (ESTA) (Act No. 62 of 1997) legislation. The movement of the land has been further compounded by an increasing shift away from traditional stock farming to less labor-intensive game farming. Approximately 80% of the LM's population lives in Laingsburg. The lack of local employment opportunities has resulted in significant concentration of poverty in the town, mainly amongst the Coloured population group.

8.7.1.3 *Central Karoo District Municipality (CKDM)*

The CKDM is the largest DM in the Western Cape Province covering an area of 38 853km², which constitutes approximately 30% of the total area of the Province. However, with a population of 71 011 the CKDM is the least populated DM in the Province. The distances between settlements within the district therefore tend to be large. The district comprises of three Local Municipalities:

- Beaufort West Municipality;
- Prince Albert Municipality; and
- Laingsburg Municipality.

Beaufort West is the most populated of the local municipalities with a population size of 49 586, followed by Prince Albert (13 136) and Laingsburg (8 289) (Census 2011). The main language spoken in the district is Afrikaans followed by IsiXhosa.

Economic overview

The CKDM IDP (2012-2017) indicates that economic development remains a developmental challenge for the DM. This is due to the low population density, distance from large markets and the arid climate. In addition, there are high levels of unemployment and poverty and a lack of skilled persons.

In 2008, the CKDM economic growth rate was 6% compared to the Province's annual growth rate of 4.3% (CKDM IDP 2012-2017). However, the due to global recession the growth rate in 2009 was 0.2%, while the Province's economy contracted by 1.2%. The decline in the growth from 2008 to 2009 was due to the impact of the 2008/09 global recession.

The contribution of the different economic sectors to the local economy has changed over the last 10 years. The 2009 figures compared to the 1999 figures indicate that the most significant changes were in the finance, insurance, real estate and business services sector and manufacturing sector. These sectors increased by 8.9% and 4.4% respectively, while the agriculture and transport, storage and communication sectors decreased by 7.0% 3.8% respectively.

In the Beaufort West LM, mining and quarrying displayed a growth rate of 26.9% while manufacturing recorded a growth rate of 10.12%. In the Prince Albert LM the construction (15.2 %) and finance, insurance, real estate and business (14.4%) sectors all displayed strong growth. In the Laingsburg LM construction (11.8%) and manufacturing (9.7%) recorded strong growth.

Employment

In terms of employment, the most important economic sector is the Community, social and personal services sector (16.9%), followed by Agriculture; hunting; forestry and fishing (15.7%) and Wholesale and retail trade (14.0%). The Agriculture sector also plays a key role in the other District Municipalities in the Western Cape, accounting for 27.9% and 24.2% the jobs in the West Coast and Cape Winelands respectively.

The Community survey of 2007 found that the Central Karoo had the lowest percentage of the Western Cape's labour force (0.8%). At the same time the DM also had the highest unemployment rate (30.8%). Based on the 2011 Census figures, the unemployment rate in the CKDM was 23.1% compared to 21.6% for the Western Cape Province. Within the DM the unemployment rates for the LLM, Prince Albert and Laingsberg LM were 25.5, 17.9 and 19.4% respectively in 2011 (Statistics South Africa, Census, 2011).

As indicated above, the majority of employment in the Central Karoo is within the agriculture sector. However, the agriculture sector is dependent on exports to the Europe. Due the financial crisis in 2008, exports to Europe have declined significantly, which in turn has resulted in job losses in the agriculture sector.

Although unemployment impacts across gender, race, age and other social divides its effects within certain groups are more pronounced. Some of the differential impacts of unemployment can be found within the breakdown of gender, population group and age.

In terms of unemployment by population group, the unemployment rate for Black Africans (45%) was greater than any other population group. The figure for Coloureds was 33.4% while for Whites is was only 2.6%. Disparities are also found within different age groups, with younger age groups experiencing higher levels of unemployment and representing significantly higher shares of the unemployed in comparison with their share of the labour force. The unemployment rate for those in younger age groups is significantly higher than the older age groups. The differences in unemployment rates between age groups may in part be accounted for in the higher education, skill and experience levels of relatively older workers – these characteristics make work-seekers more attractive to prospective employers and improve their chances of finding employment (CKDM IDP 2012-2017).

In terms of gender, males make up 52.9% of the CKDMs labour force. Although males represent more than half of the labour force, they represent only 41.3% of the district's total unemployed population. The high representation of females within the unemployed translates into a significantly higher unemployment rate for females (38.3%) compared with males (24.0%) CKDM IDP 2012-2017).

CKDM has third lowest proportion of skilled labour force (38.6%) and the second highest of low skilled (26.6 %) people in the Western Cape. The low skill levels in the CKDM places a strain on the region's economy and poses a challenge to the areas future development (CKDM IDP, 2012-2017). The IDP notes that a large proportion of occupations in the DM are classified as either skilled (39%) or high skilled (21%). The concentration of employment opportunities in the skilled sector therefore means that there are relatively few opportunities available to those with low skill levels. The current proportion of low skilled occupations available in the District is 27% (CKDM IDP 2012-2017). This mismatch in terms of skills levels and employment opportunities highlights the need for individuals to up-skill in order to improve their chances of finding employment within the district CKDM IDP 2012-2017).

Household income

The CKDM IDP (2012-2017) indicates that the 32% of households in 2009 earned income between R0 and R42 000, 41.8% earned between R42 000 and R132 000, 23.1% between R132 000 and R600 000 and 3.1% earn above R600 000. The IDP notes that the figures indicated that there has been a shift in earning power in the number of people earning at the lower end of the scale while the people in the middle to upper ends of the scale has increased significantly.

Human development index[40]

The Human Development Index (HDI) for the CKDM increased from 0.57 in 2001 to 0.60 in 2010. While the HDI within the CKDM has improved over the past decade the CKDM has the lowest HDI of all the Districts, followed by the West Coast and Cape Winelands DM. Within the CKDM the Prince Albert Municipality has the lowest HDI followed by Laingsburg Municipality. The low HDI poses a major challenge for the district in terms of creating employment opportunities to improve the standard of living in the area.

Poverty rate[41] and indigent households

Research undertaken by Global Insight indicates that the number of people living in poverty in the CKDM in 2010 was approximately 20 200 people. In this regard, the CKDM had the highest number of people living in poverty in the Western Cape (32.5%). Prince Albert has the highest proportion of poor people and it is rising compared to the rest of the district.

According to the Western Cape Department of Local Government information, the number of households in the Central Karoo District totalled 14 945 of which 5 903 (39.5%) were classified as indigent (August 2011). From the Department's information, of the total number of households, 43.1% received free basic access to water, 40.2% to electricity, and 39.4% to

[40] The Human Development Index (HDI) is a composite, relative index that attempts to quantify the extent of human development of a community and is based on measures of life expectancy, literacy and income. The HDI therefore provides a measure of people's ability to live a long and healthy life, to communicate, to participate in the life of the community and to have sufficient resources to obtain a decent living. In terms of measurement the maximum level is 1, which indicates a high level of human development, and a minimum value of 0.

[41] The poverty rate represents the percentage of people living in households with an income less than the poverty income. The poverty income is defined as the minimum monthly income needed to sustain a household and varies according to household size, the larger the household the larger the income required to keep its members out of poverty. The poverty income used is based on the Bureau of Market Research's Minimum Living Level (BMR report no. 235 and later editions, Minimum and Supplemented Living Levels in the main and other selected urban areas of the RSA, August 1996). For example, the monthly income needed to keep a 1 person household out of poverty in 2010 is estimated to be R1 315, while for a two person household it is R1 626; a four person household requires an estimated income of R2 544 to stay out of poverty while a household with eight or more person requires an estimated R4 729.

sanitation services. Within the CKDM, the Beaufort West LM has the highest number of indigent households followed by the Prince Albert and Laingsburg LM.

Gini coefficient[42]

The Gini coefficient for the DMs in the Western Cape Province are largely similar, and vary between 0.57 (City of Cape Town and 0.6 (West Coast DM). The Gini coefficient for the CKDM was 0.58 in 2019. Within the CKDM, the Prince Albert Municipality had the highest Gini coefficient in 2010 (0.61) followed by the Laingsburg Municipality (0.59). The income inequality within the CKDM is exacerbated by the high unemployment rates and low income levels.

Main transport corridors

The N1 national road that bisects the Central Karoo is a key transport corridor for road-based freight transport, passenger services and private vehicles. This vital link bisects South Africa on a northeast-southwest axis, providing access to and between Limpopo Province, Gauteng, the Free State and the Western Cape. Within the Central Karoo District it links the towns of Beaufort West, Leeu-Gamka, Laingsburg and Matjiesfontein. This road is part of the SANRAL network.

Running parallel to the N1 through the Central Karoo is the long-distance main railway line connecting Cape Town to Johannesburg / Pretoria and the other main urban centres of South Africa (Refer to **Plate 8-9**).

[42] The Gini coefficient is a summary statistic of income inequality, which varies from 0, in the case of perfect equality where all households earn equal income, to 1 in the case where one household earns all the income and other households earn nothing. In practice the coefficient is likely to vary from approximately 0.25 to 0.70.

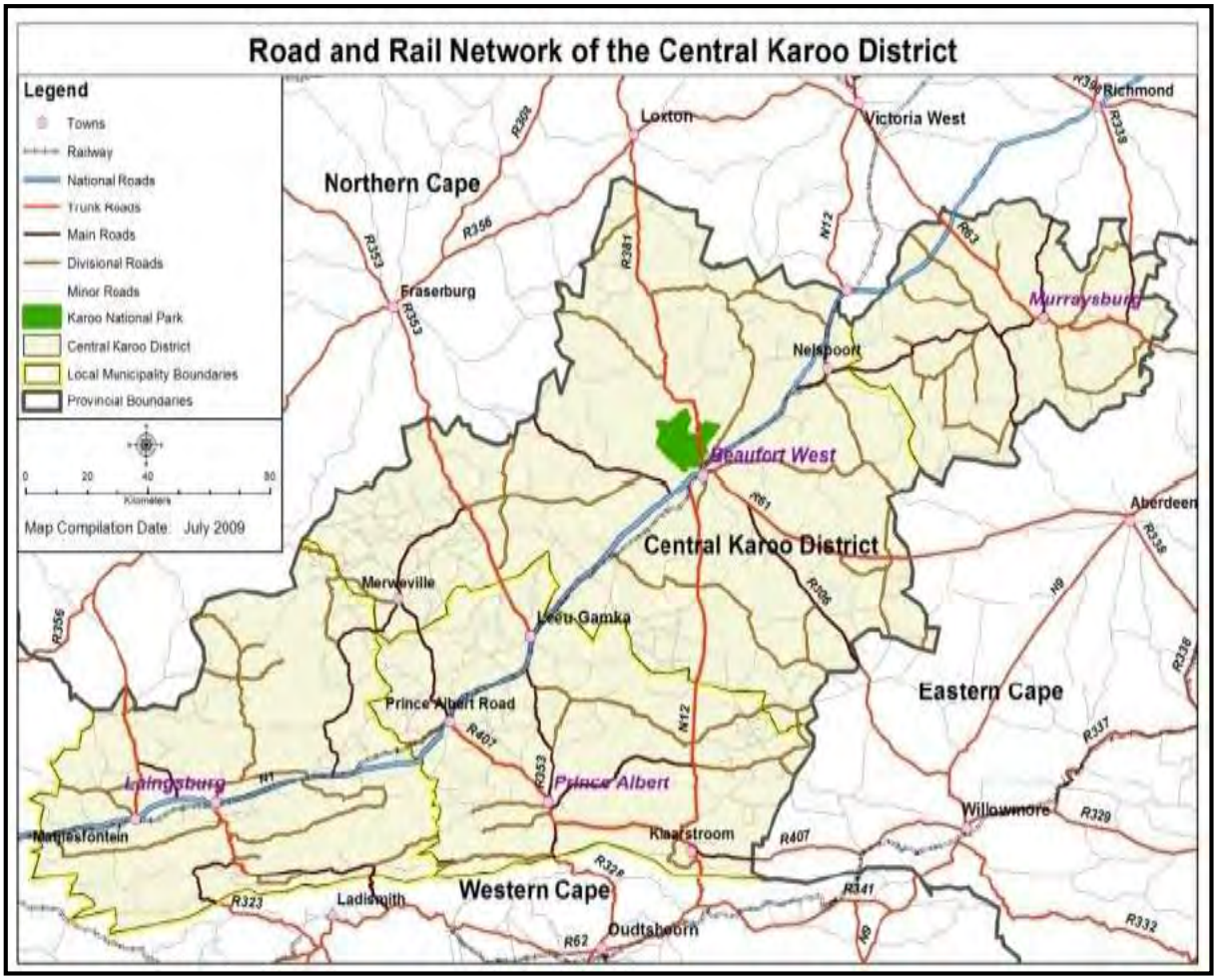


Plate 8-9: Transport links within the CKDM.

8.7.1.4 *Central Karoo and Laingsburg Municipality*

Demographics

The population of the CKDM increased by from 60 483 in 2001 to 71 011 in 2011, which represents an increase of approximately 17.4%. The population of the LLM increased from 6 680 in 2001 to 8 289 in 2011 (approximately 19%) over the same period. This represents an average annual increase of approximately 1.6% and 2.16% for the CKDM and LLM respectively.

The increase in the population in both the CKDM and LLM was linked to an increase in the economically active 15-65 year age group. The increase in the economically active 15-65 age group in also reflected in the decrease in the dependency ratios in both the CKDM and LLM (refer to **Table 8-9** below). As expected, the number of households in both the CKDM and LLM increased between 2001 and 2011. The household size in the CKDM decreased marginally, from 3.8 to 3.6. The household size in the LLM stayed at 3.3 between 2001 and 2012.

Table 8-18: Overview of key demographic indicators for the CKDM and LLM.

	CKDM		LLM	
ASPECT	**2001**	**2011**	**2001**	**2011**
Population	60 483	71 011	6 680	8 289
% Population <15 years	32.7	30.5	29.3	26.5
% Population 15-64	61.4	63.3	63.0	66.3
% Population 65+	6.0	6.2	7.7	7.2
Households	15 009	19 076	1 922	2 408
Household size (average)	3.8	3.6	3.3	3.3
Formal Dwellings %	95.7 %	97.0 %	96.6 %	96.6 %

Dependency ratio per 100 (15-64)	62.9	58.0	58.7	50.9
Unemployment rate (official) - % of economically active population	36.2 %	23.1 %	26.3 %	17.9 %
Youth unemployment rate (official) - % of economically active population 15-34	47.3 %	30.9 %	37.0 %	22.0 %
No schooling - % of population 20+	17.3 %	10.1 %	20.0 %	11.7 %
Higher Education - % of population 20+	6.1 %	7.1 %	5.9 %	8.7 %
Matric - % of population 20+	14.9 %	21.5 %	12.4 %	16.7 %

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet.

The majority of the population is in the LLM was Coloured (79 %), followed by Whites (13.3%) and Black Africans (7%) (Census, 2011). The dominant language within the Municipality is Afrikaans (~ 94%), followed by English (1.7%) and isiXhosa (~1.2%) (Census, 2011).

The dependency ratio in both the CKDM and LLM decreased from 62.9 to 58.0 and 58.7 to 50.9 respectively. The age dependency ratio is the ratio of dependents, people younger than 15 or older than 64, to the working, age population, those ages 15-64. The increase represents a positive socio-economic improvement, and reflects a decreasing number of people dependent on the economically active 15-64 age group. This decrease is linked to the increase in the percentage of economically active people in both the CKDM and LLM. Despite the decrease the dependency ratios for the CKDM and LLM are higher than the provincial (45) dependency ratio.

In terms of percentage of formal dwellings, the number of formal dwellings in the CKDM increased significantly from 95.7% in 2001 to 97.03% in 2011. The number of formal dwellings in the LLM remained constant at 96.6% for the same period. This represents a positive socio-economic advantage for the area. The high level of formal dwellings is also likely to reflect a low in-migration into the both the CKDM and LLM, which in turn is likely to be an indication of the limited economic opportunities in the area.

Employment

The official unemployment rate in both the CKDM and LLM also decreased for the ten year period between 2001 and 2011. In the CKDM the rate fell from 36.2% to 23.1%, a decrease of 13.1%. In the LLM the unemployment rate decreased from 26.3% to 17.9%, a decrease of 8.4%. Youth unemployment in both the CKDM and LLM also dropped over the same period. However, the youth unemployment rate in the both the CKDM (30.9%) and LLM (22%) remain high. This is likely to be due to the decline in the role of the agricultural sector and the subsequent loss of employment opportunities in this sector.

Household income

Based on the data from the 2011 Census, 5.3% of the population of the LLM have no formal income, 2% earn between 1 and R 4 800, 2.9% earn between R 4 801 and R 9 600 per annum, 20.9% between R9 601 and R19 600 per annum and 25.4% between R 19 600 and R38 200 per annum (Census, 2011). The poverty gap indicator produced by the World Bank Development Research Group measures poverty using information from household per capita income/consumption. This indicator illustrates the average shortfall of the total population from the poverty line. This measurement is used to reflect the intensity of poverty, which is based on living on less than R3 200 per month for an average sized household. Based on this measure 56.5% of the LLMs population live below the poverty line. The low-income levels reflect the limited formal employment opportunities in the LLM. This is due the LLMs reliance on the agricultural sector. The low income levels are a major concern given that an increasing number

of individuals and households are likely to be dependent on social grants. The low income levels also result in reduced spending in the local economy and less tax and rates revenue for the district and local municipality.

Education

The education levels in both the CKDM and LLM also improved, with the percentage of the population over twenty years of age with no schooling dropping in the CKDM decreasing from 17.31% to 10.1%. For the LLM the decrease was from 20.0 % to 11.7 %. The percentage of the population over the age of 20 with matric also increased in both the CKDM and LLM, from 14.9% to 21.5% in the CKDM and 12.4 % to 16.7% in the LLM. The levels in both the CKDM and LLM are however lower than the national (28.4%) provincial (28.1%) averages.

The IDP (CKDM 2012-2017) also notes that the population in the CKDM have limited options when it comes to higher education and further education facilities. Only one institution in Beaufort West serves the District and people are compelled to further their studies outside of the District.

Municipal services

The provision of and access to municipal services as measured in terms of flush toilets, weekly refuse removal, piped water and electricity, has, with the exception of waste removal in the LLM, increased in both the CKDM and LLM for the period 2001 to 2011. As indicated in **Table 8-10,** there have been significant improvements in the number of households with access to piped water inside their dwellings in the CKDM. However, the improvements in the LLM have not been as significant. It is also worth noting that despite the high percentage of formal dwellings in the LLM (96.6%) the level of services to these dwellings in terms of flush toilets, weekly refuse removal and piped water are all below 70%.

In addition, the service levels in the CKDM and LLM are lower than the 2011 provincial averages for the Western Cape Province. The provincial figures are flush toilets (85.9%), weekly refuse removal (89.9%), piped water (78.7%) and electricity (93.4%).

Table 8-19: Overview of access to basic services in the CKDM and LLM.

	CKDM		LLM	
	2001	**2011**	**2001**	**2011**
% households with access to flush toilet	75.1	77.6	62.8	68.1
% households with weekly municipal refuse removal	78.1	78.7	63.1	59.5
% households with piped water inside dwelling	55.5	77.2	60.1	66.3
% households which uses electricity for lighting	83.9	89.4	73.7	79.4

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet.

8.7.1.5 *Local Economy*

Agricultural sector

Commercial stock farming forms the economic backbone of the Laingsburg/Sutherland region, and consists of extensive small stock farming, typically sheep. Carcass, wool and multi-purpose breeds are stocked. The grass component is insufficient to support meaningful numbers of large stock. Goats are suited to the region, but are not generally favoured due to their very destructive browsing habit.

Operations in the Sutherland/ Laingsburg region are characterised by the seasonal movement of stock between pastures located in different farming areas. This transhumance pattern is centuries old, and is based on the utilisation of summer (Great Karoo, Moordenaarskaroo) and winter rainfall areas (Klein Roggeveld, Tankwa, Ceres Karoo) in turn in order to ensure continuous fresh pasture throughout the year, and to protect veld from overgrazing linked to

inherently low carrying capacities as a result of arid conditions. Operations therefore typically consist of a number of farms, mostly ranging in size from 5000ha to 10 000ha in total, dispersed over a large area.

The Klein Roggeveld and Tankwa are milder in winter than the Roggeveld and great escarpment north of Sutherland, and thus better suited to lambing ewes. At the same time, these regions are very hot and dry in summer, making it preferable to move stock back to the Moordenaarskaroo or Roggeveld. The majority of farms on site serve only as winter grazing for the main operations located in the Roggeveld, Klein Roggeveld or Moordenaarskaroo. The farms on which the bulk of the WEF infrastructure is proposed is valued for its comparatively warm winters, higher winter rainfall than the surrounding areas, and the number of streams and small watercourses. At the same time, it becomes extremely hot and dry in summer. Veld carrying capacities are low, at around 6ha to one sheep.

The employment opportunities associated with extensive stock farming are limited and in many instances only available seasonally (e.g. shearing). Virtually no beneficiation of primary produce (meat, wool, hides) currently takes place locally. As a result, the local primary agricultural sector supports only very limited local secondary employment and investment.

Most farming operations in the broad region produce fodder crops on a small scale, mainly for own use. The Laingsburg-Sutherland-Ceres area is a key producer of vegetable seed crops, namely onions, garlic, leeks and carrots. Olives, drying peaches, citrus and other crops are also grown on a small scale in the Laingsburg area. All cropping activities are irrigation-based. Cropping areas and potential cropping areas are therefore restricted in this region of low rainfall, ephemeral rivers and deep groundwater. With regard to the WEF study area, vegetable seed is produced on at least three site farms. Workers are transported in during planting and harvesting for a few days at a time, with a skeleton staff supervising operations throughout the year.

Game farming is currently increasingly displacing stock farming in the Laingsburg area. Game farming is even less employment-intensive than stock farming, with the result that an already limited employment base is in danger of erosion. However, this trend is at present limited to absent in the area south of Sutherland, including the WEF site and surrounds.

Tourism

Tourist flows into the study area municipalities are currently modest, and mainly associated with the town of Sutherland and the small Victorian rail siding of Matjiesfontein along the N1 west of Laingsburg.

The construction and commissioning of the South African Large Telescope (SALT), the largest telescope in the Southern Hemisphere, is credited as the most important contributing factor to the growth of the tourism sector in Sutherland. Prior to the construction of SALT, in 2005 the accommodation in the town was limited to a single guesthouse and one hotel. At present, the town has over 30 B&B/guest house facilities and one hotel (providing a total of approximately 300 beds), as well as a number of restaurants and coffee shops/ bistros. In addition, fourteen guest farms have become established around the town. An estimated 15 000 visitors visit the town annually. The majority of tourists are from the Western Cape and visit the town during the winter months when atmospheric conditions for viewing are optimal. Peak visitor numbers are over the June school holidays. Snow tourism is also becoming a major attraction. As major attractions are limited to a few winter months, accommodation facilities and restaurants battle with significant under-subscription during most of the year.

Matjiesfontein is a quaintly preserved/ restored scattering of Victorian houses and the Lord Milner Hotel around a rail siding. Thanks to its location near the N1, Matjiesfontein is arguably one of South Africa's best-known bastions of Victoriana and nostalgia tourism. Matjiesfontein is largely dedicated to residential and tourism uses. Its location along the N1, between Laingsburg and Touwsrivier, makes it ideal as a stop or stop-over for tourists. Travellers are less well catered for, as general shops and services (e.g. fuel station) are not represented.

Information provided by the Karoo Hoogland Tourism Bureau as well as the Laingsburg Tourism Bureau indicates that no significant tourism attractions or destinations are located within the WEF study area. Guest accommodation is available on two farms to the south of the WEF site, but mainly caters for contractors and consultants working in the area. In this regard, the WEF is located more or less in between two major accommodation destinations, namely Matjiesfontein and Sutherland (le Roux, pers. comm). No other tourism destinations or facilities are currently located in or around the WEF site.

8.8 Visual Baseline Environment

8.8.1 *Visual Sensitivity*

Most of the area is uninhabited and conveys a strong sense of place characterised by its remoteness and natural landscape qualities.

The landscape to the north is more mountainous, where the Komsberg Mountains form the escarpment, and is therefore more scenic in terms of topography.

The skyline ridges tend to be visually sensitive, particularly where wind turbines and other structures, such as substations will be seen in silhouette against the sky.

The stream valleys are a valuable scenic resource in the semi-arid countryside. The limited alluvial valleys provide opportunities for cultivation and are therefore a scarce resource.

There is visual integrity and scenic value associated with the Komsberg Pass and Komsberg Wilderness Nature Reserve (private).

8.8.2 *Site Opportunities and Constraints*

The landscape to the south is more undulating and lower lying, and already includes a powerline corridor, as well as substations. This southern area is therefore potentially less visually sensitive.

The broken topography, with numerous ridges and valleys, has reasonably good visual absorption capacity, which could potentially help to screen any proposed wind turbines from surrounding settlements. Ridgelines, knolls and peaks are however visually exposed and therefore considered sensitive scenic resources.

Sensitive receptors include a number of farmsteads, although several of these would be included in the project area. Refer to **Plates 8-10** to **8-13**.

Plate 8-10: Existing power lines and substation to the south of the site.

Plate 8-11: Undulating landscape and low Karoo scrub in the south.

Plate 8-12: Tree copses and stone kraals around farmsteads.

Plate 8-13: Komsberg Pass in mountainous terrain to the north.

8.8.3 *Visual Issues*

The Issues Trail compiled as a result of the public engagement process indicates a number of issues with regards to visual matters. These are summarised below:

- An existing servitude road providing access to the proposed development would run adjacent to a homestead on the farms De Fonteine and Koornplaats, which could have visual, noise and dust issues during construction.
- The particular sense of place and silence could be adversely affected by the proposed development, and possibly compromise the experience enjoyed by residents and visitors to the area. However, some of the farms form part of the project area.

- The South African Astronomy Observatory near Sutherland is concerned about lighting at night and dust generated during construction, which could affect the quality of the night sky and have a negative effect on optical astronomy. The Observatory is above the escarpment some 35km away and outside the viewshed.

8.8.4 *Visual Informants Map*

A Visual Informants Map is included in **Figure 8-15**, indicating the main scenic resources, along with recommended buffers where applicable. The buffers generally conform to those developed in the National Wind and Solar PV Strategic Environmental Assessment compiled by the authors in conjunction with the CSIR in 2014 (ongoing). The proposed wind turbines have been overlaid on the Visual Informants Map to help determine possible visual impacts.

SECTION G: IMPACT ASSESSMENT

This section describes and assesses the key potential impacts of the proposed Komsberg East WEF. These include the biophysical aspects of the site (aquatic ecosystems, fauna and flora, bats and avifauna) and the social aspects related to the site (heritage, archaeology, palaeontology, social, noise and visual).

This section therefore provides an assessment of the sensitivity of the proposed development site by identifying and describing potential impacts and determining the significance of each impact (according to a standard methodology) (**Appendix E**).

Mitigation measures are recommended which would reduce possible negative impacts and/or enhance possible positive impacts on both the biophysical and social environments. The significance of each impact is rated as high, medium or low both before and after mitigation is applied. An assessment of cumulative impacts is also provided for each field of investigation at the end of this section.

The mitigation measures are included in the Environmental Management Programme (EMPr) (**Volume 3**) for implementation by the applicant. The EMPr would be included in all tender documentation, should the proposal receive authorisation.

9 FAUNA AND FLORA ASSESSMENT

9.1 Ecological Site Sensitivity Map

The ecological sensitivity map of the site is depicted in **Figure 9-1a** for the alternative and preferred layouts. At a broad scale, the sensitivity of the area increases from east to west and from south to north, driven largely by the increase in rainfall with elevation and towards the west. Several of the ridges were identified as specifically sensitive on account of the presence of flora of conservation concern or because of the local topography of the area and the likely significance of the identified areas for fauna and flora.

There are no areas within the Komsberg East WEF that are considered highly sensitive, which relates to the aridity of this area and the lower abundance of species of concern. Therefore, there are no recommendations with regard to the placement or reduction of the number of turbines. The most sensitive area here is the high elevation node of development to the northeast of the site. Any localized sensitive features here can be avoided through turbine micro-siting following a preconstruction walk-through of the facility. The identified high sensitivity areas are important for flora as well as fauna and effective environmental management in these areas will be important for reducing the overall cumulative impact of the development. Refer to **Figure 9-1b** for the ecology sensitivity map as it relates to the final layout.

9.1.1 *Construction Phase Impact Assessment*

9.1.1.1 *Potential Impacts*

- Vegetation clearing for access roads, turbine pads, electrical trenches and other associated infrastructure is likely to impact listed plant species as well as high-biodiversity plant communities. Vegetation clearing would also lead to habitat loss for fauna and potentially the loss of sensitive faunal species, habitats and ecosystems.
- Increased erosion risk could occur due to the loss of plant cover and soil disturbance created during the construction phase. Parts of the sites are steep and risk of erosion would be high in certain areas. This may impact downstream riparian and wetland habitats if a lot of silt enters the drainage systems.
- The presence and operation of construction machinery may create a physical impact, as well as the generation of noise, pollution and other forms of disturbance at the site.
- Increased human presence may lead to poaching, illegal plant harvesting and other forms of disturbance such as fire.

9.1.1.2 *Significance Assessment*

Impact Description: Design and Construction - Impact on vegetation and listed plant species due to transformation within the development footprint.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	H	Negative	M	H	H
With Mitigation	L	M	M	Negative	M to L	H	H
Can the impact be reversed?	No. Some transformation is a necessary outcome of the development						
Will impact cause irreplaceable loss or resources?	Yes. Some loss of rare habitats or species may occur						
Can impact be avoided, managed or mitigated?	Possibly, through avoidance, but some residual impact is likely.						
Mitigation: 1. Preconstruction walk-though of the approved development footprint to ensure that sensitive habitats and species are to be avoided where possible. 2. Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible. 3. Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development. 4. A large proportion of the impact of the development stems from the access roads and the number of roads should be reduced to the minimum possible and routes should also be adjusted to avoid areas of high sensitivity as far as possible, as informed by a preconstruction walk-through survey. 5. 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. 6. Demarcate all areas to be cleared with construction tape or similar material. However caution should be exercised to avoid using material that might entangle fauna.							
Can any residual risk be monitored/managed?	No. Once the habitat is lost it cannot practically be restored to former levels of diversity and function. However, additional impact in the operational phase can be limited through access control to the site as well as ensuring effective management of alien plants and soil erosion.						
Will this impact contribute to any cumulative impacts?	Yes. Transformation for roads, turbines and other infrastructure will contribute to cumulative transformation and habitat loss in the area, however, the total extent of transformation is considered to the low to moderate.						

Impact Description: Direct faunal impacts due to construction phase noise and physical disturbance, including potential impact on Critically Endangered Riverine Rabbit.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	H	Negative	M	H	H
With Mitigation	L	M	M	Negative	M	H	H
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?	Provided that impacts to sensitive habitats such as drainage lines are minimized, then no irreplaceable loss of resources is likely to occur.						
Can impact be avoided, managed or mitigated?	No. Full mitigation is unlikely as noise and construction phase disturbance cannot be entirely avoided or reduced to low levels.						
Mitigation measures: 1. Preconstruction walk-through of the facility to identify areas of faunal sensitivity. 2. 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. 3. 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. 4. No fires should be allowed within the site as there is a risk of runaway veld fires. 5. No fuelwood collection should be allowed on-site.							

6. No dogs should be allowed on site apart from those that belong to the participating landowners. 7. 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), which do not attract insects and which should be directed downwards. 8. 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. 9. No unauthorized persons should be allowed onto the site and site access should be strictly controlled and vehicles which need to roam around the site should be accompanied by the ECO or security personnel. 10. All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises as well as the Riverine Rabbit. Speed limits should apply within the facility as well as on the public gravel access roads to the site. 11. 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 persecuted out of superstition.	
Can any residual risk be monitored/managed?	Yes. All mortalities of fauna on access roads within or to the site should be recorded with a view towards intervention and additional mitigation. If any Riverine Rabbits are killed this should be reported to the EWT Riverine Rabbit programme and additional mitigation implemented.
Will this impact contribute to any cumulative impacts?	Yes. Construction phase disturbance will contribute towards cumulative faunal impacts in the area, this will however be transient and localised.

Impact Description: During construction, the site will be highly vulnerable to soil erosion due to all the disturbed ground present.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	H	H	Negative	H	H	H
With Mitigation	L	L	L	Negative	L	H	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 of topsoil would potentially be an irreplaceable loss of resources.
Can impact be avoided, managed or mitigated?	Yes. With appropriate control measures, erosion risk can be mitigated

Mitigation measures:

1. Runoff management and erosion control should be integrated into the project design
2. Development on steep slopes should be avoided as much as possible and specific additional mitigation may be required where this cannot be avoided.
3. Dust suppression and erosion management should be an integrated component of the construction approach.
4. Disturbance near to drainage lines should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas.
5. Regular monitoring for erosion problems along the access roads and other cleared areas.
6. Erosion problems should be rectified on a regular basis.
7. Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season.
8. A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.

Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems during the construction phase, with interventions implemented where actual and potential problems are observed.
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.

9.1.2 ***Operational Phase Impact Assessment***

9.1.2.1 *Potential Impacts*

Potential impacts during the operational phase of the development may include:

- The operation of the facility will generate noise and disturbance which may deter some fauna from the area.
- The presence of the facility will disrupt the connectivity of the landscape for some species which will avoid traversing the cleared areas and may impact their ability to disperse or maintain gene flow between sub-populations.
- The facility would require management and if this is not done appropriately, it could impact adjacent intact areas through impacts such as erosion, alien plant invasion and contamination from pollutants.

9.1.2.2 *Significance Assessments*

Impact Description: Faunal impacts due to operational phase activities.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	H	Negative	M	H	H
With Mitigation	L	M	M	Negative	M	H	H
Can the impact be reversed?	The impact will persist for the lifespan of the facility, but will be reversed if the turbines are removed and disturbed areas rehabilitated.						
Will impact cause irreplaceable loss or resources?	Unlikely						
Can impact be avoided, managed or mitigated?	Partially. Some management is possible, but residual impact from the wind turbines and general disturbance will persist.						
Mitigation Measures: 1. Management of the site should take place within the context of an Open Space Management Plan. 2. No unauthorized persons should be allowed onto the site. 3. Any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. 4. The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone expect landowners with the appropriate permits where required. 5. 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), which do not attract insects. 6. 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. 7. 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. 8. 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 the fence and not the outside.							
Can any residual risk be monitored/managed?	Partially. Some risks such as those associated with the presence and activities of personnel at the site can be managed, but a proportion of the impact results from the presence and operation of the wind turbines and this cannot be avoided or mitigated.						
Will this impact contribute to any cumulative impacts?	Yes. The presence and operation of the facility will contribute towards faunal habitat loss and disturbance in the area. For most fauna this is considered to be relatively low.						

Impact Description: Following construction, the site will be highly vulnerable to soil erosion.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	H	Negative	H	H	H
With	L	L	L	Negative	L	H	H

Mitigation							
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.						
Can impact be avoided, managed or mitigated?	With appropriate control measures, erosion risk can be mitigated						
Mitigation measures: 1. Erosion management at the site should take place according to the Erosion and Rehabilitation Plan. 2. 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. 3. Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. 4. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 5. 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.							
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems during the operational phase, with interventions implemented where actual and potential problems are observed.						
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. However, if erosion is effectively controlled, then this contribution would be low.						

Impact Description: Following construction, the site will be highly vulnerable to alien plant invasion.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	M	Negative	M	H	H
With Mitigation	L	L	L	Negative	L	H	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 not be 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: 1. Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. 2. The recovery of the indigenous shrub/grass layer should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas. 3. Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem woody species such as *Prosopis* are already present in the area and are likely to increase rapidly if not controlled. 4. 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. 5. 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.							
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for alien plant problems during the operational phase, with management and control implemented according to an Alien Management Plan.						
Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. If aliens are effectively controlled, then this contribution would be low.						

9.1.3 ***Decommissioning***

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	H	H
Can the impact be reversed?	Yes. This impact will be transient and restricted to the decommissioning period.						
Will impact cause irreplaceable loss or resources?	No, this is unlikely.						
Can impact be avoided, managed or mitigated?	Partially. Some management is possible, but residual impact from general disturbance and human activity cannot be avoided.						
Mitigation measures: 1. Any potentially dangerous fauna such snakes or fauna threatened by the decommissioning activities should be removed to a safe location. 2. 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. 3. 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. 4. 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.							
Can any residual risk be monitored/managed?	Yes. Speed control can be implemented and disturbance at the site can be minimized.						
Will this impact contribute to any cumulative impacts?	Yes. The noise and activity will contribute towards disturbance in the area, but this will be transient and the contribution would be low to moderate						

Impact Description: Following decommissioning, the site will be highly vulnerable to soil erosion.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	H	Negative	H	H	H
With Mitigation	L	L	L	Negative	L	H	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 of topsoil would potentially be an irreplaceable loss of resources.						
Can impact be avoided, managed or mitigated?	With appropriate control measures, erosion risk can be mitigated						
Mitigation measures: 1. 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. 2. There should be regular monitoring for erosion for at least 2 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. 3. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 4. All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.							
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for erosion problems for at least two years after decommissioning, with immediate interventions implemented where actual and potential problems are observed.						
Will this impact contribute to any cumulative impacts?	Yes. Erosion will contribute towards cumulative habitat loss and degradation in the area. If erosion is effectively controlled, then this contribution would be low.						

Impact Description: Following decommissioning, the site will be highly vulnerable to alien plant invasion.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	H	M	Negative	H	H	H
With Mitigation	L	L	L	Negative	L	H	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 not be 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: 1. Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. 2. 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. 3. Regular monitoring for alien plants within the disturbed areas. 4. 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.							
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for alien plant problems following decommissioning.						
Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. However, if aliens are effectively controlled, then this contribution would be low.						

10 BAT ASSESSMENT

The proposed WEF has 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 this 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). This is due to the fact that the project footprint (i.e. turbines, roads) is small compared to the size of the project at 0.37%.

Direct impacts to bats will be limited to species that make use of the airspace in the rotor-swept zone of the wind turbines. Of the five species of bat that were recorded on site, at least four exhibit behaviour that may bring them into contact with wind turbine blades and they are potentially at risk of negative impacts if not properly mitigated. The significance of these potential impacts is outlined below for both the construction and operational phases based on a standard methodology (refer to **Appendix E**).

10.1 Direct Impacts

10.1.1 Construction Phase

Possible Impact: Roost disturbance: A WEF has the potential to impact bats directly through the disturbance of roosts during construction. 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) 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.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	M	M	Negative	M	M	L
With Mitigation	L	M	L	Negative	L	L	L
Can the impact be reversed?					Unknown		

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

Mitigation measures:

1. It may be possible to limit roost abandonment by avoiding construction activities near roosts.
2. No confirmed roosts have been found at the project but there are potential roosts that bats may be using including trees, caves, rocky crevices and buildings.
3. A no-go buffer zone of 200m for turbines, in which no infrastructure (excluding roads) is to come within including the tips of turbine blades, must be applied around potential roosts identified in **Figure 9-2**. The exception here would be the construction of roads which can enter the 200m buffer but cannot pass through any rocky crevices. It is recommended that a bat specialist survey the confirmed turbine locations and all other proposed site infrastructure for the presence of roosts within the 200m buffer before any construction activities commence and once the preliminary design and layout of the site 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.

Possible Impact: Roost destruction: The WEF has the potential to impact bats directly through the physical destruction of roosts during construction. 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. Potential roosts that may be impacted by construction activities include trees, rocky crevices and buildings.

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

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

Mitigation measures:

1. The WEF can 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.
2. A no-go buffer zone of 200m, in which no construction activities may take place or no infrastructure (excluding roads) is to come within including the tips of turbine blades, must be applied around potential roosts identified in **Figure 9-2**. The only exception would be for the construction of roads which can enter the 200 m buffer but cannot pass through any rocky crevices.
3. 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.
4. It is recommended that a bat specialist survey the confirmed turbine locations and all other site infrastructure for the presence of roosts within the 200m buffer before any construction activities commence and once the preliminary design and layout of the site is complete.
5. 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. All contractors are to adhere to the CEMP and should apply good environmental practice during construction.
6. 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.
7. 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 Construction Environmental Management Plan (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.

10.1.2 **Operational Phase**

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

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	H	M	H	Negative	H	M	L
With Mitigation	M	M	H	Negative	M	L	M
Can the impact be reversed?					No		
Will impact cause irreplaceable loss of resources?					Yes		
Can impact be avoided, managed or mitigated?					Yes		

Mitigation measures:

1. There are several mitigation options available to reduce the potential for bat mortality to occur or to reduce bat mortality. Designing the layout of the project to avoid areas that are more frequently used by bats may reduce the likelihood of mortality and should be the primary mitigation measure. This mitigation measure has been implemented as part of the 'embedded' mitigation which occurs during the EIA Process and evolution of the final layout.
2. A no-go buffer zone of 200m, in which no construction activities may take place or no infrastructure (excluding roads) is to come within including the tips of turbine blades, must be applied around landscape features important for bats which have been identified in **Figure 9-2**. The only exception would be for the construction of roads which can enter the 200m buffer but cannot pass through any rocky crevices.
3. Operational acoustic monitoring and carcass searches for bats must be performed to monitor mortality levels for a minimum of two years and according to current (or updated) best practice guidelines. Acoustic monitoring should include monitoring at height and at ground level at more than one location. Records of bat fatality must be shared with the relevant bodies, specifically the South African Bat Assessment Association.
4. If mortality does occur, the level of mortality should be considered by a bat specialist/s 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, turbine blade feathering and using targeted curtailment during specific seasons and time periods for specific turbines.
5. 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 when during WEF operation 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 operating in the region, the species involved and the levels of bat mortality. Bats reproduce slowly 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.

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

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	H	M	H	Negative	H	L	L
With Mitigation	M	M	H	Negative	M	L	M
Can the impact be reversed?					No		
Will impact cause irreplaceable loss of resources?					Yes		

Can impact be avoided, managed or mitigated?	Yes
Mitigation measures: 1. There are several mitigation options available to reduce the potential for bat mortality to occur or to reduce bat mortality. Designing the layout of the project to avoid areas that are more frequently used by bats may reduce the likelihood of mortality and should be the primary mitigation measure. This mitigation measure has been implemented as part of the 'embedded' mitigation which occurs during the EIA Process and evolution of the final layout. 2. A no-go buffer zone of 200m, in which no construction activities may take place or no infrastructure(excluding roads) is to come within including the tips of turbine blades, must be applied around landscape features important for bats which have been identified in **Figure 9-2**. The only exception would be for the construction of roads which can enter the 200m buffer but cannot pass through any rocky crevices. 3. Operational acoustic monitoring and carcass searches for bats must be performed to monitor mortality levels for a minimum of two years and according to current (or updated) best practice guidelines. Acoustic monitoring should include monitoring at height and at ground level at more than one location. Records of bat fatality must be shared with the relevant bodies, specifically the South African Bat Assessment Association. 4. If mortality does occur, the level of mortality should be considered by a bat specialist/s to determine if this is at a level where further mitigation needs to be considered. Mitigation options include using ultrasonic deterrents, raising the cut-in speeds of turbines, turbine blade feathering and using targeted curtailment during specific seasons and time periods for specific turbines. 5. 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 when during WEF operation 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 operating in the region, the species involved and the levels of bat mortality. Bats reproduce slowly 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 if gene flow is prevented in migratory species.

10.2 Indirect Impacts

10.2.1 Construction Phase

Possible Impact: Habitat modification: Bats can be impacted indirectly through the modification or removal of habitats. The removal of vegetation during the construction phase will impact bats by removing cover and linear features that some bats use for foraging and commuting. 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.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	M	M	Negative	M	H	H
With Mitigation	L	M	L	Negative	L	H	H
Can the impact be reversed?				Yes			
Will impact cause irreplaceable loss of resources?				Yes			
Can impact be avoided, managed or mitigated?				Yes			

Mitigation measures: 1. This impact must be reduced by limiting the removal of vegetation as far as possible. 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. All contractors are to adhere to the CEMP and should apply good environmental practice during construction. 2. During the design phase, the bat specialist should conduct a site walkthrough, covering the final road and power line routes as well as the final substation, switching station location and turbine positions, to identify any roosts/activity of sensitive species, as well as any additional sensitive habitats. 3. 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. 4. 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 Construction Environmental Management Plan (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.

Possible Impact: 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. It is assumed that regular night-time lighting will be used only for a short period if construction activities take place at night. This artificial lighting can indirectly impact bats through its effect on insect prey. Lighting attracts 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 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. However, light pollution must be carefully considered and lighting at the project should be kept to a minimum and appropriate types of lighting should be used.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	M	L	Negative	L	M	M
With Mitigation	L	M	L	Negative	L	L	H
Can the impact be reversed?				Yes			
Will impact cause irreplaceable loss of resources?				Yes			
Can impact be avoided, managed or mitigated?				Yes			

Mitigation measures: 1. This impact can be mitigated by using as little lighting as possible. Where lights need to be used, these should have low attractiveness for insects such as low pressure sodium and warm white LED lights. High pressure sodium and white mercury lighting is attractive to insects and should not be used as far as possible.	
Will this impact contribute to any cumulative impacts?	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 for cumulative impacts to be low.

10.2.2 **Operational Phase**

Possible Impact: Habitat creation in high risk locations: The construction of a WEF and associated building infrastructure may inadvertently provide new roosts for bats. It has been suggested that some bats may investigate wind turbines for their potential roosting spaces 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 road culverts at the WEF (J. Aronson, personal observation). The likelihood of large numbers of bats roosting in infrastructure at the project is low. Nonetheless, bats should be prevented from entering 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.

	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 of resources?				Yes			
Can impact be avoided, managed or mitigated?				Yes			

Mitigation measures:

1. 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.

Possible Impact: Light pollution: The indirect impact of light pollution created during the construction phase would persist if lighting is also used during the WEF's operational activities. This excludes turbine aviation lights which do not appear to impact bats. During the operation of the WEF, it is assumed that the only light sources would be motion sensor security lighting for short periods, turbine lighting at ground level and lighting associated with the substation and switching station. This artificial lighting would impact bats indirectly via the mortality of their insect prey thereby reducing foraging opportunities for certain bat species. However, other bat species actively forage around artificial lights due to the higher numbers of insects which are attracted to these lights. 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. This impact is likely to be low with mitigation but must be carefully considered. 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 of resources?				Yes			
Can impact be avoided, managed or mitigated?				Yes			

Mitigation measures:

1. This impact can be mitigated by using as little lighting as possible. Where lights need to be used, these should have low attractiveness for insects such as low pressure sodium and warm white LED lights. High pressure sodium and white mercury lighting is attractive to insects 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.

Possible Impact: Loss of ecosystem services: Bats play a critical role in many ecosystems by providing valuable ecosystem services such as pest control by insectivorous bats in agricultural systems, including in South Africa. The value of bats to this industry can be substantial. Bats also prey on other insects pests like mosquitoes which are vectors for diseases like Rift Valley Fever which can impact livestock. The loss of bats via mortality at WEFs can therefore indirectly have unanticipated social, economic and ecological impacts by reducing ecosystem service provision beyond the lifespan of the project. The degree of the impact will be influenced by the levels of bat mortality experienced.

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

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

Mitigation measures:

1. Mitigation measures targeted towards reducing bat mortality should be applied.
2. 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. This mitigation measure has been undertaken and included in the final layout as 'embedded' mitigation.
3. Operational acoustic monitoring and carcass searches for bats should be performed to monitor mortality levels. Acoustic monitoring should include monitoring at height and at ground level.
4. If mortality does occur, the level of mortality should be considered by a bat specialist/s to determine if this is at a level where further mitigation needs to be considered. Mitigation options include using ultrasonic deterrents, raising the cut-in speeds of turbines, turbine blade feathering and using targeted curtailment during specific seasons and time periods for specific turbines.
5. It is advised that both pre-construction and operational monitoring data are used to confirm the need for mitigation measures such as curtailment and to determine at during WEF operation such mitigation needs to be implemented.

Will this impact contribute to any cumulative impacts?	Because insectivorous bats are apex predators, good bio-indicators of ecosystem health, consume large amounts of insects and provide important pest control services, the cumulative impact of excessive bat mortality over a large region could be high, however there is considerable uncertainty in the ecosystem level impacts of bat mortality at WEFs.

11 AVIFAUNA ASSESSMENT

11.1 Types of Impacts

Types of potential impacts include:

- Habitat loss;
- Disturbance and displacement;
- Electrocution;
- Power line collisions;
- Turbine collisions; and
- Disruption of local bird movements.

Each type of potential impact has been assessed by the avifaunal specialist for both the construction and operational phases, as well as for the decommissioning and closure phases. The impact assessment tables below describe each potential impact and list mitigation measures. The mitigation which includes buffers and no-go areas has been included in the final layout as 'embedded' mitigation. An important mitigation measure to note is the pre-construction walk-though and the operational monitoring which is to take place should authorisation be received.

11.1.1 *Construction Phase - Habitat Destruction*

The extent of this impact is local and confined to the project site. Habitat destruction can be temporary in the case of, for example construction offices and laydown areas, or will last for the duration of the project, in the case of turbine foundations and substation compounds. The impact can be permanent (long-term) if no rehabilitation takes place, following the decommissioning of the development. The intensity of this impact is considered to be medium negative as a partial loss of habitat and resources will occur. As habitat destruction will definitely occur during construction the probability of this impact is high. The resulting significance of the impact is medium with a high confidence.

Mitigation measures can reduce the duration of the impact to the lifetime of the project, and decrease the intensity to low negative, which would result in a low significance rating for this impact.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	M	Negative	M	H	H
With Mitigation	L	M	L	Negative	L	H	H
Can the impact be reversed?			Yes – Areas disturbed during construction can be rehabilitated after construction and after decommissioning				
Will impact cause irreplaceable loss of resources?			NO – rehabilitation of habitat is possible				
Can impact be avoided, managed or mitigated?			Yes–The total area of impact (and thus the intensity rating) can be minimised. Turbine and associated infrastructure areas can be rehabilitated after project close.				

Mitigation measures:

1. A site specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat. All contractors are to adhere to the EMPr and should apply good environmental practice during construction
2. High traffic areas and buildings such as offices, batching plants, storage areas etc. should where possible be situated in areas that are already disturbed;
3. Existing roads and farm tracks should be used where possible;
4. The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths;
5. No turbines should be constructed in no-go areas, while associated infrastructure should be avoided where possible in these areas;
6. Construction of infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
7. No off-road driving;
8. Environmental Control Officers to oversee activities and ensure that the site specific construction EMPr is implemented and enforced;
9. 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.
10. Any clearing of stands of alien trees on site should be approved first by an avifaunal specialist.
11. 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 Construction EMPr.

11.1.2 *Construction Phase - Disturbance and Displacement*

Disturbances and noise from staff and construction activities can impact on certain sensitive species particularly whilst feeding and breeding. This may result in these species being displaced from the project site into other areas. The extent of this impact will be restricted to the immediate WEF site (local). It is expected that the majority of displacement will occur for the duration of the construction phase but some species may take longer to return. The impact

is considered to be of high intensity and negative. The probability of some displacement occurring is considered definite with a high confidence during the busy construction period, resulting in a medium significance of this impact.

If all mitigation measures are adhered to, the duration of the impact can be restricted to the construction phase (short-term) and the intensity of the impact can be lowered to medium, resulting in a low significance rating.

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

1. A site specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMP and should apply good environmental practice during construction.
2. Environmental Control Officers (ECO) to oversee activities and ensure that the site specific EMPr is implemented and enforced;
3. The appointed ECO must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), 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.
4. 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/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.
5. No turbines should be constructed in no-go areas, while associated infrastructure should be avoided where possible in these areas;
6. Construction of infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible;
7. During the construction phase, an avifaunal specialist must conduct surveys/exploration of the WEF site (particularly focusing on the Martial Eagle and Verreaux's Eagle Roost sites as well as suitable cliff nesting habitat). 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 nest sites, so that these may continue to be monitored during the construction and operation phase, along with the monitoring of already identified nest sites; and
8. Appoint a specialist to design and conduct monitoring of the breeding of raptors at the two identified nests (to date) of African Harrier Hawk and Verreaux's Eagle as well as any additionally located nests. 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.

11.1.3 *Operational Phase – Disturbance and Displacement*

It is expected that some species potentially occurring on the WEF site will be susceptible to displacement during the operational phase, for example smaller passerines such as larks, coursers and large terrestrial Red Data species such as Karoo Korhaan and Ludwig's Bustard. The extent of the impact will be restricted to the sites of disturbance within the WEF site. The duration of the impact will last for the duration of operations. The intensity is considered potentially high and probable to occur, resulting in a medium significance.

With implementation of the mitigation measures, the intensity can be lowered significantly to low resulting in a low significance.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	M	H	Negative	M	H	H
With Mitigation	L	M	L	Negative	L	M	H
Can the impact be reversed?	Possibly – After decommissioning and rehabilitation displaced species will possibly return.						
Will impact cause irreplaceable loss of resources?	Possibly – 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:

1. 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.
2. 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.
3. Operational phase bird monitoring, in line with applicable guidelines, must be implemented and must include monitoring of all raptor nest sites for breeding success.
4. No turbines should be constructed in no-go areas, while associated infrastructure should be avoided where possible in these areas; and
5. Construction of infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible.

11.1.4 *Operational Phase – Electrocution*

The impact occurs locally and is restricted to powerlines within the Komsberg East WEF site. A result of this impact is mortality which could affect the breeding success of species and their populations, therefore the intensity of the impact is considered to be potentially high and the duration is long-term. As electrocution is known to affect many species in South Africa the impact is probable to occur. Therefore the significance of the impact would be high without mitigation.

If all powerlines are either underground or of a bird-friendly design, the probability of electrocution occurring can be significantly reduced so that the intensity of the impact would be low. The duration of the impact would then be restricted to the life time of the project and reversible, resulting in an impact of low significance.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	H	Negative	H	M	M
With Mitigation	L	M	L	Negative	L	L	M
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 of 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: 1. Electrical infrastructure should not be constructed in 'no-go areas' and construction of infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible; 2. Place power lines underground where possible; 3. 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 of 1.8m or greater and which provides a safe bird perch.							

11.1.5 *Operational Phase - Collisions with Power Lines*

The extent of this impact is restricted to constructed powerlines within the Komsberg East WEF. If severe the effect could last beyond the duration of their existence. A result of this impact would be mortality which may affect the viability of a population and so the potential intensity is considered high negative. The impact is probable. The resulting significance is potentially high.

If mitigation measures are adhered to the intensity of the impact can be significantly reduced to low, which would prevent the duration extending beyond the lifespan of the project (medium), resulting in a low significance rating.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	H	Negative	H	M	L
With Mitigation	L	M	L	Negative	L	M	L
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 of resources?	Possibly – Collisions with 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 distance of overhead power lines and increasing their visibility by fitting bird flight diverters (BFD's) can reduce the number of collisions.						
Mitigation measures: 1. Electrical infrastructure should not be constructed in 'no-go areas' and construction of infrastructure must consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible; 2. Place new power lines underground where possible; 3. Place new overhead power lines adjacent to existing power line or linear infrastructure (e.g. roads and fence lines); 4. Attach appropriate marking devices (BFDs) on all new overhead power lines to increase visibility. Once the final power line route has been authorised and the tower/pylon positions have been pegged, an avifaunal specialist must conduct a 'walkthrough' of the authorised route prior to construction in order to identify the exact spans of line that require BFDs. 5. Develop and implement a carcass search programme for birds during the first two years of operation, in line with the South African monitoring guidelines. This program must include monitoring of overhead power lines.							

11.1.6 *Operational Phase - Collisions with Wind Turbines*

The duration of the impact will be high at least for the operational phase of the facility, but could impact populations permanently through local extinctions. The intensity of the impact is high. The effect could have an impact on the regional population of certain species and the extent is therefore considered high. The resulting significance of the impact is high negative.

If the mitigation measures detailed below are implemented, especially if turbine placement is informed by the avifaunal sensitivity map and the No-go Areas, then the extent of the impact could be reduced to local (medium), the duration to the lifespan of the facility (medium), and the intensity to medium (partial loss and slight alteration). The resulting significance with mitigation would be medium.

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

Note: The extent of the impact will be on site at a turbine where the bird collides, but if numerous collisions of an important species occur, e.g. Verreaux's Eagle, this could have an impact on the local Roggeveld/Moordenaars Karoo population, and even an impact on a more regional scale. The loss of this keystone apex predator may have other ecological impacts beyond the site boundary.

Can the impact be reversed?	Possibly – 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 of 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 intensity and probability of the impact can potentially be reduced through informed placement of turbines.

Mitigation measures:

1. Turbines must not be constructed within any of the High Sensitivity Zones identified.
2. The hierarchy of sensitivity zones should be considered, with preferential turbine placement in areas of Unknown, No or Low Sensitivity, and decreasing preference through to Medium-High Sensitivity Zones. Where two or more sensitivity areas overlap, the layer with the higher sensitivity designation should take preference.
3. Develop and implement a carcass search programme for birds during the first two years of operation, in line with the South African monitoring guidelines.
4. Develop and implement a 24 month post-construction bird activity monitoring program that mirrors the pre-construction monitoring surveys completed by Arcus and is in line with the South African post-construction monitoring guidelines. This program must include thorough and ongoing nest searches and nest monitoring.
5. 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.
6. 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), 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. As a starting point for the review of possible mitigations, the following may need to be considered:
    a. Assess the suitability of using deterrent devices (e.g. DT Bird and ultrasonic/radar/electromagnetic deterrents for bats) to reduce collision risk.
    b. Identify options to modify turbine operation to reduce collision risk.

11.1.7 *Operational Phase - Disruption of Local Bird Movement Patterns*

The extent of this impact would affect bird populations travelling through the area and therefore extend beyond the boundaries of the wind farm and is thus classified as medium.

The duration would be for the lifespan of the project (medium). The intensity would be moderate and the resulting significance medium.

While some mitigation is possible by avoiding turbine placement in obvious flyways, and by making turbines more visible through lighting, this will not change the significance of this impact.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	M	M	Negative	M	M	L
With Mitigation	M	M	M	Negative	M	M	L
Can the impact be reversed?	Yes						
Will impact cause irreplaceable loss or resources?	Possibly – Impact is not well understood.						
Can impact be avoided, managed or mitigated?	Partially- Local and regional movement of species is not well understood and so mitigation measures are difficult to identify.						

Mitigation measures:

1. Turbines must not be constructed within any of the High Sensitivity Zones identified.
2. The hierarchy of sensitivity zones should be considered, with preferential turbine placement in areas of Unknown, No or Low Sensitivity, and decreasing preference through to Medium-High Sensitivity Zones. Where two or more sensitivity areas overlap, the layer with the higher sensitivity designation should take preference.
3. 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.

11.2 Avifaunal Sensitivity Mapping

Avifaunal sensitivity mapping has been done to advise the WEF design and the turbine layout (**Figure 9-4**). Following four seasonal surveys, flight activity of Verreaux's Eagle, Jackal Buzzard, and Rock Kestrel as well as the location of raptor nests are the most important considerations in the turbine layout/design process.

The process of compiling an avifaunal sensitivity map for the WEF included the identification of sensitivity zones based on landscape features (e.g. nest sites and rivers) as well as the identification of sensitivity zones based on observed flight activity during twelve months of avifaunal monitoring.

It is recommended that turbine placement follow a hierarchy with preferential placement in No Sensitivity Zones, followed by Low, Medium and then Medium High Zones. No turbines should be placed in avifaunal No-go Areas. Where two or more sensitivity areas overlap spatially, the layer with the higher sensitivity designation is applicable.

Note that Birdlife SA and the Birds and Renewable Energy Specialist Group (BARESG) are currently compiling guidelines for Verreaux's Eagle which will require a minimum buffer of 3km, while a study in the Cederberg on Verreaux's Eagles confirmed that the majority of activity of this species in that area is within 3km of the nest site.

The above has been considered when designating a 1km' No-go' buffer and a 3km Medium-High Sensitivity Zone around the Verreaux's Eagle nests on this WEF site. Furthermore, an additional 'adjusted buffer' designated as a no-go area was created by starting with a 3km circular buffer, and then adjusting it ('shaping' it) based on areas of high flight activity.

11.2.1 *High Sensitivity Zones*

High Sensitivity Zones are designated as No-go areas for turbine placement, and it is strongly recommended that associated infrastructure (particularly overhead power lines) be placed outside of these areas (note that the final layout has taken cognisance of these zones). They include the following:

- 1km radius around a Martial Eagle Roost (west);
- 1km radius around Verreaux's Eagle roosts (east);
- 1km radius around Verreaux's Eagle nests (east);
- 500m radius around African Harrier Hawk Nest (east);
- A reshaped buffer of the active Verreaux's Eagle nest on the WEF site, based on a detailed analysis of Verreaux's Eagle flight data and an associated grid cell flight sensitivity score for Verreaux's Eagles;
- 200m buffer of agricultural fields; and
- 200m buffer of National Freshwater Ecosystem Priority Areas (NFEPA) wetlands (including dams) and Rivers.
- 200m x 200m Grid Cells with a High Grid Cell Sensitivity Score (GCSS) based on observed flight activity.

11.2.2 *Medium-High Sensitivity Zones*

Turbines and infrastructure can be built in these zones although it is strongly recommended that infrastructure and turbines, where possible, be placed first in zones of lower sensitivity. Medium-High Sensitivity Zones include:

- 1km – 2 km zone from Martial Eagle Roost (west);
- 1km – 2km zone from Verreaux's Eagle Roosts (east);
- 500m – 1km zone from African Harrier Hawk Nest (east); and
- 3km radius around active Verreaux's Eagle Nests (east).
- 200m x 200m Grid Cells with a Medium-High Grid Cell Sensitivity Score (GCSS) based on observed flight activity.

11.2.3 *Medium Sensitivity Zones*

Turbines and infrastructure can be built in these zones although it is recommended that infrastructure and turbines, where possible, be placed first in zones of Low or Unknown sensitivity. Medium Sensitivity Zones include:

- 1km radius around Inactive Unidentified Raptor Nests.
- Steep slopes (i.e areas with a >25% slope) buffered by 100m.
- 150m buffer of Dolerite sills (i.e. rocky outcrops that provide habitat for the Verreaux's Eagle's preferred prey species, the Rock Hyrax or 'Dassie').
- 200m x 200m Grid Cells with a Medium Grid Cell Sensitivity Score (GCSS) based on observed flight activity.

11.2.4 *Low Sensitivity Zones*

These zones consist of 200m X 200m Grid Cells with a Low Grid Cell Sensitivity Score (GCSS) based on observed flight activity, that fall outside of any of the zones indicated above. For example, a Grid Cell may have a low GCSS, based on flight activity, but it falls within the steep slopes buffer, the grid cell would then be considered to be of Medium Sensitivity.

11.2.5 *Unknown Sensitivity or No Sensitivity Zones*

These are all areas outside of the zones discussed above, and or areas without a GCSS. These area were either not covered by VP viewsheds, or if they were within a viewshed, priority species were not recorded, and there were no other obvious avifaunal features that could be designated. Areas of Unknown or No Sensitivity are preferred for turbine placement.

12 AQUATIC ECOSYSTEMS ASSESSMENT

12.1 Construction and Operational Phase Impact Assessment

12.1.1 *Potential Impacts*

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

- Loss of aquatic species of special concern, and
- Wetland loss as no natural wetlands were observed in close proximity to any of the proposed infrastructure (i.e. within 500m of the roads layout).
- The following direct and indirect impacts were assessed as indicated below with regard the riparian areas and water courses:
- Loss of riparian systems and water course - The physical removal of the narrow strips of riparian zones and disturbance of any alluvial watercourses by road crossings, being replaced by hard engineered surfaces. This biological impact would be localised, as a large portion of the remaining catchment would remain intact.
- Impact on riparian systems through the possible increase in surface water runoff on riparian form and function from hard surfaces or roads
- Increase in sedimentation and erosion within the development footprint.
- Potential impact on localised surface water quality– During site preparation and 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.

12.1.2 *Significance Assessment*

Nature of impact: 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 alluvial watercourses by road crossings, being replaced by hard engineered surfaces. This biological impact would be localised, as a large portion of the remaining catchment would remain intact.

	Without mitigation	With mitigation
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:

1. 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 (small footprint).
2. No vehicles to refuel or be maintained within drainage lines/ riparian vegetation.
3. During the operational phase, monitor culverts to see if erosion issues arise and if any erosion control is required.
4. 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.

Cumulative impacts:

The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is likely to occur, considering that the site is near the main drainage channels particularly when considering a possible 6-9 other renewable projects. However the annual rainfall figures are low and this impact is not anticipated and only a small percentage of the proposed projects reach the construction phase.

Residual impacts:

Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.

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

Nature of impact: Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and/or the road crossings on riparian form and function during the operational phase.		
	Without mitigation	**With mitigation**
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:
1. Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities.

Cumulative impacts:
Downstream alteration of hydrological regimes due to the increased run-off from the area. 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. This is also coupled to the fact that surrounding developments would impact on a different catchments in the neighbouring water management area, coupled to the low average rainfall figures.

Residual impacts:
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.

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

Nature of impact: Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase.		
	Without mitigation	**With mitigation**
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:
Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities.

Cumulative impacts:
Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream). 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.

Residual impacts:
During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream. 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.

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

Nature of impact: Impact on localized surface water quality mainly during the construction phase.
During both preconstruction, 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.

	Without mitigation	**With mitigation**
Reversibility	Yes (high)	Yes (high)
Irreplaceable loss of resources	Yes (medium)	Yes (low)
Can impacts be mitigated	Yes (high)	

Mitigation:
1. Strict use and management of all hazardous materials used on site.
2. Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.).

3. Containment of all contaminated water by means of careful run-off management on the development site. 4. Strict control over the behaviour of construction workers. 5. 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. 6. Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.
Cumulative impacts: 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.
Residual impacts: Residual impacts will be negligible after appropriate mitigation.

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

12.1.3 *Recommended Buffers*

Presently there are no prescribed aquatic buffers other than those proposed in the Northern Cape, thus the recommendations by Desmet and Berliner (2007)[43] will be applied as these are becoming more widely accepted (**Table 12-1**). The design of the WEF needs to take these buffers into consideration during the planning phase, i.e. construction, associated batch plants, stockpiles, lay down areas and construction camps should avoid these buffer areas i.e. 32m for this development.

Table 12-1: Recommended buffers for rivers, with those applicable to the project highlighted in green.

River criterion used	Buffer width (m)	Rationale
Mountain streams and upper foothills of all 1:500 000 rivers, i.e. rivers mapped at this scale by DWS	50	These longitudinal zones generally have more confined riparian zones than lower foothills and lowland rivers and are generally less threatened by agricultural practices.
Lower foothills and lowland rivers of all 1:500 000 rivers i.e. rivers mapped at this scale by DWS	100	These longitudinal zones generally have less confined riparian zones than mountain streams and upper foothills and are generally more threatened by development practices.
All remaining 1:50 000 scale streams, i.e. all systems that appear on the topo-cadastral maps at this scale	32	Generally smaller upland streams corresponding to mountain streams and upper foothills, smaller than those designated in the 1:500 000 rivers layer. They are assigned the riparian buffer required under South African legislation.

13 HERITAGE ASSESSMENT

13.1 Impacts to palaeontological heritage

The main cause of impacts to palaeontological sites is physical disturbance/destruction of fossil material and its context which in the study area, which may result in an un-redeemable loss to science and knowledge.

It is expected that impacts will be limited (local). There is a chance that the deep excavations for bases could potentially impact buried fossil material, similarly excavation of cable trenches and clearing of access roads could impact material that lies buried in the surface mudstones. Potential impacts caused by power line and proposed access roads are similarly likely to be

[43] Berliner D. and Desmet P. 2007. Eastern Cape Biodiversity Conservation Plan: Technical Report. Department of Water Affairs and Forestry Project No 2005-012, Pretoria. 1 August 2007

limited and local. The physical survey of the study area has shown that palaeontological material is not in the study area therefore the significance of impacts is likely to be low.

In terms of the information that has been collected, indications are that impacts to palaeontology will be low provided that mitigation is in place. Note that in real terms, the impact is very low but because the duration is always permanent (archaeological material cannot be replaced if lost) the significance results in a medium.

The loss of palaeontological material is usually considered to be negative; however opportunities for the advancement of science and knowledge can result, provided that professional assessments and mitigation is carried out. Without mitigation the impact will be medium negative, but potentially positive with successful mitigation.

No specialist palaeontological monitoring is recommended, pending the discovery of significant new fossil sites during development (e.g. well-preserved vertebrate bones, teeth and trackways, concentrations of petrified wood and/ or other plant fossils). Recommended mitigation of chance fossil finds during the construction phase involves safeguarding of the fossils (preferably *in situ*) by the responsible ECO, reporting of finds to Heritage Western Cape. Where appropriate, judicious sampling and recording of fossil material and associated geological data by a qualified palaeontologist may be required by the heritage regulatory authorities. These recommendations should be included within the Environmental Management Programme.

All South African fossil heritage is protected by law (South African Heritage Resources Act, 1999) and fossils cannot be collected, damaged or disturbed without a permit from SAHRA or the relevant Provincial Heritage Resources Agency (in this case, Heritage Western Cape for the Western Cape and SAHRA for the Northern Cape).

The palaeontologist concerned with mitigation work will need a valid fossil collection permit from HWC/SAHRA and any material collected would have to be curated in an approved depository (e.g. museum or university collection).

All palaeontological specialist work would have to conform to international best practice for palaeontological fieldwork and the study (e.g. data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies recently developed by the SAHRA.

Nature of Impact: Construction - Possibility of encountering unique fossils during excavation for turbine foundations.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	L	Negative	M	M	H
With Mitigation	L	H	L	Neutral – Positive	M	M	H
Can the impact be reversed?	No. Palaeontological heritage resources are non-renewable and key contextual data for fossils (sedimentology, taphonomy) is difficult to reconstruct following disturbance						
Will impact cause irreplaceable loss or resources?	Possible but unlikely – well-preserved, scientifically valuable fossils are scarce within the project area. Many of the fossils concerned are probably of widespread occurrence (Exceptions: well-preserved, articulated vertebrate skeletons, vertebrate trackways).						
Can impact be avoided, managed or mitigated?	Yes. Effective mitigation of chance fossil finds by the ECO and a professional palaeontologist is possible.						
Mitigation measures: 1. Safeguarding of chance fossil finds (preferably *in situ*) during the construction phase by the responsible ECO, followed by reporting of finds to Heritage Western Cape/SAHRA. 2. Recording and judicious sampling of significant chance fossil finds by a qualified palaeontologist, together with pertinent contextual data (stratigraphy, sedimentology, and taphonomy) within the final footprint. 3. Curation of fossil material within an approved repository (museum/university fossil collection) by a qualified palaeontologist.							
Can any residual risk be monitored/managed?	Yes, through ongoing application of the fossil chance finds procedure by ECO.						

Will this impact contribute to any cumulative impacts?	Yes. Cumulative impacts, albeit low-level, on local fossil heritage resources are anticipated as a result of construction of the considerable number of wind energy facilities that have been proposed for the Sutherland area.

13.2 Impacts to archaeological material

The main cause of impacts to archaeological sites is physical disturbance of the material itself and its context. The heritage and scientific potential of an archaeological site is highly dependent on its geological and spatial context. This means that even though, for example a deep excavation may expose archaeological artefacts, the artefacts are relatively meaningless once removed from the area in which they were found. In the case of the proposed activity the main source of impact (if any) is likely to be the construction of access roads, lay-down areas and excavation of the footings of the turbines.

It is expected that impacts will be very limited, if any (local). Most of the areas that will be affected by the proposed activity are archaeologically sterile due to their unfavourable habitation conditions. Potential impacts caused by power line and proposed access roads are similarly likely to be limited and local.

In terms of the information that has been collected, indications are that impacts to pre-colonial archaeological material will be extremely limited if at all. In terms of buried archaeological material, one can never be sure of what lies below the ground surface, however indications are that this is extremely sparse and that impacts caused by the construction of footings and other ground disturbance is likely to be negligible. Note that in real terms, the impact is very low but because the duration is always permanent (archaeological material cannot be replaced if lost) the significance results in a medium.

The destruction of archaeological material is usually considered to be negative; however opportunities for the advancement of science and knowledge about a place can result provided that professional assessments and mitigation is carried out in the event of an unexpected find. In this case, there is so little material on site that there will be no opportunity to benefit therefore the impact will be neutral.

Nature of Impact: Construction - Displacement or destruction of archaeological material.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	L	Negative-neutral	M	L	H
With Mitigation	L	H	L	Negative neutral	M	L	H
Can the impact be reversed?	Mitigation is not required, low or no impact expected. Significance of impact does not change even though precautionary mitigation suggested.						
Will impact cause irreplaceable loss or resources?	No, the very few occurrences noted are well represented in other area.						
Can impact be avoided, managed or mitigated?	Yes, impacts can be managed at level of ECO.						
Mitigation measures: Precautions only. 1. Do not disturb and old stone kraals or ruins, do not remove stone from walls, or artefacts from the earth or earth surface. 2. Report any chance discoveries of human remains to an archaeologist or a heritage authority.							
Can any residual risk be monitored/managed?	Yes, mainly through avoidance or seeking advice from and archaeologist or heritage authority if necessary.						
Will this impact contribute to any cumulative impacts?	No. The site is not considered archaeologically sensitive and has few unique qualities.						

13.3 Impacts to colonial period heritage (buildings and historical sites of significance)

Historic structures are sensitive to physical damage such as demolition as well as neglect. They are also context sensitive in that changes to the surrounding landscape will affect their significance.

Direct impacts are not expected. Some visual impacts in terms of Karoo context are possible; however most heritage structures and ruins are situated clear of the proposed activity.

Given that there are no structures or historical sites that will be affected by the proposed Komsberg East WEF, impacts will be low.

Within the boundaries of the proposed wind energy facility, impacts are considered to be low negative.

Nature of Impact: Construction and Operation - Displacement or destruction of colonial period heritage structures.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	L	Negative-neutral	M	L	H
With Mitigation	L	H	L	Positive - neutral	M	L	H
Can the impact be reversed?	In the unlikely event of impacts occurring, they cannot be reversed without compromising authenticity. Precautionary mitigation is provided, however the significance of impact will be reduced if structures can be avoided.						
Will impact cause irreplaceable loss or resources?	No, this kind of heritage is well represented in the region.						
Can impact be avoided, managed or mitigated?	Yes, impacts can be managed at level of ECO.						
Mitigation measures (Precautionary only): 1. Do not disturb and old stone kraals or ruins, do not remove stone from walls, or artefacts from the earth or earth surface. 2. Do not demolish without HWC authorisation, ideally reuse old structures and cottages, care for the fabric but change it as little as possible.							
Can any residual risk be monitored/managed?	Yes, mainly through avoidance or seeking advice from an archaeologist or heritage authority if necessary.						
Will this impact contribute to any cumulative impacts?	No. The site is not considered archaeologically sensitive and has few unique qualities. Most of the heritage sites are in valley bottoms which will not be affected by the proposal.						

13.4 Cultural landscape and setting

Cultural landscapes are highly sensitive to accumulative impacts and large scale development activities that change the character and public memory of a place. In terms of the National Heritage Resources Act, a cultural landscape may also include a natural landscape of high rarity value, aesthetic and scientific significance. The construction of a large facility can result in changes to the overall sense of place of a locality, if not the Roggeveld-Komsberg region.

Wind turbines are large structures which will affect the atmosphere of the "place". While this impact may be considered local in terms of physical extent, there may be wider implications in terms of the change in "identity" of the area and the accumulative effect this could have on future tourism potential. The impact of the proposed activity will be local but with a likely contribution to accumulative impacts.

Nature of Impact: Construction and Operation - Alteration of sense of place and landscape quality.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	H	Negative	M	M	H
With Mitigation	L	M	H	Negative	M	M	H

Can the impact be reversed?	Impact can be reversed after the life of the facility, however it is not expected that complete rehabilitation will be possible.
Will impact cause irreplaceable loss or resources?	No. Not if rehabilitation can be achieved after life of the facility.
Can impact be avoided, managed or mitigated?	No. Some moderate reduction in impacts may be possible with adherence to findings of the VIA
Mitigation measures: 1. Mitigation not possible due to size of turbines, hence significance of impact remains the same. 2. Adhere to findings and recommendations of the VIA	
Can any residual risk be monitored/managed?	Not possible.
Will this impact contribute to any cumulative impacts?	Yes, this will contribute to a general aesthetic degeneration of the Great Escarpment area, a remote scenic region of the Western Cape Karoo. It has been deemed an ideal locality in terms of its wind resources. The high volume of proposals for the area will result in industrialisation of a natural place of good aesthetic value. Depending on how many are built the impact on cultural/heritage sense of place could be high.

14 NOISE ASSESSMENT

This section documents the assessment of the preferred and alternative layouts. The noise impact assessment of the final layout is included in section 19.2.

14.1 Current Noise Level Assessment

The ambient sound levels were low and the area is considered naturally quiet. The site is too far from any roads or any other significant noise sources to consider potential cumulative impacts. Other activities in the area are highly unlikely to influence night-time sound levels. The larger project area is considered to have a sound character typical of a rural noise district.

14.1.1 ***Construction Phase Noise Impact***

Construction activities are highly dependent on the final operational layout. The two layouts as provided by the developer for the WEFs are presented in **Figure 9-5** (alternative layout) and **Figure 9-6** (preferred layout). As can be seen from these layouts, a number of different activities might take place close to potentially sensitive receptors, each with a specific potential impact.

14.1.1.1 *Description of Construction Activities Modelled*

The following construction activities could take place simultaneously and were considered as a noise source:

- General work at a temporary workshop area. This would be activities such as equipment maintenance, off-loading and material handling. All vehicles will travel to this site where most equipment and material will be off-loaded (general noise, crane). Material, such as aggregate and building sand, will be taken directly to the construction area (foundation establishment). It was assumed that activities will be taking place for 16 hours during the 16 hour daytime period.
- Surface preparation prior to civil work. This could be the removal of topsoil and levelling with compaction, or the preparation of an access road (bulldozer/grader). Activities will be taking place for 8 hours during the 16 hour daytime period.
- Preparation of foundation area (sub-surface removal until secure base is reached – excavator, compaction, and general noise). Activities will be taking place for 10 hours during the 16 hour daytime period.
- Pouring and compaction of foundation concrete (general noise, electric generator/compressor, concrete vibration, mobile concrete plant, TLB). As foundations must be poured in one go, the activity is projected to take place over the full 16 hour day time period.

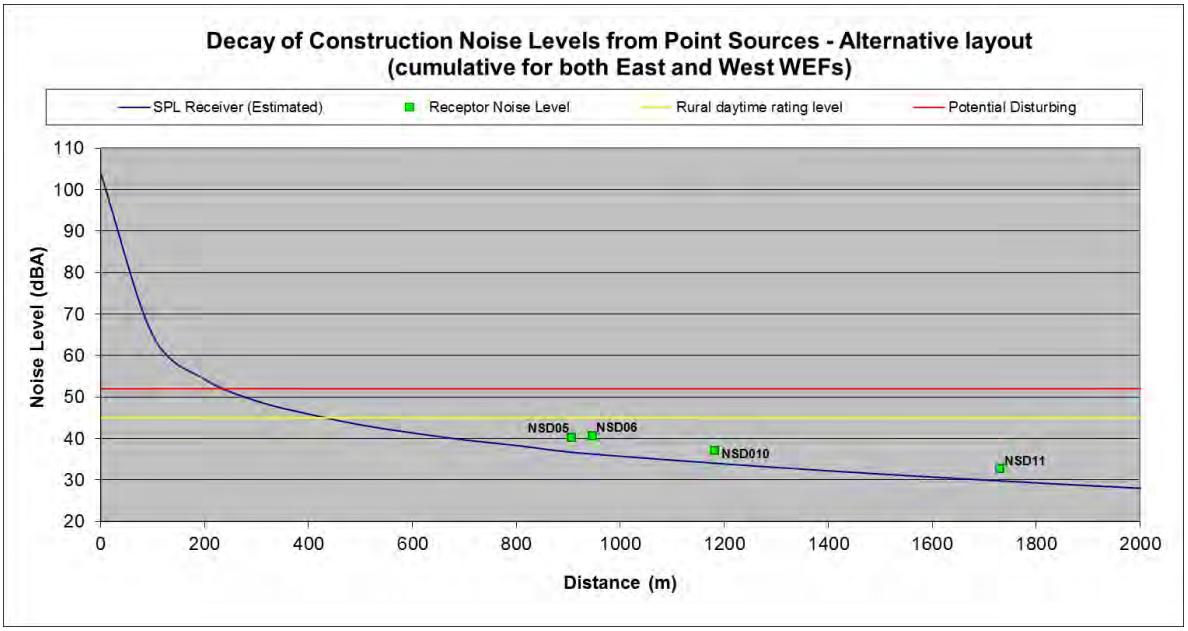
- Erecting of the wind turbine generator (general noise, electric generator/compressor and a crane). Activities will be taking place for 16 hours during the 16 hour daytime period.
- Traffic on the site (trucks transporting material, aggregate/concrete, work crews) moving from the workshop/store area to the various activity sites. All vehicles to travel at less than 60km/h, with a maximum of five trucks and vehicles per hour to be modelled travelling to the areas where work is taking place.

It is assumed that all equipment would be operating under full load (generate the most noise) at a number of locations and that atmospheric conditions would be ideal for sound propagation. This is likely the worse-case scenario that can occur during the construction of the facility.

As it is unknown where the different activities may take place, it was selected to model the impact of the noisiest activity (laying of foundation totalling 113.6dBA cumulative noise impact – various equipment operating simultaneously) at all locations (over the full daytime period of 16 hours) where wind turbines (or power pylons) may be erected for both layouts, calculating how this may impact on potential noise-sensitive developments (refer to **Graphs 14-1 and 14-2**). Noise created due to linear activities (roads) were also evaluated and plotted against distance as illustrated in **Graph 14-3**.[44]

Even though construction activities are projected to take place only during the day time, it may be required at times that construction activities take place during the night (particularly for a large project). Construction activities that may occur during night time include:

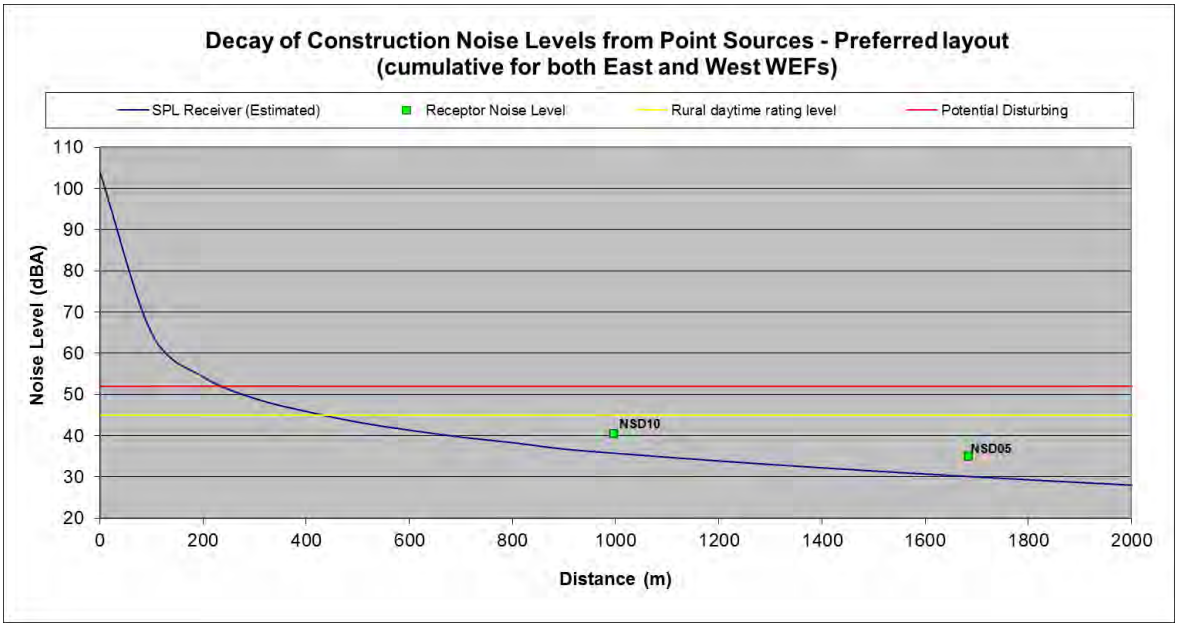
- Concrete pouring: Large portions of concrete do require pouring and vibrating to be completed once started, and work is sometimes required until the early hours of the morning to ensure a well-established concrete foundation. However the work force working at night for this work will be considerably smaller than during the day.
- Working late due to time constraints: Weather plays an important role in time management in construction. A spell of bad weather can cause a construction project to fall behind its completion date. Therefore, it is hard to judge beforehand if a construction team would be required to work late at night.



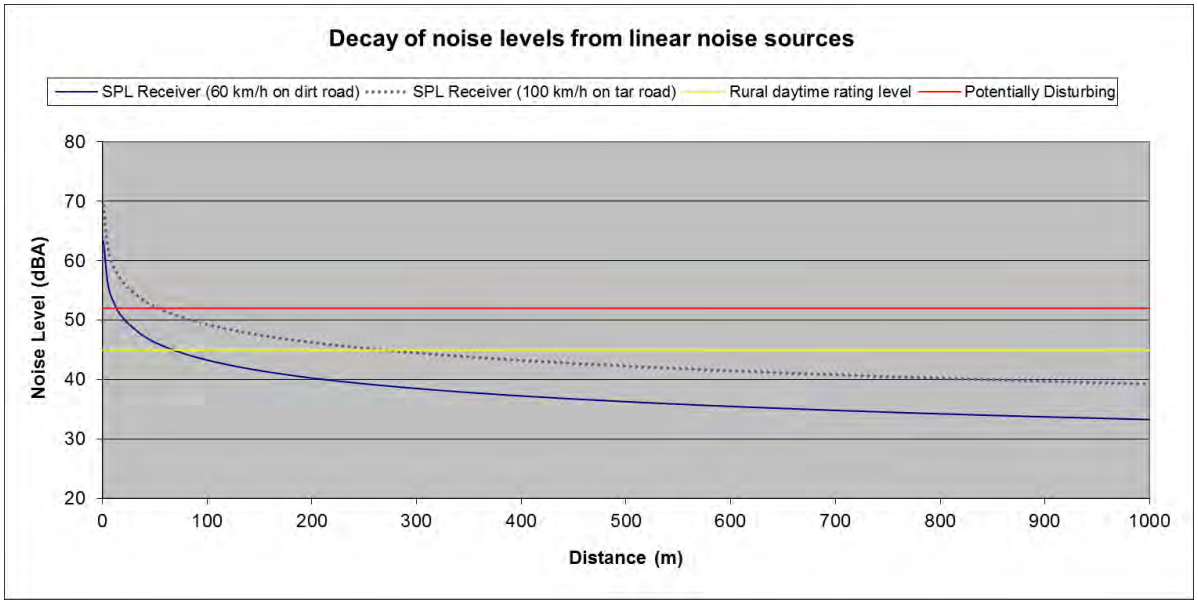
Graph 14-1: Projected conceptual construction noise levels[45] – Decay of noise from construction activities (Alternative Layout).

[44] Sound level at a receiver set at a certain distance from a road – 10 trucks per hour gravel and tar roads.

[45] The SPL Receiver graph can also be used for the construction of the overhead power line to allow connection to the ESKOM grid. Any activities further than 500m from any receiver will have a noise impact of low significance.



Graph 14-2: Projected conceptual construction noise levels – Decay of noise from construction activities (Preferred Layout).



Graph 14-3 Projected conceptual construction noise levels – Decay over distance from linear activities Operational Phase Noise Impact.

14.1.2 *Operational Phase Noise Impact*

Typical day time activities would include:

- The operation of the various WTGs; and
- Maintenance activities (relatively insignificant noise source).

The daytime period was not considered because noise generated during the day by the WEF is generally masked by other noises from a variety of sources surrounding potentially noise-sensitive developments. However, times when a quiet environment is desired (at night for sleeping, weekends etc.) ambient sound levels are more critical. The time period investigated therefore would be a quieter period, normally associated with the 22:00 – 06:00 timeslot. Maintenance activities would therefore not be considered, concentrating on the ambient sound levels created due to the operation of the various WTGs at night.

Two layouts were initially considered for the proposed WEF, namely an alternative and a preferred layout. This investigation made use of the sound power emission levels for a Vestas V117 3.3MW wind turbine. The applicant initially considered the use of the Vestas V126 3.45/3.6 MW and the Acciona AW125/3000. While the sound power emission levels of the Vestas V126 3.45/3.6 are similar to the Vestas V117 3.3 MW, the sound power emission levels of the Acciona AW125/3000 is approximately 2 dB higher than either the Vestas WTGs.

The calculated octave sound power levels of this noise source as used for modelling are presented in **Table 14-1**. The maximum sound power emission levels were used for all calculations. The difference between the proposed height of the nacelle (120m) and height used for modelling (115m) will have a negligible impact on the results.

Table 14-1: Octave Sound Power Emission Levels used for modelling: Vestas V117 3.3 MW.

Wind Turbine: Vestas V117 3.3 MW at 116.5 m HH										
Source Reference: DMS no.: 0038-6455-V00, 2013-06-07										
Z-Weighted Octave Sound Power Levels (dB)										
Frequency	**16.0**	**31.0**	**63.0**	**125.0**	**250.0**	**500.0**	**1000.0**	**2000.0**	**4000.0**	**Total (dBA)**
3.0	104.6	103.2	108.1	103.1	97.5	91.8	88.6	83.7	80.4	95.2
4.0	110.9	107.9	108.6	104.6	100.4	95.9	92.3	87.2	83.2	98.4
5.0	116.0	111.3	109.7	107.3	103.9	100.3	96.5	91.6	86.8	102.3
6.0	119.8	114.1	111.6	110.0	106.3	103.4	99.8	95.4	90.2	105.4
7.0	121.7	116.1	113.2	111.2	106.8	104.1	101.3	97.7	92.1	106.6
8.0	123.3	118.6	115.2	111.4	106.3	103.7	101.9	99.1	93.5	107.0
9.0	125.2	121.3	116.8	110.9	105.4	102.8	102.0	99.8	94.4	107.0
10.0	128.6	123.6	116.8	110.2	105.2	102.9	101.9	100.0	94.7	107.0

14.1.2.1 *Review of the Alternative and Preferred layout, East WEF*

Total noise rating levels considering the alternative layout of the proposed East WEF are presented in **Figure 9-7**, and **Figure 9-8** illustrating the noise rating levels for the preferred layout.

The cumulative noise rating levels due to both phases operating simultaneously is illustrated in **Figure 9-9**. **Table 14-2** defines the noise rating levels at the closest potential noise-sensitive receptors considering the Vestas turbines. **Table 14-3** defines the approximate noise rating levels using the Acciona turbine.

Table 14-2: Noise rating levels at closest potential noise-sensitive receptors, East WEF (noise rating levels for Vestas WTG).

NSD	**Alternative Layout (dBA)**	**Preferred Layout (dBA)**
1	0	0
2	0	0
3	11.7	0
4	27	20.2
5	41.2	34.5
6	40.3	33.4
7	15.6	0
8	24.6	29.1
9	0	0
10	0	0
11	32.2	21.7

Table 14-3: Noise rating levels at closest potential noise-sensitive receptors, East WEF (approximate noise levels – Acciona WTG).

NSD	Alternative Layout (dBA)	Preferred Layout (dBA)
1	0	0
2	0	0
3	13.7	0
4	29.0	22.2
5	43.2	36.5
6	42.3	35.4
7	17.6	0
8	26.6	31.1
9	0	0
10[46]	0	0
11	34.2	23.7

14.1.3 ***Operational Phase Noise Impact***

Only the night-time scenario was assessed, as this is the most critical time period when a quiet environment is desired.

Impact – East WEF, Alternative Layout

The projected noise levels will be higher than the rural rating level at NSD05 and NSD06, although the projected noise levels will not exceed the 42dBA noise limit when using the Vestas WTG. The noise levels will be slightly higher than the 42dBA noise limit as proposed when considering the Acciona WTG. The extent of the impact is limited to an area approximately 1000m from the wind turbines (for all the wind turbines considered), the intensity is medium on NSD05 and 06 (it may be measured) and of medium duration (life of project). The significance of the noise impact is considered to be low on all receptors for both wind turbines.

Impact – East WEF, Preferred layout

The projected noise levels will be lower than the rural rating level at all receptors with this layout. The extent of the impact is limited to an area approximately 1000m from the wind turbines, the intensity is low on all receptors and of medium duration (life of project) for all the WTG considered. The significance of the noise impact is considered to be low on all receptors.

In terms of noise there is no preference between the Alternative and Preferred layouts for the East WEF, when using the Vestas WTGs, but the preferred layout is recommended should the developer make use of the Acciona WTG.

14.1.4 ***Decommissioning and Closure Phase Noise Impact***

The potential for a noise impact to occur during the decommissioning and closure phase will be much lower than that of the construction and operational phases and noise from the decommissioning and closure phases is thus not investigated further.

[46] Reported as abandoned / old homestead by the applicant.

14.1.5 *Construction Phase Noise Impact (East WEF)*

Considering the projected noise levels (all significantly less than 45dBA) as well as the expected daytime ambient sound level (higher than 45dBA), there is a very low risk for a noise impact during the construction phase.

	Alternative layouts	**Preferred layouts**	**Typical daytime ambient sound levels**	**Extent**	**Intensity**	**Duration**	**Significance**
Receiver no	**Leq - dB(A)**	**Leq - dB(A)**			**Negative**		
1	31.4	32.8	45 - 55 dBA	L	L	L	L
2	31.6	33.3	45 - 55 dBA	L	L	L	L
3	31.3	32.7	45 - 55 dBA	L	L	L	L
4	31.7	32.8	45 - 55 dBA	L	L	L	L
5	40.6	35.0	45 - 55 dBA	L	L	L	L
6	40.2	34.1	45 - 55 dBA	L	L	L	L
7	31.3	32.7	45 - 55 dBA	L	L	L	L
8	31.4	33.0	45 - 55 dBA	L	L	L	L
9	31.3	32.7	45 - 55 dBA	L	L	L	L
10	37.0	40.4	45 - 55 dBA	L	L	L	L
11	32.8	32.8	45 - 55 dBA	L	L	L	L
Probability of impact	Very low						
Confidence in finding	Very high						
Mitigation measures	Mitigation is not required						
Cumulative impacts	Construction noises will cumulatively add to any other noises in the area, but it will be insignificant.						
Residual Impacts:	This impact will only disappear after the operational phase is finished and rehabilitation of the area is completed.						

14.1.6 *Operational Phase Noise Impact*

14.1.6.1 *Alternative layout - East WEF (Vestas turbines)*

The noise levels will be slightly higher than the 42dBA noise limit when considering the Acciona WTG. The extent of the impact is limited to an area approximately 1000m from the wind turbines (for all the wind turbines considered), the intensity is medium on NSD05 and 06 (it may be measured) and of medium duration (life of project). The significance of the noise impact is considered to be low on all receptors for both wind turbines.

Receiver no	**Projected Noise Level (dBA)**	**Typical night-time ambient sound levels**	**Extent**	**Intensity**	**Duration**	**Significance**
1	0	30 - 40 dBA	L	L	M	L
2	0	30 - 40 dBA	L	L	M	L
3	11.7	30 - 40 dBA	L	L	M	L
4	27	30 - 40 dBA	L	M	M	L
5	41.2	30 - 40 dBA	L	M	M	L
6	40.3	30 - 40 dBA	L	L	M	L
7	15.6	30 - 40 dBA	L	L	M	L

8	24.6	30 - 40 dBA	L	L	M	L
9	0	30 - 40 dBA	L	L	M	L
10	0	30 - 40 dBA	L	L	M	L
11	32.2	30 - 40 dBA	L	L	M	L
Probability of impact		Low				
Confidence in finding		Very high				
Mitigation measures		Mitigation is not required due to low significance of noise impact.				
Cumulative impacts		Ambient sound levels will increase slightly at all close NSDs, but this increase will be insignificant.				
Residual Impacts:		This impact will only disappear after the operational phase is finished and rehabilitation of the area is completed.				

14.1.6.2 *Alternative layout - East WEF (Acciona turbines)*

Receiver no	Projected Noise Level (dBA)	Typical night-time ambient sound levels	Extent	Intensity	Duration	Significance
1	0	30 - 40 dBA	L	L	M	L
2	0	30 - 40 dBA	L	L	M	L
3	13.7	30 - 40 dBA	L	L	M	L
4	29.0	30 - 40 dBA	L	L	M	L
5	43.2	30 - 40 dBA	L	M	M	L
6	42.3	30 - 40 dBA	L	M	M	L
7	17.6	30 - 40 dBA	L	L	M	L
8	26.6	30 - 40 dBA	L	L	M	L
9	0	30 - 40 dBA	L	L	M	L
10	0	30 - 40 dBA	L	L	M	L
11	34.2	30 - 40 dBA	L	L	M	L
Probability of impact		Low				
Confidence in finding		Very high				
Mitigation measures		Mitigation is not required due to low significance of noise impact.				
Cumulative impacts		Ambient sound levels will increase slightly at all close NSDs, but this increase will be insignificant.				
Residual Impacts:		This impact will only disappear after the operational phase is finished and rehabilitation of the area is completed.				

14.1.6.3 *Preferred layout – East WEF (Vestas turbines)*

The projected noise levels will be lower than the rural rating level at all receptors with this layout. The extent of the impact is limited to an area approximately 1000m from the wind turbines, the intensity is low on all receptors and of medium duration (life of project) for all the WTG considered. The significance of the noise impact is considered to be low on all receptors.

In terms of noise, there is no preference between the Alternative and Preferred layouts for the East WEF when using the Vestas WTGs, but the preferred layout is recommended should the developer make use of the Acciona WTG.

Receiver no	Projected Noise Level (dBA)	Typical night-time ambient sound levels	Extent	Intensity	Duration	Significance
1	0	30 - 40 dBA	L	L	M	L

2	0	30 - 40 dBA	L	L	M	L
3	0	30 - 40 dBA	L	L	M	L
4	20.2	30 - 40 dBA	L	L	M	L
5	34.5	30 - 40 dBA	L	L	M	L
6	33.4	30 - 40 dBA	L	L	M	L
7	0	30 - 40 dBA	L	L	M	L
8	29.1	30 - 40 dBA	L	L	M	L
9	0	30 - 40 dBA	L	L	M	L
10	0	30 - 40 dBA	L	L	M	L
11	21.7	30 - 40 dBA	L	L	M	L
Probability of impact		Low				
Confidence in finding		Very high				
Mitigation measures		Mitigation is not required due to low significance of noise impact.				
Cumulative impacts		Ambient sound levels will increase slightly at all close NSDs, but this increase will be insignificant.				
Residual Impacts:		This impact will only disappear after the operational phase is finished and rehabilitation of the area is completed.				

14.1.6.4 *Preferred layout – East WEF (Acciona turbines)*

Receiver no	Projected Noise Level (dBA)	Typical night-time ambient sound levels	Extent	Intensity	Duration	Significance
1	0	30 - 40 dBA	L	L	M	L
2	0	30 - 40 dBA	L	L	M	L
3	0	30 - 40 dBA	L	L	M	L
4	22.2	30 - 40 dBA	L	L	M	L
5	36.5	30 - 40 dBA	L	L	M	L
6	35.4	30 - 40 dBA	L	L	M	L
7	0	30 - 40 dBA	L	L	M	L
8	31.1	30 - 40 dBA	L	L	M	L
9	0	30 - 40 dBA	L	L	M	L
10	0	30 - 40 dBA	L	L	M	L
11	23.7	30 - 40 dBA	L	L	M	L
Probability of impact		Low				
Confidence in finding		Very high				
Mitigation measures		Mitigation is not required due to low significance of noise impact.				
Cumulative impacts		Ambient sound levels will increase slightly at all close NSDs, but this increase will be insignificant.				
Residual Impacts:		This impact will only disappear after the operational phase is finished and rehabilitation of the area is completed.				

14.1.7 ***Decommissioning Phase Noise Impact***

Final decommissioning activities will have a noise impact lower than either the construction or operational phases. This is because decommissioning and closure activities normally take place during the day using minimal equipment (due to the decreased urgency of the project). While there may be various activities, there is a very small risk for a noise impact.

14.2 General Mitigation Measures

14.2.1 *General Construction Phase Mitigation Measures*

It has been determined that the potential noise impact would be of low significance and specific mitigation measures are not required or recommended.

Mitigation options include both management measures as well as technical changes. While not required (due to the low significance of a noise impact during the construction phase) the following measures are included for consideration. General measures that could be applicable for the construction phase include:

Community involvement needs to continue throughout the project. Annoyance is a complicated psychological phenomenon; as with many industrial operations, expressed annoyance with sound can reflect an overall annoyance with the project, rather than a rational reaction to the sound itself.

At all stages of the development cycle, surrounding receptors should be informed about the project, providing them with factual information without setting unrealistic expectations. It is counterproductive to suggest that the activities (or facility) will be inaudible due to existing high ambient sound levels. The magnitude of the sound levels will depend on a multitude of variables and will vary from day to day and from place to place with environmental and operational conditions. Audibility is distinct from the sound level, because it depends on the relationship between the sound level from the activities, the spectral character and that of the surrounding soundscape (both level and spectral character).

The use the smaller/quieter equipment when operating near receptors;

Where possible only operate during the day. If night-time activities is required, do not operate closer than 500m from any receptors (prevent noise impact of high significance);

Ensure a good working relationship between the developer and all potentially noise-sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them (especially if work is to take place within 500m from them at night). Information that should be provided to potentially sensitive receptor(s) includes:

- Proposed working dates, the duration that work will take place in an area and working times;
- The reason why the activity is taking place;
- The construction methods that will be used; and
- Contact details of a responsible person where any complaints can be lodged should there be an issue of concern.

When simultaneous noise emitting activities are to take place close to potential noise-sensitive receptors, co-ordinate the working time with periods when the receptors are not at home. An example would be to work within the 8am to 2pm time-slot, as:

- Potential noise-sensitive receptors are most likely to be at school or work; and
- Normal daily household activities (cleaning, listening to TV/Radio, etc.) will generate other noises that would most likely mask construction noises, thus minimizing the effects of cumulative noise impacts.

Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap between the hood and vehicle body is minimised.

14.2.2 *General Operational Phase Mitigation Measures*

The significance of noise during the operational phase is low and additional mitigation measures are not required.

Special conditions that should be included in the Environmental Authorization:

- The potential noise impact must again be evaluated should the layout be changed where any wind turbines are located closer than 1000m from a confirmed NSD.
- The developer must investigate any reasonable and valid noise complaint if registered by a receptor staying within 2000m from a location where construction activities are taking place or operational wind turbine.

15 SOCIAL ASSESSMENT

15.1 Policy and Planning Related Issues

The findings of the policy and planning review indicate that renewable energy is strongly supported at a national and local level. At a national level the White Paper on Energy Policy (1998) notes:

- Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future; and
- The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

The IRP 2010 also allocates 43% of energy generation in South Africa to renewables, while the New Growth Path Framework and the National Infrastructure Plan both support the development of the renewable energy sector.

The development of and investment in renewable energy is also 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 White Paper on Sustainable Energy for the Western Cape, Climate Change Strategy and Action Plan for the Western Cape and Western Cape Growth and Development Strategy.

The findings of the review of the relevant policies and documents pertaining to the energy sector therefore indicate that wind energy and the establishment of wind energy facilities are supported at a national and provincial level. It is therefore the opinion of the social impact assessment specialist that the establishment of WEF in the area is supported by national, provincial and local policies and planning documents.

The provincial and local policy and planning documents also make reference to the importance of tourism and the region's natural resources. Care therefore needs to be taken to ensure that the development of large renewable energy projects does not impact on the region's natural resources and the tourism potential of the provinces.

15.2 Potential Construction Phase Impacts

Potential positive impacts

- Creation of employment and business opportunities, and opportunity for skills development and on-site training;
- Benefits associated with providing technical advice on wind energy to local farmers and municipalities;
- Improved cell phone reception.

Potential negative impacts

- 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;
- Impact on productive farmland.

15.2.1 *Creation of local employment, training, and business opportunities.*

Based on the information from other WEF projects, the construction phase for a 275 MW WEF is expected to extend over a period of 18-24 months and create approximately 400 employment opportunities during peak construction. Of this total approximately 55% (220) will be low skilled positions (construction labourers, security staff etc.), 30% (120) semi-skilled positions (drivers, equipment operators etc.) and 15% (60) skilled positions (engineers, land surveyors, project managers etc.). The work associated with the construction phase will be undertaken by contractors and will include the establishment of the WEF and the associated components, including, access roads, substation, services and power line.

Members from the local community in the area may be in a position to qualify for the majority of the low skilled and semi-skilled employment opportunities. The majority of these employment opportunities are also likely to accrue to Historically Disadvantaged (HD) members from the local LLM and KHLM communities. The levels of unemployment in the LLM and KHLM are relatively high. The level of unemployment in Laingsburg and Sutherland is also high and there are limited employment opportunities in the town and surrounding area. The creation of potential employment opportunities, even temporary employment, will therefore represent a significant, if localised, social benefit.

While the current pool of suitably qualified local community members in Laingsburg, Sutherland and the LLM may be limited, the construction of three wind energy projects in the area is planned to commence in 2016 and these will create opportunities to develop the required skills prior to the commencement of the construction phase for the proposed Komsberg WEF. It is estimated that these projects will be employing 50-70% of their workers local, and where training is required it will be carried out in order to comply with commitments for local employment made to the Department of Energy. In addition, the implementation of a training and skills development programme prior to the commencement of construction would also increase the potential to employ local community members. The number of low skilled and semi-skilled positions taken up by members from the local community will be enhanced by the implementation of these enhancement measures by the proponent in consultation with the LLM and Department of Labour. If required, it would be practical for the proponent (or their contractors) to implement a training and skills development programme once the project has been formally finalised or once it has reached Financial Close with the Department of Energy or appropriate government agency, but still aligned with the construction phase.

The capital expenditure associated with the construction will be in the region of R 5 billion (2015 Rand value). The total combined capital expenditure for both the proposed Komsberg East and West WEFs will therefore be approximately R10 billion (2015 Rand value). A percentage of the capital expenditure associated with the construction phase has the potential to benefit local companies. However, the opportunities for local companies in Laingsburg will be limited. In this regard the benefits are likely to accrue to building contractors and suppliers based in towns based further afield, such as Worcester, Paarl and Cape Town. Implementing certain enhancement measures (listed below) will enhance these opportunities. The potential opportunities for local companies are likely to be limited due to the high import content associated with this type of project.

The total wage bill for the 18-24 month construction phase of a single 140 MW WEF will be in the region of R 100 million (2015 Rand value). A percentage of the wage bill will be spent in the local economy and will create significant opportunities for local businesses in Laingsburg, Sutherland and Worcester. Given the high unemployment and low income levels in Laingsburg and Sutherland even a small percentage of the monthly salary bill spend in the town would represent a significant opportunity. Based on the authors' experience with other renewable energy projects, local spend by construction workers represents a significant benefit for local shops and businesses in the area. This benefit will extend over a period of 4-6 years assuming that the construction of the proposed Komsberg East and West WEFs follow on from each other.

The sector of the local economy that will also benefit from the proposed development is the local service industry. This is also confirmed by the experience with the other renewable projects. The potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport and security, etc. associated with the meeting the needs of 400 construction workers who will need to be accommodated, transported to site and fed (three meals a day) over a period of 4 years.

Experience from other renewable energy projects located near small towns, such as Pofadder in the Northern Cape Province, is that local residents and businesses have benefitted significantly from meeting the needs of construction workers. Many homeowners in Poffadder benefitted from construction of the Abengoa Solar Energy Project by turning their homes into bed and breakfast accommodation, adding extra rooms, providing catering and laundry services etc. The proposed project therefore has the potential to create an opportunity for investment in Laingsburg and Sutherland. (Note that the presence of construction workers also has the potential to impact negatively on local family and social networks).

The hospitality industry in the area will also be likely to benefit from the provision of accommodation and meals for professionals (engineers, quantity surveyors, project managers, product representatives etc.) and other (non-construction) personnel involved on the project. Experience from other renewable energy projects indicates that the potential opportunities are not limited to on-site construction workers but also to consultants and product representatives associated with the project.

Based on the findings of the site visit, there is currently not sufficient accommodation in Laingsburg and Sutherland and surrounds to accommodate the approximately 300 workers associated with the construction phase. The intention is to source the majority of labour from the local area which will reduce the need for accommodation. The local farmers in the area have also indicated that they do not support the establishment of a construction camp on the site, and such a camp would not be required as part of the construction phase. The issue of accommodation represents a potential challenge and will need to addressed in consultation with the LLM, community representatives and local farmers from the area should the project proceed.

The implementation of the proposed enhancement measures listed below would also enable the establishment of the proposed WEF to support co-operation between the public and private sectors which would support local economic development in the LLM.

Impact: Creation of employment and business opportunities during the construction phase.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Positive	M	M	H
With Mitigation/ Enhancement	H	L	H	Positive	H	H	H
No-go Option	There is no impact, as the current *status quo* will be maintained. The potential employment and economic benefits associated with the construction of the proposed WEF would be forgone. The potential opportunity costs in terms of local capital expenditure, employment, skills development						

	and opportunities for local business are therefore regarded as a negative. Potential opportunity costs would be greatest with regards to local employment provision and opportunities for the local service sector.

Mitigation/Enhancement Measures:

1. The need to implement an accredited training and skills development programme aimed at maximising to opportunity for local workers to be employed for the low and semi-skilled positions should be assessed by the proponent. Should such a programme be needed, it should be initiated prior to the initiation of the construction phase, once the project has been formally finalised or financially closed with the DoE or appropriate government agency. The aim of this type of programme should be to maximise employment opportunities for members of the local community. In this regard the programme could be aimed at community members from Laingsburg and Sutherland. If required, the programme should be developed in consultation with the Department of Labour and the LLM. The recommended targets are 50% and 30% of low and semi-skilled positions respectively should be taken up by local community members. Due to the low skills levels in the area, the majority of semi-skilled and skilled posts are likely to be filled by people from outside the area;
2. The recruitment selection process for the training and skills development programme should seek to promote gender equality and the employment of women wherever possible;
3. Before the construction phase commences the proponent should meet with representatives from the LLM 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;
4. The local authorities and relevant community representatives 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;
5. Where reasonable and practical the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria;
6. The contractor should liaise with the LLM 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;
7. Where possible, the proponent should assist local BBBEE companies to complete and submit the required tender forms and associated information.
8. The LLM, 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.

15.2.2 *Technical advice for local farmers and municipalities.*

The establishment of a WEF in the area creates an opportunity for the technical staff involved in the project to provide local farmers and the LLM with advice regarding the installation of wind energy technology to supplement their current and future energy needs. Experience from other renewable energy projects indicate that farmers would appreciate assistance in this regard in the form of expert opinion as to what type of small scale wind technologies could be installed to meet their needs and how best to install small-scale wind energy installations on their farms. This could be achieved via a workshop / discussion with the local farmers in the area. Local municipalities would also benefit from the knowledge of technical staff involved in the establishment of the project.

Impact: Potential benefit for local farmers and municipalities associated with providing advice on installation of small-scale wind energy technology to supplement their energy needs.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation/ Enhancement	N/A	N/A	N/A	N/A	Neutral	N/A	N/A
With Mitigation/ Enhancement	M	M	L	Positive	L	H	M

No-Go Option	There is no impact as the current *status quo* would be maintained. The potential positive benefit for local farmers and the municipality in terms of potential future energy savings would however be lost.

Mitigation/Enhancement Measures:

1. The proponent in consultation with the contractor should hold a workshop/s with local farmers and representatives from the LLM to discuss options for installing small-scale wind energy facilities and the technology and costs involved.

15.2.3 *Improved cell phone reception in the area.*

The cell phone reception in parts of the study area is poor. The farmers in the area indicated that any improvement in the cell phone reception would represent a significant benefit for the local famers in the area. The benefits would be linked to improving security on the farms in the area and also enabling local farmers to contact doctors etc. in the event of emergencies. In this regard the local farmers enquired if it would be possible for the proponent to establishment a booster tower as part of the construction of the proposed WEFs. The establishment of a booster tower would also enable the contractors on site to manage the construction phase more effectively.

Impact: Potential benefit for local farmers in terms of improving security on the farms in the area and also enabling local farmers to contact doctors etc. in the event of emergencies.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation/ Enhancement	N/A	N/A	N/A	N/A	Neutral	N/A	N/A
With Mitigation/ Enhancement	M	M	L	Positive	L	H	M
No-Go Option	There is no impact as the current *status quo* would be maintained. The potential positive benefit for local farmers would however be lost.						

Mitigation/Enhancement measures:

1. The proponent, in consultation with the contractor, should investigate the option of establishing a cell phone booster mast on the site.

15.2.4 *Impact of construction workers on local communities.*

The presence of low and semi-skilled construction workers poses a potential risk to family structures and social networks in the town of Laingsburg and Sutherland depending on where they are accommodated. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on local communities. The most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to potentially risky behaviour, mainly of male construction workers, including:

- An increase in alcohol and drug use;
- An increase in crime levels;
- The loss of girlfriends and/or wives to construction workers;
- An increase in teenage and unwanted pregnancies;
- An increase in prostitution; and
- An increase in sexually transmitted diseases (STDs), including HIV.

While the current pool of suitably qualified local community members in Laingsburg, Sutherland and the LLM may be limited, the construction of three wind energy projects in the area which is planned to commence in 2016 will create opportunities to develop the required skills prior to the commencement of the construction phase for this project. It is estimated that these projects will be employing 50-70% of their workers locally and where training is required it will be carried out in order to comply with commitments for local employment made to the Department of Energy. The majority of the low skilled (220) and semi-skilled (120) work opportunities associated with the construction phase are therefore likely to be taken up by local community members from the area. This will reduce the potential risked posed by

outsiders to family structures and social networks in the town of Laingsburg and Sutherland depending on where they are accommodated. This is a positive impact in that the local members of the community interviewed indicated that the likelihood of these risks developing was high with the advent of many outsiders due to the current high unemployment and low income levels in the town.

The use of local residents from Laingsburg and Sutherland to fill the low skilled job categories will also reduce the need to provide accommodation for construction workers in Laingsburg and Sutherland. As indicated above, there is limited accommodation available in both of these small towns. If necessary, the implementation of an accredited training and skills development programme prior to the initiation of the construction phase would therefore not only maximise employment opportunities for local residents but also reduce risks posed by construction workers to the local community. The programme would also assist the contractor to address the issue of providing accommodation for construction workers. The skilled workers (60) are likely to be accommodated in local guest houses in the town and on local farms.

While the risks associated with construction workers at a community level will be low, at an individual and family level they may be significant, especially in the case of contracting a sexually transmitted disease or an unplanned pregnancy. The experience with the Abengoa solar energy project in the Northern Cape Province has demonstrated that this risk is real. The presence of construction workers associated with the Abengoa project resulted in an increase in the spread of STDs, increase in un-planned pregnancies, increase in drugs, alcohol abuse and anti-social behavior. The Abengoa projects have left a tangible legacy of HIV and single mothers.

In terms of potential threat to the families of local farm workers in the vicinity of the site, the risk is likely to be low. This is due to the low number of permanent workers residing on local farms in the area. The potential risk is therefore likely to be limited. The risk can also be effectively mitigated by ensuring that the movement of construction workers on and off the site is carefully controlled and managed. However, given the nature of construction project, it is not possible to totally avoid these potential impacts at an individual or family level.

Impact: Potential impacts on family structures and social networks associated with the presence of construction workers.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation/ Enhancement	M	L	M	Negative	M	M	H
With Mitigation/ Enhancement	M	L	L	Negative	L	M	H
No-Go option	There is no impact as the current *status quo* would be maintained. The potential positive impacts on the local economy associated with the additional spending by construction workers in the local economy will also be lost.						

Mitigation Measures:

1. If necessary, the proponent should consider the implementation of an accredited training and skills development programme aimed at maximising to opportunity for local workers to be employed for the low and semi-skilled positions prior to the initiation of the construction phase, once the project has been formally finalised or Financially Closed with the DoE or appropriate government agency.. The aim of the programme should be to maximise employment opportunities for members of the local community. In this regard the programme could be aimed at community members from Laingsburg and Sutherland. The programme could be developed in consultation with the Department of Labour and the LLM. The recommended targets are 50% and 30% of low and semi-skilled positions respectively should be taken up by local community members. Due to the current low skills levels in the area, the majority of semi-skilled and skilled posts are likely to be filled by people from outside the area;
2. The recruitment selection process for the training and skills development programme should seek to promote gender equality and the employment of women wherever possible;
3. The proponent should establish 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

LLM, 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;
4. 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;
5. The proponent and contractor (s) should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;
6. 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;
7. The contractors should make the necessary arrangements to transport workers from other local towns in the area, such as Worcester and Paarl, home over weekends. This will reduce the risk posed to local family structures and social networks in Laingsburg and Sutherland;
8. No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

15.2.5 *Influx of job seekers.*

Large construction projects tend to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These job seekers can in turn become "economically stranded" in the area or decide to stay on irrespective of finding a job or not. As in the case of construction workers employed on the project, the actual presence of job seekers in the area does not in itself constitute a social impact. However, the manner in which they conduct themselves can impact on the local community.

Experience from other projects has also shown that the families of job seekers may also accompany individual job seekers or follow them at a later date. In many cases the families of the job seekers that become "economically stranded" and the construction workers that decided to stay in the area, subsequently moved to the area. The influx of job seekers to the area and their families can also place pressure on the existing services in the area, specifically low income housing. In addition to the pressure on local services the influx of construction workers and job seekers can also result in competition for scarce employment opportunities. Further secondary impacts included increase in crime levels, especially property crime, as a result of the increased number of unemployed people. These impacts can result in increased tensions and conflicts between local residents and job seekers from outside the area.

These issues are similar to the concerns associated with the presence of construction workers. However, in some instances the potential impact on the community may be greater given that they are unlikely to have accommodation and may decide to stay on in the area. In addition, they will not have a reliable source of income. The risk of crime associated with the influx of job seekers it therefore likely to be greater. However, the findings of the SIA indicate that potential for economically motivated in-migration and subsequent labour stranding in Laingsburg and Sutherland is likely to be low. This is due to the towns small size and location and the limited economic opportunities that the town has to offer. The risks associated with job seekers moving to the area staying on in Laingsburg and Sutherland are therefore likely to be low and are likely to be limited the construction phase.

Impact: Potential impacts on family structures, social networks and community services associated with the influx of job seekers.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	L	Negative	L	M	M
With Mitigation/ Enhancement	M	L	L	Negative	L	M	M
No-Go Option	There is no impact as the current *status quo* would be maintained. The potential positive impacts on the local economy associated with the additional spending by construction workers in the local economy will also be lost.						
Mitigation Measures:							

It is not possible to prevent job seekers from coming to the area in search of a job. The potential influx of job seekers to the area as a result of the proposed WEF is likely to be low. In addition:

1. The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities; and
2. The proponent should implement a policy that no employment will be available at the gate and or in Laingsburg and Sutherland (except for local residents).

15.2.6 *Risk to safety, livestock and farm infrastructure.*

The presence on and movement of construction workers on and off the site poses a potential safety threat to local famer's and farm workers in the vicinity of the site threat. In addition, farm infrastructure, such as fences and gates, may be damaged and stock losses may also result from gates being left open and/or fences being damaged or stock theft linked either directly or indirectly to the presence of farm workers on the site. All of the local farmers in the area interviewed indicated this was a key issue in that the presence of construction workers on the site increased the exposure of their farming operations and livestock to the outside world, which, in turn, increased the potential risk of stock theft and crime. The local farmers also indicated that this was also likely to be an issue during the construction phase, albeit to a reduced extent. The local farmers did, however, indicate that the potential risks (safety, livestock and farm infrastructure) can be effectively mitigated by careful planning and managing the movement of construction on the site workers during the construction phase.

The affected and adjacent properties are primarily used for stock farming. The properties are extensive. Some properties are not permanently inhabited. Most of the farms are relatively inaccessible. Only Mr Myburgh's properties (Wilgerboom and Brinksfontein) are traversed by a public road at present. Gemsbokfontein, Putterskraal and Anysrivier are at the terminus of farm roads. Due to the isolation the study area is considered very safe at present. Based on the comments from the local farmers interviewed, stock theft is not regarded as major problem and farm gates, houses and stores are typically left unlocked.

The concern is that the WEF would introduce a large number of workers ('feet and eyes') into a hitherto isolated and relatively safe area, with very limited people presence. This could expose owners to potentially significant losses in the form of organised stock theft. The potential to mask the activities of local thieves was also noted.

Impact: Potential risk to safety of farmers and farm workers, livestock and damage to farm infrastructure associated with the movement of construction workers on and to the site.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation/ Enhancement	M	L	M	Negative	M	M	H
With Mitigation/ Enhancement	M	L	L	Negative	L	M	H
No Go Option	There is no impact as it maintains the current *status quo.*						

Mitigation measures:

1. 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 WEF will be compensated for. The agreement should be signed before the construction phase commences;
2. The contractors appointed by the proponent should 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;
3. The proponent should establish a MF 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;
4. 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;

5. The Environmental Management Programme (EMPr) should outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested;
6. 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.
7. 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 should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation;
8. The housing of construction workers on the site should be strictly limited to security personnel.

15.2.7 *Increased risk of grass fires*

The presence of construction workers and construction-related activities on the site poses an increased risk of grass fires that could in turn pose a threat to livestock, crops, and farmsteads in the area. In the process, farm infrastructure may also be damaged or destroyed and human lives threatened. The issue of fire risks was raised by a number the local farmers in the area. In this regard they pointed out that grazing is the main productive resource in the study area. For some operations it provides crucial seasonal grazing. As generally the case in arid areas, the study area veld is very vulnerable to disturbance, and takes decades to recover. The local farmers also indicated that grass fires resulted in change in the composition of the veld, favouring the establishment of less palatable grazing. Given the very slow rate of succession, grass fires may therefore significantly diminish the grazing resource for a period of decades.

However, the local farmers did indicate that measures should be implemented to reduce the potential risk of fires developing. This included the provision of fire-fighting equipment on the site during the construction phase. They also indicated that the potential risk of grass fires was heightened by the windy conditions in the area, specifically during the dry, summer months from May to October.

Impact: 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/ Enhancement	M	L	M	Negative	M	M	H
With Mitigation/ Enhancement	M	L	L	Negative	L	M	H
No-Go Option	There is no impact as it maintains the current *status quo.*						

Mitigation measures:

1. 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 proposed WEF will be compensated for. The agreement should be signed before the construction phase commences;
2. Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas;
3. The 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 winter months;
4. The contractor should provide adequate firefighting equipment on-site;
5. The contractor should provide fire-fighting training to selected construction staff;
6. No construction staff, with the exception of security staff, to be accommodated on site over night;
7. 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.

15.2.8 *Impacts associated with construction vehicles.*

The movement of heavy construction vehicles during the construction phase has the potential to damage local farm roads and create dust and safety impacts for other road users in the area and also impact on farming activities. The project components are likely to be transported to the site from Cape Town via the N1. The N1 provides the key link between the Western Cape and Gauteng and is an important commercial and tourist route. The transport of components of the WEF to the site therefore has the potential to impact on other road users travelling along the N1. Measures will need to be taken to ensure that the potential impact on motorist using the N1 is minimised. The recommended mitigation measures are listed below.

At a local site-specific level, the potential impacts associated with construction related traffic was identified as a key impact by a number of affected landowners.

As far as the Komsberg East WEF is concerned the issue of access was raised as a key issue by the owner of De Fonteine Farm, adjacent to Anysrivier. De Fonteine and Anysrivier share a sole access road off the Laingsburg-Komsberg gravel road. It would appear that essentially all construction traffic associated with the proposed East WEF would make use of this road, before accessing a proposed new internal road on Anysrivier, which would also provide access to Putterskraal and Gemsbokfontein.

De Fonteine was bought three decades ago by three partners from a Stellenbosch engineering firm. The farm was acquired specifically for the semi-desolate, Karoo-wilderness aspect, as a private retreat for the partners, their families and friends. The property supports limited farming, mainly a few sheep. The partners live in Stellenbosch but visit the farm at least one weekend a month throughout the year. A farm house is located on De Fonteine, and is used when the farm is visited. One labourer household permanently lives and works on the property. Substantial work has gone into rehabilitating infrastructure on the farm. A large orchard has been established adjacent to the farmstead (Biesenbach, pers. comm.). At present, the road to Anysrivier passes between the De Fonteine farmstead and a low kopje to the west of the road.

The following key issues were raised by the owners of De Fonteine:

- The current road alignment would be physically incapable of handling the abnormal loads required. The road would need to be widened or re-aligned to the west. The potential for widening is very limited. Both options are likely to significantly disturb the current sense of place;
- A significant amount of abnormal and other traffic would be generated by during the construction phase. This would create noise and dust, affecting the orchard and farmstead, and spoiling the sense of place for this period; and
- As the owners are absent most of the time, and only one labourer family lives on the property, security issues were also raised in connection with the road, which would bring "feet and eyes" during the construction (and operational) phases (Biesenbach, pers. comm.).

The owners of De Fonteine have indicated that they have no problem with the proposed WEF but that use of the farm road as an access road would be unacceptable for the reasons stated above. The owners proposed that the developers investigate an alternative access road which would affect only WEF properties, e.g. via Gemsbokfontein (Biesenbach, pers. comm.). The proponent has confirmed that this issue has been addressed in the final layout with a road re-alignment, to the satisfaction of Mr Biesenbach.

The local farmers also noted that grazing is the main productive resource in the study area and that the veld in the area was sensitive to disturbances, such as movement of heavy vehicles. The movement of construction related traffic should therefore be confined to designated roads.

Experience from other renewable projects also indicates that the transportation of construction workers to and from the site can result in the generation of waste along the route (packaging and bottles etc. thrown out of windows etc).

Impact: Potential dust and safety impacts and damage to road surfaces associated with movement of construction related traffic to and from the site.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	L	M	Negative	M	M	H
With Mitigation/ Enhancement	M	L	L	Negative	L	M	H
No-Go Option	There is no impact as it maintains the current *status quo.*						

Mitigation Measures:

1. The final selection of access roads (micro-siting) should be discussed with the affected landowners.
2. Where possible the identification of access roads should be confined to properties on which wind turbines are located;
3. The contractor must ensure that damage caused by construction related traffic to local public and 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. Experience for other renewable energy projects is that the maintenance for roads is the responsibility of the local district roads authority. In many instances the local district roads authority lack the resources to maintain the local road network. In addition, due to legal restrictions, it is not possible for the contractor to repair damage to public roads. This can result in damage to roads not being repaired before the construction phase is completed. This is an issue that should be addressed with the local district roads authority prior to the commencement of the construction phase;
4. As far as possible, the transport of components to the site along the N1 should be planned to avoid weekends and holiday periods;
5. Laydown and construction areas should be clearly defined. No vehicles or activities should be permitted outside of these areas;
6. Movement of vehicles on the site must be confined to access road. No vehicles be allowed to drive into the veld;
7. 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;
8. All workers should receive training/ briefing on the reasons for and importance of closing farm gates and driving slowly;
9. 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;
10. 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;
11. The Contractor should be required to collect waste along the road reserve on a weekly basis;
12. Waste generated during the construction phase should be transported to the local landfill site;
13. EMP measures (and penalties) should be implemented to ensure farm gates are closed at all times;
14. EMP measures (and penalties) should be implemented to ensure speed limits are adhered to at all times.

15.2.9 *Impacts associated with loss of farmland.*

Grazing is the main productive resource in the study area. For some operations, it provides crucial seasonal grazing. As generally the case in arid areas, the study area veld is very vulnerable to disturbance, and takes decades to recover. The key construction phase related issues are linked to the movement of heavy construction vehicles on the site, establishment of laydown areas, construction roads and trenching in cultivated areas. All of these activities would impact on productive land. The key concern is therefore to avoid or minimize such impacts on arable land. Key issues raised by farmers included:

- Loss of potential productive land due to internal access roads[47]; and
- Loss of productive land due to turbine or pylons.

Properties belonging to four owners would be affected. The bulk of turbines are proposed on kopjes and ridges in the inaccessible northern portions of Anysrivier (Muller) and Putterskraal

[47] The findings of the agricultural assessment indicate that no high potential areas will be impacted.

(Stofberg). The substation and other supporting infrastructure would be located on Putterskraal. Seven turbines are proposed on Gemsbokfontein (Mr. Francois Conradie), and none on Brinksfontein. The relevant owners have indicated that the proposed turbine and substation locations would not significantly impact on grazing, and would not affect any areas suitable for cropping.

Impact: 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/ Enhancement	M	L	L	Negative	L	M	H
With Mitigation/ Enhancement	M	L	L	Negative	L	M	H
No-Go Option	There is no impact as it maintains the current *status quo*.						

Mitigation measures:

1. The location of wind turbines, access roads, laydown areas etc. should be informed by the findings of key specialist studies, including the soil and botanical study. In this regard areas of high potential agricultural soils should be avoided;
2. The location of wind turbines, access roads, laydown areas etc. should be discussed with the locally affected landowners in the finalisation process and inputs provided should be implemented in the layout as best as possible;
3. 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. No vehicles or activities should be permitted outside of these areas;
4. Movement of vehicles on the site must be confined to access road. No vehicles be allowed to drive into the veld;
5. An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase;
6. 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 a botanist with experience in arid regions;
7. The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up the Environmental Consultants appointed to undertake the EIA;
8. The implementation of the Rehabilitation Programme should be monitored by the ECO;
9. All workers should receive training/ briefing on the reasons for and importance of not driving in undesignated areas;
10. 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;
11. Disturbance footprints should be reduced to the minimum.

15.3 Operational Phase Social Impacts

Potential positive impacts

- Creation of employment and business opportunities and support for local economic development;
- Benefits associated with the establishment of a Community Trust; and
- The establishment of renewable energy infrastructure.

Potential negative impacts

- The visual impacts and associated impact on sense of place; and
- Potential impact on tourism.

15.3.1 *Creation of employment and business opportunities and support for local economic development and development.*

Based on information from other wind projects, the establishment of both the Komsberg WEF could create approximately 30 permanent employment opportunities. Of this total approximately 20 would be low skilled workers, 7-8 semi-skilled and 2-3 skilled. The annual wage bill for the operational phase will be approximately R3 million (2015 Rand value). The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community.

It will 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. Such a programme would support the strategic goals of promoting employment and skills development contained in the LLM IDP. Experience shows that with other renewable energy projects located near small rural towns, such as Laingsburg and Sutherland is that the commitment to the implementation of a skills development prior to the commencement of the construction phase tends to be limited.

Given the location of the proposed facility, the majority of permanent staff is likely to reside in Laingsburg and Sutherland. In terms of accommodation options, a percentage of the non-local permanent employees may purchase houses in the town, while 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, which will benefit local businesses in these towns. The benefits to the local economy will extend over the 20 year operational lifespan of the project. The local hospitality industry in Laingsburg and Sutherland 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.

Impact: Creation of employment and business opportunities associated with the operational phase.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	L	Positive	L	M	H
With Mitigation/ Enhancement	M	M	M	Positive	M	H	H
No-Go Option	There is no impact as it maintains the current *status quo*. The potential opportunity costs in terms of the loss of employment and skills and development training would be lost which would also represent a negative impact.						
Mitigation Measures: The enhancement measures to enhance local employment and business opportunities during the construction phase, also apply to the operational phase. In addition: 1. The proponent should implement a training and skills development programme for locals during the first five 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; 2. The proponent, in consultation with the LLM, should investigate the options for the establishment of a Community Development Trust.							

15.3.2 *Benefits associated with the establishment of a Community Trust.*

In terms of the Request for Proposal document prepared by the Department of Energy all bidders for operating licences for renewable energy projects must demonstrate how the proposed development will benefit the local community. This can be achieved by establishing a Community Trust which is funded by revenue generated from the sale for energy.

Community Trusts and other socio-economic investments provide an opportunity to generate a steady revenue stream that is guaranteed for a 20 year period. This revenue can be used to fund development initiatives in the area and to support the local community. The long-term duration of the revenue stream also allows local municipalities and communities to undertake

long-term planning for the area. In terms of the requirement, the minimum ownership percentage for a local community is 2.5%. However, projects generally exceed this figure in order to increase the competitiveness of the project. The revenue for the Community Trusts is via dividend pay-outs once the wind farm is fully operational and revenue generating.

The revenue from the proposed WEF plant can be used to support a number of social and economic initiatives in the area, including:

- Creation of jobs;
- Education;
- Support for and provision of basic services;
- School feeding schemes;
- Training and skills development; and
- Support for SMME's.

Based on the findings of the site visit, there are limited economic and associated employment opportunities in Laingsburg and Sutherland. There is a high dependency on social grants, including child support grants. Given these conditions, the benefits associated with the establishment of a Community Trust funded by revenue from the proposed WEF represents the most significant positive socio-economic opportunity for Laingsburg and Sutherland.

In addition, the establishment of the WEF is not likely to have a significant impact on the current agricultural land uses that underpin the local economic activities in the area. The loss of this relatively small area will not impact on current and future farming activities. Experience has shown that Community Trusts can be mismanaged. This issue will need to be addressed in order to maximise the potential benefits associated with the establishment of a Community Trust.

Impact: 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/ Enhancement	M	H	M	Positive	M	M	H
With Mitigation/ Enhancement[48]	M	H	H	Positive	H	H	H
No-Go Option	There is no impact as it maintains the current *status quo*. However, the potential opportunity costs in terms of the supporting the social and economic development in the area would be lost. This would also represent a negative impact.						
Mitigation Measures: 1. The LLM and members from the Laingsburg and Sutherland community should be consulted as to the structure and identification of potential trustees to sit on the Trust. The key departments in the LLM that should be consulted include the Municipal Manager's Office, IDP and LED Manager. 2. 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. 3. Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the WEFs.							

15.3.3 *Development of infrastructure for the generation of clean, renewable energy.*

South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is the nineteenth largest per capita producer of carbon emissions in the world, and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions.

The overall contribution to South Africa's total energy requirements of the proposed WEF is relatively small. However, the development will help to offset the total carbon emissions

[48] Assumes effective management of Community Trust.

associated with energy generation in South Africa. Given South Africa's reliance on Eskom as a power utility, the benefits associated with an IPP based on renewable energy are regarded as an important contribution.

Impact: Promotion of clean, renewable energy.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement[49]	H	H	L	Positive	M	H	H
With Mitigation/ Enhancement	H	H	H	Positive	M	H	H
No-Go Option	The No-Development option would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. This would represent a negative opportunity cost.						
Mitigation Measures: 1. 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 employed during the operational phase of the project. 2. In order to maximise the benefits of the proposed project the proponent should use the project to promote and increase the contribution of renewable energy to the national energy supply.							

15.3.4 *Impact on sense of place and rural character of the landscape.*

The components associated with the proposed facility will have a visual impact on the landscape and rural sense of the place of the area. Due to the isolated location of the site, it will not be visible from the N1 in the south.

Properties belonging to four owners will be affected. The bulk of turbines are proposed on kopjes and ridges in the inaccessible northern portions of Anysrivier (Muller) and Putterskraal (Stofberg). The substation and other supporting infrastructure would be located on Putterskraal. Seven turbines are proposed on Gemsbokfontein (Mr. Francois Conradie), and none on Brinksfontein. Certain turbines were a concern to the Mullers and these issues were resolved with the proponent.

The authors' experience with this issue is that a number of people have commented positively on a number of WEFs that have been established in the last 12-24 months, such as the facilities located near Vredenburg, Caledon and Humansdorp in the Western and Eastern Cape respectively. All of these facilities are clearly visible from the roads in the area, including the N2 in the case of Caledon and Humansdorp. Some observers have commented that the turbines have a negative impact on the visual quality of the landscape. The visual impact and the significance thereof associated with a WEF on the area's sense of place is therefore likely to vary from individual to individual.

Impact: Visual impact associated with the proposed WEF and the potential impact on the areas rural sense of place.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	H	Negative	H	M	M
With Mitigation/ Enhancement	M	M	M	Negative	M	M	M
No-Go Option	There is no impact as it maintains the current *status quo*.						
Mitigation Measures: 1. The final placement of wind turbines should be discussed with the affected landowner (Mr Muller). 2. The recommendations of the VIA should be implemented.							

[49] Assumes that the proposed WEF will not be established.

15.3.5 *Potential impacts on tourism.*

The N1 is an important tourism route linking Cape Town with Gauteng. The area in which the proposed WEF would be constructed, is not a tourism destination in itself and none of the turbine structures would be visible from the N1 due to the distance of the site from the N1 (approximately 40km). The findings of the SIA indicate that there appear to be no major tourism activities and/or destinations in the immediate vicinity of the site that would potentially be impacted upon by the proposed WEF. The impact on tourism in the area is therefore likely to be limited.

Careful placing would reduce the overall visual impact of the proposed WEF on the areas sense of place. However, this is unlikely to change the significance rating in terms of impact on tourism. The proposed WEF may also attract visitors to the area. The significance of this positive impact is also likely to be minor.

Impact: Potential impact of the WEF on local tourism.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	L	Negative	L	M	H
With Mitigation/ Enhancement	M	M	L	Negative	L	M	H
No-Go Option	There is no impact as it maintains the current *status quo.*						
Mitigation measures: 1. The recommendations of the VIA should be implemented.							

15.4 Assessment of Decommissioning Phase.

Typically, the major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. In the case of this proposed facility, the decommissioning phase may also involve the disassembly and replacement of the existing components with more modern technology. This would take place in the 20 - 25 years post commissioning. The decommissioning phase therefore has the potential to create additional, construction type jobs, as opposed to the jobs losses typically associated with decommissioning.

The number of people employed during the operational phase of a single 140MW WEF will be in the region of 15-20. Given the relatively low number of people employed during the operational phase, the decommissioning of the facility is unlikely to have a significant negative social impact on the local community. The potential impacts associated with the decommissioning phase can also be effectively managed with the implementation of a retrenchment and downscaling programme.

Impact: Social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	M	M	Negative	M	M	H
With Mitigation/ Enhancement	M	L	L	Negative	L	M	H
No-Go Option	There is no impact as it maintains the current status quo.						
Mitigation Measures: 1. The proponent should ensure that retrenchment packages are provided for all staff retrenched when the WEF is decommissioned; 2. All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning; 3. All disturbed areas should be rehabilitated on decommissioning;							

4. 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.

15.5 Potential Health Impacts

The potential health impacts typically associated with WEFs include, noise, 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 result in the minimization of adverse health impacts for the population as a whole.

It is thus assumed that the significance of the potential health risks posed by the proposed WEF is of **low significance**. None of the local landowners interviewed raised concerns regarding the potential noise impacts generated by the movement of the turbines.

The noise produced by wind turbines is associated with their internal operation and the movement of the turbine blades through the air. The noise levels are dependent on a number of factors, including, the number of turbines operating, wind speed and direction. Noise levels diminish with distance from the WEF. However, while noise emissions increase with increasing wind speed, this is often, but not always, accompanied by an increase in the background noise environment. The background noise is associated with wind blowing past or through objects, such as trees or buildings. As a result, the background noise near a dwelling may be high enough to 'mask' the sound of the turbines. This may not, however, always be the case.

Concerns have also been raised regarding the potential health impacts associated with low frequency noise (rumbling, thumping) and infrasound (noise below the normal frequency range of human hearing) from wind farms. Research undertaken in Australia indicates that low frequency noise and infrasound levels generated by wind farms are normally at levels that are well below the uppermost levels required to cause any health effects. However, this does not mean that the low, subliminal noise levels that are associated with WEFs do not impact on the psychological well-being of affected parties if not setback. All wind turbines are well over 1 km away from any noise receptors on the sites with 650m being the internationally accepted minimum.

The potential impacts associated with noise have been assessed in the noise impact assessment. Sensitivity to noise impacts will differ from individual to individual.

15.6 Assessment of No-Development Option.

South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, the county is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions. The No-Development option would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, this would represent a negative social cost.

At a provincial and national level, the proposed WEF development is not unique. In this regard, a significant number of other renewable energy developments are currently proposed in the Western Cape and in other parts of South Africa. Foregoing the proposed establishment of WEFs would therefore not necessarily compromise the development of renewable energy facilities in the Western/Northern Cape Provinces or South Africa. However, the socio-economic benefits for local communities in Laingsburg, Sutherland and the LLM would be forfeited.

Nature: The no-development option would result in the lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy and a lost opportunity for the towns of Laingsburg, Sutherland and LLM.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	M	H	L	Negative	M	M	H
With Mitigation/ Enhancement[50]	H	H	M	Positive	H	M	H
Mitigation Measures: 1. The recommendations associated with the creation of employment opportunities during the construction phase and operational phase, and the recommendations pertaining to the establishment of Community Trusts apply; and 2. The recommendations relating to visual impact and impact on sense of place also apply.							

16 VISUAL ASSESSMENT

16.1 Visual Considerations

Table 14-4: Visual Sources, Pathways and Receptors.[51]

Source	Pathway	Receptor
Potentially large number of proposed wind turbines (approximately 55).	The potential visual intrusion of the wind turbines on the skyline and on scenic resources.	Residents of surrounding farms, Komsberg Wilderness Nature Reserve (private), and visitors/tourists to the area.
Proposed related infrastructure, incl. access roads, (particularly up steep slopes), substations and powerlines.	Visual effect of infrastructure on the rural landscape of the Karoo. Roads on steep slopes would require cut / fill embankments.	As above, both within the viewsheds of the WEF and the connecting grid powerlines.
Potential flicker effect of rotors in the early morning and evening when the sun is near the horizon.	Potential visual disturbance caused by the flicker-effect.	Residents, visitors and road users close to the turbines. The area is however sparsely populated with few roads.
Potential effect of red navigation lights on top of the wind turbines at night.	Potential visual intrusion of the red lights on the Karoo night sky. Pilot Activated Lighting (PAL) lighting could be used, which is only activated when planes are in the area.	Residents and visitors within the viewshed of the WEF up to about 30km. Only for a brief time when the lights are activated.
Potential effect of construction activities of the proposed WEF.	Potential intrusion of heavy construction vehicles, cranes, stockpiling of materials, construction camps, and borrow pits, including dust and noise.	Residents, visitors and road users in proximity to the overall project area.

16.2 Visual Assessment Criteria

The visual assessment is based on a number of quantitative and qualitative criteria to determine potential visual impacts, as well as their relative significance. The criteria are listed below:

16.2.1 *Visibility*

Visibility is largely determined by distance between the energy facilities and the viewer. Distance radii are used to quantify visibility of the proposed facilities, (assuming 100-120m

[50] Assumes establishment of a Community Trust that is well managed.

[51] 'Visual' in its broadest meaning includes visual, scenic, aesthetic and amenity values represented by the natural and the built environment, which can in totality be described as the area's 'sense of place'.

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

High visibility: Prominent feature within the observer's viewframe 0-2.5km

Mod-high visibility: Relatively prominent within observer's viewframe 2.5-5km

Moderate visibility: Only prominent with clear visibility as part of the wider landscape 5-10km

Marginal visibility: Seen in very clear visibility as a minor element in the landscape 10-20km

The potential visibility of the Komsberg WEF from selected viewpoints is given in **Table 14-5** below, and in the photographic montages (**Figures 9-10 to 9-16**).

16.2.2 *Visual Exposure*

Visual exposure is determined by the viewshed, being the geographic area within which the project would be visible, the boundary tending to follow ridgelines and high points in the landscape. Some areas within the viewshed fall within a view shadow, and would therefore not be affected by the proposed wind energy facilities.

The viewshed for the Komsberg East WEF is reflected in **Figure 9-17**. The viewshed to the north is restricted to some extent by the Komsberg escarpment, and to the east and west by mountain ridges.

Alternative sites for wind turbines included in the latest layout would change the viewshed slightly but not significantly.

16.2.3 *Visual Absorption Capacity*

This is the potential of the landscape to screen the project. The study area has numerous ridges and koppies, with visually enclose valleys, which would help to screen the project. On the other hand, ridgelines and steep upper slopes tend to be visually exposed.

16.2.4 *Visual Sensitivity*

Visual sensitivity is determined by topographic features, steep slopes, rivers, scenic routes, cultural landscapes and nature reserves. These, together with the required setbacks have been indicated on the Visual Informants Map (**Figure 8-15**).

16.2.5 *Landscape Integrity*

Visual quality is enhanced by the scenic or rural quality and intactness of the landscape, as well as by the lack of other visual intrusions. The area to the south has a number of existing powerlines and substations, while the Komsberg escarpment area to the north is more scenically pristine.

16.2.6 *Cultural Landscapes*

Cultural landscapes are enhanced by the presence of heritage sites, historical farmsteads, gravesites and cultivated lands. These tend to occur along the river courses within the study area.

Table 14-5: Viewpoints and Potential Visibility (Figure 9-18).

View point	Location	Coordinates	Distance	Visibility
VP1	Gravel district road east of Meintjiesplaas	32.8394S, 20.8040E	4.65km	East site not visible.

VP2	Gravel district road near Kareedoornkraal	32.8426S, 20.8395E	4.55km	East site not visible.
VP3	Gravel district road at Blounek	32.8209S' 20.9525E	10.73km	East site marginally visible on skyline. Partially obscured by topography.
VP4	Gravel district road at Banksdrif	32.8106S, 20.9595E	9.43km	East site marginally visible on skyline. Partially obscured by topography.
VP5	De Fonteine farmstead	32.7857S, 20.9818E	6.14km	East site moderate-highly visible on skyline. Partially obscured by topography.
VP6	Gravel district road at Rondawel	32.7559S, 20.9314E	6.18km (E)	East site moderate-highly visible on skyline.
VP7	Gravel district road at Perdebos	32.7162S, 20.8834E	9.74km (E)	East site marginally visible.
VP8	Gravel district road at 1km radius	32.7005S, 20.8522E	1.24km	East site not visible.
VP9	Gravel district road at 2km radius	32.7021S, 20.8367E	2.40km	East site not visible.
VP10	Gravel district road at Welgemoed	32.7086S, 20.7800E	4.33km	East site not visible.
VP11	Gravel district road at top of Komsberg Pass	32.6785S, 20.7577E	8.22km	East site not visible. Less visible against mountain backdrop.
VP12	Gravel district road at entrance to 'Komsberg Wilderness Nature Reserve' (private nature reserve).	32.6944S, 20.7790E	5.61km	East site not visible.
VP13	Gravel district road near De Kom farmstead	32.7366S, 20.7274E	7.31km	East site not visible.
VP14	Access road to De Plaat farmstead	32.8068S, 20.7192E	9.18km	East site not visible.

16.3 Assessment

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Construction Phase							
Without Mitigation	L	L	H	Negative	M to H	H	H
With Mitigation	L	L	H	Negative	M	M	H
Operation Phase							
Without Mitigation	L	H	H	Negative	M to H	H	H
With Mitigation	L	H	H	Negative	M	M	M
Closure Phase (Decommissioning)							

Without Mitigation	L	H	L	Neutral	L	M	H
With Mitigation	L	H	L	Neutral	L	M	H
Can the impact be reversed?	Yes. At decommissioning phase, assuming rehabilitation of the landscape.						
Will impact cause irreplaceable loss of visual /	Yes. During the construction and operational phases, during the life of the project, but could be largely reinstated after the decommissioning phase.						
Can impact be avoided, managed or mitigated?	The scale of wind turbines makes these difficult to visually mitigate. Minor mitigation is possible through micro-siting.						

Mitigation measures:

1. Avoid locating wind turbines and related structures on prominent elevations, especially peaks (marked with yellow triangles on **Figure 8-15**), which are important markers in the landscape and therefore visually sensitive.
2. Avoid slopes steeper than 1:5 gradient, where possible, being highly sensitive. Slopes steeper than 1:10 require special measures in the siting of roads and structures to avoid visually unsightly cut and fill embankments, and possible erosion.
3. Certain access roads on steep slopes in the current layout would need to be reviewed and micro-sited during the implementation phase to avoid visual scarring of mountain slopes.
4. Avoid cultural landscapes or valuable cultivated land, particularly because of the scarcity of the latter.
5. Ensure setbacks for wind turbines as indicated in **Table 5-2**.
6. Locate substations in unobtrusive, low-lying areas, away from roads and habitations and screened by the topography if possible. Avoid ridgelines. Screen substation structures with earth berms and tree-planting if possible. Use down-reflectors for all lighting at substations to avoid light pollution.
7. Consolidate operations/ maintenance buildings and parking areas in unobtrusive areas to avoid the sprawl of buildings in the open landscape.
8. Locate access roads in sympathy with the grain of the landscape and the contours, and avoid drainage courses. Keep roads as narrow as possible to minimise cut and fill on steeper slopes. Avoid slopes steeper than 1:10 where possible.

Can any residual risk be monitored / managed?	Not easily because of the height of the wind turbines. Micro-siting and technical considerations of siting. Micro-siting and landscape rehabilitation would help to manage residual risks to some extent.
Will this impact contribute to any cumulative impacts?	Yes. The wind facility would result in additional industrial type development in the local landscape setting. Other large wind facilities are planned to the west. The potential cumulative visual impact of the wind farms together could be **high**.

The visual impact significance of the proposed Komsberg East WEF (alternative and preferred) would be **medium to high** before mitigation. The potential visual impacts could be partly mitigated by using mitigation measures as indicated in **Figure 9-19a**. The potential visual impacts could be partly mitigated by relocating some of the turbines, using alternative positions provided by the applicant. In some cases only micro-siting may be required.

Buffers around topographic features, settlements and roads as recommended in **Table 5-2** need to be implemented as indicated in the layout. The substation and operations/maintenance buildings must be relocated to a less visually exposed site. Provided these mitigations measures are implemented, the visual impact significance could potentially be reduced to **medium.**

The construction phase of the WEF and associated infrastructure would be short-term (less than two years) and would therefore have a lower visual significance rating.

As a result of these findings, certain turbine locations and power line routes were adjusted on the preferred layout. Refer to section 19.2 for the assessment of the final layout, and **Figure 9-19b** which indicated the final layout showing the relocation of the turbines according to the specialists' requirements.

17 CUMULATIVE IMPACT ASSESSMENT

Cumulative impacts result from the incremental impact of a proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. **Figure 9-20** shows the DEA's map showing the number of renewable energy EIA applications nationally for 2015. The site for the proposed Komsberg WEF has been included on this map. The status of these applications is unknown, however, it can be seen that there are a number of other proposed WEFs located near the study area and that cumulative impacts

on sense of place, visual aspects, heritage aspects, fauna and flora may occur if all renewable energy projects, or any other large developments, such as the proposed oil exploration projects, are constructed in the region.

Cumulative impacts were assessed by the specialists and their findings are summarized below.

17.1 Fauna and Flora

The broad area is quite diverse in terms of the different vegetation types present in the area, with the result that each development tends to impact different vegetation types. Exceptions include Roggeveld Shale Renosterveld which occurs on the escarpment and would be impacted upon by several different facilities and Central Mountains Shale Renosterveld, which occurs on the rugged hills and mountains south of the escarpment.

Cumulative impacts on Central Mountains Shale Renosterveld appear to be a particular concern as this vegetation type has a relatively limited extent and a significant proportion, especially in the west is within renewable energy development application areas. It is also important to note that within those developments below the escarpment, it is the higher lying ridges that are usually targeted for development and it is often these that also contain the highest levels of species of conservation concern. As the ridges themselves represent a specialized and relatively confined habitat, development of these ridges results in a much larger cumulative impact on these areas, compared to the landscape in general. In addition, it is usually the access roads rather than the turbines themselves which generate the majority of impact.

Cumulative impacts would include:

- The cumulative loss of sensitive habitats may result in biodiversity loss and reduced future ability to meet conservation targets for these habitats.
- Transformation of intact habitat with CBAs could compromise the ecological functioning of the CBAs and would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations.

Impact Description: Cumulative impact on CBAs and broad scale ecological processes.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	M	Negative	H	H	H
With Mitigation	L	H	M	Negative	M	H	H
Can the impact be reversed?	The impact would last for the lifetime of the development (20-25 years).						
Will impact cause irreplaceable loss or resources?	Unlikely.						
Can impact be avoided, managed or mitigated?	To some extent, but the main impact results from the loss and transformation of habitat as well as the presence and operation of the facility which cannot be avoided. This would be of local significance.						
Mitigation measures: 1. The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas. 2. An Open Space Management plan should be developed for the site, which should include management of biodiversity within the affected areas, as well as that in the adjacent rangeland. 3. Avoid impact to potential corridors such as the riparian corridors associated with the larger drainage lines within the facility area.							
Can any residual risk be monitored/managed?	Yes. There should be regular monitoring for alien plant problems during the operational phase, with management and control implemented according to the Alien Management Plan.						
Will this impact contribute to any cumulative impacts?	Yes. Alien plant invasion would contribute towards cumulative habitat loss and degradation in the area. If aliens are effectively controlled, then this contribution would be low.						

17.2 Bats

The cumulative impacts on bat populations were considered by searching for current and potential future development of wind energy within a 560km radius of the project. At least 177 onshore wind facilities and onshore wind/solar PV combined facilities are being considered by the Department of Energy in this cumulative 560km region (**Figure 9-20**). It is not likely that all of these facilities will reach commercial operation.

This scale was chosen because it represents the maximum reported distance the Natal long-fingered bat is estimated to migrate in South Africa. This species is known to migrate over hundreds of kilometres (i.e. 560km is not an isolated data point) between winter and summer roosts. It is important to consider cumulative impacts across the entire scale as potentially affected animals are likely to move especially mobile animals like bats and birds. Impacts at a local scale could have negative consequences at larger scales if the movement between distant populations is impacted. For example, it has been demonstrated that among Noctule bats collected beneath wind turbines in eastern Germany, 28% originated from distant populations in the Northern and North-eastern parts of Europe. The cumulative impacts could be lower for species that do not migrate over such large distances or resident species that are not known to migrate. The sphere of the cumulative impact would then likely be restricted to the home ranges and foraging distances of different species, which can range from 1km to at least 15km for some insectivorous bats.

Cumulative impacts on bats could increase as new facilities are constructed but are difficult to accurately predict or assess without baseline data on bat population size and demographics 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 also 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.

17.3 Avifauna

17.3.1 *Komsberg East WEF and Komsberg East Grid Connection*

The cumulative impacts of the Komsberg East WEF and Komsberg East Grid Connection may be slightly higher than the individual impacts for habitat destruction, disturbance and displacement, electrocution and power line collisions, but the significance is expected to remain the same for each of these impacts. The cumulative impact is therefore expected to have the significance of the component with the higher significance.

17.3.2 *Komsberg East WEF, Komsberg East Grid Connection, Komsberg West WEF and Komsberg West Grid Connection*

The cumulative impact of the Komsberg East and West Wind Energy Facilities and associated electrical grid connection infrastructure is expected to have an overall impact higher than the individual components, especially for the operational phase. Depending largely on turbine placement, the combined impact of up to 110 turbines has the potential to affect the viability of local populations. If all No-go and High Sensitivity zones are avoided, and if all recommended mitigations are correctly implemented, the cumulative impacts of the two WEFs may be acceptable. To reduce cumulative impacts, it is recommended that wherever possible, the minimum number of turbines are utilised to meet the required MW output.

Note that no-go and high sensitivity zones have been avoided in the final layout (refer to section 19.1.4.

17.3.3 *Komsberg East WEF, Komsberg East Grid Connection, Komsberg West WEF, Komsberg West Grid Connection and Proposed WEF Projects within a 50 km radius.*

The impacts assessed the avifauna study, and particularly those associated with the operational phase of the proposed project, may be intensified by each other due to the potential cumulative impacts of a number of proposed WEFs (and associated infrastructure) within 50km of the project site.

Approximately seven large WEFs in various stages of the EIA application process fall within a 50km radius of the project site. Included in these, are two projects that have preferred bidder status in the DoE's REIPPPP, and are due for construction, namely the Roggeveld Wind Farm (140 MW) and Karusa Wind Farm (140MW) (part of the Hidden Valley WEF). The latter two WEFs and the Great Karoo WEF, also part of the Hidden Valley WEF, are located adjacent to Komsberg.

Within the scope of this study, it is difficult to say with confidence at this stage what the cumulative impact of all the proposed developments would be on birds because there is no cumulative baseline to measure against.

The extent of actual impacts on the region's avifauna will become known once wind farms are developed and operational data becomes available, and once regional population viability analyses have been conducted for key species. The developments considered may not all be constructed.

Conducting a detailed cumulative impact assessment of all of these facilities together on a regional scale (which should include a population analysis of the regional Verreaux's Eagle population, as well as some level of collision risk modelling or predictions for this population) would be a useful study for the area, but is beyond the scope of this avifaunal study. This proposal can proceed without such a study being compiled at this stage. The avifaunal specialist can, outside the scope of this report, engage with the appropriate regional or national agency/ies in the context of strategic planning regarding the commissioning of such a report by these bodies.

At a high level and with low confidence it can be said that, if four or more of these facilities are approved and constructed they (together with Komsberg East WEF and Komsberg West WEF) may present a medium to high significant impact on birds, particularly from collision impacts (with either powerlines or turbines). Collisions with powerlines and wind turbines can potentially affect the viability of regional populations, particularly of Verreaux's Eagle, Karoo Korhaan, Martial Eagle and Ludwig's Bustard.

The significance of these cumulative impacts will depend largely on:

- The final turbine layouts of all facilities;
- If turbine placement was informed by pre-construction monitoring and nest surveys on these facilities;
- The density of the Verreaux's Eagle populations on the facilities (i.e the regional population of Verreaux's Eagle).
- The species richness, abundance and behaviour of the avifaunal community within and around the various WEFs; and
- Whether or not mitigation measures were recommended and implemented and are successful.

If all proposed projects that are built, implement the recommended mitigation measures as well as the post-construction monitoring programmes and share the information gained from these, then the overall significance of the discussed impacts may be reduced. The significance of some cumulative impacts is likely to remain medium to high negative even after mitigation.

As WEF developments typically only result in approximately 0.5–2% of the land being disturbed/destroyed, and considering that the habitats that are likely to be destroyed occur in

relative abundance elsewhere within the broader region, the cumulative impacts of habitat destruction on birds is predicted to be low to medium. The majority of priority species potentially occurring at the project site all have relatively large distribution ranges and as such, the cumulative impacts of disturbance and displacement are likely to be medium and regionally significant, rather than national. Furthermore, the majority of the species likely to be displaced have suitable habitat beyond the WEF (even if the four or more of the seven projects are constructed), the cumulative impact is likely to be of medium significance. Assuming that all new power line infrastructure associated with the proposed WEFs in the 50km radius will be constructed using a safe, 'bird friendly design' the cumulative impact of electrocution is likely to be of medium significance.

17.4 Aquatic Ecosystems

17.4.1 *Loss of riparian systems and water courses during the construction phase.*

This would involve the physical removal of the narrow strips of riparian zones and disturbance of any alluvial watercourses by road crossings, being replaced by hard engineered surfaces. This biological impact would be localised, as a large portion of the remaining catchment would remain intact.

In terms of cumulative impacts, the increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is likely to occur, considering that the site is near the main drainage channels particularly when considering a possible 6-9 other renewable projects. The annual rainfall figures are low and this impact is not anticipated as only a small percentage of the proposed projects may reach the construction phase.

17.4.2 *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.*

Cumulative impacts of downstream alteration of hydrological regimes could occur due to the increased run-off from the area. 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. This is also coupled to the fact that surrounding developments would impact on a different catchments in the neighbouring water management areas, as well as the low average rainfall figures.

17.4.3 *Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase.*

Cumulative impacts of downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, any unstable banks will become eroded and sediment bars, will cause sedimentation downstream. Due to the area's low mean annual runoff within the region, this impact is not anticipated due to the nature of the development together with the proposed layout.

17.4.4 *Impact on localized surface water quality mainly during the construction phase.*

During both preconstruction, 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. In terms of cumulative impacts, there is the possible impact on the remaining catchment, due to changes in run-off characteristics in the development site. As there is a low mean annual runoff within the region this impact is not anticipated due to the nature of the development together with the proposed layout.

17.5 HERITAGE ASSESSMENT

17.5.1 *Possibility of encountering unique fossils during excavation and construction for turbine foundations.*

Cumulative impacts, albeit of low-level significance, on local fossil heritage resources would be anticipated as a result of construction of the proposed number of WEFs in the region.

17.5.2 *Construction - Displacement or destruction of archaeological material.*

No cumulative impacts anticipated. The site is not considered archaeologically sensitive and has few unique qualities.

17.5.3 *Construction and Operation - Displacement or destruction of colonial period heritage structures.*

No cumulative impacts anticipated. The site is not considered archaeologically sensitive and has few unique qualities. Most of the heritage sites are in valley bottoms which will not be affected by the proposal.

17.5.4 *Construction and Operation - Alteration of sense of place, destruction of landscape quality.*

Cumulative impacts are anticipated. This proposal would contribute to a general aesthetic deterioration of the scenic region. Even though it has been deemed an ideal locality in terms of its wind resources, the high volume of potential applications for the area, if approved, and depending on how many are built, the impact on cultural/heritage sense of place could be high as there would be a change to the natural place and aesthetic value.

17.6 Noise

During the construction phase, construction noises will cumulatively add to any other noises in the area, and these will be insignificant. Note that due to the significant distance (more than 8000m) between both the proposed East and West WEFs (whether the alternative or preferred layouts) the risk of a cumulative noise impact is minimal.

During the operational phase, ambient sound levels will increase slightly at all close NSDs, but this increase will be insignificant. This is relevant for both the initial preferred layout, and the alternative proposed layout.

Due to the significant distance (more than 8000m) between proposed facilities in the area (whether the alternative or preferred layouts) the risk of a cumulative noise impact is minimal.

The significance of the noise impact for operational activities is considered to be low on all receptors.

Table 14-6: Impact Assessment Operational Activities – Maximum potential cumulative noise levels (Vestas turbines).

Receiver no.	Projected Noise Level (dBA)	Typical night-time ambient sound levels	Extent	Intensity	Duration	Significance
1	18.3	30 - 40 dBA	L	L	M	L
2	27.1	30 - 40 dBA	L	L	M	L
3	11.7	30 - 40 dBA	L	L	M	L
4	27	30 - 40 dBA	L	L	M	L
5	41.2	30 - 40 dBA	L	M	M	L
6	40.3	30 - 40 dBA	L	M	M	L
7	15.6	30 - 40 dBA	L	L	M	L

8	29.1	30 - 40 dBA	L	L	M	L
9	0	30 - 40 dBA	L	L	M	L
10	37.1	30 - 40 dBA	L	M	M	L
11	32.2	30 - 40 dBA	L	L	M	L
Probability of impact		Low				
Confidence in finding		Very high				
Mitigation measures		Mitigation is not required due to low significance of noise impact.				
Cumulative impacts		Ambient sound levels will increase slightly at all close NSDs, but this increase will be insignificant.				
Residual Impacts:		This impact will only disappear after the operational phase is finished and rehabilitation of the area is completed.				

Table 14-7: Impact Assessment: Operational Activities – Maximum potential cumulative noise levels (Acciona turbines).

Receiver no.	Projected Noise Level (dBA)	Typical night-time ambient sound levels	Extent	Intensity	Duration	Significance
1	20.3	30 - 40 dBA	L	L	M	L
2	29.1	30 - 40 dBA	L	L	M	L
3	13.7	30 - 40 dBA	L	L	M	L
4	29.0	30 - 40 dBA	L	L	M	L
5	43.2	30 - 40 dBA	L	M	M	L
6	42.3	30 - 40 dBA	L	M	M	L
7	17.6	30 - 40 dBA	L	L	M	L
8	31.1	30 - 40 dBA	L	L	M	L
9	0	30 - 40 dBA	L	L	M	L
10	39.1	30 - 40 dBA	L	M	M	L
11	34.2	30 - 40 dBA	L	L	M	L
Probability of impact		Low				
Confidence in finding		Very high				
Mitigation measures		Mitigation is not required due to low significance of noise impact.				
Cumulative impacts		Ambient sound levels will increase slightly at all close NSDs, but this increase will be insignificant.				
Residual Impacts:		This impact will only disappear after the operational phase is finished and rehabilitation of the area is completed.				

17.7 Social Aspects

17.7.1 *Cumulative Impact on Sense of Place*

The Australian Wind Farm Development Guidelines[52] indicate that the cumulative impact of multiple wind farm facilities is likely to become an increasingly important issue for wind farm developments in Australia. The key concerns in terms of cumulative impacts are linked to visual impacts and the impact on rural, undeveloped landscapes.

The Scottish Natural Heritage[53] describes a range of potential cumulative landscape impacts associated with wind farms on landscapes. The relevant issues raised include:

[52] Australian Environment Protection and Heritage Council (EPHC), *National Wind Farm Development Guidelines* Draft - July 2010.
[53] Scottish Natural Heritage, *Assessing the Cumulative Impact of Onshore Wind Energy Developments* – March 2012.

- Combined visibility (whether two or more wind farms will be visible from one location).
- Sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail).
- The visual compatibility of different wind farms in the same vicinity.
- Perceived or actual change in land use across a character type or region.
- Loss of a characteristic element (e.g. viewing type or feature) across a character type caused by developments across that character type.

The guidelines also note that cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one 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.

As indicated in **Figure 9.20**, there are a number of renewable energy projects, including WEFs and associated power lines located in the study area. The potential for cumulative impacts associated with combined visibility (whether two or more wind facilities will be visible from one location) and sequential visibility (e.g. the effect of seeing two or more renewable energy facilities along a single journey, e.g. road or walking trail) is therefore high. This should be viewed within the context of the identification of the area as a renewable energy development zone. The area has been identified as an area where renewable energy should be concentrated.

Due to the proximity of the different sites, the various WEFs and their associated power lines could be viewed as a single large WEF as opposed to a number of separate WEFs. While viewing these WEFs as a single large facility, as opposed to separate facilities, does not necessarily reduce the overall visual impact on the scenic character of the area, it does reduce the potential cumulative visual impact on the landscape.

Viewing each of the proposed WEFs as a single, large WEF eliminates the cumulative impact associated with combined visibility (whether two or more wind farms will be visible from one location) and sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail). This reduces the potential cumulative visual impact of the WEFs on the landscape. The proximity of the WEFs also has the benefit of concentrating the visual impacts on the area's sense of place into one area as opposed to impacting on a number of more spread out areas.

The potential impact of WEFs 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 establishment of a number of large renewable energy facilities in the area does have the potential to have a negative cumulative impact on the areas sense of place and the landscape. The environmental authorities should consider the overall cumulative impact on the rural character and the areas sense of place before a final decision is taken with regard to the optimal number of such facilities in an area. This must, however, also be considered in terms of the area being determined a Renewable Energy Development Zone (REDZ) by the CSIR under the DEA's SEA process and that clustering sites does reduce impact.

Impact: Cumulative visual impact associated with the establishment of a WEF on the on the areas rural sense of place and character of the landscape.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation/ Enhancement	H	H	M	Negative	H	M	M
With Mitigation/ Enhancement	M	M	M	Negative	M	M	M
No Go-Option	There is no impact as it maintains the current *status quo*.						

Mitigation Measures:
1. The recommendations of the VIA should be implemented.

17.7.2 *Cumulative Impact on Local Economy*

The establishment of the Komsberg East and West WEFs 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.

As indicated above, there are a 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 for the LLM and KHLM. However, in order to maximise the benefits these trusts will need to be properly managed.

Impact: The establishment of a number of renewable energy facilities in the region will create employment, skills development and training opportunities, creation of downstream business opportunities.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation/ Enhancement	M	H	M	Positive	M	M	H
With Mitigation/ Enhancement	H	H	M	Positive	H	M	H
No-Go Option	There is no impact as it maintains the current status quo. This would represent a lost socio-economic opportunity for the LLM and KHLM.						

Mitigation/Enhancement Measures:
1. Recommendations associated with the creation of employment opportunities during the construction phase and operational phase apply; and
2. Recommendations pertaining to the establishment of Community Trusts apply.

17.8 Visual Aspects

Cumulative visual impacts would occur as this proposed wind facility would result in industrial type development in the local landscape setting, where other large wind facilities are planned to the west. The potential cumulative visual impact of many wind farms together could be of high significance. Visual impact is related to sense of place. Refer to section 27.7.1 above (social) which discusses the potential impact on sense of place in further detail (medium significance impact post mitigation).

SECTION H: PUBLIC PARTICIPATION PROCESS AND ISSUES TRAIL

18 PUBLIC PARTICIPATION

Throughout this process, stakeholders have been and will be encouraged to communicate with the PPP team to raise issues, ask questions or make suggestions. Registration of I&APs will continues throughout the process.

As noted, the overall proposed project is for the development of two wind energy facilities and their associated grid connections and infrastructure, which include.

- Komsberg East Wind Energy Facility, Western Cape Province; and
- Komsberg West Wind Energy Facility, Northern and Western Cape Provinces.
- Komsberg East Grid Connection, Western and Northern Cape Provinces; and
- Komsberg West Grid Connection, Western and Northern Cape Provinces.

A combined Public Participation Process (PPP) is being conducted for all the above, and this process was initiated in August 2015. Refer to the minutes of the Pre-Consultation Meeting held with the DEA on the 25th June 2015 (**Appendix B**).

18.1 Key Stakeholders

At this stage of the process, a number of key stakeholders have been identified and included on the project database. These key stakeholders include (but are not limited to) the following:

- Ratepayers' associations;
- Local farmers' associations;
- Local tourism organisations covering this part of the Karoo.
- CapeNature;
- Northern Cape Department of Environmental Affairs and Nature Conservation (DENC);
- Western Cape Department of Environmental Affairs and Development Planning (DEADP)
- South African Bat Assessment Advisory Panel (SABAAP);
- National and Provincial Department of Water Affairs;
- Local bird clubs or interested bird watchers;
- BirdlifeSA;
- Department of Mineral Resources;
- National and Provincial Department of Agriculture, Forestry and Fisheries (DAFF);
- Heritage Western Cape (HWC);
- South African Weather Service;
- Sentech (state owned enterprise operating in the broadcasting signal distribution and telecommunications sectors);
- Department of Communications;
- Square Kilometre Array Project (SKA);
- Southern African Large Telescope (SALT); and
- Air Traffic and Navigation Services SOC Limited (ATNS).

Additional relevant stakeholders will be identified during the PPP. Refer to **Appendix H4** which includes a copy of the latest I&AP database.

18.2 Public Engagement Tasks undertaken during the Scoping Phase.

- Placing notification advertisements of the proposed project in one local (*Die Noordwester*) and one regional newspapers (*Die Burger*) on the 28th August 2015 – in English and Afrikaans.

  Refer to **Appendix H1** for copies of the advertisements.
- Placement of five A3 posters (in English and Afrikaans) in public areas in the towns of Laingsburg and Sutherland on the 1st September 2015.

Refer to **Appendix H2** for photographs of these posters, and a map indicating the location of where the posters were placed.

- Placement of five A1 posters (in Afrikaans and English) within and around the proposed WEF and grid connection sites.

  Refer to **Appendix H2** for photographs of these posters.

- Distribution of initial notification letters, the BID (in English and Afrikaans) and comment sheets to surrounding landowners, the municipal councillors of the areas and relevant organs of state on 28th August 2015.

  Refer to **Appendix H3** for copies of the notification letters and the BIDs and proof of delivery.[54]

- Ongoing telephonic communication with landowners and adjacent landowners in order to ensure that occupiers of their properties have been informed, and obtaining the occupiers' contact details where possible.

  Refer to **Appendix H5** which documents this ongoing process.

- Public Review of the Draft Scoping Report from the 2nd September 2015 to the 2nd October 2015 in the Sutherland and Laingsburg Public Libraries, and on the Arcus and EIMS company websites.

  Refer to **Appendix H6** for the notification letter and proof of delivery of the reports and comment sheets to the libraries.

- Distribution of hard and electronic copies of the Draft Scoping Report to relevant organs of state.

  Refer to **Appendix H6** for Proof of Delivery to these state departments.

18.3 Public Engagement Tasks undertaken for EIA Phase

- Notification letters sent to all registered I&APs on the database, informing stakeholders of the availability of the Draft EIR and EMPr during April 2016 in the Sutherland and Laingsburg Public Libraries, and on the EIMS company website.

  Refer to **Appendix H10** for these notification letters and proof of delivery to these state departments.

- Distribution of electronic copies of the Draft EIR and EMPr (hard copies upon request) to state departments.

  Refer to **Appendix H10** for proof of delivery to these state departments.

- Possible hosting of a focus group meeting/public event in Laingsburg during March/April 2016.

  The minutes of any meetings will be included in the Final EIR and EMPr, and issues raised will be included in the issues trail and addressed.

18.4 Synopsis of Key Issues

Comments received from the public during the review of the Draft Scoping Report during October 2016 have been collated into an Issues Trail (Issues and Responses Report), which documents the issues raised and provides project team responses to the comments received. This Issues Trail is included in **Appendix H7**. The original comments are included in **Appendix H8**. A summary of issues raised thus far are reflected in **Table 18-1** below, and indicates the issues raised for the proposed Komsberg East and West WEFs, and the proposed

[54] To ensure successful delivery of notification to (Interested and Affected Parties (I&APs), all possible forms of written communication where possible were utilised. As such, written notification to I&APs was sent via the following methods where this information was available:

- Registered letters;
- Faxes; and
- Email.

Failed notifications are included in the documentation (**Appendix H6**) to demonstrate that all reasonable efforts were made to notify I&APs and for the purpose of showing that the documentation of the process is fully inclusive of all communication. In the event that any failed notifications were received, further investigation was undertaken to ensure successful notification of these I&APs. By way of example, in instances where both faxes and emails were not successful, an attempt was made to contact the I&AP by telephone to obtain the correct details and so notifications were re-sent.

Komsberg East and West grid connections. Issues and responses pertaining to the proposed Komsberg East WEF are indicated where relevant, although most of the issues are general and relevant to all proposals.

The summary of issues raised will be updated to include any new issues once public review of the Draft EIR and EMPr is complete.

Table 18-1: Summary of Issues Raised Thus Far and Project Team Responses.

Summary of main issues raised by I&APs	Summary of response from Project Team
Concern regarding visual impacts.	A full visual impact assessment has been conducted for this proposal, and is included in **Volume 2.** Overall, the visual impact significance for Komsberg East WEF would be high negative before mitigation. The potential visual impacts could be mitigated by using mitigation measures as indicated in the specialist report. These measures include relocating some of the WTGs, using alternative positions, and in some cases, micro-siting will be required. Similarly, buffers around topographic features, settlements and roads are recommended as and the substation and operations / maintenance buildings should be relocated off the ridgeline. Provided these mitigation measures are implemented, the visual impact significance could be reduced to medium negative. The applicant has implemented the design phase mitigation measures in the final layout i.e. 'embedded' mitigation.
Further studies addressing archaeology and palaeontology required.	A full Heritage Impact Assessment, which addresses archaeology and palaeontology aspects has been conducted for this process. Refer to **Volume 2** for this study.
Interest in obtaining work from the construction phase of the proposed development.	Contact details have been provided to the applicant.
No impact on roads within the SANRAL's jurisdiction.	Acknowledged.
Eskom's rights and services to be acknowledged and all of Eskom's procedures to be adhered to at all times.	The design engineers on this project have been made aware of these guidelines and will take all requirements required by legislation into account in the design of the WEF.
The height of the tallest structure on the site has relevance to the South African Civil Aviation Authority.	The height of the tallest structures on site, the wind turbines, will be reported to the South African Civil Aviation Authority for their approval of the layout. At this stage, the WTGs will be 120m high (hub height) and rotor diameter of up to 140m. The height of the entire structure is therefore up to 190m.
The total area to be cleared, affected vegetation types and protected trees and plants are relevant to the Department of Agriculture, Forestry and Fisheries to determine whether or not permits are required.	The development of the total facility would result in an expected maximum direct habitat loss of approximately 250ha. This would generate some local impacts on the connectivity of the landscape, broader-scale impacts are less likely as there is significant space between the affected ridges which would maintain and facilitate connectivity of the landscape. This information will be provided to the Department, and is included in the Fauna and Flora Assessment report in **Volume 2**.
Concern regarding transport and traffic related impacts on neighbouring property Koornplaats 41. Specific concerns include noise, dust and safety[55] and the need for a detailed transport management plan.	An alternative route has been investigated with the landowner. Refer to **Volume 3** which includes the traffic and transport management plan.
Concern regarding whether existing roads will be upgraded or not.	Where existing public and private roads are used, these would be upgraded or altered to meet the required specification for equipment transportation or operations. This would be carried out in consultation with the relevant roads authorities.

[55] No fencing around the farm dwellings (A. Teroede, pers comm.).

Uncertainty regarding the possible impacts on the Riverine Rabbit and the Bat-eared fox.	The flora and fauna specialist has assessed this potential impact. The Riverine Rabbit *Bunolagus monticularis* is listed as Critically Endangered. This species is usually associated with alluvial terraces and floodplains of ephemeral rivers of the Karoo. In context of the site, it is likely to be largely restricted to the Komsberg area and to the areas on top of the plateau, which would not be impacted by the development. It is not likely to be present within the Komsberg East wind farm as there is no typically suitable habitat present within the affected areas. In terms of impact, the drainage lines where Riverine Rabbits are likely to occur are not likely to be significantly affected by the development, however, the large amount of traffic present in the area during construction is likely to pose a threat to this species. It appears to be vulnerable to collisions with vehicles in the vicinity of drainage lines and it is likely that some individuals would be lost to collisions with vehicles during the course of construction at the site. This impact would be of medium significance after mitigation. Refer to the Fauna and Flora Specialist report in **Volume 2** for detailed mitigation.
Concern regarding impacts on sense of place.	The social, heritage and visual specialists have investigated and assessed this impact, and the findings are documented in **Volume 2** of this report. Social assessment findings: Properties belonging to four owners would be affected. The sense of place impact would vary from individual to individual. This impact would have a medium significance after mitigation is implemented. Heritage assessment findings: The WTGs would be visible structures within the landscape, and would change the overall sense of place of a locality. Alteration of the sense of place of this locality would be medium negative both before and after mitigation. Visual assessment findings: The particular sense of place could be adversely affected by the proposed development, and possibly compromise the experience enjoyed by residents and visitors to the area.
Concern regarding the potential impacts of this development on rare bird species that only occur in the Moordenaars Karoo area.	To assist the avifauna specialists, this I&AP was contacted to request a list of which rare bird species had been observed in the area. In the absence of this information forthcoming, the avifaunal specialist identified all possible rare bird species potentially occurring in the project area. This was done by conducting a detailed data search as well as utilizing information gathered over twelve months of pre-construction bird surveys. These surveys were conducted in line with applicable guidelines and the results of this survey have been included in **Volume 2**. The risk exists that collisions may occur with power lines and that electrocutions may occur. Mitigation is possible that will mean that the significance of these impacts can be reduced from a high significance to a low significance impact. Mitigation includes, *inter alia*, utilizing a 'bird friendly' tower design that prevents electrocutions, reducing the total distance of overhead power lines where possible and increasing their visibility by fitting bird flight diverters (BFD's) in order to reduce the number of collisions.
The impact on shale gas exploration due to the proposed development potentially impacting seismic surveys in terms of ground vibration and surface noise	The possibility of these impacts has been investigated. A focus group meeting was held with Falcon Oil & Gas Ltd. on 30th October 2015 to discuss potential impacts.

generated near seismic lines should exploration rights be granted.	The outcome of the meeting indicated that a co-operation agreement is possible between the relevant parties should the WEF be implemented. Refer to **Appendix H9**.
Concern regarding night lighting and construction dust within the Central Astronomy Advantage Area.	The proposed WEF should not affect the Central Astronomy Advantage Area. The construction of the WEF will be done in accordance with an Environmental Management Programme (EMP) and any possible dust impacts would be monitored by an Environmental Control Officer (ECO).

Refer to the Issues Trail for the detailed project team responses to the comments received (**Appendix H7**).

With a view to further understanding the comment submitted regarding the possible impacts that the proposal could have on shale gas exploration, a Focus Group Meeting was held with Falcon Oil & Gas Limited on 30th October 2015. The minutes of this meeting and relevant correspondence are included in **Appendix H9**.

SECTION I: SUMMARY OF FINDINGS

19 SUMMARY OF FINDINGS

This EIR has provided a description of the proposed Komsberg East WEF, and its preferred and alternative layouts. 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:

- Terrestrial Ecology (Flora and Fauna);
- Bats;
- Avifauna;
- Aquatic Ecosystems;
- Cultural Heritage, Archaeology and Palaeontology;
- Noise;
- Social Aspects; and
- Visual Aspects.

The specialist reports summarized in sections F and G of this report document the assessment of potential environmental impacts that may be experienced within the realms of both the biophysical and social environments, should the proposed project be developed. All specialist reports are included in **Volume 2** of this report.

This section summarizes the EIA Phase by providing an evaluation of the significance of the environmental impacts of this proposal. In doing so, it draws on the information gathered as part of the process, and the knowledge gained by the environmental assessment practitioners whilst undertaking the EIA, and presents an informed opinion of the environmental impacts associated with the proposal. The assessments of potential environmental impacts within this EIR were made on the preferred and alternative layouts of the wind farm (consisting of the WTGs and the substation/switching station and internal access roads) as provided by Komsberg Wind Farms (Pty) Ltd. As a result of this assessment, the final layout was produced by incorporating mitigation measures, no-go areas and environmental constraints, this was assessed once more by the specialist team.

19.1 Summary of Findings – Significance Assessment

No environmental fatal flaws were identified during the assessment. Mitigation measures to avoid impacts are primarily associated with the micro-siting of turbine positions of concern, as well as measures to be utilised during the construction phase to prevent negative impacts from occurring. Where impacts cannot be avoided, appropriate environmental management measures must be implemented to mitigate impact. Environmental specifications for the management of potential impacts are detailed within the EMPr (**Volume 3**).

Table 19-1 summarises the potential social and biophysical impacts identified in terms of their degrees of significance, both before and after mitigation. Medium impacts that remain the same with mitigation are highlighted below. This can indicate that the mitigation is embedded (in the design) or not possible, and so the impact significance remains the same. Positive impacts that can also be enhanced are also highlighted below.

Table 19-1: Summary of EIA Phase Impacts – Significance before and after mitigation.

Section	Discipline	Impact	Significance Before Mitigation	Significance after Mitigation
16.3	Visual	Construction Phase: Visual impact of wind turbines on receiving environment.	M- to H-	M-
16.3	Visual	Operation Phase: Visual impact of wind turbines on receiving environment.	M- to H-	M-
16.3	Visual	Decommissioning Phase: Visual impact of wind turbines on receiving environment.	L-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Design and construction: Impact on vegetation and listed plant species due to transformation within the development footprint.	H-	M-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Construction: Direct faunal impacts due to construction phase noise and physical disturbance, including potential impact on Critically Endangered Riverine Rabbits.	M-	M-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Construction: Impact of soil erosion as a result of ground disturbance.	H-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Operation: Faunal impacts due to operational phase activities.	M-	M-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Operation: Potential soil erosion impacts.	H-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Operation: Potential of alien plant invasion.	M-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Faunal impacts due to decommissioning phase activities.	M-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Vulnerability of site to soil erosion due to decommissioning phase activities.	H-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Vulnerability of site to alien plant invasion due to decommissioning phase activities.	H-	L-
9.1.1.2	Terrestrial Ecology/Fauna and Flora	Cumulative impact on CBAs and broad scale ecological processes.	H-	M-
10.1.1	Bats	Direct Impact - Construction: Roost disturbance	M-	L-
10.1.1	Bats	Direct Impact – Construction: Roost destruction	M-	L-
10.1.2	Bats	Direct Impact - Operation: Bat mortality during commuting and/or foraging	H-	M-
10.1.2	Bats	Direct Impact - Operation: Bat mortality during migration	H-	M-

10.2.1	Bats	Indirect Impact - Construction: Habitat modification	M-	L-
10.2.1	Bats	Indirect Impact - Construction: Light Pollution	L-	L-
10.2.2	Bats	Indirect Impact – Operation: Habitat creation in high risk locations	L-	L-
10.2.2	Bats	Indirect Impact – Operation: Light Pollution	L-	L-
10.2.2	Bats	Indirect Impact – Operation: Loss of ecosystem services	M-	L-
12.1.1	Wetlands and Freshwater Ecology	Construction - Loss of riparian systems and water courses	M-	L-
12.1.1	Wetlands and Freshwater Ecology	Construction and Operation - Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and/or the 58 road crossings on riparian form and function during the operational phase.	M-	L-
12.1.1	Wetlands and Freshwater Ecology	Construction and Operation: Increase in sedimentation and erosion within the development footprint.	M-	L-
12.1.1	Wetlands and Freshwater Ecology	Construction and Operation: Impact on localized surface water quality.	M-	L-
11.2.1	Avifauna	Construction: Loss of habitat	M-	L-
11.2.2	Avifauna	Construction: Disturbance and displacement	M-	L-
11.2.3	Avifauna	Operation: Disturbance and displacement	M-	L-
11.2.4	Avifauna	Operation: Electrocution	H-	L-
11.2.5	Avifauna	Operation: Collisions with power lines.	H-	L-
11.2.6	Avifauna	Operation: Collisions with wind turbines.	H-	M-
11.2.7	Avifauna	Operation: Disruption of local bird movement patterns.	M-	M-
13.1	Cultural Heritage, Archaeology and Palaeontology	Construction: Possibility of encountering unique fossils during excavation for turbine foundations**.**	M-	L neutral/+
13.2	Cultural Heritage, Archaeology and Palaeontology	Construction: Displacement or destruction of archaeological material.	M-/neutral	M+/neutral
13.3	Cultural Heritage, Archaeology and Palaeontology	Displacement or destruction of colonial period heritage structures.	M-/neutral	M-/neutral
13.4	Cultural Heritage, Archaeology and Palaeontology	Construction and Operation: Alteration of sense of place and landscape quality.	M-	M-

14.1.4	Noise	Construction phase noise impact.	L-	Mitigation not required.
14.1.5	Noise	Operation phase noise impact (alternative layout) (Vestas and Acciona turbines)	L-	Mitigation not required.
14.1.5	Noise	Operation phase noise impact (preferred layout) (Vestas and Acciona turbines)	L-	Mitigation not required.
14.1.6	Noise	Noise impact: Cumulative Noise Levels (Vestas and Acciona) turbines.	L-	Mitigation not required.
15.2.1	Social	Construction: Creation of local employment, training and business opportunities.	M+	H+
15.2.2	Social	Technical advice for local farmers and municipalities.	Neutral	L+
15.2.3	Social	Improved cell phone reception in the area (improving security and improving emergency situations).	Neutral	L+
15.2.4	Social	Impact of construction workers on local communities – potential impacts on family structures and social networks.	M-	L-
15.2.5	Social	Construction: Potential influx of job seekers.	L-	L-
15.2.6	Social	Construction: Risk to safety, livestock and farm infrastructure.	M-	L-
15.2.7	Social	Construction: Increased risk of grass fires.	M-	L-
15.2.8	Social	Construction: Impacts associated with construction vehicles – potential dust, safety impacts and damage to road surfaces.	M-	L-
15.2.9	Social	Construction: Potential impacts associated with loss of farmland.	L-	L-
15.3.1	Social	Operation: Creation of employment and business opportunities and support for local economic development and development.	L+	M+
15.3.2	Social	Benefits associated with the establishment of a Community Trust.	M+	H+
15.3.3	Social	Development of infrastructure for the generation of clean, renewable energy.	M+	M+
15.3.4	Social	Impact on sense of place and rural character of the landscape.	H-	M-
15.3.5	Social	Potential impacts on local tourism.	L-	L-
15.4	Social	Potential impacts of decommissioning phase such as job losses.	M-	L-
15.6	Social	Cumulative impact on sense of place.	H-	M-

15.7	Social	Cumulative impact on local economy.	M+	H+
15.8	Social	Assessment of no-go option. – i.e. the overall general social benefit of the project (where H+ represents that the project is supported rather than not being developed).	M-	H+

It is clear from the table above that the majority of potential impacts are mitigatable from High or Medium significance to a Low or lower significance. There are also eight notable positive impacts related to social aspects.

The following additional observations are made:

19.1.1 *Visual impact, sense of place and tourism*

The heritage impact regarding the alteration to sense of place is a potential impact that would have medium negative significance, and with mitigation, it would remain of medium negative significance. According to the heritage specialist, mitigation for sense of place is not possible, hence the significance of the impact remains as is. The heritage specialist states that even though mitigation is not possible, the recommendations of the VIA must be implemented. The construction of a large facility such as a wind farm shall result in changes to the overall sense of place of the locality. While the impact may be considered local in terms of physical extent, there may also be wider implications in terms of the change in "identity" of the area.

Related to this impact, the visual specialist notes that the impacts of the wind turbines during both the construction and operational phases would be of high to medium negative significance, and with mitigation, would be reduced to medium negative, should all mitigation measures be implemented.

With respect to visual and heritage sense of place impacts, the social specialist notes that there appear to be no major tourism activities and/or destinations in the immediate vicinity of the site that would be impacted upon by the proposed WEF. The impact on tourism in the area is therefore likely to be limited. The proposed WEF may also attract visitors to the area. No participating landowners who were interviewed raised concerns regarding the visual impact of the turbines.

The social specialist also notes that the visual impact of a WEF and the significance thereof associated with an area's sense of place is likely to vary from individual to individual. The careful positioning of each WTG would reduce the overall visual impact of the proposed WEF on the area's sense of place.

19.1.2 *Positive Impacts*

Table 19-1 also indicates that a number of positive impacts would be experienced should the proposed WEF be constructed. These lie within the social environment and include:

- Creation of local employment, training and business opportunities during construction.
- The opportunity to provide technical advice to local farmers and municipalities regarding the installation of wind energy technology.
- The possibility for improved cell phone reception in the area, which would improve security and assist with emergency situations.
- The creation of employment and business opportunities and support for local economic development during the operation phase.
- The provision of community benefits associated with the establishment of a Community Trust.

- The development of infrastructure for the generation of clean, renewable energy will help to offset the total carbon emissions associated with energy generation in South Africa, as well as drive development through power generation and contribute to solving the region's current power crisis.
- Cumulative impact on the local economy will create employment, skills development and training opportunities, creation of downstream business opportunities.
- The no-development option would result in a lost opportunity for South Africa to supplement its current energy needs with clean, renewable energy and a lost opportunity for the towns of Laingsburg, Sutherland and LLM, therefore the implementation of this proposed WEF would be a positive one.

19.1.3 ***Environmental Sensitivity Mapping – Preferred and Alternative WTG locations***

The proponent provided an initial layout to the specialist team for their assessment, taking into account the scoping phase outcomes and recommendations. This included 55 preferred turbine positions and 22 alternative locations, as well all the associated ancillary infrastructure such as roads, hardstands, laydowns, buildings and electrical cable and line routings.

The specialist team then identified a number of potentially sensitive areas through their assessment process. These have been mapped on **Figure 9-21**, and shows the final layout overlaid. The following specialist studies recommended that certain turbines be relocated.

19.1.3.1 *Fauna and Flora:*

At a broad scale, the sensitivity of the area increases from east to west and from south to north, driven largely by the increase in rainfall with elevation and towards the west of the site. Several ridges were identified as specifically sensitive on account of the presence of flora of conservation concern or because of the local topography of the area and the likely significance of the identified areas for fauna and flora.

There are no areas within the Komsberg East WEF that are considered highly sensitive, which relates to the aridity of this area and the lower abundance of species of concern. Therefore, there are no recommendations with regard to the placement or reduction in the number of turbines. The most sensitive area here is the high elevation node of development in the northeast of the site. Any localized sensitive features here can be avoided through turbine micro-siting following a preconstruction walk-through of the facility. The identified high sensitivity areas are important for flora, as well as fauna and effective environmental management in these areas will be important for reducing the overall cumulative impact of the development.

19.1.3.2 *Visual:*

The visual specialist recommended that wind turbines on prominent elevations and outlying areas, especially peaks must be avoided, as should turbines located on slopes steeper than 1:5 gradient.

As such, the applicant replaced or removed a number of turbines in order to adequately adhere to these recommendations. This process is further outlined in section 19.1.4.1 below.

The visual impact significance for Komsberg East WEF would be medium-high before mitigation and medium after mitigation.

19.1.3.3 *Avifauna:*

Generally the proposed project is situated in an area with a moderate species richness, and the WEF site does not appear to be overly sensitive in terms of avifauna. In the specialists opinion (based on experience in other parts of the country) the Komsberg/Sutherland area

appears to be a relatively good area for the placement of a WEF, as the abundance and activity of priority species is generally low. However, some Red Data species are present, and these few species require protection.

The species of most concern were identified as Verreaux's Eagle, Martial Eagle, Ludwig's Bustard and Karroo Korhaan. Of these, Verreaux's Eagle is most likely to be impacted by the development, with the breeding pair situated on the Komsberg East WEF being at most risk. To provide protection to this pair, as well as to other priority species, detailed sensitivity mapping was conducted and 'no-go' areas were identified.

The developer must take into consideration the recommendations made regarding the sensitivity zones, no-go areas and all the mitigations described in this report when designing the layout of the WEFs and grid connections. If this is implemented it has been assessed that the impacts are likely to be brought to a moderately significant level, and would be acceptable.

Of more concern to the specialists are the potential cumulative impacts of the additional (possibly up to seven) WEFs proposed for within 50km of the Komsberg WEF site. It was found that cumulatively, the residual impact of collision from both the Komsberg East and West WEFs and both grid connections (with turbines and/or over-head power lines) may be medium to high negative (low confidence).

Conducting a detailed cumulative impact assessment of all of these facilities together on a regional scale (which should include a population analysis of the regional Verreaux's Eagle population, as well as some level of collision risk modelling for this population) is beyond the scope of this particular specialist study in this EIA. The specialist shall (outside of the scope of this report) engage with the appropriate regional or national agency/ies in the context of strategic planning regarding the commissioning of such a report by these bodies.

The confidence in the cumulative impact assessment is low in the absence of the study outlined above. The specialist notes that this project may proceed (should all recommendations and mitigation measures be implemented) prior to such a study being initiated, and this is primarily due to the generally low numbers of priority species encountered on site and the low levels of flight activity, when compared with other regions worked in by the specialist.

19.1.3.4 *Bats:*

No turbines are planned for riparian or drainage areas, but these must still be buffered with a 200m no-go buffer zone (**Figure 9-2**). No turbines (excluding roads), including the turbine blade tip, should be found within this buffer zone.

The turbines of the WEF were proposed to be placed in areas on ridges near some of the dolerite sills and as such a 200m turbine no-go buffer zone has been placed around several of the more prominent dolerite sills to reduce the risk to bats (**Figure 9-2**). No infrastructure (excluding roads), including the turbine blade tip, should be within this buffer zone.

Other features of the site that are also buffered due to their importance for bats include farm buildings (200m), agricultural fields (200m), NFEPA wetlands and farm dams (200m), major drainage areas (200m) and NFEPA rivers (200m). A 50m buffer was also placed around the location MET2 (east) which recorded high numbers of bats in summer. All of these buffers, mapped in **Figure 9-2** are no-go zones, therefore no infrastructure, including the turbine blade tip, should be within them. This necessitated the relocation of the following seven turbines on Komsberg East:

- KE3, KE4, KE5, KE15, KE33, KE56, KE60.

Based on the pre-construction monitoring data there are several species of bat that may be at risk from the project. These include the Cape serotine, Natal long-fingered bat, Roberts's flat-headed bat and Egyptian free-tailed bat. Compared to activity levels at other sites at which the specialist has been involved, the activity levels are moderate on average despite several nights with very high activity, especially in December and January. Bat activity is also concentrated during specific time periods and appears lower in some parts of the site.

The design of the facility adhering to the no-go buffer zones (**Figure 9-2**) is a first mitigation step to reduce possible impacts to bats. Additional steps during operation could include using the temporal activity data (i.e. months and times during the night) and meteorological data to determine periods when bats are likely to be at greatest risk of mortality from operational wind turbines. This would be based initially on pre-construction activity data coupled with activity and fatality data collected during operation of the WEF.

In this way, peak periods in activity may be identified and related to weather conditions and, with spatial fatality data, specific turbines that cause unacceptable impacts can be targeted for mitigation of residual impacts not captured by turbine siting.

19.1.4 *Evolution of Layouts and the Final Site Development Plan (SDP)*

The compilation of constraints from a wide variety of disciplines – visual, heritage and the various ecological disciplines as well as I&AP input - have been considered as part of an iterative exercise by the EAP, together with the applicant, to develop a final proposed layout/site development plan which takes all constraints into account in order to produce a best practicable environmental option which is depicted in **Figure 4-1**.

It should be noted that in the process of removing and relocating the 55 turbine positions in line with the specialist constraints, the applicant determined that there were in fact 58 possible turbine positions that would be acceptable to the specialists, and which would be feasible for wind energy generation. The proponent has requested that these 58 positions are put forward for approval from the DEA in this final layout plan, with the maximum generation output of up to 275MW.

The approval of 58 turbines would allow the applicant flexibility to choose the most environmentally practicable and productive options, upon micro-siting. Not all of the 58 turbine positions would be constructed, only 55 as a maximum.

The third and final layout (**Figure 4-1**) indicates the turbine re-positioning and placement of associated infrastructure which has taken cognisance of the sensitive areas documented by the specialists. This layout is considered technically and financially feasible and is considered acceptable from an environmental perspective. Each specialist has assessed and commented on the final layout in their reports.

Each WTG must be micro-sited during the pre-construction phase through a walk-down of the final layout by an avifauna specialist, a bat specialist and by a terrestrial ecologist.

The evolution of alternatives is a process which has considered the extant nature and characteristics of the site, and has presented a reasonable and feasible preferred layout option. The preferred WEF site development plan has evolved logically, taking into account the site's constraints and opportunities, the specialists' findings, the project team's findings and inputs from the public. The first and alternative layouts were adapted as a result of these findings and the best practicable environmental option for the site has been created (**Figure 4-1**).

The specialists' assessed the final SDP as follows:

19.1.4.1 *Visual*

At the request of the specialists, the applicant replaced and removed a number of turbines within the alternative and preferred options in order to adhere to their recommendations. Refer to **Figure 9-19b**. Three additional mitigation measures are recommended:

- Certain access roads on steep slopes in the current layout would need to be reviewed and micro-sited during the implementation phase to avoid visual scarring of mountain slopes.
- The final layout is generally acceptable, however, the position of certain wind turbines positions could be improved through micro-siting, in particular turbine numbers KE1, KE2, KE18, KE25 and KE45, in order to avoid visually sensitive steep slopes or scarp edges.
- Preferably locate the substation and O&M buildings on the proposed southern site, rather than the alternative northern site, which has a visually more sensitive ridgeline. Locate the proposed structures further away from the scarp edge (i.e. to the west). The applicant has confirmed that the alternative northern site shall be chosen.

It has been determined that the visual impact significance of the Komsberg East WEF would be medium-high before mitigation, given the number of wind turbines, the large size of turbines, and the nature of the receiving environment, as well as receptors in the area.

The need for 20m wide roads during construction in mountainous terrain, and the location of the substation and other operations / maintenance buildings on ridgelines in certain parts of the site were a further concern. These roads would be rehabilitated to 6-8m wide roads.

The potential visual impacts have been partly mitigated by relocating some of the turbines, in consultation with the specialists. In some cases, only micro-siting is required.

Buffers around topographic features, settlements and roads need to be implemented have generally been followed. The (southern) option for the substation and operations / maintenance buildings must should be used in preference to the alternative (northern) option. Where these mitigations have been implemented, as indicated in the final layout, the visual impact significance would potentially be reduced to medium.

The construction phase of the WEF and associated infrastructure would be short-term (<2 years) and would therefore have a lower visual significance rating.

19.1.4.2 *Avifauna*

The proponent has responded to the identified sensitivities and during the design of the final layout has adjusted the layout significantly, with more than 25 turbine positions being relocated or removed from the layout. The proponent has hence adhered to the avifauna recommendations. Should a further reduction in the total turbine count be possible at implementation due to improved turbine technologies etc., this would consequently further reduce the impacts and significance levels as assessed in this report.

If all remaining mitigation measures are implemented, the specialist has noted that the impacts would be of medium negative significance, and would be acceptable.

19.1.4.3 *Bats*

The final layout reflects the implementation of the relocation of the seven turbines as recommended, and the implementation of the required no-go areas, and the stipulated buffers.

19.1.4.4 *Freshwater Ecology*

The proposed layout for the WEF would seem to have limited impact on the aquatic environment as the proposed structures can avoid the delineated watercourses with the exception of water course crossings. Refer to **Figure 8-9b**. Use of any existing roads will support this. Thus based on the findings of this study no objection to the authorisation of any of the proposed activities for the WEF facility is made.

No aquatic protected or species of special concern (flora) were observed during the site visit. Therefore, based on the site visit the significance of the impacts assessed for the aquatic systems after mitigation would be low.

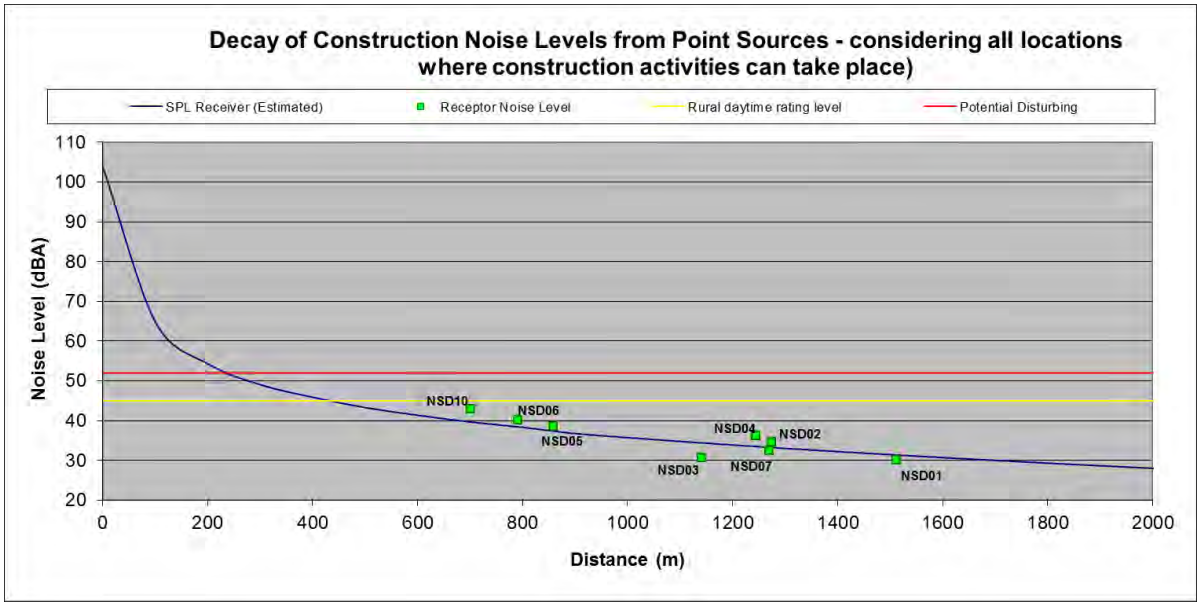
19.1.4.5 *Noise*

The noise specialist re-modelled the final layout in order to assess the potential noise impacts. The findings are reflected below.

Proposed Construction Phase Noise Impact

The final wind turbine layout, location of the overhead lines as well as the proposed access roads is presented in **Figure 9-22**. These are locations where construction activities may take place. Not shown on this figure are locations where other construction activities may take place, including the building of culverts, temporary site camps and laydown areas, although the noise from these locations was considered and assessed. The projected noise levels are shown in **Graphs 19.1** and **19.2**. Noise created due to linear activities were also evaluated and plotted against distance as illustrated in **Graph 19.2**[56].

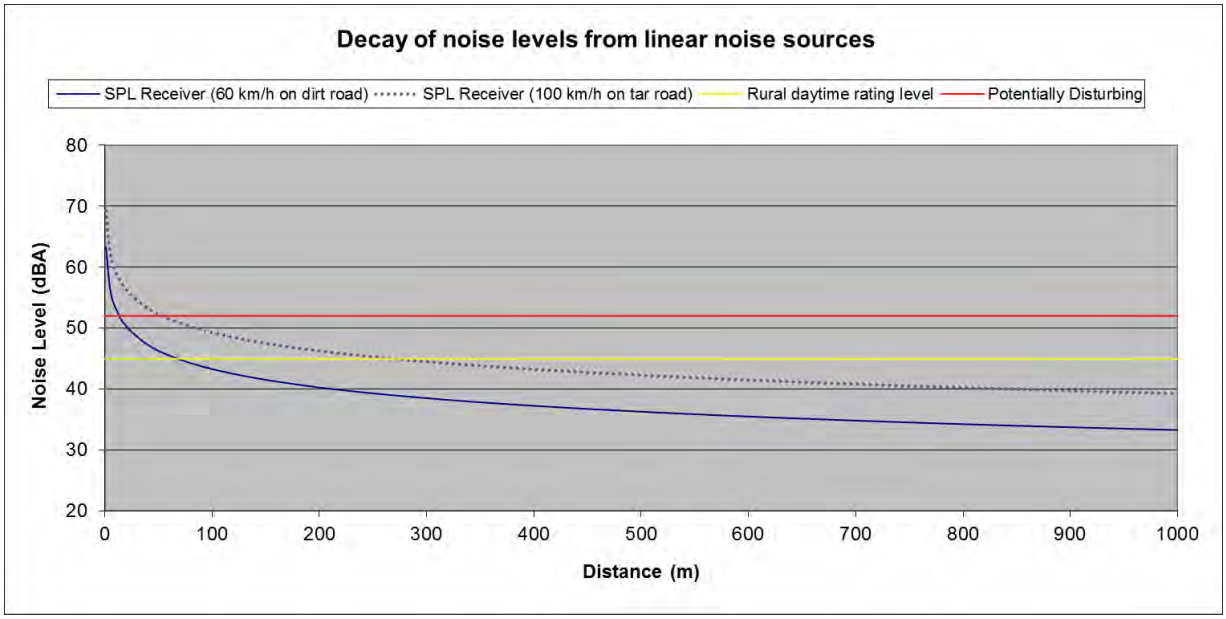
As it is unknown at this stage where the different activities would take place it was selected to model the impact of the noisiest activity (laying of foundations totalling 113.6dBA of cumulative noise impact – various equipment operating simultaneously) at all locations (over the full daytime period of 16 hours) where wind turbines (or power pylons or road construction activities) may take place, calculating how this may impact on potential noise-sensitive developments.



Graph 19-1: Projected conceptual construction noise levels[57] – Decay of noise from construction activities.

[56] Sound level at a receiver set at a certain distance from a road – 10 trucks per hour gravel and tar roads.

[57] The graph includes all construction activities, including road, pylon and wind turbine construction as well as other small construction projects where significant noise can be generated.



Graph 19-2: Projected conceptual construction noise levels – Decay over distance from linear activities.

Even though construction activities are projected to take place only during day time, it might be required at times that construction activities take place during the night.

Operational Phase Noise Impact

This study makes use of the sound power emission levels for an Acciona AW125/3000 although the applicant is also considering the use of the Vestas V126 3.45/3.6 MW and the Acciona AW125/3150 as well as other wind turbines as they enter the market.

The octave sound power levels of the Acciona AW125/3000 wind turbine used for modelling are presented in **Table 19.2**. The maximum sound power emission levels were used for all calculations. This model used a hub height of 87.5m, but the results should be applicable for other hub heights for the same wind turbine, as changes in hub-height generally do not change the sound power emission level (for the same wind turbine), or the change is insignificantly small.

Table 19-2: Octave Sound Power Emission Levels used for modelling.

Wind Turbine: Acciona AW125/3000 at hub height 87.5m										
Source Reference: Acciona Windpower. General Document DG200383, Rev D dated 04/04/14										
Maximum expected A-weighted Octave Sound Power Levels (dB re 1 pW)										
Frequency	**16**	**31.5**	**63**	**125**	250.0	**500**	**1000**	**2000**	**4000**	**8000**
Lpa (dB)	*not reported*	117.3	111.5	110.9	109.9	107.0	103.3	97.0	86.6	81.3
L_{WA} (dBA)	*not reported*	77.4	85.3	94.7	101.2	103.8	103.3	98.2	87.6	81.3

Wind speed at 10m height	Wind speed at hub height	A-Weighted Sound Power Level
6 m/s	8.5 m/s	107.3 dBA
7 m/s	9.9 m/s	108.4 dBA
8 m/s	11.3 m/s	108.3 dBA
9 m/s	12.7 m/s	107.8 dBA
10 m/s	14.1 m/s	107.8 dBA

Review of East WEF Layout for the Acciona WTG

Total noise rating levels considering the layout of the East WEF are presented in **Figure 9-23,** with **Table 19-3** defining the noise rating levels at the closest potential noise-sensitive receptors for the East WEF for the Acciona turbine.

Table 19-3: Noise rating levels at closest potential noise-sensitive receptors, East WEF (approximate noise rating levels – Acciona WTG).

NSD	East WEF Layout (dBA)	NSD	East WEF Layout (dBA)
1	Less than 20	7	22.2
2	Less than 20	8	Less than 20
3	26.7	9	Less than 20
4	40.0	10[58]	Less than 20
5	41.1	11	31.9
6	40.2	12	28.8

Cumulative Noise Impact – Acciona WTG

The cumulative noise rating levels due to both the proposed East and West WEFs operating simultaneously is illustrated in **Figure 9-24** with the potential cumulative noise rating levels defined in **Table 19-5**.

Table 19-4: Noise rating levels at closest potential noise-sensitive receptors, Cumulative from West and East WEFs.

NSD	Cumulative Noise Rating Levels (dBA)	NSD	Cumulative Noise Rating Levels (dBA)
1	26.0	7	27.8
2	38.2	8	33.9
3	28.9	9	Less than 20
4	40.0	10[59]	43.6
5	41.1	11	31.9
6	40.2	12	28.8

Decommissioning and Closure Phase Noise Impact

The potential for a noise impact to occur during the decommissioning and closure phase will be much lower than that of the construction and operational phases and noise from the decommissioning and closure phases will hence not require further investigation.

Construction Phase Noise Impact

Considering the projected noise levels (all significantly less than 45dBA) as well as the expected daytime ambient sound level (higher than 45dBA), there is a very low risk for a noise impact during the construction phase (for the WEF and all construction activities). The noise impact is quantified in **Table 19-6**. The potential noise impact from road traffic is quantified in **Table 19-7**.

Operational Phase Noise Impact

Only the night-time scenario was assessed as this is the most critical time period when a quiet environment is desired.

Noise Impact Assessment – East WEF

As can be seen from **Table 19-3**, the projected noise levels will be higher than the rural rating level at NSD04, NSD05 and NSD06, although the projected noise levels will not

[58] Abandoned / old homestead.

[59] Abandoned / old homestead.

exceed the 42dBA noise limit when considering the Acciona WTG. The extent of the impact is limited to an area approximately 1000m from the wind turbines (for all the wind turbines considered), the intensity is medium on NSD04, NSD05 and NSD06 (it may be measured) and of medium duration (life of project). The significance of the noise impact is considered to be low on all receptors.

The significance of the noise impact is assessed and summarized in **Table 19-8** for the Acciona WTGs.

Cumulative Noise Impact Assessment – East and West WEF

As can be seen **Table 19-9**, the projected noise levels will be higher than the rural rating level at NSD02, NSD04, NSD05 and NSD06, with the projected noise rating level higher than the 42dBA limit at NSD10. While it was confirmed that the dwelling at location NSD10 is not used, it was kept in this assessment as this was identified as a NSD during the scoping phase. The applicant should get confirmation from the land owner that this dwelling will no longer be used for residential purposes.

The extent of the impact is limited to an area approximately 1000m from the wind turbines, the intensity is a potential medium on NSD04, NSD05 and NSD06, with a potential high intensity for receptor NSD10. The significance is low except for NSD10, which is medium (but as mentioned, this is currently an abandoned dwelling).

Decommissioning Phase Noise Impact

Final decommissioning activities will have a noise impact lower than either the construction or operational phases. This is because decommissioning and closure activities normally take place during the day using minimal equipment (due to the decreased urgency of the project). While there may be various activities, there is a very small risk for a noise impact.

Table 19-5: Construction Activities (wind turbines, pylons, roads) – Noise Impact Assessment.

	All construction activities – Noise rating level	**Typical daytime ambient sound levels**	**Extent**	**Intensity**	**Duration**	**Significance**
Receiver no	**Leq - dBA**			**Negative**		
1	30.0	45 - 55 dBA	Low	Low	Low	Low
2	34.6	45 - 55 dBA	Low	Low	Low	Low
3	30.7	45 - 55 dBA	Low	Low	Low	Low
4	36.3	45 - 55 dBA	Low	Low	Low	Low
5	38.5	45 - 55 dBA	Low	Low	Low	Low
6	40.2	45 - 55 dBA	Low	Low	Low	Low
7	32.4	45 - 55 dBA	Low	Low	Low	Low
8	30.7	45 - 55 dBA	Low	Low	Low	Low
9	29.6	45 - 55 dBA	Low	Low	Low	Low
10[60]	*43.0*	*45 - 55 dBA*	*Low*	*Low*	*Low*	*Low*
11	30.8	45 - 55 dBA	Low	Low	Low	Low
12	30.0	45 - 55 dBA	Low	Low	Low	Low
Probability of impact		Very low				
Confidence in finding		Very high				

[60] Confirmed that dwelling is not used. NSD kept in Impact Assessment as it was identified during Scoping as a dwelling.

Mitigation measures	Mitigation is not required
Cumulative impacts	Construction noises will cumulatively add to any other noises in the area, but it will be insignificant.
Residual Impacts:	This impact will only disappear after the construction phase.

Table 19-6: Construction Activities – Noise Impact Assessment: Road traffic.

	Construction road traffic noise, average	**Typical daytime ambient sound levels**	**Extent**	**Intensity**	**Duration**	**Significance**
Receiver no	**Leq - dB(A)**			**Negative**		
1	Less than 20 dBA	45 - 55 dBA	Low	Low	Low	Low
2	Less than 20 dBA	45 - 55 dBA	Low	Low	Low	Low
3	Less than 20 dBA	45 - 55 dBA	Low	Low	Low	Low
4	Less than 20 dBA	45 - 55 dBA	Low	Low	Low	Low
5	Less than 20 dBA	45 - 55 dBA	Low	Low	Low	Low
6	Less than 20 dBA	45 - 55 dBA	Low	Low	Low	Low
7	Less than 20 dBA	45 - 55 dBA	Low	Low	Low	Low
8	Less than 20 dBA	45 - 55 dBA	Low	Low	Low	Low
9	Less than 20 dBA	45 - 55 dBA	Low	Low	Low	Low
10[61]	*Less than 20 dBA*	*45 - 55 dBA*	*Low*	*Low*	*Low*	*Low*
11	Less than 20 dBA	45 - 55 dBA	Low	Low	Low	Low
12	Less than 20 dBA	45 - 55 dBA	Low	Low	Low	Low
Probability of impact		Very low				
Confidence in finding		Very high				
Mitigation measures		Mitigation is not required				
Cumulative impacts		Road traffic noises will cumulatively add to any other noises in the area, but it will be insignificant.				
Residual Impacts:		This impact will only disappear after the construction phase.				

Table 19-7: Operational Activities – Noise Impact Assessment: East WEF (Acciona turbines).

Receiver no	**Projected Noise Level (dBA)**	**Typical night-time ambient sound levels**	**Extent**	**Intensity**	**Duration**	**Significance**
1	Less than 20 dBA	30 - 40 dBA	Low	Low	Medium	Low
2	Less than 20 dBA	30 - 40 dBA	Low	Low	Medium	Low
3	26.7	30 - 40 dBA	Low	Low	Medium	Low
4	40.0	30 - 40 dBA	Low	Medium	Medium	Low
5	41.1	30 - 40 dBA	Low	Medium	Medium	Low
6	40.2	30 - 40 dBA	Low	Medium	Medium	Low
7	22.2	30 - 40 dBA	Low	Low	Medium	Low
8	Less than 20 dBA	30 - 40 dBA	Low	Low	Medium	Low
9	Less than 20 dBA	30 - 40 dBA	Low	Low	Medium	Low

[61] Confirmed that dwelling is not used. NSD kept in Impact Assessment as it was identified during Scoping as a dwelling.

10[62]	*Less than 20 dBA*	*30 - 40 dBA*	*Low*	*Low*	*Medium*	*Low*
11	31.9	30 - 40 dBA	Low	Low	Medium	Low
12	28.8	30 - 40 dBA	Low	Low	Medium	Low
Probability of impact		Low				
Confidence in finding		Very high				
Mitigation measures		Mitigation is not required due to low significance of noise impact.				
Cumulative impacts		Ambient sound levels will increase slightly at all close NSDs, but this increase will be insignificant.				
Residual Impacts:		This impact will only disappear after the operational phase finished and rehabilitation of the area is completed.				

Table 19-8: Operational Activities – Noise Impact Assessment: Cumulative, East and West WEFs (Acciona turbines)

Receiver no	Projected Noise Level (dBA)	Typical night-time ambient sound levels	Extent	Intensity	Duration	Significance
1	26.0	30 - 40 dBA	Low	Low	Medium	Low
2	38.2	30 - 40 dBA	Low	Low	Medium	Low
3	28.9	30 - 40 dBA	Low	Low	Medium	Low
4	40.0	30 - 40 dBA	Low	Medium	Medium	Low
5	41.1	30 - 40 dBA	Low	Medium	Medium	Low
6	40.2	30 - 40 dBA	Low	Medium	Medium	Low
7	27.8	30 - 40 dBA	Low	Low	Medium	Low
8	33.9	30 - 40 dBA	Low	Low	Medium	Low
9	Less than 20 dBA	30 - 40 dBA	Low	Low	Medium	Low
10[63]	*43.6*	*30 - 40 dBA*	*Low*	*High*	*Medium*	*Medium*[64]
11	31.9	30 - 40 dBA	Low	Low	Medium	Low
12	28.8	30 - 40 dBA	Low	Low	Medium	Low
Probability of impact		Low				
Confidence in finding		Very high				
Mitigation measures		Mitigation is not required due to low significance of noise impact.				
Cumulative impacts		Ambient sound levels will increase slightly at all close NSDs, but this increase will be insignificant.				
Residual Impacts:		This impact will only disappear after the operational phase finished and rehabilitation of the area is completed.				

In sum, considering the projected noise levels (all significantly less than 45dBA) as well as the expected daytime ambient sound level (higher than 45dBA), there is a very low risk for a noise impact during the construction phase (for the WEF and all construction activities).

The output of the modelling exercise indicated that there is low risk of a noise impact (low significance of a noise impact) for the WEF and for all locations where people currently reside. The potential medium significance for a noise impact at receptor NSD10 is of no concern, as the dwelling is not used for residential purposes. Mitigation is not required although generic measures are recommended for the developer to ensure that any potential noise impacts are minimised during the construction phase.

[62] Confirmed that dwelling is not used. NSD kept in Impact Assessment as it was identified during Scoping as a dwelling.

[63] Confirmed that dwelling is not used. NSD kept in Impact Assessment as it was identified during Scoping as a dwelling.

[64] If dwelling is used for residential purposes. While not used, the applicant should get commitment from owner that it will not be used in future for residential purposes.

Due to the low significance of a noise impact, no routine noise measurement programme is recommended.

While this project will have a very slight noise impact at a number of the closest noise-sensitive receptors, these impacts is of low significance and can be considered insignificant. It is however important that the potential noise impact be evaluated should the layout be changed where any wind turbines are located closer than 1000m from a confirmed NSD.

The significance of the noise impact during the operational phase is considered low for all receptors. No additional mitigation measures are required to be included in the EMPr.

19.1.4.6 *Heritage*

Most heritage occurrences are located in river valleys, all of which have been successfully avoided, which means that the physical impacts to heritage sites, buildings and places are generally low. The issues of impacts to landscape and sense of place are more challenging to resolve due to the size of wind turbines. The overall impact will remain of medium significance.

19.1.4.7 *Social Aspects*

The social specialist assessed the preferred and alternative layouts initially put forward for assessment by the applicant post Scoping Phase. Within these layouts, certain participating and neighbouring farmers were affected and required changes to the layouts, which have now been addressed as part of the EIA process.

19.1.4.8 *Fauna and Flora*

Changes to Komsberg East WEF layout have been made, mostly due to avifaunal considerations. Here, there has been an increase in the number of turbines proposed for the lower ridges to the south, and all turbines on several of the eastern ridges have been removed to reduce potential avifaunal impacts.

This is positive from a terrestrial ecological perspective, as a large number of turbines have been moved from areas which are considered to be medium-high sensitivity to areas which are of medium sensitivity (**Figure 9-1b**). As the lower ridges are more arid, and contain a lower abundance of species of conservation concern, the impact of the additional turbines on the lower ridges should lower the overall impact of the development compared to the assessed layout.

The recommended mitigation and avoidance measures remain unchanged and a preconstruction walk-though of the final development footprint should be conducted to enable micro-siting of the turbines and access roads which shall reduce impacts on species and habitats of conservation concern.

19.1.5 ***Need and Desirability***

The Komsberg East WEF is located in a proven high wind resource area. Section C of this EIR has noted that the project is needed and desirable for the following reasons:

- Positive impact on climate change;
- Overcoming the country's energy constraints;
- Diversification and decentralisation of supply;
- Reduced costs of energy; and
- Positive economic development including job creation.

This project, if successfully implemented, would have the potential to positively transform key development areas of South Africa and would assist South Africa to meet its

development goals, while meeting its carbon emission reduction targets as per international protocols.

19.1.6 *Cumulative Impacts*

The specialists have each addressed concerns regarding cumulative impacts within their investigations. Cumulative impacts result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Most cumulative impacts are able to be reduced to medium negative significance with the implementation of mitigation measures. The visual impact and impact upon sense of place would remain high. This impact is difficult to mitigate and certain aspects of this impact are subjective.

In addition to potential negative impacts, the establishment of the Komsberg East WEF has the potential to result in significant positive cumulative socio-economic opportunities for the region. The positive cumulative impacts include the creation of employment opportunities, skills development and training opportunities, and downstream business opportunities. A Community Trust associated with the project would also create significant socio-economic benefits

19.2 Conclusion and Evaluation of the Proposed Project

Komsberg Wind Farms (Pty) Ltd is proposing to develop wind energy facility of up to 55 (with 58 turbine positions on the final layout) turbines and associated infrastructure, with a 275MW maximum contracted capacity. The project is located in the Laingsburg Local Municipal area, which forms part of the Central Karoo District Municipality in the Western Cape Province.

As noted in section 1.3, the following land portions make up the site:

Table 19-9: Affected property details.

	Property Name	Erf number	Portion	SG number	Size (hectares)
1	Taayboschkraal	12	4	C04300000000001200004	2 782,9282ha
2	Taayboschkraal	12	3	C04300000000001200003	2919,1296ha
3	Taayboschkraal	12	1	C04300000000001200001	811,5327ha
4	Koornplaats	41	2	C04300000000004100002	1695,4694ha
5	Boschmans Kloof	9	3	C04300000000000900003	255,3623ha
6	Anys Riviers Plaat	13	0	C04300000000001300000	1548,5599ha
7	Dwars River	14	RE	C04300000000001400000	5024.1806ha

With a view to reducing the effects of climate change, South Africa has committed to decreasing its dependence on fossil fuels, and increasing its utilization of renewable energy. The additional power produced by WEFs would supplement the national grid with a sustainable form of renewable energy, thus driving regional and national economic development, as well as providing local business opportunities, skills development and employment opportunities.

This EIA process for the proposed Komsberg East Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in Government Notice GN 38282 of December 2014, in terms of Section 24(5) of NEMA, 1998 (Act No. 107 of 1998), and includes an assessment of the listed activities associated with the construction and operation of the proposed Komsberg East Wind Energy Facility.

The assessment for this proposed wind farm has highlighted potential impacts associated with this proposal and it has prioritised them in terms of high, medium or low significance, according to a standard methodology. The specialist assessments have determined that negative impacts would result from the implementation of the proposal, and that these negative impacts can be mitigated to an acceptable level. The assessment has also identified a number of positive social and economic impacts.

It has been determined that:

- The turbines fall outside of the identified environmentally sensitive areas;
- There are no environmental fatal flaws that would prevent the proposed WEF from being constructed on the identified site, provided that all mitigation, monitoring and management measures are implemented;
- This proposal represents an investment in clean, renewable energy; and
- The proposed Komsberg East WEF would be located directly adjacent to the proposed Komsberg West WEF (should both be approved). The proximity of both facilities within a REDZ would consolidate the impacts into a single node with a proven wind resource. The development of WEFs in viable nodes presents a certain amount of benefit through the minimisation of the extent of impacts.

With reference to the information available at this planning approval stage in the project cycle, the confidence in this environmental assessment is considered acceptable.

Based on the nature and extent of the proposed project, the local level disturbance predicted as a result of the construction and operation of the WEF, the findings of the EIA, and the understanding of the levels of significance in relation to the potential environmental impacts, it is the opinion of the environmental assessment practitioners that the application of the proposed project can be mitigated to an acceptable level, provided all mitigation documented within this EIR is implemented and adhered to.

Should a positive Environmental Authorisation be issued by the DEA for this application, it is recommended that the following additional mitigation is applied as conditions of the Environmental Authorisation:

- The preferred layout for implementation is indicated in **Figure 4-1**, and following final design (and micro-siting with relevant specialists), a final layout is to be submitted to the DEA for review and approval pre-construction.
- All mitigation measures documented within this report and the specialist reports (**Volume 2**) must be implemented and adhered to by the applicant.
- A comprehensive search for protected plant and mammal species must be undertaken within the footprint of the proposed infrastructure prior to construction.
- The EMPr (**Volume 3**) must form part of the contract with the contractors appointed to construct and maintain, operate and decommission the WEF.
- Specialist input (avifauna, bats and terrestrial ecology) must be sought during the detailed design phase which will determine the precise and final location of turbines. This would include specialists' walk-throughs/surveys as part of a micro-siting process.
- Strict environmental monitoring must take place during site mobilisation and construction phases and the EMPr must be included in all tender documentation.
- A comprehensive search for threatened and near-threatened plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is known. This must ideally take place during an appropriate season to maximise the likelihood of detecting plants of conservation concern. If any plants (or animals) of conservation concern are found within areas proposed for infrastructure, localised modifications in the position of infrastructure must be made (if possible) to avoid such populations and a suitable buffer zone around them applied, where applicable. Where it is not possible to relocate

infrastructure, a permit may be required to be obtained in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.

- The EMPr must be enforced by an independent and suitably qualified Environmental Control Officer (ECO).
- The development of the WEF must be planned so that the clearing of vegetation is minimised.
- An on-going monitoring programme must be established to detect, quantify and manage alien plant infestations.
- Bird and bat monitoring programmes (in line with the latest version of the South African best practice bird and bat monitoring guidelines) must be commissioned during the operational phase. If necessary, and based on operational monitoring data, additional mitigation measures must be implemented during operation to minimise and control impacts.
- Any disturbance of the site must be kept to a minimum during construction and rehabilitated as quickly as possible.
- A storm water management plan and method statement must be implemented during construction and operation and must be compiled as part of the final design of the project. Effective storm water management measures are to be implemented across the site so as to prevent any erosion.
- Where feasible, training and skills development programmes for the local communities should be initiated at the initiation of the construction phase.
- Before construction is initiated construction managers/foremen must be informed about the possible types of heritage/archaeological/palaeontological sites/artefacts that may be encountered and the procedures that need to be followed should these be encountered.
- Fire prevention and fire management strategies must be implemented so as to reduce risks to landowners (Refer to the EMPr in **Volume 3**).
- Due to the low risk of noise impacts, no routine noise measurements are recommended. However, if a valid and reasonable noise complaint is registered relating to the operation of the facility, additional noise monitoring should be conducted by an acoustic consultant. Noise monitoring must be continued as long as noise complaints are registered.
- The developer should re-evaluate the noise study if the layout is changed (where any wind turbines are moved closer, or if any wind turbines are added within 1000m from any potential noise-sensitive receptor) or if the developer selects to use a different wind turbine that is louder than the turbine evaluated in this report (a higher sound power level).
- All other relevant permits must be obtained by Komsberg Wind Farms (Pty) Ltd, such as mining permits (borrow pits) and water use licences, if necessary.
- Upon decommissioning, the main facility and all associated infrastructure not required for the rehabilitation must be removed from the site, recycled where possible, and all disturbed areas appropriately rehabilitated. An ecologist must be appointed to provide input into the rehabilitation specifications.

AFFIRMATION/COMMISSIONER OF OATHS

FIGURES

Number	Title
1-1a 1-1b	Location of the proposed Komsberg East WEF, in relation to its surrounds. The site boundary with co-ordinates at the bend points.
1-2	Preferred layout of the proposed Komsberg East WEF.
1-3	Alternative layout of the proposed Komsberg East WEF.
1-4	Proposed layout of the grid connection indicating the location of the proposed switching station on site, the transmission line corridors, and the Eskom Main Substation.
1-5	Slope analysis map.
4-1	Final preferred layout, incorporating specialists' findings.
7-1	Location of bat detectors.
7-2	Locations used to measure ambient sound levels.
8-1	Vegetation types that occur within the development area.
8-2	Critical Biodiversity Areas (CBAs) on site.
8-3	WEF and Control site location
8-4	Focal Site, Driven and Walked Transects
8-5	Vantage Points and Viewsheds
8-6	Vegetation Map and SABAP Grid Squares
8-7	Site location within the Nama Karoo Ecoregion located within the Gouritz Water Management Area (final layout).
8-8	Natural and artificial wetlands occurring within the site boundary (final layout).
8-9a 8-9b	Watercourses crossed by the proposed road layout (preferred and alternative layouts). Various activities in relation to the water courses (final layout).
8-10	Archaeological occurrences recorded on the proposed Komsberg East site.
8-11	Palaeontological occurrences recorded on the proposed Komsberg East site.
8-12	Location of noise-sensitive developments on site.
8-13	Visual informants map.
9-1a 9-1b	Ecological sensitivity map (preferred and alternative layout) Ecological sensitivity map (final layout)
9-2	Komsberg East Bat Constraints Map
9-3	Raptor Nest and Roost Locations
9-4	Avifaunal Sensitivities and No Go Areas.
9-5	Location of proposed WTGs in relation to noise sensitive receptors (alternative layout).
9-6	Location of proposed WTGs in relation to noise sensitive receptors (preferred layout).
9-7	Projected conceptual night-time noise rating levels during operation - alternative layout (Vestas WTG)
9-8	Projected conceptual night-time noise rating levels during operation - preferred layout (Vestas WTG)
9-9	Projected conceptual night-time noise rating levels during operation - cumulative effects - preferred layout (Vestas WTG)
9-10	Photomontages: viewpoints 1 and 2.
9-11	Photomontages: viewpoints 3 and 4.
9-12	Photomontages: viewpoints 5 and 6.
9-13	Photomontages: viewpoints 7 and 9.
9--14	Photomontages: viewpoints 10 and 11.
9-15	Photomontages: viewpoints 12 and 13.
9-16	Photomontages: viewpoint 14.
9-17	Visual exposure – viewshed and distance radii.

9-18	Local context – viewpoints and distance radii.
9-19a 9-19b	Proposed layout based on visual constraints (preferred and alternative layouts) Proposed amended layout (final layout) indicating the layout changes after input from the visual specialist team.
9-20	DEA map indicating number of renewable energy applications 2015
9-21	Overall environmental sensitivity map (final layout).
9-22	Infrastructure Locations – Locations where construction activities may take place.
9-23	Projected conceptual night-time noise rating levels during operation – Acciona WTG.
9-24	Projected conceptual night-time noise rating levels during operation – Komsberg Cumulative (Acciona WTG).

APPENDICES